Measuring the cost of environmental compliance for Waikato dairy farmers – a survey approach

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Abstract
The link between dairy farm systems and cost of environmental compliance is not always clear. A survey of Waikato dairy farmers was conducted to establish the real (non-modelled) cost of compliance with environmental regulation in the region. Quantitative and qualitative data were gathered to improve understanding of compliance costs and implementation issues for a range of Waikato farm systems. The average one-off capital cost of compliance determined through a survey approach was $1.02 per kg milksolids, $1490 per hectare and $403 per cow. Costs experienced by Waikato farmers have exceeded average economic farm surplus for the region in the past 5 years. As regulation increases there are efficiencies to be gained through implementing farm infrastructure and farm management practice to best match farm system intensity.

Keywords: Dairy, compliance, farm systems, nitrogen, Waikato

Introduction
Waikato dairy farmers have faced an increase in the cost of compliance with regard to mitigating the environmental impact of their farm systems (Federated Farmers 2015). The primary objective of this research was to determine the on-farm capital costs of compliance for different Waikato dairy farm systems. Modelling of average Waikato farm systems was used to detail the relative environmental and economic farm scenario (Macdonald *et al*. 2015). An understanding of the specific costs incurred to achieve compliance under each farm system is needed to analyse the efficiencies and comparative costs between farming systems and mitigation options. Specific costs and characteristics of compliance spending were collected through an interview and survey process with selected questions presented to Waikato dairy farmers with differing scales, farming systems and physical/geographical constraints. The data collected were analysed to determine the comparative costs of compliance.

Method
A three page survey (Appendix 1) was presented to 35 Waikato dairy farmers selected to represent a range of farm systems, in hard copy and electronic (email) form as the basis for discussion and information gathering regarding the initial capital cost of environmental compliance for their own farm system. Section one gathered a physical systems profile with regard to scale, farm system and production. Section two determined what, when and why investment was made in compliance, as well as the economic cost of compliance incurred. Section three determined the benefits of the compliance spending with regard to receiving certification of a compliant farm system from the Waikato Regional Council as well as gains in efficiency of farm nitrogen (N) usage. This section also provided scope for farmers to discuss support mechanisms for environmental compliance and their general attitude and understanding of the compliance process.

Survey results
The average size of farms surveyed was 107 hectares with 353 cows. Respondents included 29 percent with low input systems, 38 percent medium input and 33 percent high input systems (defined by DairyNZ (2014b)).

Aggregated survey results showed that environmental compliance was a significant cost to every farm business through a capital infrastructure establishment cost or an ongoing financial cost or opportunity cost to run an environmentally compliant farm system. Every farm surveyed indicated that costs had been incurred since 2010 to achieve environmental compliance as a result of regulation imposed by the Waikato Regional Council or their dairy company. For the majority of farmers the costs incurred to date have been associated with effluent compliance and the need for upgraded storage and treatment of effluent. An underlying theme evident in each survey response was the general lack of existing effluent infrastructure. This highlights that central government objectives, under the National Policy Statement for Freshwater, of moving to compliant farm systems require significant technological advancement in effluent infrastructure. In addition, the lack of existing infrastructure provides insight as to the mentality shift required by dairy farmers, who have for generations seen limited effluent infrastructure as adequate.

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Quantitative results

The economic cost of compliance was determined by asking dairy farmers about the initial capital cost of farm infrastructure for compliance, as well as for a quantified loss of revenue due to changes in the farming system. The responses given were used in conjunction with the physical parameters stated in section one of the survey to report a cost of compliance expressed as a per cow, a per hectare and a per kg milksolid (MS) capital cost.

Within the survey questions, the cost of compliance infrastructure was asked for in grouped valuations to the nearest $50 000. For the purposes of this analysis, where the actual cost was not specified, the midpoint of each valuation group was used as the actual cost.

Aggregated results show the average initial capital cost of compliance surveyed was $1.02 per kg MS. For the average farm system surveyed, this placed the capital spend in the bracket of $130 000 to $170 000 dollars as an establishment cost. In contrast, for the average Waikato dairy farm (DairyNZ 2014a) with lower total MS, the capital cost was $110 000. Further analysis shows that average capital costs were $1490 per hectare and $403 per cow.

A clear indication of the comparative capital cost of compliance is gained by analysing survey responses in their respective farm system groupings. Table 1 details the results of the analysis per farm system.

