2012 Mallee Horticulture Crop Report

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Sustainable Irrigation Program

Cover images

Left: Spray irrigation
Middle: Drip irrigation
Right: Flood irrigation
Photos: Mallee CMA

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Project partners

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Introduction

This report was commissioned by the Mallee Catchment Management Authority (Mallee CMA) to accurately measure irrigation status and development in the Victorian Mallee region; along the Murray River from Nyah to the South Australian border.

The 2012 Crop Report will be used by the Mallee CMA to inform Monitoring, Evaluation, Reporting and Improvement (MERI) of the Victorian Mallee Land and Water Management Plan and its main implementation mechanism, the Mallee CMA Regional Sustainability Program.

Information in the report is of high value to both the Mallee region and the Murray-Darling Basin Authority. It provides an understanding of the dynamics of irrigation development and its potential impacts on salinity and water quality, facilitating better informed management of these issues. Recording the extent of irrigation development enables management agencies to plan on-ground activities that enhance biodiversity and minimise salinity and water quality impacts, and improve planning of future developments.

Information in the report is produced from analysis of SunRISE 21's spatial crop mapping and datasets which have been consistently maintained for fifteen years.

The crop mapping is based on a time series of high resolution orthophoto imagery (scale accurate, digital, aerial photography). Crop details, such as crop type, area, irrigation method etc., are derived from interpretation of the imagery and field checks. Crop details such as variety, rootstock, year planted etc. are provided by individual irrigators.

Since 1997 the orthophoto imagery, crop mapping and Crop Reports have been contributed to and used by many regional agencies, industry organisations, local businesses and individual irrigators and land managers.

Acknowledgements

The following are acknowledged for their contribution to the 2012 Crop Report:

- The Department of Sustainability and Environment's Sustainable Irrigation Program as a funding contributor to the production of this report
- The Department of Sustainability and Environment's Coordinated Imagery Program for acquisition of January 2012 orthophoto imagery
- Funding contributors to acquisition of the 2012 imagery; Mallee CMA, Mildura Rural City Council, Lower Murray Water, Lower Murray Darling CMA, SunRISE 21 and Murray Valley Winegrowers
- The Flood Relief Environmental Employment Program for undertaking field surveys to check crop types and irrigation methods
- The Murray Valley Citrus Board and citrus growers for annual updates on citrus plantings
- Brian Boulton for input to crop mapping in the Nyah area

Method

Orthophoto imagery

SunRISE 21's crop mapping is based on high resolution orthophoto imagery (i.e. scale accurate digital imagery processed from aerial photography) which has been updated every three years since 1997.

Information presented in this report is for the years; 1997, 2003, 2006, 2009 and 2012[1]. The orthophoto imagery used for each of these years was captured at the start of the year. Hence the information represents the 1996-97, 2002-03, 2005-06, 2008-09 and 2011-12 irrigation seasons respectively. The 2012 crop mapping is based on imagery acquired in January 2012 by the Department of Sustainability and Environment's Coordinated Imagery Program. It was acquired as 4 band (red, green, blue and an infrared band) imagery at 35cm pixel resolution.

Positional and area accuracies

The orthophoto imagery is generally processed to sub-metre positional accuracy. The crop mapping has been captured at a scale of 1:2,000 or better from the imagery. Hectares for seasonal plantings of vegetables and field crops (such as pasture) have a lesser reliability as the imagery provides only one snap-shot of the season, making it difficult to determine irrigation activity in a given season.

Totalled area figures in this report have been rounded to the nearest five hectares.

Field surveys

Field surveys are undertaken to check interpretation of data sources, in particular in areas where it is unclear whether cultivated land is vacant, being prepared for annual cropping or has a newly planted permanent crop.

Extensive field surveys were undertaken by the Flood Recovery Environmental Employment Program in the Merbein, Mildura, Red Cliffs, Robinvale and Nyah areas. Further field surveys were undertaken by SunRISE 21 in the Colignan, Lake Cullulleraine and Wemen areas.

[1] Note: Imagery was acquired in 2000 however funding was not available at the time to complete crop mapping for the 1997-2000 irrigation season.

Definitions

The following definitions are applied for the purpose of this report.

IRRIGABLE area: The area that has been irrigated in the past and is still irrigated or could be irrigated. It is the sum of the irrigated area plus the VACANT area.

An increase in irrigable area can arise from new 'greenfield' development and/or from an increase in the irrigated area following redevelopment and the removal of furrow irrigation, drying racks etc.

PROPERTY: One property is a holding with the one owner or corporate entity. A property generally comprises more than one 'farm', 'fruit block' or land parcel. Property numbers are estimates only due to difficulties in resolving and maintaining ownership details.

Note that some property owners have irrigated land in more than one pumped district and/or have irrigated land in pumped districts and private diverter areas. Hence, property numbers across the Murray Mallee are less than the sum of property numbers for each of the study areas.

RETIRED: 'Retired' areas are those that were irrigated in the past but have undergone a change in land use that precludes the area from being irrigated. SunRISE 21 generally relies on updated orthophoto imagery, or digital cadastre, for evidence of land use change such as residential development and building construction. Areas known to have been set aside for conservation purposes are also 'retired' from the crop mapping.

VACANT: The crop mapping includes a crop type of 'vacant'. Vacant areas were previously irrigated but not irrigated in the season that the crop mapping refers to. The previous crop may, or may not, have been cleared from a vacant area. Where the vacant area was previously a permanent planting, it is referred to in this report as **Vacant P**. Where the vacant area was previously a seasonal planting, such as pasture or vegetables, it is referred to as **Vacant S**.

Salinity impact zones: Salinity impact zones are mapped zones in north-west Victoria that correlate to tonnes of salt displaced to the Murray River from new irrigation. The salinity impact zones in this report refer to 'Hazard B' zones (comprising four low impact zones (LIZ) and one high impact zone (HIZ)). Hazard B zones are used for determining levy charges for new developments, and have been used in this study, purely for ease of presentation, rather than the 'Hazard A' zones (seven low impact zones and 5 high impact zones) which are used for reporting river salinity impacts to the Murray-Darling Basin Authority (salinity register). The relationship between Hazard A and Hazard B zones is as follows:

Hazard B Zones	Hazard A Zones
LIZ 1	LIZ 1, LIZ 2
LIZ 2	LIZ 3
LIZ 3	LIZ 4, LIZ 5
LIZ 4	LIZ 6, LIZ 7
HIZ	HIZ 1, HIZ 2, HIZ 3, HIZ 4, HIZ 5

Study areas of the crop report

This 2012 Crop Report covers irrigated horticulture in Victoria along the Murray River and within the Mallee catchment. The region has been divided in to eleven study areas: five pumped irrigation districts and six river reaches (Map 1).

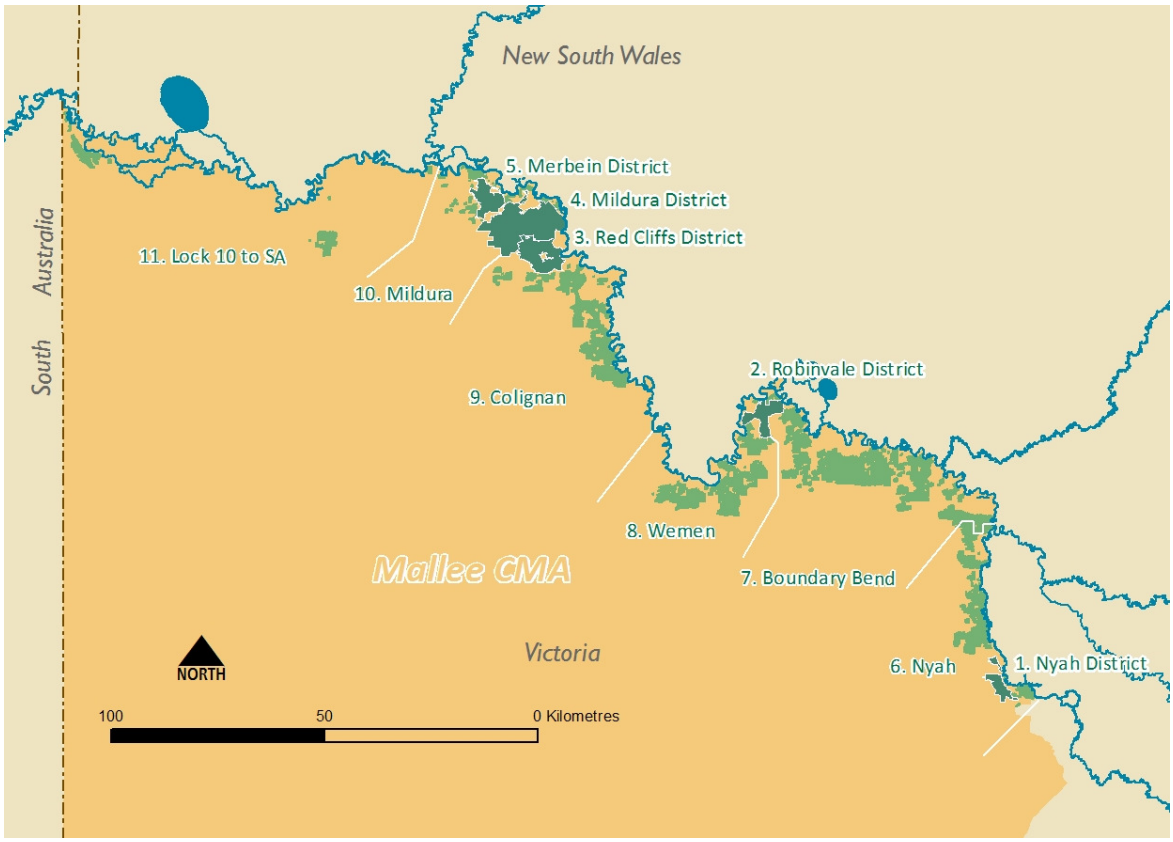
Pumped Irrigation Districts

1. Nyah Irrigation District
2. Robinvale Irrigation District
3. Red Cliffs Irrigation District
4. Mildura Irrigation District
5. Merbein Irrigation District

River Reaches (private diverters)

6. Nyah River Reach - Nyah to the Wakool River junction
7. Boundary Bend River Reach - Wakool River junction to the Euston weir
8. Wemen River Reach - Euston weir to Liparoo
9. Colignan River Reach - Colignan to Yatpool
10. Mildura River Reach - Mildura to Lock 10
11. Lock 10 to SA River Reach - Lock 10 to the South Australian border

Map 1 – Study areas of the 2012 Crop Report



1. Victorian Murray Mallee - Summary

In summary for irrigated horticulture in the Victorian Murray Mallee from 1997 to 2012

Irrigation properties

- The Victorian Murray Mallee has approximately 2,159 irrigation properties. Average property size (irrigable area) is 33.6 hectares.
- 79% of properties are in the pumped irrigation districts and 21% of properties are private diverters. Average property size is 10.1 hectares in the pumped district and 116.5 hectares for private diverters.
- There were 293 fewer irrigation properties in 2012 than in 1997; a 12% decline in property numbers.
- The average property size (irrigable area) more than doubled from 16.4 hectares in 1997 to 33.6 hectares in 2012.

Irrigable area

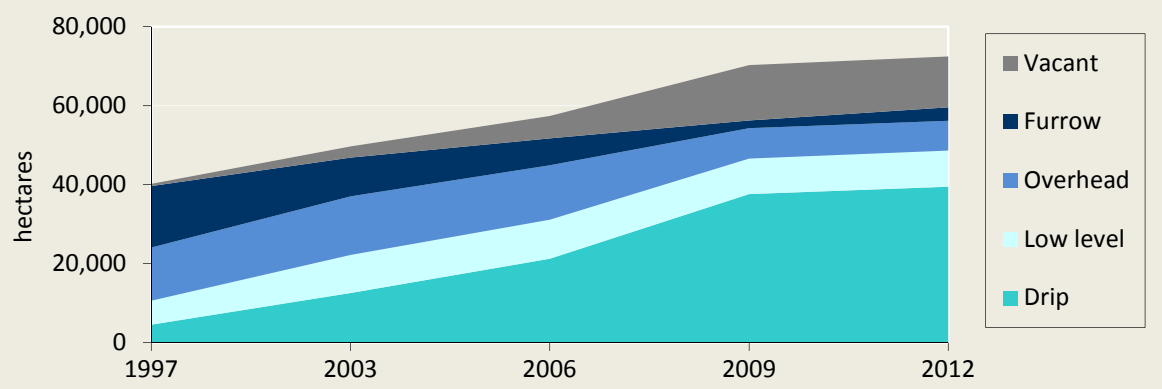
- In 2012 the irrigable area in the Victorian Murray Mallee was 72,450 hectares. Between 1997 and 2012 there was an 80% increase in the irrigable area (from 40,225 hectares in 1997).
- 82%, (59,590 hectares) was irrigated in the 2011-12 season and 18% (12,860 hectares) was vacant but previously irrigated and still irrigable.
- Of the 18% vacant area; 11% was previously permanent plantings and 7% was previously seasonal plantings.
- The overall increase of 32,225 hectares since 1997 comprised 33,575 hectares of new irrigation areas, minus 1,350 hectares of land retired from irrigation (i.e. a change in land use precluding it from irrigating such as urban development, housing, sheds and dams).

Dominant crop types and change

- Grapevines remained the dominant crop from 1997 to 2012, even though the total area of vines decreased by 345 hectares in this period.
- Grapevines were predominantly grown for wine production from 1997 to 2012. Wine grape plantings peaked around 2006 then decreased by 4,145 hectares between 2006 and 2012.
- Table grape plantings increased by 2,410 hectares and dried vine fruit plantings decreased by 3,335 hectares between 1997 and 2012.
- Nut trees (99% almonds) were a close second to grapevines in area dominance in 2012. (Grapevines were 29% (20,845 hectares) of the irrigable area and nut trees were 28% (20,575 hectares) of the irrigable area.) Nut tree plantings increased by 18,455 hectares between 1997 and 2012.
- Plantings of fruit trees (excluding citrus) increased by 3,950 hectares between 1997 and 2012. This increase was principally due to olive tree plantings.
- The area planted to annual crops (vegetables and field crops) reduced in the drought period between 2006 and 2009, but recovered by 2012.

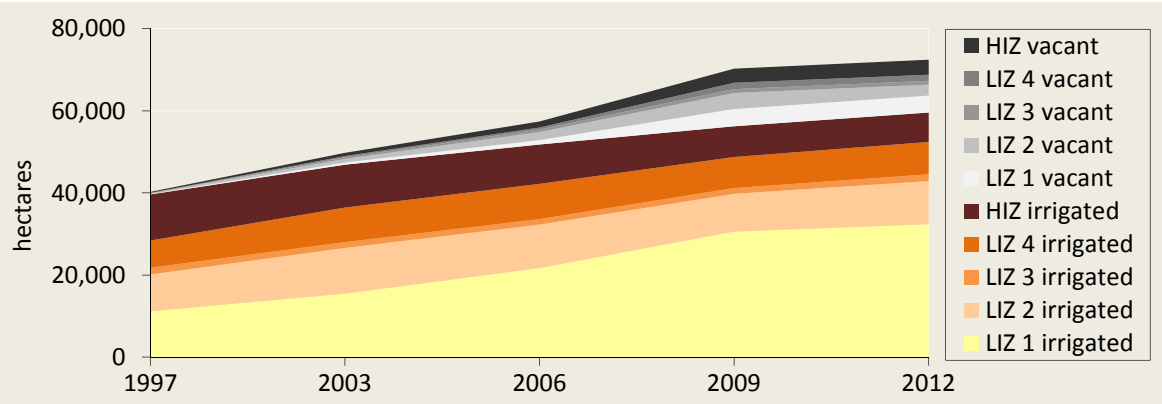
Dominant irrigation methods and change

- The dominant irrigation method changed from furrow irrigation in 1997, to overhead sprinklers by 2003 and then to drip irrigation by 2006. Drip irrigation has remained the dominant irrigation method since 2006.
- Drip irrigation increased from 4,550 hectares in 1997 to 39,525 hectares (55% of the irrigable area and 66% of the irrigated area) in 2012.
- Furrow and flood irrigation decreased by 12,205 hectares between 1997 and 2012; from 15,605 hectares in 1997 to 3,400 hectares in 2012.
- The proportion of irrigated land under furrow or flood irrigation decreased to less than 3% by 2009. The decrease was most apparent in the Nyah River Reach, and due to withholding from irrigating of broad-acre field crops during the drought and low water allocations.



Salinity impact zones

- Irrigated crops in the Victorian Murray Mallee are predominantly (50%) grown in the lowest river salinity impact zone, LIZ 1.
- Irrigation development from 1997 to 2012 predominantly occurred in LIZ 1.
- 15% of the irrigable area is in the high salinity impact zone, HIZ.
- The irrigable area in the HIZ decreased by 550 hectares between 1997 and 2012.



1.1 Victorian Murray Mallee crop types in 2012

Crops irrigated in the 2011-12 season along the Murray River in the Victorian Mallee catchment are shown in Figure 1.

Areas were classified as 'vacant' if they were irrigated prior to 2011-12, and could potentially be irritated again, but were vacant or not irrigated in 2011-12. Vacant areas may be in redevelopment, or may have been abandoned.

Figure 1 – Irrigated crops in the Victorian Murray Mallee in 2012

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	11,405	16%	
	Table	6,630	9%	
	Dried	2,785	4%	
	Other	25	0%	
Citrus		3,810	5%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other Orange, Pummelo, Tangelo, Valencia
Fruit tree	***unspecified***	80	0%	
	Avocado	405	1%	
	Olive	3,760	5%	
	Stone fruit	525	1%	Apricot, Nectarine, Peach, Plum
	Other	125	0%	Apple, Date Palm, Fig, Jujube, Mango, Persimmon, Pomegranate, Tamarillo
Nut tree	Almond	20,305	28%	
	Other	270	0%	Pecan, Pistachio, Walnut
Other	Nursery	185	0%	
	Woodlot	250	0%	
	Other	30	0%	Arboretum, Flowers, Native Plants, Passionfruit, Roses
Field crop	***unspecified***	2,260	3%	
	Other	1,345	2%	Cereal, Lucerne, Hay, Lucerne, Maize, Oats, Pasture, Turf
Vegetable	***unspecified***	1,155	2%	
	Asparagus	350	0%	
	Carrot	2,110	3%	
	Potato	1,270	2%	
	Other	510	1%	Beetroot, Broccoli, Butternut, Cabbage, Capsicum, Chili, Corn, Eggplant, Garlic, Melon, Pumpkin, Rockmelon, Salad Greens, Strawberry, Tomato, Zucchini
Vacant S		5,255	7%	*Vacant S – previously a seasonal planting*
Vacant P		7,605	11%	*Vacant P – previously a permanent planting*
Total		**72,450**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

1.2 Victorian Murray Mallee – crop type change

Figure 2 summarises crop types across the Victorian Murray Mallee from 1997 to 2012.

- The irrigable area in the 2011-12 irrigation season was 72,450 hectares; 82% (59,590 hectares) irrigated and 18% (12,860 hectares) vacant but previously irrigated and still irrigable.
- Of the 18% vacant area; 11% was previously permanent plantings and 7% was previously seasonal plantings.
- The irrigable area expanded between 1997 and 2012 from 40,225 to 72,450 hectares; an 80% (32,225 hectare) increase. Only 3% of this expansion occurred after 2009.
- Grapevines remained the dominant crop from 1997 to 2012, even though the area of vines decreased by 345 hectares in this period.
- Nut trees (99% almonds) were a close second to grapevines in area dominance in 2012. Nut tree plantings increased by 18,455 hectares between 1997 and 2012.

Figure 2 – Crop types in the Victorian Murray Mallee from 1997 to 2012

	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	21,190	25,300	25,680	21,935	20,845	29%	-345
	Citrus	4,000	3,835	3,985	3,720	3,810	5%	-190
	Fruit Tree	945	1,615	2,175	4,850	4,895	7%	+3,950
	Nut Tree	2,120	4,345	9,220	19,935	20,575	28%	+18,455
	Other	595	685	740	555	465	1%	-130
Seasonal	Field Crop	6,725	5,020	3,975	920	3,605	5%	-3,120
	Vegetable	4,055	6,085	5,955	4,290	5,395	7%	+1,340
Vacant	Vacant S	410	1,980	3,780	7,640	5,255	7%	+4,845
	Vacant P	185	900	1,860	6,405	7,605	11%	+7,420
Total (ha)		**40,225**	**49,765**	**57,370**	**70,250**	**72,450**	**100%**	**+32,225**
% Vacant		**1%**	**6%**	**10%**	**20%**	**18%**		

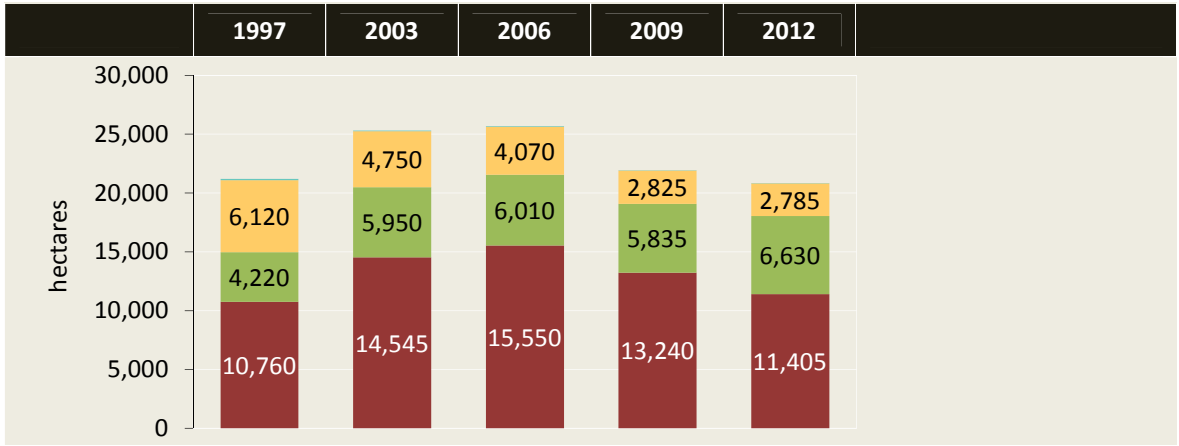
Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

1.3 Victorian Murray Mallee - grapevines

Figure 3 summarises grapevine types across the Victorian Murray Mallee from 1997 to 2012. Grapevines remained the dominant crop from 1997 to 2012.

- Wine grapes continue to be the main type of grapevine across the Victorian Murray Mallee. Wine grape plantings peaked around 2006 but decreased by 4,145 hectares between 2006 and 2012 with a net expansion of 6% (645 hectares) between 1997 and 2012.
- Table grape plantings expanded by 57% (2,410 hectares) between 1997 and 2012.
- Dried vine fruit plantings decreased by 54% (3,335 hectares) between 1997 and 2012.
- The total area of vines decreased by 2% (345 hectares) between 1997 and 2012.

Figure 3 – Hectares of grapevines grown in the Victorian Murray Mallee from 1997 to 2012



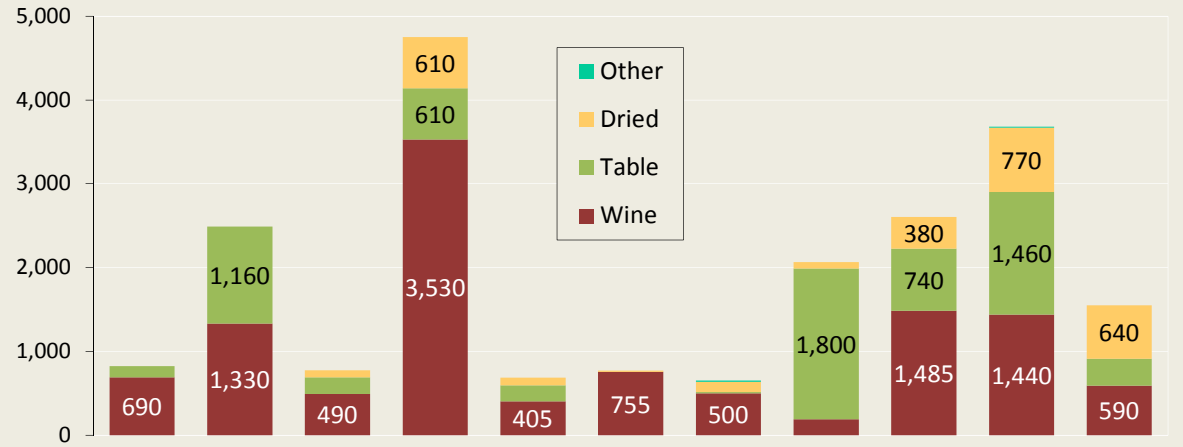
Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	10,760	14,545	15,550	13,240	11,405	55%	+645
Table	4,220	5,950	6,010	5,835	6,630	32%	+2,410
Dried	6,120	4,750	4,070	2,825	2,785	13%	-3,335
Other	90	55	50	35	25	0%	-65
Total (ha)	**21,190**	**25,300**	**25,680**	**21,935**	**20,845**	**100%**	**-345**

Note: 'Other' includes grapes for juicing, research and cannery.

Grapevines in 2012 in each of the study areas

Figure 4 summarises grapevine types in 2012 in each of the eleven Victorian Murray Mallee study areas.

Figure 4 – Hectares of grapevines grown in each of the Murray Mallee study areas in 2012



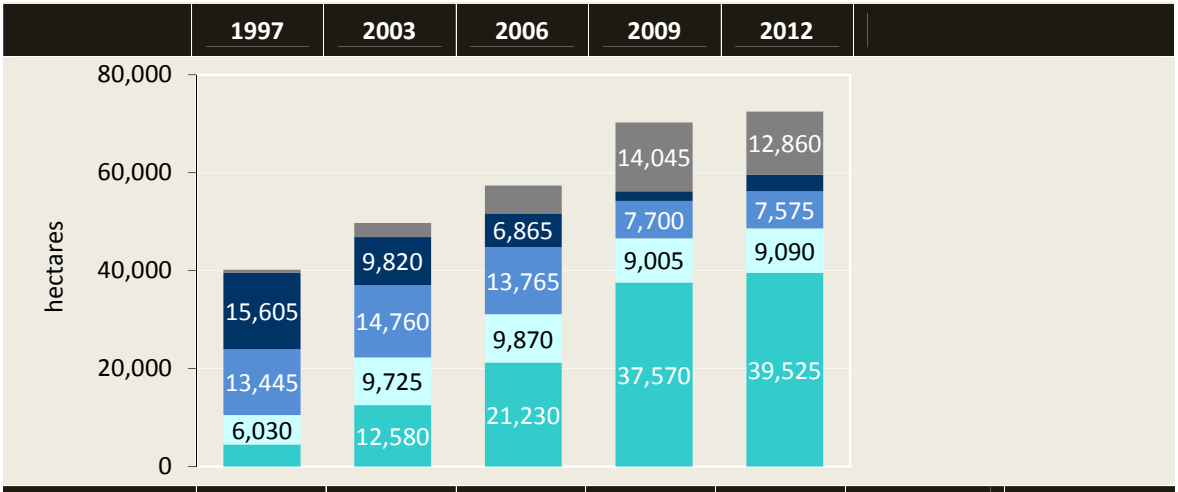
2012 ha	Nyah	B. Bend	Wemen	Colignan	Mildura	L10-SA	Nyah	Robinvale	RedCliffs	Mildura	Merbein
	825	2,490	775	4,750	685	770	650	2,065	2,605	3,680	1,550
% of 2012 total	4%	12%	4%	23%	3%	4%	3%	10%	12%	18%	7%
	Private Diverters 49% of grape ha						Pumped Districts 51% of grape ha				
Dominant use	wine	wine	wine	wine	wine	wine	wine	table	wine	table	dried
	wine						table				

1.4 Victorian Murray Mallee - irrigation methods

Figure 5 summarises irrigation methods across the Victorian Murray Mallee from 1997 to 2012.

- The dominant irrigation method changed from furrow irrigation in 1997, to overhead sprinklers by 2003 and then to drip irrigation by 2006. Drip irrigation has remained the dominant irrigation method since 2006.
- Drip irrigation increased from 4,550 hectares in 1997 to 39,525 hectares (55% of the irrigable area and 66% of the irrigated area) in 2012.
- Furrow and flood irrigation decreased by 12,205 hectares between 1997 and 2012; from 15,605 hectares in 1997 to 3,400 hectares in 2012.
- The proportion of irrigated land under furrow or flood irrigation decreased to less than 3% by 2009. The decrease was most apparent in the Nyah River Reach, and due to withholding from irrigating of broad-acre field crops during the drought and low water allocations. A return to 5% furrow/flood irrigation by 2012 corresponds to improved water availability for broad-acre field crops.

Figure 5 – Irrigation methods in the Victorian Murray Mallee from 1997 to 2012

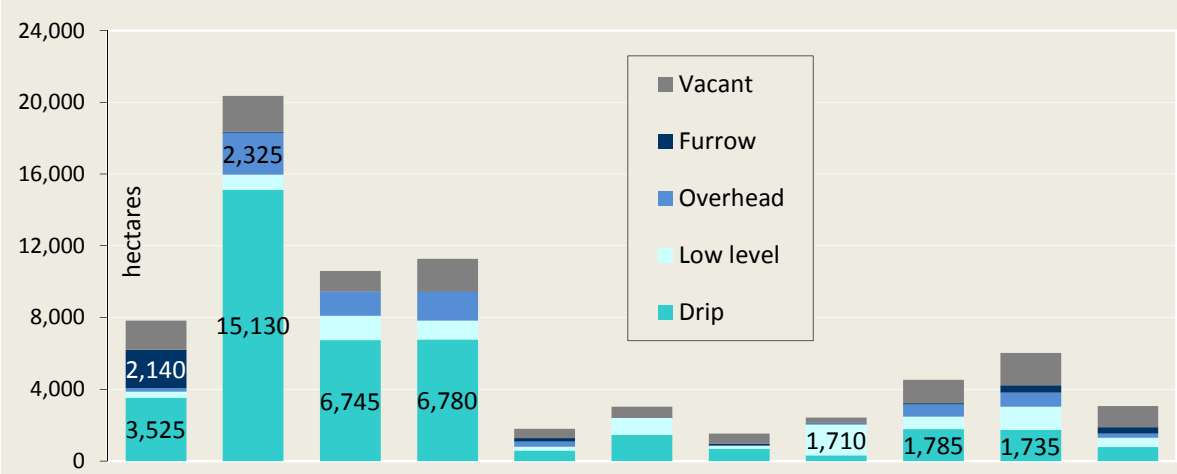


Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	4,550	12,580	21,230	37,570	39,525	55%	+34,975
Low level	6,030	9,725	9,870	9,005	9,090	12%	+3,060
Overhead	13,445	14,760	13,765	7,700	7,575	10%	-5,870
Furrow	15,605	9,820	6,865	1,930	3,400	5%	-12,205
Vacant	595	2,880	5,640	14,045	12,860	18%	+12,265
Total (ha)	**40,225**	**49,765**	**57,370**	**70,250**	**72,450**	**100%**	**+32,225**

Irrigation methods in 2012 in each of the study areas

Figure 6 compares irrigation methods in 2012 in each of the eleven Victorian Murray Mallee study areas.

Figure 6 – Irrigation methods in 2012 in each of the study areas



2012 ha	Nyah	B. Bend	Wemen	Colignan	Mildura	L10-SA	Nyah	Robinvale	RedCliffs	Mildura	Merbein
	7,835	20,365	10,590	11,270	1,790	3,030	1,535	2,425	4,520	6,030	3,060
% of 2012 total	11%	28%	15%	16%	2%	4%	2%	3%	6%	8%	4%
	Private Diverters 76% of irrigable area						Pumped Districts 24% of irrigable area				
Dominant Method	drip	drip	drip	drip	drip	drip	drip	low level	drip	drip	drip

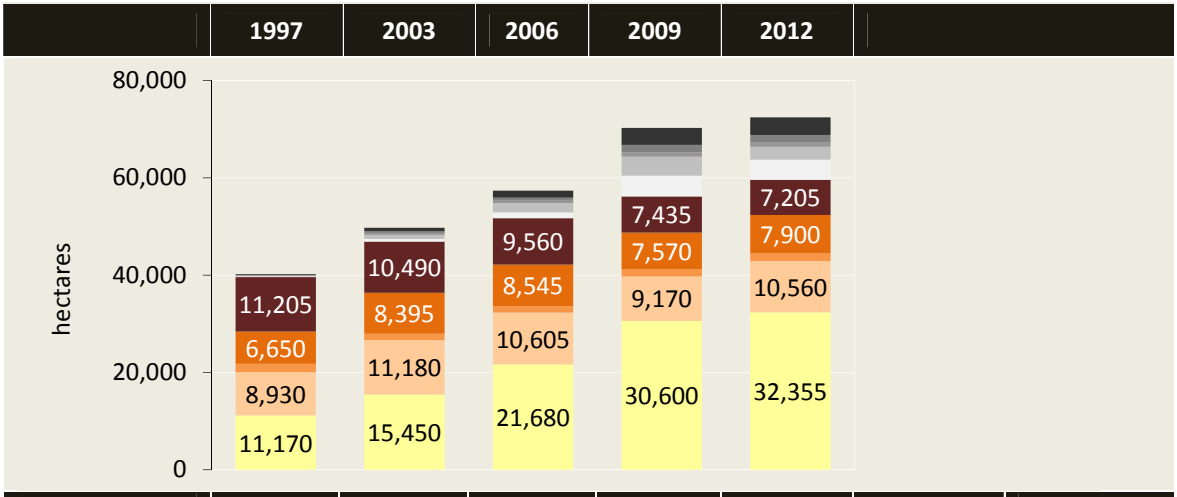
Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

1.5 Victorian Murray Mallee - salinity impact zones

Figure 7 summarises the irrigable area in each river salinity impact zone across the Victorian Murray Mallee from 1997 to 2012.

- Irrigated crops in the Victorian Murray Mallee are predominantly (50% of the irrigable area in 2012) grown in the lowest river salinity impact zone, LIZ 1
- 15% of the irrigable area is in the high salinity impact zone, HIZ
- In 2012, the area irrigated in the HIZ was 4,000 hectares less than the area in 1997
- The decrease in irrigable area in the HIZ from 1997 to 2012 (550 hectares) is the balance of retired HIZ areas and an increase in the irrigable area on existing HIZ properties due to more efficient irrigation and effective planting layouts, removal of drying racks, headlands etc.

Figure 7 – Hectares within each salinity impact zone in the Murray Mallee from 1997 to 2012



Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	11,170	15,450	21,680	30,600	32,355	44%	+21,185
	LIZ 2	8,930	11,180	10,605	9,170	10,560	15%	+1,630
	LIZ 3	1,675	1,370	1,340	1,430	1,570	2%	-105
	LIZ 4	6,650	8,395	8,545	7,570	7,900	11%	+1,250
	HIZ	11,205	10,490	9,560	7,435	7,205	10%	-4,000
Not Irrigated	LIZ 1	95	555	1,165	4,225	4,130	6%	+4,035
	LIZ 2	175	850	1,920	3,900	2,655	4%	+2,480
	LIZ 3	40	385	640	915	885	1%	+845
	LIZ 4	95	325	460	1,555	1,550	2%	+1,455
	HIZ	190	765	1,455	3,450	3,640	5%	+3,450
Total (ha)		**40,225**	**49,765**	**57,370**	**70,250**	**72,450**	**100%**	**+32,225**

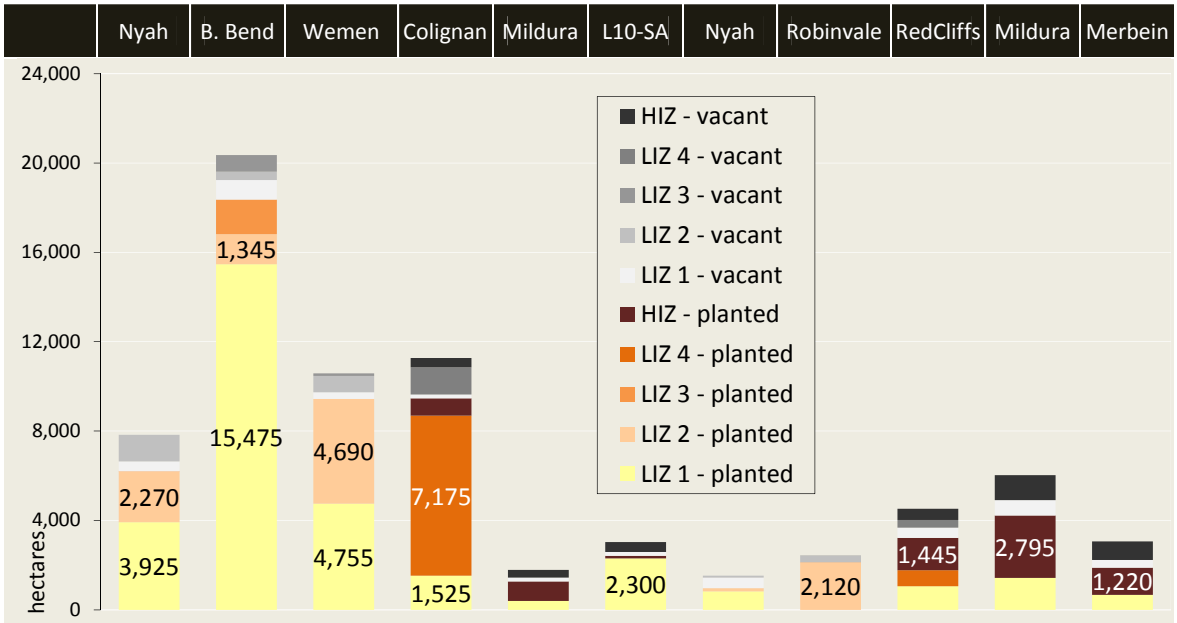
Salinity zones in 2012 in each of the study areas

Figure 8 compares the salinity impact zones in each of the eleven Victorian Murray Mallee study areas in 2012.

The total irrigable area in the high salinity impact zone (HIZ) is 10,850 hectares:

- 27% of the HIZ area is in the private diverter areas
- 73% of the HIZ area is in the pumped irrigation districts

Figure 8 – Hectares of each salinity impact zone in each of the study areas in 2012

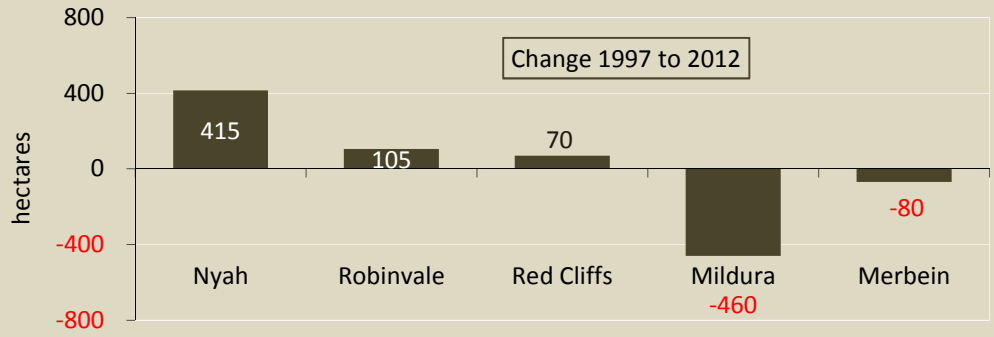
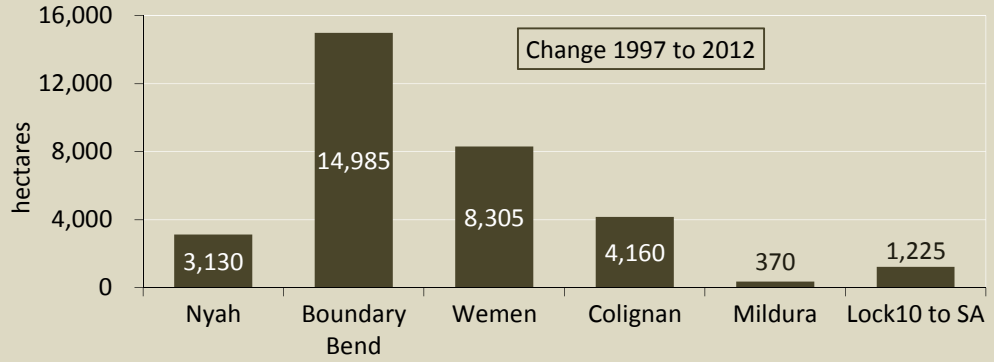


	Nyah	B. Bend	Wemen	Colignan	Mildura	L10-SA	Nyah	Robinvale	RedCliffs	Mildura	Merbein
Total 2012 ha	7,835	20,365	10,590	11,270	1,790	3,030	1,535	2,425	4,520	6,030	3,060
HIZ ha	0	0	0	1,170	1,225	545	0	0	1,950	3,910	2,045
% of HIZ total	0%	0%	0%	11%	11%	5%	0%	0%	18%	36%	19%
	Private Diverters 27% of the HIZ area						Pumped Districts 73% of the HIZ area				
Dominant zone	LIZ 1	LIZ 1	LIZ 2	LIZ 4	HIZ	LIZ 1	LIZ 1	LIZ 2	HIZ	HIZ	HIZ
	LIZ 1						HIZ				

1.6 Victorian Murray Mallee – irrigation development

Figure 9 summarises irrigation development with respect to new and retired areas across the Victorian Murray Mallee from 1997 to 2012.

Figure 9 – Irrigation development in the Victorian Murray Mallee from 1997 to 2012

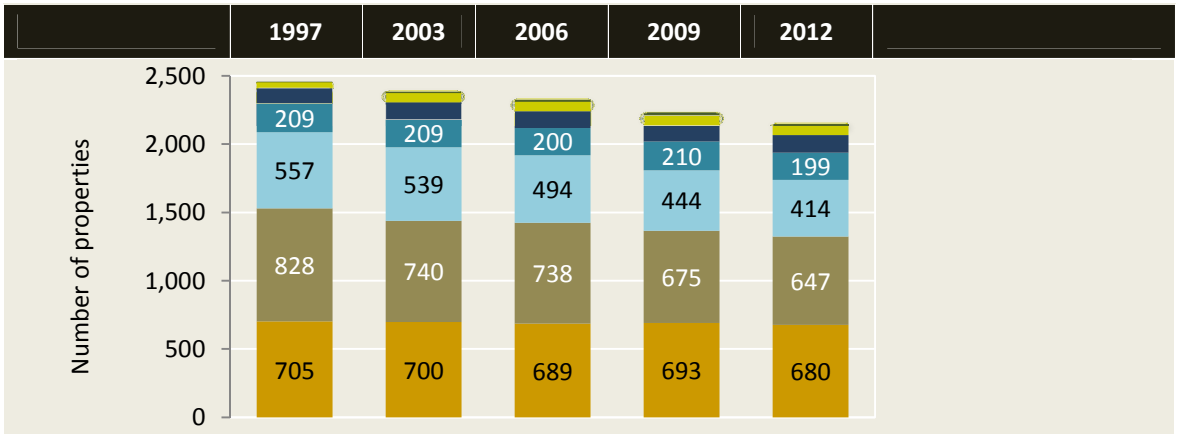
	Study area	1997 (ha)	1997 to 2012		2012 (ha)	Change 1997-2012	Growth 1997-2012
			Retired	New			
Pumped irrigation districts	Nyah	1,120	-10	+425	1,535	+415	+37%
	Robinvale	2,320	-20	+125	2,425	+105	+5%
	Red Cliffs	4,450	-95	+165	4,520	+70	+2%
	Mildura	6,490	-665	+205	6,030	-460	-7%
	Merbein	3,140	-95	+15	3,060	-80	-3%
	Total	**17,520**	**-885**	**+935**	**17,570**	**+50**	**0%**
							
Private diverters	Nyah	4,705	-20	+3,150	7,835	+3,130	+67%
	Boundary Bend	5,380	-145	+15,130	20,365	+14,985	+279%
	Wemen	2,285	-40	+8,345	10,590	+8,305	+363%
	Colignan	7,110	-55	+4,215	11,270	+4,160	+59%
	Mildura	1,420	-55	+425	1,790	+370	+26%
	Lock10 to SA	1,805	-150	+1,375	3,030	+1,225	+68%
	Total	**22,705**	**-465**	**+32,640**	**54,880**	**+32,175**	**+142%**
							
Vic Murray Mallee Total		**40,225**	**-1,350**	**+33,575**	**72,450**	**+32,225**	**+80%**

1.7 Victorian Murray Mallee - property change

Figure 10 provides estimates of property numbers and average property size (irrigable area) across the Victorian Murray Mallee from 1997 to 2012.

