MANAGING INDUSTRIAL STORMWATER – FONTERRA'S APPROACH

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ABSTRACT

Fonterra is known for processing milk products, it is a brand synonymous with farming in New Zealand and relies heavily on New Zealand's image as a clean food producing nation. The environmental impact of the dairy industry is a topic often hotly discussed in the national media. As the country's largest dairy producer, Fonterra is looking hard at the systems on their industrial sites to gain a better understanding of the risks and opportunities to improve operations, one area Fonterra has paid particular attention to is stormwater management.

Many of Fonterra's sites have been developed over the last 100 plus years as the dairy industry has been industrialised. During much of this time there has been no recognised stormwater management, standards or national policy statements to guide how stormwater should be managed, especially in the typically rural locations in which the production sites are located.

Fonterra is systematically assessing their sites to assess the stormwater infrastructure and ensuring they understand and minimise the risks of uncontrolled contaminant discharges via this infrastructure. Where appropriate they are installing treatment or altering management regimes to reduce the risk of the discharges from their sites. They are also developing a stormwater management strategy to aid them in decision making with respect to their stormwater infrastructure.

At the same time they are an organisation with shareholders, and stormwater management is not their core business. They need to ensure any money spent will bring value to those shareholders.

This is a story of how a New Zealand industry leader is approaching their stormwater responsibilities. In particular it focuses on two sites in the upper South Island. The paper describes the drivers behind Fonterra's approach, the Strategy, the challenges, the process and the success factors, as well as a few lessons learnt along the way.

Keywords: Industry, stormwater, management, dairy, risk

PRESENTER PROFILE

Mike Roberts is an Environmental Engineer with 6 years' experience, primarily in the three waters sector. Mike is MWH's technical lead engineer for the Takaka and Brightwater sites on this project and works with a number of specialist within MWH to deliver the project.

Emily Macdonald is the Environmental Manager for the Upper South Island Fonterra Sites. Emily has been with Fonterra for 5 years, working in a variety of areas including Ingredients Innovation and South Island Operations, and has been in her current Environmental role for 8 months.

1 INTRODUCTION

Fonterra has approximately 30 sites around New Zealand processing dairy products, many of which have evolved over 100 years of the dairy industries industrialisation. During this time society has changed its view on what is an acceptable use of the environment. A 100 years ago it was considered more acceptable to discharge runoff from a factory to a nearby waterway than now. This change in attitude is driven by more information on the discharges and contaminants and the effects on the downstream environment. , The scale of the discharges has increased both by the number of discharges and the size of the discharges. Additionally, society places competing demands on the environment to provide a resource for development, cultural and recreational requirements.

As the sites were developed for changing markets and processes, regulation around stormwater management was not as prominent as it is now and often changes to the site neglected the need to also consider the stormwater discharges from them.

In more recent times, pressures on water management are well known and understood. Fonterra is an important stakeholder in how water is managed across the country from a quantity and quality perspective as well as brand reputation perspective.

Fonterra is a farmer shareholder owned company and the farmers rely on plentiful good quality water to produce milk on the farms. It is important for the brand of the company that it is in control of the discharges from their sites.

Fonterra is taking proactive steps to gain control of stormwater discharges through, identification, assessment, risk classification and mitigation at several sites across the country. At the Takaka, Brightwater and Stirling sites Fonterra have engaged MWH to assist them through the process.

This paper describes the process the Fonterra/MWH team have developed to understand and mitigate the risks of uncontrolled stormwater discharges at these sites.

At the time of writing this paper the project is at various stages for each site. The project has not yet been completed, so while the paper talks discusses the project across all sites, when describing examples of risks or solutions they may be specific to single sites.

2 PROBLEM STATEMENT

Fonterra wanted to understand, what, if any risks existed at the sites and how they could work toward reducing them.

Understanding the problem when there is not a complete picture of the components is the first issue, once the components of the stormwater network are understood Fonterra would be in a better position to understand the risks associated with them. This meant that defining the problem would be an iterative process.

Broadly stated, the problem statement was; how can Fonterra understand and control the risks associated with the stormwater network at the sites.

