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Groundwater resource update and managed aquifer recharge

Introduction

This talk is in two halves:

1. state of the groundwater resource quantity and quality and how these have changed since 2009.
2. critical assessment of the possibilities and issues associated with managed aquifer recharge (MAR).

Review of catchment key points

Everything is connected

Environment Canterbury Regional Council

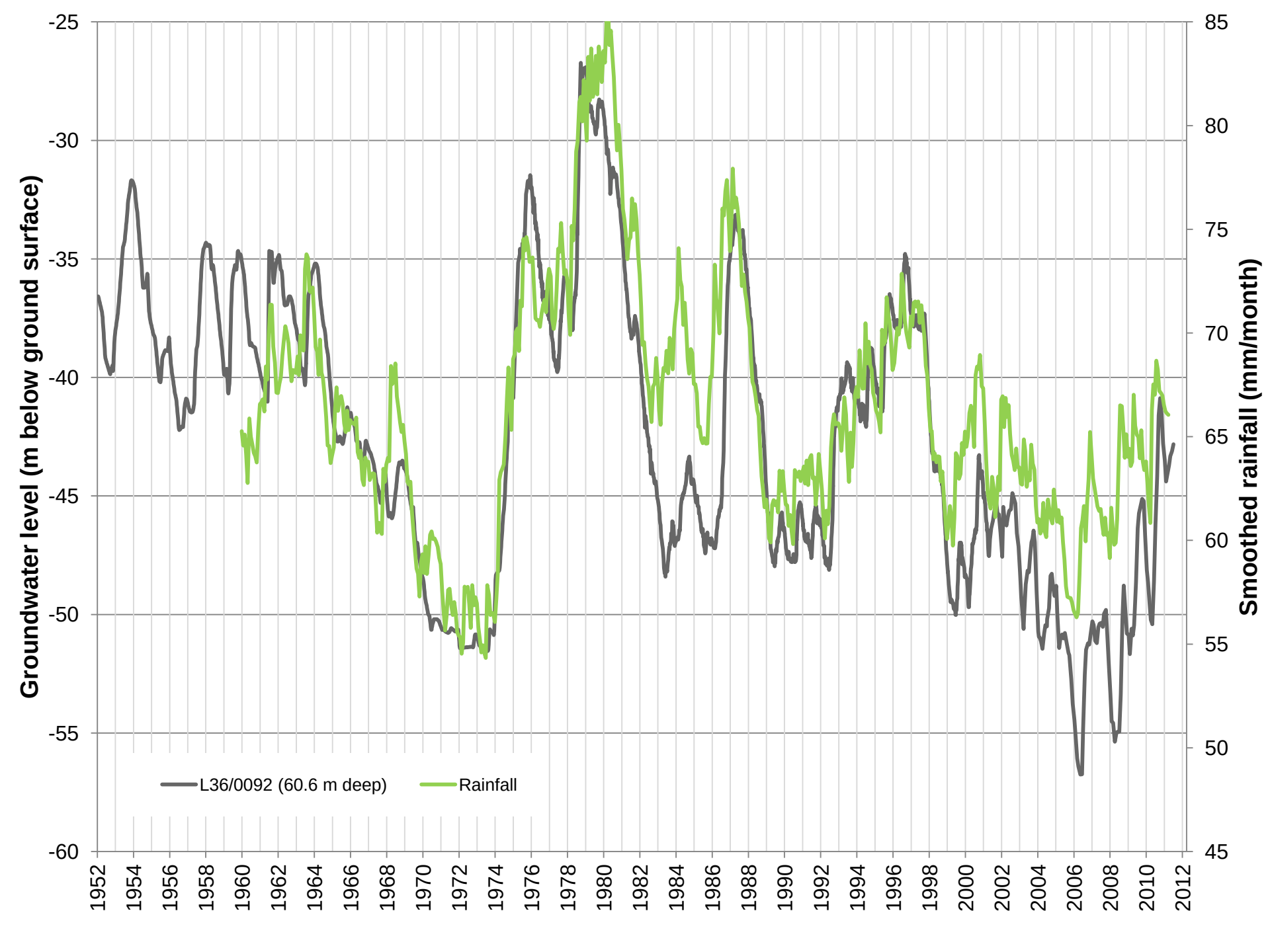
Golder Associates

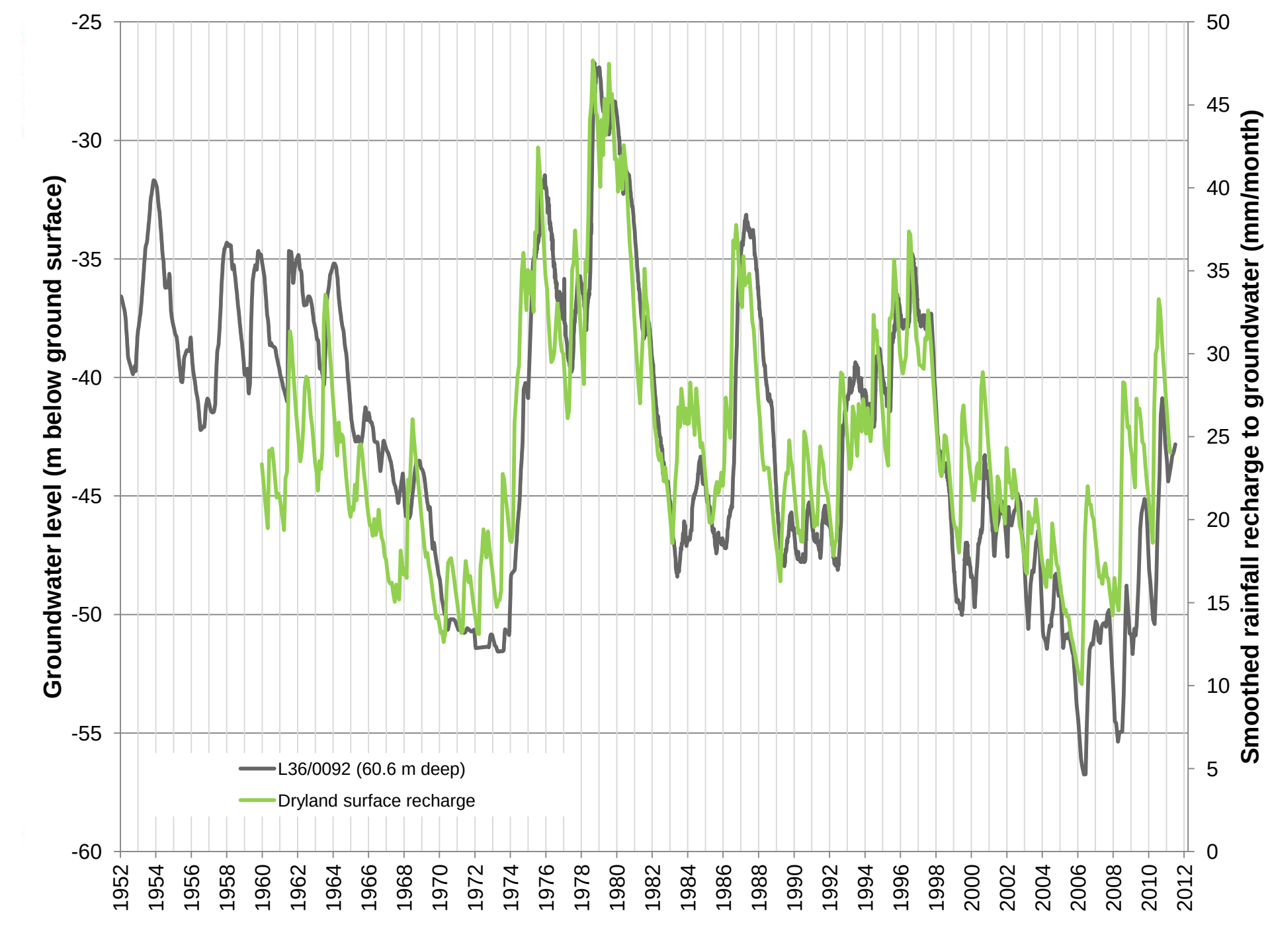
Groundwater – Quantity:

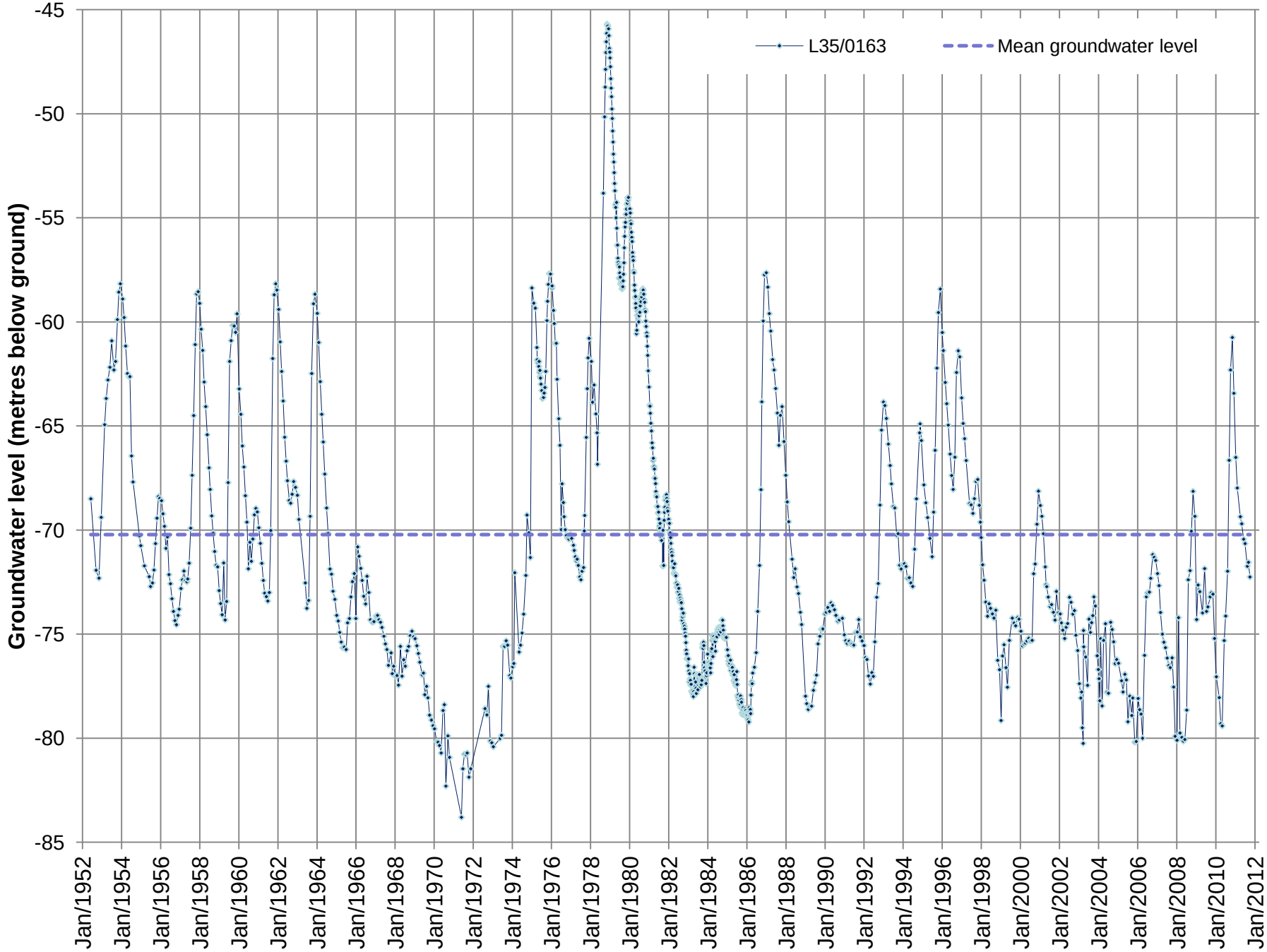
STATE OF RESOURCE:

- Groundwater levels are currently about average to above average in most of the catchment.
- Groundwater levels in the northern part of the catchment, especially West Melton, are slightly lower than average.