- The Victorian Murray Mallee has approximately 2,159 irrigation properties. Average property size (irrigable area) is 33.6 hectares.
- 79% of properties are in the pumped irrigation districts and 21% of properties are private diverters. Average property size is 10.1 hectares and 116.5 hectares respectively.
- There were 293 fewer irrigation properties in 2012 than in 1997; a 12% decline in property numbers.
- The average property size (irrigable area) more than doubled; from 16.4 hectares in 1997 to 33.6 hectares in 2012.

Figure 10 - Property changes in the Victorian Murray Mallee from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	705	700	689	693	680	31%	-25
5 to 10 ha	828	740	738	675	647	30%	-181
10 to 20 ha	557	539	494	444	414	19%	-143
20 to 40 ha	209	209	200	210	199	9%	-10
40 to 100 ha	107	123	122	124	128	6%	+21
100 to 500 ha	41	61	69	70	74	3%	+33
> 500 ha	5	11	15	17	17	1%	+12
Total properties	**2,452**	**2,383**	**2,327**	**2,233**	**2,159**	**100%**	**-293**
Average size (ha)	**16.4**	**20.9**	**24.7**	**31.5**	**33.6**		

	2012 Properties	%	Ave. size
Pumped districts	1,739	79%	10.1
Private diverters	471	21%	116.5

Note: Total property numbers across the Victorian Murray Mallee are less than the sum of property numbers in each of the eleven study areas as some property owners have irrigated land in more than one study area.

2. Pumped Irrigation Districts - Summary

In summary for the Pumped Irrigation Districts; Nyah, Robinvale, Red Cliffs, Mildura and Merbein

- In 2012 there are approximately 1,739 properties in the pumped irrigation districts. The average property size (irrigable area) is 10.1 hectares.
- The irrigable area increased by 0.3% (50 hectares) between 1997 and 2012 (from 17,520 to 17,570 hectares)
- 29% (5,135 hectares) of the irrigable area was vacant in the 2011-12 irrigation season.
    - 25% was previously permanent plantings
    - 4% was previously seasonal plantings.
- Grapevines grown for wine production were the dominant crop type from 1997 to 2009. By 2012, table grape plantings became the dominant crop.
- In 1997 the dominant irrigation method was furrow irrigation. By 2006 this had changed to low level sprinklers, then to drip irrigation by 2012.
    - The area of drip irrigation increased by 4,465 hectares between 1997 and 2012
    - Furrow irrigation decreased by 8,445 hectares between 1997 and 2012
    - Only 6% (990 ha) of the irrigable area was furrow irrigated in 2012
- Irrigable areas are predominantly (45%) in the high salinity impact zone, HIZ.
- The irrigable area in the HIZ decreased by 570 hectares between 1997 and 2012.

2.1 Pumped Irrigation Districts crop types in 2012

Crops irrigated in the 2011-2012 season across the five pumped irrigation districts are shown in Figure 11.

Figure 11 – Irrigated crops in the pumped irrigation districts in 2012

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	4,205	24%	
	Table	4,335	25%	
	Dried	1,985	11%	
	Other	25	0%	
Citrus		265	2%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other Orange, Tangelo, Valencia
Fruit tree	***unspecified***	25	0%	
	Avocado	75	0%	
	Olive	120	1%	
	Stone fruit	55	0%	Apricot, Nectarine, Peach, Plum
	Other	60	0%	Date Palm, Fig, Mango, Persimmon, Pomegranate
Nut tree	Almond	145	1%	
	Other	50	0%	Pecan, Pistachio, Walnut
Other	Nursery	75	0%	
	Woodlot	30	0%	
	Other	20	0%	Flowers, Native Plants, Passionfruit, Roses
Field crop	***unspecified***	90	1%	
	Other	325	2%	Cereal, Lucerne, Oats, Pasture, Turf
Vegetable	***unspecified***	335	2%	
	Asparagus	135	1%	
	Carrot	-	-	
	Potato	-	-	
	Other	80	0%	Capsicum, Chili, Corn, Eggplant, Melon, Pumpkin, Zucchini
Vacant S		785	4%	*Vacant – previously a seasonal planting*
Vacant P		4,350	25%	*Vacant – previously a permanent planting*
Total		**17,570**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

2.2 Pumped Districts summary - crop type change

Figure 12 summarises crop types across the Mallee pumped irrigation districts of Nyah, Robinvale Red Cliffs, Mildura and Merbein from 1997 to 2012.

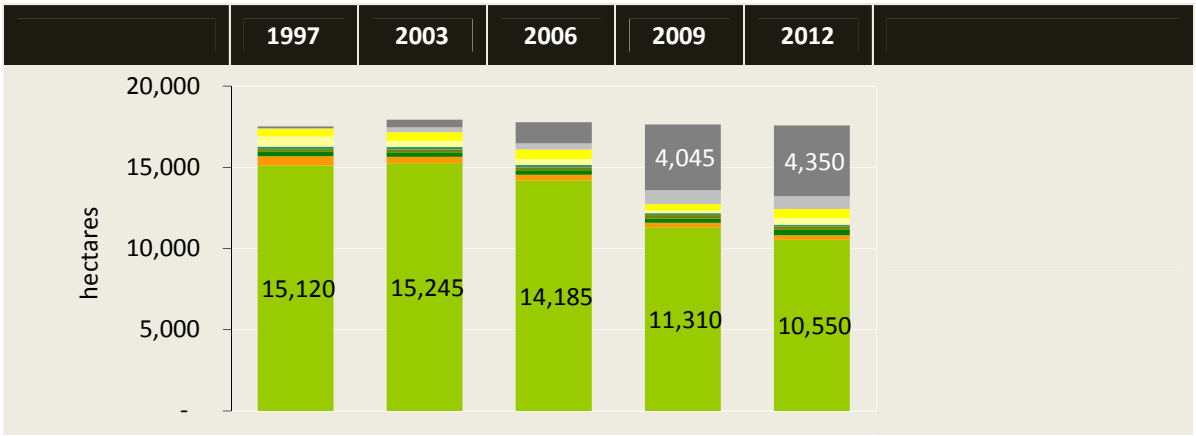
In the 2011-12 irrigation season the irrigable area was 17,570 hectares of which:

- 71% (12,435 hectares) was irrigated;
- 29% (5,135 hectares) was vacant or not irrigated.

The irrigable area increased by 0.3% (50 hectares) from 17,520 hectares in 1997 to 17,570 hectares in 2012.

Grapevines remained the dominant crop type from 1997 to 2012.

Figure 12 – Changes in crop type in the pumped irrigation districts between 1997 and 2012



	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	15,120	15,245	14,185	11,310	10,550	60%	-4,570
	Citrus	555	400	355	280	265	2%	-290
	Fruit Tree	300	285	275	260	335	2%	+35
	Nut Tree	140	165	180	215	195	1%	+55
	Other	160	155	150	105	125	1%	-35
Seasonal	Field Crop	625	380	365	185	415	2%	-210
	Vegetable	455	540	580	380	550	3%	+95
Vacant	Vacant S	60	290	385	860	785	4%	+725
	Vacant P	105	475	1,290	4,045	4,350	25%	+4,245
Total (ha)		**17,520**	**17,935**	**17,765**	**17,640**	**17,570**	**100%**	**+50**
% Vacant		**1%**	**4%**	**9%**	**28%**	**29%**		

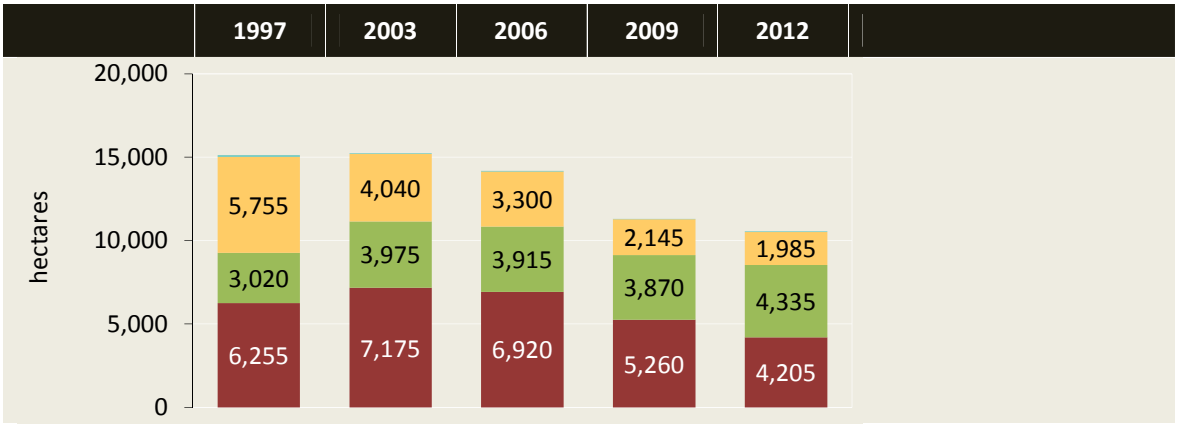
Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

2.3 Pumped Districts summary - grapevines

Figure 13 summarises grape use across the Mallee pumped irrigation districts from 1997 to 2012. Figure 14 compares grape use in each of the irrigation districts in 2012.

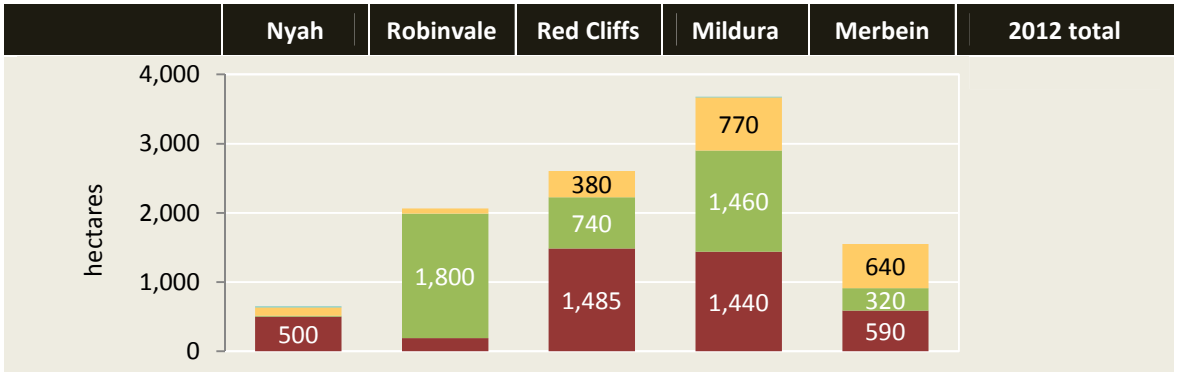
- From 1997 to 2009 grapevines had predominantly been grown for wine production.
- By 2012, table grapes replaced wine grapes as the dominant grapevine planting across the pumped irrigation districts.
- The area planted to dried vine fruit decreased by 65% (3,770 hectares) between 1997 to 2012 (from 5,755 to 1,985 hectares)

Figure 13 – Grape use in the pumped districts from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	6,255	7,175	6,920	5,260	4,205	40%	-2,050
Table	3,020	3,975	3,915	3,870	4,335	41%	+1,315
Dried	5,755	4,040	3,300	2,145	1,985	19%	-3,770
Other	90	55	50	35	25	0%	-65
Total (ha)	**15,120**	**15,245**	**14,185**	**11,310**	**10,550**	**100%**	**-4,570**

Figure 14 – Grape use in each pumped irrigation district in 2012



	Nyah	Robinvale	Red Cliffs	Mildura	Merbein	2012 total
Grape hectares	650	2,065	2,605	3,680	1,550	**10,550**
% of 2012 total	6%	20%	25%	35%	15%	**100%**

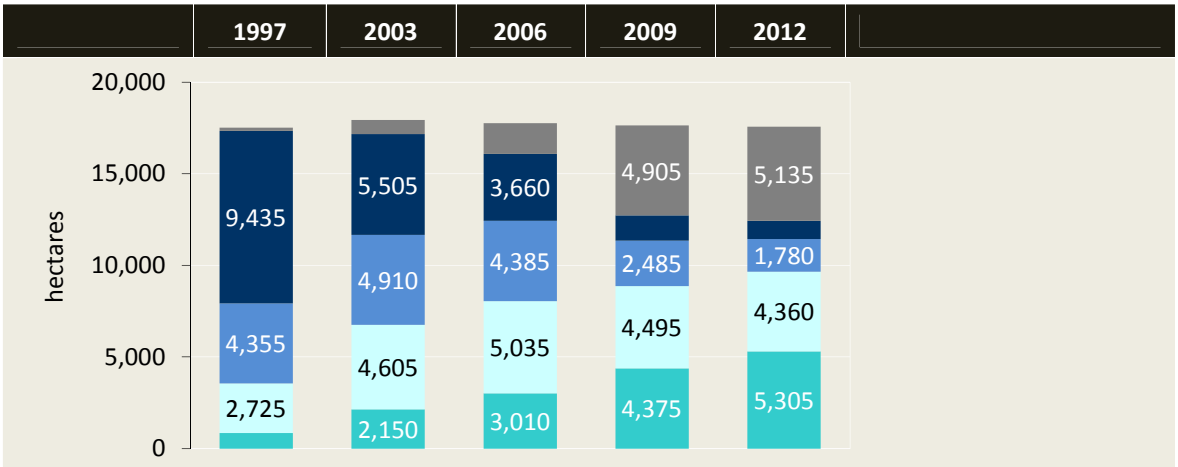
Note: 'Other' includes grapes for juicing, research and cannery.

2.4 Pumped Districts summary - irrigation methods

Figure 15 summarises irrigation methods across the pumped irrigation districts from 1997 to 2012. Figure 16 compares irrigation methods in each of the pumped irrigation districts in 2012.

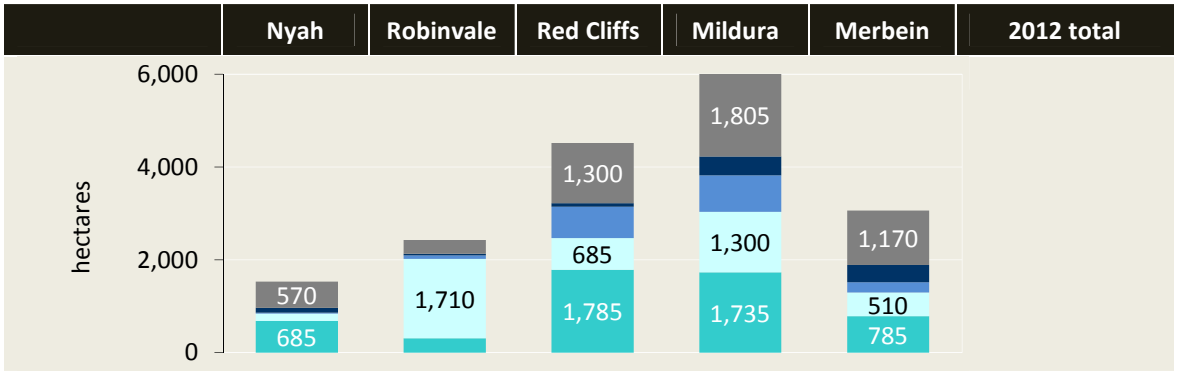
The dominant irrigation method changed from furrow irrigation in 1997 to low level sprinklers by 2006 and then to drip irrigation by 2012. Drip irrigation increased by 4,465 hectares between 1997 and 2012, while furrow irrigation decreased by 8,445 hectares. Only 6% (990 ha) of the irrigable area was furrow irrigated in 2012.

Figure 15 - Irrigation methods in the pumped districts from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	840	2,150	3,010	4,375	5,305	30%	+4,465
Low level	2,725	4,605	5,035	4,495	4,360	25%	+1,635
Overhead	4,355	4,910	4,385	2,485	1,780	10%	-2,575
Furrow	9,435	5,505	3,660	1,380	990	6%	-8,445
Vacant	165	765	1,675	4,905	5,135	29%	+4,970
Total (ha)	**17,520**	**17,935**	**17,765**	**17,640**	**17,570**	**100%**	**+50**

Figure 16 – Irrigation methods in each pumped irrigation district in 2012

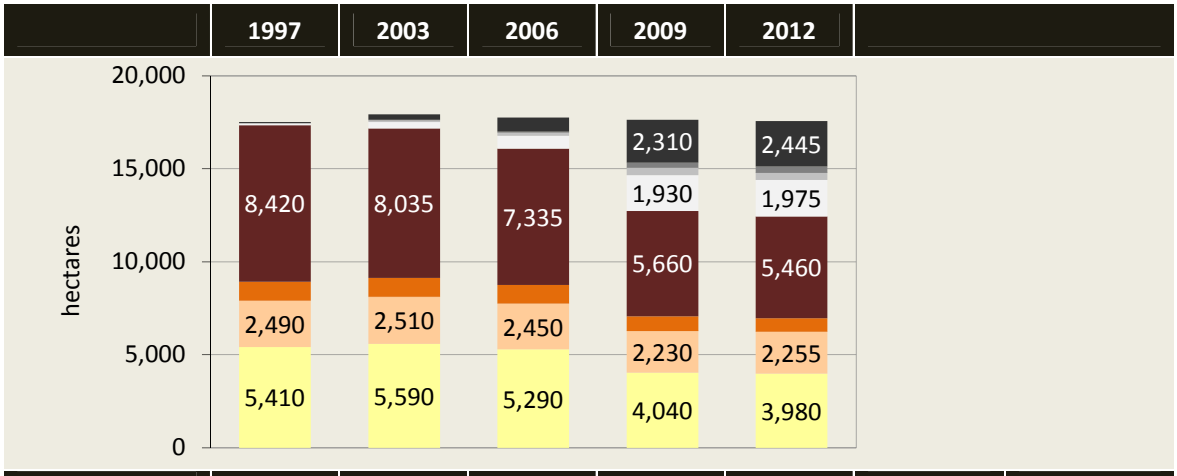


	Nyah	Robinvale	Red Cliffs	Mildura	Merbein	2012 total
hectares	**1,535**	**2,425**	**4,520**	**6,030**	**3,060**	**17,570**
% of 2012 total	**9%**	**14%**	**26%**	**34%**	**17%**	**100%**

2.5 Pumped Districts summary - salinity impact zones

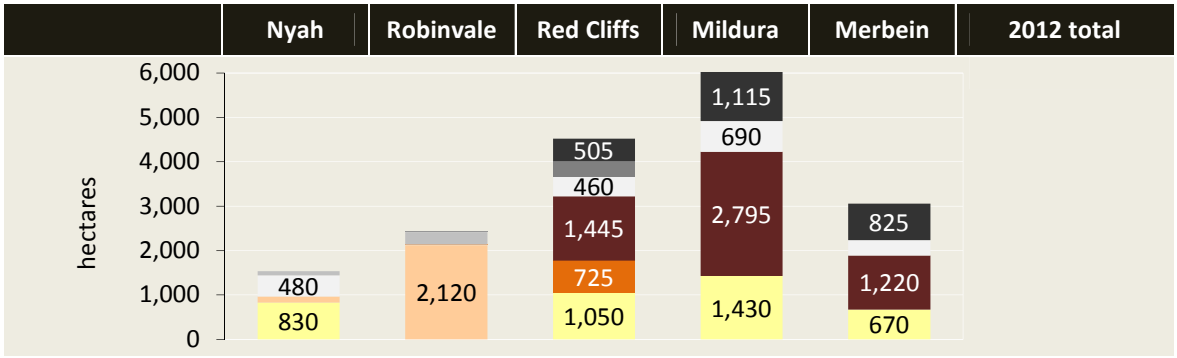
Figure 17 summarises the irrigable areas in each river salinity impact zone across the five pumped irrigation districts from 1997 to 2012.Figure 18 compares the zones in each pumped district in 2012. In the pumped districts, 45% of irrigable land is in the high salinity impact zone, HIZ. Overall, the irrigable area in the HIZ declined by 570 hectares between 1997 and 2012.

Figure 17 – Irrigable areas in each salinity impact zone in the pumped districts from 1997 to 2012



Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	5,410	5,590	5,290	4,040	3,980	23%	-1,430
	LIZ 2	2,490	2,510	2,450	2,230	2,255	13%	-235
	LIZ 3	20	20	20	15	15	0%	-5
	LIZ 4	1,015	1,015	995	790	725	4%	-290
	HIZ	8,420	8,035	7,335	5,660	5,460	31%	-2,960
Not Irrigated	LIZ 1	85	345	685	1,930	1,975	11%	+1,890
	LIZ 2	15	85	170	395	370	2%	+355
	LIZ 3	0	0	5	5	10	0%	+10
	LIZ 4	10	45	60	265	335	2%	+325
	HIZ	55	290	755	2,310	2,445	14%	+2,390
Total (ha)		**17,520**	**17,935**	**17,765**	**17,640**	**17,570**	**100%**	**+50**

Figure 18 – Hectares classed as high salinity impact (HIZ) within each pumped district in 2012



	Nyah	Robinvale	Red Cliffs	Mildura	Merbein	2012 total
HIZ hectares	0	0	1,950	3,910	2,045	**7,905**
% of HIZ total	0%	0%	25%	49%	26%	**100%**

2.6 Pumped Districts summary – irrigation development

Figure 19 summarises irrigation development with respect to new and retired areas across the Pumped Irrigation Districts from 1997 to 2012.

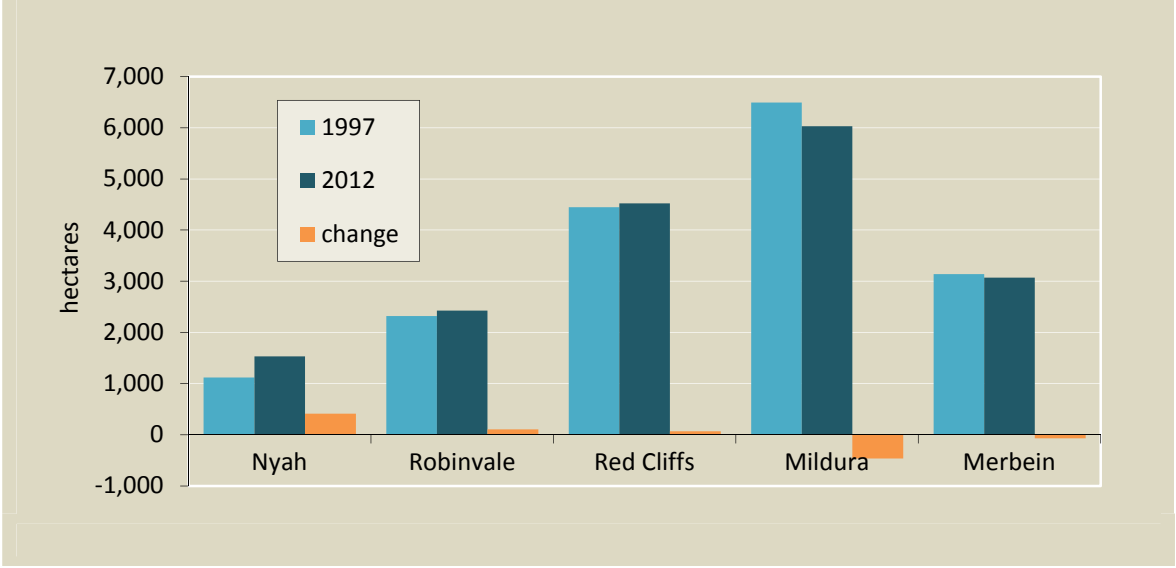
Between 1997 and 2012, the irrigable area in the Nyah, Robinvale and Red Cliffs Irrigation Districts increased by 37% (415 hectares), 5% (105 hectares) and 2% (70 hectares) respectively.

The irrigable area in the Mildura and Merbein Irrigation Districts decreased by 7% (460 hectares) and 3% (80 hectares) respectively.

Note that figures for the Nyah Irrigation District include all areas serviced by the district, but some areas may be outside the gazetted district boundary. This does not apply to other districts.

Figure 19 - Irrigation development in the pumped districts from 1997 to 2012

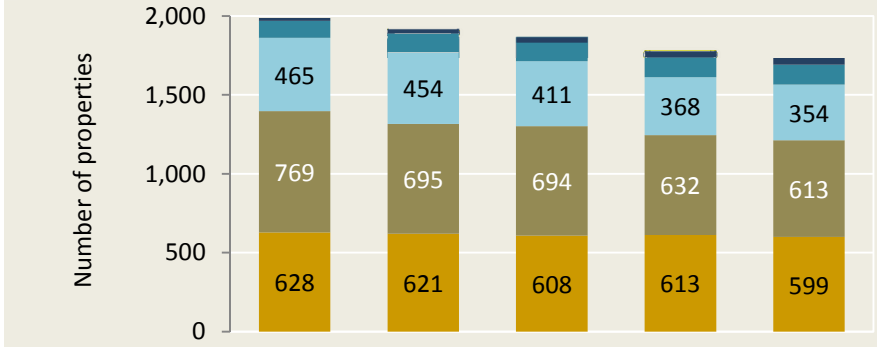
District	1997 (ha)	1997 to 2012		2012 (ha)	Change 1997-2012	Growth 1997-2012
		Retired	New			
Nyah	1,120	-10	+425	1,535	+415	+37%
Robinvale	2,320	-20	+125	2,425	+105	+5%
Red Cliffs	4,450	-95	+165	4,520	+70	+2%
Mildura	6,490	-665	+205	6,030	-460	-7%
Merbein	3,140	-95	+15	3,060	-80	-3%
Total	**17,520**	**-885**	**+935**	**17,570**	**+50**	**0%**



2.7 Pumped Districts summary – property change

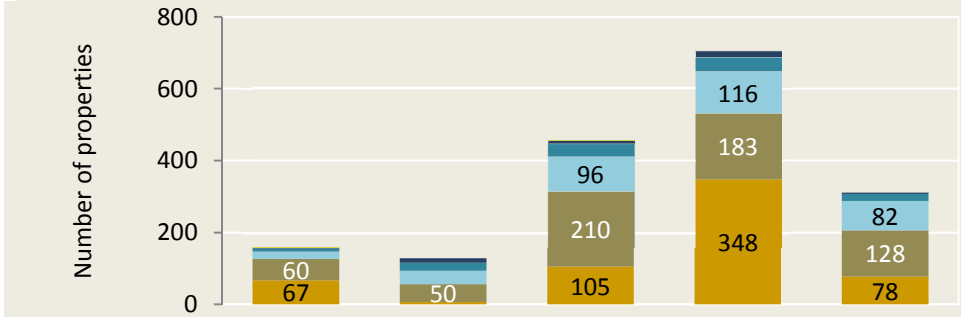
Figure 20 and Figure 21 provide estimates of property numbers and average property size (irrigable area) across the five pumped irrigation districts from 1997 to 2012. The pumped irrigation districts have approximately 1,739 irrigation properties (land holdings). Average property size (irrigable area) is 10.1 hectares.

Figure 20 – Property numbers and size in the pumped districts from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	628	621	608	613	599	34%	-29
5 to 10 ha	769	695	694	632	613	35%	-156
10 to 20 ha	465	454	411	368	354	20%	-111
20 to 40 ha	108	116	115	128	125	7%	+17
40 to 100 ha	17	29	37	40	45	3%	+28
100 to 500 ha	0	1	2	3	3	0%	+3
> 500 ha	-	-	-	-	-	-	-
Total properties	**1,987**	**1,916**	**1,867**	**1,784**	**1,739**	**100%**	**-248**
Average size (ha)	**8.8**	**9.4**	**9.5**	**9.9**	**10.1**		

Figure 21 - Property numbers and average size in the pumped districts in 2012



	Nyah	Robinvale	Red Cliffs	Mildura	Merbein	2012 total
Total properties	**160**	**128**	**455**	**705**	**310**	**1,758**
% of 2012 total	**9%**	**7%**	**26%**	**40%**	**18%**	**100%**
Average size (ha)	**9.6**	**18.9**	**9.9**	**8.6**	**9.9**	**10.0**

Note: Total property numbers across the pumped districts are less than the sum of districts as some property owners have irrigated land in more than one district.

3. Private Diverters - summary

In summary for Private Diverters; Nyah to South Australia

- There are approximately 471 irrigation properties (land holdings) in the private diverter areas from Nyah to the South Australian border. Average property size (irrigable area) is 116.5 hectares.
- In 2012 the irrigable area was 54,880 hectares of which 86% (47,155 hectares) was irrigated and 14% (7,725 hectares) was vacant or not irrigated.
- The 14% vacant area comprised 6% previously permanent plantings and 8% previously seasonal plantings.
- The irrigable area increased by 32,175 hectares between 1997 and 2012; comprising 465 hectares retired and 32,640 hectares of new areas not irrigated prior to 1997.
- The dominant crop type changed from field crops in 1997 to grapevines (predominantly wine grapes) by 2003 and then to nuts (almonds) by 2009.
- In 1997 the dominant irrigation method was overhead sprinklers. Since 2003 drip irrigation has been the dominant irrigation method.
- Drip irrigation increased by 30,510 hectares between 1997 and 2012, while furrow irrigation and overhead sprinklers decreased by 3,760 hectares and 3,295 hectares respectively.
- Irrigable areas are predominantly (56%) in the lowest salinity impact zone, LIZ 1.
- The irrigable area in the HIZ increased by 20 hectares between 1997 and 2012.

3.1 Private Diverters - crop types in 2012

Crop types managed by private diverters between Nyah and the South Australian border, during the 2011-12 irrigation season, are shown in Figure 22.

Figure 22 – Irrigated crops managed by private diverters in 2012

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	7,200	13%	
	Table	2,295	4%	
	Dried	800	1%	
Citrus		3,545	6%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other Orange, Pummelo, Tangelo, Valencia
Fruit tree	unspecified	55	0%	
	Avocado	330	1%	
	Olive	3,640	7%	
	Stone fruit	470	1%	Apricot, Nectarine, Peach, Plum
	Other	65	0%	Apple, Fig, Jujube, Mango, Persimmon, Pomegranate, Tamarillo
Nut tree	Almond	20,160	37%	
	Other	220	0%	Pistachio, Walnut
Other	Nursery	110	0%	
	Woodlot	220	0%	
	Other	10	0%	Arboretum, Flowers, Native trees
Field crop	unspecified	2,170	4%	
	Other	1,020	2%	Cereal, Hay-Oats, Lucerne, Maize, Pasture
Vegetable	unspecified	820	1%	
	Asparagus	215	0%	
	Carrot	2,110	4%	
	Potato	1,270	2%	
	Other	430	1%	Beetroot, Broccoli, Butternut, Cabbage, Garlic, Melon, Pumpkin, Rockmelon, Salad Greens, Strawberry, Tomato, Zucchini
Vacant S		4,470	8%	
Vacant P		3,255	6%	
Total		**54,880**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

3.2 Private Diverters summary - crop type change

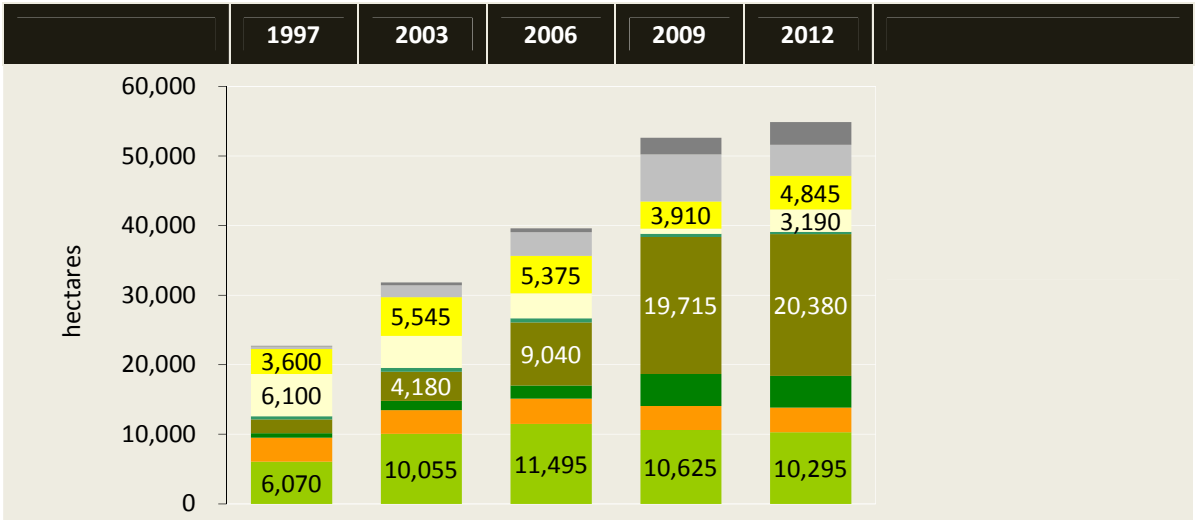
Figure 23 summarises crop types across the six private diverter study areas from 1997 to 2012.

The irrigable area in the 2011-12 irrigation season was 54,880 hectares; 86% (47,155 hectares) irrigated and 14% (7,725 hectares) vacant but previously irrigated and still irrigable.

The irrigable area increased between 1997 and 2012 from 22,705 to 54,880 hectares; a 142% (32,175 hectare) increase. Only 7% of this expansion occurred after 2009.

In 1997 the dominant crop type was field crops. By 2003 this changed to grapevines (predominantly wine grapes). By 2009 nuts (almonds) became the dominant crop.

Figure 23 - Crop types in the private diverter study areas from 1997 to 2012



	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	6,070	10,055	11,495	10,625	10,295	19%	+4,225
	Citrus	3,445	3,435	3,630	3,440	3,545	6%	+100
	Fruit Tree	645	1,330	1,900	4,595	4,560	8%	+3,915
	Nut Tree	1,980	4,180	9,040	19,715	20,380	37%	+18,400
	Other	435	530	590	450	340	1%	-95
Seasonal	Field Crop	6,100	4,640	3,610	735	3,190	6%	-2,910
	Vegetable	3,600	5,545	5,375	3,910	4,845	9%	+1,245
Vacant	Vacant S	350	1,690	3,395	6,780	4,470	8%	+4,120
	Vacant P	80	425	570	2,360	3,255	6%	+3,175
Total		**22,705**	**31,830**	**39,605**	**52,610**	**54,880**	**100%**	**+32,175**
% Vacant		**2%**	**7%**	**10%**	**17%**	**14%**		

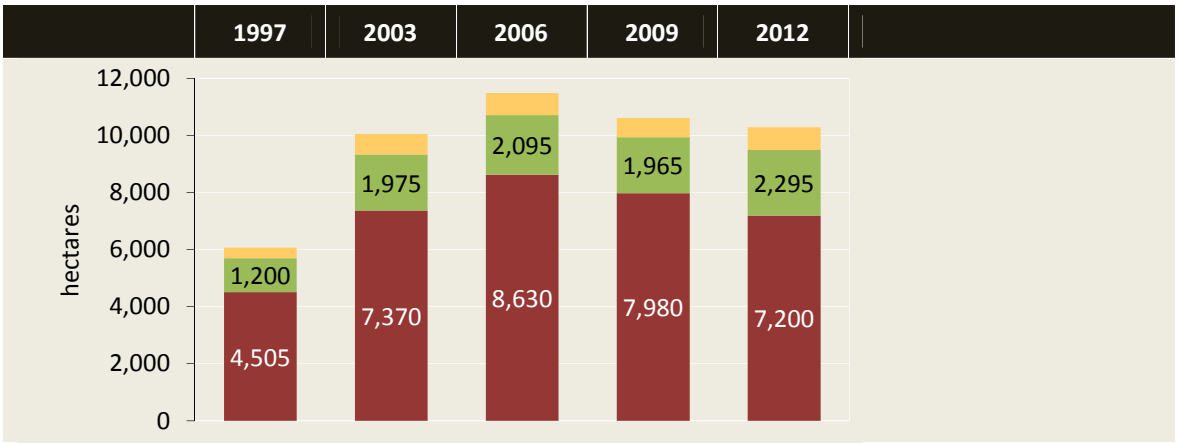
Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

3.3 Private Diverters summary - grapevines

Figure 24 summarises grape use for all private diverters, Nyah to the SA border, from 1997 to 2012. Figure 25 summarises grape use in each of the private diverter river reaches.

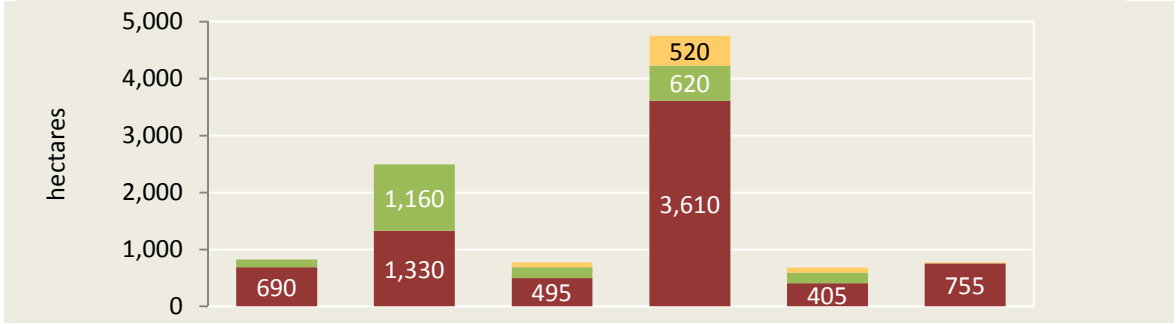
- Wine grape plantings remained the dominant grape type from 1997 to 2012.
- The area of wine grape plantings peaked at 8,630 hectares in 2006, then decrease by 1,430 hectares between 2006 and 2012.

Figure 24 – Hectares of grapevines grown in the private diverter areas from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	4,505	7,370	8,630	7,980	7,200	70%	+2,695
Table	1,200	1,975	2,095	1,965	2,295	22%	+1,095
Dried	365	710	770	680	800	8%	+435
Other	-	-	-	-	-	-	-
Total	**6,070**	**10,055**	**11,495**	**10,625**	**10,295**	**100%**	**+4,225**

Figure 25 – Grapevine use in each of the private diverter river reaches in 2012



	Nyah	B. Bend	Wemen	Colignan	Mildura	Lock10-SA	2012 total
Grape hectares	**825**	**2,490**	**775**	**4,750**	**685**	**770**	**10,295**
% of 2012 total	**8%**	**24%**	**8%**	**46%**	**7%**	**7%**	
Dominant use	wine	wine	wine	wine	wine	wine	

Note: 'Other' includes grapes for juicing, research and cannery.

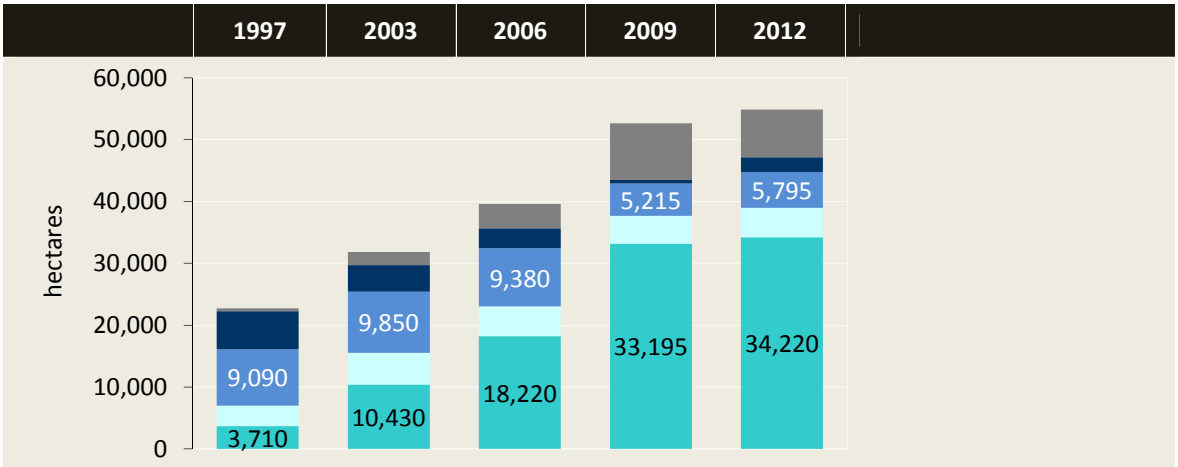
3.4 Private Diverters summary - irrigation methods

Figure 26 summarises irrigation methods for private diverters in the Victorian Murray Mallee from 1997 to 2012. Figure 27 summarises private diverter irrigation methods in 2012 for each river reach.

Drip irrigation has been the dominant irrigation method since 2003, replacing overhead sprinklers as the dominant method in 1997. Drip irrigation increased by 30,510 hectares between 1997 and 2012.

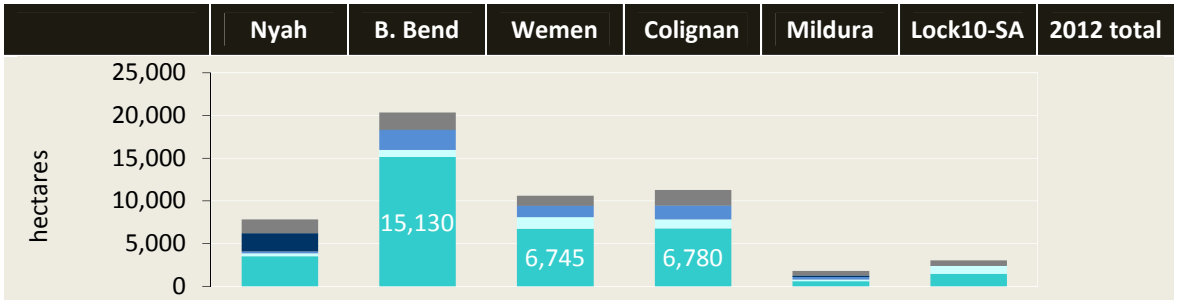
The area under furrow irrigation decreased by 3,760 hectares between 1997 and 2012, primarily due to farmers withholding irrigation from broad-acre field crops during the drought and low water allocations.

Figure 26 - Private diverter's irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	3,710	10,430	18,220	33,195	34,220	62%	+30,510
Low level	3,305	5,120	4,835	4,510	4,730	9%	+1,425
Overhead	9,090	9,850	9,380	5,215	5,795	11%	-3,295
Furrow	6,170	4,315	3,205	550	2,410	4%	-3,760
Vacant	430	2,115	3,965	9,140	7,725	14%	+7,295
Total	**22,705**	**31,830**	**39,605**	**52,610**	**54,880**	**100%**	**+32,175**

Figure 27 –Irrigation methods in each private diverter river reach in 2012

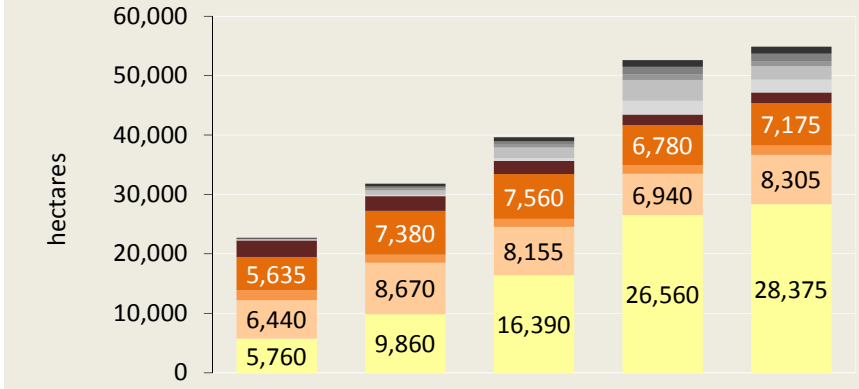


	Nyah	B. Bend	Wemen	Colignan	Mildura	Lock10-SA	2012 total
hectares	7,835	20,365	10,590	11,270	1,790	3,030	**54,880**
% of 2012 total	14%	37%	19%	21%	3%	6%	**100%**
Dominant	drip	drip	drip	drip	drip	drip	

3.5 Private Diverters summary - salinity impact zones

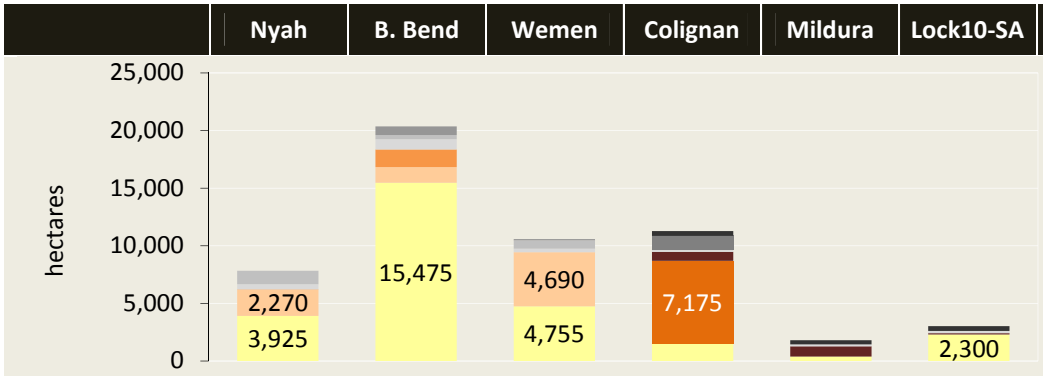
Figure 28 summarises the area of each salinity impact zone for private diverters, Nyah to the SA border, from 1997 to 2012. Figure 29 compares between the private diverter river reaches in 2012.