This type of broad problem statement was always going to lead to changes in project scope as information came in from the various investigations.

Adding to the issue of starting with only a broad problem statement, Fonterra is a business with strict financial processes, they have firm timeframes in which funds for operational and capital projects must be applied for. This meant that as risks were uncovered during the project, mitigation strategies needed to be formulated and funded and the work carried out under tight timeframes. This process is quite different to similar investigation and capital works projects for government agencies where the project life cycle can be many years.

Photograph 2.1: Typical yard with milk reception area and truck loading out products

3 FONTERRA'S STORMWATER STRATEGY

Along with defining the problem, another important step was to define what was Fonterra's strategy with regard to stormwater, both nationally and site specific. Early project meetings between the project team defined the strategy to be:

- Meet regulatory requirements and where possible exceed them
- Eliminate or reduce risk of breaches and loss of reputation
- Reduce the impact from stormwater on plant operations

In addition to the project specific strategy stated above, Fonterra are working independently of this project to define a national strategy and code of practice for stormwater.

4 INVESTIGATION

4.1 CONDITION AND CAPACITY MODELLING

CCTV of the drainage networks was the first investigation carried out to locate underground stormwater, wastewater and sewer pipelines as well to record the condition of the pipes. Drain layers produced sketched as-builts of the drainage network while the CCTV camera location was traced on the ground.

This information led into topographic surveys to record the pipe locations in an updated plan. Each pipe and drainage structure was given an individual tag.

Survey levels, pipe sizes and material information fed into a basic pipe capacity model using EXCEL to calculate the pipe capacity based on the Colebrook-White formula.

CCTV footage was checked and pipe condition assessed. This information was added to the capacity check spreadsheet.

Site catchment boundaries were defined using a combination of visual site identification, LiDAR, and survey levels where available of drainage structures and ground levels. This information fed into a flow calculation using the Rational method to determine storm flows for 10, 20, 50 and 100 year ARI storm events.

