



Draft recommendations for priority investments in dryland salinity for the North Central CMA from community identified priority areas

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The recommendations in this document update those developed for the North Central CMA Board, based on analysis of areas identified by the community through workshops and discussions over July and August. The recommendations are to be used as an input to the Dryland Management Plan. There are specific recommendations for asset protection within each of the 4 river basins, catchment wide recommendations and over-arching 'principles' based recommendation. Each of the three sets of recommendations is crucial if the Dryland Management Plan is to achieve salinity outcomes.

Recommendations for asset protection in each of the four river basins

Tables 1-4 summarise the recommendations for specific asset protection in each of the Avon-Richardson, Avoca, Loddon and Campaspe catchments. Each priority area identified in the Tables can be conceived of as a project. Note that much greater detail is provided in an accompanying detailed document.

We suspect that the salinity budget will be insufficient to cover all the recommendations. The CMA need to indicate the available budget and the Dryland Management Plan Steering Committee (or appropriate staff or Board) need to estimate (or at least best-guess) the cost of doing a realistic job on each of the current short list. This will help establish how many assets can be handled in the plan. We can provide any expert opinion as required. This step is crucial as it will not be much of an improvement if the Dryland Management Plan includes twice as many assets as there are funds for!

Catchment wide recommendations

Table 5 summarises the catchment wide recommendations that can also each be considered as projects. Without these underpinning investments, investment decisions about salinity impacts will almost certainly be significantly compromised.

Over-arching principles based recommendations

In Table 6 we present some over-arching recommendations for investment in natural resource management issues other than salinity and also some principles to ensure greater quality of technical information presented to the CMA. Overall we have been struck by the number of non-peer reviewed reports on work that the CMA has commissioned and relied upon. Research providers (public and private) and the CMA itself share the responsibility in this, which has meant that the CMA is not in a strong position to understand the quality of the research and technical information it relies on.

Table 1. Avon Richardson SIF3 priority areas (11 areas analysed)

Community priority area	Major assets	SIF3 recommendation	Management Actions
Donald township	<ul style="list-style-type: none"> – Township – Reach 43 	<ul style="list-style-type: none"> – Engineering if economic. Rural Towns Program. 	<ul style="list-style-type: none"> – Actively engage with Buloke Shire to work out a strategy for co-investment – Lobby DSE for a Rural Towns Program.
Avon Plains lakes	<ul style="list-style-type: none"> – Batyo Catyo – Avon Plains lakes – High value dispersed vegetation 	<ul style="list-style-type: none"> – For Avon Plains lakes, use perennials to protect lakes. Would require long-term incentive payments imposing some land use restrictions. – For Batyo Catyo need to assess whether value is in fact high enough for next steps 	<ul style="list-style-type: none"> – Feasibility – use available bore information and hydrogeologists opinion to assess the feasibility of using perennial vegetation for asset-protection (likely for Avon Plains lakes). – Subject to feasibility, develop a local area plan around the Avon Plains lakes with landholders to use lucerne and re-vegetation to protect high-value assets. Long term incentives would be tied to farm planning and land use caveats to ensure hydrologic control. – Determine if Batyo Catyo is high enough in value to warrant protecting – Assess base-line resource condition of assets that are to be protected and a program of periodic re-assessment of condition (5 yearly?). – Invest in monitoring and reporting of bore information to assess the effectiveness of treatments. If required, additional bores may need to be installed – If all this is not possible then the recommendation is not to invest in asset protection.
Grays Bridge – Banyena	York Plains, large clusters of wetlands and Reach 46	<ul style="list-style-type: none"> – Use extension if lucerne is profitable. – If not then approach would be similar as to Avon Plains lakes. 	<ul style="list-style-type: none"> – Feasibility – use available information to assess feasibility of perennial vegetation for asset-protection – Assess the size of the wetland ecosystem cluster for protection subject to likely landholder willingness and ecosystems value – Develop local area plan, assess base line condition, invest in monitoring similar as to Avon Plains lakes
General dispersed assets	Agricultural land and dispersed vegetation in the lower catchment	<ul style="list-style-type: none"> – Participatory approaches with farmers in partnership with the CRC Future Farm Industries (FFI) and DPI to find long-term options for salt and non-salt-tolerant perennial species. 	<ul style="list-style-type: none"> – Negotiate research and extension commitments with DPI and CRC FFI – Plan and commence projects in 2007-8, including economic analyses for saltland and non-saltland options

Note that Lake Buloke, Cope Cope and the river reaches 43 and 45 were considered but rejected on the basis of expense of treatment and tractability. Wooroonook, Chirrup swamp, Jil Jil were considered and rejected on the grounds of asset values not being sufficiently high. Mt Jeffcott was rejected as a priority for salinity investment on the basis of limited salinity risk and possibly asset values not being sufficiently high. Reedy Paradise was also considered in the initial analysis. The catchment wide program to develop options for salt and non-salt affected agricultural land covers these areas. Note that in the Grays Bridge Banyena area Creswick swamp was initially considered due to high scientific value, but was subsequently excluded on the basis of local knowledge.