Figure 28 – Hectares in each salinity impact zone in the private diverter areas 1997 to 2012



Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	5,760	9,860	16,390	26,560	28,375	52%	+22,615
	LIZ 2	6,440	8,670	8,155	6,940	8,305	15%	+1,865
	LIZ 3	1,655	1,350	1,320	1,415	1,555	3%	-100
	LIZ 4	5,635	7,380	7,550	6,780	7,175	13%	+1,540
	HIZ	2,785	2,455	2,225	1,775	1,745	3%	-1,040
Not Irrigated	LIZ 1	10	210	480	2,295	2,155	4%	+2,145
	LIZ 2	160	765	1,750	3,505	2,285	4%	+2,125
	LIZ 3	40	385	635	910	875	2%	+835
	LIZ 4	85	280	400	1,290	1,215	2%	+1,130
	HIZ	135	475	700	1,140	1,195	2%	+1,060
Total		**22,705**	**31,830**	**39,605**	**52,610**	**54,880**	**100%**	**+32,175**

Figure 29 – Hectares of salinity impact zones in each private diverter study area in 2012



	Nyah	B. Bend	Wemen	Colignan	Mildura	Lock10-SA	2012 total
HIZ hectares	0	0	0	1,170	1,225	545	**2,940**
% of HIZ total	0%	0%	0%	40%	42%	19%	**100%**
Dominant	LIZ 1	LIZ 1	LIZ 2	LIZ 4	HIZ	LIZ 1	

3.6 Private Diverters summary – irrigation development

Figure 30 summarises irrigation development from 1997 to 2012, with respect to new and retired areas, for private diverters from Nyah to the South Australian border.

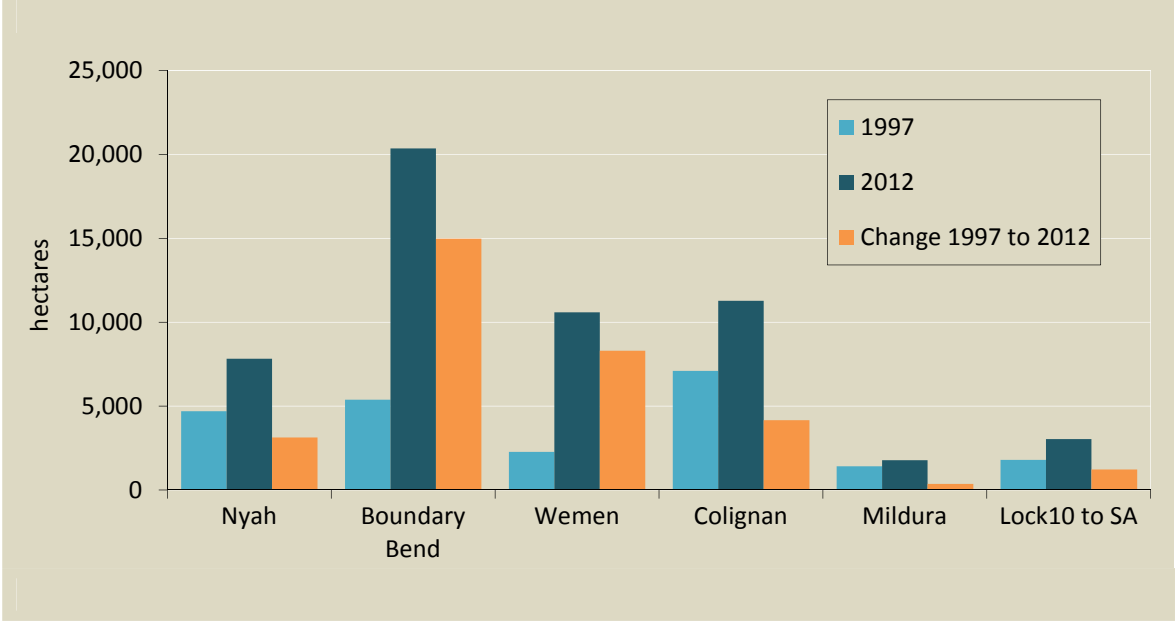
The irrigable area increased by 32,175 hectares between 1997 and 2012. This comprised 465 hectares retired from irrigation and 32,640 hectares of new areas not irrigated prior to 1997.

Expansion of the irrigable area occurred in each of the river reaches between 1997 and 2012.

- The Boundary Bend river reach increased by the largest area (14,985 hectares)
- The Wemen river reach had the largest percentage growth (363%)

Figure 30 - Private Diverter's irrigation development from 1997 to 2012

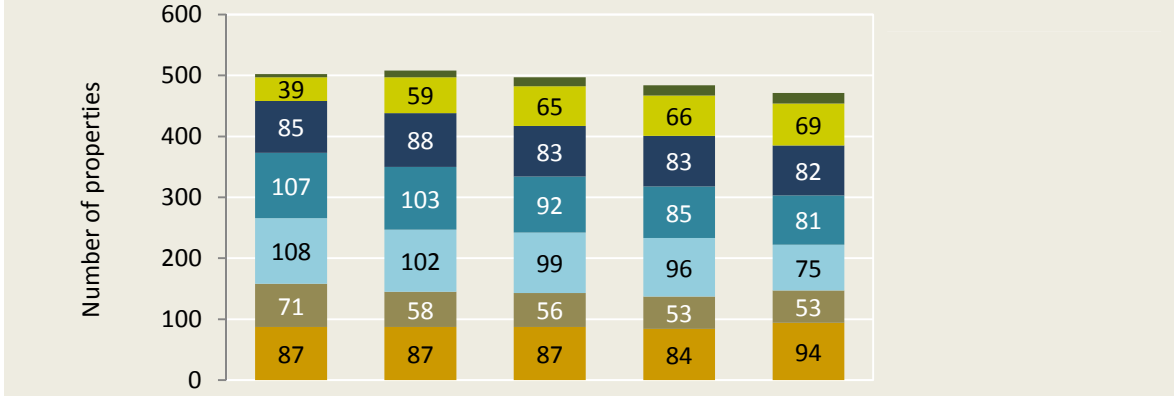
River Reach	1997 (ha)	1997 to 2012		2012 (ha)	Change 1997-2012	Growth 1997-2012
		Retired	New			
Nyah	4,705	-20	+3,150	7,835	+3,130	+67%
Boundary Bend	5,380	-145	+15,130	20,365	+14,985	+279%
Wemen	2,285	-40	+8,345	10,590	+8,305	+363%
Colignan	7,110	-55	+4,215	11,270	+4,160	+59%
Mildura	1,420	-55	+425	1,790	+370	+26%
Lock10 to SA	1,805	-150	+1,375	3,030	+1,225	+68%
Total	**22,705**	**-465**	**+32,640**	**54,880**	**+32,175**	**+142%**



3.7 Private Diverters summary - property change

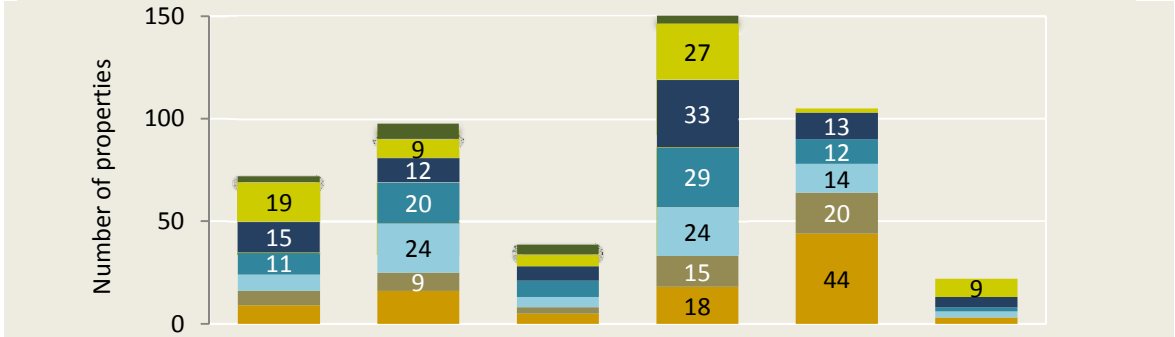
Figure 31 provides estimates of property numbers and average property size (irrigable area) for private diverters, Nyah to the South Australian border, from 1997 to 2012. Figure 32 summaries 2012 property information for each of the private diverter river reaches.

Figure 31 – Property numbers and average size in the private diverter areas from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	87	87	87	84	94	20%	+7
5 to 10 ha	71	58	56	53	53	11%	-18
10 to 20 ha	108	102	99	96	75	16%	-33
20 to 40 ha	107	103	92	85	81	17%	-26
40 to 100 ha	85	88	83	83	82	17%	-3
100 to 500 ha	39	59	65	66	69	15%	+30
> 500 ha	5	11	15	17	17	4%	+12
Total properties	**502**	**508**	**497**	**484**	**471**	**100%**	**-31**
Average size (ha)	**45.2**	**62.7**	**79.7**	**108.7**	**116.5**		

Figure 32 – Property numbers and average size in each private diverter river reach in 2012



	Nyah	B. Bend	Wemen	Colignan	Mildura	Lock10-SA	2012 total
Total properties	72	98	39	150	105	22	**495**
% of 2012 total	15%	20%	8%	30%	21%	4%	**100%**
Average size (ha)	108.8	207.8	271.5	75.1	17.0	137.7	

Note: The total property number for private diverters is less than the sum of each river reach as some property owners have irrigated land in more than one river reach.

4. Pumped Irrigation Districts

4.1 Nyah Irrigation District

In summary for the Nyah Irrigation District

- The Nyah Irrigation District has approximately 160 properties. Average property size (irrigable area) is 9.6 hectares.
- The dominant crop type is grapevines and these are predominantly grown for wine production.
- In 2012, the irrigable area in Nyah was 1,535 hectares; a 37% (415 ha) increase from 1,120 hectares in 1997.
- 37% of the irrigable area was vacant in the 2011-12 irrigation season; 14% was previously permanent plantings and 23% was previously seasonal plantings.
- The dominant irrigation method changed from furrow irrigation in 1997 to drip irrigation by 2006. Drip irrigation remained the dominant method in 2009 and 2012.
- Crops are predominantly (85%) grown in the lowest salinity impact zone, LIZ 1.

4.1.1 Nyah Irrigation District 2012 crop types

Crop types grown in the Nyah Irrigation District in the 2011-12 season are shown in Figure 33 and Map 2.

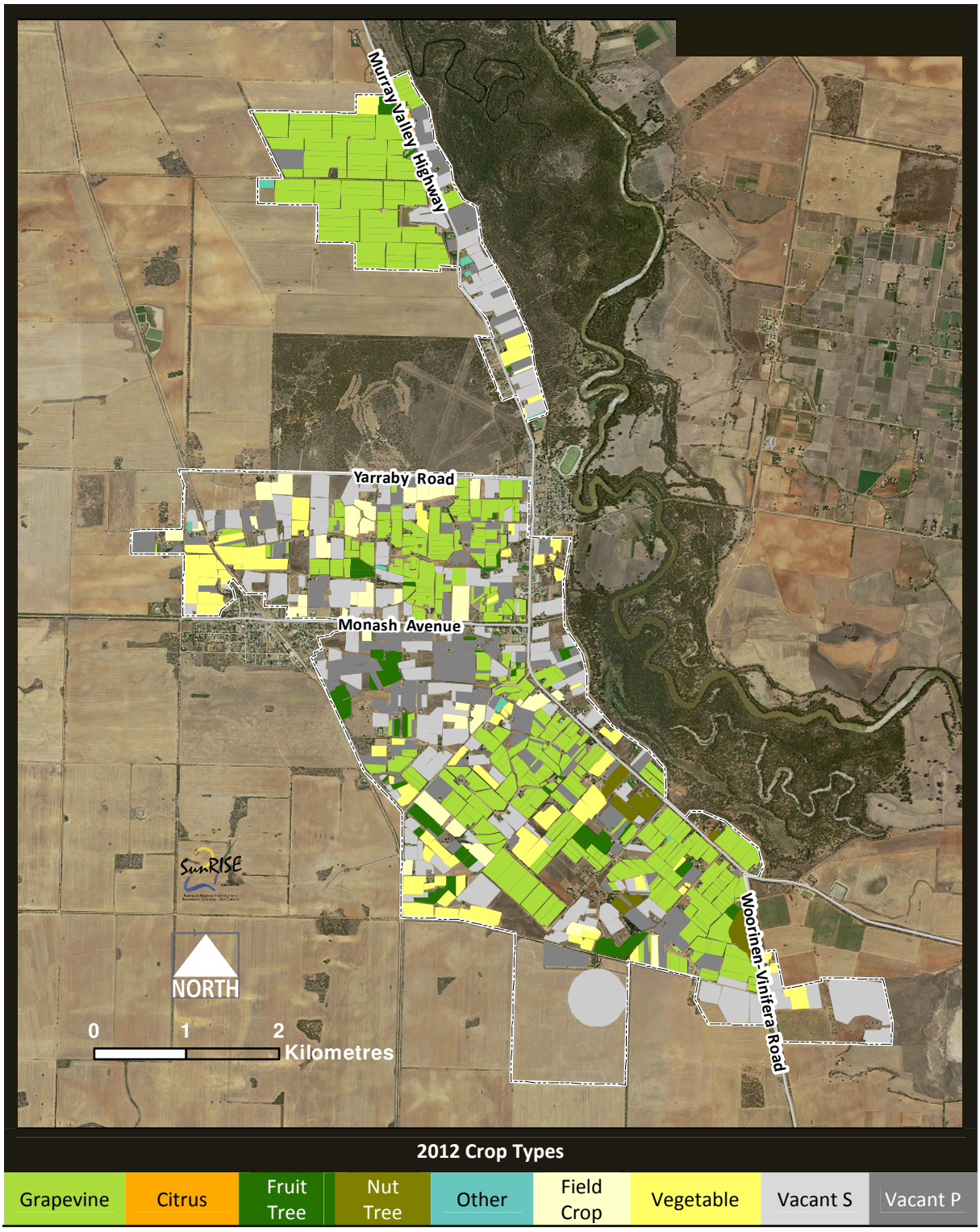
Figure 33 – Nyah Irrigation District 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	500	33%	
	Table	15	1%	
	Dried	120	8%	
	Other	15	1%	
Citrus		0	0%	<2ha
Fruit tree	***unspecified***	5	0%	
	Avocado	-	-	
	Olive	10	1%	
	Stone fruit	45	3%	Apricot, Nectarine, Peach, Plum
Nut tree	Almond	5	0%	
	Other	25	2%	Pistachio, Walnut
Other	Nursery	0	0%	
	Woodlot	5	0%	
	Other	0	0%	<1ha Passionfruit
Field crop	***unspecified***	40	3%	
	Other	40	3%	Cereal, Oats, Pasture
Vegetable	***unspecified***	130	8%	
	Asparagus	-	-	
	Carrot, Potato	-	-	
	Other	10	1%	Pumpkin
Vacant S		350	23%	*Vacant S – previously a seasonal planting*
Vacant P		220	14%	*Vacant P – previously a permanent planting*
Total		**1,535**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Nyah Irrigation District 2012 crop types

Map 2 – Nyah Irrigation District 2012 crop types



Note: The Nyah Irrigation District as shown in this map is not the gazetted district. It has been extended to include new areas adjacent to the original district that are supplied with irrigation water from the district.

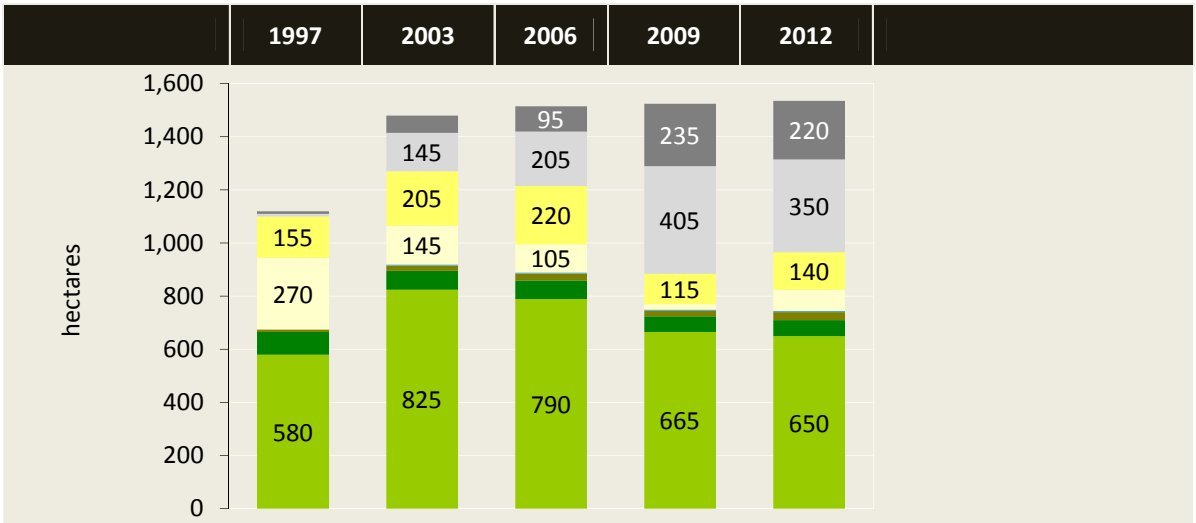
4.1.2 Nyah Irrigation District – crop type change

Figure 34 summarises crop types in the Nyah Irrigation District from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 1,535 hectares of which 63% (965 hectares) was irrigated and 37% (570 hectares) was vacant or not irrigated.

The irrigable area increased by 415 hectares, a 37% increase from 1,120 hectares in 1997 to 1,535 hectares in 2012.

Figure 34 – Crop types in the Nyah Irrigation District from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	580	825	790	665	650	42%	+70
	Citrus	-	-	-	-	-	-	-
	Fruit Tree	85	70	70	55	60	4%	-25
	Nut Tree	10	20	25	25	30	2%	+20
	Other	0	5	5	5	5	0%	+5
Vacant Seasonal	Field Crop	270	145	105	20	80	5%	-190
	Vegetable	155	205	220	115	140	9%	-15
Vacant	Vacant S	10	145	205	405	350	23%	+340
	Vacant P	10	65	95	235	220	14%	+210
Total (ha)		**1,120**	**1,480**	**1,515**	**1,525**	**1,535**	**100%**	**+415**
% Vacant		**2%**	**14%**	**20%**	**42%**	**37%**		

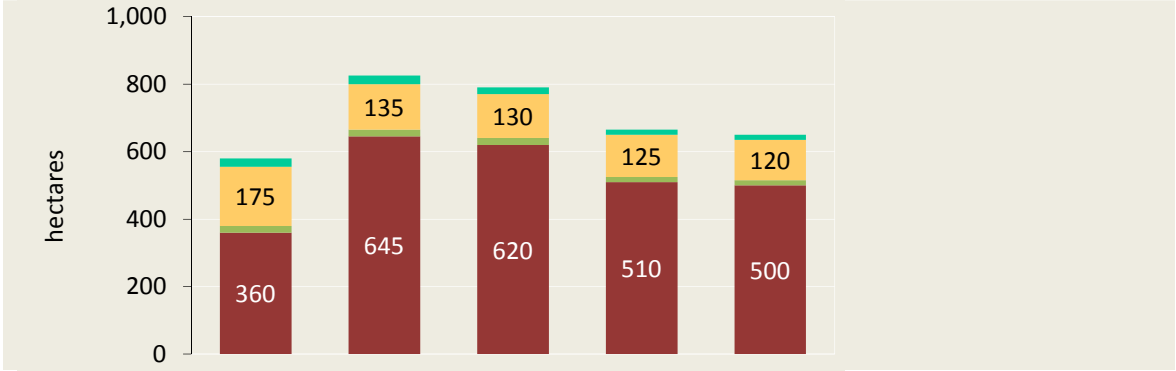
Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

4.1.3 Nyah Irrigation District – grapevines

Figure 35 summarises grapevine types in the Nyah Irrigation District from 1997 to 2012.

- Grapevines are predominantly (77%) grown for wine production in the Nyah Irrigation District.
- Wine grape plantings increased by 140 hectares between 1997 and 2012. This is the net change after an increase of 285 hectares of wine grapes between 1997 and 2003 and subsequent removal of 145 hectares of wine grapes after 2003.
- Table grape plantings decreased by 5 hectares between 1997 and 2012
- Dried vine fruit plantings decreased by 55 hectares between 1997 and 2012

Figure 35 – Hectares of grapevines grown in the Nyah Irrigation District 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	360	645	620	510	500	77%	+140
Table	20	20	20	15	15	2%	-5
Dried	175	135	130	125	120	18%	-55
Other	25	25	20	15	15	2%	-10
Total (ha)	**580**	**825**	**790**	**665**	**650**	**100%**	**+70**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

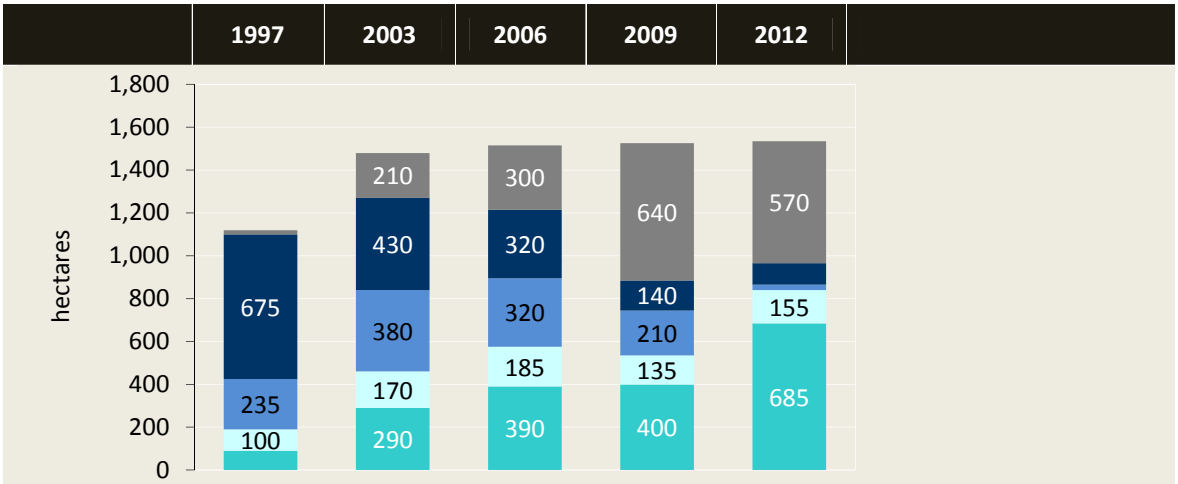
4.1.4 Nyah Irrigation District – irrigation methods

Figure 36 summarises irrigation methods in the Nyah Irrigation District from 1997 to 2012.

The dominant irrigation method was furrow irrigation in 1997, but changed to drip irrigation by 2006. Drip irrigation remained the dominant method in 2009 and 2012.

Drip and low level irrigation increased by 650 hectares between 1997 and 2012, while overhead and furrow irrigation decreased by 210 and 575 hectares respectively.

Figure 36 – Irrigation methods in the Nyah Irrigation District 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	90	290	390	400	685	45%	+595
Low level	100	170	185	135	155	10%	+55
Overhead	235	380	320	210	25	2%	-210
Furrow	675	430	320	140	100	7%	-575
Vacant	20	210	300	640	570	37%	+550
Total (ha)	**1,120**	**1,480**	**1,515**	**1,525**	**1,535**	**100%**	**+415**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers.
'Furrow' includes flood irrigation.

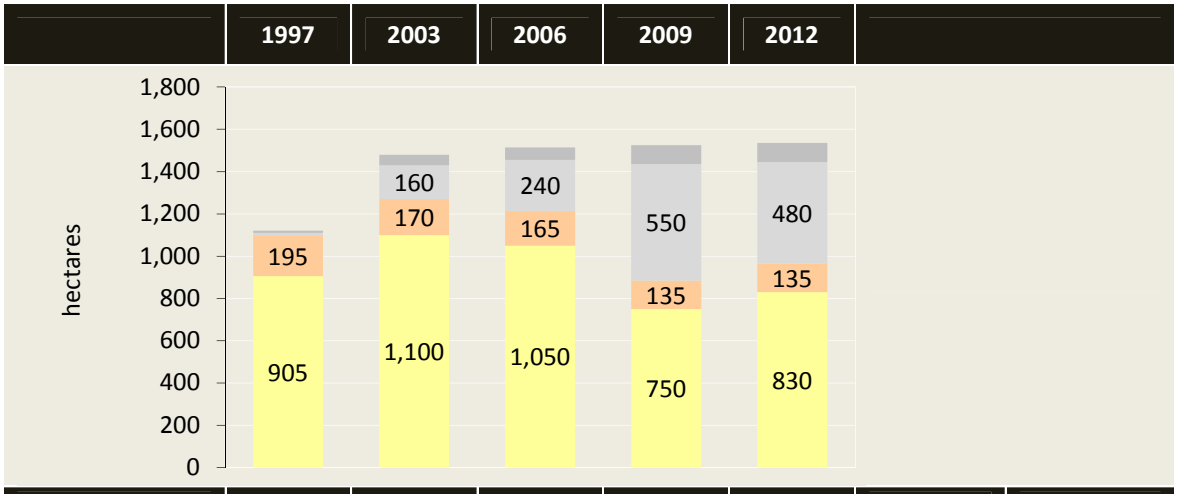
4.1.5 Nyah Irrigation District – salinity impact zones

Figure 37 summarises the irrigable area in each river salinity impact zone in the Nyah Irrigation District from 1997 to 2012.

In the Nyah Irrigation District:

- 85% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 15% of the irrigable area is in low salinity impact zone LIZ 2
- There are no irrigable areas in the high salinity impact zone, HIZ.

Figure 37 – Hectares in each salinity impact zone in Nyah Irrigation District from 1997 to 2012

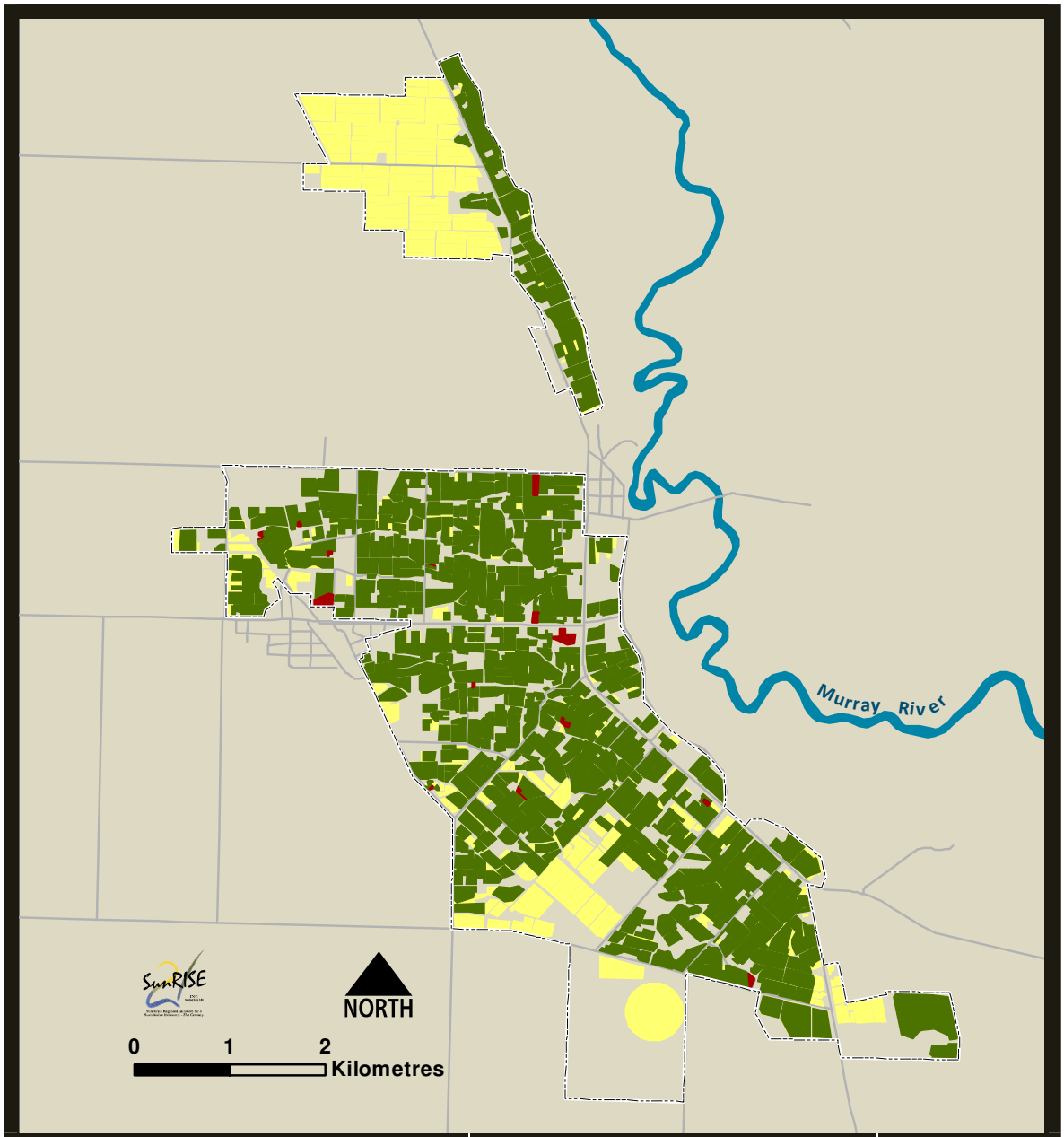


Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	905	1,100	1,050	750	830	54%	-75
	LIZ 2	195	170	165	135	135	9%	-60
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Not Irrigated	LIZ 1	10	160	240	550	480	31%	+470
	LIZ 2	10	50	60	90	90	6%	+80
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Total (ha)		**1,120**	**1,480**	**1,515**	**1,525**	**1,535**	**100%**	**+415**

4.1.6 Nyah Irrigation District – irrigation development

Map 3 shows irrigation development with respect to new and retired areas in the Nyah Irrigation District from 1997 to 2012. The irrigable area increased by 415 hectares between 1997 and 2012; comprising 10 hectares retired and 425 hectares of new areas not irrigated prior to 1997.

Map 3 – Irrigation development in Nyah Irrigation District from 1997 to 2012



	Hectares	% of 1997
Irrigated crops in 1997 (1996-97 season)	1,120	
Retired between 1997 and 2012	-10	-1%
New areas between 1997 and 2012	+425	+38%
Irrigated crops in 2012 (2011-12 season)	1,535	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

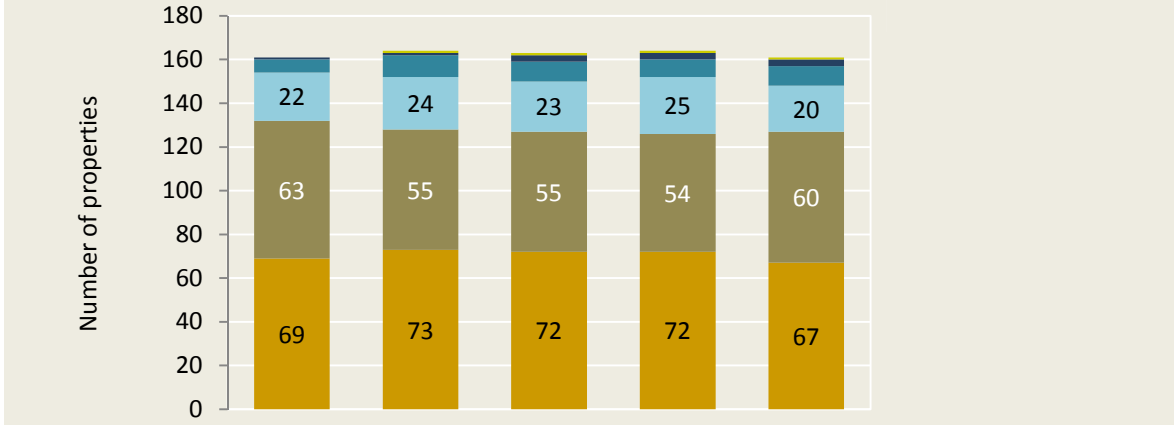
4.1.7 Nyah Irrigation District – property change

Figure 38 provides estimates of property numbers and average property size (irrigable area) in the Nyah Irrigation District from 1997 to 2012.

The Nyah Irrigation District has approximately 160 irrigation properties (land holdings). Average property size (irrigable area) is 9.6 hectares.

The number of irrigation properties decreased by 1 property between 1997 and 2012. During the same time, the average irrigable area per property increased by 37%, from 7.0 to 9.6 hectares.

Figure 38 – Property numbers and size in Nyah Irrigation District from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	69	73	72	72	67	42%	-2
5 to 10 ha	63	55	55	54	60	37%	-3
10 to 20 ha	22	24	23	25	20	13%	-2
20 to 40 ha	6	10	9	8	9	6%	+3
40 to 100 ha	1	1	3	3	3	2%	+2
100 to 500 ha	0	1	1	1	1	1%	+1
> 500 ha	-	-	-	-	-	-	-
Total properties	**161**	**164**	**163**	**163**	**160**	**100%**	**-1**
Average size (ha)	**7.0**	**9.0**	**9.3**	**9.4**	**9.6**		

4.2 Robinvale Irrigation District

In summary for the Robinvale Irrigation District

- The Robinvale Irrigation District has approximately 128 irrigation properties. Average property size (irrigable area) is 18.9 hectares.
- Grapevines grown for fresh table grapes have been the dominant crop from 1997 to 2012.
- The irrigable area increased by 5% (105 hectares) from 2,320 hectares in 1997 to 2,425 hectares in 2012.
- 12% of the irrigable area was vacant in the 2011-12 irrigation season. This had previously been permanent plantings.
- Low level sprinklers have been the dominant irrigation method since 2003, replacing furrow irrigation as the dominant method in 1997.
- Crops are predominantly (99%) in the low salinity impact zone, LIZ 2.

4.2.1 Robinvale Irrigation District 2012 crop types

Crop types grown in the Robinvale Irrigation District in the 2011-12 season are shown in Figure 39 and Map 4.

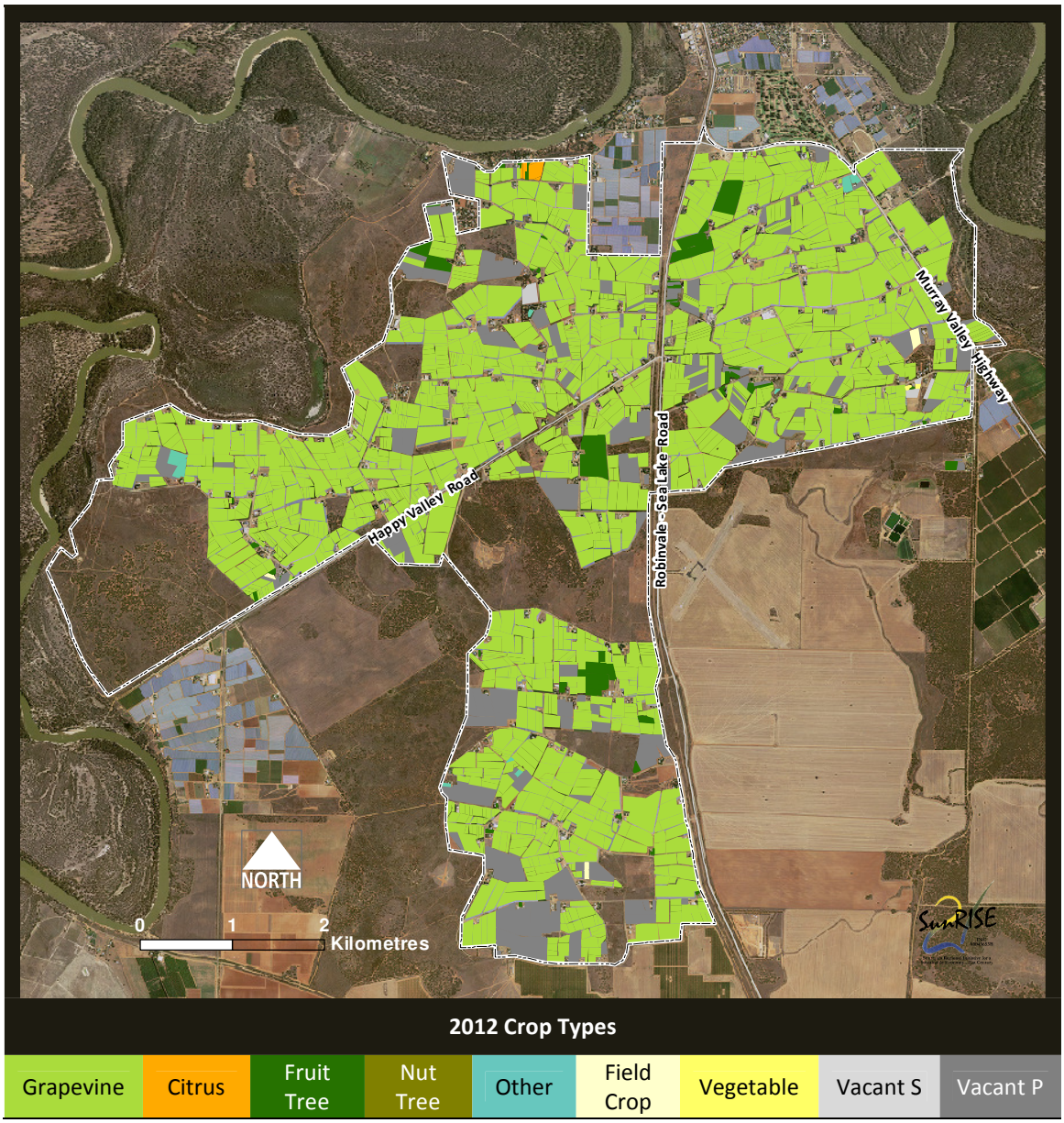
Figure 39 – Robinvale Irrigation District 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	190	8%	
	Table	1,800	74%	
	Dried	75	3%	
	Other	-	-	
Citrus		5	0%	Mandarin, Tangelo
Fruit tree	***unspecified***	5	0%	
	Avocado	35	1%	
	Olive	0	0%	<1ha
	Stone fruit	0	0%	<1ha including Apricot, Plum
	Other	15	1%	Date Palm, Mango, Pomegranate
Nut tree	Almond	-	-	
	Other	-	-	
Other	Nursery	5	0%	
	Woodlot	-	-	
	Other	-	-	
Field crop	***unspecified***	5	0%	
	Other	-	-	
Vegetable	***unspecified***	0	0%	<1ha
	Asparagus	-	-	
	Carrot	-	-	
	Potato	-	-	
	Other	-	-	
Vacant S		5	0%	*Vacant – previously a seasonal planting*
Vacant P		285	12%	*Vacant – previously a permanent planting*
Total		**2,425**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Robinvale Irrigation District 2012 crop types

Map 4 - Robinvale Irrigation District showing 2012 crop types



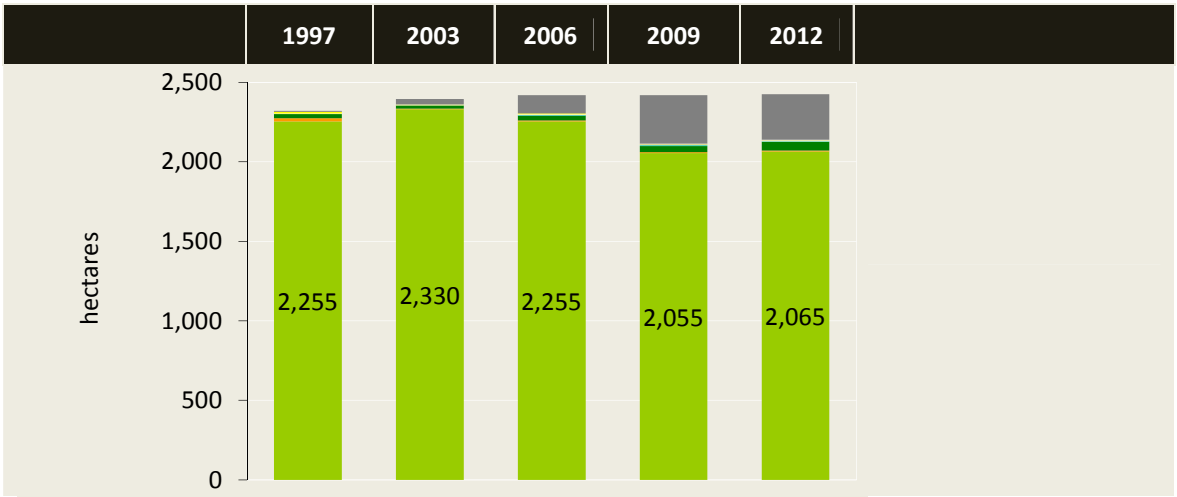
4.2.2 Robinvale Irrigation District – crop type change

Figure 40 summarises crop types in the Robinvale Irrigation District from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 2,425 hectares of which 88% (2,135 hectares) was irrigated and 12% (290 hectares) was vacant or not irrigated.

The irrigable area increased by 105 hectares; a 5% increase from 2,320 hectares in 1997 to 2,425 hectares in 2012.

Figure 40 – Crop types in the Robinvale Irrigation District from 1997 to 2012



	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	2,255	2,330	2,255	2,055	2,065	85%	-190
	Citrus	20	5	5	5	5	0%	-15
	Fruit Tree	25	20	30	40	55	2%	+30
	Nut Tree	-	-	-	-	-	-	-
	Other	0	0	5	5	5	0%	+5
Seasonal	Field Crop	5	5	5	0	5	0%	0
	Vegetable	10	0	5	5	0	0%	-10
Vacant	Vacant S	0	0	0	5	5	0%	+5
	Vacant P	5	35	115	305	285	12%	+280
Total (ha)		**2,320**	**2,395**	**2,420**	**2,420**	**2,425**	**100%**	**+105**
% Vacant		**0%**	**1%**	**5%**	**13%**	**12%**		

% Vacant 2008 to 2011 Irrigation status reports#	2008	2009	2010	2011
	12%	13%	15%	14%

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

Supplementary data from Irrigation Status Reports prepared by SunRISE 21 for the Mallee CMA.

4.2.3 Robinvale Irrigation District – grapevines

Figure 41 summarises grape use in the Robinvale Irrigation District from 1997 to 2012.

- Grapevines are the dominant crop in the Robinvale Irrigation District, predominantly (87%) grown for fresh table grapes. Table grape plantings increased by 405 hectares (29%) between 1997 and 2012.
- Wine grape plantings and dried vine fruit plantings decreased by 270 hectares and 290 hectares respectively in the period 1997 to 2012.

Figure 41 - Robinvale Irrigation District grape use from 1997 to 2012

Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	460	430	425	310	190	9%	-270
Table	1,395	1,755	1,725	1,665	1,800	87%	+405
Dried	365	140	100	80	75	4%	-290
Other	35	5	5	0	0	0%	-35
Total (ha)	**2,255**	**2,330**	**2,255**	**2,055**	**2,065**	**100%**	**- 190**

Note: 'Other' includes grapes for juicing, research and cannery.

4.2.4 Robinvale Irrigation District – irrigation methods

Figure 42 summarises irrigation methods in the Robinvale Irrigation District from 1997 to 2012.

