SUPPLEMENTARY SUBMISSION TO THE SENATE INQUIRY INTO THE EXTENT AND ECONOMIC IMPACT OF SALINITY

South Australia's Upper South East Dryland Salinity and Flood Management Program - Landholder Views –

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SUMMARY

The House of Representatives' report titled "Science Overcoming Salinity: Coordinating and extending the science to address the nation's salinity problem" contains several comments and statements that will be familiar to many landholders and scientists who have experienced the work of the Upper South East (USE) Dryland Salinity and Flood Management Program. It is disappointing that the report's recommendations were not implemented a decade ago!

The USE Program is characterised by highly polarised views, which Program staff conveniently argue is the result of people attributing different values and priorities to agricultural productivity and the environment. While partially true, the reasons are more a response to Program staff's uncompromising commitment to a groundwater drain network, using arguments that do not match experience or published observations. There are generally no arguments about whether drains are needed – flooding and high watertables have been a characteristic of the region since before European settlement. The arguments are about whether groundwater drainage is the optimum solution for the region, or whether a solution based on surface drains and increased emphasis on recharge control is more appropriate and cost-effective in the long-term.

The Program has been characterised by poor, selective and dismissive communications with landholders who want to learn more about the Program, express concerns about it, or challenge its direction[1]. Even advice from independent experts has been dismissed without credible justification, or ignored, if it detracts from the case for groundwater drains. Science to support agriculture after drainage has low priority and very little funding, although the adverse effects of salinity on agriculture were the primary motivation for the Program[2].

The priority given to science appears to reflect a view that there is little to be learned, and all that needs to be done is to implement on-ground works. However, unfolding reports of new discoveries (more appropriately defined as old but over-looked knowledge) indicate that there is still much to be learned, and which are adding to the costs of groundwater drainage for local landholders.

In 1992, the science predicted that watertables in the region would continue rising (increasing the area affected by dryland salinity by 7,700 ha/year), drains would remove an average of up to 2.7ML/km/day of groundwater (for a 3m drain situated in a steep gradient groundwater zone), and that drainage flows to the southern lagoon of the Coorong should be minimised to maintain its hyper-saline nature. Benefit-cost analyses of the Program conducted in 1993 and 2002 incorporated these predictions into their calculations.

In 2005, landholders learned that watertables had been generally falling in the region since 1993, that a 3m trial drain constructed in 1998 in a steep groundwater zone was discharging at 83% less than predicted, and that the dying Coorong only become hyper-saline since the mid 1900s as a result of Europeans reducing natural surface flows from the USE into the southern lagoon. Landholders also learned that as a result of groundwater drainage, the structure of drained saline soils was failing (which should have been anticipated because the science has existed since at least the 1950s), that salt-tolerant pastures[3] and native vegetation were dying[4], and that some of the USE's fresh water wetlands had become dangerously saline (up to half the salinity of sea water).

Credible reasons for the Program continuing to place such a high priority on a solution that addresses a symptom of a problem that has been diminishing, and not the cause, can not be found in any of its published reports. Even economic analyses (1993 and 2002) under-pinned by flawed science and predictions were only able to demonstrate that a Program based on groundwater drainage was barely economical.

The region is partially drained swamp and wetlands that has experienced thousands of years of flooding, high watertables and dryland salinity. Evidence to date indicates that groundwater drainage is proving ineffective at the regional and, in many cases, local scale, and is damaging soils and polluting wetlands. The benefits of groundwater drainage are considerably less than predicted, and financial and environmental costs, including maintenance costs, are significantly higher than anticipated. In order to regain lost credibility, the Program should be subjected to an independent technical and economic review before it commits to any more works.

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[1] Clearly embarrassed by adverse publicity over the past few months, Program staff are now making a serious and hopefully genuine attempt to address its major deficiency in communications. See its website at http://www.dwlbc.sa.gov.au/land/programs/use/.

[2] Agriculture only rates just 16 lines on one page of the updated USE Program's website, at http://www.dwlbc.sa.gov.au/land/programs/use/reclaim.htm, and no reports.

[3] Puccinellia recommended by the Program.

[4] Reported in 2002 before the current stage of drain construction.

Comments are made on submissions relevant to the USE Program, on points that came out of the Adelaide hearing, and on matters that relate to recommendations made in the House of Representative's report. The comments aim to provide an informed, end-user's perspective of salinity science, its extension and application.

INTRODUCTION

Differences of opinion on salinity between USE landholders, scientists, engineers and Program managers, has led to damaging divisions between landholders, which continue to become deeper. This will have been apparent at the Adelaide hearing, and from submissions received by the Committee. There has also been considerable adverse local media interest in and comment on the USE Program over the past 6 months (see Attachment 1 for examples). Landholders are generally divided between:

- those who believe that a groundwater drain network to remove saline groundwater and lower watertables (ie address a symptom of excessive recharge) is essential to control and reverse the spread of salinity, and
- those who believe that a less invasive approach, based on more effective and efficient use of rainfall and surface water (ie revegetate to reduce recharge, and construct shallow drains to retain water quality and move flood water more effectively off agricultural land into watercourses and wetlands), is more cost-effective and better for the environment.

The case against groundwater drainage continues to be misrepresented by the Program. A recent media release[5] failed to acknowledge that three of the four independent expert groups commissioned by the Program advised against groundwater drainage, failed to quantify the agricultural and environmental benefits of the proposed drain, and implied that people opposed to the proposed drain were opposed to all forms of drain.

There are no obvious clues why groundwater drainage became the Program's primary solution for addressing dryland salinity and flooding. Since the Program was formed in 1993, there has only ever been minority support from landholders, expert reviewers, and government departments[6]. As recently as 2002, USE landholders ranked salinity behind weeds, animal pests, soil fertility/nutrition, water repellent soils, and waterlogging, as a land management issue[7], which was two places lower than all regions in the state. In the same survey, only 8% of USE landholders claimed to have a salinity problem, and only 14% believed that drainage was the best method to control salinity!

In my view, the divisions have been caused by Program staff who, in the 1990s, created an atmosphere of crisis over the threat from and impact of salinity, grossly exaggerated the benefits arising from groundwater drains, and ignored or over-looked their environmental and financial life-cycle costs. The divisions are not helped by conflicting advice given by experts, even within the Program, and the reluctance of the Program to credibly consider, review and quantify the benefits and costs of options that might be used in an integrated dryland salinity and flood management strategy.

The major point of contention is the USE Program's dogged pursuit of a solution based primarily on a groundwater drain network deemed necessary in 1993 for "groundwater level and associated soil salinisation control"[8], even though watertables have been falling since then. Latest estimates of dryland salinity and its effects have been over-stated, and, indeed, recent Farm Institute Journal[9] articles drew attention to concerns that estimates of dryland salinity in Australia were exaggerated because of the methodologies adopted.

Concerns over groundwater drains contained in submissions[10], advice from experts[11], and later recommendations made by the State Government's own Environmental Impact Assessment Branch[12] to direct decision-making to

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[5] Presumably prepared by the Program for the responsible Minister, and accessed at http://www.ministers.sa.gov.au/minister.asp?mId-10&pId=6&sId=5913.

[6] See for example the Part B Summary of Submissions and Part C Appendices to the Program's plan published in 1994, and the Assessment Report (produced by the Environmental Impact Assessment Branch of South Australia) published in 1995. These documents were made available in the past few weeks for down-load from the USE Program's web-site at http://www.dwlbc.sa.gov.au/land/programs/use/reports.html.

[7] Truscott Research, "Upper South East Landholder Survey – Evaluation of Revegetation Enhancement Programs Research Report", August 2002. Attached.

[8] Section 2, draft EIS for the Program, produced in 1993. See Program's website.

[9] November 2005 issue, abstracts at http://www.farminstitute.org.au/publications/journal2?cid=18&pid=196.

[10] Part B to NRC Supplement, Summary of Submissions, 1994. See Program's website.

surface water drainage, were all ignored. The continuing justification for retaining a focus on groundwater drainage provided in 1994[13] was clearly flawed. Watertables have been falling since then, and groundwater drain effectiveness has been shown to be considerably less than predicted.

The 1992 predictions on watertable trends and drain benefits were incorporated into a benefit-cost analysis[14] (BCA) that evaluated the agricultural benefits of several drainage and revegetation options, and also the cost of not taking any action. In attempting to gain an estimate of the likely benefits and costs to landholders from their adoption of a pasture redevelopment program, a "model farm" was examined. The analysis showed that "the investment [for pasture renovation] barely breaks even on financing costs (interest payments) with little or no additional remuneration to the farm business owners".

A Progress Report[15] stated that watertable levels were lowered at distances to about 1-1.5 km to the west of a trial groundwater drain, and 1.5-2.5 km to the east. Analysis of the graphed data (Figure 5.2b and c) shows that the watertable influence was only just discernible at these distances, and which would have had no impact on dryland salinity! Groundwater drain flow for the period November 1998 to April 1999 was reported to be less than half that predicted in the draft EIS (Table 10.4). Subsequently, in a response to the SA Parliament's ERDC inquiry into the Program[16], the drain flow was revised down to an annual average 87% less than predicted (0.35ML/km/day compared with a predicted 2.69ML/km/day)! This represents a major difference from the 1992 predictions that were used as the basis for benefit-cost analyses conducted in 1993 and 2002[17]. Furthermore, unpublished work[18] shows that watertables adjacent to a 3m deep section of the trial drain are within 2m of the land surface (ie within capillary rise distance) at distances beyond about 20m from the drain.

While I admit that I may not have read every document produced by and for the Program, until recently every Program action appears to have uncritically presumed that the 1992 predictions remained valid, that the benefit-cost analyses were accurate, and that there were no serious environmental or agricultural consequences of drainage. The predictions turned out to be wrong (and should have been known before implementation of the full drainage scheme commencing in 2000), and unfolding reports of damage to soils, wetlands and native vegetation, indicate that there are many other unexpected costs of drainage. I suspect that after incorporating valid benefits and costs for the Program, the benefit-cost ratio (BCR) for the Program will have fallen to below 0.5, which is considerably less than the unrealistic figure of 1.38 (after the addition of environmental values described in the 2002 benefit-cost-analysis as "not realistic") presented to the SA Parliament's Public Works Committee when approval was sought to proceed with the Program[19].

The USE is a drained swamp and wetland[20] that was covered by the ocean a few hundred thousand years ago. The region is situated over an extensive unconfined aquifer[21] that flows slowly to the coast in the west. High

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[11] For example, Part C to NRC Supplement, Appendices, 1994 (see Program's website) and Semeniuk Research Group, A critical Review of the EIS and its Implications for Nature Conservation in the Coorong, November 1993.

[12] Environmental Impact Assessment Branch, Assessment Report, January 1995. See Program's website. The report together with the draft EIS and Supplement, formed the "officially recognised EIS" for the Program.

[13] Section 9, Part A, Supplement Report, 1994. See Program's website.

[14] Barber A, "Benefit:Cost Analyses of On-Farm Pasture Renovation Strategies and Catchment Drainage Options", Department of Primary Industries, South Australia, 1993. See Program's website.

[15] Upper South East Dryland Salinity & Flood Management Plan: Progress Report, October 1999. See Program's website.

[16] Under cover of DWLBC letter 05WLB7933 dated 13 October, from R Freeman, CEO.

[17] Wheeler S, Young D, Bright M, "Review of Benefit-Cost Analyses, Cost Sharing Frameworks and Valuation of Landholder Environmental Activity for the USEDSFMP", Natural Resource Economics team of Rural Solutions SA, October 2002 (copy attached).

[18] Michael Durkay, PhD student, University of Adelaide.

[19] See PWC website at http://www.parliament.sa.gov.au/committees/committee.asp?doCmd=show&intID=43, and access reports by selecting "Reports" > "Water" > "Report 192".

[20] According to GW Goyder, surveyor general in 1864, half of the South-East from the north of the USE southwards into the Lower South East was under water in every wet season prior to drainage of the Lower South East. South Australian Parliamentary Paper No 126 of 1866-1867.

