

# **KULIN/DUDININ CATCHMENTS WATER MANAGEMENT PLAN**

## **Appendices A & B**

### **Final Report**



# Kulin/Dudinin Catchments Water Management Plan

**Final Report – Appendix A & B  
May 2009**

PO Box 3596  
Australia Fair,  
QLD 4215  
Australia

Tel: +61 7 5564 0916  
Fax: +61 7 5564 0946  
e-mail: qld@dhigroup.com  
Web: www.dhigroup.com.au

Client  Western Australia Department of Water	Client's representative  Mr Jason Lette
-----------------------------------------------------	-----------------------------------------------

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Authors  Graeme Cox (GJC) Tony Chiffings (TWC) Ashley Prout		Date  02 March 2009			
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## **INTRODUCTION**

This document has been prepared by DHI Water and Environment P/L under contract to the Department of Water on behalf of the Kulin-Dudinin Catchment Water Management Plan Steering Committee comprising:

- Land owners from lower, middle and upper catchment areas
- WA Department of Water (DOW)
- WA Department of Environment and Conservation DEC)
- WA Department of Agriculture and Food (DAFWA)
- Avon Catchment Council (ACC)

The Document contains four distinct outputs;

- A Draft Water management Plan
- A Land Holder Consultation Survey (Appendix A of the Plan)
- A Pit Survey (Appendix B of the Plan)
- A Management Options Evaluation (Appendix C of the Plan)

This document contains

- A Land Holder Consultation Survey (Appendix A of the Plan)
- A Pit Survey (Appendix B of the Plan)



# **A P P E N D I X A**

***Public Consultation***



**Kulin / Dudinin Creek**

**Catchment Water Management Plan**

**Public Consultation**

**Shire of Kulin April-June 2008**

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## **EXECUTIVE SUMMARY**

- All farmers visited and interviewed were fully aware of the salinity and drainage issues facing them. Most thought that a deep arterial drainage system would assist them, and if available most farmers would use it.
- Seventeen farmers said there was a need for a surface water management scheme. Some confusion did exist when discussing surface water control and a general lack of understanding of the effects of surface water logging was noticed. In fact some farmers said they either were or considering removing grade and contour banks on their properties.
- The majority of farmers indicated that they are still using dams and on farm stored water to a large degree even when connected to the pipe scheme system and indicated that any drainage system should allow fresh water to be separated from deep saline water.
- Younger farmers were very strong in their opinions relating to the differing views in the community and suggested that for a catchment drainage scheme to be successful, a unified and cooperative approach was needed. The lack of a suitably funded and technical catchment body or committee, such as a catchment land care committee, was partly to blame for this.
- Cropping percentages varied around 60-65% with farmers suggesting that this figure may stay constant or slightly increase with decreasing stock numbers in the near future. The use of salt bush and trees was common, while lucerne was considered by only a few farmers.
- Flooding issues were not considered to be a major problem for most farmers.
- Responses to specific options and needs was mixed with strong opinions offered to improve drainage to the Lockhart River, improve the capacity of floodways culverts etc and against the proposed diversion bank on the Quicke and Carmody farms. Strong opinion against installing culverts to restrict flow and permanently blocking existing deep drains was given, while mixed responses to re-routing drains and building low flow separators was received.



## CONTENTS

1	INTRODUCTION.....	1
1.1	Methodology.....	1
1.2	Survey sample.....	1
1.3	Analysis of data.....	2
2	KEY ISSUE: SALINITY .....	3
2.1	Current condition and trends .....	3
2.1.1	Question 1 .....	3
2.1.2	Question 2 .....	3
2.2	Actions .....	3
2.2.1	Question 3 .....	3
2.3	Reducing ground water recharge.....	4
2.3.1	Question 4 .....	4
2.3.2	Question 5 .....	7
2.3.3	Question 6 .....	7
2.3.4	Question 7 .....	7
2.4	Increasing ground water discharge.....	7
2.4.1	Question 8 .....	7
2.4.2	Question 9 .....	7
2.4.3	Question 10 .....	8
2.4.4	Question 11 .....	8
2.4.5	Question 12 .....	10
2.5	Desired outcomes.....	10
2.5.1	Question 13 .....	10
2.5.2	Question 14 .....	10
3	KEY ISSUE: WATER SUPPLY .....	12
3.1	Current condition and trend .....	12
3.1.1	Question 15 .....	12
3.1.2	Question 16 .....	12
3.2	Actions .....	12
3.2.1	Question 17 .....	12
3.2.2	Question 18 .....	13
3.3	Desired outcomes.....	13
3.3.1	Question 19 .....	13
3.4	Responsibilities .....	14
3.4.1	Question 20 .....	14
4	KEY ISSUE: FLOODING.....	15
4.1	Current condition and trend .....	15
4.1.1	Question 21 .....	15
4.2	Actions .....	15
4.2.1	Question 22 .....	15
4.2.2	Question 23 .....	15
4.3	Desired outcomes.....	17
4.3.1	Question 24 .....	17
4.4	Responsibilities .....	17
4.4.1	Question 25 .....	17



5	KEY ISSUE: WATER QUALITY .....	18
5.1	Current condition and trend .....	18
5.1.1	Question 26 .....	18
5.2	Actions .....	18
5.2.1	Question 27 .....	18
5.2.2	Question 28 .....	18
5.2.3	Question 29 .....	19
5.2.4	Question 30 .....	19
6	OTHER .....	21
6.1	Other issues, any valuable data and any other comments.....	21
7	RECOMMENDATIONS .....	22
8	QUESTIONNAIRE .....	23



## **1 INTRODUCTION**

A survey of farmers in the Kulin and Dudinin Creek catchment areas was undertaken during April and June 2008.

The aim of the survey was to detail the current and future requirements and plans for water, drainage and salinity management practices. This would then allow options to be selected that would address the current salinity issues in the catchment.

This report presents the findings, conclusions and recommendations arising from the survey.

### **1.1 Methodology**

Introductory letters were sent to catchment land holders advising them of the process and making them aware that they would be contacted to discuss the issues involved and allow them to express their individual situations regarding salinity and drainage issues.

Appointments were made with twenty farmers whose properties were located either close to the valley floor or adjoining properties that were close. A further four high land farmers whose properties were close to the catchment divide were also invited to take part.

The time allowed for each interview was four hours for a one on one discussion.

Interviewing ceased on May 2<sup>nd</sup> due to seeding operations commencing and recommenced on June 16<sup>th</sup> after most farmers had completed seeding their crops.

