IDMOU – THE KEY TO BETTER RELATIONSHIPS AND IMPROVED WATER QUALITY TARGET SETTING IN NORTHERN VICTORIA.

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ABSTRACT

Irrigation drainage or Surface Water Management (SWM) is an integral part of sustainable irrigated agriculture in northern Victoria. Without an effective way of managing the irrigation influenced water balance, summer rainfall may result in rising watertables, irrigation induced land salinisation and consequent loss of biodiversity. SWM systems are designed to remove the irrigation induced component of rainfall runoff and convey this to receiving waterways.

In June 2004 a multi agency agreement, the Memorandum of Understanding for Irrigation Drainage Management and Water Quality (IDMOU), was signed by the five key catchment partners in the North Victorian irrigation region, ensuring the water quality and needs of downstream users are understood and protected.

This paper outlines the genesis of the IDMOU and the process and steps taken to reach agreement on what the signatories to the IDMOU should achieve. A key driver was the need to document the roles and responsibilities of the catchment partners as they related to the management of irrigation drainage. It was also recognised in the early stages that an agreed method of setting realistic water quality targets related to irrigation drainage was vital to demonstrate implementation of the IDMOU and water quality improvement and best practice.

To ensure that SMART (Specific, Measurable, Achievable, Realistic and Time based) targets were set a Decision Support System (DSS) was developed. This paper describes how the DSS is used to facilitate the setting of Key Performance Indicator water quality targets and help determine a package of management actions that must be implemented in each drainage catchment to achieve the agreed water quality targets.

The IDMOU has been operating for four years and has resulted in a significant improvement in communication and common understanding between stakeholders, has minimised conflict and provided a high degree of transparency in target setting.

To illustrate the target setting process and implementation of the IDMOU, this paper describes a case study of the recently completed application of the DSS to the Broken Creek catchment in northern Victoria.

INTRODUCTION

North Central Catchment Management Authority (NCCMA) and Goulburn Broken Catchment Management Authority (GBCMA) are the catchment and waterway health managers in the north Victorian irrigation region where the IDMOU was developed and is operating. As catchment managers the Catchment Management Authorities (CMAs) are responsible for the development of strategies and plans to manage of land, water and waterway health. The successful development and delivery of these strategies and plans relies on cooperation and assistance from other agencies, including Goulburn-Murray Water (G-MW), the Environment Protection Authority (EPA), the Department of Sustainability and Environment (DSE) and the Department of Primary Industries (DPI). To aid this implementation and improve communication and cooperation between the agencies in relation to irrigation drainage and water quality, the IDMOU was developed.

Irrigation drainage, also known as Surface Water Management (SWM), is an integral part of sustainable irrigated agriculture in northern Victoria. Without an effective way of managing the irrigation influenced water balance, summer rainfall may result in rising watertables, irrigation induced land salinisation and consequent loss of biodiversity. In northern Victoria SWM systems are designed to remove the irrigation induced component of rainfall runoff and convey this to

receiving waterways. In achieving this objective, they also more rapidly remove surface water and consequently reduce the risk to irrigated agriculture.

In 1989 a Land and Water Salinity Management Plan was developed by the regional community for the Shepparton Irrigation Region (SIR). At that time only about 20% of the SIR had some form of drainage service with some 336,900 ha not being served by adequate drainage. In the intervening years there have been a number of strategy/implementation plan reviews and the document has been superseded by the SIR Catchment Strategy. Under this strategy an additional 95,390 ha now has effective drainage. The SIR covers about 500,000 ha of the northern irrigation region. The remainder of the irrigation region is covered by the Loddon-Murray Surface Water Management Strategy.

Surface water management system (SWMS) generally comprise unlined earthen open drains that follow natural drainage lines and outfall to natural waterways which flow perennially. Most waterways within the northern irrigation region receive water from SWMS serving irrigated land. The construction of these SWMS is managed by Goulburn-Murray Water in close consultation with DPI both of which are acting as agents for the CMAs.

In 2001 an independent review of the environmental aspects of SWM within the Goulburn Murray Irrigation District (GMID) in northern Victoria was undertaken. This review was to inform various State and Federal government ministers, departments and agencies of the environmental outcomes resulting from SWMS, their design evolution, environmentally related processes, and monitoring programs within the GMID.

The overall finding of the review was that the current SWMS are providing significant environmental benefits and were operating with a high level of environmental sensitivity. It was also concluded the SWMS design, construction and operational processes were considered to be 'best practice' compared to elsewhere in Australia and overseas. However, the review identified a few areas where the SWM program fell short of its potential to maximise environmental benefits. The most important of these was an apparent lack of clarity regarding respective roles and responsibilities of government agencies and no rigorous regulatory and management framework for setting water quality goals.