[21] The groundwater flow system exists across the whole of the region and extends into western Victoria. The system is of variable depth, typically up to about 20m to 30m thick on the flats (Fennell R, Stadter F, "Production Testing Programme to Determine the Unconfined Aquifer Parameters in the Upper South East", Department of Mines and Energy, South Australia, September 1992 – see Program's website for a copy).

watertables, dryland salinity[22] and flooding occurred prior to European settlement, and will continue to occur with any new drainage.

Surface water that used to flow north-west from the Lower South East through the USE into the Coorong was drained directly west to the ocean, starting nearly 150 years ago. A key means of flushing soluble salts accumulating in the upper soil layers of the USE was thus removed. The primary means of removing accumulating salt[23] is now in the westward flowing unconfined aquifer.

The Program has failed to acknowledge the relationship between vegetation cover and soil structure on the incidence of dryland salinity, focusing instead just on the height of watertables. Rising watertables in the 1980s are believed to have been caused by higher than average rainfall and the loss of deep-rooted perennial vegetation from high ground in the region, resulting in increased recharge of the unconfined aquifer. Excessive recharge as a result of leakage beyond the root zone on higher ground exerts an upward pressure on watertables, raising them closer to the land surface on the flats, whereas recharge on the flats generally adds a fresh water layer to the top of the existing watertable. Where groundwater drains are effective, they will remove this fresh water layer.

Amongst other factors, the incidence of dryland salinity will depend upon the salinity of the watertable, the capillary rise distance, vegetation cover, and climatic factors. Capillary rise can be as great as six metres in less permeable clay soils, and as little as a few centimetres in porous soils[24]. The conundrum is that soils worst affected by dryland salinity are also least effectively drained, and are damaged (becoming impermeable and infertile) by drainage. Inconsistencies between falling watertable trends and apparent increases in dryland salinity in the USE have been explained by over-grazing, vegetation cover, soil structure, and rapid surface drainage[25]. Also, waterlogging leading to poor vegetation health has resulted in land being incorrectly mapped as saline[26].

The identification, cause, effects and management of dryland salinity is thus not simply a function of watertable levels and their management.

ADELAIDE HEARING AND SUBMISSIONS

EXPERTISE

At the Adelaide hearing, in response to a question by Senator Stephens, I gave information on my graduate and post-graduate science degrees, and on some of my professional experience. Relevant also are analytical studies (mainly by development and use of computer models) I conducted for 15 years on highly complex systems involving interacting processes in a 3-dimensional environment. I thus understand the analytical techniques that could be used to analyse the interactions of environmental processes that cause dryland salinity and flooding, and that might assist in identifying cost-effective solutions. I have also completed post-graduate courses on, and applied, hydraulic and fluid flow theory, which has assisted my understanding of the science of groundwater and drain flows. I became a registered Chartered Engineer in 1980.

I was born on a farm to a farming family, and have maintained family ties with farming throughout my life. I have lived in rural communities for most of the period since the early 1970s, and have owned, lived and worked on farms for the past 16 years. For the last 7 years, my wife and I have owned and successfully (I believe) farmed a 840 ha property that is officially classified as one-third "very highly saline" (but made highly productive with salt-tolerant pastures), one-third "mildly to moderately saline" (a grossly exaggerated

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[22] The evidence is the less soluble calcium salts, in the form of gypsum and calcrete, formed at or near the land surface, especially in the central and northern catchments of the USE. See also Barr C, Gell P, "An Investigation of Historical Hydrological and Modern Water Quality Change in The South East of South Australia", University of Adelaide, 2002, which reported on an analysis of sediments in a waterhole in the central catchment.

[23] Deposited at a rate of about 100kg/ha/year in rainfall (derived from a PowerPoint presentation, Walker G, Groundwater Proceses in the Upper South East Region, CSIRO, September 2004) and pre-existing from when the USE was covered by ocean.

[24] Durkay M, "Soils and Groundwater in the Marcollat Region, Upper South East, South Australia", Liquid Gold Hydrology Services, August 2004.

[25] Durkay M (as above); GHD, Didicoolum Drain/Marcollat Watercourse Hydrogeologist Assessment, July 2004; Horizon Farming Pty Ltd, Pasture Report – Marcollat Flat Proposed Drain, June 2004.

[26] Furby S, Flavel R, Sherrah M, McFarlane J, Mapping Salinity in the Upper South East Catchment in South Australia, CSIRO MIS and PISA, CMIS 98/104, 1998. Available at http://www.cmis.csiro.au/RSM/research/pdf/sasaltmap.pdf.

classification, because the land has been successfully sown to lucerne), and the remainder "not currently saline and not at risk". I am one of the 92% of USE landholders who claimed not to have problems with salinity!

My background, including experience in the management of major Government projects, has placed me in a good position to understand and comment on the science and management of dryland salinity in the USE.

REASON FOR PROGRAM CONTINUING DOWN A PATH THAT EVIDENCE MIGHT SUGGEST IS WRONG.

Senator Bartlett asked why I thought the Program was continuing down a path that evidence might suggest is not the right way to go, to which I postulated an answer (basically, I did not know). I have since become aware of some reasons that are influencing the Program's decision-making process.

The most recent reason documented by the Program was contained in a list of negative impacts of not constructing a drain, which read "some landholders have been expecting a drain [since 1993] and not providing one may have adverse political impacts"! The document also stated that the no drain option "will not satisfy those landowners who believe they have a major salinity problem due to shallow watertables", and also points out that some land affected by salinity "will always be marginal agricultural country".

Having created an atmosphere of crisis over dryland salinity in the USE in the early 1990s, and continued to promote groundwater drains as a miracle cure, Program staff now presumably feel under pressure from some landholders to proceed with construction.

The Program is still continuing to fuel an atmosphere of crisis by using emotive language when it states that an "estimated 250,000 hectares or 40 per cent of the land in the Upper South East of South Australia comprising productive farmland, native vegetation and wetlands have been degraded by salinisation caused by high groundwater levels and flooding" [27]. The SA Audit report[28] actually described land as either "at risk" or "affected" by salinity, and never "degraded". The national audit website[29] also provides an explanation of why the figures for areas "at risk" areas are likely to be over-estimates. Many USE landholders who successfully farm saline-affected land would be highly offended to know that their land is being described by the Program as degraded.

An article written for "Natural Heritage – The Journal of the Natural Heritage Trust"[30] reported that estimated annual production losses of $436 million were arising from salinity in the USE. This is another major exaggeration of the damage caused by salinity in the region. The SA Audit report estimated total annual losses for the whole of SA of $44.4 million, and an earlier study[31] estimated long-term farm gate income losses of $9.8 million! Losses directly attributable to salinity are difficult to estimate, especially when it has been part of the landscape for thousands of years. Given that watertables have fallen since 1993, I suspect annual farm gate losses attributable to secondary salinity are now significantly less than $9.8 million (even after adjusting for inflation).

The following diagram[32] was presented by the Program to landholders about a year ago, and was the first occasion many of them, if not all, became aware that dryland salinity had been contracting in the USE for over a decade. Red arrows indicate rising trends, and blue falling trends. The larger the arrow, the more significant the rise or fall. The diagram clearly shows a general falling trend in watertables across the region.

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[27] See for example the website of the USE Dryland Salinity and Flood Management Program, at http://www.dwlbc.sa.gov.au/land/programs/use/, accessed 29 Jan 2006.

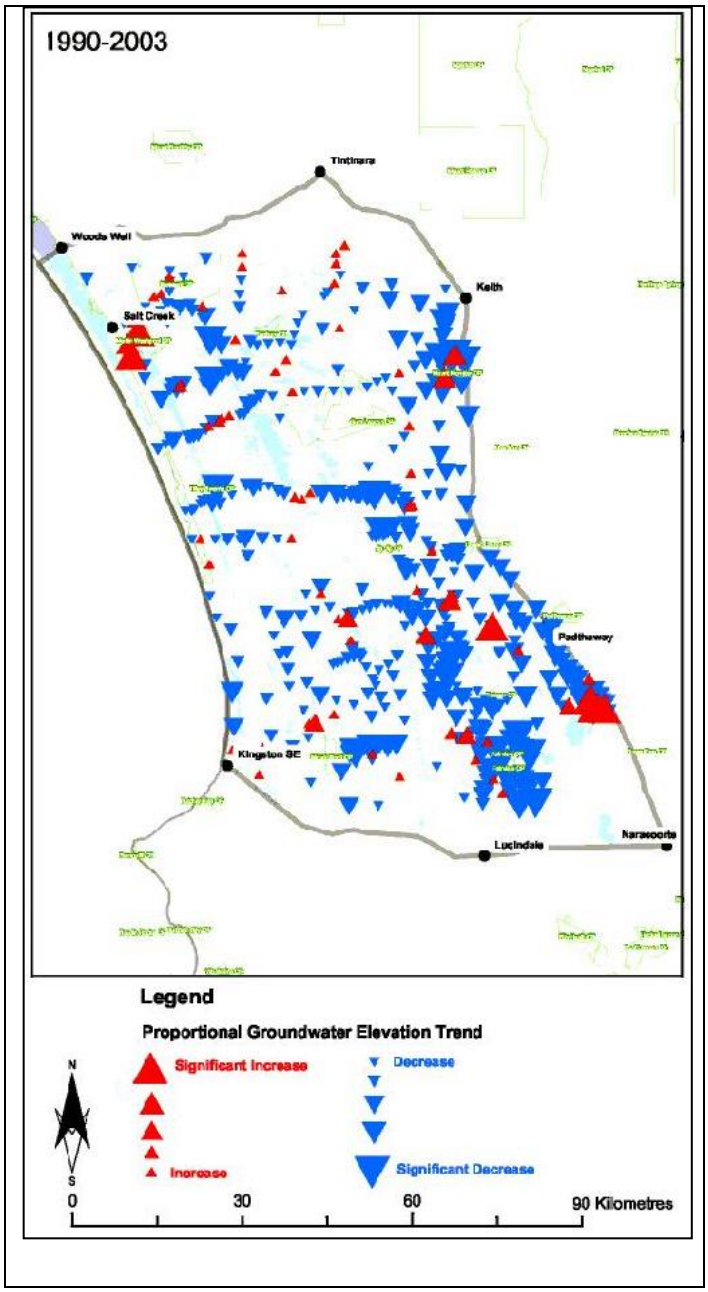
[28] SR Barnett, "Extent and impact of dryland salinity in South Australia", December 2000, at http://audit.ea.gov.au/ANRA/land/docs/state/SA/SA_DrylandSalinity.pdf, and summary at http://audit.ea.gov.au/ANRA/land/docs/ntaional/Salinity_SA.html, accessed 8 Jul 2005.

[29] http://audit.ea.gov.au/ANRA/land/docs/national/Salinity_AUS.html accessed 8 July 2005.

[30] Copy can be found at http://www.nht.gov.au/publications/journal/nht19/pubs/biodiversity.pdf, accessed 26 Jan 2006.

[31] Barber S, Benefit-Cost Analysis Background Paper, 1993. See Program's website.

[32] From Howieson P, "Groundwater-Surface Water Interaction between Bonney's Camp North Wetland and the Northern Outlet Drain", Flinders University, October 2003



Mr Rasheed at the Adelaide hearing referred to groundwater now being shallower than when farming commenced. It is difficult to know where this statement came from, as I am not aware of any such statements being made by CSIRO scientists, or any other experts in the field! CSIRO studies did show a possible rising trend in a short period preceding 2004, but the general trend since about 1993 has been distinctly down[33]. A review of watertables in the Marcollat region (Attachment 2) also shows them to be lower now than in 1993, and generally lower than or similar to levels in the 1970s where records go back that far.

Similarly, again quoting CSIRO, it is unclear where Mr Rasheed got the information that rainfall trends will increase. CSIRO in fact projects a decrease in annual rainfall of around 10% for the USE over at least the next half century[34]!

