Greenhouse Nutrient Water Discharge
TomatoesNZ
3rd August 2016, Nelson

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Outline

- Objectives
- Background
- Grower survey and John Thompson analysis
- Checklist and decision tree with reference values
- Storage – soil moisture in winter
- Case study
- Discharge plan
- Issues for consideration

Project Objectives

- Benchmark the current level of nutrient discharge and how this relates spatially to land use in the region – grower survey
- Work with the Auckland Council and growers to develop a framework for consenting nutrient discharge
- Develop grower support material
- Grower communication

Background

Authors -
Reg Lewthwaite,
et al.,
(Unitec New Zealand)

51 pages
Auckland Council Reference in their Plan

Industry working party:
A. Ivicevich,
C. Smellie,
B. Smith,
K. Robertson

A Code of Practice for

The Management of Greenhouse Nutrient Discharges

June 2007

Horticulture™ New Zealand

Sustainable Farming Fund
www.maf.govt.nz/sff

Reduced to a 10 page Growers Guide

A Growers' Guide to

The Management of Greenhouse Nutrient Discharges

Based on "A Code of Practice for the Management of Greenhouse Nutrient Discharges"

June 2007

Grower Survey and John Thompson Analysis

» 13 growers responded

Question	Response (number)	John Thompson
Plant water use m^3/ha	12,000 (7)	15,000
Run-to-waste		
Drain %	22% (9)	28%
Drain m^3/ha	2,700	**4,200**
Recirculation		
Drain %	5 - 8%	-
Drain m^3/ha	750 – **1,000**	-
Nitrogen concentration		
run-to-waste	150 ppm (4)	**410 ppm**
recirculation	180 ppm (4)	**410 ppm**

Grower Survey and John Thompson Results

Question	Response (number)	John Thompson
Available storage		
More than required	3 (13)	-
Less	5 (13)	-
None	5 (13)	-
Disposal area		-
More than required	10 (13)	
Less	3 (13)	-

Checklist

Auckland permitted activity rule checklist

Recordkeeping for Auckland Council evidence	✓ ×
Storage volume (m^3).	
A property map with the size and unique code of each paddock used for irrigating discharged nutrient solution.	
Soil moisture level. Soil moisture probes (see possible examples below), physical soil checks and rainfall records can be used to show that irrigation occurred when the soil had adequate capacity for the volume of solution applied.	
Daily diary: The date, soil moisture level, rainfall, field code, area irrigated, total volume of nutrient solution applied, and the cumulative nitrogen. See the Code of Practice for a suggested record keeping form.	
Lab results from analysis of discharged nutrient solution samples collected from the storage structure. It is recommended that samples are analysed at least annually for total nitrogen.	

[1] Check with Auckland Council for your nitrogen rate limits.

[2] Topography, rainfall, soil moisture, soil type and drainage all influence the risk of runoff and ponding. Therefore the soil moisture at the time of irrigation must be checked to ensure there is adequate capacity in the soil to accept the discharged solution. Good practice is to walk over the irrigation area prior to each application event to check soil moisture conditions. Soil moisture can be checked using soil moisture probes or records of evapotranspiration, rainfall and irrigation events. As a general guide between May and August do not apply irrigation unless there has been 10 days without rain (<2mm).

Five key elements of success	✓ ×
1. Have sufficient winter storage.	
2. Know the soil moisture to determine when and how much discharged solution to irrigate.	
3. Know and track nitrogen application rates.	
4. Ensure even irrigation.	
5. Keep a record of your activities and prevailing conditions.	

Possible soil moisture probes

Quick Draw Tensiometers
Approximately $975

Hand-held time-domain reflectometer (TDR)
Approximately $1,300 - $1,900

Decision Tree and Default Values

Greenhouse Nutrient Discharge Decision Process

Do you discharge nutrient solution?

No → No problem

Yes

Calculate the volume and nitrogen content of the discharge.

Reference values.
Your measured values should be used.

Water and nitrogen 1 ha greenhouse - per year	Run-to-waste	Recirculate
Discharged solution (m^3/ha/yr)	4,000	1,000
Nitrogen concentration (ppm)	400	400
Nitrogen (kgN/ha/year)	1,600	400

Next

Is irrigating to your land an option?

No →
Other options include:
- Collect and supply to a neighbouring landowner with land for irrigation.
- Truck it away as waste.
- Connect to a sewer – consents may be required.
- Investigate denitrification / filter beds.
- Obtain a consent to discharge.

Yes

Calculate the area needed.

Disposal area 1 ha of greenhouse - per year	Run-to-waste	Recirculate
Area (ha) @ 150 kgN/ha/year	10.7	2.7
Area (ha) @ 200 kgN/ha/year	8.0	2.0

Next

Calculate the storage area needed.