The thirty question survey form is attached as an appendix to this report. Farmers were also given the opportunity to add any further comments they wished.

The survey questionnaire was split up into four key issues, namely

- *Salinity*
- *Fresh water supply*
- *Flooding*
- *Water quality*

### **1.2 Survey sample**

Of the original twenty farmers selected, one declined the invitation to discuss the situation; however a lengthy telephone discussion allowed an indication of the family's desires to be noted. Another farmer did not attend the planned meeting; however an additional land holder farming on the catchment boundary was added to the list, making a total of nineteen farmers, some with multiple properties, and one telephone discussion.

Those farmers and their families interviewed were generally happy to provide the information requested and provide opinions on what to do in the catchment.



The whole process took longer than planned and a total of fourteen days was spent gathering the information. This extra time was mainly due to weather conditions and the commencement of seeding earlier than expected.

### **1.3 Analysis of data**

Given the small number of interviews, no statistical analysis is presented, only an indication of responses and common ideas is presented with minimal interpretation.



## **2 KEY ISSUE: SALINITY**

### **2.1 Current condition and trends**

#### **2.1.1 Question 1**

*Salt affected land, where and when were salinity symptoms first observed? Aerial photographs were used previously by Dr Richard George from the Western Australian Department of Agriculture and Food (DAFWA) to assist farmers in defining various areas of salinity and definite future salt susceptible areas.*

There were only seven valid responses to this question. Three farmers had not been on property long enough to comment. Five farmers stated that salt appeared around 50-60 years ago with two families stating it had become worse over the last 30 years.

#### **2.1.2 Question 2**

*Observed ground water levels/trends e.g. depth below ground with dates, when and where water arrived at ground level e.g. bottom of creek.*

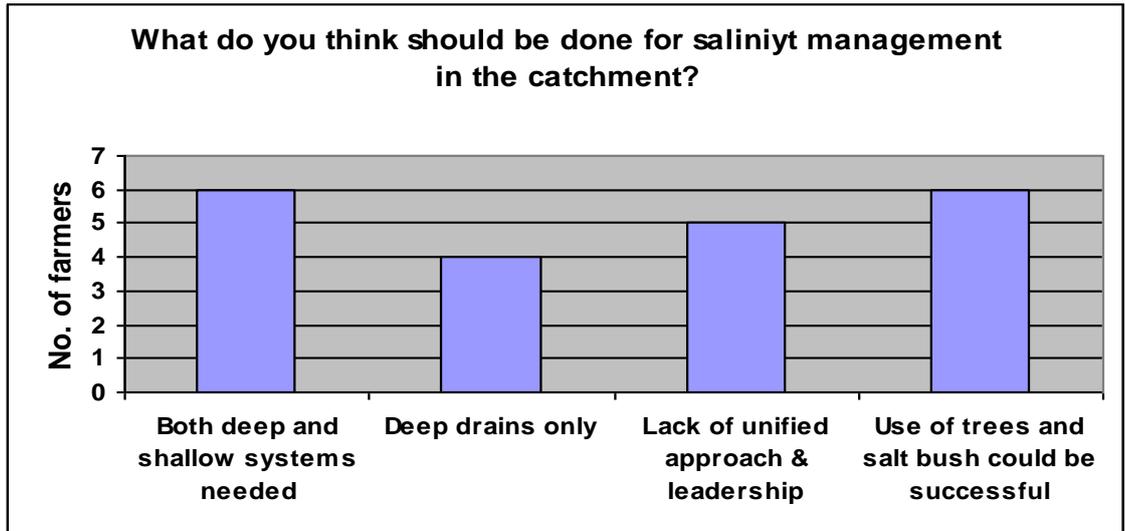
Dr Richard George has data on bores. Several farmers commented on salt appearing in the bottom of dams at a depth of around 5-6 meters below ground level.

### **2.2 Actions**

#### **2.2.1 Question 3**

*Broadly what do you think should be done for salinity management catchment wide?*

Responses were not clear and covered a range of options with 6 farmers suggesting both deep and shallow drainage systems were warranted while a further 4 suggested deep drains only. Five suggested that the catchment lacked a unified approach and had no leadership while, six farmers suggested that the use of trees and salt bush could be a successful method of reducing the salinity problem.



*Figure 1 Summary of results to Question 3.*

## **2.3 Reducing ground water recharge**

### **2.3.1 Question 4**

*Complete the 'leakage calculator'*

The spreadsheet was completed for all farmers interviewed. Where different land holdings were separated by another property, the data was entered as a separate farm. This data after correcting for soil type is used in the drainage model.

A summary and totals have been tabulated and set out on the next two pages.