[33] Cox J, Durkay M, Smitt C, Davies P, Ferdowsian R, "Predicting the likely impacts of the Bald Hill Drain in the Upper South-East, South Australia", August 2005.

[34] Whetton P (2001). Climate Change Projections for Australia". CSIRO Atmospheric Research, 2001, accessed at http://www.dar.csiro.au/publications/projections2001.pdf

DO AN OVERWHELMING MAJORITY OF LANDHOLDERS WANT GROUNDWATER DRAINS?

In 2002, salinity in the USE was ranked by landholders behind weeds, animal pests, soil fertility/nutrition, water repellent soils, and waterlogging as a land management issue, only 8% believed they had a salinity problem, and only 14% believed that drainage was the best method to control salinity [35]! Even in 1993, when the USE Program was initiated, and dryland salinity was considered by landholders to be an even greater threat than now, two-thirds of landholder and government submissions on the proposed dryland salinity and flood management plan questioned or opposed it, primarily because of the proposed depth of drains.

Prior to the commencement of construction of the northern catchment drains, "only 17 landowner agreement letters were returned from 35 sent, primarily because the depth of the drain was perceived to be detrimental to agricultural production in the upper sections"[36].

The statement by Mr Rasheed at the Adelaide hearing that "an overwhelming majority of landowners support ground water drains" is thus not supported by the evidence. If there had been overwhelming support, there would not have been a need for the Upper South East Dryland Salinity and Flood Management Act 2002, which provided legislative powers to the State Government to impose a drainage network on the landholders of the USE. Previous, and still current, legislation, namely the South Eastern Water Conservation and Drainage Act 1992, provided the legislative power to proceed with drainage works if there had been overwhelming majority support[37].

IS A COORDINATED APPROACH NEEDED TO ADDRESS DRYLAND SALINITY?

Senator Wortley asked if it would be adequate to allow individual land-holders to address dryland salinity, or whether a coordinated approach was needed. I pointed out that some individuals had successfully addressed dryland salinity on their properties, by planting recharge areas with deep-rooted perennials, principally lucerne. I have been shown areas where saline land has been reclaimed on at least two properties using this method. I also have been successful in lowering watertables using the same methods, although the area affected used to be seasonally waterlogged, not saline.

The ability to lower watertables locally will depend upon the recharge and discharge areas and the nature of underlying the soils. Local control of watertables is likely to be more effective if recharge areas are greater than discharge areas, and the underlying aquifer is in less permeable soils. If most of the recharge comes from neighbouring properties, and soils are more permeable, then reduction of recharge locally is likely to be offset by groundwater flowing in from remote areas. In such cases, coordinated approaches will be needed, which is likely to be the case across most of the USE.

Recharge control by revegetation has been demonstrated to be effective, is potentially very profitable, and which should have formed a principal component of the USE Program. The 1993 Benefit-Cost Analysis[38] noted that stocking rates could be improved by 2 to 3 dse with pasture improvement of recharge areas, which amounts to a minimum increase in gross margin of the order of $60 - $90 per year. The cost of pasture improvement with lucerne is typically no more than about $200/ha, so renovation costs should be recovered within about three years. Lucerne should remain viable for 10-15 years. Financial assistance and costs were cited in 2002 as the main changes that would need to occur before landholders would undertake more revegetation on their properties[39].

The USE Program reported[40] that when 50% of USE pastures were lucerne in the 1970s, it provided an effective means of reducing groundwater recharge. USE recharge areas amount to about 431,000 ha, and in 2002, at least 88,000 ha (reported to be a "gross underestimate", potentially by up to five-fold) of lucerne was reported to have

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[35] Truscott Reasearch, "Upper South East Landholder Survey – Evaluation of Revegetation Enhancement Programs Research Report", August 2002.

[36] Upper South East Program Board, Meeting 18 (November 2003), Agenda Item 6.

[37] The relevant words are contained in Section 39(2) of the Act, namely "The authority may proceed with any proposed work if an agreement is reached in accordance with subsection (1) with at least 55% of the landholders whose land will, in the opinion of the authority, benefit from the work, provided that those landholders with whom agreement has been reached represent between them at least 75% of the total area of land that will be so benefited".

[38] Barber A, cited earlier.

[39] Anon, "Review of the USE Program Revegetation and Nature Vegetation Enhancement Achievement – Supplement Report", Rural Solutions SA, August 2002.

[40] Information sheet titled "Sustainable Production", available on Program's website.

been planted[41]. A concerted effort to achieve the 1970's level of lucerne plantings in the region would have achieved what the groundwater drainage system aimed to achieve at about the same cost (assuming a 100% subsidy to landholders), but using rainfall more efficiently, and producing an immediate cash return for landholders. A 50% subsidy to landholders would have halved the cost of the Program, and eliminated maintenance costs of groundwater drains, which will continue to be an impost on landholders. Alternatively, the 50% balance could have been used to construct surface drains to relieve flooding in localised and land-locked areas, and to direct surface water more effectively to existing watercourses.

THE SCIENCE OF DRYLAND SALINITY.

In a reply to a question from Senator Stephens, Mr Wickes claimed that "we [the Program] continually update our science", which, when analysed in detail, is clearly incorrect in several key areas. In particular, I have been told by officers associated with the Program that science played only a minor part in the drainage component, until very recently, and economic analysis of options played even less of a part. The Program management structure, comprising a Program Board, Environmental Management Advisory Group, and Technical Reference Groups, might imply that the decision-making process is impeccable, but it has been based on flawed science and predictions, and limited knowledge in several key areas. Examples of how science is receiving lower priority than on-ground works, or scientific concerns are being dismissed, are summarised:

- Responses by the Program to questions provided by the SA Parliament's Environment, Resources and Development Committee demonstrated deficiencies in knowledge of topics fundamental to the effective and efficient operation of the USE Program, and a disinterest in demonstrating that the Program is providing cost-effective solutions.
- Members of the SA Government's Department for Environment and Heritage[42] stated that a "clear assumption of the current process is that drainage construction will occur, and that only technical elements of design (ie depth, location) are to be negotiated ….. Our increasing ecological understanding warning against the impacts of any drainage does not fit into a process with this in-built bias…..the current process will lead to a forced "compromise" involving drainage".
- A theme running through key background papers produced in 2002 was the lack of time (typically 2 months) to conduct analyses in support of the current stage of Program implementation.
- Groundwater drains had been justified in 1993 by a need to control and reverse rising watertables, but a natural falling trend, which started immediately after, did not trigger a review of the Program's objectives – in fact, the drainage network increased in size. Watertables were monitored by an extensive network of observation wells installed by the State Government, and were monitored routinely.
- Continued references by the Program to the area of land degraded or affected by salinity, and at risk of increasing, lack credibility. The 2000 salinity audit map of the USE was not verified by detailed ground inspection, which would have shown land degraded by causes other than salinity (eg flooding, over-grazing, poor land management), as described in a mapping study reported in 1998[43]. Illogically, despite falling watertables, more USE land was reported to be at risk of becoming saline! Current land salinity maps are strikingly similar to those produced in 1992, even though watertables have been falling in the region for 14 years.
- Initial groundwater drain effectiveness predictions were based on measurements of aquifer permeability made in 1992. The measurement methodology was inappropriate for groundwater drains proposed for construction, which should have been apparent when the performance of the trial drain was analysed in 1999. Subsequent groundwater modelling has also been based on permeability measurements that produced incorrect predictions, which has been acknowledged by the authors of key reports[44,45], and very recently by

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[41] McEwan K, Davies P, Walker G, Cox J (2002). Review of the status and condition of perennial vegetation in the Upper South East region of South Australia. CSIRO Land and Water, report for Rural Solutions South Australia, August 2002

[42] Presentation to SA Parliament's ERDC on 17 October 2005. A copy of the presentation can be found in the USE Dryland Salinity folder at http://www.parliament.sa.gov.au/committees/committee.asp?doCmd=show&intID=41.

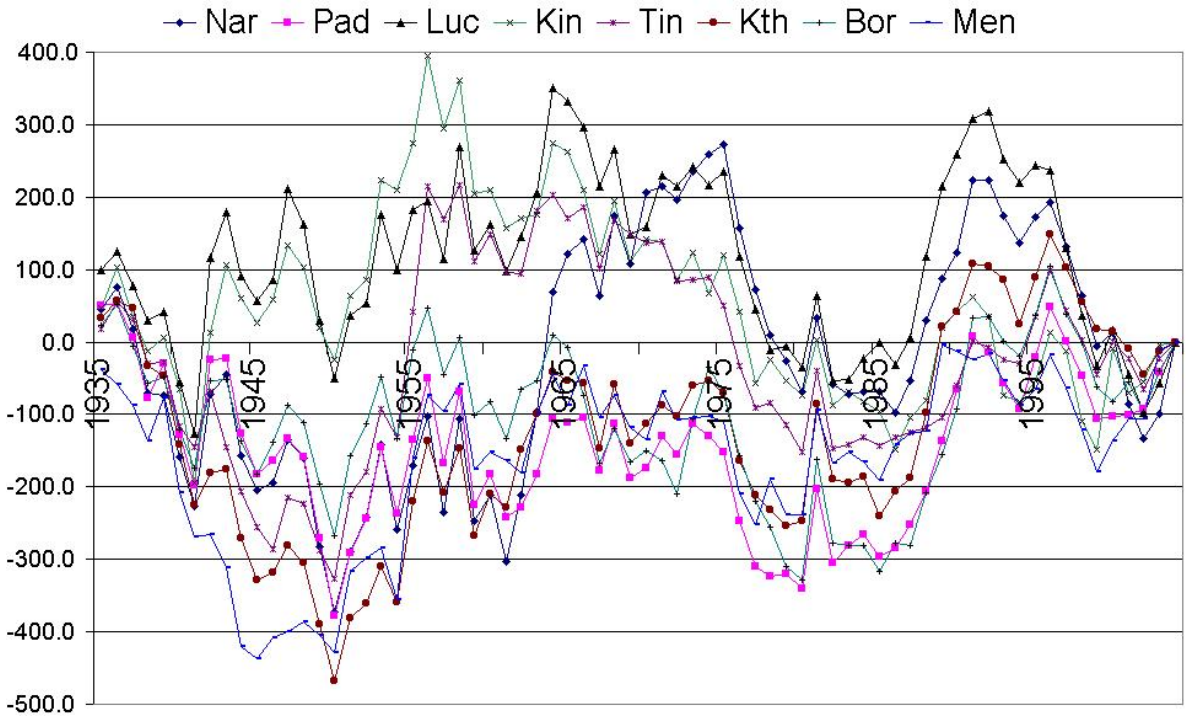
[43] Furby S, Flavel R, Sherrah M, McFarlane J, Mapping Salinity in the Upper South East Catchment in South Australia, CSIRO MIS and PISA, CMIS 98/104, 1998. Available at http://www.cmis.csiro.au/RSM/research/pdf/sasaltmap.pdf.

[44] Armstrong D, Stadter F, "Computer Modelling to Examine the Performance of Groundwater Drains", 1992, and referred to in Telfer A et al, "Upper south East Drains – Effectiveness Trial: Stage 1 – Assessment of Impacts", Australian Water Environments, April 2002.

[45] Cox J, Durkay M, Smitt C, Davies P, Ferdowsian R, "Predicting the likely impacts of the Bald Hill Drain in the Upper South-East, South Australia", August 2005.

Program staff[46]. As a result, drain effectiveness is significantly less than predicted, which will impact on the economic viability of the Program.

- While average annual rainfall has trended down since 1993, May-August rainfall, which controls watertables[47], has been average or above average in USE centres for most years between 2000 and 2004 (see diagram below – upward trending lines indicate above average rainfall). Despite this, watertables continued a downward trend, possibly because of increased revegetation with deep-rooted perennial pastures on recharge areas. There has been no reference to this observation in Program reports.