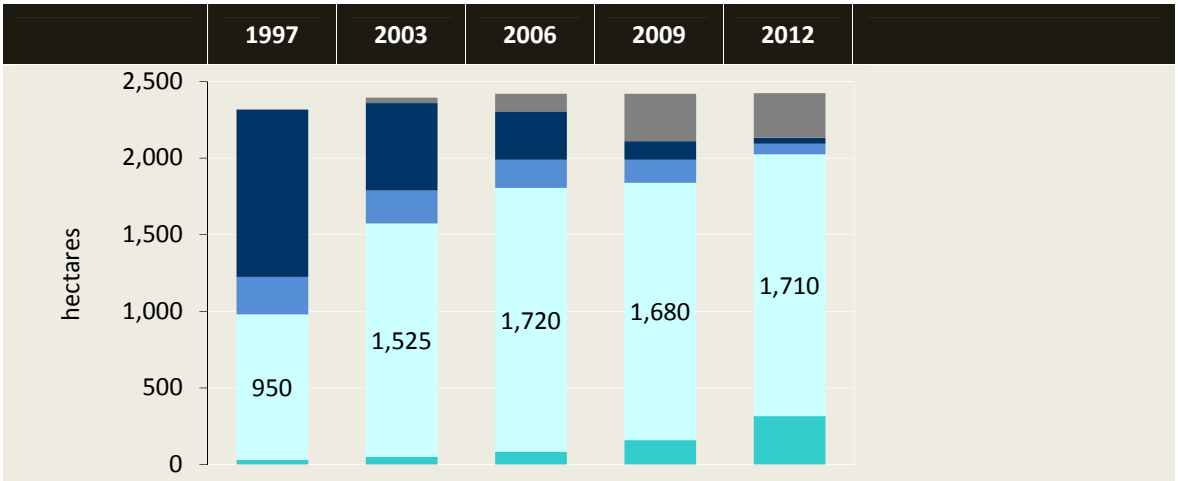
Low level sprinklers have been the dominant irrigation method since 2003, replacing furrow irrigation as the dominant method in 1997.

Drip and low level irrigation increased by 285 hectares and 760 hectares respectively between 1997 and 2012.

Furrow irrigation decreased by 1,050 hectares. Furrow irrigation comprised 2% (40 hectares) of the 2012 irrigable area.

Overhead irrigation decreased by 175 hectares.

Figure 42 – Irrigation methods in the Robinvale Irrigation District from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	30	50	85	160	315	13%	+285
Low level	950	1,525	1,720	1,680	1,710	71%	+760
Overhead	245	215	185	150	70	3%	-175
Furrow	1,090	570	315	120	40	2%	-1,050
Vacant	5	35	115	310	290	12%	+285
Total	**2,320**	**2,395**	**2,420**	**2,420**	**2,425**	**100%**	**+105**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

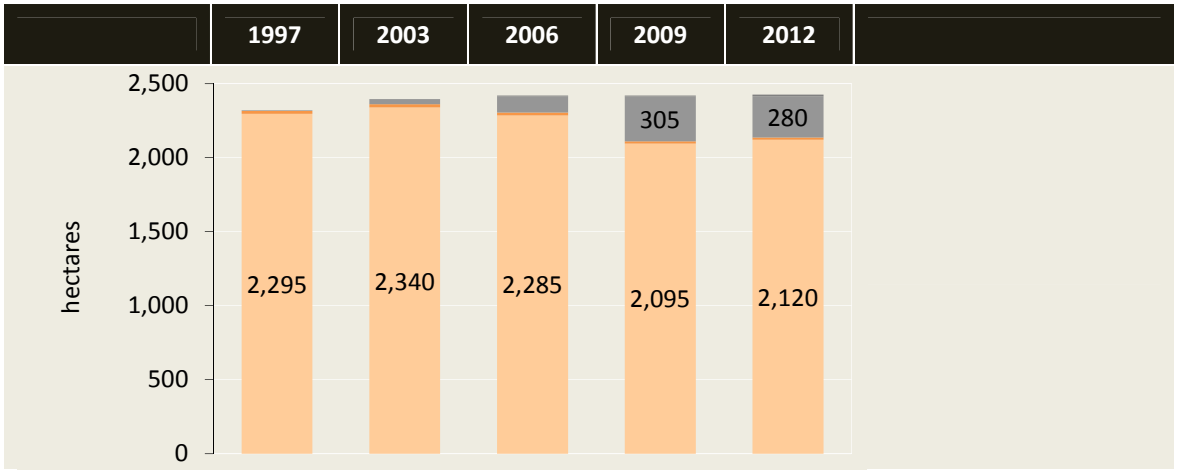
4.2.5 Robinvale Irrigation District – salinity impact zones

Figure 43 summarises the irrigable area in each river salinity impact zone in the Robinvale Irrigation District from 1997 to 2012.

In the Robinvale Irrigation District:

- 99% of the irrigable area is in the second lowest salinity impact zone, LIZ 2
- 1% of the irrigable area is in low salinity impact zone LIZ 3
- There are no irrigable areas in the high salinity impact zone

Figure 43 - Hectares in each salinity impact zone in the Robinvale Irrigation District 1997 to 2012



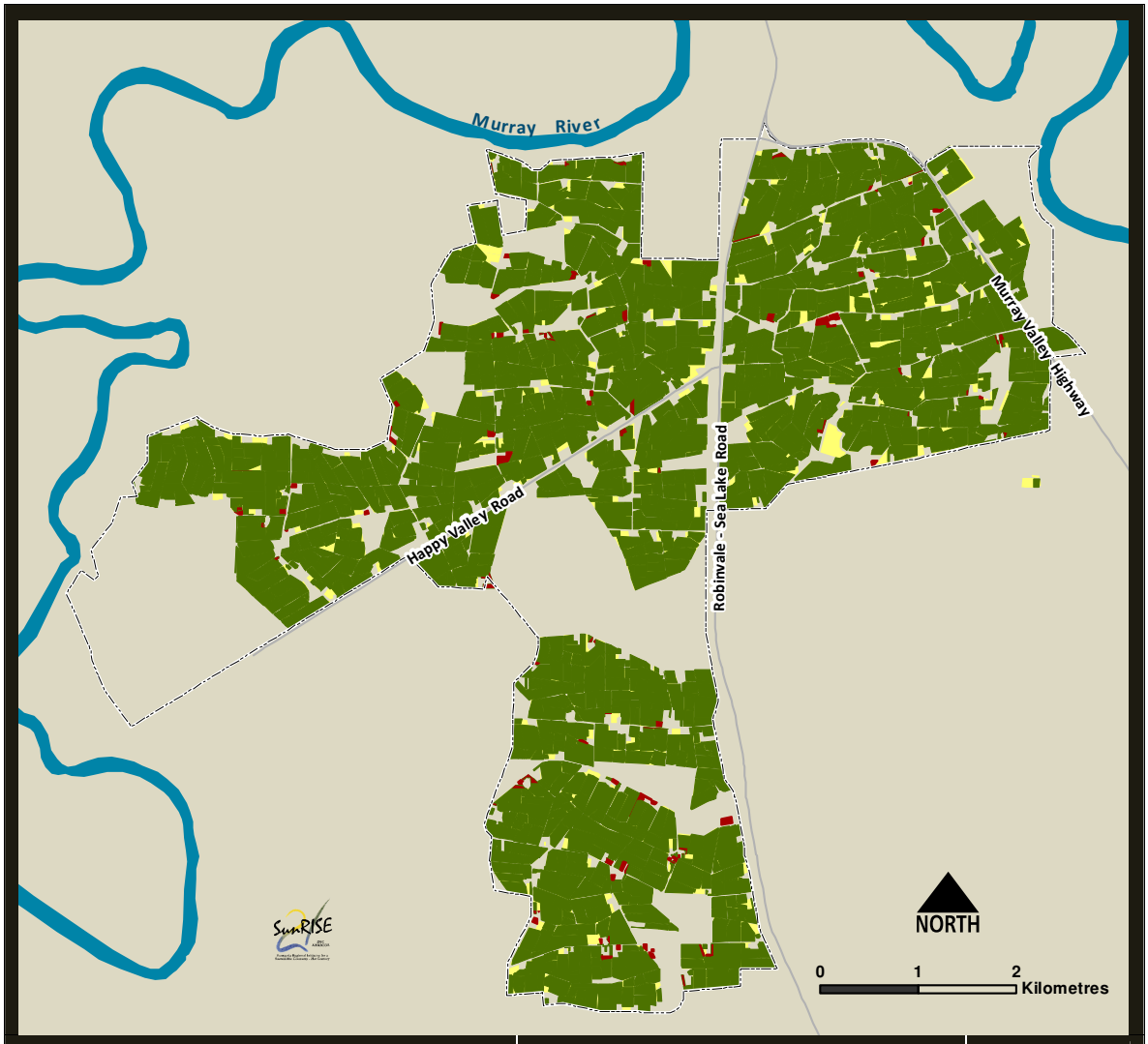
	Salinity impact zone	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	-	-	-	-	-	-	-
	LIZ 2	2,295	2,340	2,285	2,095	2,120	87%	-175
	LIZ 3	20	20	20	15	15	1%	-5
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Not Irrigated	LIZ 1	-	-	-	-	-	-	-
	LIZ 2	5	35	110	305	280	12%	+275
	LIZ 3	0	0	5	5	10	0%	+10
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Total (ha)		**2,320**	**2,395**	**2,420**	**2,420**	**2,425**	**100%**	**+105**

4.2.6 Robinvale Irrigation District – irrigation development

Map 5 shows irrigation development with respect to new and retired irrigation areas in the Robinvale Irrigation District from 1997 to 2012.

The irrigable area increased by 105 hectares between 1997 and 2012; comprising 20 hectares retired and 125 hectares of new areas not irrigated prior to 1997.

Map 5 - Irrigation development in the Robinvale Irrigation District from 1997 to 2012



	Hectares		% of 1997
Irrigated crops in 1997 (1996-97 season)	2,320		
Retired between 1997 and 2012	-20		-1%
New areas between 1997 and 2012	+125		+5%
Irrigated crops in 2012 (2011-12 season)	2,425		

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

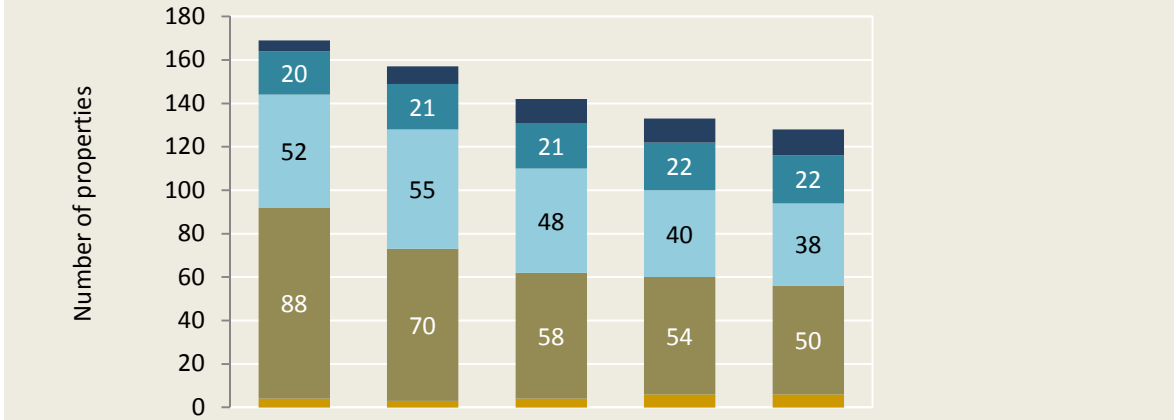
4.2.7 Robinvale Irrigation District – property change

Figure 44 provides estimates of property numbers and average property size (irrigable area) in the Robinvale Irrigation District from 1997 to 2012.

The Robinvale Irrigation District has approximately 128 irrigation properties (land holdings). Average property size (irrigable area) is 18.9 hectares.

The number of irrigation properties decreased by 41 properties between 1997 and 2012. The average irrigable area per property increased from 13.7 hectares in 1997 to 18.9 hectares in 2012.

Figure 44 – Property numbers and size in Robinvale Irrigation District from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	4	3	4	6	6	5%	+2
5 to 10 ha	88	70	58	54	50	39%	-38
10 to 20 ha	52	55	48	40	38	30%	-14
20 to 40 ha	20	21	21	22	22	17%	+2
40 to 100 ha	5	8	11	11	12	9%	+7
100 to 500 ha	-	-	-	-	-	-	-
> 500 ha	-	-	-	-	-	-	-
Total properties	**169**	**157**	**142**	**133**	**128**	**100%**	**-41**
Average size (ha)	**13.7**	**15.3**	**17.0**	**18.2**	**18.9**		

4.3 Red Cliffs Irrigation District

In summary for the Red Cliffs Irrigation District

- The Red Cliffs Irrigation District has approximately 455 properties. Average property size (irrigable area) is 9.9 hectares.
- Grapevines grown for wine production have remained the dominant crop from 1997 to 2012.
- In 2012, the irrigable area was 4,520 hectares; a 2% (70 ha) increase from 4,450 hectares in 1997.
- 29% of the irrigable area was vacant in the 2011-12 irrigation season; 27% was previously permanent plantings and 2% was previously seasonal plantings.
- The dominant irrigation method changed from furrow irrigation in 1997 to overhead sprinklers by 2003. Drip irrigation has been the dominant method since 2009.
- 43% of the irrigable area is in the high salinity impact zone (HIZ), 34% in the lowest salinity impact zone (LIZ 1) and 23% in LIZ 4.

4.3.1 Red Cliffs Irrigation District 2012 crop types

Red Cliffs Irrigation District crop types in the 2011-12 season are shown in Figure 45 and Map 6.

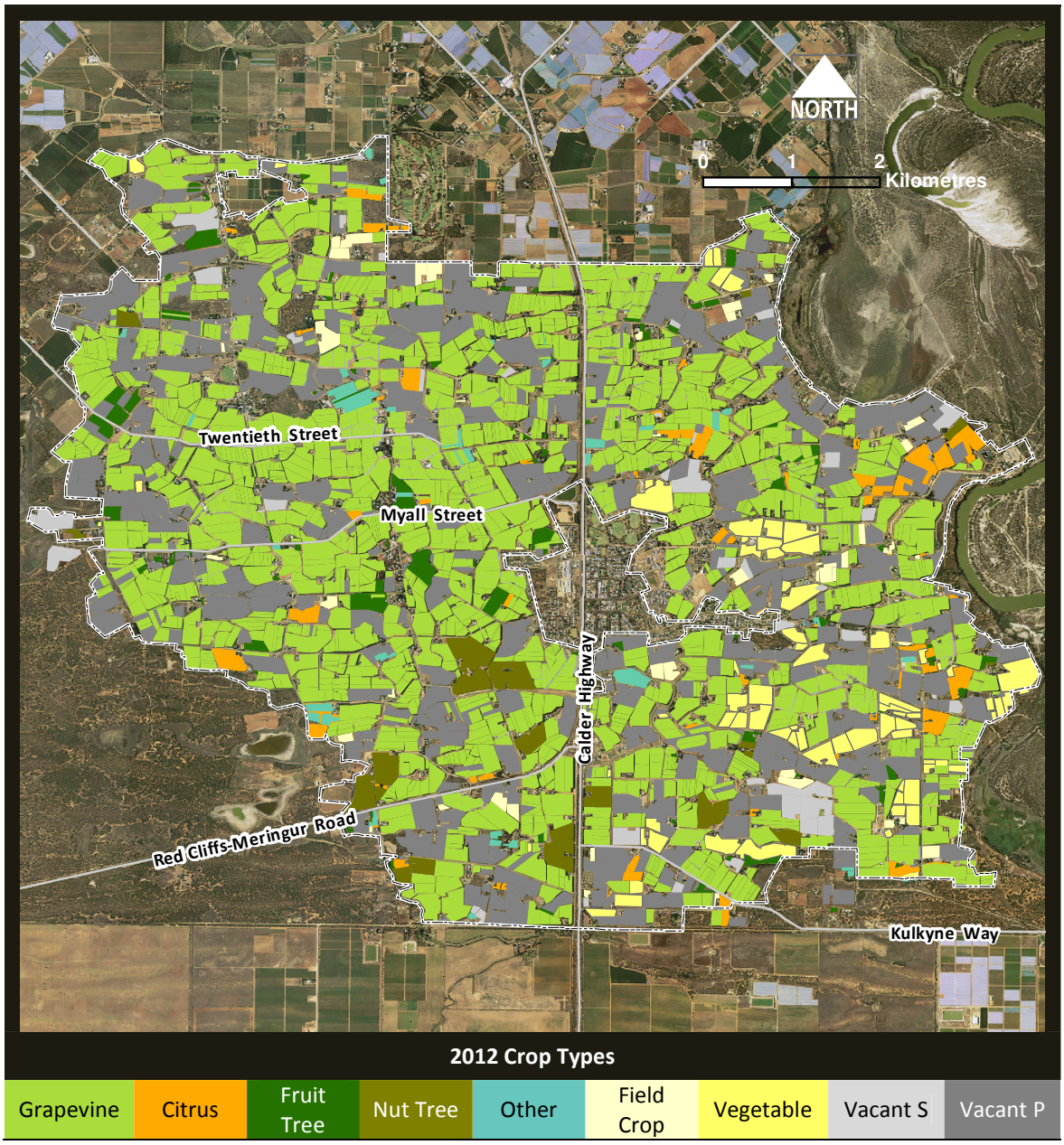
Figure 45 - Red Cliffs Irrigation District 2012 crop types

Crop Type	Category	2012 (ha)	2012 %	
Grapevine	Wine	1,485	33%	
	Table	740	16%	
	Dried	380	8%	
Citrus		95	2%	Lemon, Lime, Mandarin, Navel, other Orange, Tangelo, Valencia
Fruit tree	***unspecified***	5	0%	
	Avocado	15	0%	
	Olive	45	1%	
	Stone fruit	0	0%	<5ha including Plum, Apricot
	Other	20	0%	Date Palm, Fig, Mango, Persimmon, Pomegranate
Nut tree	Almond	95	2%	
	Other	10	0%	Pistachio, Walnut
Other	Nursery	30	1%	
	Woodlot	-	-	
	Other	10	0%	Native Plants, Flowers, Passionfruit
Field crop	***unspecified***	15	0%	
	Other	50	1%	Lucerne, Pasture
Vegetable	***unspecified***	75	2%	
	Asparagus	105	2%	
	Other	45	1%	Melon, Pumpkin
Vacant S		100	2%	*Vacant – previously a seasonal planting*
Vacant P		1,200	27%	*Vacant – previously a permanent planting*
Total		**4,520**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Red Cliffs Irrigation District 2012 crop types

Map 6 - Red Cliffs Irrigation District showing 2012 crop types



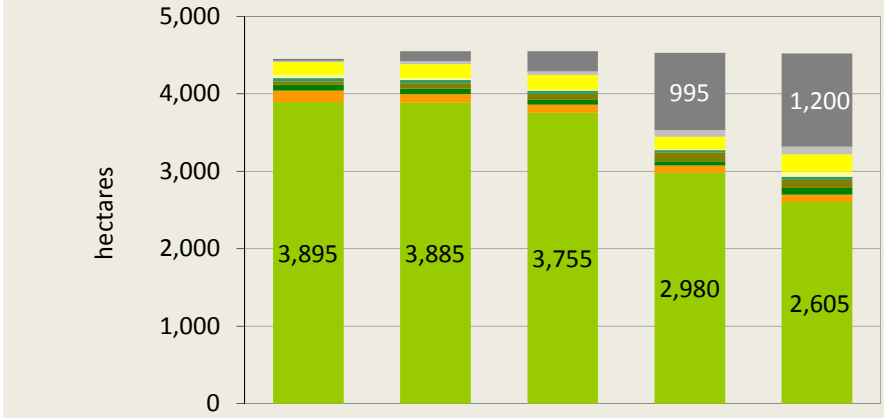
4.3.2 Red Cliffs Irrigation District – crop type change

Figure 46 summarises crop types in the Red Cliffs Irrigation District from 1997 to 2012.

In the 2011-2012 irrigation season the irrigable area was 4,520 hectares of which 71% (3,220 hectares) was irrigated and 29% (1,300 hectares) was vacant or not irrigated.

The irrigable area increased by 70 hectares, a 2% increase, from 4,450 hectares in 1997 to 4,520 hectares in 2012.

Figure 46 - Red Cliffs Irrigation District crop types 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	3,895	3,885	3,755	2,980	2,605	58%	-1,290
	Citrus	145	110	105	95	95	2%	-50
	Fruit Tree	75	70	60	55	85	2%	+10
	Nut Tree	45	70	80	115	105	2%	+60
	Other	45	45	40	30	40	1%	-5
Seasonal	Field Crop	45	25	15	10	65	1%	+20
	Vegetable	160	180	190	160	225	5%	+65
Vacant	Vacant S	15	35	45	90	100	2%	+85
	Vacant P	25	130	260	995	1,200	27%	+1,175
Total		**4,450**	**4,550**	**4,550**	**4,530**	**4,520**	**100%**	**+70**
% Vacant		**1%**	**4%**	**7%**	**24%**	**29%**		

% Vacant 2008 to 2011 Irrigation status reports#	2008	2009	2010	2011
	16%	24%	31%	31%

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

Supplementary data from Irrigation Status Reports prepared by SunRISE 21 for the Mallee CMA.

4.3.3 Red Cliffs Irrigation District – grapevines

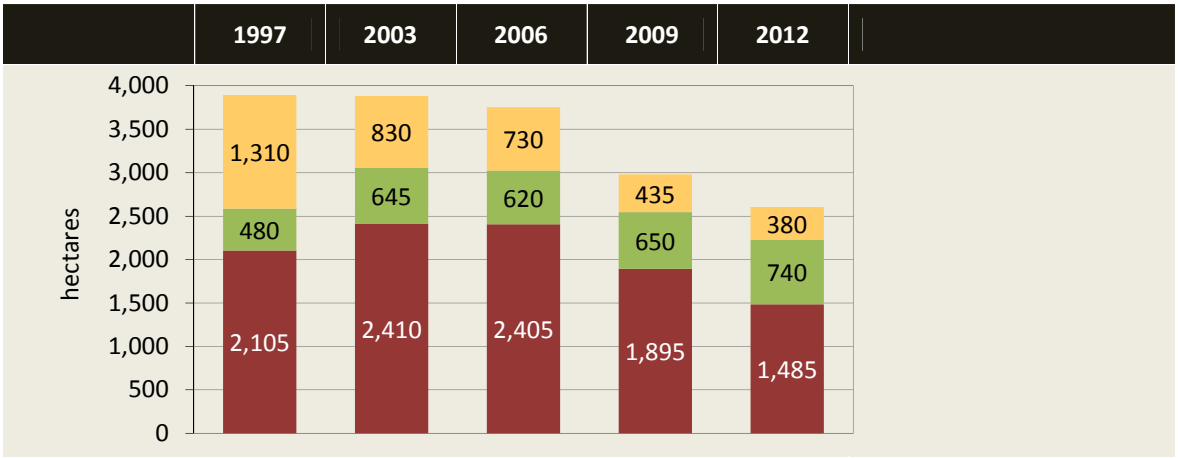
Figure 47 summarises grape use in the Red Cliffs Irrigation District from 1997 to 2012.

Grapevines are the dominant crop in the Red Cliffs Irrigation District. They have been predominantly grown for wine production from 1997 to 2012.

Between 1997 and 2012 wine grape plantings and dried vine fruit plantings decreased by 620 hectares and 930 hectares respectively. Table grape plantings increased by 260 hectares.

Grapevine plantings decreased by 33% (1,290 hectares) in the period from 1997 to 2012.

Figure 47 - Red Cliffs Irrigation District grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	2,105	2,410	2,405	1,895	1,485	57%	-620
Table	480	645	620	650	740	28%	+260
Dried	1,310	830	730	435	380	15%	-930
Other	-	-	-	-	-	-	-
Total	**3,895**	**3,885**	**3,755**	**2,980**	**2,605**	**100%**	**- 1,290**

Note: 'Other' includes grapes for juicing, research and cannery.

4.3.4 Red Cliffs Irrigation District – irrigation methods

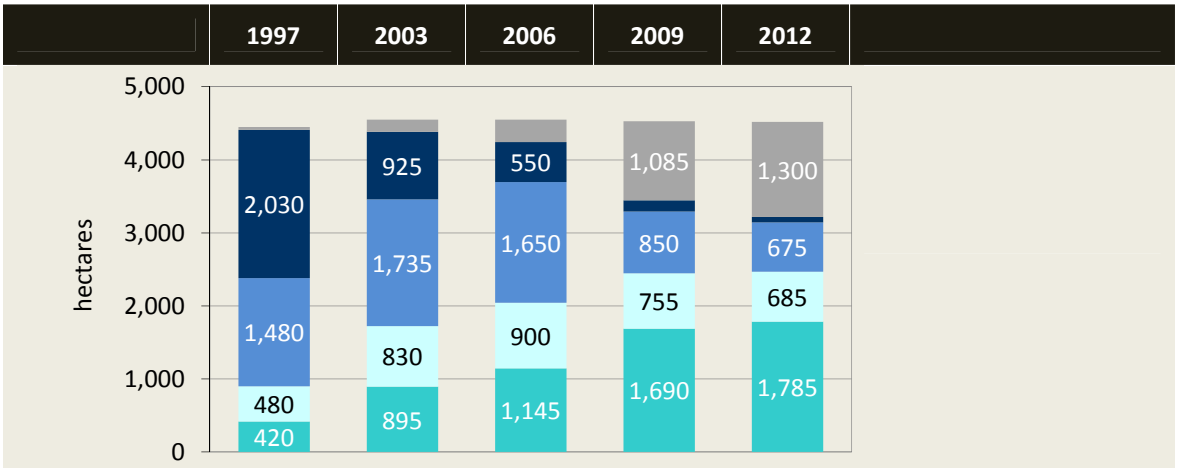
Figure 48 summarises irrigation methods in the Red Cliffs Irrigation District from 1997 to 2012.

The dominant irrigation method was furrow in 1997, however this changed to overhead sprinklers by 2003. Drip irrigation has been the dominant method since 2009.

Drip irrigation increased by 1,365 hectares between 1997 and 2012, while furrow irrigation decreased by 1,955 hectares.

Furrow irrigation comprised 2% (75 hectares) of the 2012 irrigable area.

Figure 48 - Red Cliffs Irrigation District irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	420	895	1,145	1,690	1,785	39%	+1,365
Low level	480	830	900	755	685	15%	+205
Overhead	1,480	1,735	1,650	850	675	15%	-805
Furrow	2,030	925	550	150	75	2%	-1,955
Vacant	40	165	305	1,085	1,300	29%	+1,260
Total	**4,450**	**4,550**	**4,550**	**4,530**	**4,520**	**100%**	**+70**

Note: 'Overhead' includes centre pivot and travel sprays and 'Low level' includes sprinklers.

4.3.5 Red Cliffs Irrigation District – salinity impact zones

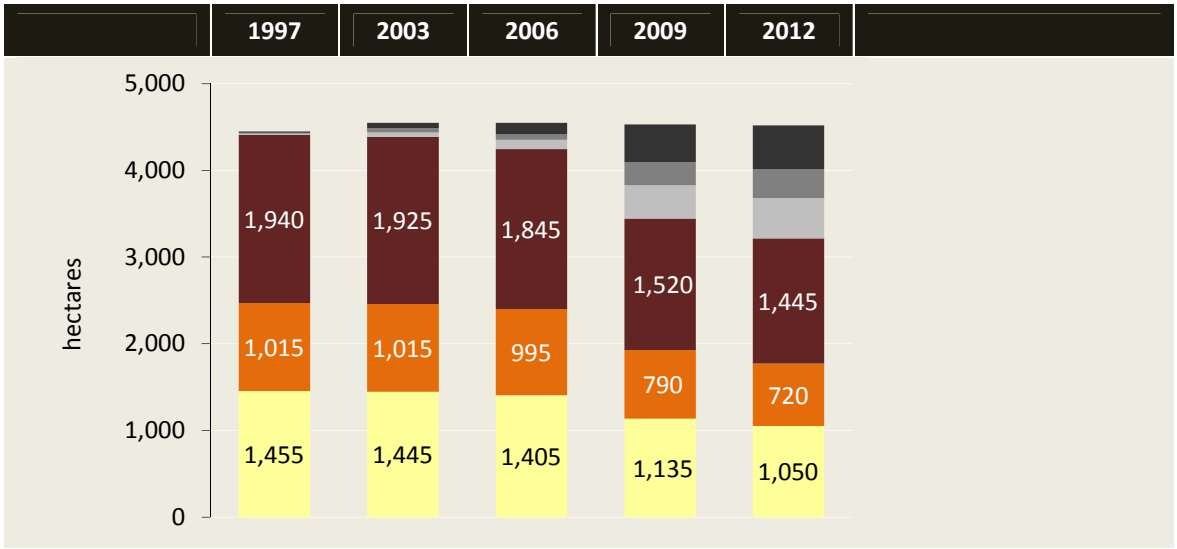
Figure 49 summarises the irrigable area in each river salinity impact zone in the Red Cliffs Irrigation District from 1997 to 2012.

In the Red Cliffs Irrigation District:

- 43% of the irrigable area is in the high salinity impact zone, HIZ
- 34% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 23% of the irrigable area is in low salinity impact zone LIZ 4

The irrigable area in the HIZ decreased from 1,955 hectares in 1997 to 1,950 hectares in 2012.

Figure 49 - Red Cliffs Irrigation District salinity impact zones from 1997 to 2012

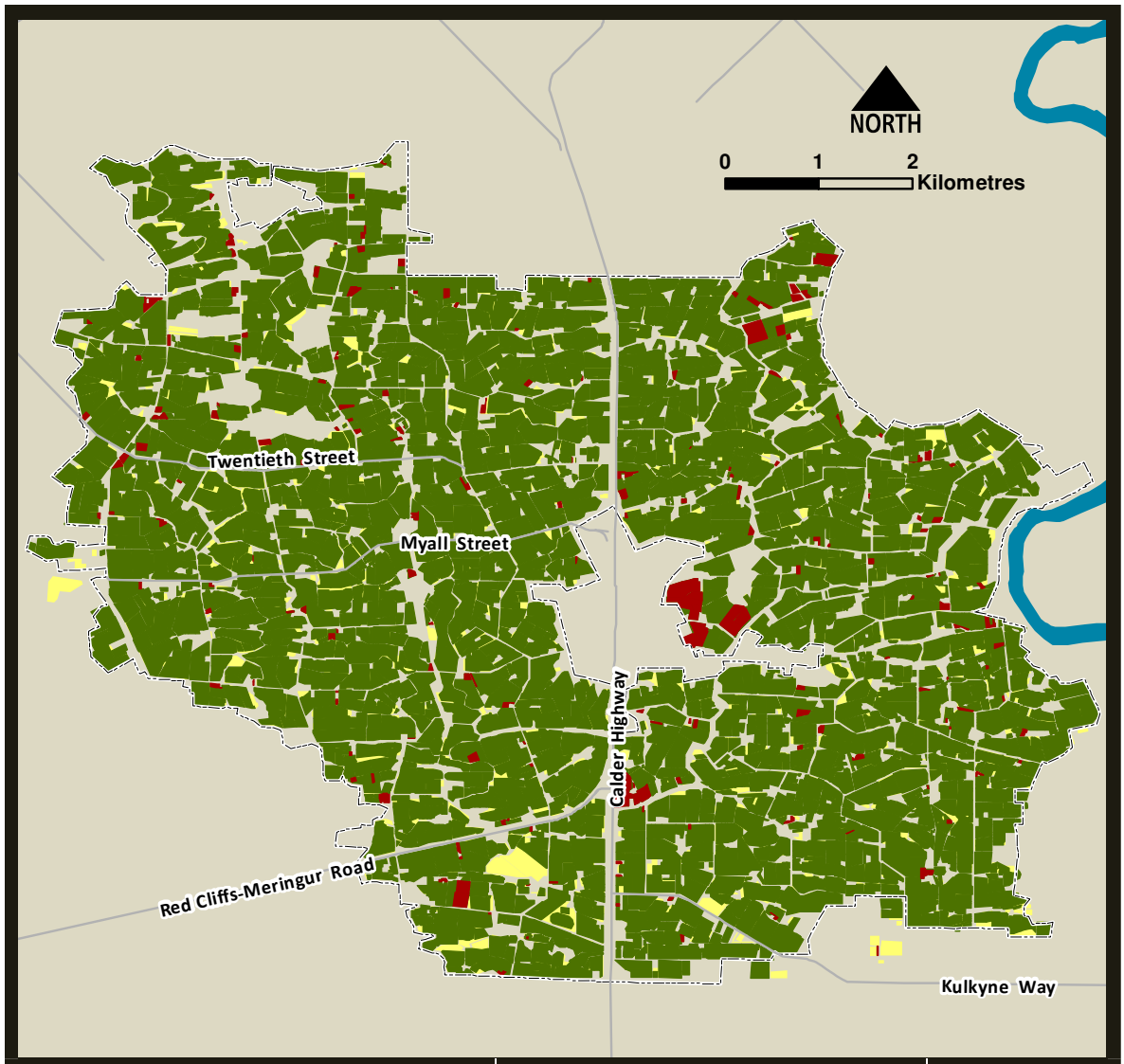


Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	1,455	1,445	1,405	1,135	1,050	24%	-405
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	1,015	1,015	995	790	720	16%	-295
	HIZ	1,940	1,925	1,845	1,520	1,445	32%	-495
Not Irrigated	LIZ 1	15	55	110	385	465	10%	+450
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	10	45	60	265	335	7%	+325
	HIZ	15	65	135	435	505	11%	+490
Total		**4,450**	**4,550**	**4,550**	**4,530**	**4,520**	**100%**	**+70**

4.3.6 Red Cliffs Irrigation District – irrigation development

Map 7 shows irrigation development in the Red Cliffs Irrigation District with respect to new and retired irrigation areas from 1997 to 2012.

Map 7 - Red Cliffs Irrigation District development from 1997 to 2012



	Hectares		% of 1997
Irrigated crops in 1997 (1996-97 season)	4,450		
Retired between 1997 and 2012	-95		-2%
New areas between 1997 and 2012	+165		+4%
Irrigated crops in 2012 (2011-12 season)	4,520		

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

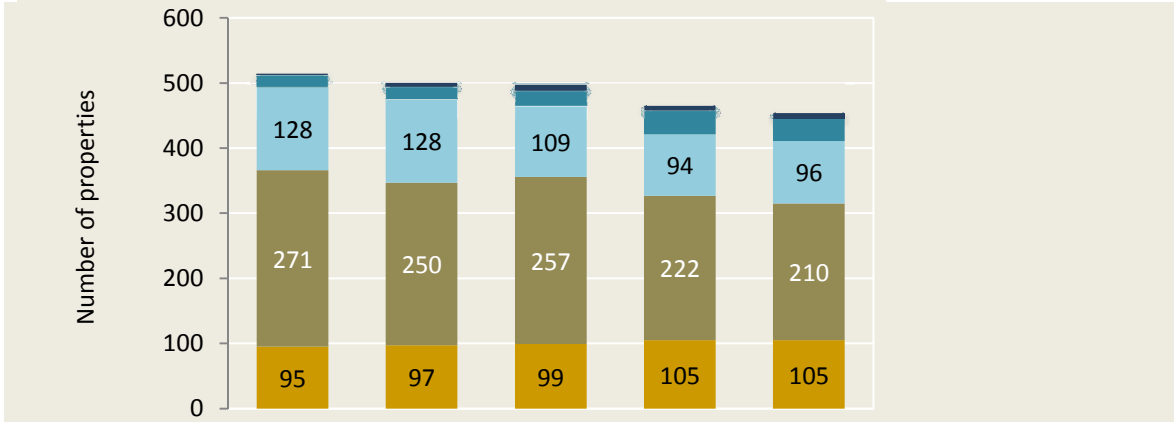
4.3.7 Red Cliffs Irrigation District – property change

Figure 50 provides estimates of property numbers and average property size (irrigable area) in the Red Cliffs Irrigation District from 1997 to 2012.

The Red Cliffs Irrigation District has approximately 455 irrigation properties (land holdings). Average property size (irrigable area) is 9.9 hectares.

The number of irrigation properties decreased by 59 properties between 1997 and 2012. The average irrigable area per property increased from 8.7 hectares in 1997 to 9.9 hectares in 2012.

Figure 50 – Property numbers and size in Red Cliffs Irrigation District from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	95	97	99	105	105	23%	+10
5 to 10 ha	271	250	257	222	210	46%	-61
10 to 20 ha	128	128	109	94	96	21%	-32
20 to 40 ha	17	19	23	37	35	8%	+18
40 to 100 ha	3	6	9	8	9	2%	+6
100 to 500 ha	-	-	-	-	-	-	-
> 500 ha	-	-	-	-	-	-	-
Total properties	**514**	**500**	**497**	**466**	**455**	**100%**	**-59**
Average size (ha)	**8.7**	**9.1**	**9.2**	**9.7**	**9.9**		

4.4 Mildura Irrigation District

In summary for the Mildura Irrigation District

- The Mildura Irrigation District has approximately 705 irrigation properties. Average property size (irrigable area) is 8.6 hectares.
- Grapevines remained the dominant crop from 1997 to 2012. These were predominantly grown for wine production until 2009. By 2012, table grapes were the dominant grape commodity.
- The irrigable area decreased by 7% (460 hectares), from 6,490 hectares in 1997 to 6,030 hectares in 2012.
- 30% of the irrigable area was vacant in the 2011-12 irrigation season; 25% previously permanent plantings and 5% previously seasonal plantings.
- The dominant irrigation method changed from furrow irrigation in 1997 to overhead sprinklers by 2006. Drip irrigation has been the dominant method since 2009.
- Crops are predominantly (65%) in the high salinity impact zone, HIZ.

4.4.1 Mildura Irrigation District 2012 crop types

Mildura Irrigation District crop types in the 2011-12 season are shown in Figure 51 and Map 8.

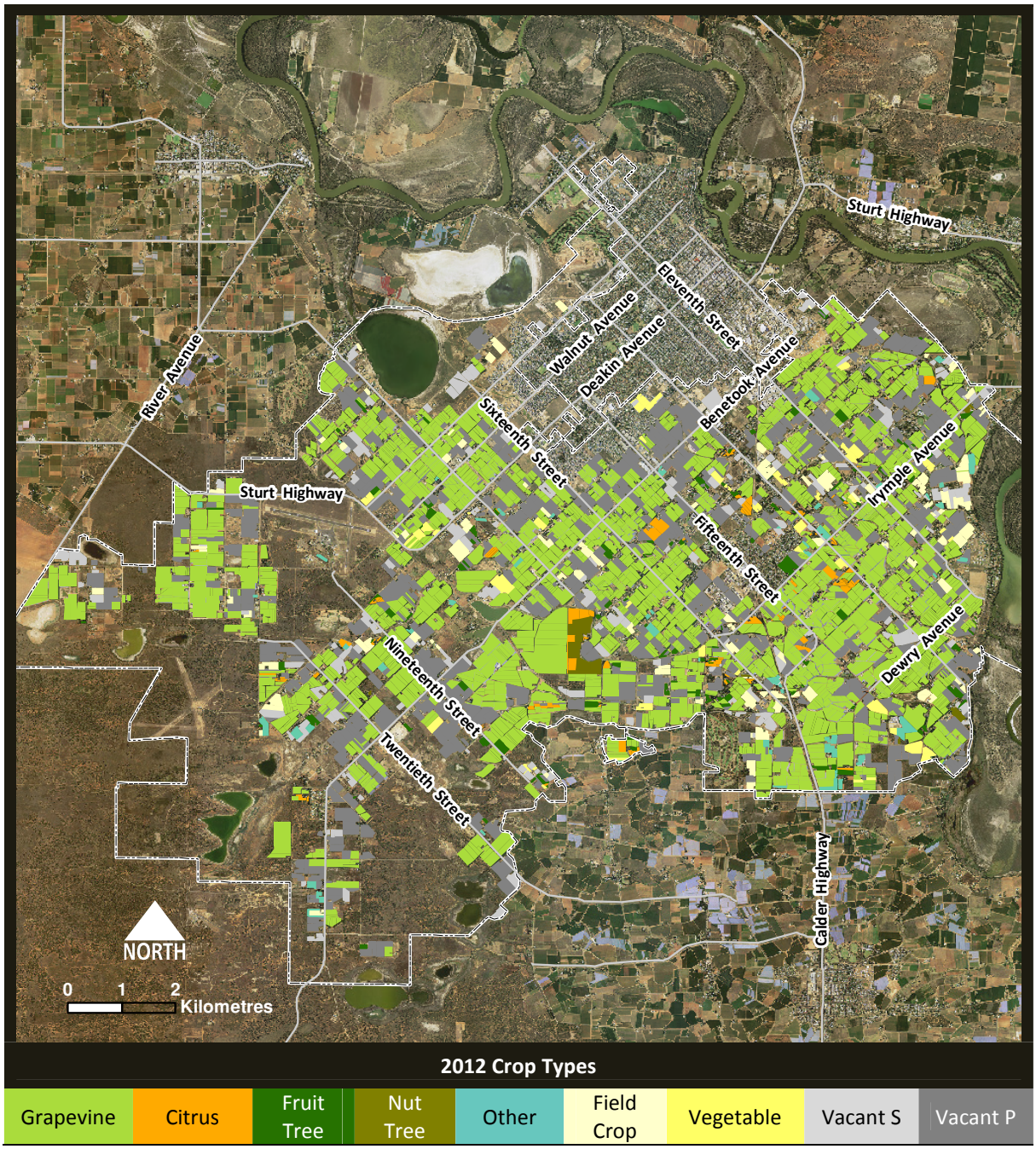
Figure 51 - Mildura Irrigation District 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	1,440	24%	
	Table	1,460	24%	
	Dried	770	13%	
	Other	10	0%	Cannery, Juicing, Research
Citrus		90	1%	Grapefruit, Lemon, Mandarin, Navel, other Orange, Tangelo, Valencia
Fruit tree	***unspecified***	5	0%	
	Avocado	15	0%	
	Olive	45	1%	
	Stone fruit	5	0%	including Apricot, Nectarine, Plum
	Other	15	0%	Date Palm, Fig, Mango, Pomegranate
Nut tree	Almond	30	0%	
	Other	5	0%	Pecan, Pistachio, Walnut
Other	Nursery	35	1%	
	Woodlot	25	0%	
	Other	5	0%	Miscellaneous
Field crop	***unspecified***	25	0%	
	Other	155	3%	Cereal, Lucerne, Oats, Pasture
Vegetable	***unspecified***	85	1%	
	Asparagus	0	0%	<2ha
	Carrot, Potato	0	0%	
	Other	5	0%	Capsicum, Chilli, Corn, Pumpkin
Vacant S		290	5%	*Vacant – previously a seasonal planting*
Vacant P		1,515	25%	*Vacant – previously a permanent planting*
Total		**6,030**	**100%**	

Note: 'unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Mildura Irrigation District 2012 crop types

Map 8 – Mildura Irrigation District showing 2012 crop types



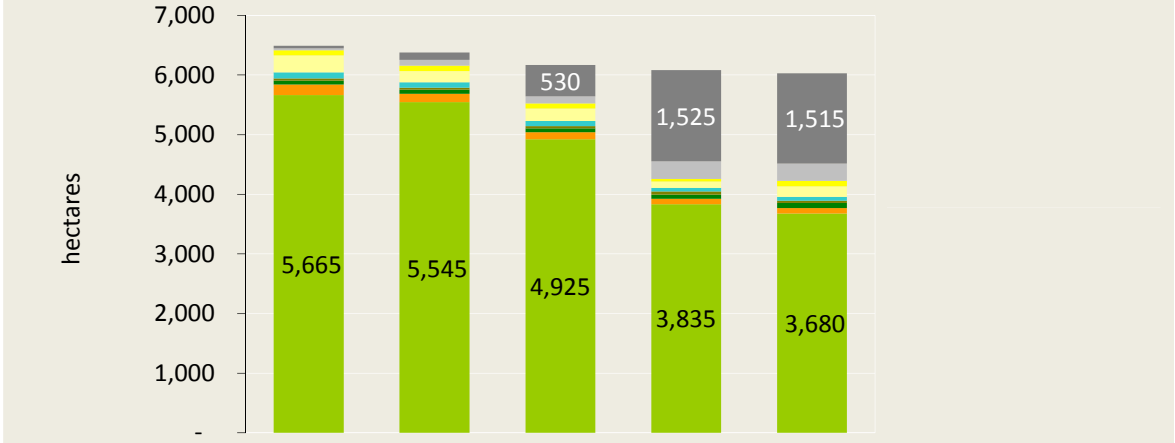
4.4.2 Mildura Irrigation District – crop type change

Figure 52 summarises crop types in the Mildura Irrigation District from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 6,030 hectares of which 70% (4,225 hectares) was irrigated and 30% (1,805 hectares) was vacant or not irrigated.

The irrigable area decreased by 460 hectares, a 7% decrease from 6,490 hectares in 1997 to 6,030 hectares in 2012. Grapevines remained the dominant crop type from 1997 to 2012.