For the low input farms surveyed the capital cost due to compliance was found to be lowest across each measure. This reflects the lower impact of these farm systems on the environment through lower stocking rates and less effluent generation. Cost per kg MS was recorded as $0.65, half that of the medium input system. Per hectare cost was $718 and per cow cost was $234. Of the farmers surveyed, the average one-off capital investment in compliance systems was $75 000.

Medium input systems incurred increased need for compliance infrastructure as a function of stocking rate and nutrient input. This was reflected in the survey data which showed expenditure due to the need for compliance per kg MS was $1.24, the highest of all systems. Further, the reported cost per cow was $472. For the medium input farms (38 percent of total survey), the average investment in compliance was the highest of all systems at $167 000.

For the high input farms surveyed, results show that despite the higher infrastructure requirements needed to operate a compliant high input system, the capital cost of establishing compliance infrastructure and farm management systems (e.g., shelters, feed pads, duration controlled grazing) was a more effective investment when considered from a per kg MS and a per cow perspective. However, as a function of higher stocking rates, the cost per hectare was greater. Results from high input farmers (33 percent of respondents) showed the cost per kg MS was $0.93, $0.31 lower than that for the medium input system. Similarly per cow cost was lower, however by a smaller margin than the per kg MS cost. Capital cost per cow was $464 compared with $472 for the medium system. A steep increase in the compliance cost of $605 per hectare was calculated for the high input systems surveyed when compared to the medium input systems. Total capital cost per hectare was $2112.

Further, analysis of the aggregate survey data shows there was a significant cost differential on the basis of farm size. For the large farms surveyed (above 150 hectares), the average farm size was 220 hectares. Despite the higher total cost as a function of scale, there were efficiencies with respect to cost incurred when analysed per kg MS, per cow and per hectare. The capital cost of compliance per kg MS, per hectare and per cow were all shown to be less than for the aggregated survey results. Average capital cost per kg MS was $0.56, near half the cost in the aggregated results. Similar reductions were recorded in both the per hectare and the per cow measures, being $681 and $221 respectively.

An explanation for the lower compliance cost structure was revealed through qualitative survey results. For the large farms surveyed, there was a higher level of existing compliance infrastructure in place, therefore lowering the required capital required to achieve minimum compliance standard. Further, there were evident economies of scale with regard to implementing capital infrastructure projects with fixed cost spread over greater production and scale.

A validation of the quantitative survey results has been provided through the survey of environmental spending conducted for the Horizons Manawatu region. The survey published by Federated Farmers reports average compliance spending of $110 000 per farm (i.e., 85 cents per kg MS) over the last 5 years (Hutching 2014). Nationally, Federated Farmers (2015) reports that farmers have spent one billion dollars protecting the environment over the past 5 years. In the Waikato the average expenditure has been approximately $90 000, with approximately $70 000

Table 1 Survey results by farm system

	Aggregated	Low	Medium	High
Cost per kg MS ($)	1.02	0.65	1.24	0.93
Cost per hectare ($)	1490	718	1507	2112
Cost per cow ($)	403	234	472	464
Average total ($)	138 556	75 000	167 000	158 333

on effluent management. The difference in the cost estimates reflects a targeted survey in the current report and the five percent response rate in the widespread survey done by Federated Farmers. The targeted survey enabled the cost comparison for different farming systems.

It is important to note that this expenditure is an advance of regulatory obligation for dairy farmers in the Waikato to perform nutrient budgeting or to understand their environmental impact measured through N loss per hectare based on the OVERSEER® Nutrient Budgets model; farmers are, however, aware that regulation is likely.

Nutrient reporting facilitated by dairy companies and fertiliser company representatives has given some farmers the ability to understand their nutrient impact. Within the survey, farmers were asked for their most recent N leaching figure if known. It was found 44 percent of surveyed farmers knew their N loss per hectare. The average N leaching for all farms surveyed was 40 kg N per hectare. Notably, the N leaching data reported was from nutrient budgets completed since installing compliance infrastructure. In combination with the Federated Farmers (2015) data, this suggests that compliance investment to date has not been concentrated on diffuse environmental impacts, rather mitigating point source effluent contamination.

Qualitative results

Section three of the survey provided farmers with the opportunity to expand on their experience with the compliance process, dealings with the Waikato Regional Council and their thoughts as to the ideal support structures for compliance as well as providing recommendations for administration of regulatory frameworks.

