Attachment (d)

Assessment of Potential Pollution Impact of the Proposed Millbrook Resort Extension

For

Millbrook Country Club Ltd

February 2015

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Assessment of Potential Pollution Impact of the Proposed Millbrook Country Club Development of Dalgliesh Farm

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
A	Draft for review	CP	GD	19 February 2015
O	FINAL	CP	GD	23 February 2015

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1.0 INTRODUCTION

1.1 Objective

Millbrook Country Club Ltd (MCC) is seeking the rezoning of Dalgleish Farm to support a residential and golf course development of the site. Figure 1 shows the proposed structure plan for Dalgleish Farm. The proposal includes the development of approximately 50 residential sections and a 9 hole golf course. The development will also include the establishment and management of landscape protection and ecological restoration areas. MCC has identified that neighbouring properties may consider that the proposed development could result in the pollution of adjacent land with chemicals associated with the maintenance of the golf course.

In order to assess the potential effects on neighbouring properties from chemicals associated with management of the proposed golf course MCC commissioned Davis Consulting Group Limited (DCG) to undertake an assessment of potential sources of pollution, assess the possible impacts these could have on neighbouring properties and provide recommendations to reduce pollution impacts.

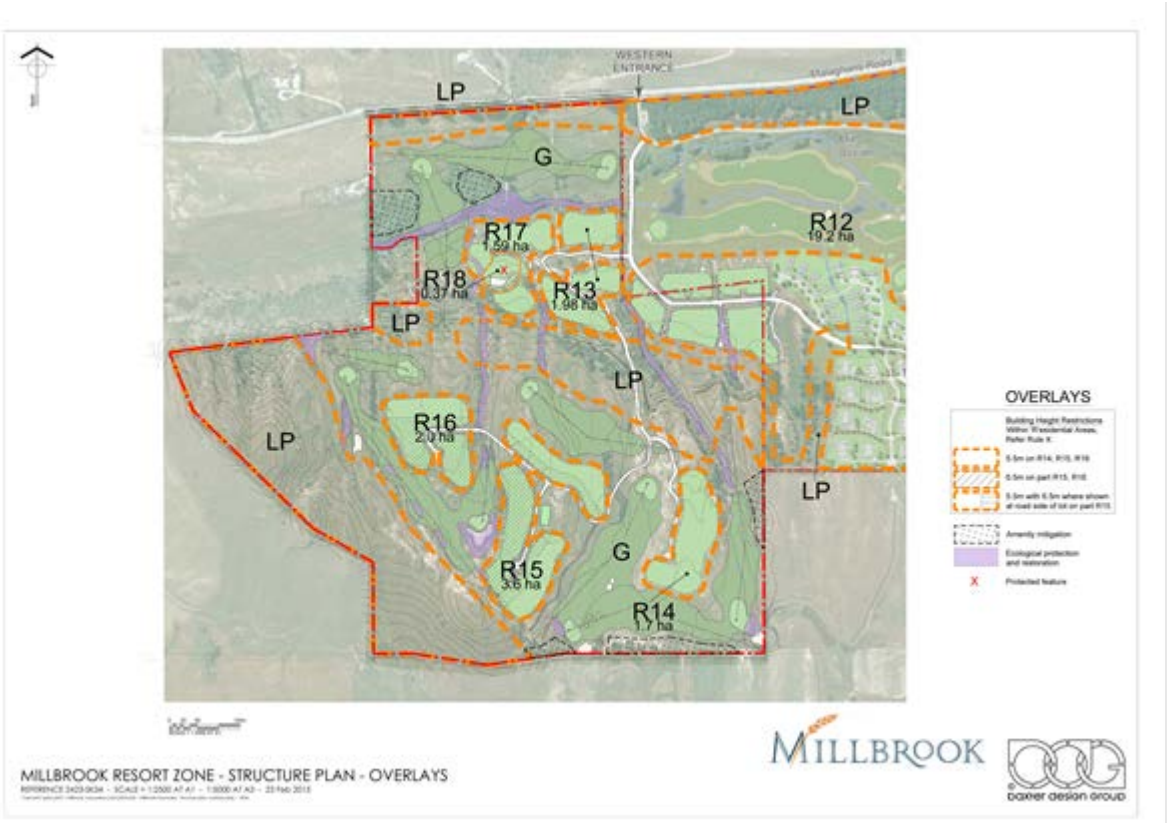

Figure 1: Proposed Structure Plan

2.0 RISK OF OFFSITE POLLUTION EFFECTS

The application of chemicals to Dalgleish Farm is anticipated on rural land and the application of approved agrichemicals such as fertilisers and pesticides similar to those used on golf courses are permitted activities. While we have not undertaken a detailed analysis of the volumes of agrichemicals used we do note that the application of chemicals on a golf course are well confined to the areas of fairways, tees and greens while the broadacre application of chemicals across crops and pasture on rural properties is routine.