May – August Residual Rainfall (mm), 1935 – 2004
Naracoorte, Padthaway, Lucindale, Kingston, Tintinara, Keith, Bordertown, Meningie (40km north of USE)

- Warnings from scientists of damage to soils, wetlands, and vegetation, by groundwater drainage had been officially reported in 2002[48] and 2003[49], but ignored or over-looked until after the current stage of drain construction commenced. These additional costs are significant and have not been factored into economic analyses. Drainage-induced sodicity only became a topic of scientific interest to the Program a little over a year ago, several decades after its cause had been first reported and optimum remediation identified[50].
- A review of reports available on the USE's reports' webpage shows none relevant to agriculture, one that describes the chemical changes to soils on drainage (but probably not understandable by the majority of landholders), and a hyperlink to a website in Montana[51] describing salinity and sodicity induced by irrigation, but not by drainage! The latter link is a poor reflection on the indifference being shown to the

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[46] Program comments on Resource and Environmental Management Pty Ltd, "Impact Assessment of the Proposed Didicoolum Drain, Upper South East, South Australia", July 2005.

[47] Reported on p6, Barnett S, Extent and impact of dryland salinity in South Australia, PIRSA Report Book 2000/00045, December 2000. See Program's website.

[48] McEwan K, Davies P, Walker G, Cox J (2002). Review of the status and condition of perennial vegetation in the Upper South East region of South Australia. CSIRO Land and Water, report for Rural Solutions South Australia, August 2002

[49] Fitzpatrick RW, Merry RH, Cox JW, Rengasamy P, Davies PJ (2003). Assessment of physico-chemical changes in dryland saline soils when drained or disturbed for developing management options. CSIRO Land and Water Technical Report 2/03, January 2003, available at http://www.clw.csiro.au/publications/technical2003/tr2-03.pdf

[50] For example Quirk JP, Shofield RK (1955). Effect of electrolyte concentration on soil permeability. Journal of Soil Science, 6(2), pp 163-178, 1955.

[51] See http://www.dwlbc.sa.gov.au/land/programs/use/reports.html, and look under FAQ's at bottom of page.

problem, and for which the Program has still not produced and distributed its own information. More relevant Australian websites already provide information on the subject[52].

- Recharge management has not been given appropriate priority and support by the Program. Although in 2002 a reported 88,000 ha of dryland lucerne had been planted, the area was also reported to be "grossly underestimated". There has been a lost opportunity to consolidate recharge management since 1993, and to reinforce the current falling trends in watertables. A short distance to the north of the USE, recharge management has been the primary means of controlling watertables, as reported by Mr Gale at the Adelaide hearing.
- Sand columns, leading to preferred drainage routes for fresh water, bypassing saline clays, were discovered less than a year ago. They exist across large areas of the USE, and are expected to have a major effect on groundwater drain effectiveness. A CSIRO scientist described as incomprehensible the fact that the structures had not been discovered before.
- Most recently, a proposal by the Program to feed fresh water from the Lower South East north via the Fairview Drain through the USE to the Coorong appears to have over-looked the damage that will caused to the drain's sodic banks, and the acidifying effect (mobilising heavy metals) of fresh water acting on the monosulfidic black ooze sediment. Dispersion of sodic clays from the drain banks is likely to result in a significant and unexpected maintenance cost that will continue for the life of the drain. Dispersion of clays will also lead to turbidity, which has been associated algal blooms.
- Systems (multidisciplinary) analysis of the interacting processes that cause dryland salinity and flooding has been woefully inadequate. This has led to scientists and engineers making subjective judgements on the effectiveness of drainage options. Where quantitative analysis has been conducted, this was based on erroneous data, eg drain effectiveness and economic studies.
- Adaptive management should be based on incorporating new learning into management models, not re-learning old knowledge. The Program is currently reacting to problems that were predictable, eg reduced drain effectiveness, damage to soils caused by over-drainage, damage to wetlands.
- There has been an ongoing debate over whether the southern lagoon of the Coorong has only recently become hyper-saline, and whether relatively fresh drain water discharging into it could have a damaging effect. A number of credible hypotheses[53], only very recently supported by scientific investigations[54], suggested that the southern lagoon was naturally freshened by USE surface waters. Past drainage of South East surface waters to sea appear to have been the cause of the Coorong's hyper-saline nature!

In the Hansard transcript of the Adelaide hearing, Senator Bartlett thanked Mr Richardson for Submission 43 on salinity affecting a property in the Marcollat area. I understand that Mr Richardson is an employee of a company (Resources and Environmental Management Pty Ltd - REM) engaged by the Program for technical support and analysis, and which has also been engaged by a group of landholders who want groundwater drains. There thus appears to be an undeclared conflict of interest between the company's representation of landholder's holding strong views on the need for groundwater drains, and with the objectivity needed to undertake its responsibilities to the Program. Landholders with views that groundwater drains are inappropriate will thus be highly suspicious of studies produced by REM and presented by the Program.

REM conducted groundwater flow modelling in support of the proposed and highly contentious Didicoolum Drain. Aquifer properties used in the modelling were unrepresentative, with the result that drain effectiveness is over-estimated.

Furthermore, Submission 43 describes how dryland salinity has been increasingly affecting the subject property. The neighbours, the Prossers, who appeared at the Adelaide hearing, have no problems with dryland salinity. A review of data surrounding the subject property shows that watertables have generally been falling since the early 1990s, and where records go back to the 1970s, they are now similar to or lower than then (see Attachment 2 for watertable records). The problems experienced on the property are thus not caused by rising watertables.

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[52] For example, the Agricultural Bureau of South Australia at http://www.bettersoils.com.au/module6/6_1.htm, CRC Soil and Land Management, Introduction to soil sodicity, pdf files accessed from http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/sodic_soils/, Rehabilitating sodic soils. Australian Academy of Science, June 1999, http://www.science.org.au/nova/035/035key.htm

[53] England R, The Cry of the Coorong – The History of Water Flows into the Coorong, 1993

[54] Gell P, Haynes D, A Palaeoecological Assessment of Water Quality Change in the Coorong, South Australia, Diatoma, University of Adleaide, November 2005.

Three different consultants were engaged by the Program[55] and concluded that a deep drain would not have a significant impact on salinity in the Marcollat region, because salinity was generally associated with clay soils, which had a large capillary rise distance and which would not drain well. Agricultural productivity would be adversely affected on the more permeable soils, because of de-watering of soil profiles. The consultants concluded that the most important issues to be addressed were waterlogging, inappropriate internal drainage, pasture improvement, and reinstatement of more natural watercourse flows from the south (which would flush soluble salts that concentrate in the upper soil profile). The findings of the three consultants were summarily dismissed by the Program because of "inadequate assessment made of the observations and trends in watertables and the consequent dryland salinity risks that have been previously documented in the USE"[56]. A review of watertable bore records[57] would have shown this Program statement to be invalid, but it was still used to gain approval for a groundwater drain in the region!

HOW WERE DRAINS DESIGNED, LANDHOLDERS CONSULTED, AND WHAT ARE THE EFFECTS ON SOILS?

Submission 24A from the Department of Agriculture, Fisheries and Forestry and Department of the Environment and Heritage contains supplementary information provided in response to a request by Senator Wortley. The submission provides a simple description of the objectives of the USE drains, but did not describe how they were designed, as Senator Wortley requested.

Groundwater drain design.

Northern catchment drains drains were designed using a subjective assessment of likely flows. A so-called run-off factor of 1mm/day/ha was assumed for the catchment area (about 51,000 ha). The catchment was to be drained by four drains that fed a main drain that discharged to the Coorong via a settling basin. The design flow of the drain was calculated by multiplying 1mm (the average daily amount of rain expected to run-off into the drain) by the catchment area of 51,000 ha. This produced a drain design volume of 510 ML/day. The desired drain flow volume is then used to estimate a cross-sectional area and gradient, which are adjusted to ensure that the drain flow velocity is maintained below a critical figure above which drain bank erosion is likely to occur.

The calculation led to the prediction that the drain running through my property should be designed to carry a peak flow of 259 ML/day. The peak flow during the last wet season, a period of average rainfall, was 6.8ML/day, ie less than 3% of the design flow. The drain has thus been over-designed and over–constructed by 97% for an average year! About 60 km of drain lies up-stream from my property. If the catchment had been concreted over so all rain falling on the catchment flowed to the drain, it is unlikely that the drain would have achieved its design flow (average annual rainfall is about 450mm/year and evaporation is 1,750mm/year)! A consultant hydrologist[58] warned the Program in 2003 about the dangers of using subjective assessments of run-off factors, and recommended a more rigorous assessment of requirements, advice that was ignored by the Program.

The Fairview trial drain constructed in 1998 was to have been monitored for adverse impacts and benefits before the full drainage scheme was implemented[59]. The drain was constructed in an area of steep groundwater gradient, because of the expectation that this would produce greatest drain flows[60]. Initially, only summer drain flow (1998-1999) was measured, which was about 70% less than predicted[61]. Salinity levels were "likely to be above the adopted threshold for use in healthy wetlands". Diversion of water from a groundwater drain into the Cortina Lakes wetlands has already resulted in its salinity rising steadily from a relatively fresh 3,000 mg/L in 1995 to half that of sea water (18,000 mg/L) in 2005[62].

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[55] Liquid Gold Hydrology Services, GHD Pty Ltd, and Horizon Farming Pty Ltd.

[56] Recent Program paper presenting information on drain options for the Marcollat region.

[57] Freely available to the public at https://info.pir.sa.gov.au/obswell/page/water_level/start.html.

[58] G Lush, Sinclair Knight Merz, letter to Program titled "Upper South East – Northern catchment Drainage Scheme Comments", 1 Oct 2003.

[59] Supplement Report produced in 1994 and Assessment Report produced in 1995, both of which formed the "officially recognised EIS" for the Program.

[60] Upper South East Dryland Salinity and flood Management Plan – Progress Report October 1999, p29.

[61] Armstrong D, Stadter F, "Computer Modelling to Examine the Performance of Groundwater Drains", background paper produced for Program, p 11.

[62] Upper South East Program Update, December 2005.

Subsequently, a more thorough review of the trial drain was conducted, but the report[63] was never formally published. Total drain flow in the period June 1998 – June 2000 also averaged about 30% of that predicted, but the flow attributable to the presence of the drain (called the "drain effect") was only 17% of the predicted flow. The ability of drains to lower watertables was thus demonstrated in 1999, and again in 2002, to be considerably less than predicted, but this did not result in the Program basis, including the economic viability of groundwater drains, being re-evaluated. Deficiencies in the drain modelling were identified, and have been acknowledged by hydrologists[64].

Photograph taken 27/1/2006 is of saline (NaCl) patches less than 200m from a groundwater drain constructed 18 months ago. The drain spoil bank is visible across the photograph just below the horizon. Program staff advised that this drain's benefits would extend to 1.5 km!

The area comprises sandy loam about 0.5m deep over sandy clay.

Waterlogging occurred 300 m from the drain at the end of last winter (ie watertable at land surface), and measurements in September 2005 showed that the watertable at distances of 100 m and further were unchanged from the pre-drained condition. There has been no discernible impact on watertables 500m from the drain (monitored monthly for 5 years).

At the Adelaide hearing, Mr Leak referred to a response to questions made by the State Parliament's Environment, Resources and Development Committee[65]. In one answer, the Program advised incorrectly that "the effective influence of the Fairview Drain [a trial drain with 2m and 3m deep sections] on the groundwater table is 0.5m at 1.5km from the drain on the western side and 3km from the drain on the eastern side". The report[66] referred to by the Program actually indicated that the average drawdown was half of the quoted figures, with the 0.5m drawdown in winter felt no more than 250m in one area to the west, and about 1km to the east. Unpublished work of 2004[67] shows that at the end of autumn 2004 (at the end of the SA dry season), the watertable 15m from the drain was still 80cm higher than the water level in a 3m section of drain, and at distances beyond, the watertable was within capillary rise distance of the land surface and thus could still cause dryland salinity!