A thematic assessment of survey responses revealed three major discussion points for farmers. Individual farmer comments were grouped accordingly. The first and most significant theme which emerged in comments related to uncertainty with regard to regulation. This encompassed uncertainty regarding future regulatory frameworks as well as a lack of understanding of the current regulation. A second theme established in survey comments was the high financial cost of compliance with little tangible financial reward to the business. The majority of the survey respondents indicated the capital cost imposed on the business was high with regard to existing capital commitments and annual cash flow. Lastly, the survey asked respondents their opinion of current support mechanisms and structures for the compliance process as well as seeking to prompt discussion as to the optimum support structures.

Farmer uncertainty

Many respondents expressed uncertainty about their compliance obligations, both for current regulation as well as to the impact that future regulation will impose on the farm business. One identified uncertainty was the number of authorities and advisors in the regulatory process. For Waikato farmers, regulation is ultimately set and administrated by the Waikato Regional Council. However, further to this individual dairy companies such as Fonterra have taken an active role in auditing and enforcing the environmental compliance of farms. There is uncertainty as to what is required and by whom. Currently famers are reporting data on compliance to multiple organisations requiring data in different ways. For the purposes of accuracy, a standardised cross-organisation data collection process would eliminate wastage and go some way to resolving farmer uncertainty.

A significant majority of the farmers surveyed (84 percent) had been visited by a representative of the Waikato Regional Council to discuss their individual farm with regards to the existing regulation. Contrary to popular perception, selected results indicate that farm visits from a Regional Council representative were helpful in understanding the obligations for compliance under existing regulation. However, it was noted that although able to comment on existing regulation, council representatives were unable to advise on suitable compliance measures to ensure the farm meet regulatory requirements into the foreseeable future.

Further, comments in 22 percent of the surveys indicated that despite the farmers having invested significantly to become environmentally compliant, Regional Council staff were not able to advise if the farm met or would continue to meet compliance regulation to become compliance approved. For administrators of the regulatory framework, amending the perception of uncertainty post-compliance investment is necessary in shifting both attitude and a culture of compliance, especially given further regulatory restriction and subsequent changes to farm systems will be required in future.

Despite the uncertainty expressed in the survey responses, there was an appreciation by dairy farmers that the science informing regulatory frameworks is a continuous process and because of this, regulation will change. In response, it was suggested that fixed term compliance certificates could be granted as a guarantee for farm businesses to assist with annual planning for capital works as well as allowing for flexibility from both regulator and farmer in environmental compliance for future periods.

An appreciation of current flexibility by council with regard to deadlines for compliance is in some instances promoting a culture of postponing compliance investment in case of rule changes. There was general

consensus that fixed and specific guide lines at a local catchment level would provide a stable platform for farmers to invest in compliance by removing the termed "grey" area from investment decisions.

High capital cost requirements

The capital cost of compliance was identified as having a poor return to the farm business. The majority of respondents struggled to see the benefits from the infrastructure investment and saw it rather as a new operational and infrastructure expense. With the average cost of compliance determined in the survey as being above $130 000, the implementation of adequate compliance infrastructure is not realistically financed out of farm cash flow. DairyNZ (2014b) reported national average farm surplus for drawings and investment in capital projects to be $1.01 per kg MS, meaning for most farm businesses the cost of compliance is equal to the pre-drawings surplus. This means to complete effluent compliance there is a necessity for debt funding. The compliance loan facilities of some banks (offered at the cost of capital) was welcomed by farmers surveyed.

When the MS payout is considered, there is apparent merit to operating a low input, low impact system for resilience of the farm business. However there is a significant opportunity cost to these businesses in years with high payout. This has been highlighted in the media through Lincoln University. In a high MS pay out year ($8.40/kg) the cost to the Lincoln University Dairy Farm to reduce N-leaching was $84 000 (Pellow & Edwards 2014). In the immediate past season ($4.40/kg MS) financial performance was in the lower third of benchmarking farms in the Canterbury region.

Despite the uncertainty regarding the cost versus benefit of compliance investment, the high capital costs were adequately placed into perspective by a survey respondent with the remark *"the costs to our business will be greater if we do not do anything"*.