Notwithstanding the risk of pollution from existing farming activities DCG has undertaken an assessment of the risk associated with the proposed golf course The risk of effects on neighbouring properties can be examined by assessing the three core elements of risk including the sources of pollution, the pathway for migration of pollutants and the proximity of neighbouring properties.

2.1 Pollution Sources

There is a number of potential pollution sources to neighbouring properties associated with the development and operation of Dalgleish Farm including:

- Noise from construction, landscaping and maintenance activities during operation;
- Air quality from dust during construction and landscaping and overspray from chemical applications during green keeping and landscaping construction.
- Water quality from nutrient and chemical inputs during landscaping and green keeping activities during operation.
- Air and water quality from the disturbance of contaminated sites.

The generation of noise and effects on air quality during construction of the development is outside the scope of this assessment.

2.1.1 Chemicals Used in Golf Course Maintenance

A full list of chemicals used in the maintenance of Millbrook Golf Course is provided in Appendix A. The chemicals used can be categorised as follows:

- Fertilisers for the support of grass growth;
- Herbicides for the control of weeds;
- Insecticides to control turf damaging insects;
- Fungicides to control fungal diseases;
- Wetting agents to increase the spreading ability of liquid applied to turf.

DCG has reviewed the Material Safety Data Sheets for the chemicals currently used on Millbrook golf course (see table 1). This review has found that the herbicides and fungicides are toxic to aquatic organisms, but are practically non-toxic to terrestrial birds and invertebrates. In all cases the herbicides and fungicides are also considered to have a low mobility in the environment.

Table 1: Golf Course Chemicals, Toxicity and Mobility

Trade Name	Substance	Toxicity	Mobility in the Environment
Calvary (Fungicide)	Chlorothalonil	Low toxicity in terrestrial environment but highly toxic to aquatic organisms	Low mobility in soil and not persistent in soil and water
Dithane Rainshield (Fungicide)	Mancozeb	Highly toxic to aquatic organisms, practically non-toxic to birds	Low mobility in soil, metabolizes to carbon dioxide
Instrata (Fungicide)	Chlorothalonil	See above	See above
	Fludioxonil	Highly toxic to aquatic organisms, practically non-toxic to birds	Low mobility in soil, not persistent in soil or water
	Propiconazole	Highly toxic to aquatic organisms, practically non-toxic to birds	Low mobility in soil, not persistent in soil or water
Headway Maxx (Fungicide)	Azoxystrobin	Highly toxic to aquatic organisms. Practically non-toxic to insects and birds	Low to moderate mobility in soil. Moderately persistent – persistent in soil or water
Smackdown (Herbicide)	Carfentrazone-ethyl	Very toxic to algae, less toxic to aquatic organisms. Low toxicity to birds and earthworms	Rapidly degrades in soil, low potential for movement in soils
Image (Herbicide)	Bromoxynil octanoate	Risk to birds and insects expected to be low, medium to high for mammals	EPA considers potential for groundwater contamination is low and should not persist in surface waters
Roundup	Glyphosate	Harmful to aquatic organisms	Adsorption studies indicate glyphosate has low mobility
Du Wett (wetting agent)	Trisiloxane ethoxylate Polyalkylene oxide Alcohol ethoxylate	Low risk to birds and aquatic organisms other than at very high concentrations	No information
Acelepryn	Chlorantraniliprole	Low toxicity to terrestrial and aquatic vertebrates. Clearly toxic to invertebrates as this is the intent of the pesticide	Persistent and mobile in terrestrial and aquatic environments. Extended use expected to cause accumulation of residues in soil

The pesticide Acelepryn has a low toxicity to terrestrial and aquatic vertebrates, but is clearly toxic to invertebrates given this is the intent of the substance. Acelepryn is considered persistent and mobile in the terrestrial and aquatic environments and extended use is considered to cause accumulation of residues in soil. According to the Millbrook green keeper this product is predominantly used on the greens and tees of the golf course and applied once per year.