The structural decline referred to in Submission 24A puts a positive spin on sodicity, but which is an example of a preventable and predictable adverse effect of drainage known by soil scientists for decades. In fact, CSIRO warned Program staff about it in 2002 and 2003, but the need to construct groundwater drains in a short time-scale appeared to attract higher priority. The State Government in a recent article printed in local newspapers[68] also put a positive spin on sodicity, and contrary to national and international advice on the treatment of sodicity, suggested that its treatment with gypsum would adversely affect soils by depleting available potassium, an essential plant nutrient. While partially true (rainfall also depletes potassium), the depletion is of considerably lesser importance than effective treatment of sodicity.

Sodicity is universally acknowledged to be most effectively treated as saline soils are drained, while they are still in a permeable state. The Program made no attempt to identify potential areas where sodicity could be a problem. A farmer group in the central catchment last year received a National Landcare grant for $110,000 to

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[63] Telfer A et al, "Upper south East Drains – Effectiveness Trial: Stage 1 – Assessment of Impacts", Australian Water Environments, April 2002.

[64] By co-authors of the original study, and of a recent CSIRO study.

[65] Under cover of DWLBC letter, 05WLB7933 dated 13 October 2005.

[66] Telfer A et al, a draft and still incomplete report titled "Upper South East Drains – Effectiveness Trial: Stage 1 Assessment of Impacts", Australian Water Environs, April 2002.

[67] Durkay M, PhD student, University of Adelaide.

[68] Reproduced at http://www.pir.sa.gov.au/pages/rur_sol/latest_news/soid.htm:sectID=2055&tempID=1, accessed 10 October 2005.

investigate sodicity and develop treatments. The cost of remediating sodicity is another unexpected cost that was not included in the Benefit-Cost Analyses of 1993 and 2002.

The USE Program has unhelpfully, and probably confusingly for many landholders, provided a link to a website containing frequently asked questions on salinity and sodicity. The link, the only landholder-friendly information on sodicity provided by the Program, is to information on salinity and sodicity induced by irrigation, and in Montana of all places[69]!! No links have been provided to the vast information resources that already exist in Australia.

Flood management.

Contrary to the DAFF/DEH statement, winter (May to August) rainfall for 7 USE centres has been average to above average over most of the past 5 years. See above residual rainfall diagram. Flood management, and not salinity management, is the major benefit of the Program, which could have been achieved with less costly and environmentally friendlier shallow drains.

Consultation with landholders.

The described continuous process, also referred to by Mr Wickes at the Adelaide hearing, was only introduced last year, and still continues to be primarily subjectively based. Documents produced in the process also contain a clear spin that exaggerates the threat from salinity, that does not accurately report the benefits of drainage, and does not adequately consider all options available to address dryland salinity and flooding.

Like many landholders in the northern catchment, I had no say in whether I wanted a drain, the depth of it, or its profile, and alignment was confined to a pre-determined 200m wide corridor compulsorily acquired by the State Government. The presumption was always that there would be a groundwater drain. Like the more than 50% of other landholders in my catchment, I chose not to sign an agreement letter, but construction still went ahead without further seeking landholder support, because the drain had been mandated! It was not until after the drains were constructed that landholders were advised that pastures planted on recommendation by the Program would die after drainage, and that soil structure could fail. These costs were not factored into the landholder decision-making process.

I am aware of landholders who felt pressured into accepting the Program's preferred solution. Even landholders who were long-term supporters of drain construction have expressed disappointment at the result, and in particular there is wide-spread agreement that the drains are deeper and wider than landholders were led to believe. These landholders now regret succumbing to the Program's pressure.

Mr Leak referred to "trying to provide the right information and the right science to the decision-making process". Very little analysis has been rigorously applied to the USE Program, a view repeated by technical experts involved in the processes. The subjective application, integration, and interpretation of science from many disciplines has deficiencies, which many landholders can see. Landholders have been poorly informed in the consultation process.

The "correct balance" referred to in the DAFF/DEH submission has always assumed that a groundwater drain will be the central component of the "solution", which is the main reason for landholder resentment over the Program.

[69] See http://www.dwlbc.sa.gov.au/land/programs/use/reports.html, and look under FAQ's at bottom of page.

CONTRADICTIONS

The USE Program can be characterised by many contradictions. Key contradictions not already described in detail are summarised and illustrated below:

DRYLAND SALINITY AND HIGH WATERTABLES IN THE USE PRECEDED EUROPEAN SETTLEMENT

From aerial photographs and apparent vegetation health, this land in the USE would be classified as saline land. However, a field inspection (none was undertaken in the 2000 audit) would have shown it to be gypsum at least 1.5 m deep. It used to be a natural wetland (a few trees remain), but was illogically cleared for grazing.

Dark and dense organic rich top-soil over a well defined gypsum and limestone layer. The layer formed over thousands of years as a result of high watertables leading to less soluble salts concentrating at the surface as groundwater evaporated. Throughout the USE, calcrete (limestone) sheet rock forms at about the same depth (10-20 cm) covering vast areas, and which are almost impermeable to water. Waterlogging is extensive on these soils.

Extremely saline but pristine wetland in the USE, with uncleared and very healthy vegetation surrounding very healthy salt-affected land.

SALINITY IS NOT A SERIOUS PROBLEM FOR AGRICULTURE IN THE USE

In 2002, only 8% of landholders believed they had a dryland salinity problem! Landholders ranked salinity behind weeds, animal pests, soil fertility/nutrition, water repellent soils, and waterlogging, as a land management issue[70]. The majority of landholders have accepted that dryland salinity is part of the landscape, and have adapted their farm management practices to work with it.

[70] Truscott Reasearch, "Upper South East Landholder Survey – Evaluation of Revegetation Enhancement Programs Research Report", August 2002.

Over-simplified Descriptions of Recharge and Causes of Dryland Salinity in the USE

The relationship between seasons, rainfall patterns, vegetation growth, soil depth to watertable, land management, and recharge, is poorly understood and defined.

The role of vegetation and cover, soil structure and type, in potential discharge areas is poorly defined.

The Salt Balance in the USE

Salt (eg chlorides, carbonates, sulfates) already exists in the soil's profile, and is deposited in rainfall (variously estimated to be at a rate of about 100kg/ha/year). A salt balance is achieved when the amount being brought into the region is equal to the amount being removed, principally by surface water or groundwater flows. The role of past surface water flows in maintaining a healthy salt balance is poorly understood.

The Truth About Dryland Salinity in the USE

Contrary to Program reporting, the area affected by dryland salinity has been contracting in the USE since the early 1990s, because watertables have been generally falling in the region!

The Role of Drains as a Dryland Salinity Management Option

Despite little demonstrated acknowledgement of the true effectiveness and economics of groundwater drains, they remain the Program's preferred option for addressing dryland salinity.

Major discrepancies between predictions and actual drain performance can be traced back to the original measurements of hydraulic transmissivity (from which aquifer permeability is derived). Measurements were below the bed levels of installed drains, and when watertables were almost at their lowest level. Also, no allowance has been made for changes to aquifer properties as a result of saline soil structural decline.

The drain is about 2 m deep at this point. The bank has a sandy loam top soil, typically about 0.5 m thick, over a sandy-clay sub-soil 2-3 m thick.

The light green areas on the drain bank are the tops of vertical sand columns exposed during drain construction. The top of a column has been uncovered for clarity in the foreground.

The columns provide a preferential flow path for water through the less permeable sandy-clay sub-soil to the groundwater.

The sand columns were first discovered in early 2005, and their existence was identified extensively throughout the Upper South East.

They are expected to have a major impact on drain performance, and the ability of drains to leach salts from saline soils.

Correction

My original submission to the ECITA inquiry has been reviewed for errors by members of the Department of Water Land and Biodiversity Conservation. I have been advised of one error, which I would like to correct. The second bullet up from the bottom of page B-7 refers to a failed South Australian Research and Development Institute (SARDI) pasture trial. The puccinellia trial in fact failed because the site had been "inundated" with background germination of pre-existing puccinellia seeds, and not "inundated" with water. An unfortunate choice of words by the speaker who introduced the topic, and coincidence that the following speaker, a soil scientist, spoke of sodic clay soils similar to those at the trial site, led me and other landholders attending the field day to arrive at the wrong conclusion.

I apologise for the error. I am aware of much work performed by SARDI, which I rate as excellent, and is the type I believe that should be given much higher priority and funding.

ECITA TOR#1: WHETHER GOALS OF NATIONAL PROGRAMS TO ADDRESS SALINITY HAVE BEEN ATTAINED, INCLUDING THOSE STATED IN THE NATIONAL ACTION PLAN FOR SALINITY AND WATER QUALITY, NATIONAL HERITAGE TRUST AND NATIONAL LANDCARE PROGRAMS.

The goals of NAP were to "motivate and enable regional communities to use coordinated and targeted action to prevent, stabilise and reverse trends in dryland salinity affecting the sustainability of production, the conservation of biological diversity and the viability of infrastructure; and improve water quality and secure reliable allocations for human uses, industry and the environment". NAP as applied to the USE enabled a state government agency to undemocratically impose a groundwater drain network on landholders in the USE, despite advice to the contrary.

These actions have caused major divisions in the community, and the Program has lost considerable credibility as a result. Trends in dryland salinity had reversed naturally in the early 1990s, and broad-scale adoption of deep drainage has proved inefficient at controlling watertables, while damage has been caused to native vegetation and wetlands in the region[71][72]. A BCA updated with accurate information on drain benefits and costs would inevitably show that the Program is uneconomic.

Warnings about draining saline soils without pre-treatment were made to the Program by CSIRO in 2002, and have been made internationally for decades. The causes and management of sodicity, caused by draining saline soils, have been known in Australia since the mid-1950s. A $110,000 National Landcare grant to investigate sodicity and treatments was awarded last year to a farming group in the USE, when the effects were predictable and should have been anticipated!

ECITA TOR#2: THE ROLE THAT REGIONAL CATCHMENT MANAGEMENT AUTHORITIES ARE REQUIRED TO PLAY IN MANAGEMENT OF SALINITY-AFFECTED AREAS, AND THE LEGISLATIVE AND FINANCIAL SUPPORT AVAILABLE TO ASSIST THEM IN ACHIEVING NATIONAL GOALS.

The role of the regional Board in managing salinity-affected areas in the USE was transferred by legislation to a State Government agency.

ECITA TOR#3: ACTION TAKEN AS A RESULT OF HOUSE OF REPRESENTATIVES' RECOMMENDATIONS

Recommendations were concerned with science and its application to solving the nation's salinity problems. A major impediment to the application of science continues to be contradictions that continue to exist in the interpretation of the science, which leads to differing views on solutions and their priorities. This is particularly apparent in the USE, where the scientist's "warring camps" (referred to in the House of Representatives' report) have expanded to include those involved in the implementation of the USE Program, and to landholders affected by the Program's actions. This outcome does little for the credibility of the science.

Recommendation 1. Validated Research Findings Considered in Regional Planning Processes: Best Science to CMOs and Land Managers; Adequate Support and Resources to CMOs and Land Managers; Provide Guidelines for CMOs and Land Managers.

Previous comments apply. Summary observations include:

- Views contrary to the Program's policy on groundwater drains appear to be suppressed.
- Simplistic and flawed understanding by Program of drainage processes.
- Drain modelling based on incorrect aquifer permeability measurements.
- Program failed to adequately evaluate trial drain performance, and even now there seems to be a reluctance to publish findings.

[71] McEwan K, Davies P, Walker G, Cox J (2002). Review of the status and condition of perennial vegetation in the Upper South East region of South Australia. CSIRO Land and Water, report for Rural Solutions South Australia, August 2002

[72] Program Update, December 2005.