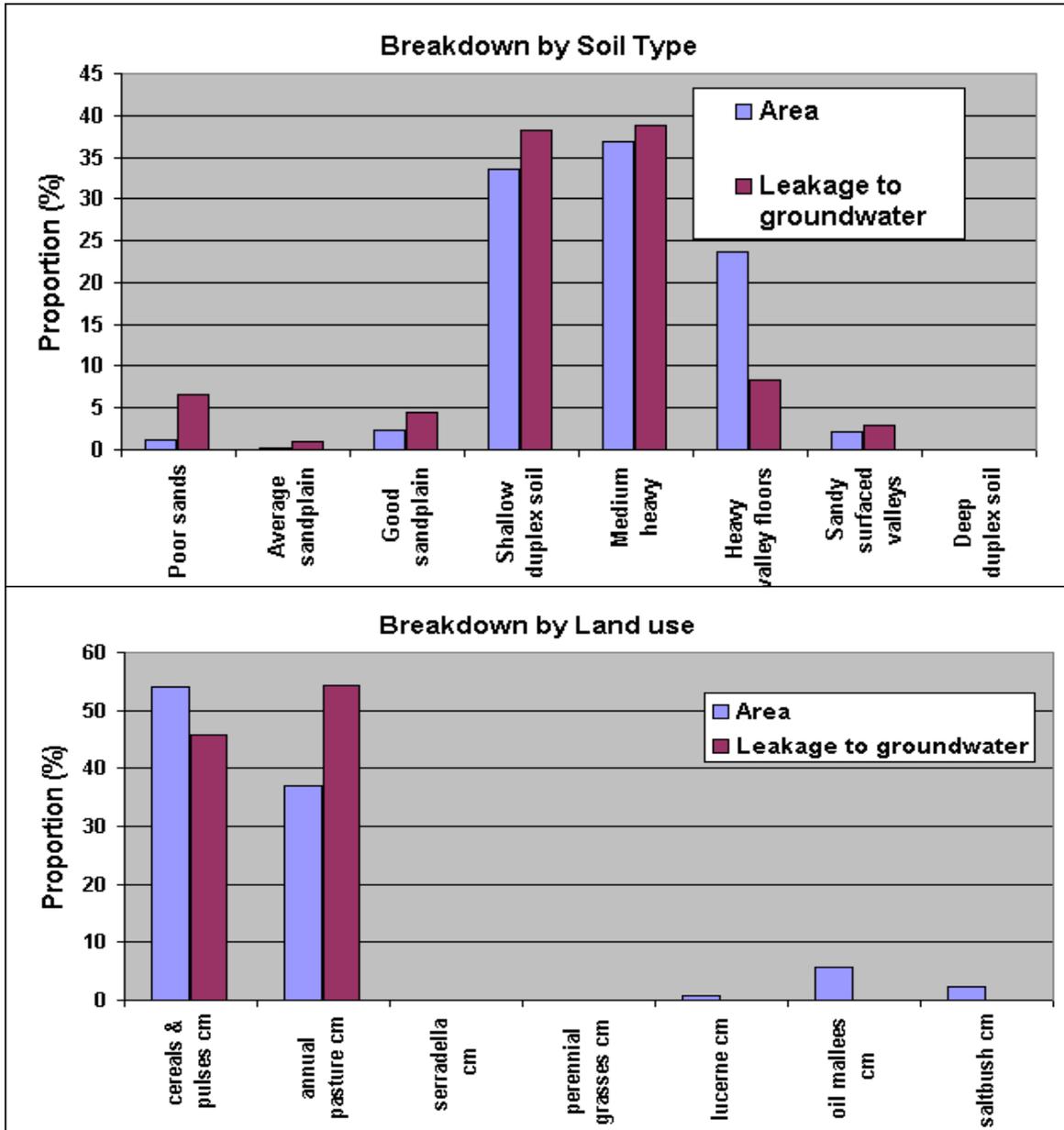


*Table 1 Summary of the results and totals from the responses to Question 4 – Leakage Calculator*

Land Management Unit	LMU x Plant - Areas input in hectares							Total	% of Total
	cereals & pulses	annual pasture	serradella	perennial grasses	lucerne	oil mallees	saltbush		
Poor sands	63.0	372.0						435	1
Average sandplain	25.0	54.0						79	0
Good sandplain	456.0	393.0				45.0		894	2
Shallow duplex soil	6,773.0	5,007.0			127.0	651.0		12,558	33
Medium heavy	8,373.0	4,951.0				388.0	148.0	13,860	37
Heavy valley floors	3,935.0	3,103.0			128.0	1,096.0	624.0	8,886	24
Sandy surfaced valleys	689.0	23.0					95.0	807	2
Deep duplex soil								0	0
<b>Total</b>	20,314	13,903	0	0	255	2,180	867	37,519.0	100.0
% of Total	54	37	0	0	1	6	2	100	63%

Note: Area surveyed is only 63% of catchment area.

Land Management Unit	'LMU x Plant - Leakage							Total cm	% of Total	Average Leakage (mm/yr)
	cereals & pulses cm	annual pasture cm	serradella cm	perennial grasses cm	lucerne cm	oil mallees cm	saltbush cm			
Poor sands	27,700.0	189,700.0	0.0	0.0	0.0	0.0	0.0	217,400	7	50
Average sandplain	9,300.0	22,700.0	0.0	0.0	0.0	0.0	0.0	32,000	1	41
Good sandplain	68,400.0	78,600.0	0.0	0.0	0.0	500.0	0.0	147,500	4	16
Shallow duplex soil	609,600.0	650,900.0	0.0	0.0	0.0	0.0	0.0	1,260,500	38	10
Medium heavy	586,100.0	693,100.0	0.0	0.0	0.0	0.0	1,500.0	1,279,200	39	9
Heavy valley floors	118,100.0	155,200.0	0.0	0.0	0.0	0.0	0.0	273,300	8	3
Sandy surfaced valleys	89,600.0	4,100.0	0.0	0.0	0.0	0.0	0.0	93,700	3	12
Deep duplex soil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
<b>Total</b>	1,508,800	1,794,300	0	0	0	500	1,500	3,305,100	100	8.8
% of Total	46	54	0	0	0	0	0	100		
<b>Average Leakage (mm/yr)</b>	7	13	0	0	0	0	0	9		



**Summary**

Based on farmer estimated land use and soil types plus the assumptions of the leakage calculator:

77% of leakage to groundwater occurs from two soil types: Shallow Duplex and medium heavy which cover 70% of the area

100% of leakage to groundwater occurs from two land uses: Cereals/Pulses and annual pasture which cover 90% of the area

Average leakage across the catchment is 9mm/yr, primarily due to the 13mm/yr from annual pasture and 7mm/yr from cereals/pulses.

**Notes**

1 Only 63% of the total catchment was covered by this survey and the results may be biased by surveying farmers from lower in the catchment/valleys.

2 Remnant vegetation has been included with the oil mallee group to balance farm areas with titles

**Figure 2 Summary of the results and totals from the responses to Question 4**



### **2.3.2 Question 5**

*Do you currently use of plan any cropping and vegetation management to reduce groundwater re-charge?*

Sixteen of the 19 farmers have planted some type of vegetation in an attempt to reduce re-charge. Eight have tried salt bush, seven have planted trees, six have planted oil mallees and four have stands of lucerne. Cropping percentages vary around 60-65 % crop with 35-40 % remaining in pasture.

### **2.3.3 Question 6**

*What are your surface water management plans?*

Twelve of the 19 farmers have used grade banks to assist in filling dams and removing flood water to creek lines in attempts to reduce the time the water remains on the property. Four farmers do not have banks and three stated that they have either filled them in or graded them out because of hindrance to cropping.

### **2.3.4 Question 7**

*Do you have any other re-charge plans?*

Only three farmers have plans for reducing re-charge and these are to fill in salty dams, tree planting in gullies and trying lucerne.

## **2.4 Increasing ground water discharge**

### **2.4.1 Question 8**

*Deep drainage, where do you have deep drains and where do you plan to have?*

Five farmers stated that they have deep drains on their properties and these are already shown on maps. Fourteen other farmers do not have deep drains and do not plan any at this stage. Some farmers indicated their acceptance of deep drainage but were waiting to see the outcome of the present situation. One farmer said that if it could be shown that deep drainage was profitable and it worked and did not cause social hostility, then he would accept the solution.