Figure 52 - Mildura Irrigation District crop types from 1997 to 2012



	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	5,665	5,545	4,925	3,835	3,680	61%	-1,985
	Citrus	175	140	115	90	90	1%	-85
	Fruit Tree	65	70	65	70	85	1%	+20
	Nut Tree	35	30	35	55	35	1%	0
	Other	105	95	90	55	65	1%	-40
Seasonal	Field Crop	285	185	210	110	180	3%	-105
	Vegetable	85	90	85	40	90	1%	+5
Vacant	Vacant S	30	100	115	300	290	5%	+260
	Vacant P	45	120	530	1,525	1,515	25%	+1,470
Total		**6,490**	**6,375**	**6,170**	**6,080**	**6,030**	**100%**	**-460**
% Vacant		**1%**	**3%**	**10%**	**30%**	**30%**		

% Vacant 2008 to 2011 Irrigation status reports#	2008	2009	2010	2011
	23%	**30%**	**34%**	**32%**

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

Supplementary data from Irrigation Status Reports prepared by SunRISE 21 for the Mallee CMA.

4.4.3 Mildura Irrigation District – grapevines

Figure 53 summarises grape use in the Mildura Irrigation District from 1997 to 2012.

Grapevines are the dominant crop in the Mildura Irrigation District. They were predominantly grown for wine production from 1997 to 2009. Table grape plantings increased by 490 hectares between 1997 and 2012 and are now the dominant grape type.

Wine grape plantings and dried vine fruit plantings decreased by 960 hectares and 1,515 hectares respectively between 1997 and 2012.

Figure 53 - Mildura Irrigation District grape use from 1997 to 2012

Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	2,400	2,575	2,400	1,740	1,440	39%	-960
Table	970	1,315	1,275	1,270	1,460	40%	+490
Dried	2,285	1,650	1,245	820	770	21%	-1,515
Other	10	5	5	5	10	0%	0
Total	**5,665**	**5,545**	**4,925**	**3,835**	**3,680**	**100%**	**-1,985**

Note: 'Other' includes grapes for juicing, research and cannery.

4.4.4 Mildura Irrigation District – irrigation methods

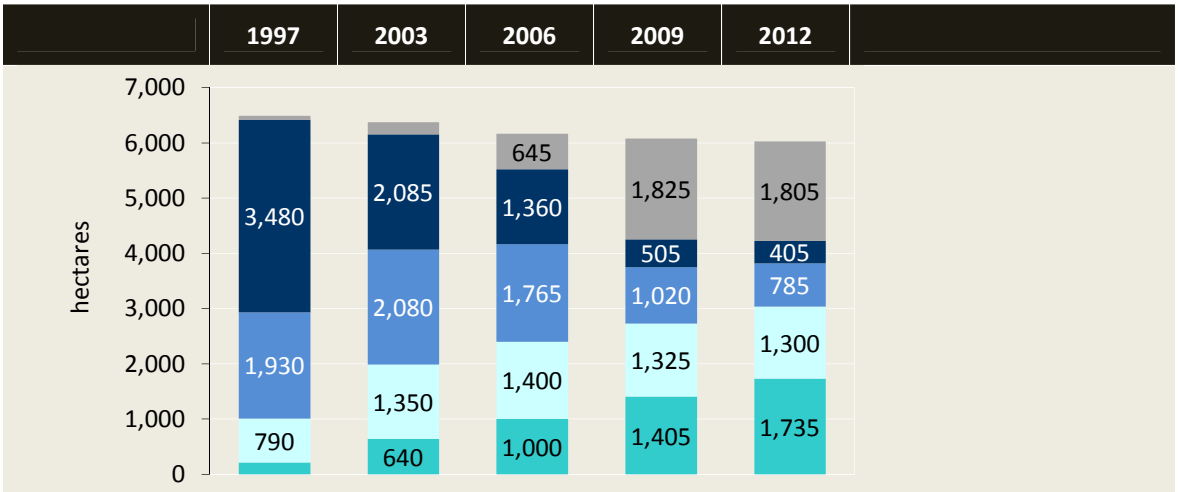
Figure 54 summarises irrigation methods in the Mildura Irrigation District from 1997 to 2012.

The dominant irrigation method was furrow in 1997 and 2003, however this changed to overhead sprinklers by 2006, then to drip irrigation in 2009 and 2012.

Drip irrigation increased by 1,520 hectares between 1997 and 2012, while furrow irrigation decreased by 3,075 hectares.

Furrow irrigation comprised 7% (405 hectares) of the 2012 irrigable area.

Figure 54 - Mildura Irrigation District irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	215	640	1,000	1,405	1,735	29%	+1,520
Low level	790	1,350	1,400	1,325	1,300	21%	+510
Overhead	1,930	2,080	1,765	1,020	785	13%	-1,145
Furrow	3,480	2,085	1,360	505	405	7%	-3,075
Vacant	75	220	645	1,825	1,805	30%	+1,730
Total	**6,490**	**6,375**	**6,170**	**6,080**	**6,030**	**100%**	**-460**

Note: 'Overhead' includes centre pivot and travel sprays and 'Low level' includes sprinklers.

4.4.5 Mildura Irrigation District – salinity impact zones

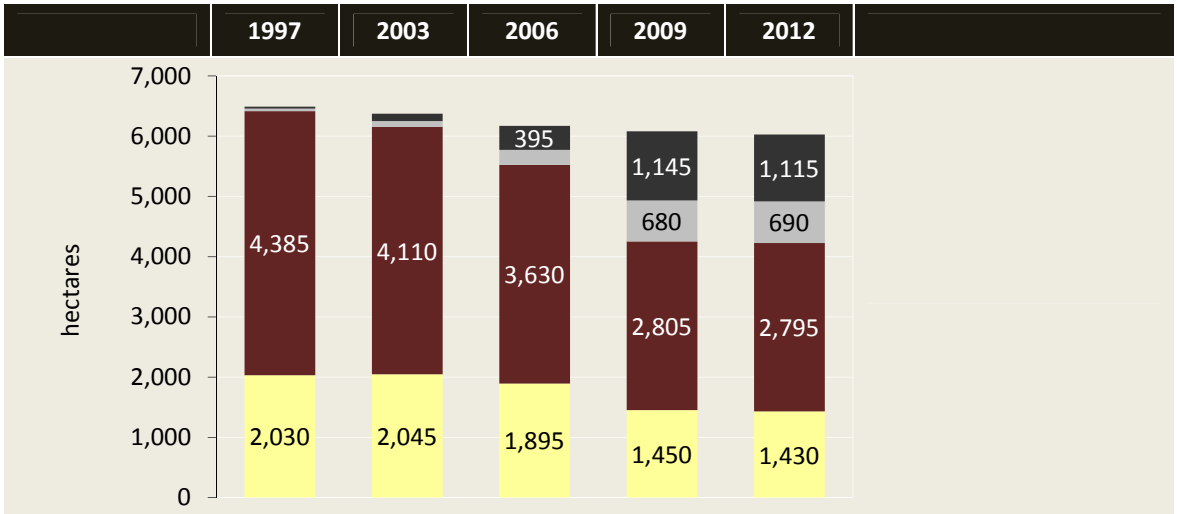
Figure 55 summarises the irrigable area in each river salinity impact zone in the Mildura Irrigation District from 1997 to 2012.

In the Mildura Irrigation District:

- 65% of the irrigable area is in the high salinity impact zone, HIZ
- 35% of the irrigable area is in the lowest salinity impact zone, LIZ 1

The irrigable area in the HIZ decreased by 505 hectares between 1997 and 2012, predominantly as a result of areas retired from irrigation due to urban development.

Figure 55 - Mildura Irrigation District salinity impact zones from 1997 to 2012

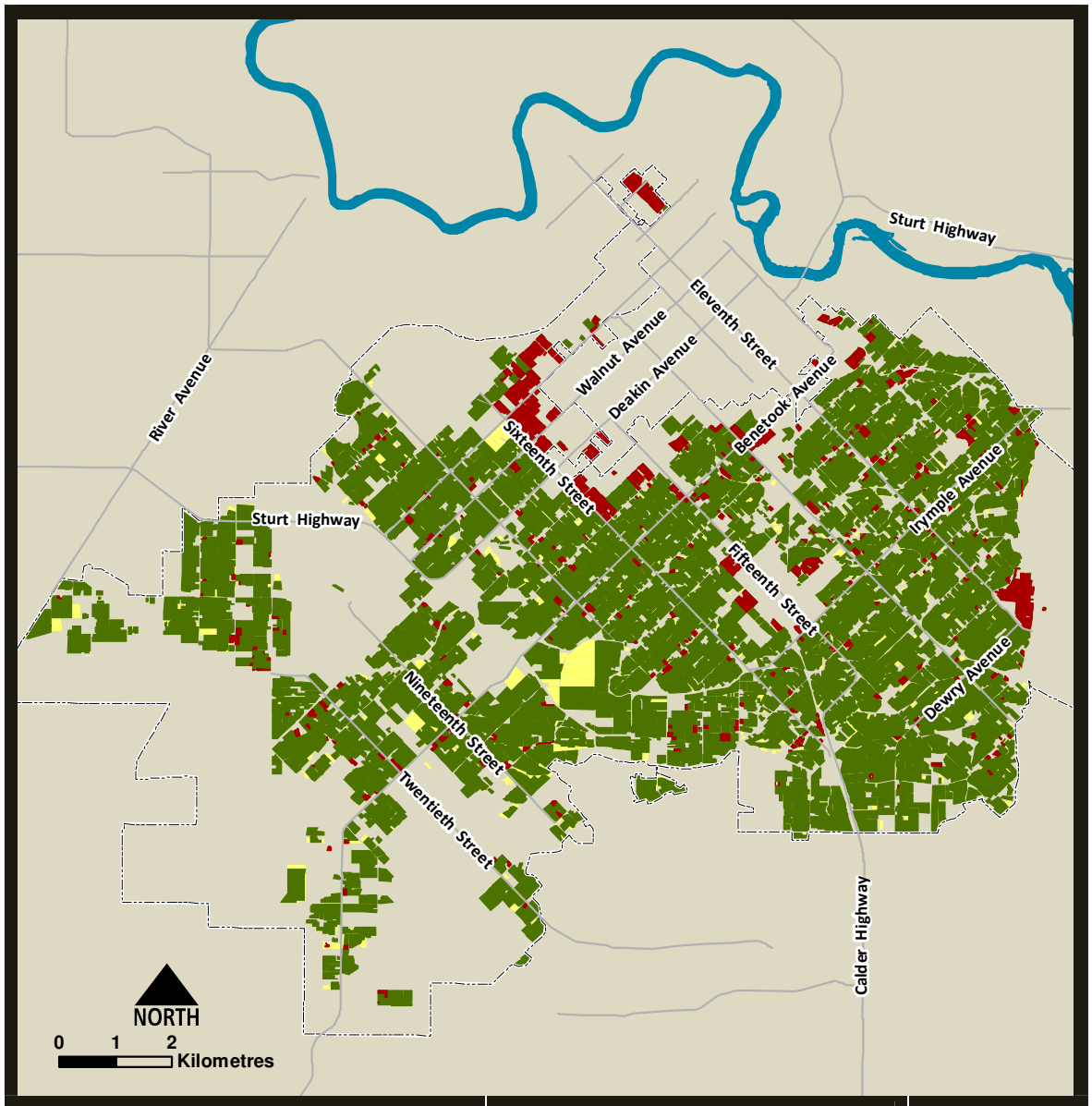


Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	2,030	2,045	1,895	1,450	1,430	24%	-600
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	4,385	4,110	3,630	2,805	2,795	46%	-1,590
Not Irrigated	LIZ 1	45	95	250	680	690	11%	+645
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	30	125	395	1,145	1,115	19%	+1,085
Total		**6,490**	**6,375**	**6,170**	**6,080**	**6,030**	**100%**	**-460**

4.4.6 Mildura Irrigation District – irrigation development

Map 9 shows irrigation development in the Mildura Irrigation District with respect to new and retired irrigation areas from 1997 to 2012.

Map 9 - Mildura Irrigation District development from 1997 to 2012



	Hectares			% of 1997
Irrigated crops in 1997 (1996-97 season)	6,490			
Retired between 1997 and 2012		-665		-10%
New areas between 1997 and 2012		+205		+3%
Irrigated crops in 2012 (2011-12 season)			6,030	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

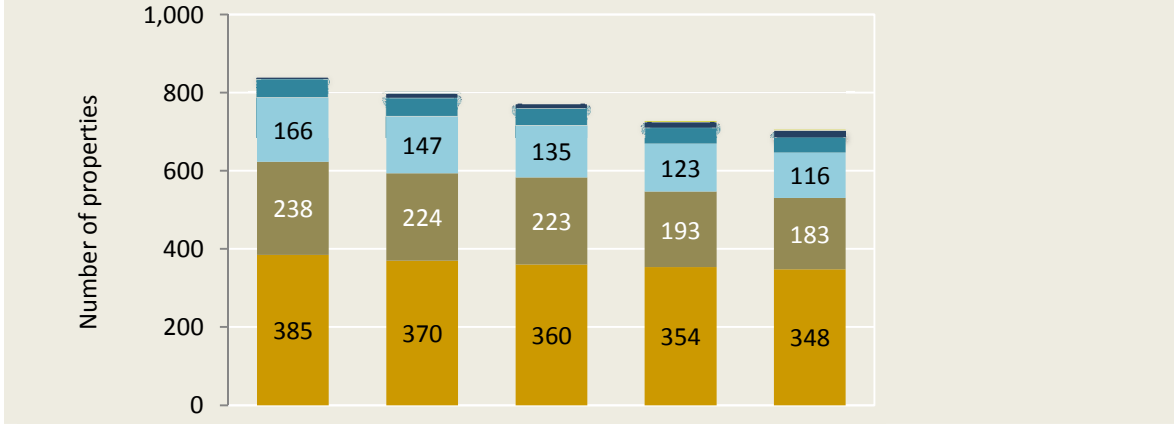
4.4.7 Mildura Irrigation District – property change

Figure 56 provides estimates of property numbers and average property size (irrigable area) in the Mildura Irrigation District from 1997 to 2012.

The Mildura Irrigation District has approximately 705 irrigation properties (land holdings). Average property size (irrigable area) is 8.6 hectares.

The number of irrigation properties decreased by 122 properties between 1997 and 2012. The average irrigable area per property increased from 7.7 hectares in 1997 to 8.4 hectares in 2012.

Figure 56 – Property numbers and size in Mildura Irrigation District from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	385	370	360	354	348	49%	-37
5 to 10 ha	238	224	223	193	183	26%	-55
10 to 20 ha	166	147	135	123	116	16%	-50
20 to 40 ha	45	45	42	41	39	6%	-6
40 to 100 ha	5	11	12	15	18	3%	13
100 to 500 ha	-	-	-	-	-	-	-
> 500 ha	-	-	-	-	-	-	-
Total properties	**839**	**797**	**772**	**727**	**705**	**100%**	**-134**
Average size (ha)	**7.7**	**8.0**	**8.0**	**8.4**	**8.6**		

4.5 Merbein Irrigation District

In summary for the Merbein Irrigation District

- The Merbein Irrigation District has approximately 310 irrigation properties. Average property size (irrigable area) is 9.9 hectares.
- Grapevines remained the dominant crop type from 1997 to 2009. These were predominantly grown for dried vine fruit from 1997 to 2006. While wine grape plantings dominated by 2009, dried vine fruit regained dominance by 2012.
- The irrigable area decreased by 3% (95 ha), from 3,140 ha in 1997 to 3,060 ha in 2012.
- 38% of the irrigable area was vacant in the 2011-12 irrigation season; 37% was previously permanent plantings and 1% was previously seasonal plantings.
- The dominant irrigation method was furrow from 1997 to 2006, changing to drip irrigation by 2009. Drip irrigation increased by 695 hectares between 1997 and 2012 while furrow irrigation decreased by 1,795 hectares.
- Crops are predominantly (67%) grown in the high salinity impact zone, HIZ.

4.5.1 Merbein Irrigation District 2012 crop types

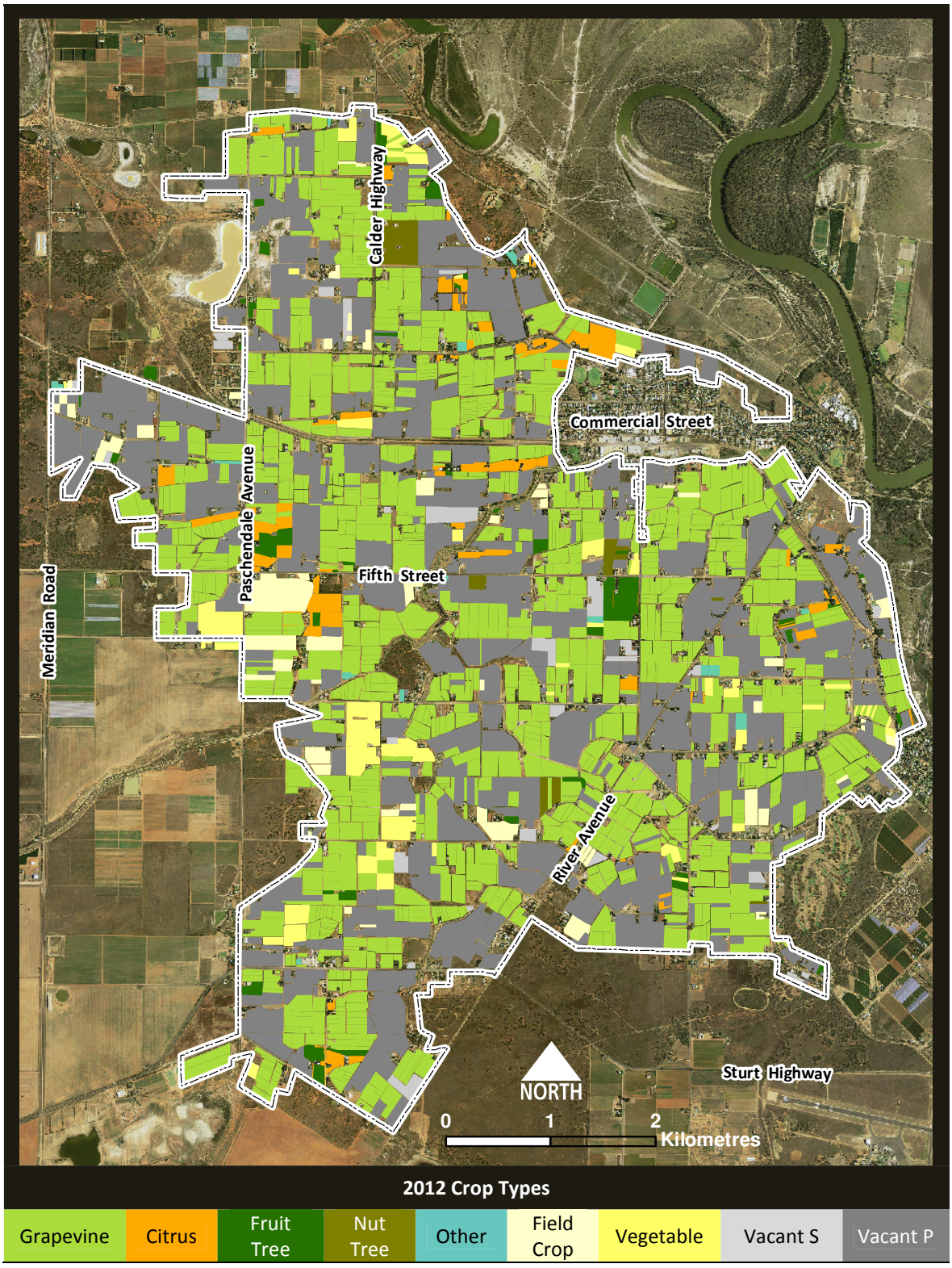
Merbein Irrigation District crop types in the 2011-12 season are shown in Figure 57 and Map 10.

Figure 57 – Merbein Irrigation District 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	590	19%	
	Table	320	10%	
	Dried	640	21%	
	Other	-	-	
Citrus		75	2%	Grapefruit, Lemon, Mandarin, Navel, other Orange, Tangelo, Valencia
Fruit tree	***unspecified***	5	0%	
	Avocado	10	0%	
	Olive	20	1%	
	Stone fruit	5	0%	including Plum
	Other	10	0%	Fig, Mango, Persimmon, Pomegranate
Nut tree	Almond	15	0%	
	Other	10	0%	Pistachio, Walnut
Other	Nursery	5	0%	
	Woodlot	0	0%	< 1ha
	Other	5	0%	Pine trees, Roses
Field crop	***unspecified***	5	0%	
	Other	80	3%	Cereal, Lucerne, Pasture
Vegetable	***unspecified***	45	1%	
	Asparagus	30	1%	
	Carrot	-	-	
	Potato	-	-	
	Other	20	1%	Eggplant, Pumpkin, Zucchini
Vacant S		40	1%	*Vacant – previously a seasonal planting*
Vacant P		1,130	38%	*Vacant – previously a permanent planting*
Total		**3,060**	**100%**	

Merbein Irrigation District 2012 crop types

Map 10 - Merbein Irrigation District showing 2012 crop types



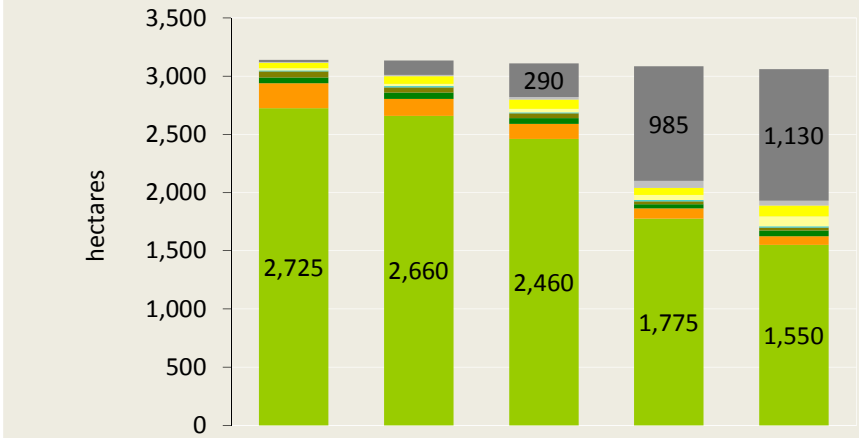
4.5.2 Merbein Irrigation District – crop type change

Figure 58 summarises crop types in the Merbein Irrigation District from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 3,060 hectares of which 62% (1,890 hectares) was irrigated and 38% (1,170 hectares) was vacant or not irrigated.

The irrigable area decreased by 80 hectares, a 3% decrease from 3,140 hectares in 1997 to 3,060 hectares in 2012.

Figure 58 – Merbein Irrigation District crop types from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	2,725	2,660	2,460	1,775	1,550	51%	-1,175
	Citrus	215	145	130	90	75	2%	-140
	Fruit Tree	50	55	50	35	50	2%	0
	Nut Tree	50	45	40	25	25	1%	-25
	Other	10	10	10	10	10	0%	0
Seasonal	Field Crop	20	20	30	45	85	3%	+65
	Vegetable	45	65	80	60	95	3%	+50
Vacant	Vacant S	5	10	20	60	40	1%	+35
	Vacant P	20	125	290	985	1,130	37%	+1,110
Total		**3,140**	**3,135**	**3,110**	**3,085**	**3,060**	**100%**	**-80**
% Vacant		**1%**	**4%**	**10%**	**34%**	**38%**		

% Vacant 2008 to 2011 Irrigation status reports#	2008	2009	2010	2011
	26%	34%	43%	41%

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

Supplementary data from Irrigation Status Reports prepared by SunRISE 21 for the Mallee CMA.

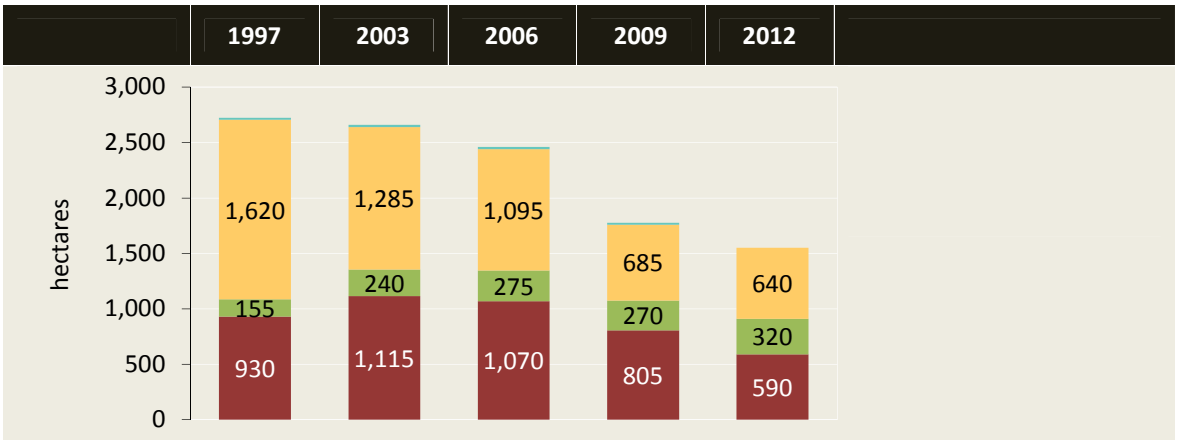
4.5.3 Merbein Irrigation District – grapevines

Figure 59 summarises grape use in the Merbein Irrigation District from 1997 to 2012.

Grapevines have predominantly been grown for dried vine fruit production except for in 2009 when wine grape plantings dominated.

Both dried vine fruit and wine grape plantings decreased between 1997 and 2012, by 980 hectares and 340 hectares respectively. Only table grape plantings increased with 165 more hectares planted in 2012 than in 1997.

Figure 59 – Merbein Irrigation District grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	930	1,115	1,070	805	590	38%	-340
Table	155	240	275	270	320	21%	+165
Dried	1,620	1,285	1,095	685	640	41%	-980
Other	20	20	20	15	0	0%	-20
Total	**2,725**	**2,660**	**2,460**	**1,775**	**1,550**	**100%**	**-1,175**

Note: 'Other' includes grapes for juicing, research and cannery.

4.5.4 Merbein Irrigation District – irrigation methods

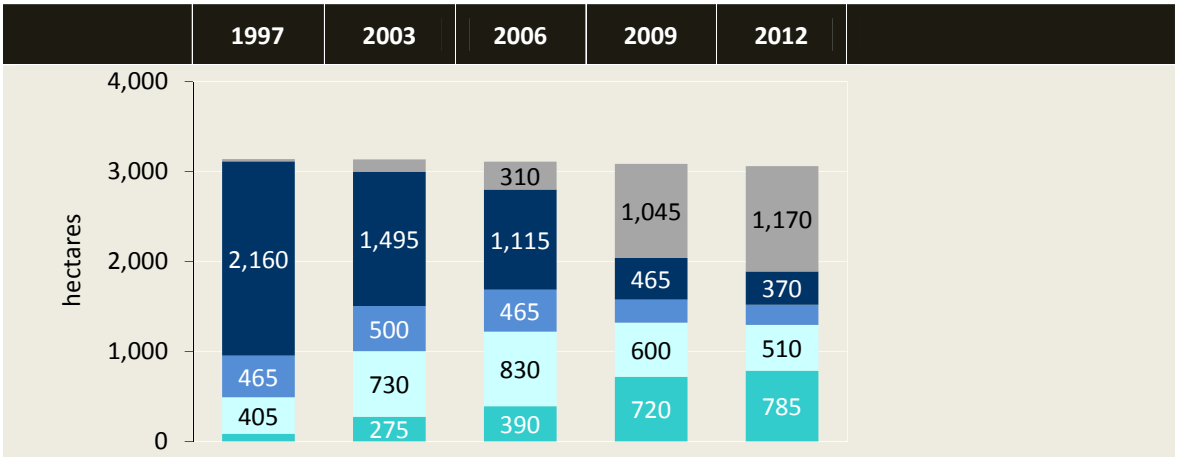
Figure 60 summarises irrigation methods in the Merbein Irrigation District from 1997 to 2012.

The dominant irrigation method was furrow from 1997 to 2006, changing to drip irrigation by 2009.

Drip irrigation increased by 700 hectares between 1997 and 2012 while furrow irrigation decreased by 1,790 hectares.

Furrow irrigation comprised 12% (370 hectares) of the 2012 irrigable area.

Figure 60 – Merbein Irrigation District irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	85	275	390	720	785	26%	+700
Low level	405	730	830	600	510	17%	+105
Overhead	465	500	465	255	225	7%	-240
Furrow	2,160	1,495	1,115	465	370	12%	-1,790
Vacant	25	135	310	1,045	1,170	38%	+1,145
Total	**3,140**	**3,135**	**3,110**	**3,085**	**3,060**	**100%**	**-80**

Note: 'Overhead' includes centre pivot and travel sprays, and 'Low level' includes sprinklers.

4.5.5 Merbein Irrigation District – salinity impact zones

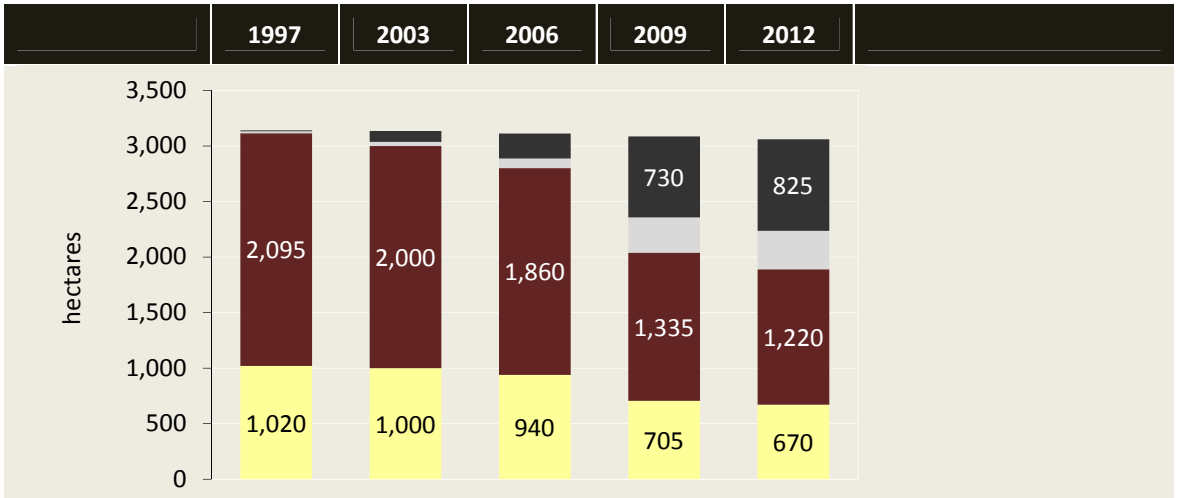
Figure 61 summarises the irrigable area in each river salinity impact zone in the Merbein Irrigation District from 1997 to 2012.

In the Merbein Irrigation District:

- 67% of the irrigable area is in the high salinity impact zone, HIZ
- 33% of the irrigable area is in the lowest salinity impact zone, LIZ 1

The irrigable area in the HIZ decreased by 60 hectares; from 2,105 hectares in 1997 to 2,045 hectares in 2012.

Figure 61 – Merbein Irrigation District salinity impact zones from 1997 to 2012

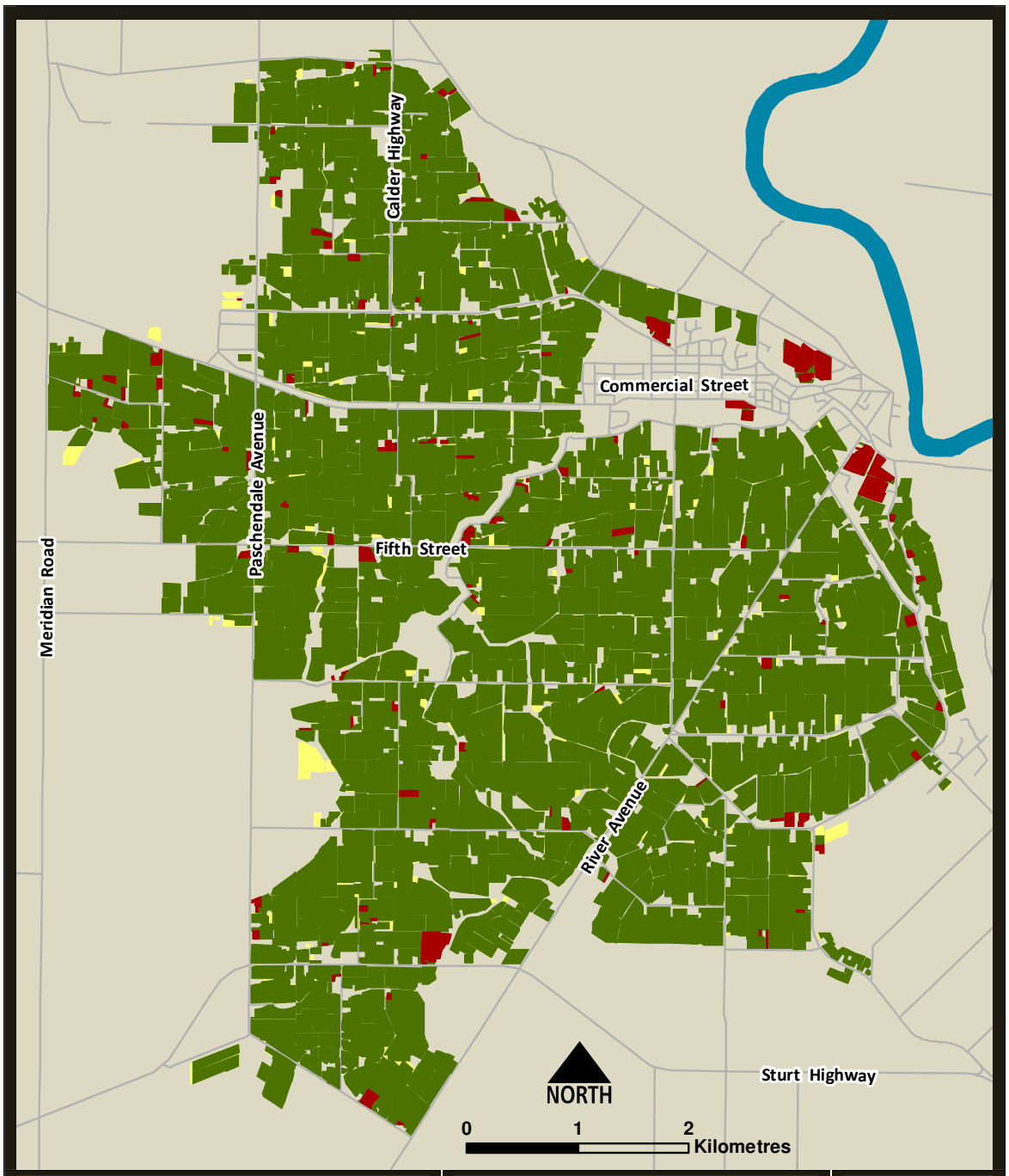


Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	1,020	1,000	940	705	670	22%	-350
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	2,095	2,000	1,860	1,335	1,220	40%	-875
Not Irrigated	LIZ 1	15	35	85	315	345	11%	+330
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	10	100	225	730	825	27%	+815
Total		**3,140**	**3,135**	**3,110**	**3,085**	**3,060**	**100%**	**-80**

4.5.6 Merbein Irrigation District – irrigation development

Map 11 shows irrigation development with respect to new and retired areas in the Merbein Irrigation District from 1997 to 2012.

Map 11 – Merbein Irrigation District development from 1997 to 2012



	Hectares		% of 1997
Irrigated crops in 1997 (1996-97 season)	3,140		
Retired between 1997 and 2012	-95		-3%
New areas between 1997 and 2012	+15		+1%
Irrigated crops in 2012 (2011-12 season)	3,060		

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

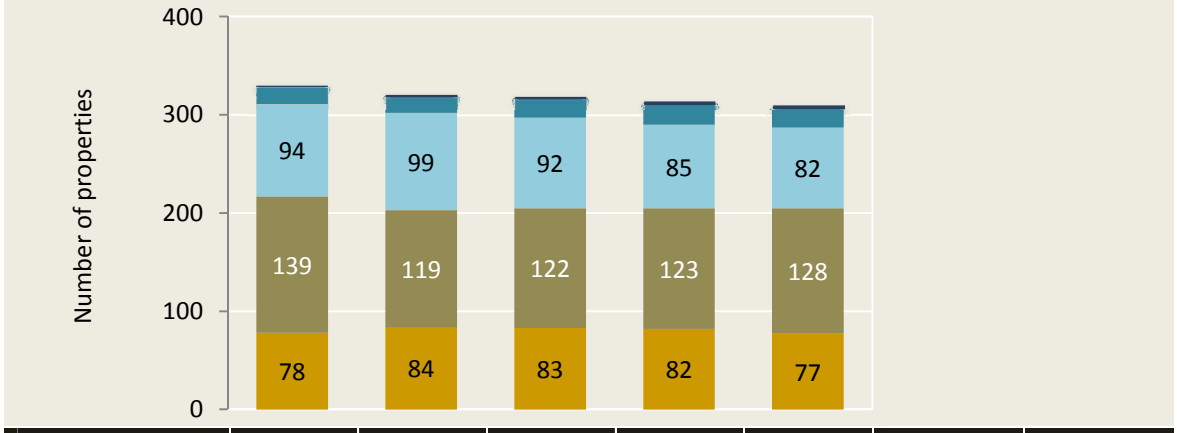
4.5.7 Merbein Irrigation District – property numbers

Figure 62 provides estimates of property numbers and average property size (irrigable area) in the Merbein Irrigation District from 1997 to 2012.

Merbein has approximately 310 irrigation properties (land holdings). Average property size (irrigable area) is 9.9 ha.

The number of irrigation properties decreased by 20 properties between 1997 and 2012. The average irrigable area per property increased from 9.5 hectares in 1997 to 9.9 hectares in 2012.

Figure 62 – Property numbers and size in Merbein Irrigation District from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	78	84	83	82	77	25%	-1
5 to 10 ha	139	119	122	123	128	42%	-11
10 to 20 ha	94	99	92	85	82	26%	-12
20 to 40 ha	17	16	19	20	19	6%	+2
40 to 100 ha	2	3	3	4	4	1%	+2
100 to 500 ha	-	-	-	-	-	-	-
> 500 ha	-	-	-	-	-	-	-
Total properties	**330**	**321**	**319**	**314**	**310**	**100%**	**-20**
Average size (ha)	**9.5**	**9.8**	**9.7**	**9.8**	**9.9**		

5. Private Diverter river reaches

5.1 Nyah River Reach

In summary for the Nyah River Reach

- The Nyah River Reach has approximately 72 irrigation properties. Average property size (irrigable area) is 108.8 hectares.
- Field crops such as irrigated cereal crops, lucerne and pasture are the dominant crop type. Nut trees (almonds) are a close second with 2,230 hectares planted between 2003 and 2012.
- The irrigable area increased by 67% (3,130 hectares) from 4,705 hectares in 1997 to 7,835 hectares in 2012.
- 21% of the irrigable area was vacant in the 2011-12 irrigation season comprising 2% previously permanent plantings and 19% previously seasonal plantings.
- The dominant irrigation method was furrow - flood irrigation from 1997 to 2006, changing to drip irrigation in 2009 and 2012.
- Crops are predominantly (56%) grown in the lowest salinity impact zone, LIZ 1.

5.1.1 Nyah River Reach 2012 crop types

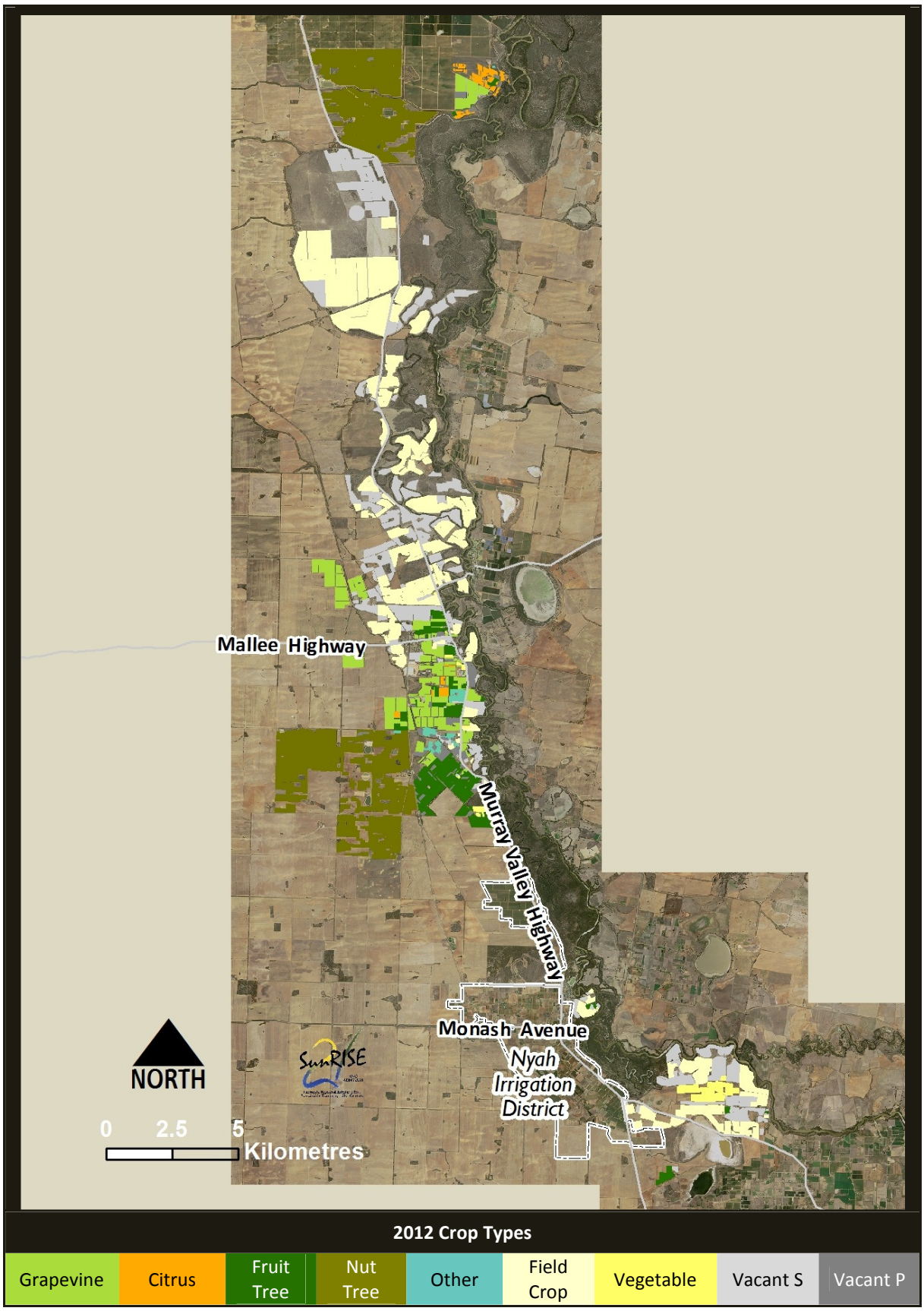
Nyah River Reach crop types in the 2011-12 season are shown in Figure 63 and Map 12.

Figure 63 – Nyah River Reach 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	690	9%	
	Table	135	2%	
Citrus		115	1%	Mandarin, Navel, Valencia
Fruit tree	***unspecified***	20	0%	
	Avocado	5	0%	
	Olive	5	0%	
	Stone fruit	470	6%	Apricot, Nectarine, Plum
	Other	5	0%	Apple
Nut tree	Almond	2,230	28%	
	Other	-	-	
Other	Nursery	45	1%	
	Woodlot	15	0%	
Field crop	***unspecified***	1,980	25%	
	Other	360	5%	Cereal, Oats, Lucerne, Pasture
Vegetable	***unspecified***	115	1%	
	Asparagus	-	-	
	Carrot, Potato	-	-	
	Other	15	0%	Pumpkin, Tomato
Vacant S		1,490	19%	*Vacant S – previously a seasonal planting*
Vacant P		140	2%	*Vacant P – previously a permanent planting*
Total		**7,835**	**100%**	

Nyah River Reach 2012 crop types

Map 12 – Nyah River Reach 2012 crop types



5.1.2 Nyah River Reach – crop type change

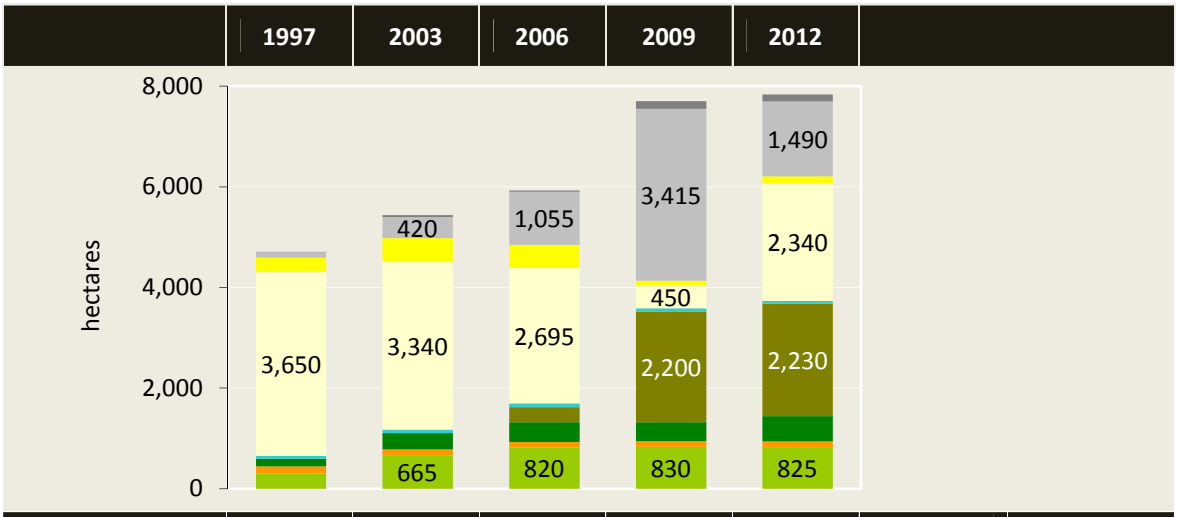
Figure 64 summarises crop types in the Nyah River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 7,835 hectares of which 79% (6,205 hectares) was irrigated and 21% (1,630 hectares) was vacant or not irrigated land. The irrigable area increased by 3,130 hectares; a 67% increase from 4,705 hectares in 1997 to 7,835 hectares in 2012.