- Systems (multi-disciplinary) analysis has been totally inadequate for a project of the magnitude of the USE Program. Subjective reviews of science, and a failure to incorporate rigour constrained by economic reality is undoubtedly leading to the selection and application of uneconomic solutions.
- Program does not require any commitments from landholders for land use change, to exploit benefits of drainage. If left to landholders alone, with no external encouragement, it is unlikely there will be wide-scale revegetation. A 1993 study[73] determined that pasture renovation is unlikely to increase cash flow.
- Little information has been made available to land managers on how they should manage their land post-drainage. The Program has focused communications on its own achievements, and is failing to respond to adverse media reporting.

Recommendation 2. Audit of Australian Salinity R&D, Including Identifying Critical Research gaps.

In addition to earlier comments, summary observations are:

- Systems analysis needs greater effort.
- Inconsistencies have been identified in soil mapping of dryland salinity. Falling watertable trends in the USE indicate that there should be a reduction in the area affected by dryland salinity, but the 2000 audit indicates that the affected area has remained constant since 1992, and there is a risk that it will increase.
- Major inconsistencies exist between land classifications produced by the 2000 audit, and that known by landholders to exist on the ground. The audit has over-stated the area affected by salinity.
- The effect of drainage on soils has been known for some time by scientists, but was ignored until recently by Program staff.

Recommendation 3. Coordinate Australian salinity R&D.

The SA Government in its submission to the House of Representatives inquiry recognised that there will be a focus on funding for actions to address regional issues, and there will be a tendency to give investment into longer term R&D lower priority. This negative view of science occurs within the USE Program.

Recommendation 4. Greater Science Emphasis to Develop New, Economically Viable land and Water Use Systems.

There is little evidence of this being given priority in the USE Program, even though it is clear that many landholders have achieved significant success working with salinity, whereas other landholders have failed. A preoccupation with drain construction appears to have suppressed Program interest in identifying alternative solutions to dryland salinity and flooding.

The DAFF view that salinity is well researched (House of Representatives' report), and the key issue now was targeted intervention, is surprising and disappointing. This view provides an additional explanation for current USE Program policy and priorities.

The absence of systems analysis has resulted in the failure to deliver effective and economic solutions for dryland salinity. The Program continues to advance drain construction despite it acknowledging that "Important issues relating to the impact of drainage on the Upper South East landscape remain unresolved and may have implications for agricultural production and environmental management"[74].

Recommendation 7. Foster Greater Cooperation Between Scientists & Examine Ways to Foster Multidisciplinary Research in NRM in General.

A major deficiency in research and analysis has been the absence of serious analytical systems (multidisciplinary) studies. The techniques for systems studies are well developed in other disciplines, and have not been given priority by the USE Program. Systems studies could model the interactions of climate and climate change, terrain, soils and structure, groundwater and surface water flows, salinity, drain options, vegetation, growth and revegetation options, etc. Development of a systems model would not be trivial, but from experience I suspect that one could have been produced for the USE for somewhere in the region of $200k to $300k. This cost would represent less than 0.5% of the total Program cost, would have assisted in identifying

[73] Barnett S, Benefit-Cost Analysis for the Program, 1993.

[74] http://www.dwlbc.sa.gov.au/land/programs/use/integrated.html accessed 26 Jan 06.

optimum solutions to address dryland salinity and flooding, and would have provided a model to support adaptive management.

The USE Program has a very small scientist base, which does not foster critical review and analysis. A scientist who has worked with the Program has claimed that specialist scientists providing advice to the Program have demonstrated little understanding of fields outside of their specialist fields. Integration of specialist advice to support the Program has thus been undertaken by non-specialists!

Recommendation 9. Enourage R&D Corporations to Invest More Substantially in R&D of New` Salinity Technologies.

I agree, but they need to push the science more effectively to land managers, and there needs to be greater encouragement to adopt new concepts, especially when the economics do not appear to be convincing. R&D programs must demonstrate credibly how new concepts will improve economic benefits in the long-term.

Recommendation 10. Identify & Remove Impediments for CMOs to Undertake or Commission Research, Improve collaboration between CMOs, support evaluation of Tenders & Contracts at Regional Level.

The USE Program has a poor record of carrying through research and analysis, eg the Fairview trial drain, and in investing in and responding to science advice (drain modelling, sodicity, watertable data, potential acid sulfate soils). Its approach can be characterised as reactive to what should have been predictable problems.

Recommendation 11. Encourage Investment in (Contracting Out) Private Sector Salinity R&D.

I agree. I have experienced the positive benefits of this policy being applied in another science discipline, which has enabled scientists to concentrate more on strategic/basic research. It is probably appropriate that the strategic/basic science base remains in government and university research centres, with applied research and development (eg modelling, monitoring, analysis, development of solutions) more appropriately done by industry.

Recommendation 12. Encourage Development of Industry Capacity to Conduct Salinity R&D.

The discussion preceding this recommendation referred to land mapping. As discussed earlier, there are significant discrepancies between land mapped as being affected by salinity in the USE, and ground observations. Watertable trends in the USE also indicate that there is a reduction in risk of land becoming salinised, but the 2000 audit described a risk of more land becoming salinised!

The mapping methodology did not record land affected by salinity, but land with degraded vegetation and watertables within 2m of the land surface. Degraded vegetation occurs because of poor land management practices (eg over-grazing, poor pasture management), flooding, waterlogging, as well as salinity. Furthermore, land is not saline if the underlying watertable is not saline, or if the soil is porous and the watertable is below the capillary rise distance. These variables were not incorporated into the audit.

Recommendation 15. Build on Existing Initiatives to Establish a Database of Interpretative Material, Scientific Research and Data, Related to Salinity and its Management.

Information on salinity is extensive, comprehensive, widely distributed, and probably overwhelming for many land managers. This information needs to be simplified, directed at showing how land use change can be economic, and provided free if it is to be of wide-spread use to land managers.

Recommendation 16. Enhance Support for Face-to-Face Extension for Land Managers with Adequate Numbers of Qualified Extension Staff.

This is very important if the benefits of the USE Program are to be maximised. However, past experience indicates that some Program staff lack appropriate knowledge, or are indifferent to or dismissive of landholder needs and concerns.

The stated communications goals of Program[75] are to "eliminate misconceptions and misinformation particularly among the local community", and the Program's stated focus[76] "that all stakeholders are kept well informed on

[75] http://www.dwlbc.sa.gov.au/land/programs/use/index.html accessed 15 Dec 05.

[76] http://www.dwlbc.sa.gov.au/land/programs/use/communication.html accessed 15 Dec 06.

the aims of the Program, its achievements and how these affect or involve them". Information of value for landholders continues to be lacking.

The efforts of the South Australian Research and Development Institute, in conjunction with the Sustainable Grazing of Saline Land project, have been excellent, but clearly under-funded and under-staffed for the area of coverage of the USE Program. This generally is a known source of frustration for extension officers. Currently, messages are only getting through to land managers who want to learn. More information should be pushed to landholders, with particular focus on developing and demonstrating viable farming systems in saline and drained landscapes. If the systems are not viable, the majority of farmers will not have the funds, capacity or inclination to change their practices, unless they have alternative sources of income.

Recommendation 17. Publish State by State Viable Salinity Management Options, Which Should be Free of Charge to Extension Staff and Land Managers.

An excellent recommendation, but there is no evidence of it being applied extensively by the SA Government. However, none SA Government information sources, such as the National Dryland Salinity Program and the Cooperative Research Centre for Plant-Based Management of Dryland Salinity, have available excellent and very useful articles, magazines and updates on farming saline-affected land. The articles are relevant to many landholders, but I suspect only a small proportion read and understand them.

The SA Government publishes information and short articles of a local and general nature on farming and management practices, including on saline-land, which appear in local newspapers and in quarterly publications.

Recommendation 21. Review Extension Services Provided Through NAP and NHT.

Community capacity building was to have been a central element of the NAP model, but this has not been effective in the USE, because it has been under-staffed and under-funded. The primary NAP focus of the USE Program has been on-ground works (principally drain construction)

19 February 2006

Attachments:

1. Media Reports

2. Marcollat Area Observation Well Details

3. Truscott Research, "Upper South East Landholder Survey – Evaluation of Revegetation Enhancement Programs Research Report", August 2002

4. Wheeler S, Young D, Bright M, "Review of Benefit-Cost Analyses, Cost Sharing Frameworks and Valuation of Landholder Environmental Activity for the USEDSFMP", Natural Resource Economics team of Rural Solutions SA, October 2002

ATTACHMENT 1: MEDIA REPORTS

Summaries of media reports on the Upper South East drainage scheme and related topics can be accessed by clicking on the following links.