### **2.4.2 Question 9**

*Ground water pumping, where do you have and plan to have?*

Two farmers tried and both failed to achieve a satisfactory result. Currently two other farmers are pumping fresh perched or soak water using windmills for stock/domestic water. No one has plans to use this system.



### 2.4.3 Question 10

*What do you think the best way to dispose of drainage water is?*

- A *On farm evaporation ponds*
- B. *Retention basins that release saline flows during high flows.*
- C. *Catchment drainage scheme.*

*i Arterial drain with evaporation area near bottom of catchment? Drain would separate the Kulin Creek and Dudinin Creek flows available for downstream capture. Drain could be levied or open.*

*ii Piped drainage with evaporation areas near bottom of catchment*

- D. *Natural salt lakes,*
- E. *Other*

Seventeen farmers suggested the best disposal point was the salt lake areas at the catchment discharge end. Some concern was expressed that flooding sometimes occurred if the Ski Lake was banked to prevent salt water from entering. Another farmer wanted the drain to be continued further downstream and a further farmer suggested that the discharge be on non private land.

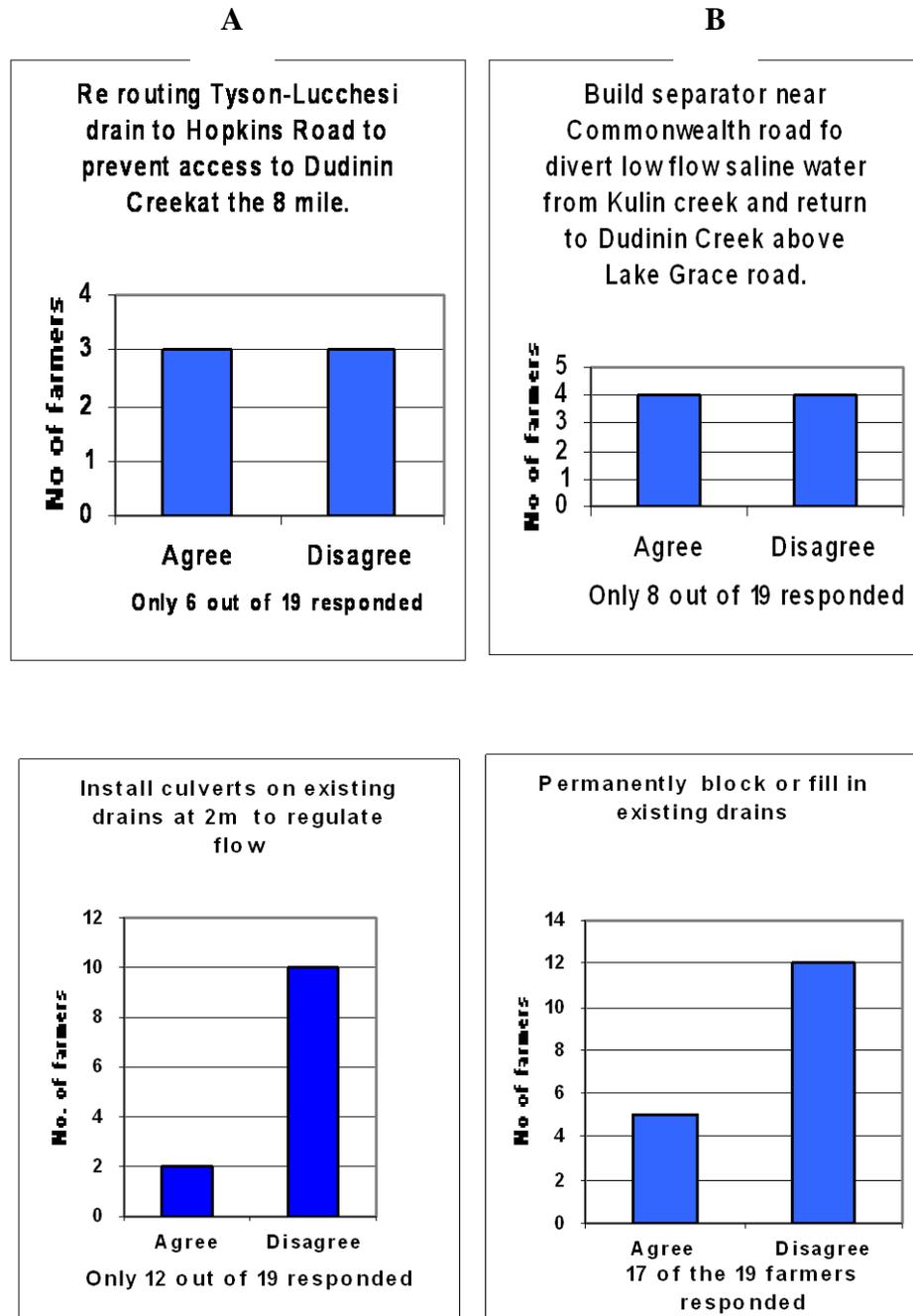
### 2.4.4 Question 11

*Do you have comments on these specific options?*

- A *RE-routing discharge from Tyson Lucchesi and Lucchesi Francis drains to the Hopkins Road drains, to prevent access to Dudinin Creek at the 8 – mile*
- B *Build a low flow separator near Commonwealth Tarin Rock Roads and water way to divert low saline flows (approx < 10ML/ day) from the Kulin Creek. Low flow structure travels parallel to Kulin Creek or via low areas to the south and east. Flow returns to Dudinin Creek upstream of Lake Grace Road.*
- C *Install culverts on existing drains at 2m to regulate peak flow, suggest restricted maximum flow at < 0.5 ML/day (5L/sec).*
- D *Permanent blockage and or filling in existing drains.*



This question posed problems and farmers found it difficult to respond without more knowledge of the real issues. Many 'no comment' responses were received and comments such as it is only a 'feel good approach', a 'band aid measure' 'does not address the real issues' were common...