Field crops are the dominant crop type in the Nyah River Reach, closely followed by almond tree plantings. Almond plantings increased by 2,230 hectares between 1997 and 2012, while field crops decreased by 1,310 hectares.

Drought and low water allocations were experienced in 2009 and only 550 hectares of seasonal crops, field crops and vegetables, were irrigated.

Figure 64 – Nyah River Reach crop type change from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	305	665	820	830	825	11%	+520
	Citrus	140	115	110	115	115	1%	-25
	Fruit Tree	155	325	395	380	505	6%	+350
	Nut Tree	0	0	295	2,200	2,230	28%	+2,230
	Other	55	70	75	60	60	1%	+5
Seasonal	Field Crop	3,650	3,340	2,695	450	2,340	30%	-1,310
	Vegetable	285	465	455	100	130	2%	-155
Vacant	Vacant S	110	420	1,055	3,415	1,490	19%	+1,380
	Vacant P	5	35	30	150	140	2%	+135
Total		**4,705**	**5,435**	**5,930**	**7,700**	**7,835**	**100%**	**+3,130**
% Vacant		**2%**	**8%**	**18%**	**46%**	**21%**		

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

5.1.3 Nyah River Reach – grapevines

Figure 65 summarises grape use in the Nyah River Reach from 1997 to 2012.

Grapevines were predominantly (84%) grown for wine production from 1997 to 2012.

Wine grape plantings peaked in 2009 then decreased by 20 hectares between 2009 and 2012. Table grape plantings increased by 15 hectares between 2009 and 2012.

Figure 65 – Nyah River Reach grape use from 1997 to 2012

Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	210	525	695	710	690	84%	+480
Table	90	140	125	120	135	16%	+45
Dried	5	0	0	0	0	0%	-5
Other	-	-	-	-	-	-	-
Total	**305**	**665**	**820**	**830**	**825**	**100%**	**+520**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

5.1.4 Nyah River Reach – irrigation methods

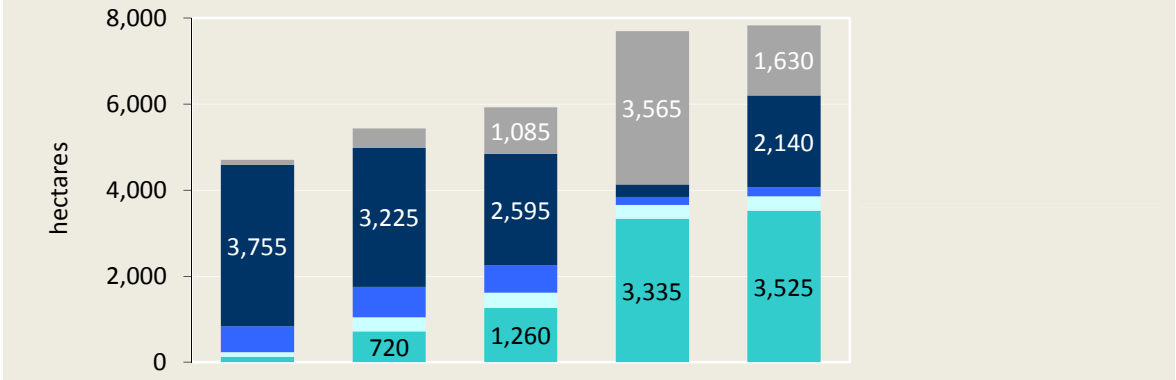
Figure 66 summarises irrigation methods in the Nyah River Reach from 1997 to 2012.

The dominant irrigation method was furrow irrigation until 2009. Drip irrigation has been the dominant method since 2009.

Drip irrigation increased by 3,405 hectares between 1997 and 2012, while furrow irrigation decreased by 1,615 hectares.

Furrow irrigation temporarily decreased to only 295 hectares in 2009. With drought and low water allocations in 2009 few of the seasonal field crops were irrigated.

Figure 66 – Nyah River Reach irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	120	720	1,260	3,335	3,525	45%	+3,405
Low level	115	325	360	325	335	4%	+220
Overhead	600	710	630	180	205	3%	-395
Furrow	3,755	3,225	2,595	295	2,140	27%	-1,615
Vacant	115	455	1,085	3,565	1,630	21%	+1,515
Total	**4,705**	**5,435**	**5,930**	**7,700**	**7,835**	**100%**	**+3,130**

Note: 'Overhead' includes centre pivot and travel sprays.
'Low level' includes sprinklers.
'Furrow' includes flood irrigation.

5.1.5 Nyah River Reach – salinity impact zones

Figure 67 summarises the irrigable area in each river salinity impact zone in the Nyah River Reach from 1997 to 2012.

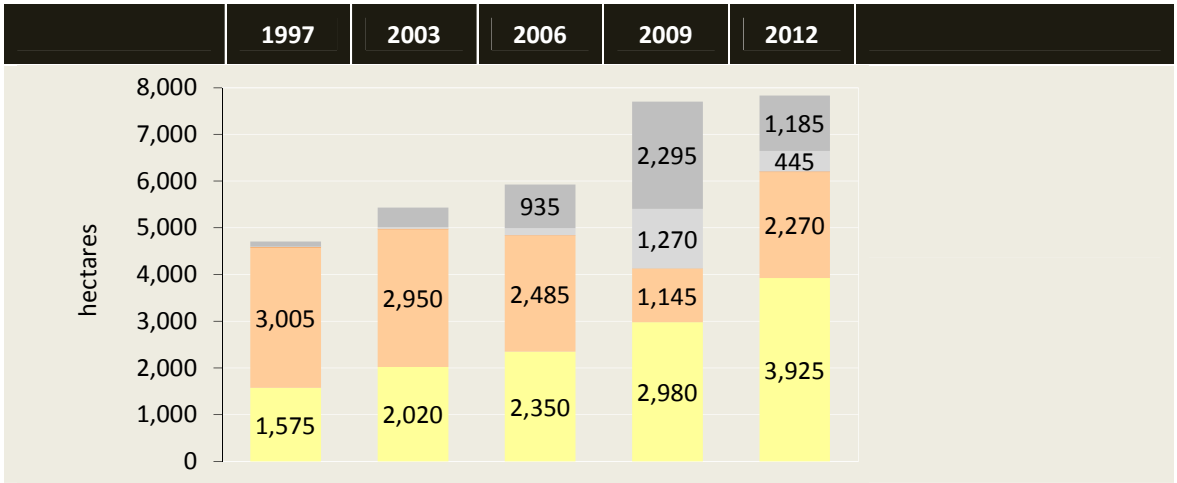
In the Nyah River Reach:

- 56% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 44% of the irrigable area is in low salinity impact zone LIZ 2
- Less than 1% of the irrigable area is in low salinity impact zone LIZ 3

Irrigation development occurred predominantly in low salinity impact zone LIZ 1.

There are no high salinity impact zones in the Nyah River Reach.

Figure 67 – Nyah River Reach salinity impact zones from 1997 to 2012



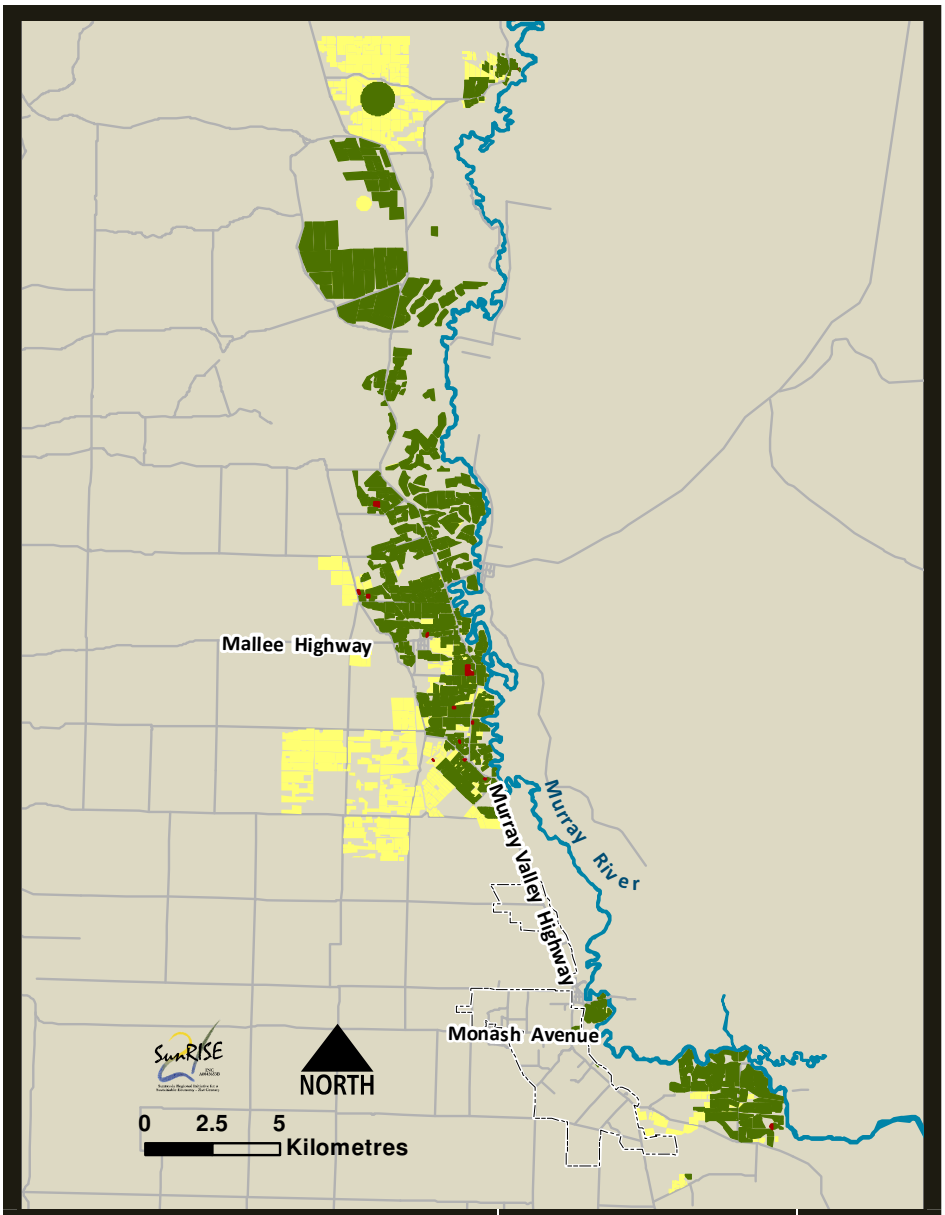
Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	1,575	2,020	2,350	2,980	3,925	50%	+2,350
	LIZ 2	3,005	2,950	2,485	1,145	2,270	29%	-735
	LIZ 3	10	10	10	10	10	0%	0
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Not Irrigated	LIZ 1	5	35	150	1,270	445	6%	+440
	LIZ 2	110	420	935	2,295	1,185	15%	+1,075
	LIZ 3	0	0	0	0	0	0%	0
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Total		**4,705**	**5,435**	**5,930**	**7,700**	**7,835**	**100%**	**+3,130**

5.1.6 Nyah River Reach – irrigation development

Map 13 shows irrigation development with respect to new and retired areas in the Nyah River Reach from 1997 to 2012.

The irrigable area increased by 3,130 hectares between 1997 and 2012; comprising 20 hectares retired and 3,150 hectares of new areas not irrigated prior to 1997.

Map 13 – Nyah River Reach development from 1997 to 2012



	Hectares	% of 1997
Irrigated crops in 1997 (1996-97 season)	4,705	
Retired between 1997 and 2012	-20	0%
New areas between 1997 and 2012	3,150	+67%
Irrigated crops in 2012 (2011-12 season)	7,835	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

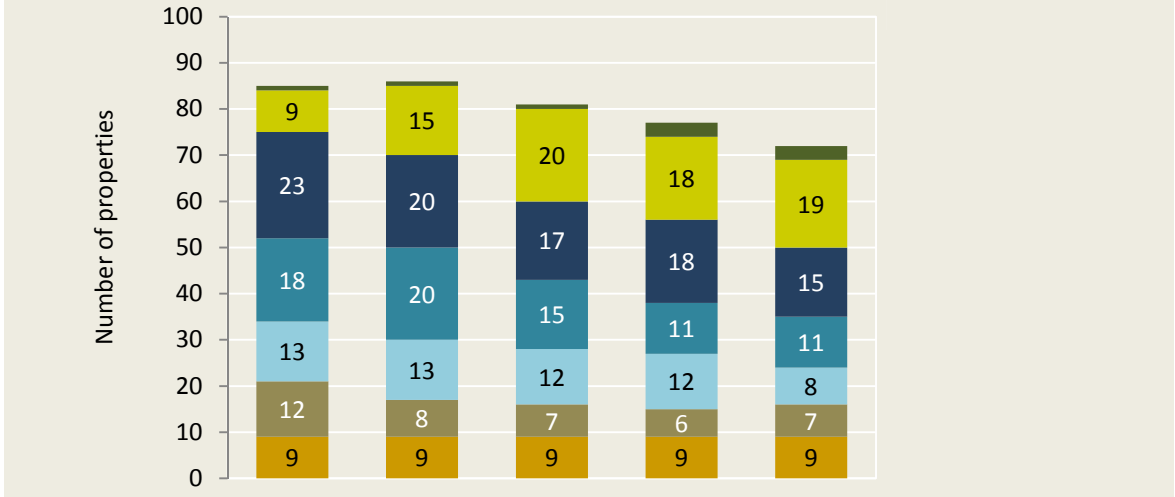
5.1.7 Nyah River Reach – property change

Figure 68 provides estimates of property numbers and average property size (irrigable area) in the Nyah River Reach from 1997 to 2012.

Nyah River Reach has approximately 72 irrigation properties (land holdings). Average size (irrigable area) is 108.8 hectares.

The number of irrigation properties decreased by 13 properties between 1997 and 2012. The average irrigable area per property increased from 55.4 hectares in 1997 to 108.8 hectares in 2012.

Figure 68 – Property numbers and size in Nyah River Reach from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	9	9	9	9	9	13%	0
5 to 10 ha	12	8	7	6	7	10%	-5
10 to 20 ha	13	13	12	12	8	11%	-5
20 to 40 ha	18	20	15	11	11	15%	-7
40 to 100 ha	23	20	17	18	15	21%	-8
100 to 500 ha	9	15	20	18	19	26%	+10
> 500 ha	1	1	1	3	3	4%	+2
Total properties	**85**	**86**	**81**	**77**	**72**	**100%**	**-13**
Average size (ha)	**55.4**	**63.2**	**73.2**	**100.0**	**108.8**		

5.2 Boundary Bend River Reach (*Wakool to Euston weir*)

In summary for Boundary Bend River Reach

- The Boundary Bend River Reach has approximately 98 irrigation properties (land holdings). Average property size (irrigable area) is 207.8 hectares.
- In 2012 the irrigable area was 20,365 hectares of which 90% (18,365 hectares) was irrigated and 10% (2,000 hectares) was vacant or not irrigated.
- The irrigable area increased by 14,985 hectares between 1997 and 2012; comprising 145 hectares retired and 15,130 hectares of new areas not irrigated prior to 1997.
- Almond trees (51% of the irrigable area) are the dominant crop in the Boundary Bend River Reach, followed by olive trees (14% of the irrigable area).
- Grapevines are grown for wine production (53%) and table grapes (47%).
- While the dominant irrigation method was overhead sprinklers from 1997 to 2003, drip irrigation has remained the dominant irrigation method since 2006.
- The irrigable area is predominantly (80%) in the lowest salinity impact zone, LIZ 1.

5.2.1 Boundary Bend River Reach 2012 crop types

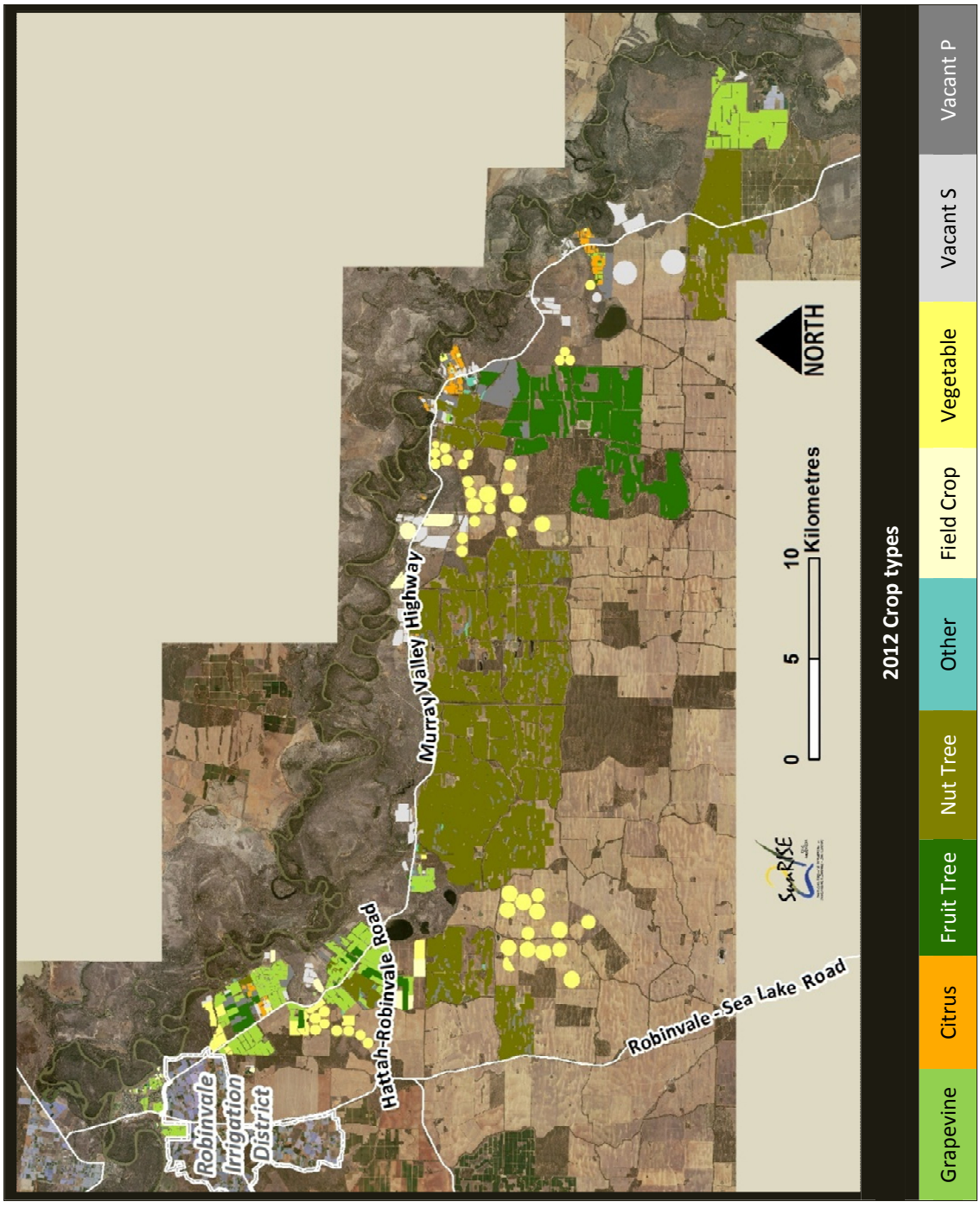
Boundary Bend River Reach crop types in the 2011-12 season are shown in Figure 69 and Map 14.

Figure 69 – Boundary Bend River Reach 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	1,330	7%	
	Table	1,160	6%	
	Dried, Other	-	-	
Citrus		275	1%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Other Orange, Pummelo, Valencia
Fruit tree	***unspecified***	10	0%	
	Avocado	145	1%	
	Olive	2,760	14%	
	Stone fruit	0	0%	<2ha including Apricot
	Other	30	0%	Apple, Fig, Mango, Persimmon, Pomegranate
Nut tree	Almond	10,315	51%	
	Other	170	1%	Pistachio
Other	Nursery	10	0%	
	Woodlot	30	0%	
	Other	-	-	-
Field crop	***unspecified***	140	1%	
	Other	175	1%	Hay-Oats, Lucerne, Pasture
Vegetable	***unspecified***	115	1%	
	Asparagus	125	1%	
	Carrot	320	2%	
	Potato	1,230	6%	
	Other	25	0%	Garlic
Vacant S		1,065	5%	*Vacant S – previously a seasonal planting*
Vacant P		935	5%	*Vacant P – previously a permanent planting*
Total		**20,365**	**100%**	

Boundary Bend River Reach 2012 crop types

Map 14 – Boundary Bend River Reach 2012 crop types



5.2.2 Boundary Bend River Reach - crop type change

Figure 70 summarises crop types in the Boundary Bend River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 20,365 hectares of which 90% (18,365 hectares) was irrigated and 10% (2,000 hectares) was vacant or not irrigated.

The irrigable area increased by 14,985 hectares; a 279% increase from 5,380 hectares in 1997 to 20,365 hectares in 2012.

Almond trees (51% of the irrigable area) are the dominant crop in the Boundary Bend River Reach, followed by olive trees (14% of the irrigable area). The increase in vacant area of previously permanent plantings (Vacant P) between 2009 and 2012 is largely due to loss of almond trees drowned in February 2011 flooding and removal of olive trees that are planned to be replaced.

Figure 70 - Boundary Bend River Reach crop type change from 1997 to 2012

	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	990	1,785	2,520	2,340	2,490	12%	+1,500
	Citrus	475	415	380	305	275	1%	-200
	Fruit Tree	185	710	1,235	3,140	2,945	14%	+2,760
	Nut Tree	755	760	5,180	10,330	10,485	51%	+9,730
	Other	30	25	45	50	40	0%	+10
Seasonal	Field Crop	1,170	720	515	45	315	2%	-855
	Vegetable	1,700	1,925	1,960	1,340	1,815	9%	+115
Vacant	Vacant S	25	415	850	1,280	1,065	5%	+1,040
	Vacant P	50	235	160	440	935	5%	+885
Total		**5,380**	**6,990**	**12,845**	**19,270**	**20,365**	**100%**	**+14,985**
% Vacant		**1%**	**9%**	**8%**	**9%**	**10%**		

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

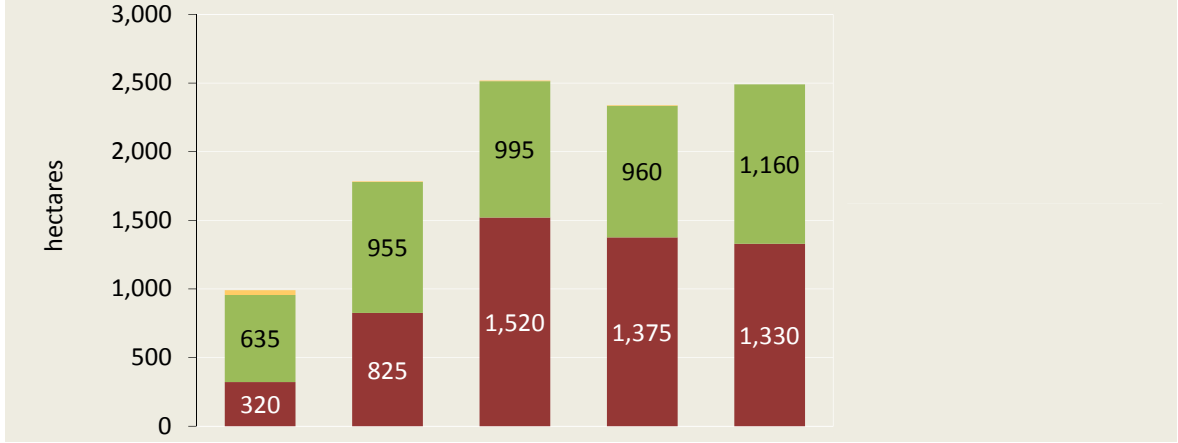
5.2.3 Boundary Bend River Reach – grapevines

Figure 71 summarises grape use in the Boundary Bend River Reach from 1997 to 2012.

Grapevines in the Boundary Bend River Reach are grown for wine production (53%) and for fresh table grapes (47%).

Wine grape plantings increased by 1,200 hectares between 1997 and 2006 then decreased by 190 hectares between 2006 and 2012. This was counterbalanced with an increase in table grape plantings, particularly between 2009 and 2012.

Figure 71 - Boundary Bend River Reach grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	320	825	1,520	1,375	1,330	53%	+1,010
Table	635	955	995	960	1,160	47%	+525
Dried	35	5	5	5	0	0%	-35
Other	-	-	-	-	-	-	-
Total	**990**	**1,785**	**2,520**	**2,340**	**2,490**	**100%**	**+1,500**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

5.2.4 Boundary Bend River Reach – irrigation methods

Figure 72 summarises irrigation methods in the Boundary Bend River Reach from 1997 to 2012.

While the dominant irrigation method was overhead sprinklers from 1997 to 2003, drip irrigation has remained the dominant irrigation method since 2006.

Drip irrigation increased by 14,395 hectares between 1997 and 2012, while furrow irrigation decreased by 940 hectares.

Figure 72 - Boundary Bend River Reach irrigation methods from 1997 to 2012

Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	735	1,720	7,675	14,850	15,130	74%	+14,395
Low level	910	1,080	855	880	845	4%	-65
Overhead	2,655	3,045	3,120	1,785	2,325	11%	-330
Furrow	1,005	495	185	35	65	0%	-940
Vacant	75	650	1,010	1,720	2,000	10%	+1,925
Total	**5,380**	**6,990**	**12,845**	**19,270**	**20,365**	**100%**	**+14,985**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

5.2.5 Boundary Bend River Reach – salinity impact zones

Figure 73 summarises the irrigable area in each river salinity impact zone in the Boundary Bend River Reach from 1997 to 2012.

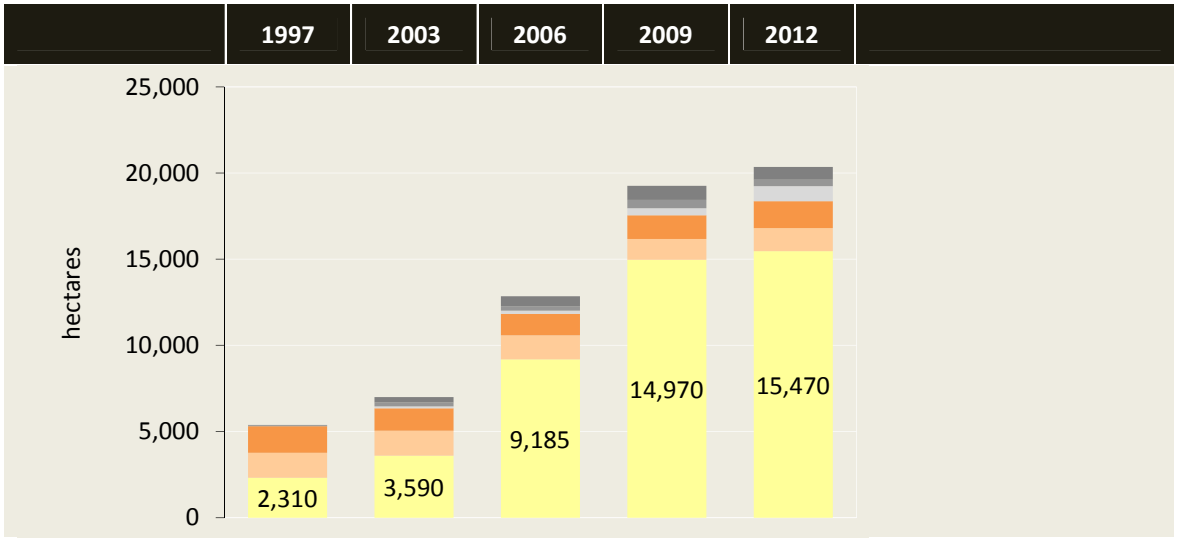
In the Boundary Bend River Reach:

- 80% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 8% of the irrigable area is in low salinity impact zone LIZ 2
- 12% of the irrigable area is in low salinity impact zone LIZ 3

There are no high salinity impact zones in the Boundary Bend River Reach.

Irrigation development occurred predominantly in the lowest impact zone, LIZ 1.

Figure 73 - Boundary Bend River Reach salinity impact zones from 1997 to 2012



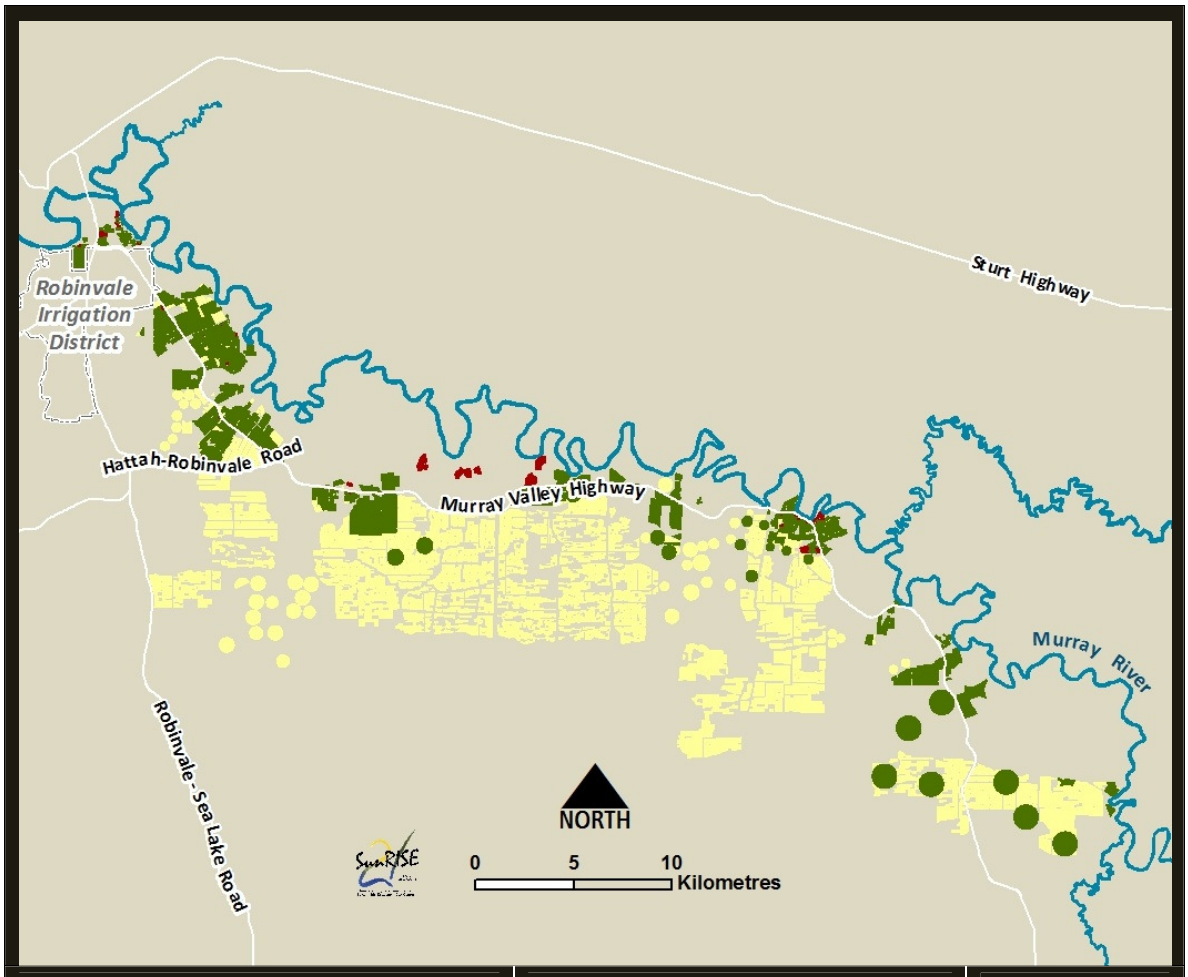
Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	2,310	3,590	9,185	14,970	15,475	76%	+13,165
	LIZ 2	1,460	1,455	1,405	1,215	1,345	6%	-115
	LIZ 3	1,535	1,295	1,245	1,365	1,545	8%	+10
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Not Irrigated	LIZ 1	0	120	175	415	875	4%	+875
	LIZ 2	50	220	265	480	375	2%	+325
	LIZ 3	25	310	570	825	750	4%	+725
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Total		**5,380**	**6,990**	**12,845**	**19,270**	**20,365**	**100%**	**+14,985**

5.2.6 Boundary Bend River Reach – irrigation development

Map 15 shows irrigation development in the Boundary Bend River Reach with respect to new and retired irrigation areas from 1997 to 2012.

The irrigable area increased by 14,985 hectares between 1997 and 2012; comprising 145 hectares retired and 15,130 hectares of new areas not irrigated prior to 1997.

Map 15 – Boundary Bend River Reach development from 1997 to 2012



	Hectares		% of 1997
Irrigated crops in 1997 (1996-97 season)	5,380		
Retired between 1997 and 2012	-145		-3%
New areas between 1997 and 2012	+15,130		+281%
Irrigated crops in 2012 (2011-12 season)	20,365		

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction, land set aside for conservation purposes.

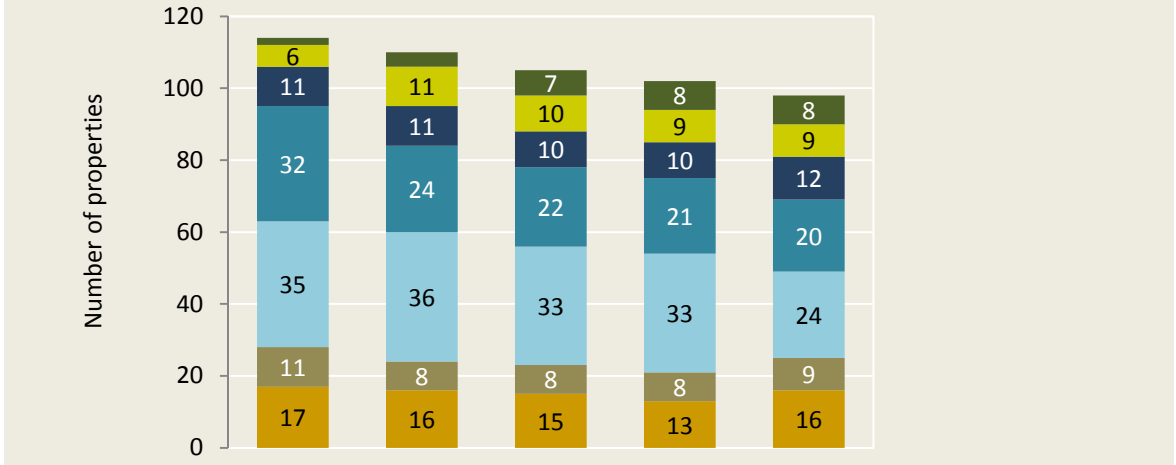
5.2.7 Boundary Bend - property change

Figure 74 provides estimates of property numbers and average property size (irrigable area) in the Boundary Bend River Reach from 1997 to 2012.

Boundary Bend River Reach has approximately 98 irrigation properties (land holdings). Average property size (irrigable area) is 207.8 hectares.

The number of irrigation properties decreased by 16 properties between 1997 and 2012. The average irrigable area per property increased from 47.2 hectares in 1997 to 207.8 hectares in 2012.

Figure 74 – Property numbers and size in Boundary Bend River Reach from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	17	16	15	13	16	16%	-1
5 to 10 ha	11	8	8	8	9	9%	-2
10 to 20 ha	35	36	33	33	24	24%	-11
20 to 40 ha	32	24	22	21	20	20%	-12
40 to 100 ha	11	11	10	10	12	12%	+1
100 to 500 ha	6	11	10	9	9	9%	+3
> 500 ha	2	4	7	8	8	8%	+6
Total properties	**114**	**110**	**105**	**102**	**98**	**100%**	**-16**
Average size (ha)	**47.2**	**63.5**	**122.3**	**188.9**	**207.8**		

5.3 Wemen River Reach (*Euston weir to Liparoo*)

In summary for the Wemen River Reach

- The Wemen River Reach has approximately 39 irrigation properties (land holdings). Average property size (irrigable area) is 271.5 hectares.
- In 2012 the irrigable area was 10,590 hectares of which 89% (9,445 hectares) was irrigated and 11% (1,145 hectares) was vacant or not irrigated.
- The irrigable area increased by 8,305 hectares between 1997 and 2012; comprising 40 hectares retired and 8,345 hectares of new areas not irrigated prior to 1997.
- Almonds (50%) are the dominant crop in the Wemen River Reach followed by vegetables (21%), predominantly carrots.
- Grapevines are grown for wine production (63%), table grapes (26%) and dried vine fruit (11%).
- While the dominant irrigation method was overhead sprinklers in 1997, drip irrigation has remained the dominant irrigation method since 2003.
- The irrigable area is predominantly (51%) in the second lowest salinity impact zone, LIZ 2.

5.3.1 Wemen River Reach 2012 crop types

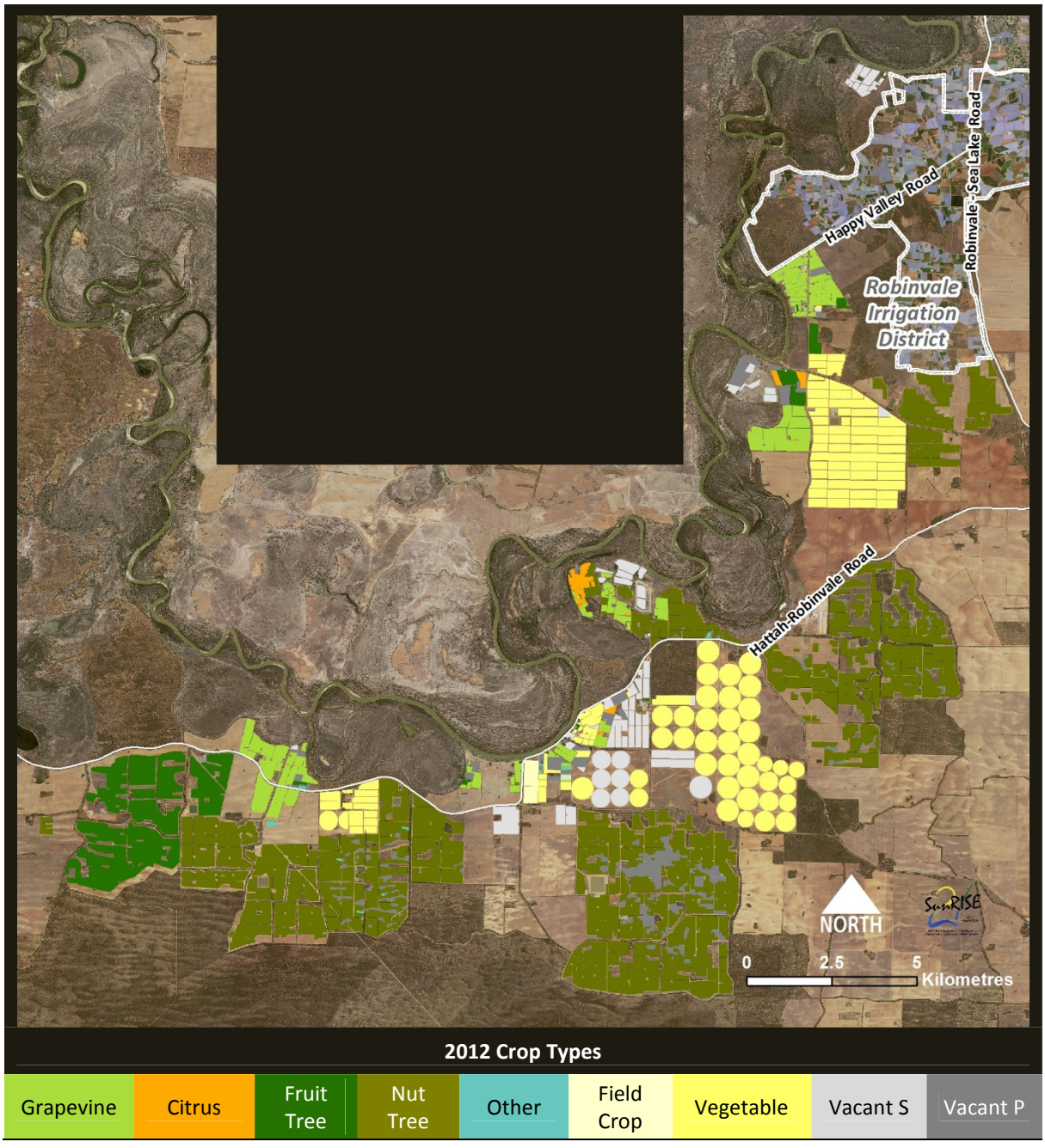
Figure 75 and Map 16 show crop types in the Wemen River Reach in the 2011-12 irrigation season.

Figure 75 – Wemen River Reach 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	495	5%	
	Table	195	2%	
	Dried	85	1%	
Citrus		75	1%	Lime, Mandarin, Navel, Tangelo, Valencia
Fruit tree	***unspecified***	5	0%	
	Avocado	65	1%	
	Olive	855	8%	
	Other	10	0%	Pomegranate, Tamarillo
Nut tree	Almond	5,325	50%	
	Other	15	0%	Walnut
Other	Nursery	5	0%	
	Woodlot	10	0%	
	Other	0	0%	<2 Flowers
Field crop	***unspecified***	-	-	
	Other	45	1%	Maize, Pasture
Vegetable	***unspecified***	200	2%	
	Carrot	1,790	17%	
	Potato	-	-	
	Other	270	3%	Broccoli, Salad Greens
Vacant S		665	6%	*Vacant S – previously a seasonal planting*
Vacant P		480	5%	*Vacant P – previously a permanent planting*
Total		**10,590**	**100%**	

Wemen River Reach 2012 crop types

Map 16 – Wemen River Reach 2012 crop types



5.3.2 Wemen River Reach – crop type change

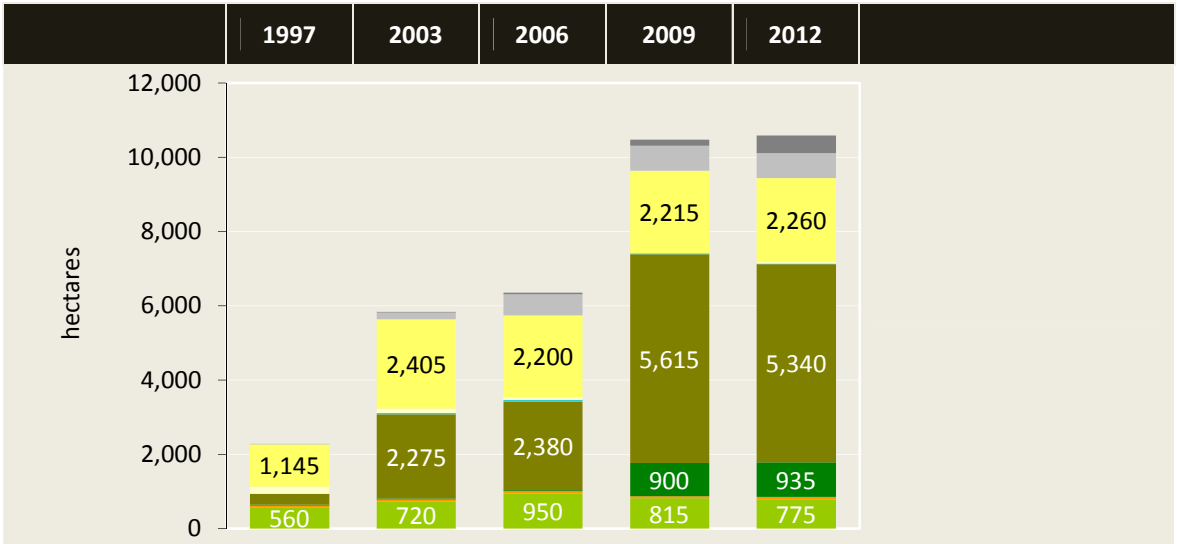
Figure 76 summarises crop types in the Wemen River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 10,590 hectares of which 89% (9,445 hectares) was irrigated and 11% (1,145 hectares) was vacant or not irrigated.