Support for compliance process

In surveying farmers regarding support organisations and systems for compliance, there was evidence to suggest the current system is not sufficiently meeting the needs of farmers. The main causes for inadequacy relate to the multi-organisation and mixed message approach. Asked who should be providing support for dairy farmers with understanding and implementing compliant farm systems there was unity in opinion. Respondents stated that support from DairyNZ, their dairy company and the Waikato Regional Council is required on an ongoing basis. However the continued support must be provided in a consistent approach.

Farmers emphasised they are financially supporting DairyNZ through a milksolid levy, Fonterra sustainability teams through the cooperative ownership model as well as the Waikato Regional Council through paying rates. A commonly expressed view was that farmers have already invested in their own farms, their dairy companies, in their regional councils, in the levy bodies and research institutions; this should be adequate to develop adequate support for the compliance process without the need for further financial input from the farmer.

Conclusion

The on-farm capital cost of compliance for Waikato dairy farm systems is a significant cost for the farm business to internalise. An extrapolation of this surveyed data places the total capital cost of compliance in the Waikato region in the vicinity of $400 million dollars. Analysis suggests in the future there will be potential capital and profitability efficiencies to be gained through lower input and lower footprint farm systems as well as through high input farms with mitigation strategies utilising economies of scale. Based on the qualitative analysis it is clear that considerably more work is required by industry and regional councils to assist farmers with continued cost-effective improvement in environmental performance.

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Appendix 1. Survey questions

On Farm cost of environmental compliance survey

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Waikato Management School
Te Raupapa

Thomas Macdonald- Masters of Agribusiness- The cost of dairy compliance

1. **Farm physical details:**

   a) Effective Hectares: _____
   b) Peak cows milked: _____
   c) DairyNZ farm system(1-5): _____
   d) Soil type: _____
   e) Milksolids produced: _____ kg MS – Average year

2. **Did your farm have existing environmental compliance infrastructure prior to 2010? Eg. Pond storage,**

   Yes ☐
   No ☐

   If yes – Detail: eg: unsealed pond, sump _____

   _____

3. **In the last 4 years, has your farm upgraded the effluent system, stand-off/ feed pads, water metering, restricted water use technology or any other measures to increase compliance with environmental regulation.**

   Yes ☐
   No ☐

4. **If No, is upgrading required within the next 3 years for the effluent system, stand-off/ feed pads, water metering, restricted water use technology or any other measures to increase compliance with environmental regulation.**

   Yes ☐
   No ☐

5. **What compliance infrastructure have you now installed/plan to install?**

   _____

   _____ Date of installation/proposed installation date: _____

6. **What has been/will be the cost to your farm business in implementing the above environmental compliance infrastructure?**

   $0 to $50,000 ☐

   $50,000 to $100,000 ☐

   $100,000 to $200,000 ☐

   $200,000 to $300,000 ☐

   $ 300,000 to $500,000 ☐

   $ 500,000+ ☐

7. **To your understanding, will the above changes classify the farm as compliant with current regulation for the Waikato region?**

   Yes ☐

   No ☐

   Don't Know ☐

   Comment: _____

8. **Has your on farm management or farming system changed in light of investment into compliance infrastructure? e.g. Stocking rate, imported feed, reduced fertiliser use?**

   _____

   _____

   _____

   _____

9. **Has your farm been visited by a representative of the Regional Council in the past two years?**

   Yes ☐

   No ☐

10. **If Yes, was the visit helpful in understanding your obligations to meet environmental regulation and the expectations of the Regional Council?**

    No ☐

    Yes ☐ **Comment:** _____

    _____

11. **Do you know a recent value for Nitrogen loss (leaching) per hectare for your farm?**

    Yes ☐ _____kg N per Hectare lost per year

    No ☐

12. Do you know the Nitrogen Leaching Efficiency of your farm system?
Formula = kgMS Ha / Kg N leached per hectare

Yes ☐ _____kg MS per kg N leached
No ☐

13. Who do you think should be providing on-farm support for environmental compliance given the current framework of rates, retentions and levys? Tick all that apply

- DairyNZ ☐
- Dairy company ☐
- Waikato Regional Council ☐
- Independent farm consultants ☐
- Other _____ ☐
- _____

14. What form of support will best suit the needs of your farm business in terms of the compliance process and the requirements of environmental compliance?

_____
_____
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15. General comments regarding the cost of environmental compliance for your farm?

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