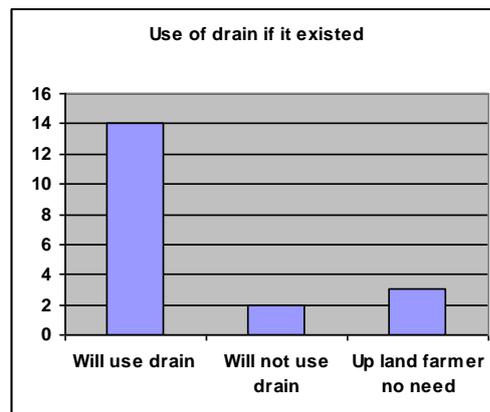
*Figure 3 Summary of responses to Question 11*



### 2.4.5 Question 12

*If a drainage scheme existed would you use it?*

The question did not refer to the type of drain. If the plan was for a deep catchment based drainage scheme then 14 of the 19 farmers said they would use it, while 5 said they would not or could not see a need to use it. Of the 5 who said they would not use the drain, 3 were considered high catchment land holders who would not get any direct benefit. Two farmers said they would use a shallow drainage system if available. One farmer suggested that consideration of a bigger drain with a greater capacity should be given to take both deep saline water and fresher surface run-off.



*Figure 4 Summary of responses to Question 12*

Although it was suggested to respondents that the deep drain may be leveled to prevent surface flows from entering, some farmers may not have considered the fact that they may need to excavate more deep drains to connect into the arterial system.

## 2.5 Desired outcomes

### 2.5.1 Question 13

*What outcomes from salinity management do you think are reasonable to expect? Now and in 20 years time.*

Respondents had considerable difficulty in responding to this question. Thoughts were wide and varied however 7 farmers stated that they hoped salt encroachment would slow down while 5 said there should be less salt affected land.

Other comments suggested that high land farmers should adopt management techniques that used more water, infrastructure protected from rising salt water tables, the land will return to pre 2006 flood levels of salinity, on farm water quality will be improved, some land will be reserved for trees and that land holders will have made a resolution to co-operate in an overall catchment plan.

### 2.5.2 Question 14

*With regards to any salinity management, who do you think should be responsible for?*



The question posed a few issues in understanding the intent between responsibility and payment, however most responded on the basis of payment and the responsible body arranging the funds. The table numbers refer to the number of times the organization was mentioned. One farmer did not wish to comment.

*Table 2 Summary of responses to Question 14*

	<b>Funding</b>	<b>Construction</b>	<b>Maintaining</b>
<b>Landholders</b>	10	1	14
<b>Kulin Council</b>	3	3	10
<b>Avon Catchment Council</b>	8	10	2
<b>State Government</b>	12	7	2
<b>Federal Government</b>	11	2	2

The table suggests that respondents prefer both the State and Federal Governments to fund the scheme and the Avon Catchment Council be responsible for the construction, presumably calling tenders for supervision and construction etc using funds from the Federal and State Governments. Maintaining the scheme was thought to be the responsibility of farmers and the local council possibly funded through a rate based on the degree of potential improvement or some similar classification.



### 3 KEY ISSUE: WATER SUPPLY

#### 3.1 Current condition and trend

##### 3.1.1 Question 15

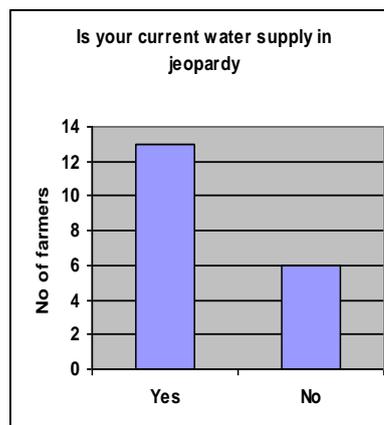
*What are your current and future water needs that you require to come from off farm e.g. pipe scheme and creek flows?*

Large volumes of fresh water are required for spray purposes and modern trends indicate that this use may increase rather than decrease. Quality water is also required for domestic purposes and stock water, where on farm supplies are too saline to use.

##### 3.1.2 Question 16

*Is your current supply in jeopardy e.g. from salinity?*

Eighteen of the 19 farmers reported that their properties were connected to the pipe scheme, and 13 of those reported having salinity problems in their dams and problems in locating suitable dam sites. Six farmers did not report any problems with dams.



*Figure 5 Summary of responses to Question 16*

One respondent reported that soon or later the cost of scheme water supply may be out of reach for agricultural purposes. Farmers have also readily used scheme water stand pipes both under drought conditions and for convenience.

#### 3.2 Actions

##### 3.2.1 Question 17

*What do you think should be done for water supply management in the catchment?*



Eight of the 19 farmers suggested that the aim should be for self sufficiency and the use of large dams and roaded catchments. Eight farmers also wanted the pipe scheme to remain and be maintained. Other comments suggested that access to Government funds through the Farm Water Supply Grant funding arrangement should be made available to land holders where it could be shown that large areas of land was further than 4-5 kilometers away from the pipe scheme.

One farmer did not offer a comment. Other land holders suggested that: diverting the Dudinin creek was an option to improve fresh water creek flow, deep drainage will help and a suggestion about using bore water as a water source for a community based desalination plant was made.

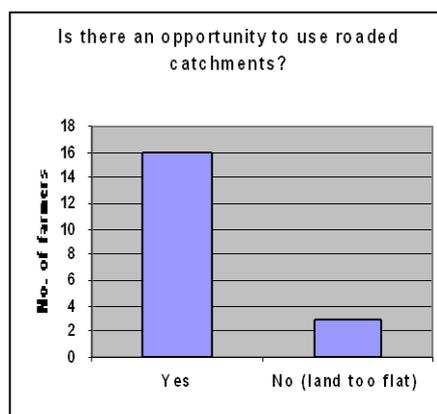
### 3.2.2 Question 18

*Is there an opportunity for?*

*A Roaded catchments to increase runoff to dams*

*B Other*

Sixteen of the 19 farmers stated that there was an opportunity to construct roaded catchments. Three farmers reported that their land was too flat for efficient roaded catchments to be constructed.



*Figure 6 Summary of responses to Question 18*

Other suggestions were made about using grade banks, large turkey nest dams where most of the water is stored above ground level, and one farmer stated that filling from creeks is an option.

## 3.3 Desired outcomes

### 3.3.1 Question 19

*What outcomes from water supply management do you think are reasonable to expect now and in 20 years time?*



Fourteen of the 19 farmers suggested that self sufficiency should be an outcome while increased research into improving the runoff characteristics of roaded catchments and improved desalination techniques would assist in becoming self sufficient.

One land holder did not wish to comment. Other comments related to using the pipe scheme during times of drought only, two farmers needed to rely on the pipe scheme because of high water tables preventing them from excavating suitable dams and 1 other said that water quality would be maintained.