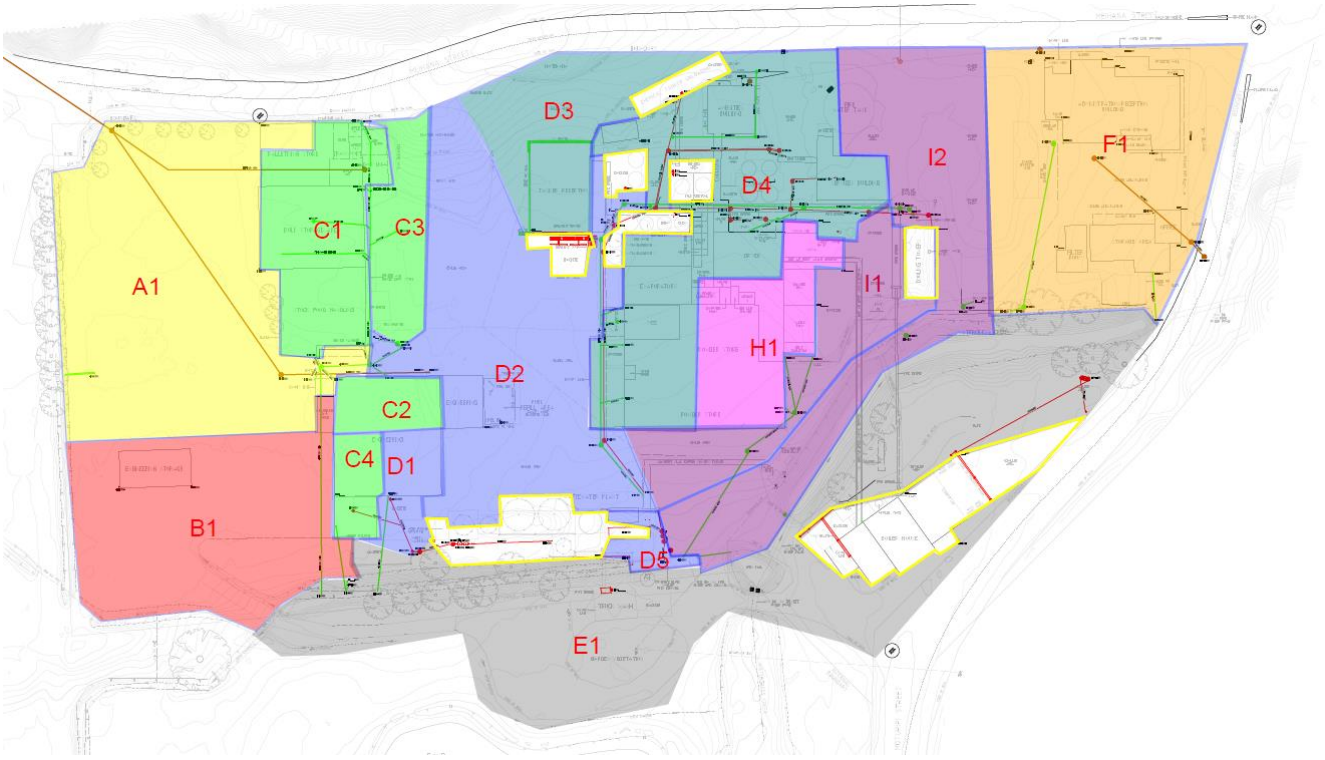

Figure 4.1: Example of a catchment map

The pipe capacity was assessed against the storm events with the minimum allowable capacity set at the 10 year ARI flow.

The pipe capacity check and condition assessment were both reported for each pipe with a recommendation where either the capacity or the condition was unsatisfactory.

4.2 RISK ASSESSMENT

Risks were identified through discussions with Operations staff to record known issues, site walk overs to identify potential risk areas and a review of the site against the resource consent conditions.

All identified risks no matter how trivial or extensive were added to a register and given a likelihood and consequence rating based on environmental risks and Fonterra's already existing environmental risk assessment tool. These risks were reviewed with the Fonterra/MWH team and tested against the strategy. Decisions were made by the team as to which risks would be included in the current project. From there options for risk mitigation were included in the register and residual risks determined. The level of risk reduction was then reviewed against the high level estimates for the mitigation and the risks into be included in the project were again reviewed.

4.2.1 KEY RISKS

Some of the key site risks that began to define the project were identified as follows:

- Spill of dairy products, process chemicals or wastewater
- Ageing infrastructure, conveyance, treatment and containment
- Risk of breaches in compliance from contaminant discharges
- Site discharge locations are not aligned to the resource consents
- Poor condition or damage to the stormwater asset

4.2.2 PROJECT CHALLENGES

The main challenges of the project were a mixture of site and business constraints, some are listed below:

- Impacts on wastewater capacity – Fonterra's sites have four water sources which they manage; potable water, foul sewer, wastewater (from the processing plant), and stormwater. Some sites have constraints on their wastewater capacity and therefore any stormwater entering the wastewater system can compound operational and compliance issues for the site and potentially either reduce or even negate operational capacity.
- Justification of spend to shareholders – Stormwater is not Fonterra's core business and therefore demonstrating the justification of expenditure on stormwater to shareholders needs to be rigorous.
- Site constraints, space, topography
- Programme – Dairy production is a seasonal operation. The processing of products stops through the winter months as milk production drops and so this is when the upgrade work is preferred to be carried out. This defines the lifecycle of the project and reduces any acceptability of programme delays.

4.2.3 RESOURCE CONSENT COMPLIANCE

Resource consent conditions were reviewed against any compliance monitoring and reports, discharge locations and the catchment boundaries.

The risk of non-compliance were added to the risk assessment matrix and discussed at project meetings.

4.2.4 WATER QUALITY SAMPLING

Water quality sampling was undertaken at Takaka by site operators to help the project team understand the type of contaminants which could be expected to discharge to the environment throughout the different stages of a storm event. 11 different locations

around the site was sampled 6 times throughout a single rain event. While the sampling did not target spill events the information was important to help indicate the typical contaminants from each catchment and match an appropriate solution to each catchment. This information was also critical in selecting the appropriate treatment.