Table 2. Avoca SIF3 priority areas (10 areas analysed)

Community priority area	Major assets	SIF3 recommendation	Management Actions
Amphitheatre	Amphitheatre Avoca river reach 8	<ul style="list-style-type: none"> – Engineering if economic, Rural Towns Program. – Several possible recommendations including regulation, technology development or incentives for land retirement. 	<ul style="list-style-type: none"> – Assess salinity threat to town and river – Assess risk and responsiveness to treatment for river reach 8. Response will depend upon this assessment – Assess salt loads to Avoca reach 8 and Glenlogie creek – Evaluate feasibility using prior knowledge in a participatory process with council. Rural Towns Program – Assemble technical experts and those with strong local knowledge to work out most likely scenario. – Develop a project on CAT modelling in the Avoca to work out salt-water yield trade-offs.
Natte Yallock	Natte Yallock Reach 7	<ul style="list-style-type: none"> – Engineering if economic, Rural Towns Program – Technology development (see Avoca wide recommendation) 	<ul style="list-style-type: none"> – Assess whether the value of Bradshaws swamp is sufficiently high to warrant further investigation of salinity threat and intervention – Evaluate feasibility using prior knowledge in a participatory process with council. Rural Towns Program – Extension is recommended if lucerne is economic, but no incentives. If economics marginal, invest in technology development
Gowar east springs	Reaches 5 and 6	<ul style="list-style-type: none"> – Technology development (see catchment wide recommendation) 	<ul style="list-style-type: none"> – See catchment wide recommendations below (Table 5).
Indigenous site	Indigenous site Reach 5	<ul style="list-style-type: none"> – Engineering if economic plus incentives or incentives for land retirement 	<ul style="list-style-type: none"> – Note that this was the only indigenous site identified. A program to identify and classify sites of cultural heritage across the whole North Central CMA region is needed.
Avoca Marshes	Avoca Marshes	<ul style="list-style-type: none"> – Engineering if economic 	<ul style="list-style-type: none"> – Assess feasibility and cost-effectiveness of engineering – Plan has been developed to address the Avoca Marshes –presumably this has been developed with more detailed local knowledge/science than SIF3. Use as appropriate.
Rest of lower Avoca floodplain	Reaches 1-4, numerous high value wetlands and floodplain	<ul style="list-style-type: none"> – Due to the size of the floodplains, if under salinity threat there are several possibilities. Extension for lucerne if profitable (no incentives), floodplain regeneration with possible incentives to cover opportunity cost. 	<ul style="list-style-type: none"> – Establish a considered position on the risk of salinity with a local knowledge and bore data. – Assess the asset values of the major assets on the floodplain, recognising that strong prioritisation is needed as there will not be sufficient funds to protect all assets from threats. – Continued active program of floodplain regeneration (not with salinity investment money unless threat is urgent). Tighter targeting will be needed. – Where the salinity threat is not urgent, there should be no specific investment into salinity, but a focus on developing profitable perennial options for farmers. – Where there are salinity threats, assess specific recommendations using SIF3 analysis and assess base-line resource condition of assets and a program of periodic re-assessment of condition (5 yearly?).

For all of Avoca

Avoca river reaches 1-8

The community identified all reaches as high priority assets. A continued program of riparian vegetation and fencing is recommended as part of the River Health program.

Note that Redbank tourism, Carapooeee, Warrenmang were considered – the catchment wide program to develop options for salt and non-salt affected agricultural land help cover these areas. Dalyenong and Teddington reservoir were considered, but its priority will depend upon the salinity risk and the value of the dispersed vegetation. Pental Hills was also covered in the original analysis.