### **3.4 Responsibilities**

#### **3.4.1 Question 20**

*With regard to any water supply system, who do you think should be responsible for?*

The table below suggests that land holders had a very strong desire to be responsible for all facets of on farm water supplies, given the suggestion that the State Government should assist with funding of the water supply improvements.

The table data shows the number of times farmers suggested the organization responsible for each section.

*Table 3 Summary of responses to Question 20*

	<b>Funding</b>	<b>Construction</b>	<b>Maintaining</b>
<b>Landholders</b>	15	14	18
<b>Kulin Council</b>			4
<b>Avon Catchment Council</b>	1	1	
<b>State Government</b>	14	8	5
<b>Federal Government</b>	1	3	1



## 4 KEY ISSUE: FLOODING

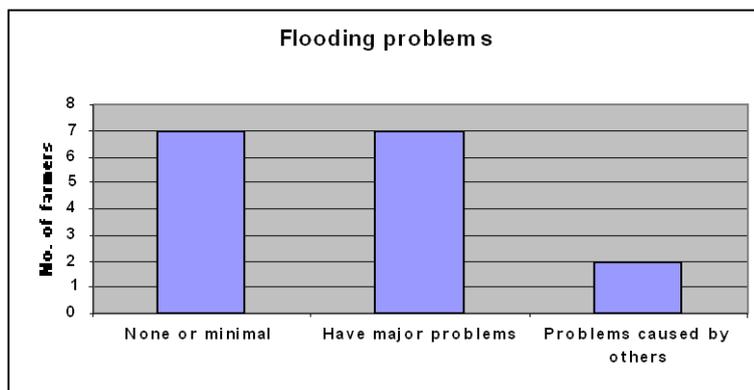
### 4.1 Current condition and trend

#### 4.1.1 Question 21

*What and where are your current flooding problems?*

Respondents varied in answering this question with 7 farmers saying they had no or minimal flooding and it was not a real problem. Seven farmers stated that up to 80% of their farms were under water up to 50cm deep. Two farmers blamed the actions of other property owners and water flooding from the Kulin town site.

There was difficulty in assessing the degree of damage as there was a large variation in responses.



*Figure 7 Summary of responses to Question 21*

### 4.2 Actions

#### 4.2.1 Question 22

*What do you think should be done for flood management in the catchment?*

Eight farmers thought that nothing could be done to reduce the severity of 2006 type flood, while 7 others suggested that better use of grade banks and possibly shallow retention basins may help.

Other comments related to diverting water from the Kulin town site, diverting the Dudinin Creek and stopping flood waters from filling a swamps and the Ski Lake. De-silting the main creek lines was also mentioned twice, this was to allow water to move off the farms faster.

#### 4.2.2 Question 23

*Is there an opportunity or need for?*



*A Improving surface water drainage to the Lockhart River (e.g. creek cleaning)*

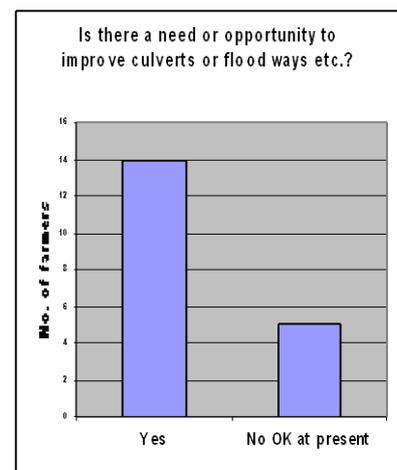
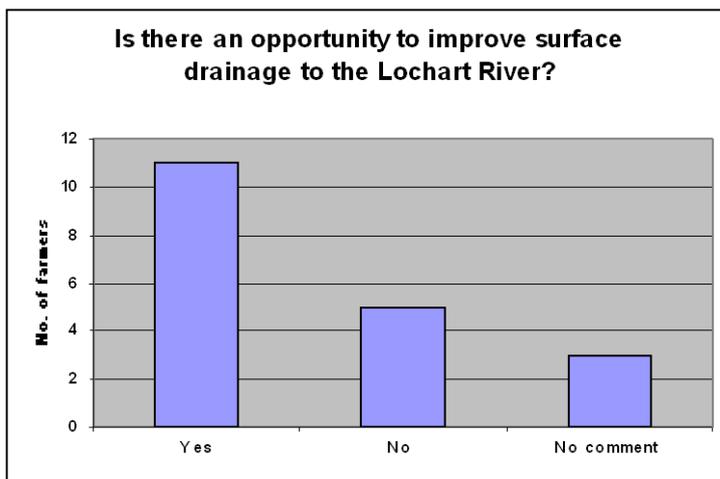
*B Improved sizing of existing road crossings / culverts and flood ways,*

*C Diversion bank and waterway on the Quicke and Carmody farms to prevent swamp from filling after major floods,*

*D Other*

**A**

**B**



**Figure 8 Summary of responses to Question 23, parts A and B**

**C** Ten of the 19 farmers said that this was a private matter and not related to the catchment's salinity issues, 4 agreed with the idea and 5 made no comment.

**D** There was only 1 suggestion and that was to clean creeks to allow water to move faster and reduce recharge time.



### 4.3 Desired outcomes

#### 4.3.1 Question 24

*What outcomes from flood management do you think are reasonable to expect? In the near future and in 20 years time.*

Five of the 19 farmers stated that surface drains and or cleaning out creeks will help reduce severity however 4 farmers said flooding was not a major issue and 3 had no comment. Two farmers said they needed floods to provide fresh water. Other farmers said they did not expect any changes and suggested that grade banks etc are not favoured because of large cropping machinery and some farmers have actually filled in or graded out these banks.

### 4.4 Responsibilities

#### 4.4.1 Question 25

*With regard to any flood management system, who do you think should be responsible for?*

*Table 4 Summary of responses to Question 25*

	<b>Funding</b>	<b>Construction</b>	<b>Maintaining</b>
<b>Landholders</b>	12	10	13
<b>Kulin Council</b>	7	9	10
<b>Avon Catchment Council</b>	2	3	
<b>State Government</b>	5	1	4
<b>Federal Government</b>	2	1	1

Three farmers did not offer a comment; one said it was not achievable while a further land owner stated that flooding was not relevant.