The irrigable area increased by 363% (8,305 hectares) between 1997 and 2012.

Nut trees (almonds) are the dominant crop in the Wemen River Reach followed by vegetables, predominantly carrots. The increase in vacant area of previously permanent plantings (Vacant P) between 2009 and 2012 is largely due to loss of almond trees drowned in February 2011 flooding.

Figure 76 – Wemen River Reach crop type change from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	560	720	950	815	775	7%	+215
	Citrus	60	60	55	55	75	1%	+15
	Fruit Tree	25	25	25	900	935	9%	+910
	Nut Tree	285	2,275	2,380	5,615	5,340	50%	+5,055
	Other	10	30	55	30	15	0%	+5
Seasonal	Field Crop	185	125	75	10	45	0%	-140
	Vegetable	1,145	2,405	2,200	2,215	2,260	21%	+1,115
Vacant	Vacant S	15	180	570	675	665	6%	+650
	Vacant P	0	20	45	165	480	5%	+480
Total		**2,285**	**5,840**	**6,355**	**10,480**	**10,590**	**100%**	**+8,305**
% Vacant		**1%**	**3%**	**10%**	**8%**	**11%**		

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

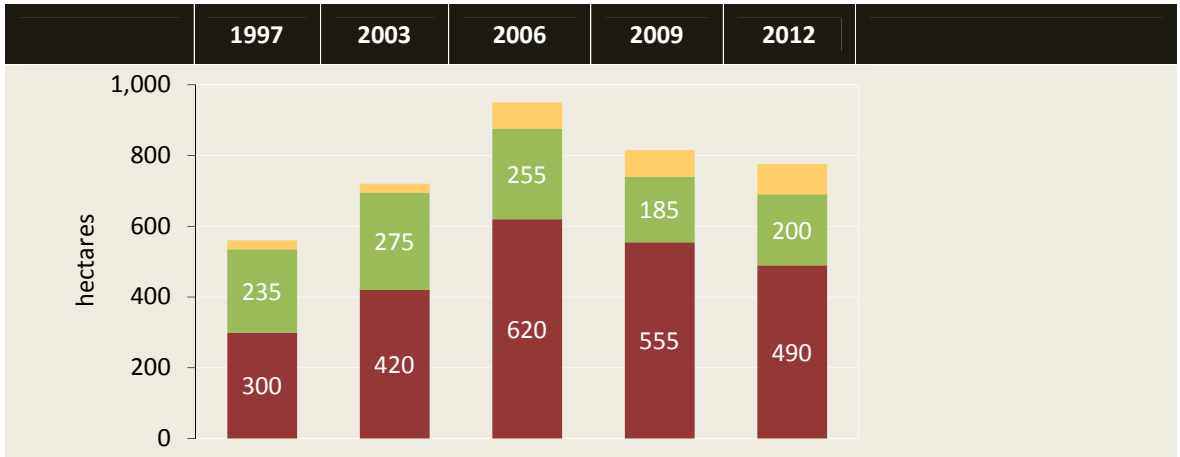
5.3.3 Wemen River Reach – grapevines

Figure 77 summarises grape use in the Wemen River Reach from 1997 to 2012.

Grapevines are grown for wine production (63%), table grapes (26%) and dried vine fruit (11%).

The area of grapevines peaked in 2006 then decreased between 2006 and 2012. This was largely due to an oversupply of wine grapes culminating around 2006, followed by a drought period with low water allocations between 2006 and 2009. Dried vine fruit was the only commodity not impacted with a decrease in area in this period.

Figure 77 – Wemen River Reach grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	300	420	620	555	490	63%	+190
Table	235	275	255	185	200	26%	-35
Dried	25	25	75	75	85	11%	+60
Other	-	-	-	-	-	-	-
Total	**560**	**720**	**950**	**815**	**775**	**100%**	**+215**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

5.3.4 Wemen River Reach – irrigation methods

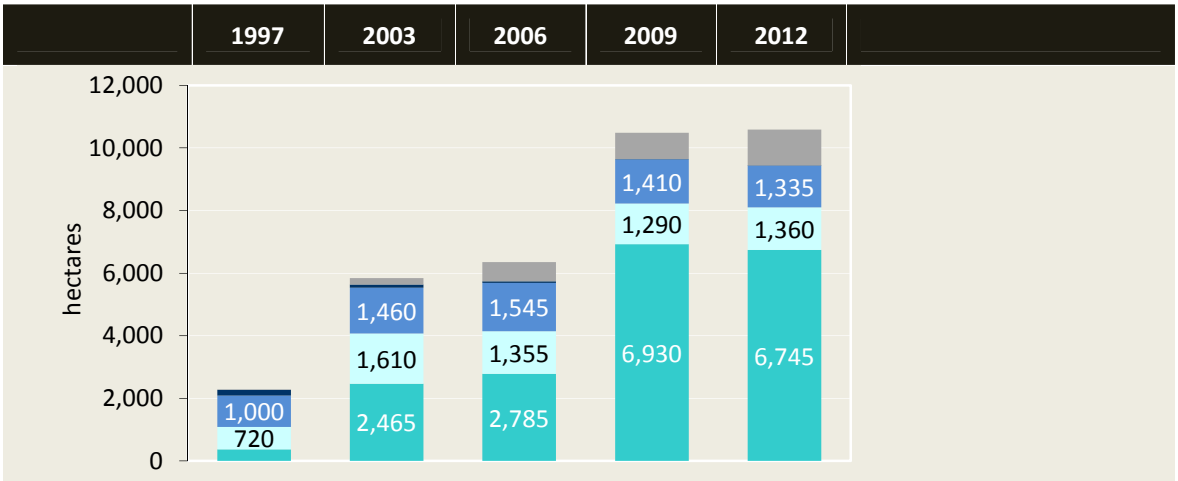
Figure 78 summarises irrigation methods in the Wemen River Reach from 1997 to 2012.

Overhead sprinklers were the dominant irrigation method in 1997. This changed to drip irrigation by 2003 and drippers have remained the dominant method since.

Drip and low level irrigation increased by 7,015 hectares between 1997 and 2012, while furrow irrigation decreased by 175 hectares.

Less than 5 hectares was flood or furrow irrigated in the 2011-12 irrigation season.

Figure 78 – Wemen River Reach from irrigation methods 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	370	2,465	2,785	6,930	6,745	64%	+6,375
Low level	720	1,610	1,355	1,290	1,360	13%	+640
Overhead	1,000	1,460	1,545	1,410	1,335	13%	+335
Furrow	180	105	55	10	5	0%	-175
Vacant	15	200	615	840	1,145	11%	+1,130
Total	**2,285**	**5,840**	**6,355**	**10,480**	**10,590**	**100%**	**+8,305**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

5.3.5 Wemen River Reach – salinity impact zones

Figure 79 summarises the irrigable area in each river salinity impact zone in the Wemen River Reach from 1997 to 2012.

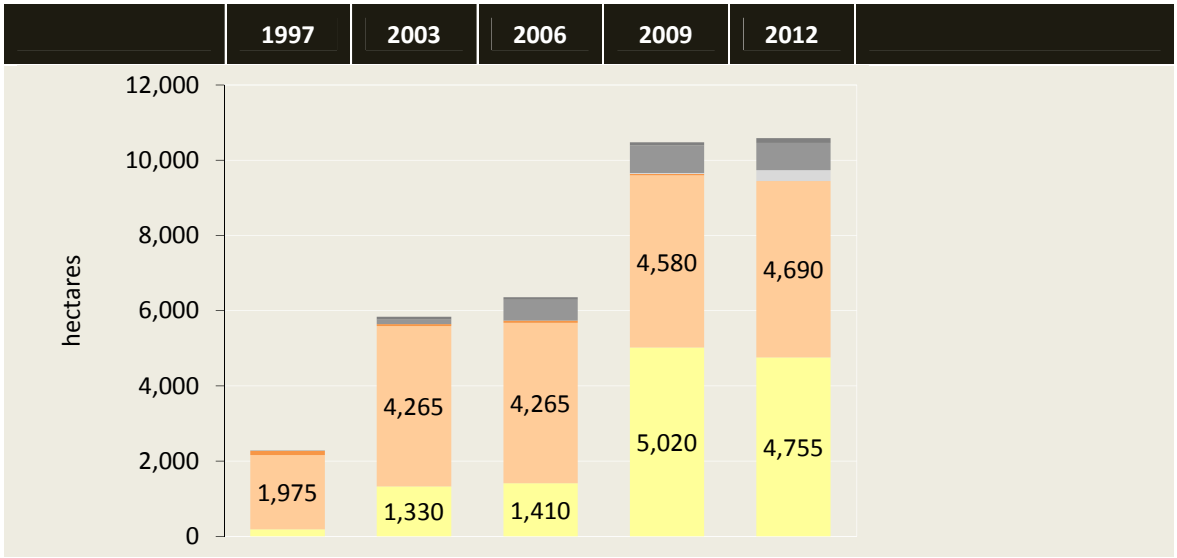
In the Wemen River Reach:

- 48% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 51% of the irrigable area is in low salinity impact zone LIZ 2
- 1% of the irrigable area is in low salinity impact zone LIZ 3

There are no high salinity impact zones in the Wemen River Reach.

Irrigation development occurred predominantly in the lowest impact zone, LIZ 1.

Figure 79 – Wemen River Reach salinity impact zones from 1997 to 2012

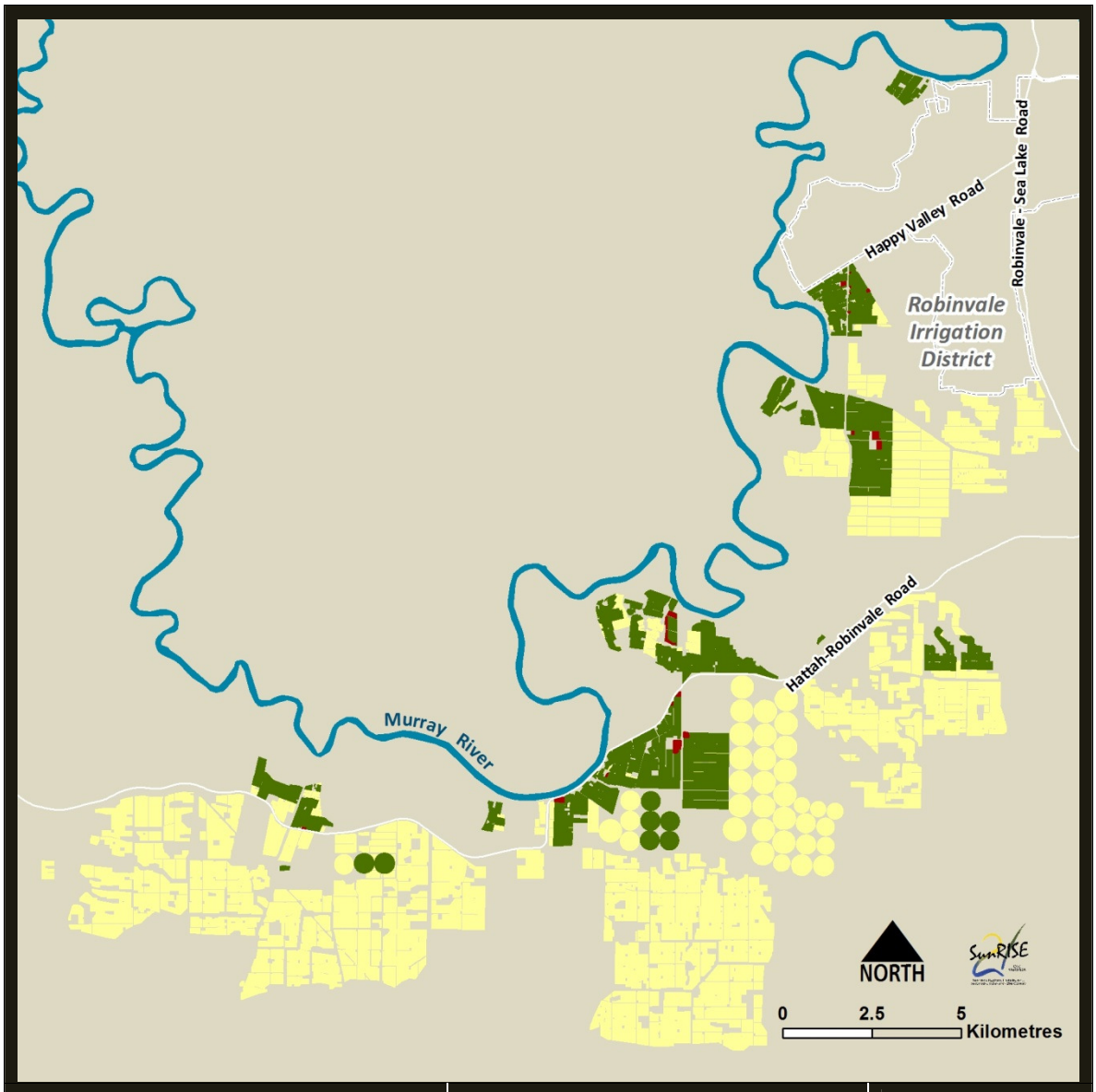


	Salinity impact zone	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	185	1,330	1,410	5,020	4,755	45%	+4,570
	LIZ 2	1,975	4,265	4,265	4,580	4,690	44%	+2,715
	LIZ 3	110	45	65	40	0	0%	-110
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Not Irrigated	LIZ 1	0	0	0	25	295	3%	+295
	LIZ 2	0	125	550	730	725	7%	+725
	LIZ 3	15	75	65	85	125	1%	+110
	LIZ 4	-	-	-	-	-	-	-
	HIZ	-	-	-	-	-	-	-
Total		**2,285**	**5,840**	**6,355**	**10,480**	**10,590**	**100%**	**+8,305**

5.3.6 Wemen River Reach – irrigation development

Map 17 shows irrigation development in the Wemen River Reach with respect to new and retired irrigation areas from 1997 to 2012.

Map 17 – Wemen River Reach development from 1997 to 2012



	Hectares	% of 1997
Irrigated crops in 1997 (1996-97 season)	2,285	
Retired between 1997 and 2012	-40	-2%
New areas between 1997 and 2012	+8,345	+365%
Irrigated crops in 2012 (2011-12 season)	10,590	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

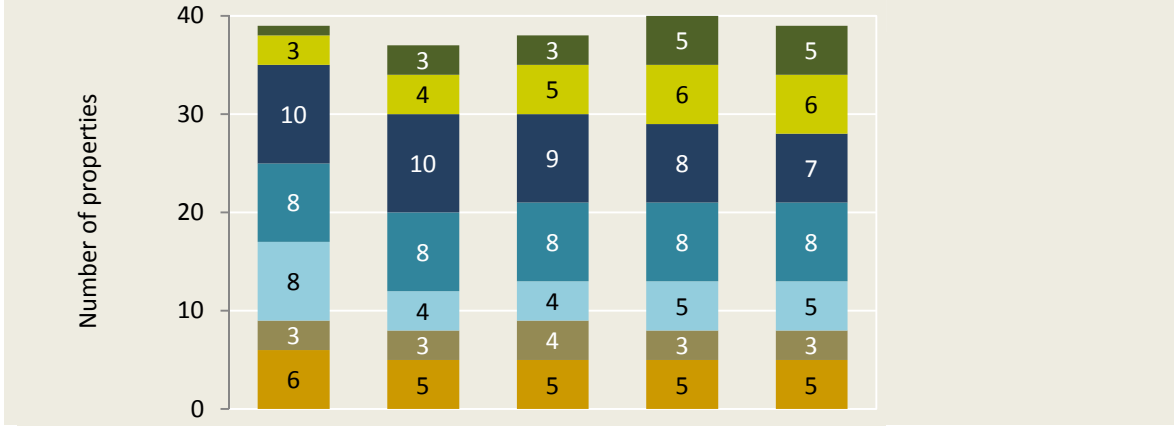
5.3.7 Wemen River Reach – property change

Figure 80 provides estimates of property numbers and average property size (irrigable area) in the Wemen River Reach from 1997 to 2012.

Wemen River Reach has approximately 39 irrigation properties (land holdings). Average property size (irrigable area) is 271.5 hectares.

The average irrigable area per property increased from 58.6 hectares in 1997 to 271.5 hectares in 2012.

Figure 80 – Property numbers and size in Wemen River Reach from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	6	5	5	5	5	13%	-1
5 to 10 ha	3	3	4	3	3	8%	0
10 to 20 ha	8	4	4	5	5	13%	-3
20 to 40 ha	8	8	8	8	8	21%	0
40 to 100 ha	10	10	9	8	7	18%	-3
100 to 500 ha	3	4	5	6	6	15%	+3
> 500 ha	1	3	3	5	5	13%	+4
Total properties	**39**	**37**	**38**	**40**	**39**	**100%**	**0**
Average size (ha)	**58.6**	**157.8**	**167.2**	**262.0**	**271.5**		

5.4 Colignan River Reach (*Colignan to Yatpool*)

In summary for the Colignan River Reach

- The Colignan River Reach has approximately 150 irrigation properties (land holdings). Average property size (irrigable area) is 75.1 hectares.
- In 2012 the irrigable area was 11,270 hectares of which 84% (9,460 hectares) was irrigated and 16% (1,810 hectares) was vacant or not irrigated.
- The irrigable area increased by 4,160 hectares between 1997 and 2012; comprising 55 hectares retired and 4,215 hectares of new areas not irrigated prior to 1997.
- Grapevines remained the dominant crop type from 1997 to 2012. They are predominantly (74%) grown for wine production. The remaining grapevines are table grape plantings (13%) and dried vine fruit plantings (13%).
- While the dominant irrigation method was overhead sprinklers in 1997, drip irrigation has remained the dominant irrigation method since 2003.
- Drip irrigation increased by 4,905 hectares between 1997 and 2012, while furrow irrigation decreased by 200 hectares.
- The irrigable area is predominantly (75%) in the low salinity impact zone, LIZ 4.

5.4.1 Colignan River Reach 2012 crop types

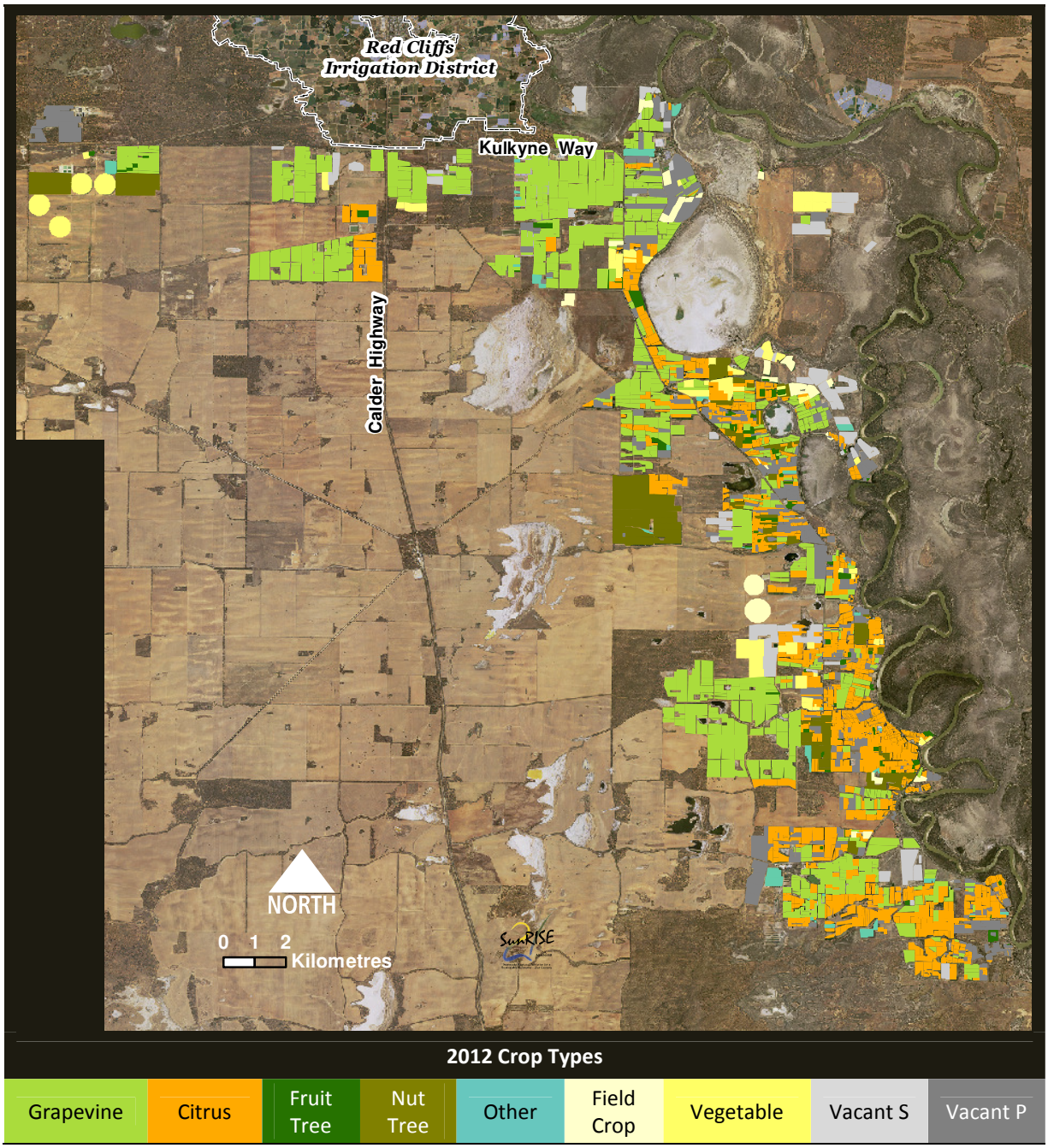
Figure 81 and Map 18 show crop types in the 2011-12 irrigation season in the Colignan River Reach.

Figure 81 – Colignan River Reach 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	3,530	31%	
	Table	610	5%	
	Dried	610	5%	
Citrus		2,840	25%	Grapefruit, Lemon, Lime, Mandarin, Navel, Other Orange, Tangelo, Valencia
Fruit tree	***unspecified***	20	0%	
	Avocado	105	1%	
	Olive	5	0%	
	Stone fruit	0	0%	<3ha including Plum
	Other	15	0%	Fig, Mango, Persimmon, Pomegranate
Nut tree	Almond	830	7%	
	Other	25	0%	Pistachio, Walnut
Other	Nursery	35	0%	
	Woodlot	100	1%	
	Other	5	0%	Flowers, Native Plants
Field crop	***unspecified***	10	0%	
	Other	205	2%	Lucerne, Maize, Pasture
Vegetable	***unspecified***	345	3%	
	Asparagus	90	1%	
	Other	80	1%	Melon, Pumpkin
Vacant S		570	5%	*Vacant S – previously a seasonal planting*
Vacant P		1,240	11%	*Vacant P – previously a permanent planting*
Total		**11,270**	**100%**	

Colignan River Reach 2012 crop types

Map 18 – Colignan River Reach 2012 crop types



5.4.2 Colignan River Reach crop type change

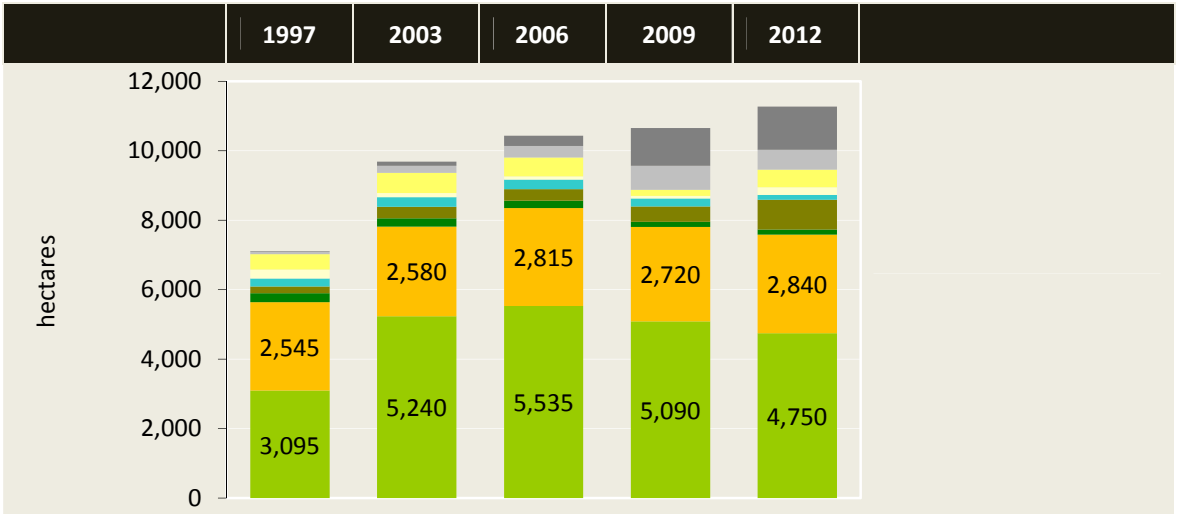
Figure 82 summarises crop types in the Colignan River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 11,270 hectares, of which 84% (9,460 hectares) was irrigated and 16% (1,810 hectares) was vacant or not irrigated.

The irrigable area increased by 4,160 hectares; a 59% increase from 7,110 hectares in 1997 to 11,270 hectares in 2012.

Grapevines remained the dominant crop type from 1997 to 2012. The area of grapevines peaked in 2006 then decreased by 785 hectares between 2006 and 2012. The area of nut trees almost doubled between 2009 and 2012. Citrus plantings increased by 295 hectares between 1997 and 2012.

Figure 82 – Colignan River Reach crop type change from 1997 to 2012



	Crop Type	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	3,095	5,240	5,535	5,090	4,750	42%	+1,655
	Citrus	2,545	2,580	2,815	2,720	2,840	25%	+295
	Fruit Tree	260	240	215	145	145	1%	-115
	Nut Tree	195	330	325	440	855	8%	+660
	Other	230	275	285	230	140	1%	-90
Seasonal	Field Crop	255	120	90	80	215	2%	-45
	Vegetable	440	580	545	175	515	5%	+80
Vacant	Vacant S	70	200	330	690	570	5%	+500
	Vacant P	20	120	290	1,085	1,240	11%	+1,220
Total		**7,110**	**9,685**	**10,430**	**10,655**	**11,270**	**100%**	**+4,160**
% Vacant		**1%**	**3%**	**6%**	**17%**	**16%**		

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

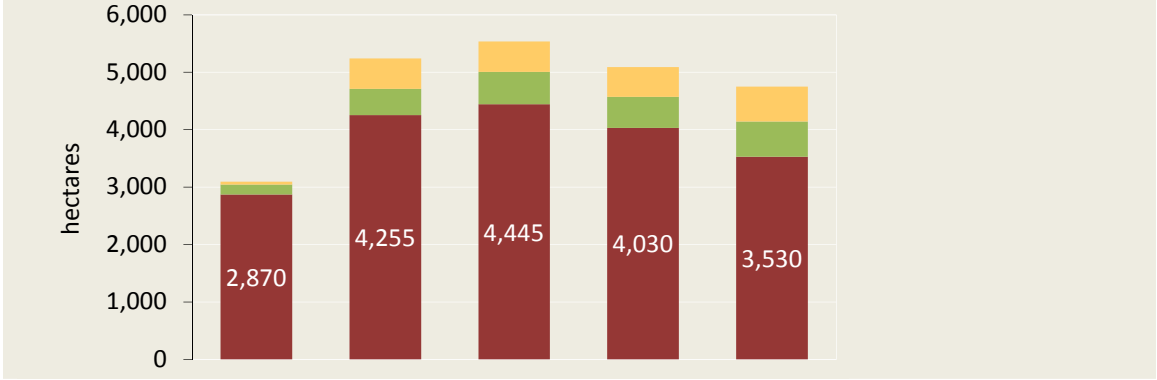
5.4.3 Colignan River Reach – grapevines

Figure 83 summarises grape use in the Colignan River Reach from 1997 to 2012.

Grapevines are predominantly (74%) grown for wine production. The remaining grapevines are table grape plantings (13%) and dried vine fruit plantings (13%).

The area of grapevines increased by 2,440 hectares between 1997 and 2006, and decreased by 785 hectares between 2006 and 2012. This was in response to an oversupply of wine grapes culminating around 2006, followed by a drought period with low water allocations between 2006 and 2009.

Figure 83 – Colignan River Reach grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-
Wine	2,870	4,255	4,445	4,030	3,530	74%	+660
Table	175	455	560	540	610	13%	+435
Dried	50	530	530	520	610	13%	+560
Other	-	-	-	-	-	-	-
Total	**3,095**	**5,240**	**5,535**	**5,090**	**4,750**	**100%**	**+1,655**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

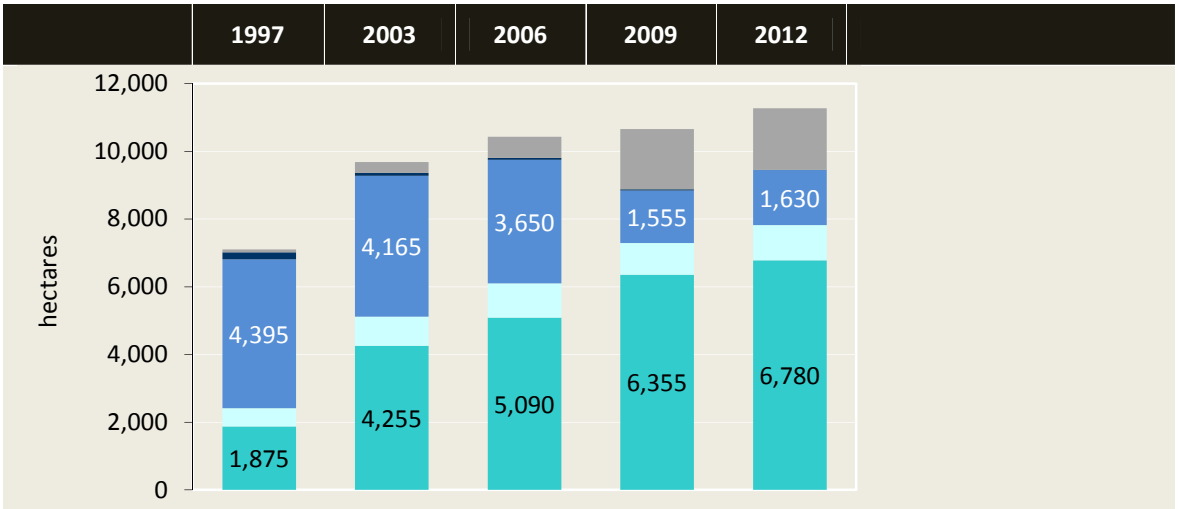
5.4.4 Colignan River Reach – irrigation methods

Figure 84 summarises irrigation methods in the Colignan River Reach from 1997 to 2012.

While the dominant irrigation method was overhead sprinklers in 1997, drip irrigation has remained the dominant irrigation method since 2003.

Drip irrigation increased by 4,905 hectares between 1997 and 2012, while furrow irrigation decreased by 200 hectares.

Figure 84 – Colignan River Reach irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	1,875	4,255	5,090	6,355	6,780	60%	+4,905
Low level	540	860	1,010	935	1,040	9%	+500
Overhead	4,395	4,165	3,650	1,555	1,630	14%	-2,765
Furrow	210	85	60	35	10	0%	-200
Vacant	90	320	620	1,775	1,810	16%	+1,720
Total	**7,110**	**9,685**	**10,430**	**10,655**	**11,270**	**100%**	**+4,160**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

5.4.5 Colignan River Reach – salinity impact zones

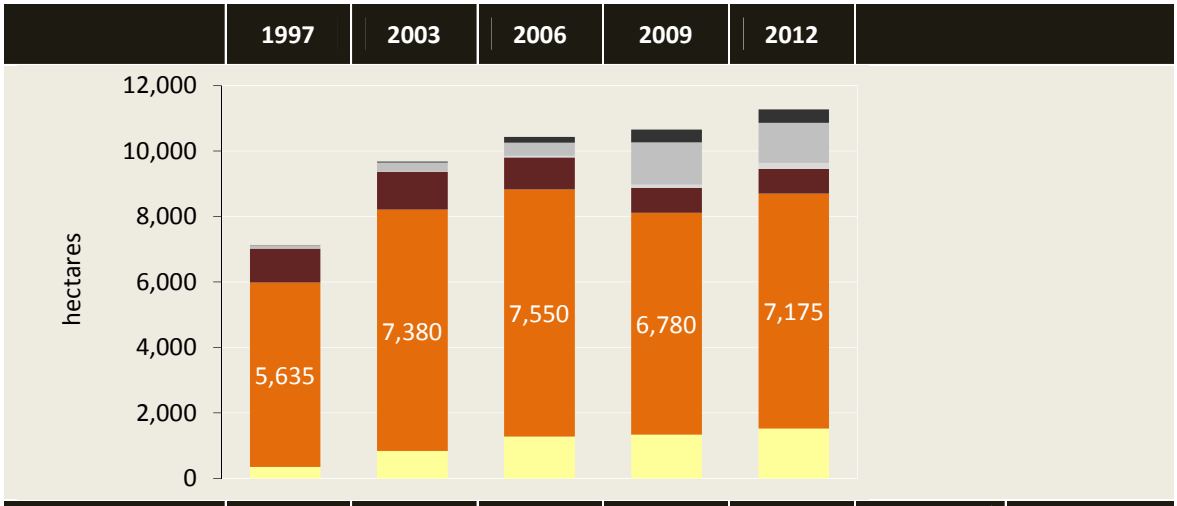
Figure 85 summarises the irrigable area in each river salinity impact zone in the Colignan River Reach from 1997 to 2012.

In the Colignan River Reach:

- 75% of the irrigable area is in the low salinity impact zone LIZ 4
- 15% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 10% of the irrigable area is in the high salinity impact zone, HIZ

The irrigable area in the HIZ increased by 125 hectares between 1997 and 2012. The area irrigated in the HIZ was 280 hectares less in 2012 than in 1997.

Figure 85 – Colignan River Reach salinity impact zones from 1997 to 2012



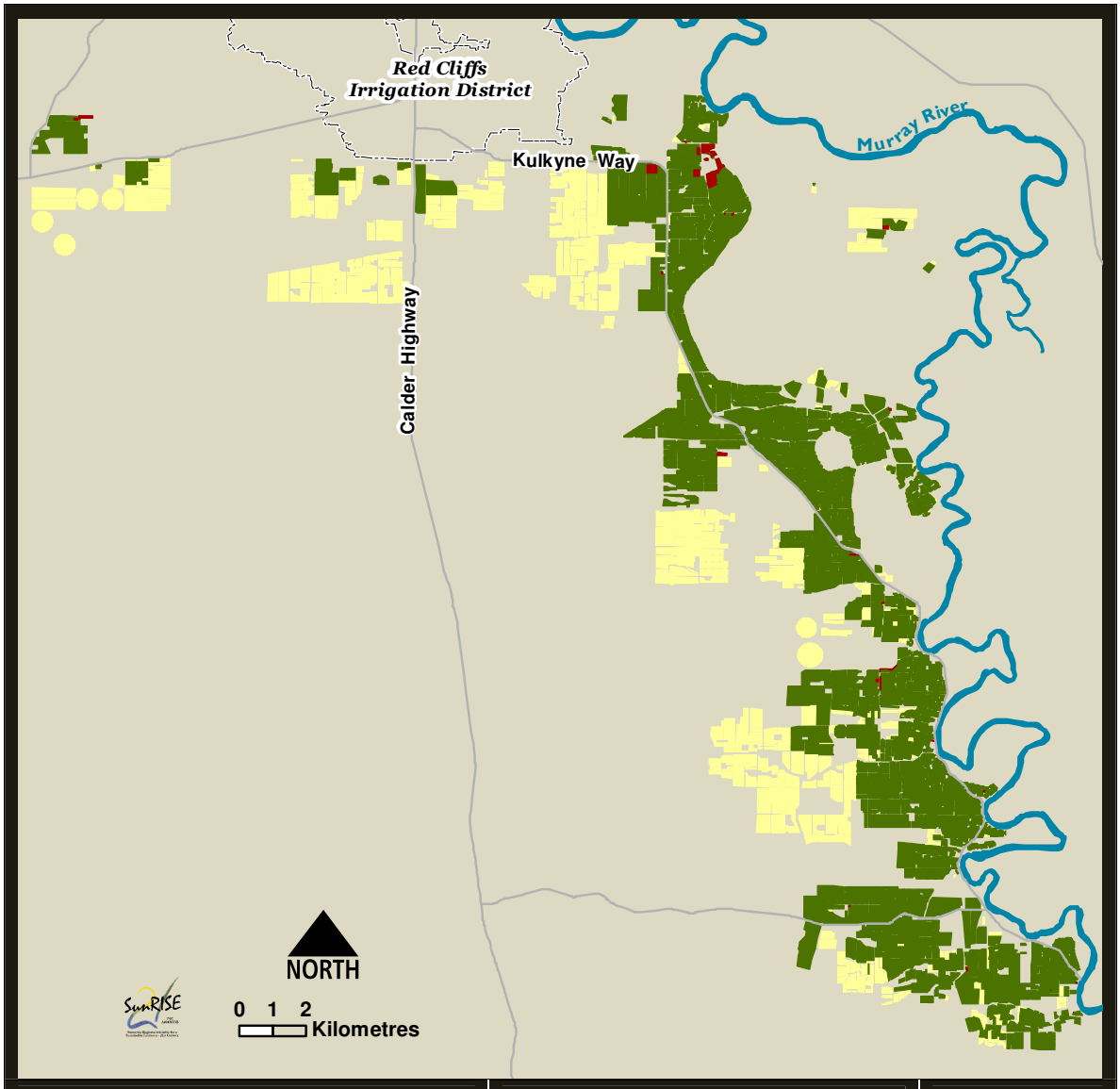
	Salinity impact zone	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	345	835	1,275	1,340	1,525	13%	+1,180
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	5,635	7,380	7,550	6,780	7,175	64%	+1,540
	HIZ	1,040	1,150	985	760	760	7%	-280
Not Irrigated	LIZ 1	0	10	45	95	185	2%	+185
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	85	280	400	1,290	1,215	11%	+1,130
	HIZ	5	30	175	390	410	3%	+405
Total		**7,110**	**9,685**	**10,430**	**10,655**	**11,270**	**100%**	**+4,160**

5.4.6 Colignan River Reach – irrigation development

Map 19 shows irrigation development in the Colignan River Reach with respect to new and retired irrigation areas from 1997 to 2012.

The irrigable area increased by 4,160 hectares between 1997 and 2012; comprising 55 hectares retired and 4,215 hectares of new areas not irrigated prior to 1997.

Map 19 – Colignan River Reach development from 1997 to 2012



	Hectares	% of 1997
Irrigated crops in 1997 (1996-97 season)	7,110	
Retired between 1997 and 2012	-55	-1%
New areas between 1997 and 2012	+4,215	+59%
Irrigated crops in 2012 (2011-12 season)	11,270	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction.

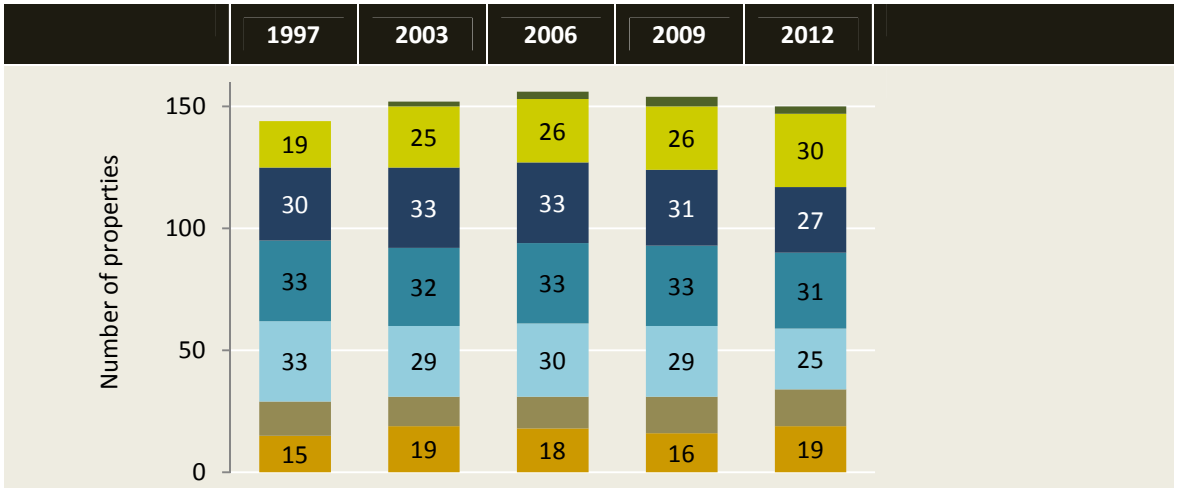
5.4.7 Colignan River Reach – property change

Figure 86 provides estimates of property numbers and average property size (irrigable area) in the Colignan River Reach from 1997 to 2012.

The Colignan River Reach has approximately 150 irrigation properties (land holdings). Average size (irrigable area) is 75.1 hectares.

The number of irrigation properties increased by 6 properties between 1997 and 2012. The average irrigable area per property increased from 49.4 hectares in 1997 to 75.1 hectares in 2012.

Figure 86 – Property numbers and size in Colignan River Reach from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	15	19	18	16	19	13%	+4
5 to 10 ha	14	12	13	15	15	10%	+1
10 to 20 ha	33	29	30	29	25	17%	-8
20 to 40 ha	33	32	33	33	31	21%	-2
40 to 100 ha	30	33	33	31	27	18%	-3
100 to 500 ha	19	25	26	27	30	20%	+11
> 500 ha	0	2	3	3	3	2%	+3
Total properties	**144**	**152**	**156**	**154**	**150**	**100%**	**+6**
Average size (ha)	**49.4**	**63.7**	**66.9**	**69.2**	**75.1**		

5.5 Mildura River Reach (*Mildura to Lock 10*)

In summary for the Mildura River Reach

- The Mildura River Reach has approximately 105 irrigation properties (land holdings). Average property size (irrigable area) is 17.0 hectares.
- In 2012 the irrigable area was 1,790 hectares of which 71% (1,270 hectares) was irrigated and 29% (520 hectares) was vacant or not irrigated.
- The irrigable area increased by 370 hectares between 1997 and 2012; comprising 55 hectares retired and 425 hectares of new areas not irrigated prior to 1997.
- Grapevines are the dominant crop in the Mildura River Reach. They are predominantly (59%) grown for wine production, the remaining plantings are 28% table grapes and 13% dried fruit.
- The dominant irrigation method was furrow in 1997. This changed to overhead sprinklers by 2003 then to drip irrigation by 2006. Drip irrigation has been the dominant method since 2006.
- Drip irrigation increased by 345 hectares between 1997 and 2012, while furrow irrigation decreased by 400 hectares.
- 68% of the irrigable area is in the high salinity impact zone (HIZ), 32% in the lowest salinity impact zone, LIZ 1.