The Victorian government responded to the findings of the review by supporting the development of the Memorandum of Understanding for Irrigation Drainage Management and Water Quality (IDMOU). The IDMOU is a multi agency agreement that clarifies the respective roles and responsibilities of the signatories with respect to the management of water quality and associated quantity in SWMS that service irrigated land in the GMID.

IDMOU DEVELOPMENT

Work on the IDMOU development commenced in 2002, with a committee formed from each of the proposed signatory organisations. With the support of Hydro Environmental, many workshops were held to gain agreement of the member agency's roles and responsibilities and any other measures required to improve the environmental performance of SWM in northern Victoria.

On the 22 June 2004, after significant negotiation, the IDMOU was signed by the Department of Sustainability and Environment (DSE), the Environment Protection Authority (EPA), the Goulburn Broken and North Central Catchment Management Authorities (CMAs) and Goulburn-Murray Water (G-MW). The Department of Primary Industries (DPI) is a service provider to the CMAs and therefore is not a signatory to the memorandum.

The primary outcome of the IDMOU is a document that clearly defines the roles and responsibilities of the signatory organisations in implementing SWM and improving environmental performance. It also summarises the legislative and policy framework under which SWM sits. The IDMOU is a high level document and describes the outcomes expected from setting water quality targets, and how and when auditing of SWM performance is to be undertaken. It outlines a timeframe to achieve certain outcomes and milestones and puts in place a mechanism for monitoring progress against these milestones.

A steering committee, comprising representatives from each of the signatory organisations, meets every six months. DSE is responsible for convening these steering committee meetings. The committee's role is to provide high level oversight of work being done under the IDMOU and review progress against timelines. The actual setting of targets and implementation of works is the responsibility of the various agencies as defined in the IDMOU. The steering committee has proven to be an effective means of improving communication between the signatories and the relationships formed have strengthened partnerships and increased understanding of what is achievable. The steering committee is also the means whereby any amendments required to the IDMOU are discussed and recommended. This ensures that the IDMOU continues to remain relevant and meet the needs of the signatories.

Successful delivery of the IDMOU results in the following outputs and reporting mechanisms:

- Development of Resource Condition Targets and Key Performance Indicators for water quality
- Setting of irrigation drainage related water quality targets
- Development of Catchment and Asset Management Plans
- A sustained and clear communication process amongst signatories
- Annual reporting against the IDMOU objectives.

This paper focuses on the setting of targets for water quality management in irrigation drains.

TARGET SETTING FOR WATER QUALITY

A key outcome of the IDMOU was the need to initially develop a rapid Decision Support System (DSS) to enable CMAs to set irrigation drainage related water quality targets for receiving waterways and at irrigation drainage outfall points. It was recognised early in the process that it in order to set SMART (Specific, Measurable, Achievable, Realistic and Time based) targets consideration of works that could be done within the catchments to improve water quality was required. To this end a 14 step semi-quantitative, risk based approach has been developed.

The first nine steps form the Rapid Resource Condition (RRC) DSS which uses risk management processes and generic process models to determine monitoring site location priorities, monitoring parameter priorities at each priority site and interim water quality related Key Performance Indicators (KPI) at each monitoring site.

The last five steps form the Rapid Management Action (RMA) DSS and enable the setting of irrigation drainage related management action targets and the finalisation or modification of KPI targets set in Step 9 of the RRC DSS.

The sequence of steps in the DSS is shown in **Figure 1**. The process involves a combination of desktop work processing the available data and several workshop sessions to determine and rank the values of the receiving waterway and associated risks. The workshop sessions are important as they draw upon the knowledge of experts, practitioners and the community. As well as providing input the workshop sessions also allow the results of the work to be presented and for stakeholders to gain a better understanding of the likely outcomes.

A number of the steps are linked to form iterative loops both within and between the RRC DSS and the RMA DSS. This approach allows targets to be set starting from an altruistic position, before the realities of space, time and money are taken into account. It enables targets to be given an upper bound and helps put the final targets into perspective of what can really be justified and achieved.

The DSS holds all the information to easily enable revision of targets should funding for certain things increase without having to re run the DSS and modify targets.