2.2 Pathways and Receptors

The pathways for potential offsite migration of herbicides, fungicides and pesticides include the following:

- Spray drift in air during application of chemicals;
- Spray drift entering waterways and subsequent migration of contaminants within a waterbody;
- Chemicals that sorb to soil particles and runoff from the site into waterways;
- Migration of contaminants through the soil column and into shallow aquifers;
- Offsite migration of contaminants within groundwater.

In our view the migration pathways are only potentially open along the southern and eastern boundaries of Dalgliesh Farm as the farm is predominantly within the catchment of Mill Creek and most drainage occurs in a northerly direction. The southern portion of the ridge plateau does slope to the south and golf holes 1 and 2 are within this catchment (see Figure 1). Site drainage in the vicinity of golf holes 1 and 2 will migrate in a southerly direction and has the potential to transport any contaminants that may migrate through the soil column into groundwater. Notwithstanding the above, in our view, while a migration pathway is open to the south and east, the low mobility and low persistence of the chemicals applied and the management measures employed by Millbrook Resort in the operation of the golf course will result in a low risk of offsite pollution.

The following provides a list of management practices currently utilised by Millbrook Resort to minimise the loss of silt, chemicals and nutrients to Mill Stream:

- Maintenance of silt collection areas;
- Establishing vegetation along the edges of streams to prevent bank erosion and runoff;
- Management of irrigation schedules and treatment of irrigation water with water penetrant to maximise seepage thereby minimising water runoff;
- Application of herbicides, pesticides and fertiliser with a low boom spray, and restricting application to low wind conditions to avoid overspray;

- Designation of buffer areas around surface water features where herbicides, pesticides and fertiliser are not applied;
- Application of fertiliser is minimised by selecting turf species that require low inputs, use of foliar applications, incorporation of zeolite as a soil amendment to improve nutrient holding capacity, and the use of biological and fish product to improve turf health and performance. This reduces the potential for nutrient loss to runoff or seepage;
- The golf course nutrient management plan is reviewed annually. Nutrient application is recorded each year with the objective of lowering the total nutrient application without sacrificing turf quality;
- Monitoring of water quality within Mill Stream twice a year at the stream entry and exit of Millbrook; and
- Chemical treatments are prepared and stored within a fully bunded and roofed washdown and chemical mixing facility designed to contain all runoff within a holding tank. Water contained within the holding tank is removed from site by a chemical removal firm. This minimises the risk of chemical loss to the environment.

The above practices would be extended through the proposed golf course and will mitigate the risk of pollutants migrating off the site.

To support the assessment of impacts of the existing Millbrook golf course on Mill Creek, MCC undertakes a biannual monitoring program of Mill Creek assessing nutrient concentrations that enter and exit Millbrook Resort. The monitoring results (provided in Appendix B) show that there is no discernible difference between water entering and exiting Millbrook Resort. While the results do not include all the chemicals used in the maintenance of the golf course and it is only a "snapshot" in time it is useful to show that relatively mobile substances such as nitrate do not appear to be impacting the water quality of Mill Creek.

2.3 Summary of Risk

In summary DCG has reviewed the nature of the chemicals applied to the existing golf course, the possible pathways for offsite migration of these chemicals and the proximity of neighbouring properties. In our view the application methods utilised by Millbrook and the low mobility of the chemicals within the soil column minimises the risk of chemicals migrating offsite either in air, within surface water or through groundwater. We therefore conclude that the risk to neighbouring properties from offsite pollution is low.

Appendices

Appendix A

Chemicals Used on Millbrook Golf Course

EMT

Millbrook Golf Course			
Course Manager	James Omalley		
	Price list 2014.15 Season	Pack size	2014 season Pricelist X GST
Catergory number	Product		
Seed			
	Arrowtown Browntop	1kg	$31.00 kg
	Duraturf Tradtional	1kg	$6.50kg
Foliar/Soluable Fertilisers			
33826	Ferrous Sulphate	25kg	$23.00
33824	SOA tech grade	25kg	$26.00
33827	Magnesium Sulphate	25kg	$20.00
34011	True Foliar Si	10L	$150.00
34003	Fairway sequential	57L	$590.00
34033	Andersons Turgade	10L	$100.00
Granule			
33532	DAP Granule	40kg	$45.33
33574	SOA Granule	40kg	$42.00
33678	RegenR8	25kg	$82.60
33613	Mini Complex	25kg	$38.00
33846	Andersons 18-0-3 5% fe	20kg	$43.75
Fungicides			
33156	Calvary	10L	$113.00
33162	Dithane Rainshield	10kg	$118.66
33406	Instrata	10L	$475.00
33405	Headway Maxx	5L	$445.00
?????????	Fontelis	20L	??
Plant growth regulaters			
33404	Primo maxx	5l	$355.00
Herbicides			
33348	Smackdown Moss	1L	$265.00
33236	Image	5L	$241.30
Miscellaneous			
33416	Acelepryn Insecticide	750mls	$430.00
36049	Li1000	5L	$140.00
?????	Du Wett	5L	
36014	Keymark Foam	5L	$100.00
Wetting Agent			
33482	Biagra	200L	$2,821.00
38037	Injectorforce	200L	$1,179