Groundwater – Quantity:


Groundwater level (m below ground surface)
Smoothed rainfall (mm/month)
-25
-30
-35
-40
-45
-50
-55
-60
85
80
75
70
65
60
55
50
45
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
L36/0092 (60.6 m deep)
Rainfall


Groundwater level (m below ground surface)
Smoothed rainfall recharge to groundwater (mm/month)
-25
-30
-35
-40
-45
-50
-55
-60
50
45
40
35
30
25
20
15
10
5
0
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
L36/0092 (60.6 m deep)
Dryland surface recharge

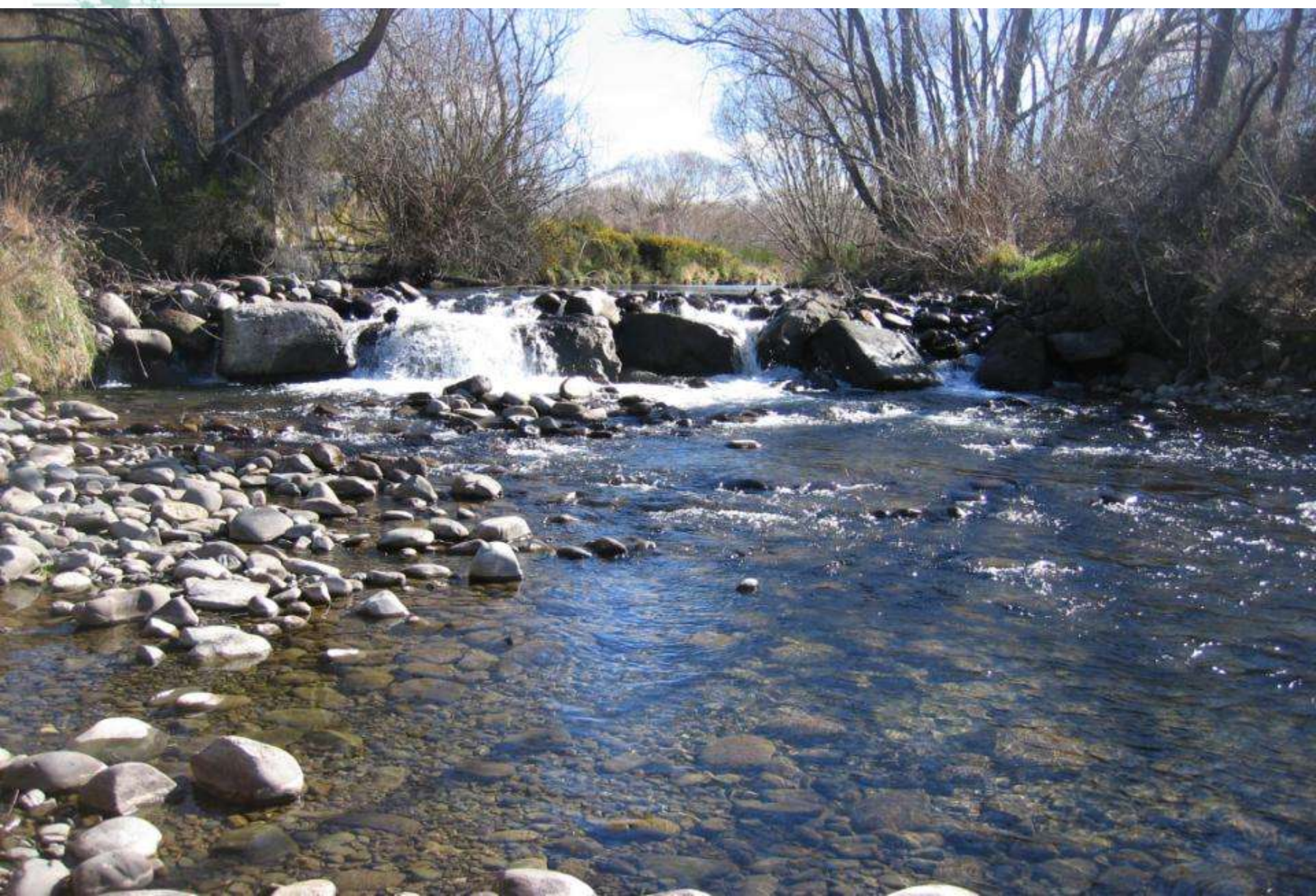

L35/0163
Mean groundwater level
Groundwater level (metres below ground)
-45
-50
-55
-60
-65
-70
-75
-80
-85
Jan/1952
Jan/1954
Jan/1956