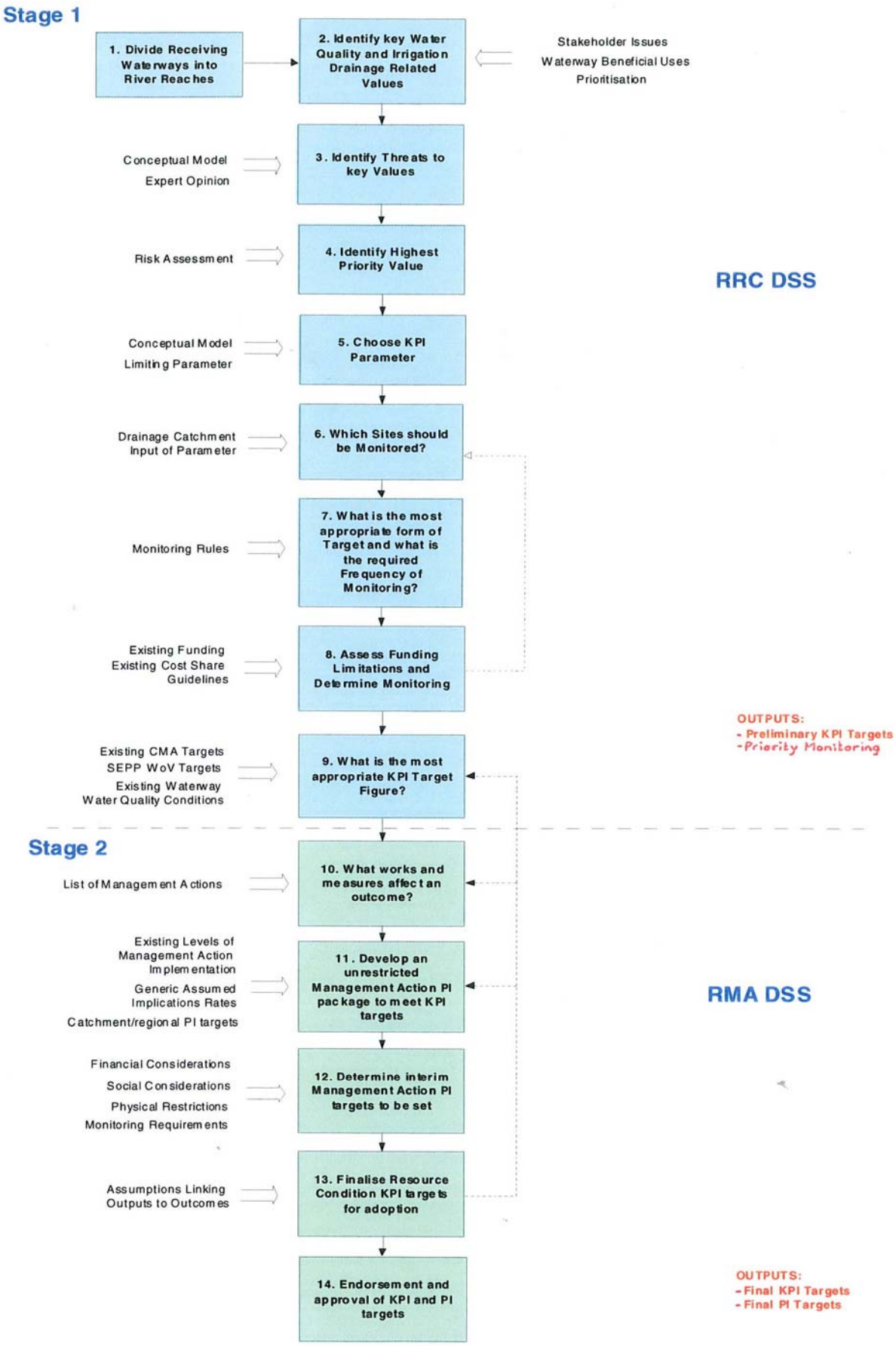

Figure 1: Overall 14 Step DSS

The following briefly outlines the details of each step of the DSS:
Step 1 determines which waterways will be defined as receiving waterways and which will be treated as an irrigation drainage system. Each of the receiving waterways are then divided into reaches. Reach lengths are chosen to encompass sections of the waterway with similar characteristics. This is done to facilitate risk assessment target setting at appropriate locations.

Step 2 documents and prioritises water quality related Values (otherwise be known as beneficial uses) contained within each waterway reach so only the highest priority Values will be used to develop water quality related targets.