Dosing Pump.

Appendix B

Mill Creek Water Quality Monitoring Results

Watercare
Laboratory Services

Auckland
52 Aintree Ave,
PO Box 107028,
Auckland Airport,
Auckland, 2150
Tel: (09) 539 7614
Fax: (09) 539 7601

Invercargill
142 Esk Street,
PO Box 747,
Invercargill, 9840
(03) 214 4040
(03) 214 4041

Queenstown
74 Glenda Drive,
PO Box 2614,
Wakatipu,
Queenstown, 9349
(03) 409 0559

www.watercarelabs.co.nz
clientsupport@water.co.nz

Certificate of Analysis
Laboratory Reference:141015-166

Attention:	James O'Malley	*Final Report:*	**111941-0**
Client:	**MILLBROOK COUNTRY CLUB LTD**	*Report Issue Date:*	**22-Oct-2014**
Address:	**MALAGHANS ROAD, ARROWTOWN, 9196**	*Received Date:*	**16-Oct-2014**
Client Reference:	**Millbrook 6 Monthly October 2014**		
Purchase Order:	**MILLBROOKRES**	*Quote Reference :*	**948**

Sample Details		WATERS	WATERS	WATERS
Lab Sample ID:		**141015-166-1**	**141015-166-2**	**141015-166-3**
Client Sample ID:				
Sample Date/Time:		15/10/2014	15/10/2014	15/10/2014
Description:		Millbrook Irrigation Pond	Millbrook Spa Exit	Millbrook Entry
General Testing				
Ammoniacal Nitrogen (as N)	mg/L	<0.005	0.0080	<0.005
Bicarbonate Alkalinity (as HCO3)	mg/L	57	68	64
Carbonate Alkalinity (as CO3)	mg/L	<1.0	<1.0	<1.0
Conductivity (at 25 °C)	mS/m	10.3	13.4	12.8
Nitrate (as N)	mg/L	<0.002	0.23	0.25
Nitrite (as N)	mg/L	<0.002	0.0078	0.0077
pH (at room temp c. 20 °C)	pH unit	7.9	7.8	7.7
Total Alkalinity (as CaCO3)	mg/L	47	56	53
Total Oxidised Nitrogen (as N) by Calculation	mg/L	<0.002 *	0.23 *	0.26 *
Total Phosphorus (as P)	mg/L	0.0090	0.028	0.024
Total Suspended Solids	mg/L	<1.0	11	7.6
Turbidity	NTU	0.45	4.0	3.3

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N)	MEWAM, HMSO 1981, ISBN 0117516139	0.005 mg/L	All	Auckland
Bicarbonate Alkalinity (as HCO3)	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Carbonate Alkalinity (as CO3)	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Conductivity (at 25 °C)	APHA (online edition) 2510 B	0.5 mS/m	All	Auckland
Nitrate (as N)	APHA (online edition) 4110 B (Modified)	0.002 mg/L	All	Auckland
Nitrite (as N)	APHA (online edition) 4110 B (Modified)	0.002 mg/L	All	Auckland
pH (at room temp c. 20 °C)	APHA (online edition) 4500-H B	0.1 pH unit	All	Auckland
Total Alkalinity (as CaCO3)	APHA (online edition) 2320 B	1 mg/L	All	Auckland
Total Oxidised Nitrogen (as N) by Calculation	APHA (online edition) 4110 B (Modified)	0.002 mg/L	All	Auckland
Total Phosphorus (as P)	APHA (online edition) 4500-P B, J (modified)	0.004 mg/L	All	Auckland
Total Suspended Solids	APHA (online edition) 2540 D, E	1 mg/L	All	Auckland
Turbidity	APHA (online edition) 2130 B (modified)	0.05 NTU	All	Auckland
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.