## 5 KEY ISSUE: WATER QUALITY

### 5.1 Current condition and trend

#### 5.1.1 Question 26

*What and where are your current water quality problems?*

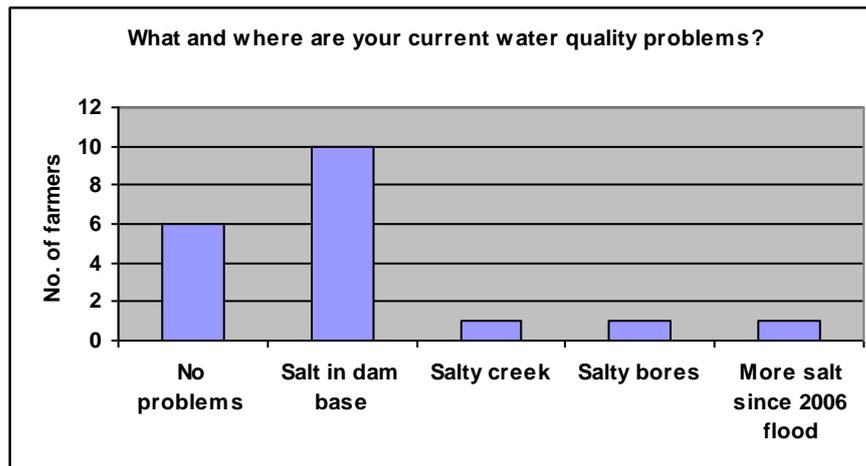


Figure 9 Summary of responses to Question 26

### 5.2 Actions

#### 5.2.1 Question 27

*What do you think should be done for water quality in the catchment?*

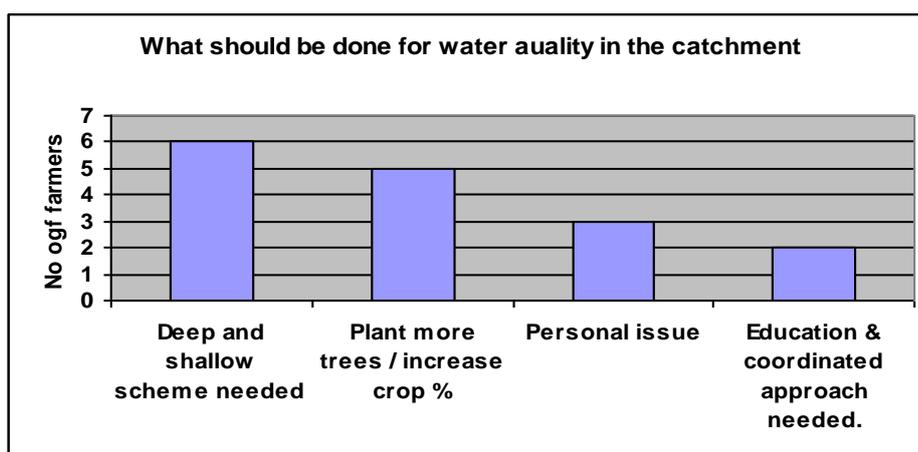


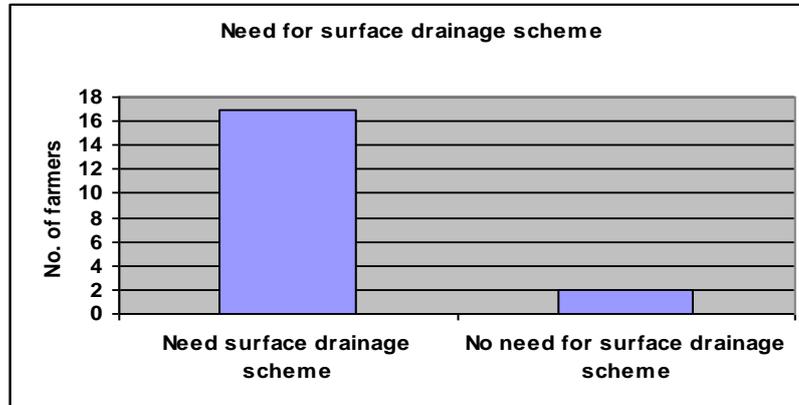
Figure 10 Summary of responses to Question 27

#### 5.2.2 Question 28

*Is there an opportunity or need for?*



- A Catchment surface drainage scheme
- B Management of salt lakes and low lying areas near the catchment outlet?
- C Other



*Figure 11 Summary of responses to Question 28*

All agreed that management was needed near the catchment outlet.

### 5.2.3 Question 29

*What outcomes from water quality management do you think are reasonable to expect in the near future and in the next 20 years?*

Sixteen farmers said that a system that reduced salinity levels, reduced flooding and allowed some regeneration should be expected, while 4 farmers needed to see improved stock water supplies by preventing deep drainage water from entering the creek system. A combination of drains and plant based systems will assist while another farmer stated that unless a shallow system was used the situation will get worse.

### 5.2.4 Question 30

*With regards to any water quality management system, who do you think should be responsible for?*

This question posed some difficulty or misunderstanding amongst land owners. Responses have been totaled to indicate the over all position. The percentages of responsibilities varied greatly amongst the three categories of work.



*Table 5 Summary of responses to Question 30*

	<b>Funding</b>	<b>Construction</b>	<b>Maintaining</b>
<b>Landholders</b>	15	9	18
<b>Kulin Council</b>	4	8	14
<b>Avon Catchment Council</b>	11	10	1
<b>State Government</b>	9	3	2
<b>Federal Government</b>	4	1	0

The values in the table indicate the number of farmers who suggested which organization should have some responsibility for the particular activity. For example, with funding, 15 of the 19 farmers thought that they should carry some responsibility, while 4 suggested that the Kulin Council should have some responsibility, 11 suggested that the Avon Catchment Council be involved, 9 thought that the State Government should carry some responsibility while 4 suggested that the Federal Government should be responsible for some of the funding.

Similarly for the other activities of Construction and Maintenance



## **6 OTHER**

### **6.1 Other issues, any valuable data and any other comments.**

A large range of comments were received as set out below.

1. Nothing should be done in the catchment without all land holders approving it.
2. Education and a system that allows differences to be put aside.
3. Funding options for salt bush, lucerne and weeping tagasaste.
4. Funding options for on farm water supplies even where there is a pipe scheme.
5. Coordinated cropping and tree planting is most important and protection of assets.
6. Water management plan should incorporate plant based animal and crop interactions.
7. Block drains until the issues have been resolved.
8. More research on drainage and effects on salinity management.
9. Need more open and honest discussion and strong guidelines, a time schedule and reporting of information on progress.
10. Buy land where drains are to be excavated.
11. Animosity amongst land owners is the most serious problem preventing action taken place in the catchment.
12. Release genetically modified wheat and barley varieties.