5.5.1 Mildura River Reach 2012 crop types

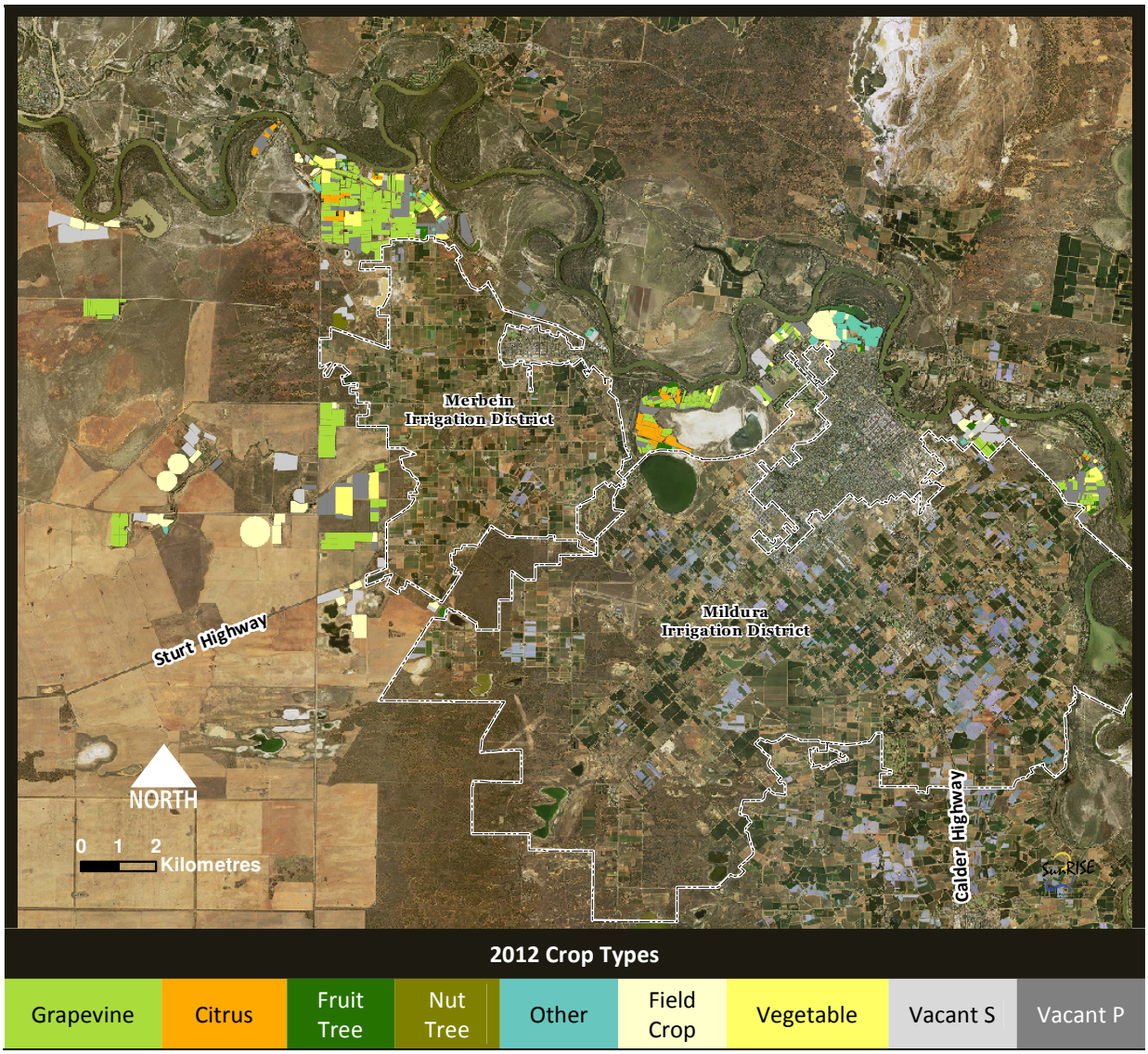
Figure 87 and Map 20 show crop types in the Mildura River Reach in the 2011-12 irrigation season.

Figure 87 – Mildura River Reach 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	405	23%	
	Table	190	11%	
	Dried	90	5%	
Citrus		95	5%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Valencia
Fruit tree	Avocado	10	1%	
	Olive	15	1%	
	Stone fruit	0	0%	<2ha Apricot, Plum
	Other	5	0%	Jujube, Mango
Nut tree	Almond	0	0%	
	Other	10	1%	Pistachio, Walnut
Other	Nursery	0	0%	<2ha
	Woodlot	65	4%	
	Other	5	0%	Arboretum, Flowers
Field crop	***unspecified***	40	2%	
	Other	220	12%	Cereal, Fodder, Lucerne, Pasture
Vegetable	***unspecified***	40	2%	
	Asparagus	0	0%	<1ha
	Potato	40	2%	
	Other	40	2%	Butternut, Cabbage, Rockmelon, Strawberry, Zucchini
Vacant S		250	14%	*Vacant – previously a seasonal planting*
Vacant P		270	15%	*Vacant – previously a permanent planting*
Total		**1,790**	**100%**	

Mildura River Reach 2012 crop types

Map 20 – Mildura River Reach 2012 crop types



5.5.2 Mildura River Reach crop type change

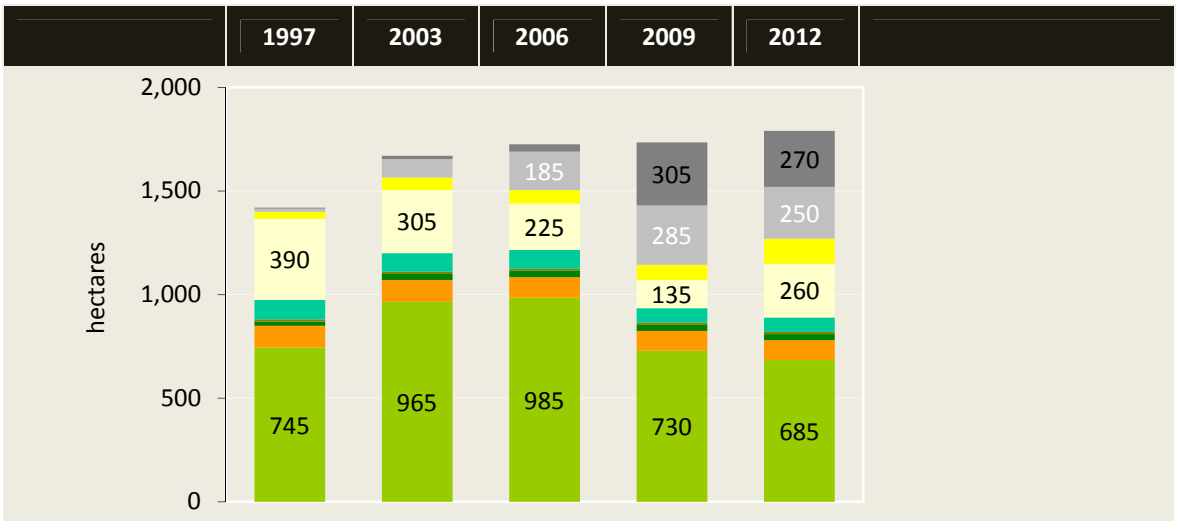
Figure 88 summarises crop types in the Mildura River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 1,790 hectares of which 71% (1,270 hectares) was irrigated and 29% (520 hectares) was vacant or not irrigated.

The irrigable area increased by 370 hectares, a 26% increase from 1,420 hectares in 1997 to 1,790 hectares in 2012.

Grapevines are the dominant crop type in the Mildura River Reach.

Figure 88 – Mildura River Reach crop type change from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	745	965	985	730	685	38%	-60
	Citrus	105	105	100	95	95	5%	-10
	Fruit Tree	20	30	30	30	30	2%	+10
	Nut Tree	10	10	10	10	10	1%	0
	Other	95	90	90	70	70	4%	-25
Seasonal	Field Crop	390	305	225	135	260	15%	-130
	Vegetable	35	60	65	75	120	7%	+85
Vacant	Vacant S	15	90	185	285	250	14%	+235
	Vacant P	5	15	35	305	270	15%	+265
Total		**1,420**	**1,670**	**1,725**	**1,735**	**1,790**	**100%**	**+370**
% Vacant		**1%**	**6%**	**13%**	**34%**	**29%**		

Note: 'Vacant S' is vacant or not irrigated areas that were previously irrigated seasonal crops.
'Vacant P' is vacant or not irrigated areas that were previously irrigated permanent plantings.

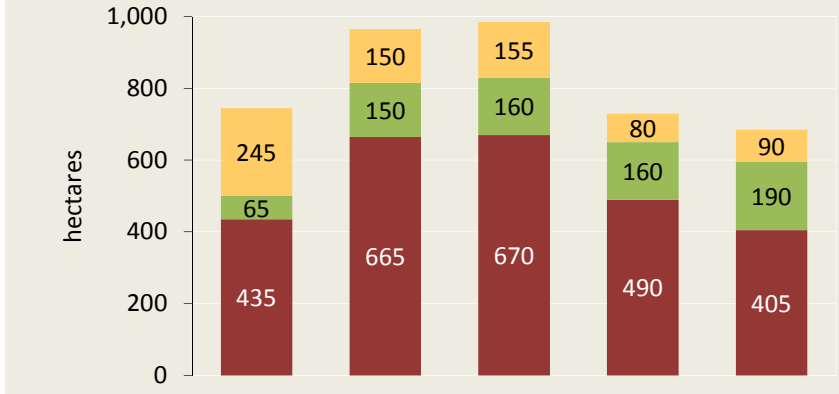
5.5.3 Mildura River Reach – grapevines

Figure 89 summarises grape use in the Mildura River Reach from 1997 to 2012.

Grapevines are predominantly (59% in 2012) grown for wine production.

Between 1997 and 2012 wine grape plantings and dried vine fruit plantings decreased by 30 hectares and 155 hectares respectively. Table grape plantings increased by 125 hectares.

Figure 89 – Mildura River Reach grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	435	665	670	490	405	59%	-30
Table	65	150	160	160	190	28%	+125
Dried	245	150	155	80	90	13%	-155
Other	-	-	-	-	-	-	-
Total	**745**	**965**	**985**	**730**	**685**	**100%**	**-60**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

5.5.4 Mildura River Reach – irrigation methods

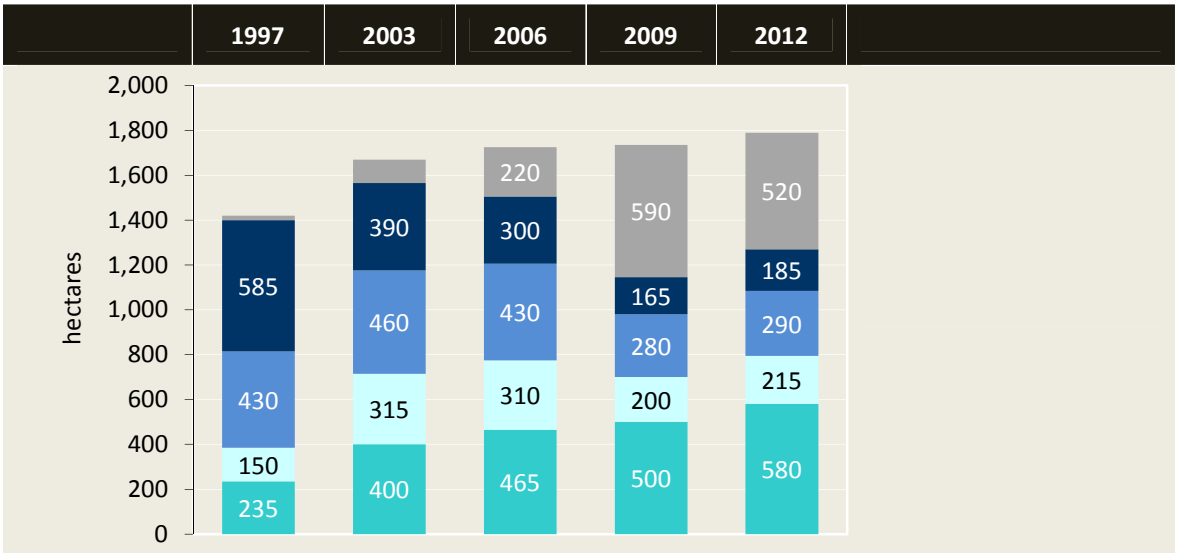
Figure 90 summarises irrigation methods in the Mildura River Reach from 1997 to 2012.

While the dominant irrigation method was furrow in 1997 this changed to overhead sprinklers by 2003. Drip irrigation has remained the dominant method since 2006.

Drip and low level irrigation increased by 410 hectares between 1997 and 2012, while furrow and overhead irrigation decreased by 540 hectares.

Furrow irrigation comprised 10% (185 hectares) of the 2012 irrigable area.

Figure 90 – Mildura River Reach irrigation methods from 1997 to 2012



Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	235	400	465	500	580	32%	+345
Low level	150	315	310	200	215	12%	+65
Overhead	430	460	430	280	290	16%	-140
Furrow	585	390	300	165	185	10%	-400
Vacant	20	105	220	590	520	29%	+500
Total	**1,420**	**1,670**	**1,725**	**1,735**	**1,790**	**100%**	**+370**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

5.5.5 Mildura River Reach – salinity impact zones

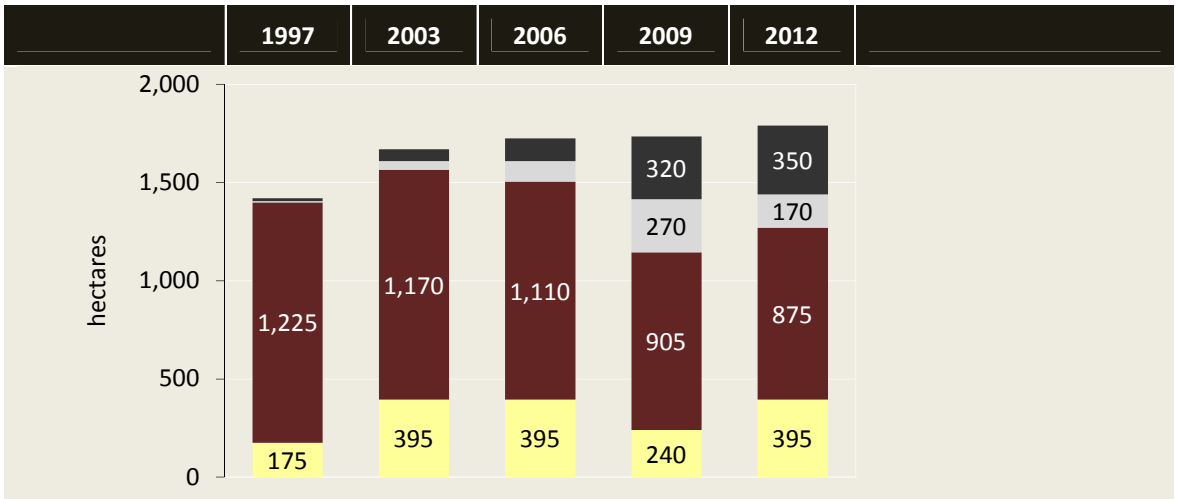
Figure 91 summarises the irrigable area in each river salinity impact zone in the Mildura River Reach from 1997 to 2012.

In the Mildura River Reach:

- 68% of the irrigable area is in the high salinity impact zone, HIZ
- 32% of the irrigable area is in the lowest salinity impact zone, LIZ 1

The irrigable HIZ area decreased by 15 hectares between 1997 and 2012. The irrigated HIZ area was 350 hectares less in 2012 than in 1997.

Figure 91 – Mildura River Reach salinity impact zones from 1997 to 2012



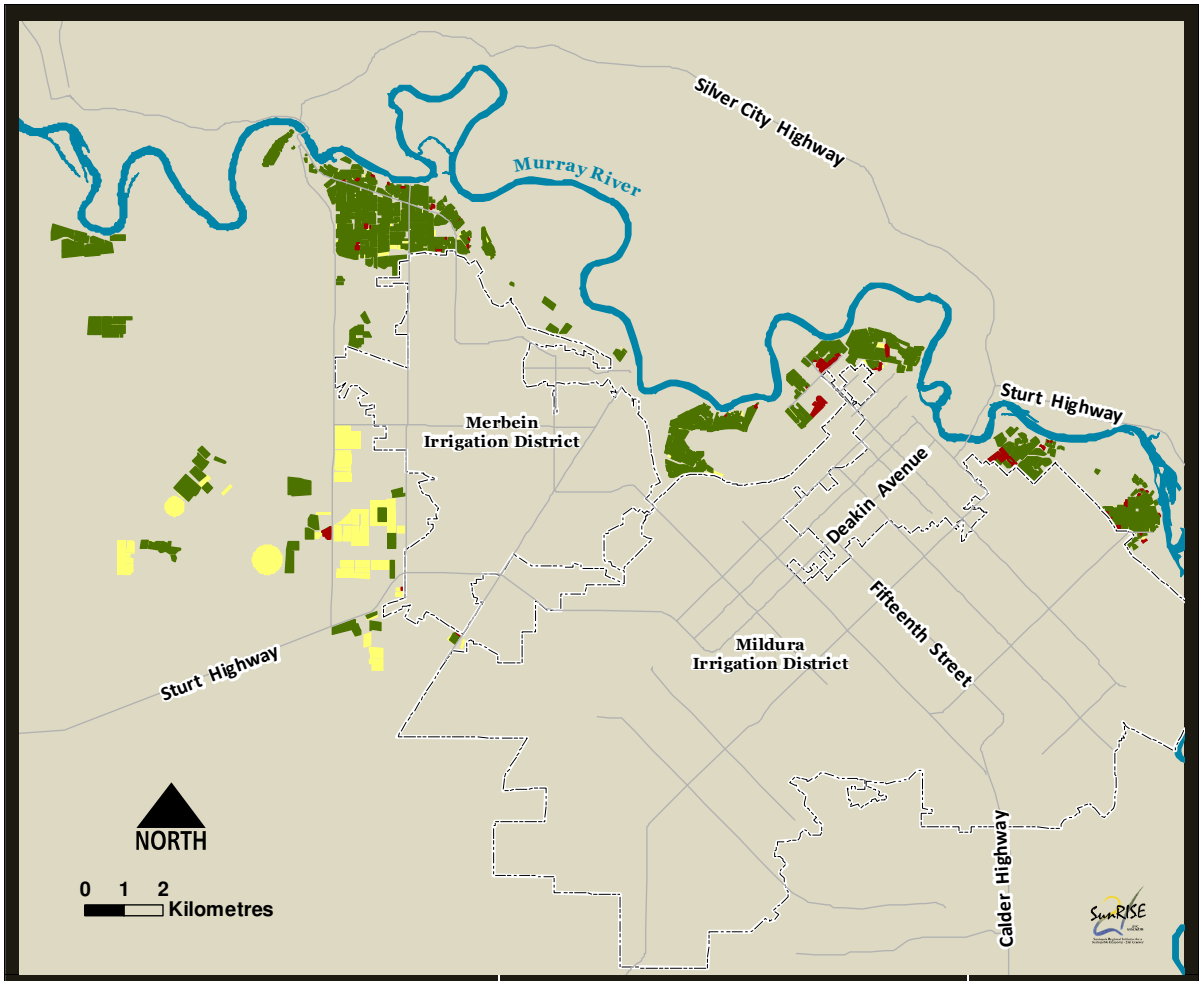
Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	175	395	395	240	395	22%	+220
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	1,225	1,170	1,110	905	875	49%	-350
Not Irrigated	LIZ 1	5	45	105	270	170	10%	+165
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	15	60	115	320	350	19%	+335
Total		**1,420**	**1,670**	**1,725**	**1,735**	**1,790**	**100%**	**+370**

5.5.6 Mildura River Reach – irrigation development

Map 21 shows irrigation development in the Mildura River Reach with respect to new and retired irrigation areas from 1997 to 2012.

The irrigable area increased by 370 hectares between 1997 and 2012; comprising 55 hectares retired and 425 hectares of new areas not irrigated prior to 1997.

Map 21 - Mildura River Reach development from 1997 to 2012



	Hectares		% of 1997
Irrigated crops in 1997 (1996-97 season)	1,420		
Retired between 1997 and 2012	-55		-4%
New areas between 1997 and 2012	+425		+30%
Irrigated crops in 2012 (2011-12 season)	1,790		

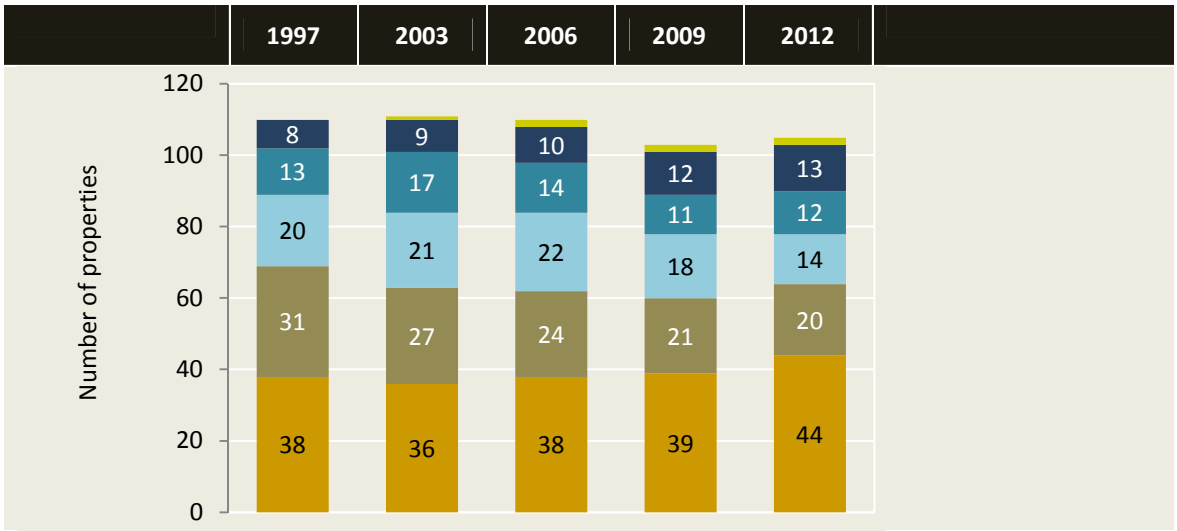
5.5.7 Mildura River Reach – property change

Figure 92 provides estimates of property numbers and average property size (irrigable area) in the Mildura River Reach from 1997 to 2012.

The Mildura River Reach has approximately 105 irrigation properties (land holdings). Average property size (irrigable area) is 17.0 hectares.

The number of irrigation properties decreased by 5 properties between 1997 and 2012. The average irrigable area per property increased from 12.9 hectares in 1997 to 17.0 hectares in 2012.

Figure 92 – Property numbers and size in Mildura River Reach from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	38	36	38	39	44	42%	+6
5 to 10 ha	31	27	24	21	20	19%	-11
10 to 20 ha	20	21	22	18	14	13%	-6
20 to 40 ha	13	17	14	11	12	11%	-1
40 to 100 ha	8	9	10	12	13	12%	+5
100 to 500 ha	0	1	2	2	2	2%	+2
> 500 ha	-	-	-	-	-	-	-
Total properties	**110**	**111**	**110**	**103**	**105**	**100%**	**-5**
Average size (ha)	**12.9**	**15.0**	**15.7**	**16.8**	**17.0**		

5.6 Lock 10 to the South Australian Border

In summary for the Lock 10 to SA River Reach

- The Lock 10 to South Australia River Reach has approximately 22 irrigation properties (land holdings). Average property size (irrigable area) is 137.7 hectares.
- In 2012 the irrigable area was 3,030 hectares of which 80% (2,410 hectares) was irrigated and 20% (620 hectares) was vacant or not irrigated.
- The irrigable area increased by 1,225 hectares between 1997 and 2012; comprising 150 hectares retired and 1,375 hectares of new areas not irrigated prior to 1997.
- Almond trees are the dominant planting (48%) in the Lock 10 to South Australia River Reach.
- Grapevines are predominantly (98%) grown for wine grape production, the remaining 2% are dried vine fruit plantings.
- While the dominant irrigation method was low level sprinklers in 1997 and 2003, drip irrigation has been the dominant method since 2009.
- 82% of the irrigable area is in the lowest salinity impact zone, LIZ 1.

5.6.1 Lock 10 to South Australia 2012 crop types

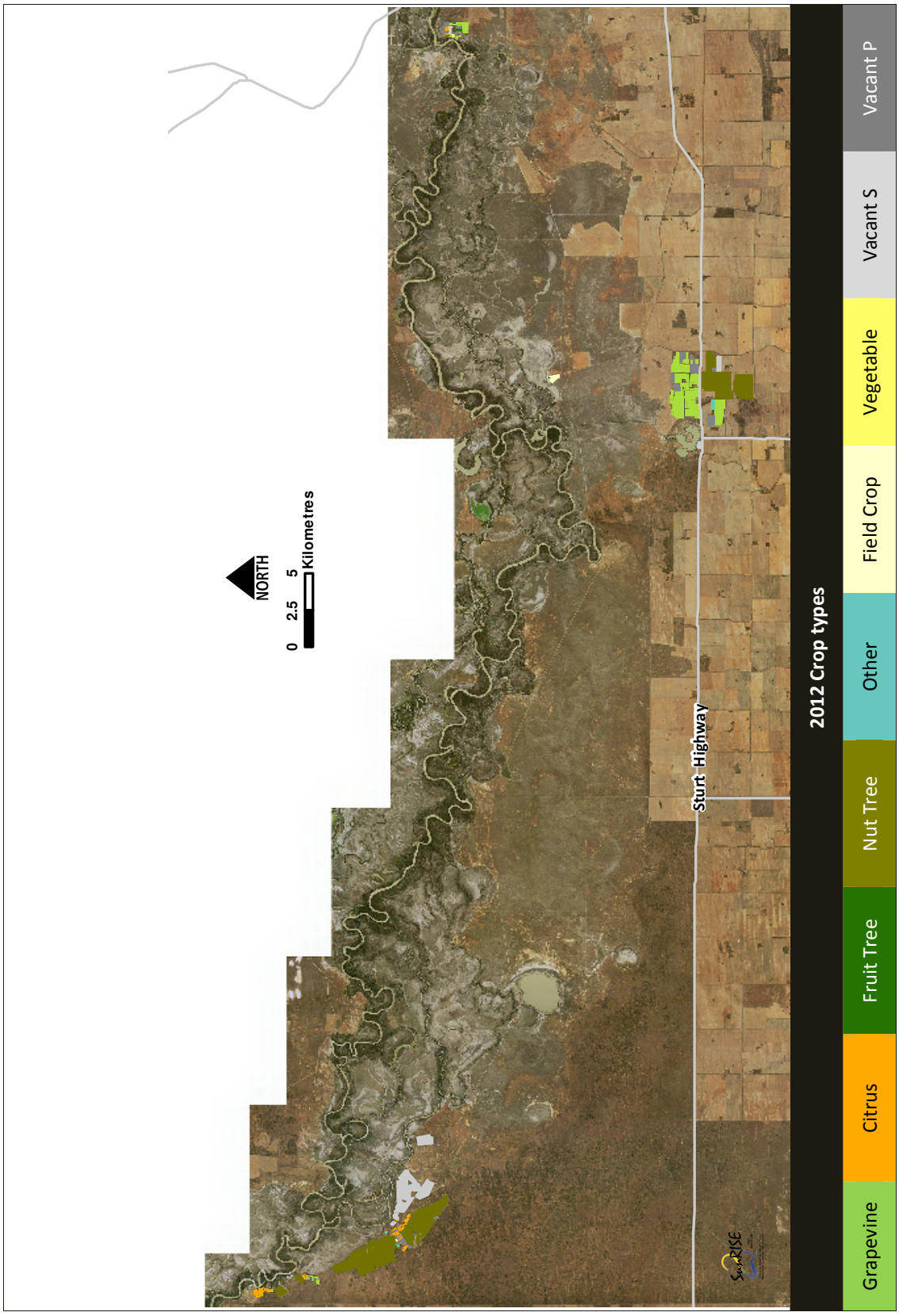
Figure 93 and Map 22 show Lock 10 to SA River Reach crop types in the 2011-12 irrigation season.

Figure 93 – Lock 10 to South Australia 2012 crop types

Crop type	Category	2012 (ha)	2012 %	
Grapevine	Wine	755	25%	
	Table	-	-	
	Dried	15	0%	
	Other	-	-	
Citrus		145	5%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Tangelo, Valencia
Fruit tree	Avocado	-	-	
	Olive	-	-	
	Stone fruit	-	-	
	Other	0	0%	<2ha Pomegranate
Nut tree	Almond	1,460	48%	
	Other	0	0%	<3ha Pistachio
Other	Nursery	15	0%	
	Woodlot	-	-	
Field crop	***unspecified***	-	-	
	Other	15	0%	Pasture
Vegetable	***unspecified***	5	0%	
	Asparagus	-	-	
	Carrot, Potato	-	-	
	Other	-	-	
Vacant S		430	14%	*Vacant – previously a seasonal planting*
Vacant P		190	6%	*Vacant – previously a permanent planting*
Total		**3,030**	**100%**	

Lock 10 to South Australia 2012 crop types

Map 22 – Lock 10 to South Australia 2012 crop types



5.6.2 Lock 10 to South Australia crop type change

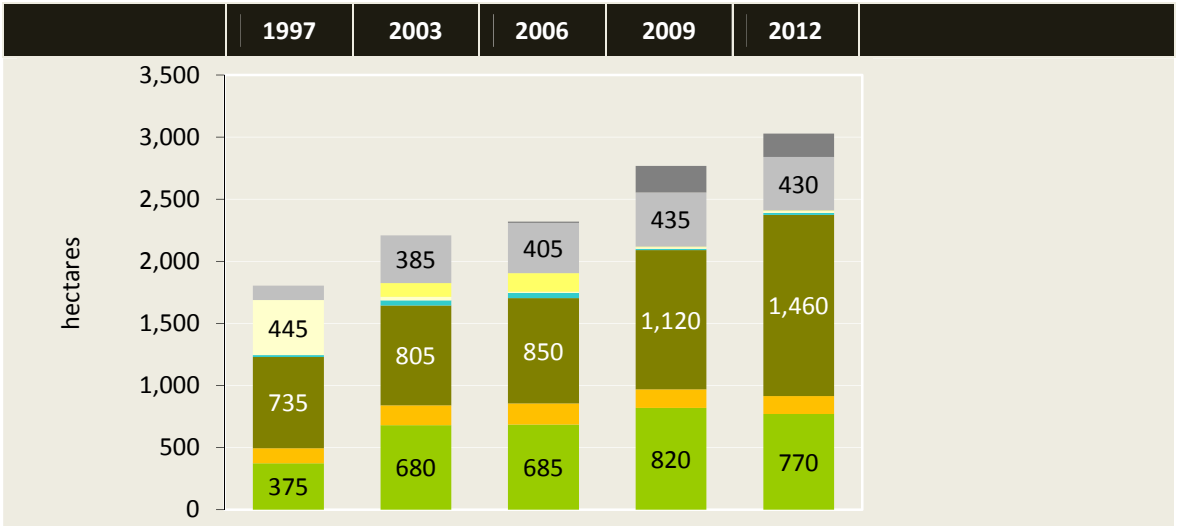
Figure 94 summarises crop types in the Lock 10 to South Australia River Reach from 1997 to 2012.

In the 2011-12 irrigation season the irrigable area was 3,030 hectares of which 80% (2,410 hectares) was irrigated and 20% (620 hectares) was vacant or not irrigated.

The irrigable area increased by 1,225 hectares; a 68% increase from 1,805 hectares in 1997 to 3,030 hectares in 2012.

Nut trees (almonds) are the dominant crop type. Plantings increased by 725 hectares between 1997 and 2012.

Figure 94 – Lock 10 to South Australia crop type change from 1997 to 2012



Crop Type		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Permanent	Grapevine	375	680	685	820	770	25%	+395
	Citrus	120	160	170	150	145	5%	+25
	Fruit Tree	-	-	-	-	-	-	-
	Nut Tree	735	805	850	1,120	1,460	48%	+725
	Other	15	40	40	10	15	0%	0
Seasonal	Field Crop	445	30	10	15	15	0%	-430
	Vegetable	0	110	150	5	5	0%	+5
Vacant	Vacant S	115	385	405	435	430	14%	+315
	Vacant P	0	0	10	215	190	6%	+190
Total		**1,805**	**2,210**	**2,320**	**2,770**	**3,030**	**100%**	**+1,225**
% Vacant		**6%**	**17%**	**18%**	**23%**	**20%**		

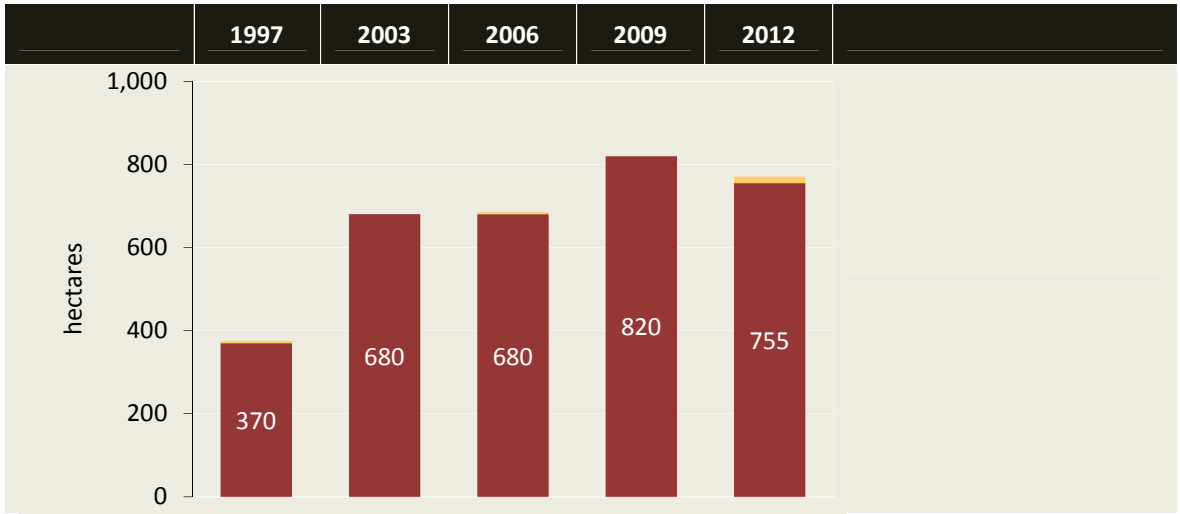
5.6.3 Lock 10 to South Australia – grapevines

Figure 95 summarises grape use in the Lock 10 to South Australia River Reach from 1997 to 2012.

Grapevines are predominantly (98%) grown for wine production, the remaining 2% are dried vine fruit plantings.

Grapevines increased by 445 hectares between 1997 and 2009 then decreased by 50 hectares between 2009 and 2012.

Figure 95 – Lock 10 to South Australia grape use from 1997 to 2012



Grape Use	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Wine	370	680	680	820	755	98%	+385
Table	-	-	-	-	-	-	-
Dried	5	0	5	0	15	2%	+10
Other	-	-	-	-	-	-	-
Total	**375**	**680**	**685**	**820**	**770**	**100%**	**+395**

Note: 'Other' includes grapes for juicing, research/trial varieties and cannery.

5.6.4 Lock 10 to South Australia – irrigation methods

Figure 96 summarises irrigation methods in the Lock 10 to South Australia River Reach from 1997 to 2012.

While the dominant irrigation method was low level sprinklers in 1997 and 2003, drip irrigation has been the dominant method since 2009.

Drip irrigation increased by 1,085 hectares between 1997 and 2012, while furrow irrigation decreased by 430 hectares.

Figure 96 – Lock 10 to South Australia irrigation methods from 1997 to 2012

Irrigation method	1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Drip	375	870	945	1,225	1,460	48%	+1,085
Low level	870	930	945	880	935	31%	+65
Overhead	10	10	5	5	10	0%	0
Furrow	435	15	10	10	5	0%	-430
Vacant	115	385	415	650	620	20%	+505
Total	**1,805**	**2,210**	**2,320**	**2,770**	**3,030**	**100%**	**+1,225**

Note: 'Overhead' includes centre pivot and travel sprays
'Low level' includes sprinklers
'Furrow' includes flood irrigation

5.6.5 Lock 10 to South Australia – salinity impact zones

Figure 97 summarises the irrigable area in each river salinity impact zone in the Lock 10 to South Australia River Reach from 1997 to 2012.

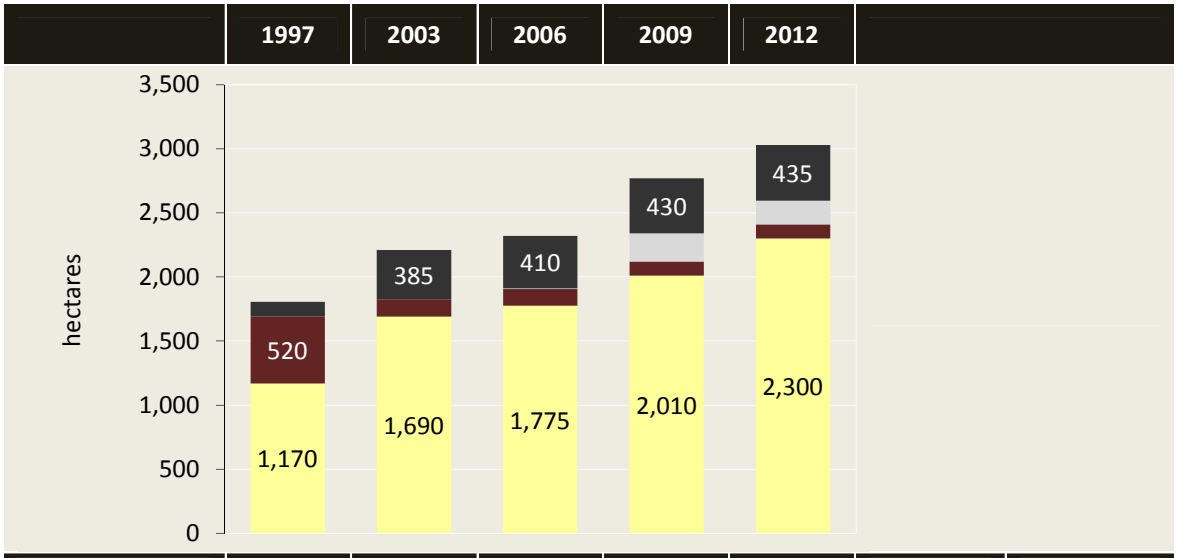
In the Lock 10 to South Australia River Reach:

- 82% of the irrigable area is in the lowest salinity impact zone, LIZ 1
- 18% of the irrigable area is in the high salinity impact zone, HIZ

The HIZ irrigable area decreased by 90 hectares between 1997 and 2012.

Irrigation development occurred in the low impact zone, LIZ 1.

Figure 97 – Lock 10 to South Australia salinity impact zones from 1997 to 2012



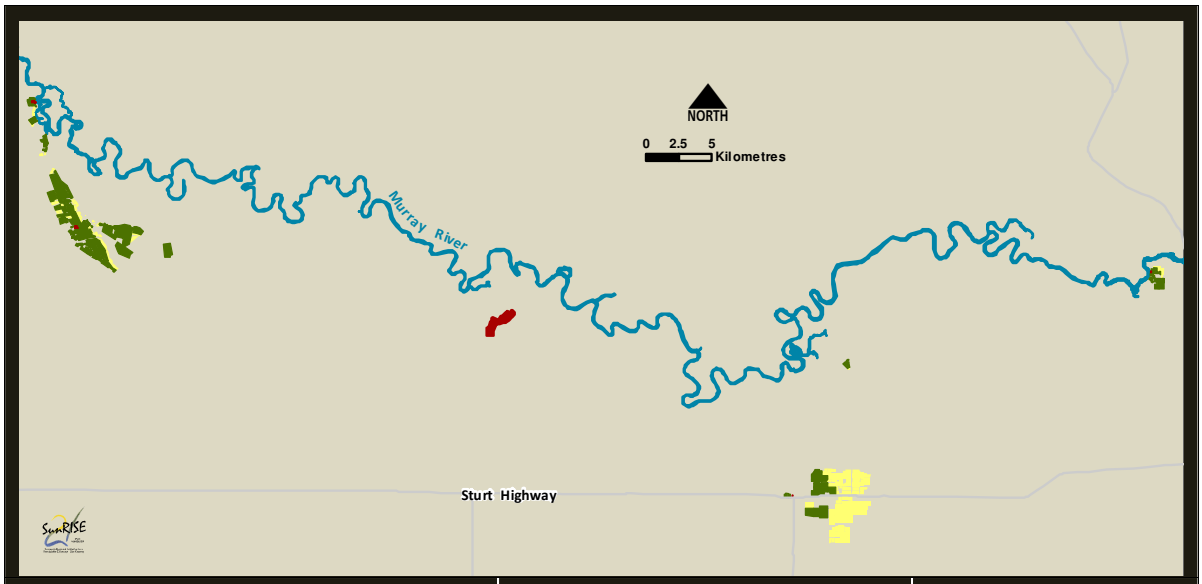
Salinity impact zone		1997	2003	2006	2009	2012	% of 2012 total	Change (ha) 1997-2012
Irrigated	LIZ 1	1,170	1,690	1,775	2,010	2,300	76%	+1,130
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	520	135	130	110	110	4%	-410
Not Irrigated	LIZ 1	0	0	5	220	185	6%	+185
	LIZ 2	-	-	-	-	-	-	-
	LIZ 3	-	-	-	-	-	-	-
	LIZ 4	-	-	-	-	-	-	-
	HIZ	115	385	410	430	435	14%	+320
Total		**1,805**	**2,210**	**2,320**	**2,770**	**3,030**	**100%**	**+1,225**

5.6.6 Lock 10 to South Australia – irrigation development

Map 23 shows irrigation development in the Lock 10 to South Australia River Reach with respect to new and retired irrigation areas from 1997 to 2012.

The irrigable area increased by 1,225 hectares between 1997 and 2012; comprising 150 hectares retired and 1,375 hectares of new areas not irrigated prior to 1997.

Map 23 - Lock 10 to South Australia development from 1997 to 2012



	Hectares	% of 1997
Irrigated crops in 1997 (1996-97 season)	1,805	
Retired between 1997 and 2012	-150	-8%
New areas between 1997 and 2012	+1,375	+76%
Irrigated crops in 2012 (2011-12 season)	3,030	

Note: Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, sheds and dam construction, and land set aside for conservation purposes.

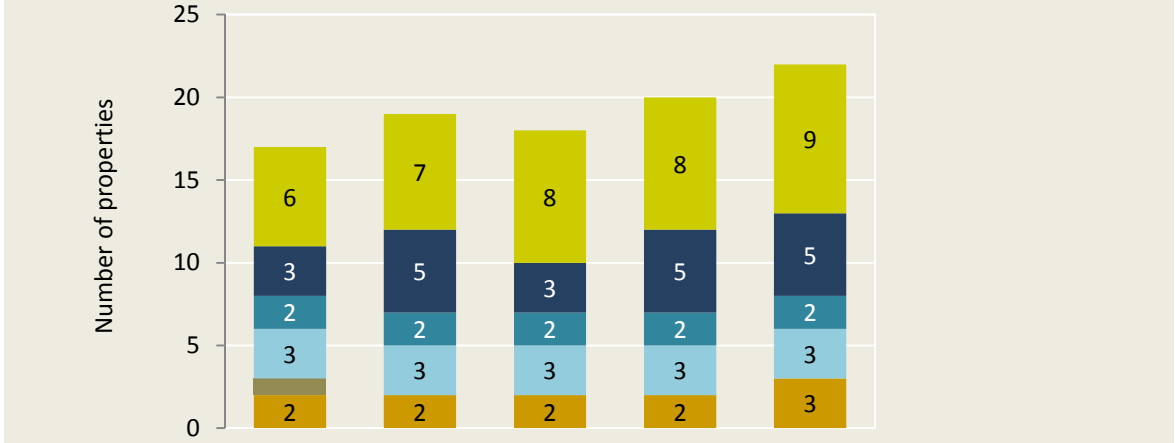
5.6.7 Lock 10 to South Australia – property change

Figure 98 provides estimates of property numbers and average property size (irrigable area) in the Lock 10 to South Australia River Reach from 1997 to 2012.

The Lock 10 to South Australia River Reach has approximately 22 irrigation properties (land holdings). Average property size (irrigable area) is 137.7 hectares.

The number of irrigation properties increased by 5 properties between 1997 and 2012. The average irrigable area per property increased from 106.2 hectares in 1997 to 137.7 hectares in 2012.

Figure 98 – Property numbers and size - Lock 10 to South Australia from 1997 to 2012



Property size (irrigable area)	1997	2003	2006	2009	2012	% of 2012 total	Change 1997-2012
1 to 5 ha	2	2	2	2	3	14%	+1
5 to 10 ha	1	0	0	0	0	0%	-1
10 to 20 ha	3	3	3	3	3	14%	0
20 to 40 ha	2	2	2	2	2	9%	0
40 to 100 ha	3	5	3	5	5	23%	+2
100 to 500 ha	6	7	8	8	9	41%	+3
> 500 ha	-	-	-	-	-	-	-
Total properties	**17**	**19**	**18**	**20**	**22**	**100%**	**+5**
Average size (ha)	**106.2**	**116.3**	**128.9**	**138.5**	**137.7**		

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