Photograph 4.1: Receiving waterway at the Takaka site

5 DECISION MAKING

Risks, issues and solutions were discussed during regular team meetings to ensure that the many stakeholders within Fonterra are informed of the process and the decisions made. The wider project team is made up of multi-discipline stakeholders, site operators and managers, environmental managers, consenting planners, process engineers, civil engineers, project managers and representatives of the business and shareholders.

Industrial sites such as Fonterra's are planned around the efficient use of space to carry out the main processes. Changes to the why the site can operate need to be adopted by the wider Fonterra team to insure all the people involved in the site understand the purpose and requirements. Achieving a common acceptance of any site changes is a critical factor for the success of the project.

6 SOLUTIONS

Solutions at the Takaka site were split between two categories:

1. Adjusting the resource consent to meet the site
2. Upgrading the site to meet the resource consent or good industry practise.

The decision to put which risk into which category was based on the catchment and the operations that occurred in that catchment. For example if a catchment discharged stormwater without any monitoring and the ability to contain spills, and the operations in that catchment meant there was a risk of a spill, then the solution category was to change the site. If the resource consent required a catchment to discharge through the existing spill containment facility but the existing site discharged direct to a watercourse and there are no operational activities in the catchment and low risk of contaminants, then the solution would be to apply for a change in resource consent to reflect the existing site.

6.1 CONVEYANCE SYSTEMS

Changes in conveyance are based on industry best practice, utilising local and national standards for the basis of design. Capacity of conveyance systems are design on the New Zealand Building Code requirements which is generally to convey 10 year ARI flows.

6.2 TREATMENT SYSTEMS

The principal behind the solution for upgrading any stormwater treatment was first to look at options for treating at the source or eliminating the contaminants from entering the environment, such as changes in operation or diverting high risk areas to wastewater. Where changing the operation or diversion was not possible, the approach was of a best practicable option which meant treatment devices were proposed to be installed to treat the discharge to the highest practical level without it becoming cost prohibitive, and installing treatment which is aligned with current best industry practice.

At Takaka due to constraints on space and topography, as well as the indication that metals both dissolved and total need to be removed, the solution for treatment is flow based filtration rather than volume based detention and dilution. We have been investigating options for filtration with activated media, the media filters suspended solids from the influent water and the activated media traps dissolved metal through adsorption.

A further solution for any areas where there is a risk of spills, is for spill diversion and containment to be installed. Fonterra sites have a range of tools that are standard in their process which can be used to help control stormwater discharges such as a network of pressurised air that can be used to actuate valves and a site SCADA and PLC system that can use inputs from instruments to control flows or alert operators. These systems are intended to be integrated in the solutions where appropriate. For example, in order to maintain spill diversion and detention at the Takaka site the intention is to use instruments to detect a spill before it gets to the treatment system and divert it to containment. Picture 6.1 below shows how sensitive turbidity is to the presence of milk in water. This is useful as even at relatively low concentrations of milk in water, the turbidity is higher than expected stormwater turbidity. Automatic detection and diversion coupled with alarms and operator input will allow good protection of the environment and monitoring of the site discharges.

Photograph 6.1: Indication of changes in turbidity with changes in milk/water dilutions

7 CONCLUSIONS

Fonterra are making positive steps toward gaining control of and improving the stormwater discharges from their industrial sites. They have engaged experts in the field to provide technical advice while managing the project themselves and making sure the wider Fonterra team are engaged in the project.

They have embarked in a process across several sites that is new to many of the Fonterra staff engaged in the project and while they are learning they are also developing a process which could be duplicated across other industries faced with similar issues.

The processes developed for risk identification assessment and mitigation need to fit within the business's existing approval, funding and timeframe models.

Solutions are based on industry best practice and are not too different to solutions installed on municipal stormwater systems, except that they need to include systems for the mitigation of spills entering the environment. In this respect there are a range of intelligent systems, SCADA etc that can be used to implement spill diversion and capture where appropriate.

As this paper is being written the project is still being worked through and is at various stages across the different sites. While there is work still to do, Fonterra are making great progress in improving their understanding and management of their stormwater systems.

ACKNOWLEDGEMENTS

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