Jan/1958
Jan/1960
Jan/1962
Jan/1964
Jan/1966
Jan/1968
Jan/1970
Jan/1972
Jan/1974
Jan/1976
Jan/1978
Jan/1980
Jan/1982
Jan/1984
Jan/1986
Jan/1988
Jan/1990
Jan/1992
Jan/1994
Jan/1996
Jan/1998
Jan/2000
Jan/2002
Jan/2004
Jan/2006
Jan/2008
Jan/2010
Jan/2012

Groundwater – Quantity:

CHANGE SINCE 2009:

- Levels are much the same as in 2009, perhaps slightly higher as a result of the relatively wet winters, though this winter has been slightly drier than average.
- The biggest change since 2009 has been the gradual rise in deep groundwater levels in the upper parts of the catchment.

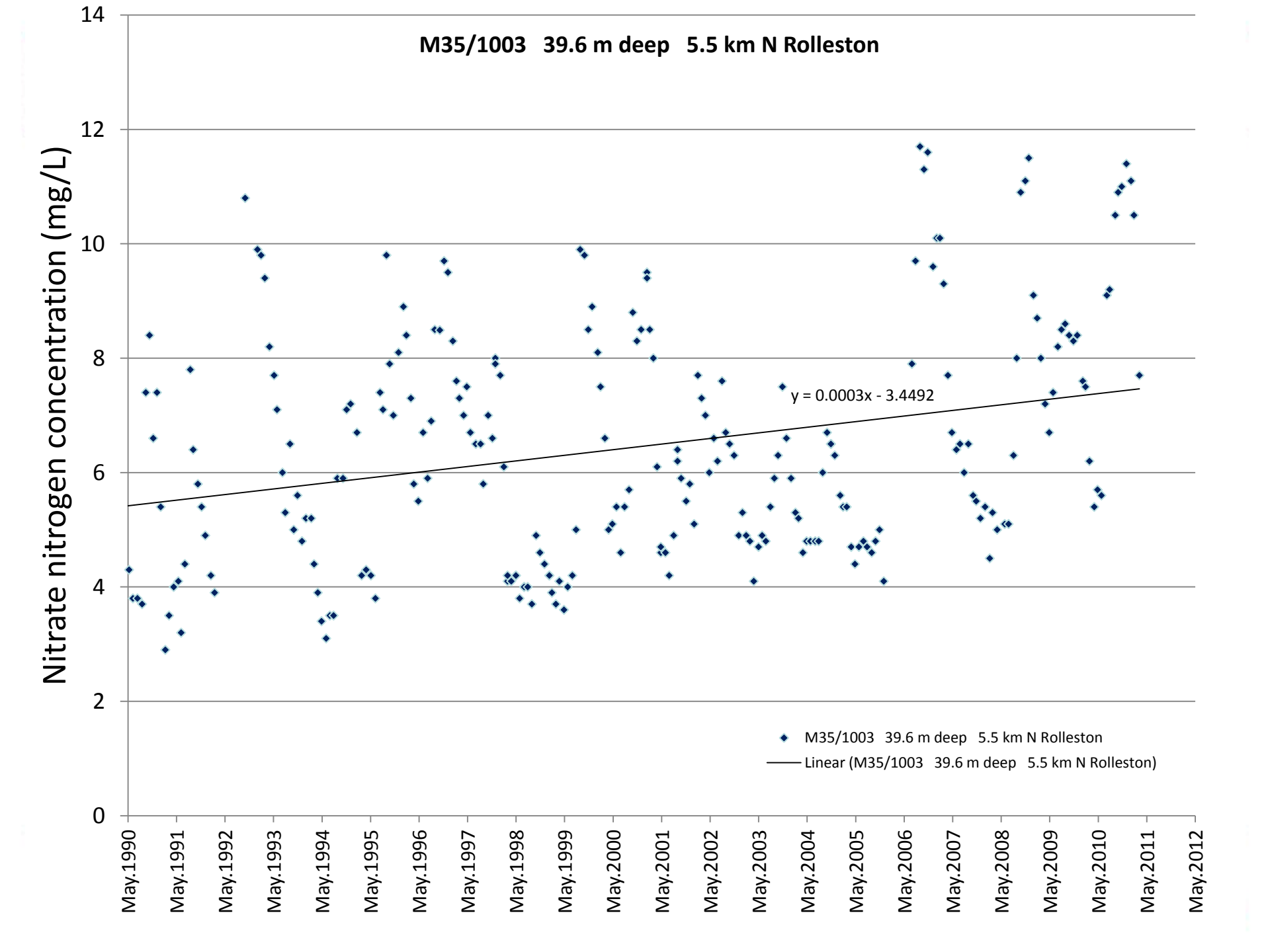
Groundwater – Quantity: LESSONS LEARNED SINCE 2009:

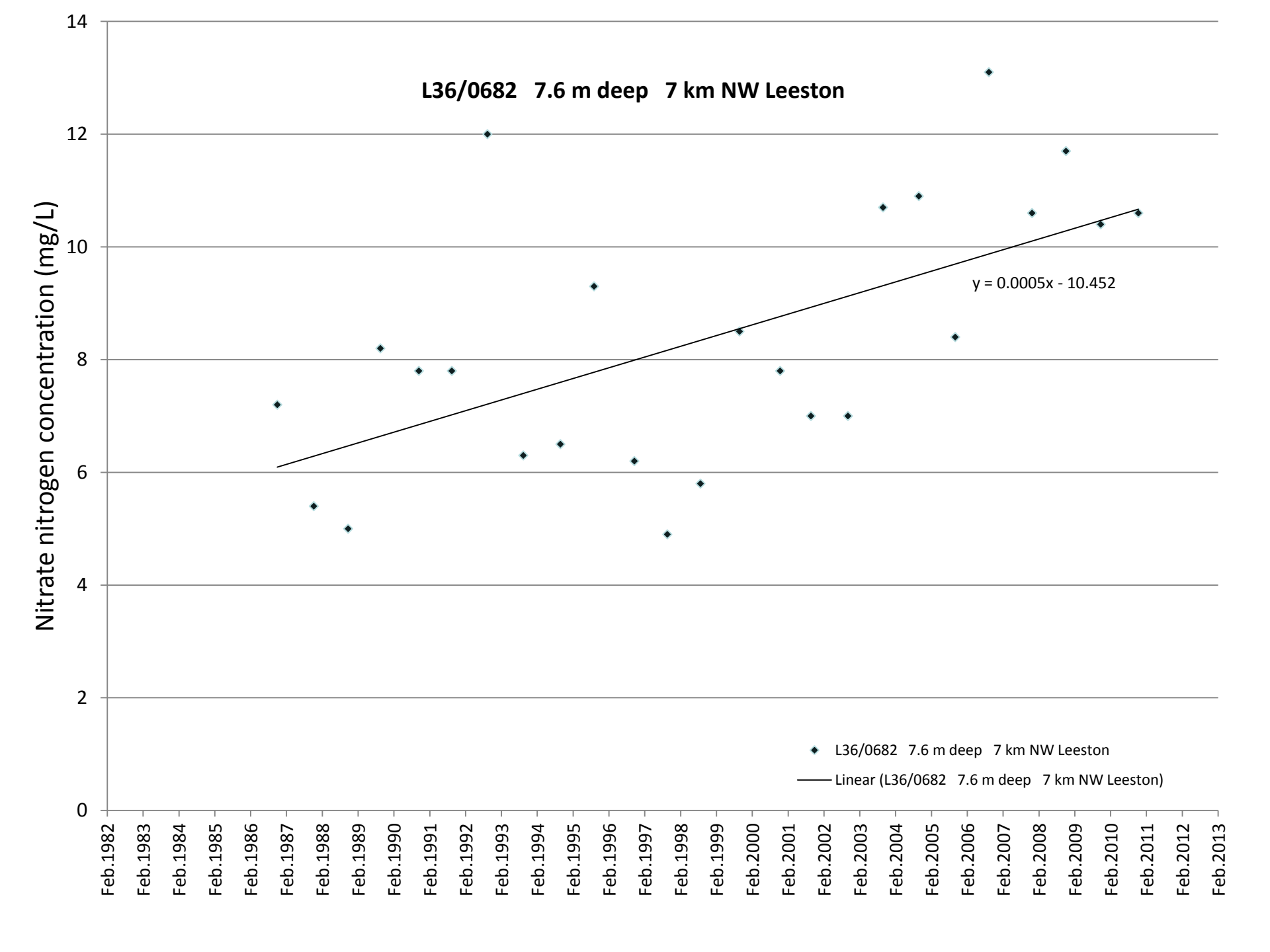