Radio

Another drain approved - landholders outraged 21/12/2005

The colour of Lake George - drains chock with weeds 12/12/2005

Salinity scare taken with a pinch of salt 6/12/2005

Senate Committee hears USE drains project concerns 18/11/2005

Debate continues over the SE drains 17/11/2005

To drain or not to drain some see benefits 16/11/2005

Divert Didicoolom drain says ERD committee 10/11/2005

Too much reliance on drains says DEH report 4/11/2005

One froggy evening 22/9/2005

SE drain system seems to be working! 23/9/2005

The final flows of Drain M 12/9/2005

Down the Drain: A journey along Drain M 9/9/2005

Bool Lagoon: The dry start to the big drain 29/8/2005

Effectiveness of drainage scheme questioned 22/6/2005

Rebel with a cause offers drought hope 3/6/2005

Drainage defiance 11/5/2005

Zone C landowners refuse to pay levy 11/5/2005

Northern catchment drains opened 14/12/2004

Drains create new soil horror 13/12/2004

Sodicity caused by drainage 13/12/2004

Drains about to be opened 8/12/2004

Wetlands rehabilitated in the South East 30/8/2004

Drain system construction finally underway 21/4/2004

South Australia has the best drains 29/10/2003

RSPCA says salinity trenches trapping

Rural Press / Journals

Drains nightmare for Bald Hill landowners 9/2/2006

DWLBC stuck in deep drain mindset: landowners 2/2/2006

Green light for drain devastates landholders 22/12/2005

Salinity: Dryland threat 'substantially exaggerated' 5/12/2005

Salinity: Farmers proved right on exaggerated claims 5/12/2005

Salinity: Leading researcher on claims of exaggeration 5/12/2005

Community rift a concern for long term 17/11/2005

Expert urges SE drains halt 17/11/2005

Landholders launch drains case 11/11/2005

Drains give new life to Willalooka 28/7/2005

Project chiefs dig in on drains 7/7/2005

Upper SE drains project needs new vision 7/7/2005

Drain debate: the untold story 30/6/2005

Drain impact unknown says ERD committee 24/6/2005

Minister slams newspaper advertisement 24/6/2005

Drain Block 24/6/2005

SE landholders buck over drain levy 19/5/2005

Sodicity concerns as stocking rates rise 19/5/2005

Drains improve pasture productivity: DWLBC 19/5/2005

Decisions should be scientific, not emotional 19/5/2005

Drains divide SE 12/5/2005

Proposed drain divides Marcollat landholders 12/5/2005

Producers call for inquiry 12/5/2005

SE land is far more productive 12/5/2005

Acidity - broad shallow drains better than deep drains 10/6/2004

Radio

stock 1/9/2003

Stressed couple sell up after Government land grab 24/6/2003

Government acquired land without compensation! 24/6/2003

Bureaucrats out of hand and out of control 20/6/2003

Revegetation efforts can't keep up 24/4/2003

Lucerne comeback in SE 22/4/2003

Further $50 million wanted for SE drainage project 26/4/2003

Hidden consequences of drainage? 3/4/2003

Landholders want resolution to drainage scheme woes 31/3/2004

Evidence treating salty land pays off 14/2/2003

USE Drainage Bill passed despite opposition 6/12/2002

A landholder's response to Government land grab 15/11/2002

Government wants to increase its landownership powers 14/11/2002

Budget blowout may mean levies to triple 12/8/2002

Brinkworth bypass could jeopardise drainage scheme 24/1/2002

Tom Brinkworth's drainage bypass 22/1/2002

Budget blowout, but SAFF pushes USE drainage scheme 15/1/2002

Opening of stage 2 5/11/2001

NAP funding places USE on salinity & environment map 25/10/2001

Major problem with drainage program 18/12/2000

Rural Press/Journals

Drains have worked wonders despite cost blowout 9/10/2003

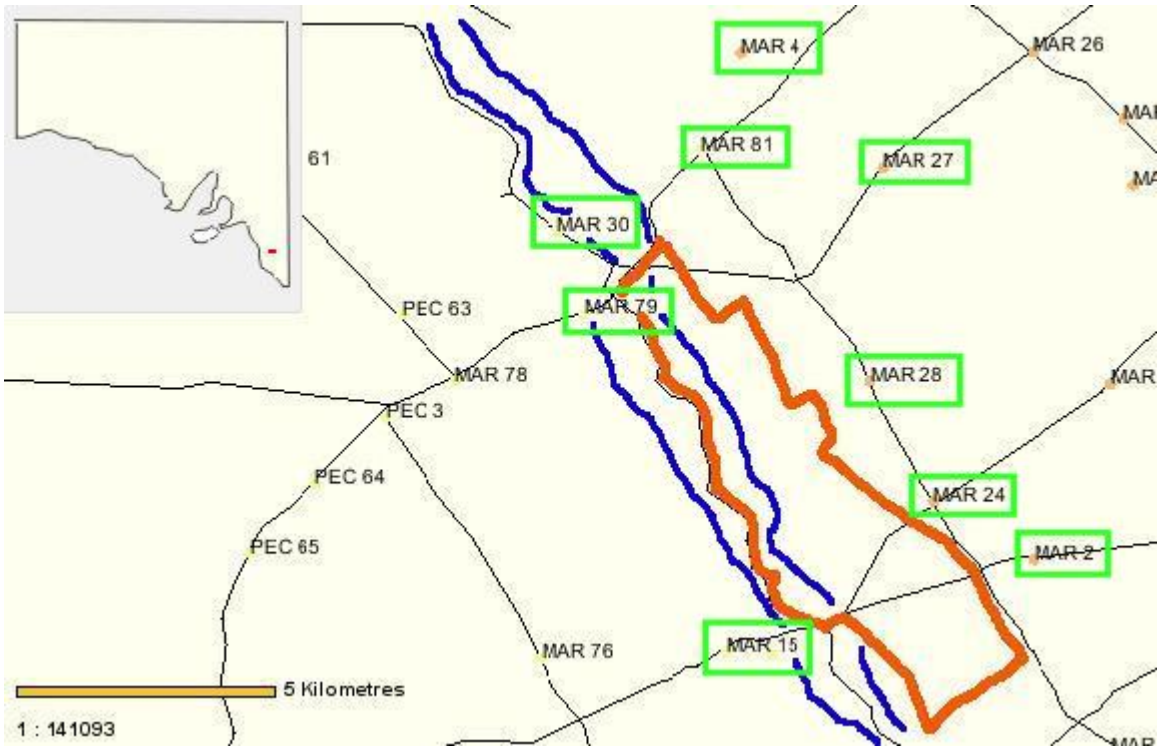
Salinity funding not hitting the ground: poll 10/4/2002

Drain plan to combat SE salinity 2/10/2001

Salinity audit throws focus onto farming practices 22/3/2001

Moratorium delays SE drains project 4/11/1999

ATTACHMENT 2 - MARCOLLAT AREA OBSERVATION WELL DETAILS



General map of Marcollat area, with approximate boundary of property described in submission 43 highlighted in orange, and boundary of watercourse country in blue. Watertable observation wells are identified by three letters and a number, and records of those copied below are outlined within a green box.

All data has been derived from the SA State Government's Observation Well website at https://info.pir.sa.gov.au/obswell/page/water_level/start.html.

The abbreviations in the following graphs have the following meanings:

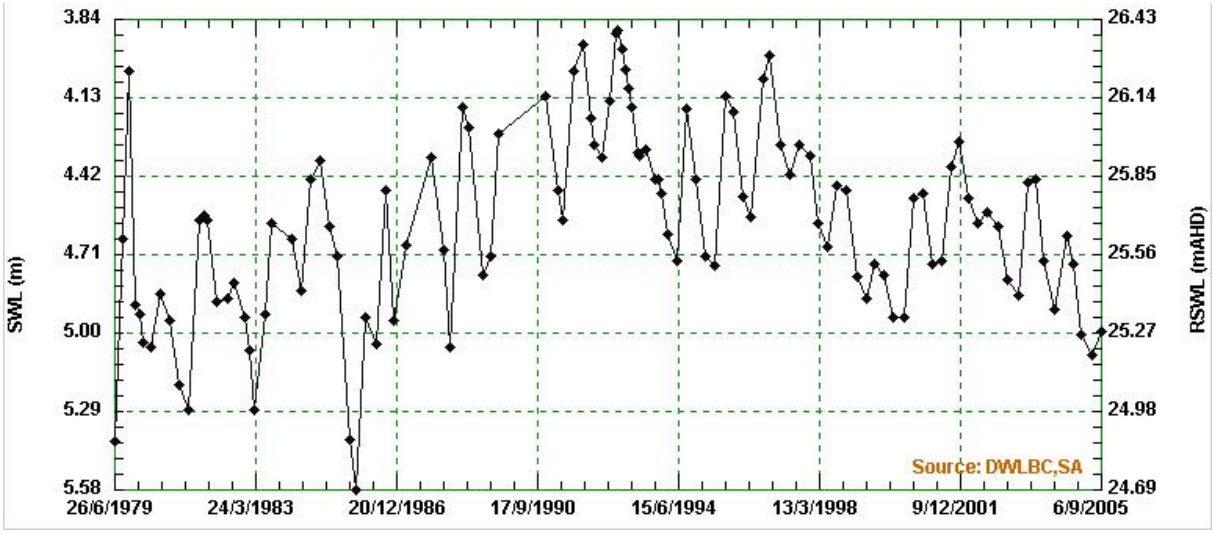
SWL – standing water level (distance from the land surface to the watertable).

RSWL – reduced standing water level (height of watertable measured in mAHD).

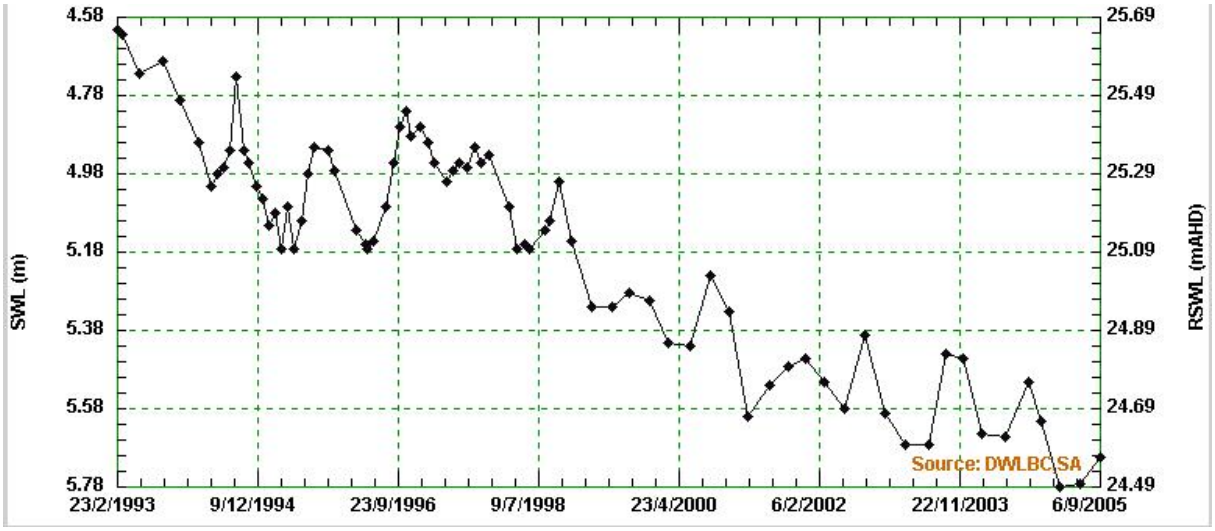
mAHD – metres above the Australian height datum (approximately mean sea level)

The graphs show that watertables under the dunes (the primary cause of rising saline watertables) are similar to or lower than they were in the 1970s (eg MAR 30, MAR 15, MAR 28, MAR 24). MAR 79 installed in 1993 shows a steady fall of over 1m until September 2005. MAR 15 shows a rise to a peak in about 1993, then a fall of about 1.5m since then.

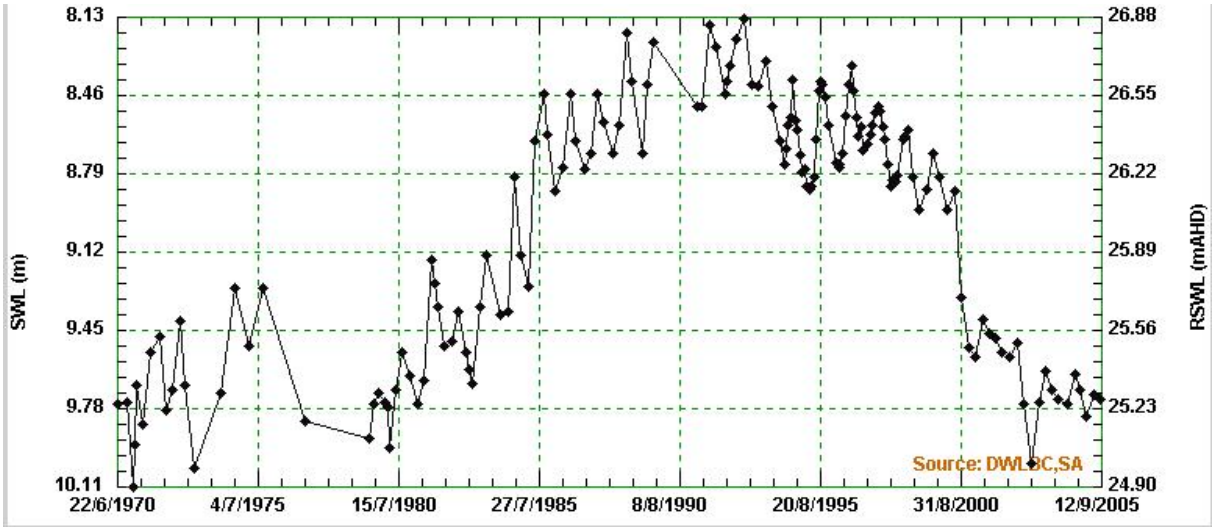
Where records are long enough (ie MAR 4, MAR 27, MAR 2), watertables on the flats show, if anything, a falling trend since the 1970s. MAR 81 shows no obvious rising or falling trend since 1993.