Table 3. Loddon SIF3 priority areas (15 areas analysed)

Community priority area	Major assets	SIF3 recommendation	Management Actions
Tang Tang	Tang Tang and other lower value wetlands Reach 42	<ul style="list-style-type: none"> - Engineering if economic for Tang Tang itself - Other wetlands not a priority unless of sufficient value as a cluster. - Technology development (see all of Loddon recommendation) 	<ul style="list-style-type: none"> - Establish the value of the wetland cluster ecosystem as a whole for ecological value of Tang Tang. - Confirm if the value of Tang Tang is high enough to warrant protection using engineering if economic and subject to feasibility of using perennial vegetation. - Feasibility – use available bore information and hydrogeologists opinion to assess the feasibility of using perennial vegetation for asset-protection of the wetland cluster that is sufficiently high in value as an ecosystem. - If the asset values are high enough, and using perennials is deemed feasible to largely prevent recharge, then use extension to develop a local action plan in negotiation with individual landholders around the assets. The approach would be similar as for Avon Plains lakes. Assess base-line resource condition of assets that are to be protected and a program of periodic re-assessment of condition (5 yearly?). - Invest in monitoring and reporting of bore information to assess the effectiveness of treatments. If required, additional bores may need to be installed – case by case analysis - If this is not feasible then technology development is the recommendation or protection of Tang Tang and surrounding wetlands.
Bendigo Urban Growth area and peri-urban surrounds	City of Greater Bendigo and surrounds	<ul style="list-style-type: none"> - Engineering subject to feasibility. Statewide Rural Towns Program - Planning controls to stop development in high-risk salinity areas. 	<ul style="list-style-type: none"> - There are a series of specific actions for Council to consider in the detailed document. For the CMA: - Develop a clear key point of contact to manage the relationship between the City of Greater Bendigo, and other councils where salinity is a significant risk. - On a council by council basis, use existing information to develop a 'next steps' including knowledge generation through bore monitoring data. This may require a full-time person to lead and have responsibility for. - Be pro-active in lobbying DSE to establish a State-wide Rural Towns Program. - Commit an on-going budget for co-investment with the City of Greater Bendigo
Castlemaine Heritage	Castlemaine, Chewton and Campbells creek	<ul style="list-style-type: none"> - Engineering subject to feasibility. 	<ul style="list-style-type: none"> - Establish risk of salinity using available bore data and opinions of hydrogeologists and local knowledge - If sufficient salinity threat, develop a strategy in partnership with local government - Lobby DSE for Rural Towns Program.
Merin Merin	Merin Merin swamp	<ul style="list-style-type: none"> - Recommendations depend upon urgency. - The value of Merin Merin could be high enough to 	<ul style="list-style-type: none"> - Urgency and feasibility – use available bore information and hydrogeologists opinion to assess the urgency of the problem and the feasibility of treatment using engineering or perennial vegetation. - Confirm whether Merin Merin is of sufficiently high value to warrant

		<p>recommend engineering if economic and problem is urgent.</p>	<p>protection through assessment of vegetation condition and salinity risk</p> <ul style="list-style-type: none"> – If perennials are deemed feasible, then use extension to develop a local action plan in negotiation with individual landholders around the assets (see for Avon Plains lakes). – If engineering is the only option, work out the likely cost of protecting Merin Merin. – Assess base-line resource condition of the assets and a program of periodic re-assessment of condition (5 yearly?). – Invest in monitoring and reporting of bore information to assess the effectiveness of treatments. If required, additional bores may need to be installed – case by case analysis.
Cairn Curran	Cairn Curran reservoir	<ul style="list-style-type: none"> – Recommendations dependent upon an assessment of the salt/water yield trade-off issues. Could be penalties to increased perennials – Middle and Joyces creek sub-catchments to be targeted for recommendations subject to salinity threat being urgent enough 	<ul style="list-style-type: none"> – Establish using available knowledge and bore data as to whether Cairn Curran is at risk. – Establish appropriate recommendation considering salt/water yield trade-off issues
Tullaroop	Tullaroop reservoir	<ul style="list-style-type: none"> – Recommendations depend upon confirming salinity risk. Recommendations may need to consider salt/water yield trade-offs 	<ul style="list-style-type: none"> – Establish using available knowledge and bore data as to whether Tullaroop is at risk. – Establish appropriate recommendation considering salt/water yield trade-off issues
Upper Loddon	Reach 10	<ul style="list-style-type: none"> – Penalties or incentives depending upon the water yield/ salt trade-off issues 	<ul style="list-style-type: none"> – Establish if there is a salinity risk – Use CAT modelling and available data to see if penalties to prevent perennials or incentives for land retirement is most appropriate if there is salinity threat
Bridgewater	<p>Bridgewater</p> <p>Loddon Reach 7</p>	<ul style="list-style-type: none"> – Engineering if economic and subject to risk assessment. – Technology plus engineering if economic 	<ul style="list-style-type: none"> – Establish risk of salinity using available knowledge and bore data. – If at risk develop a strategy in partnership with local government and Rural Towns Program

Note that Laanecoorie, Bet Bet/Timor West, Mt Franklin, Birches and Creswick creeks, Mt Beckworth, Tullaroop and Tanfards swamp were considered but not as highly valued as other areas. Bullabul was also covered in the original analysis. Boort lakes are not reported as the high-value Woolshed swamp should be covered by the Irrigation Plan. Tang Tang swamp is also within the irrigation area.