## **7 RECOMMENDATIONS**

- There is sufficient interest amongst land holders to progress the drainage issues further, given that better descriptions of the types of drainage and the proposed system are needed.
- It was apparent that there was a lack of knowledge amongst some farmers as to what a drainage system will do and confusion concerning the responsibilities of the various stakeholders.
- A process of education and positive feedback on current and future directions together with on ground demonstrations of techniques relating to salt and drainage issues is needed.



## **8 QUESTIONNAIRE**



**Questionnaire**

**Kulin & Dudinin Creeks  
Catchment Water Management Plan  
Landholder Consultation Questionnaire**

**Name**

**Phone number.....Mob.....**

**KEY ISSUE: SALINITY**

***Current Condition and Trend***

- 1. Salt Affected Land - where and when salinity symptoms were observed. Use Richard George's mapping and confirm with the landholders and fill gaps if required.
- 2. Observed groundwater levels/trends e.g bores level below ground with date, where and when water arrived at the ground surface e.g bottom of a creek.


***Actions***

- 3. Broadly what do you think should be done for salinity management catchment wide?


**Reducing Groundwater Recharge**

- 4. Complete Leakage Calculator 'Areas' sheets for the current 2008 year and the likely 2020 enterprise mix on the range of soil types.
- 5. Do you currently use or plan any cropping and vegetation management to reduce groundwater recharge? How?

e.g. use of perennials and alternative cropping systems; and Revegetation (e.g Oil mallees) and remnant vegetation (protected, enhanced)



6. Surface-water control - Reduces groundwater recharge, water erosion, water logging, flooding. Water that is collected can be channeled: into dams for livestock, into natural waterways or lake systems or into artificial waterways. What are your current and future Surface-water management plans?


7. Do you have any other recharge reduction plans?

**Increasing ground water discharge**

8. Deep Drainage - Where do you have and plan to have?


9. Groundwater pumping - Where do you have and plan to have?


10. Disposal options – What do you think the best way to dispose of drainage water is?

- a. On farm evaporation basins
- b. Retention basins that release saline flows during high flows
- c. Catchment drainage scheme:
  - i. Arterial drain with evaporation area near bottom of catchment? Drain would separate the Kulin Creek and Dudinin Creek flows, making the Kulin Creek flows available for downstream capture. Drain could be levied or open.
  - ii. Piped drainage with evaporation area near bottom of catchment?
- d. Natural salt lakes Other .....

11. Do you have comments on these specific options:

- a. Re-routing discharge from Tyson-Lucchesi and Lucchesi-Francis (ex Bell) drains to the Hopkins Rd drains, to prevent access to Dudinin Creek at 8-Mile
- b. Build a low flow separator near Commonwealth-Tarin Rock Rds and waterway to divert low, saline flows (approx. <10 ML/day) from the Kulin Creek. Low flow structure travels parallel to Kulin Creek or via low areas to South and East. Flow returns to Dudinin Creek upstream of Lake Grace Rd.
- c. Install culverts on existing drains at 2m to regulate peak flow; suggest restrict maximum flow at <0.5 ML/day (5 L/sec).



d. Permanent blockage and/or filling in existing drains


12. What are your intentions if a catchment drainage scheme existed? Would you use it?

***Desired Outcomes***

13. What outcomes from salinity management do you think are reasonable to expect? Now and in 20 years


***Responsibilities***

14. With regards to any salinity management system, who do you think should be responsible for:

	Funding (%)	Constructing (%)	Maintaining (%)
Landholders			
Kulin Council			
Avon Catchment Council			
State Government			
Federal Government			

**KEY ISSUE: WATER SUPPLY**

***Current Condition and Trend***

15. What are your current and future water needs that you require to come from off-farm (e.g. pipe scheme and creek flows)?

--

16. Is your current supply in jeopardy? E.g from salinity



--

**Actions**

17. What do you think should be done for water supply management in the catchment?


18. Is there opportunity for:

- a. Roaded catchments to increase runoff to dams Other:

**Desired Outcomes**

19. What outcomes from water supply management do you think are reasonable to expect? Now and in 20 years e.g. self sufficiency


**Responsibilities**

20. With regards to any water supply system, who do you think should be responsible for:

	Funding (%)	Constructing (%)	Maintaining (%)
Landholders			
Kulin Council			
Avon Catchment Council			
State Government			
Federal Government			

**KEY ISSUE: FLOODING**

**Current Condition and Trend**

21. What and where are your current flooding problems?


**Actions**

22. What do you think should be done for flood management in the catchment?




23. Is there opportunity or need for:

- a. Improving surface water drainage to Lockhart River (e.g. creek cleaning)? ...  
Improved sizing of existing road crossings / culverts and floodways? ...  
.....
- b. Diversion bank and waterway on the Quickie and Carmody farms to prevent  
swamp from filling after major floods.
- c. Other:.....

***Desired Outcomes***

24. What outcomes from flood management do you think are reasonable to expect?  
Near future and in 20 years


***Responsibilities***

25. With regards to any flood management system, who do you think should be  
responsible for:

	Funding (%)	Constructing (%)	Maintaining (%)
Landholders			
Kulin Council			
Avon Catchment Council			
State Government			
Federal Government			

**KEY ISSUE: WATER QUALITY**

***Current Condition and Trend***

26. What and where are your current water quality problems?




**Actions**

27. What do you think should be done for water quality management in the catchment?


28. Is there opportunity or need for:

- a. Catchment surface drainage scheme
- b. Management of salt lakes and low-lying areas near catchment outlet:  
.....
- c. Other:.....

**Desired Outcomes**

29. What outcomes from water quality management do you think are reasonable to expect? Near future and in 20 years




**Responsibilities**

30. With regards to any water quality management system, who do you think should be responsible for:

	Funding (%)	Constructing (%)	Maintaining (%)
Landholders			
Kulin Council			
Avon Catchment Council			
State Government			
Federal Government			

**OTHER**

31. Do you have any other issues you think should be covered in by the catchment water management plan?


32. Do you have any data that maybe useful? E.g. past survey results interceptor banks etc, groundwater investigations, past flood levels?


33. Do you have any other comments?




# **A P P E N D I X B**

## ***Soil Pits***