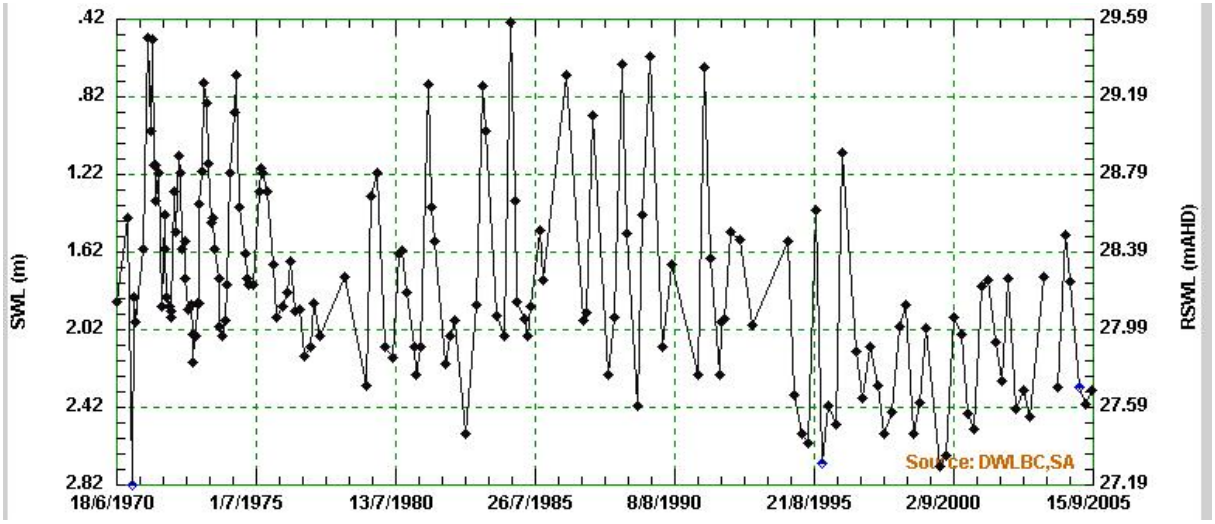
MAR 30



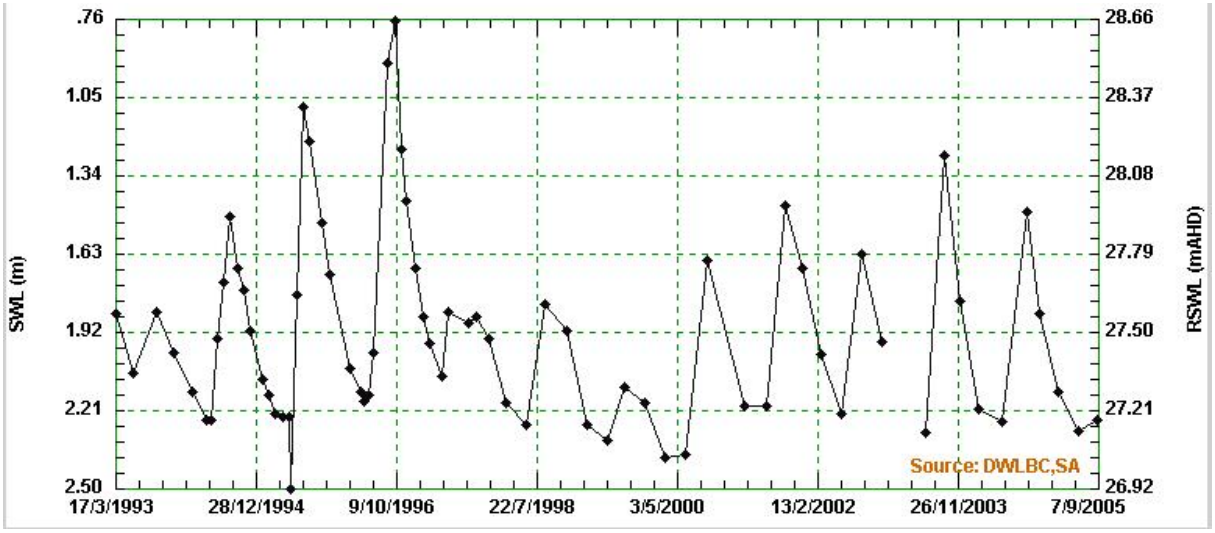
MAR 79



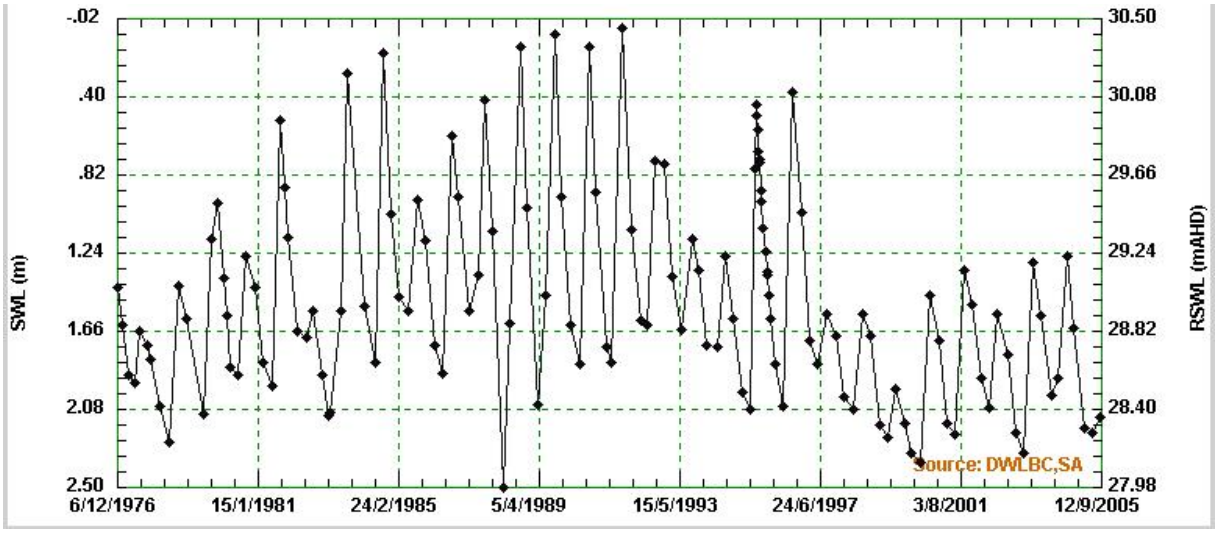
MAR 15



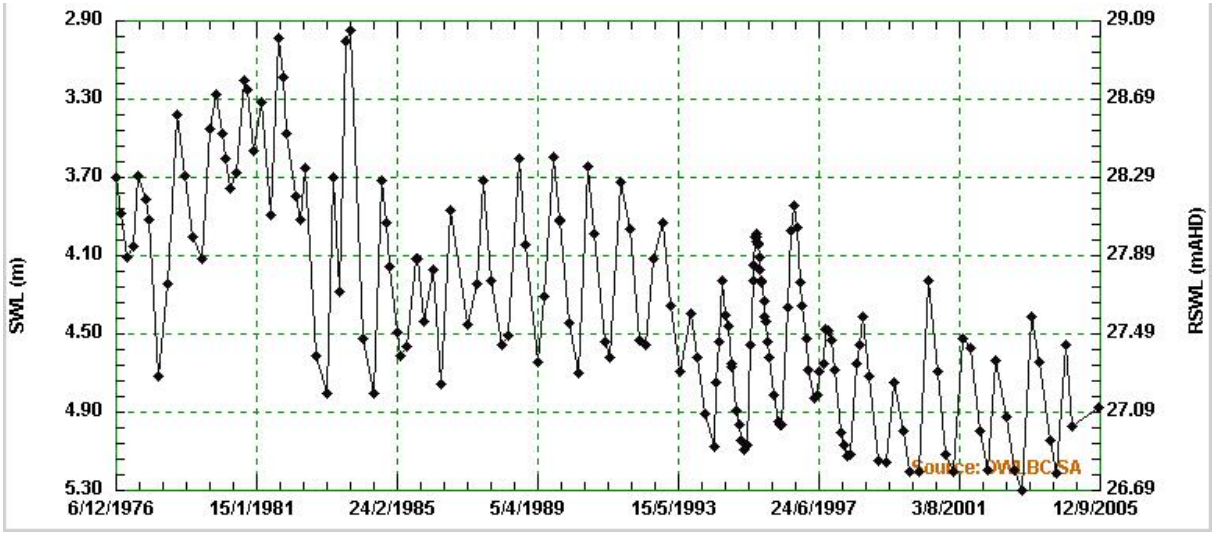
MAR 4



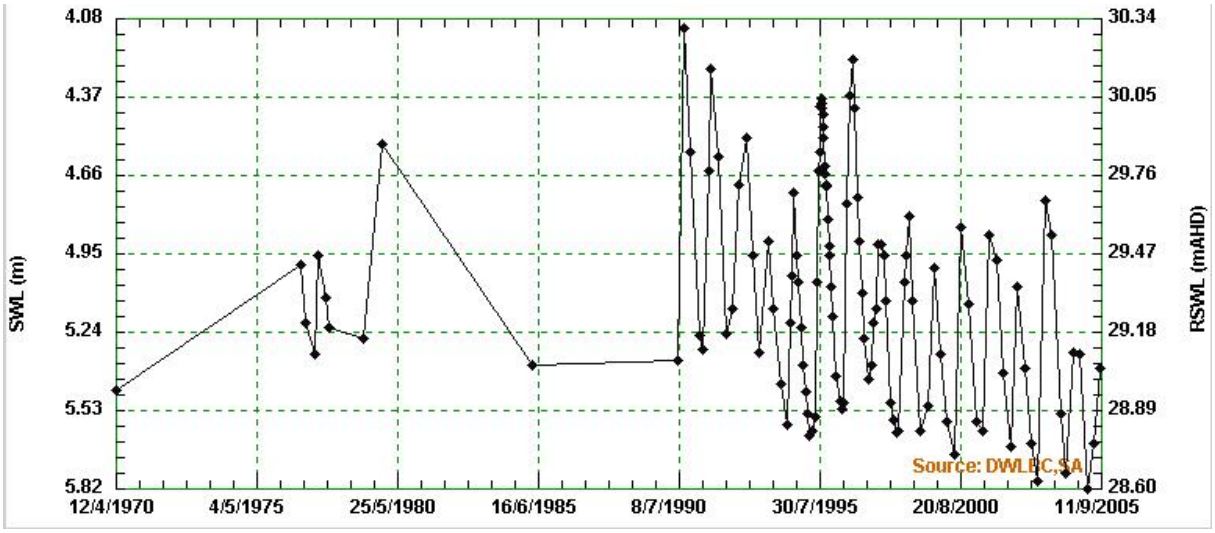
MAR 81



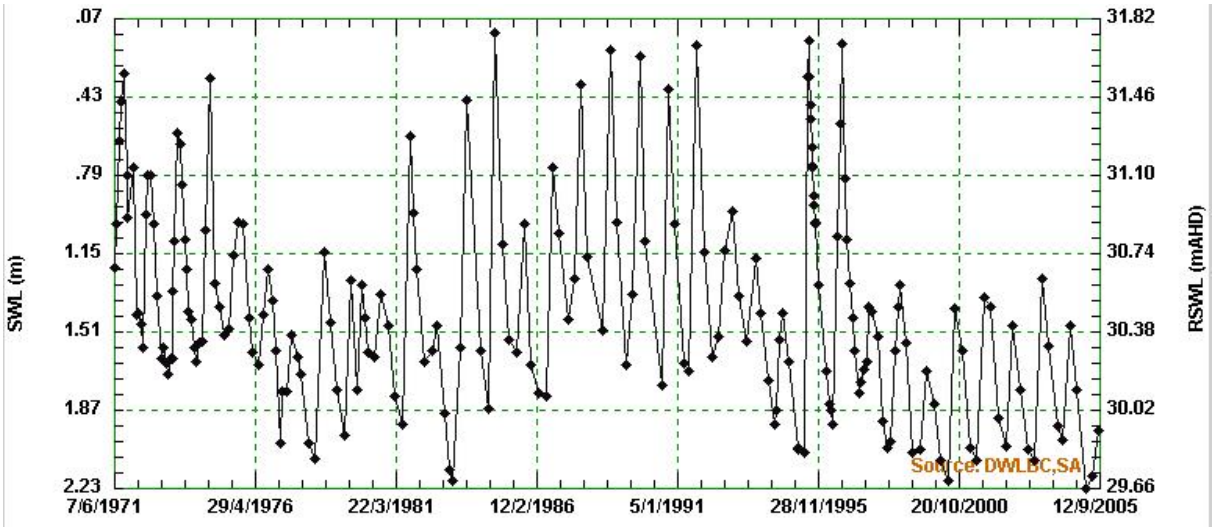
MAR 27



MAR 28



MAR 24



MAR 2