Sufficient storage is crucial. You may need 3 months or more storage, at winter discharge rates. See the next page for examples.

Storage – 3 months 1 ha of greenhouse	Run-to-waste	Recirculate
Covered storage (m^3/ha)	1,000	250
Uncovered storage (m^3/ha)	1,600	400

Next

How will you manage the land application?

Refer to the Code of Practice

Next

Do you meet the permitted activity conditions in the Regional Plan?

No → Apply for a resource consent.

Yes

Less than 1 hectare plus comply with performance conditions – see checklist

Apply discharged nutrient solution to land using best management practices, including keeping records to show how conditions are being met.

Storage

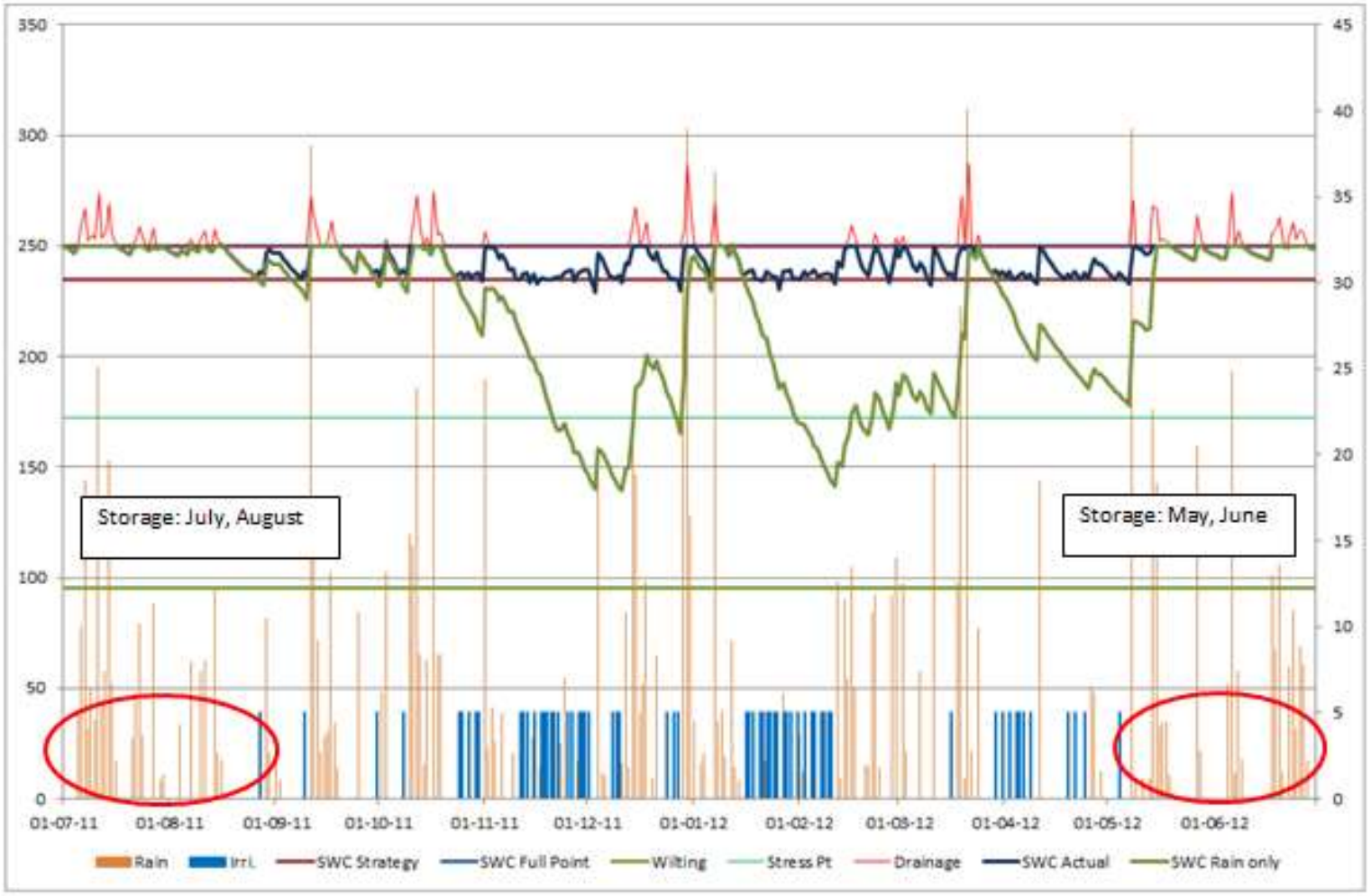
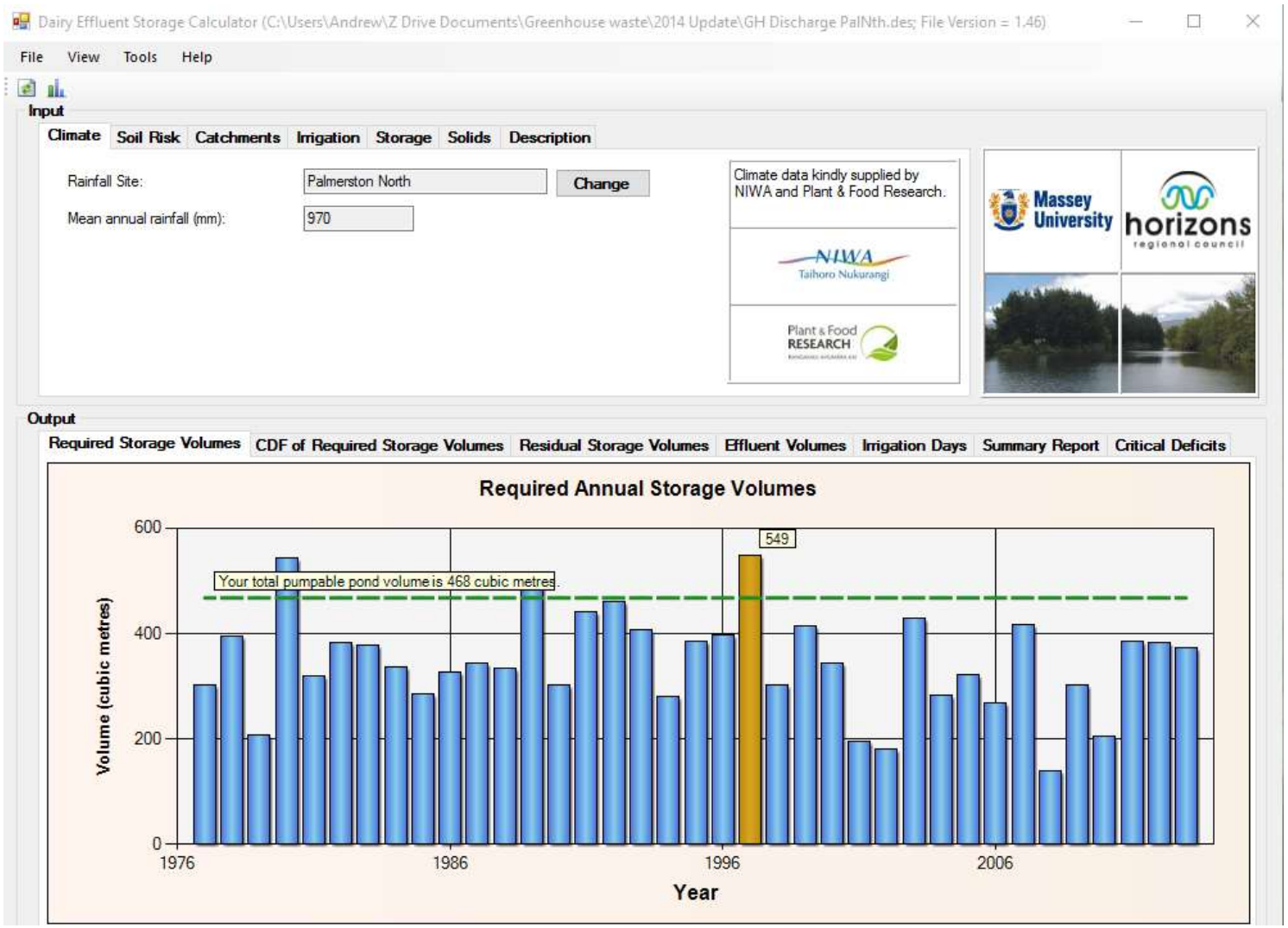