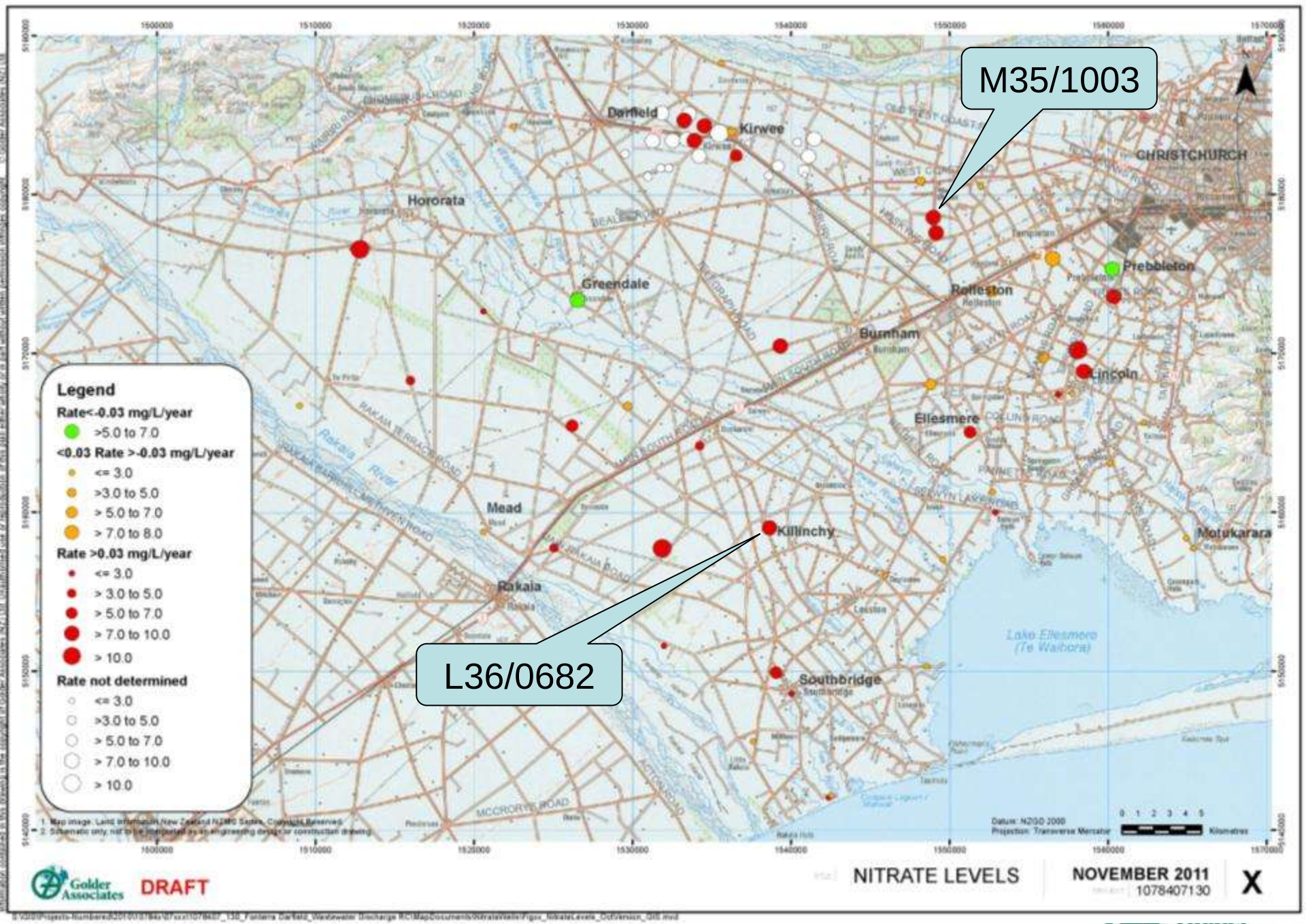
Groundwater – Quality:

STATE OF RESOURCE:

- Groundwater quality as measured by the increase in nitrogen concentration has continued to decline.
- Over the last ten years in 49 wells, 22 show upwards trends, 2 downward, the remainder no clear trend.
- The nitrogen concentration in groundwater and in groundwater-fed streams exceeds ANZECC guidelines.


M35/1003 39.6 m deep 5.5 km N Rolleston
Nitrate nitrogen concentration (mg/L)
0
2
4
6
8
10
12
14
y = 0.0003x - 3.4492
M35/1003 39.6 m deep 5.5 km N Rolleston
Linear (M35/1003 39.6 m deep 5.5 km N Rolleston)
May.1990
May.1991
May.1992
May.1993
May.1994
May.1995
May.1996
May.1997
May.1998
May.1999
May.2000
May.2001
May.2002
May.2003
May.2004
May.2005
May.2006
May.2007
May.2008
May.2009
May.2010
May.2011
May.2012


L36/0682 7.6 m deep 7 km NW Leeston
Nitrate nitrogen concentration (mg/L)
y = 0.0005x - 10.452
L36/0682 7.6 m deep 7 km NW Leeston
Linear (L36/0682 7.6 m deep 7 km NW Leeston)
0
2
4
6
8
10
12
14
Feb.1982
Feb.1983
Feb.1984
Feb.1985
Feb.1986
Feb.1987
Feb.1988
Feb.1989
Feb.1990
Feb.1991
Feb.1992
Feb.1993
Feb.1994
Feb.1995
Feb.1996
Feb.1997
Feb.1998
Feb.1999
Feb.2000
Feb.2001
Feb.2002
Feb.2003
Feb.2004
Feb.2005
Feb.2006
Feb.2007
Feb.2008
Feb.2009
Feb.2010
Feb.2011
Feb.2012
Feb.2013



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DRAFT

NITRATE LEVELS

NOVEMBER 2011

1078407130

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Groundwater – Quality: CHANGE SINCE 2009

LESSONS LEARNED SINCE 2009:

- Continued and more effective management required.

MAR – 1 Managed aquifer recharge

MAR – 2 Managed aquifer recharge

MAR – 3 Clogging of basins

MAR – Managed aquifer recharge

Managed Aquifer Recharge (MAR) - 4

MAR – 5: Advantages

Issue	Advantages
Recharge time	Recharge when water available
Storage for retrieval	No evaporation of water as in a reservoir
Increase in flows	Recharge timed to provide increase where and when it is needed
Cost	Much less costly than a dam
Water quality	Providing source water is good, stored water quality improved; can be used to ‘clean’ water

MAR – 6: Disadvantages

Issue	Disadvantages	Solution
Clogging	Unless water has very low turbidity, basins clog	Engineered basins with periodic removal of fines
Storage for retrieval	Not all water recharged can be used	Ensure that un-used water derives an environmental benefit
Unplanned increase in flows	Potential for flooding if recharge winter followed by wet summer	Maintain natural drainage systems to alleviate flooding potential

CONCLUSIONS

- That groundwater levels are healthy, despite dry winter (until mid October!!).
- That continued and more effective management of nitrogen use in the catchment is required if the observed rise in nitrogen levels towards the NZDWS MAV is to be halted.
- MAR can address both these issues.