Table 4. Campaspe SIF3 priority areas (8 priority areas analysed)

Community priority area	Major assets	SIF3 recommendation	Management Actions
Axe Creek	Axe creek Dispersed vegetation	<ul style="list-style-type: none"> - Incentives for land retirement and development of low-cost land retirement strategies 	<ul style="list-style-type: none"> - Assess the priority for Axe creek as a priority area compared with other priority areas. This needs to be weighed up in terms of the importance of salt reduction downstream before funding is allocated. CAT modelling would be useful to assist with this.
Tooborac Heathcote	Heathcote Tooborac	<ul style="list-style-type: none"> - Engineering if economic and subject to sufficient salinity risk 	<ul style="list-style-type: none"> - The salinity risk to Heathcote needs to be verified using available knowledge and bore data before developing a strategy with local government. Rural Towns Program.
Wild Duck creek	Lake Eppalock	<ul style="list-style-type: none"> - Need to establish if the salt exports are important enough to consider encouraging increased perennials 	<ul style="list-style-type: none"> - If salt export not important enough, then it is not a priority for salinity investment, if it is, then land retirement is the recommendation. - Use CAT modelling to help assess water yield/salt trade-offs. - If maintaining freshwater flows is more important than reducing salt exports then penalties to prevent establishment of perennials or incentives for land retirement could be warranted. Would need careful analysis due to controversy this would generate.
Elmore	Elmore Campaspe reach 4	<ul style="list-style-type: none"> - Engineering if economic and subject to urgent salinity threat - Technology plus engineering if economic and subject to urgent salinity threat 	<ul style="list-style-type: none"> - The salinity risk to Elmore needs to be established using available knowledge and bore data before developing a strategy with local government. Rural Towns Program.

Knowsley east was analysed but not deemed high enough in asset value to be considered further. Mt Camel Range and Barnadown also considered, and the recommendations on technology development would cover this.

Table 5. Catchment wide recommendations

Projects to be developed to address issues relevant to more than one river basin	
Protect agricultural land and dispersed remnant vegetation assets	Invest in development of profitable new plant-based technologies/systems to protect against further salinity impacts. This could be achieved through a project or projects in partnership between DPI (extension and research), the CRC Future Farm Industries and the CMA to make maximum use of Australian research into perennial farming systems options. The projects could be conducted anywhere in the catchment, but we suggest that the Avon-Richardson, parts of the Avoca and Loddon are the highest priority areas.
Saltland agronomy	Develop a participatory approach with farmers, extension and research staff to develop practical and profitable perennial based systems, based on the partnership approach outlined above. This program would be focussed on practical dryland agronomy options for salt-affected land. Economics, and potential downstream impacts of saltland systems need to be built in. Whilst the projects could be conducted anywhere in the catchment, we suggest that the Avon-Richardson is a high priority area for development of a partnership with local farmer groups, as is a partnership with the Northern United Forestry Growers (Loddon) who have shown strong leadership.
Indigenous cultural heritage sites	Indigenous cultural heritage is very poorly represented. A program of cultural site identification and site prioritisation is urgently needed if this information is to be meaningfully incorporated into salinity investment.
Catchment Modelling	Avon-Richardson: Use CAT modelling with local validation to assess scenarios of feasibility and practicality of protecting all key assets and for assisting to assess the impacts of groundwater pumping (mine and private bores being put in for de-salination). Avoca: CAT modelling will help assess risks to lower Avoca and to assess issues of salt-water yield trade-offs in upper Avoca. Loddon: CAT modelling will help assess risks and treatability of asset protection as well as to assess salt-water yield trade-offs in the Loddon, especially in the Upper Loddon, Bet Bet and Timor West areas. Campaspe: Especially useful to assess salt and water yield issues in Axe Creek and Wild Duck Creek.
Bore monitoring	A bore monitoring program needs to be put into place around each of the key assets which are to be protected. The investment needs to be made on a case by case analysis considering whether new bores are required, the frequency of monitoring and specifications for plain-english interpretation of bore information.
Groundwater conceptualisation	Development of more detailed (1:100,000) maps of groundwater flow systems are essential as the current 1:250,000 layer is too coarse. Hydrogeologists agree that 1:100,000 scale is as fine as is worth investing in (Mark Reid, Phil Dyson, <i>personal communication</i>), with additional point scale bore data and local knowledge being used to refine recommendations around specific assets. Agreed groundwater conceptualisation of the whole of NC CMA at a scale that enables CAT analysis of interventions at the point scale is essential.
Salinity risk assessment	We have been struck by how unreliable the watertable mapping data are. That the new SKM data are to be peer-reviewed instigated by DSE is welcome news. Water table height and trend data are not presented in a way that enables reliable assessment of salinity hazard. There appears to be no reliable layer of salinity concentration of watertables. Development of a more robust method to assess salinity risk is essential, preferably incorporating watertable salt concentration data.
Rural Towns Program	CMA and local government to lobby DSE to fund a State Rural Towns Program to assist towns develop salinity programs