Figure 1. Soil moisture profile medium soil in 2011/12 – a typical year

Dairy Storage Calculator



Storage volume

- High risk soil (coarse soil, > 7 deg., artificial drainage)
- Average discharge of 2.7m^3/day (1,000 m^3/year)

	Covered storage			Uncovered storage (includes direct rainfall)
	Volume (m^3)	Days of storage		Volume (m^3)
Warkworth	290	107		490
Pukekohe	390	143		620
Palmerston North	360	133		550
Lincoln	200	73		280

- Dimensions:
- 500m^3 = 20m x 17m x 4m deep

Storage volume

- Low risk soil (sandy soil, < 7 deg.)
- Average discharge of 2.7m^3/day (1,000 m^3/year)

	Covered storage			Uncovered storage (includes direct rainfall)
	Volume (m^3)	Days of storage		Volume (m^3)
Warkworth	40	16		50
Pukekohe	50	19		57
Palmerston North	40	15		40
Lincoln	40	14		40

- Dimensions:
- 45m^3 = 2 x 5,000 gallon tanks

Case study - Southern Paprika

Greenhouse Discharge Management Plan:

A case study for Greenhouse management.

Contents

Greenhouse Discharge Management Plan – Over 1 ha (outside permitted conditions)

Greenhouse Discharge Management Plan

Greenhouse operators currently manage a variety of different crops under glass. The crops are watered, via a hydroponic system, with a nutrient solution. This solution is mostly recirculated until a water quality or crop performance trigger is reached, and then the solution is discharged to a storage (including treatment) area and discharged to land. A lot of the smaller greenhouse operations have a run-to-waste system with none or very little storage.

Councils require a range of controls which address the actual and potential environmental risks from the nutrient discharges. A *Greenhouse Discharge Management Plan* (The Plan) is required for use by growers to enable them to meet the requirements of the regional planning instruments and manage risks to the environment.

The objective for The Plan is to address the risks and put into practice tools and processes which manage the expectations from Council to manage these risks and any potential effects on the environment.

Description of the Environment and Activity

Each greenhouse will have its own soil and climate conditions for the nutrient management. Each site will also be different in terms of environmental sensitivity to the discharges. This will include: areas of special interest in planning documents, depths to groundwater, proximity of streams and overall load to the catchment.

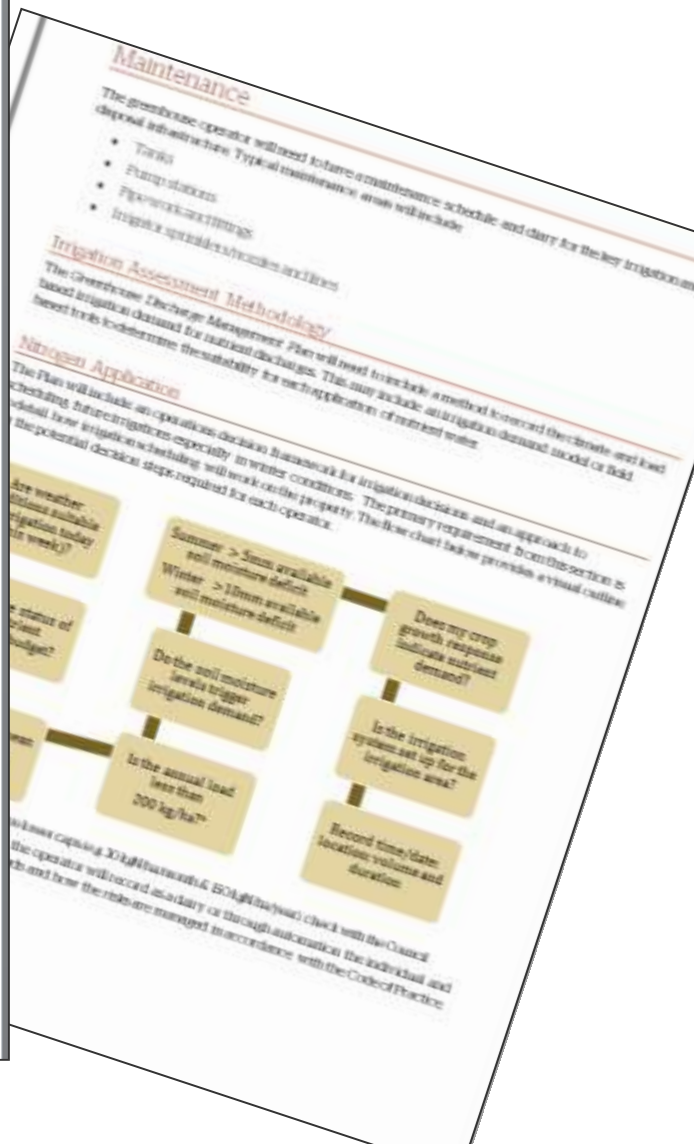
Plan topics include:

- Site description
- Detailed soils information
- Water use for irrigation and nutrient discharges
- Storage
- Nutrient discharge areas
- Outline area of application site(s)
- Buffer zones
- Depth to groundwater

Nutrient Irrigation Methods

The discharges will need to be managed according to the *Code of Practice* for greenhouse operations. The Plan topics include:

- Risk management and contingency methods
- Pump failure
- Storage tank failure
- Discharge volumes
- Distribution system (pipe, sprinkler or valve) failure
- Loss of access to a dispersal area and alternatives
- Seasonal operation of irrigation and disposal
- Winter weather effects & storage capacity



Issues for consideration

- Storage volumes
  - Most have none or insufficient
  - Required 3 months storage. This could be conservative.
- Pasture irrigation management – upskilling members
- Other nutrients e.g. potassium (animal health issues)
- Large number of >1 ha operations still requiring consents in Auckland
- How other councils roll their rules out

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