Table 6. Over-arching recommendations for investment in natural resource management issues and principles to ensure greater quality of technical information in future

SIF3 recommendation	Management action
Empower catchment managers to be able to conduct their own SIF3 analysis and communicate with the community the reasons for a change in direction in dryland salinity management	<p>Elements of this recommendation include:</p> <ul style="list-style-type: none"> • <i>A communications strategy</i>: Undertake a process of community engagement in light of SIF3. Explain the need for change in the light of new knowledge, experience and more comprehensive analysis. • <i>A timetable for change</i>: Identify recommendations that are priorities for earlier change (see above Tables). Set a timetable for changes over the coming two or three years, taking into account the seasonal delivery by DPI and the CMA, and inform stakeholders of this timetable. • <i>Training of catchment managers in SIF3</i>: The SIF3 team to train catchment managers to be able to conduct their own analyses as new knowledge becomes available. • <i>'Capacity needs' considerations</i>: Based on the capacity needs identified in the SIF3 project (yet to be completed), develop a plan for securing the necessary skills within the CMA or key service providers. • <i>Liaise with extension service providers</i>: Discuss the need for more strategic targeting of salinity extension, and refocussing of extension strategies in light of SIF3 recommendations.
Provide regular (annual?) opportunities for the community to discuss and nominate high priority assets.	The process for asset prioritisation was largely based on scientific asset values. The current process is imperfect and there is the large possibility that important assets have not been identified. The community holds knowledge that is not available to those making the scientific assessments. The CMA should provide a regular opportunity for the community to identify and discuss key assets to be considered as priorities for investments. Each asset would have a 'business case' developed for why it should be considered, and a process for working out which assets are downgraded in priority would also need to be established.
Embed SIF3 thinking into planning for other natural resource management issues	Commission a project co-funded with DSE to extend SIF3 to encompass multiple natural resource management outcomes.
Build external peer review into any research projects and insist on a short, plain-English version of the project outcomes.	All research projects should be subjected to rigorous peer-review. This is the accepted method for quality assurance in research.
Consider salinity more fully in River Health Strategy investment	Despite detailed consideration of threats to rivers, salinity was not explicitly considered as a threat. This is a major oversight, given that in some rivers (eg lower Richardson) salt-water intrusion is a major issue. We recommend that salinity threat is considered in all rivers as part of the River Health Program.
Further prioritise river reaches for investment	The River Health Strategy has prioritised 42 of the 101 river reaches as priorities and has spread investments over all reaches. This strategy has its strengths in terms of community involvement, but is unlikely to result in the best public-good outcomes. We suggest that further prioritisation is worth considering to better protect very high value reaches – this applies over all threats, not only salinity.
Better prioritise high value biodiversity assets	There are numerous dispersed high-value biodiversity assets which we have not been able to deal with as well as we would have liked. Stronger and robust prioritisation methods for biodiversity would be useful. This should be negotiated with DSE.
Consider the salt and water yield trade-offs in much more detail than currently.	The issue of water yield and salt reduction will become even more important in future than it is now. We recognised that the broad issue of salt reduction to the Murray River is not that well catered for in SIF3 as yet, and neither is it in the current target area approach. Debate and discussion with DSE and the Murray Darling Basin Commission would be useful to assess how to best start to address this in a more meaningful way. We suggest that CAT modelling would be an excellent start to better considering this issue.

Citation: Ridley, A.M. and Pannell, D.J. (2006). Draft recommendations for priority investments in dryland salinity for the North Central CMA from community identified priority areas, SIF3 Working Paper 0603, CRC for Plant-Based Management of Dryland Salinity, Perth.

Content is Version 6, Sept 2006

Updated to Version 6a, 1 Oct 2007 by including citation details