In **Step 3**, the Threats to the water quality related Values documented in Step 2 are identified through the use of Conceptual Models. A set of five generic Conceptual Models have been developed to enable identification of irrigation drainage related water quality Threats and Parameters that influence each Value. An example of a conceptual model is the for Floodplain Wetlands and Birds conceptual model shown in **Figure 2**.

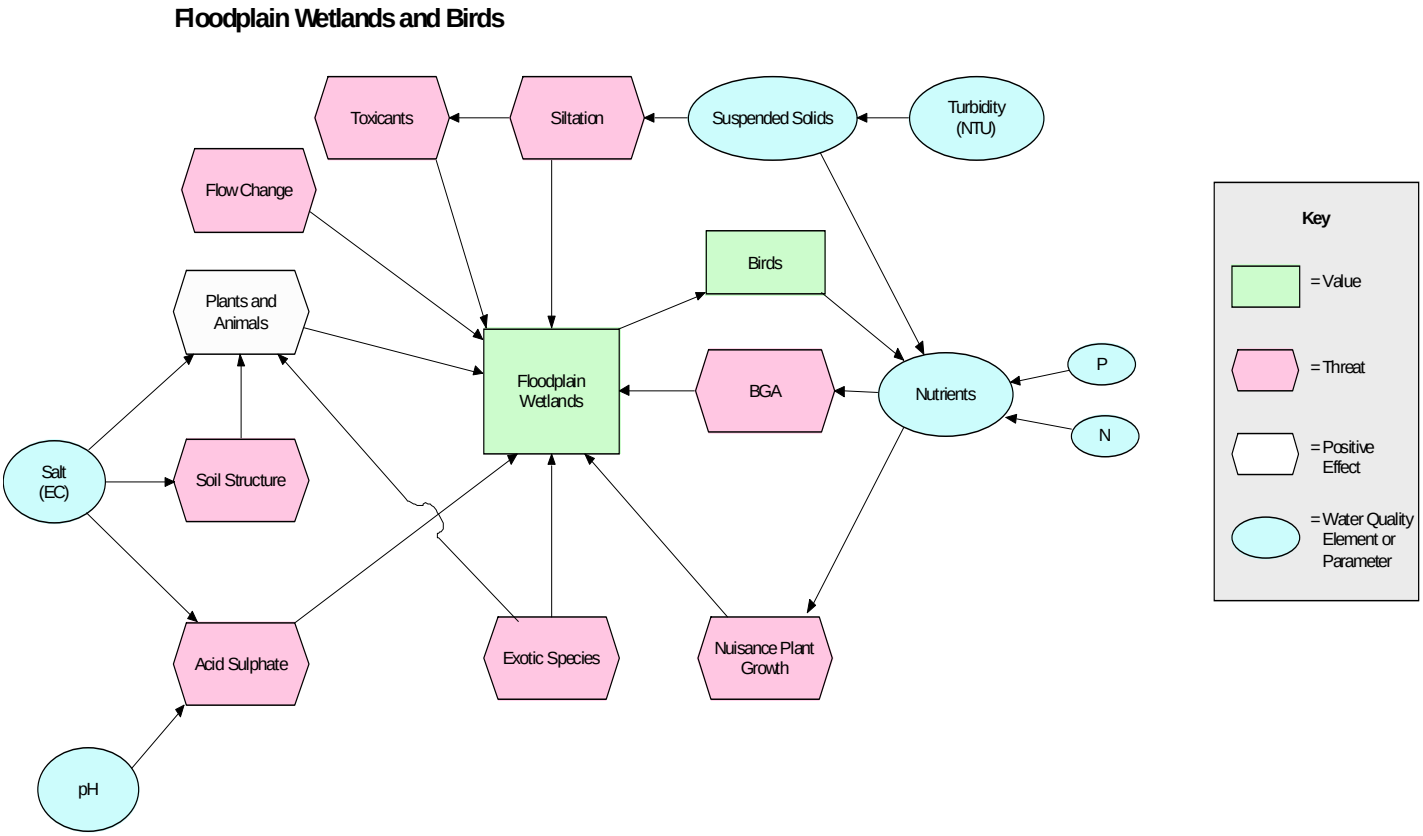

Figure 2: Conceptual Model used for Floodplain Wetlands and Birds

Step 4 uses a risk assessment process to choose the Value and Threat combination in each Reach that poses the highest risk. This is then combined with the Value prioritisation made in Step 2 to obtain an 'Overall Value/Risk' score through a two step process. The highest scoring Overall Value/Risk is used to set the KPI parameter in Step 5.

Step 5 uses the Conceptual Models from Step 3 to identify the water quality parameters that relate to the highest priority Threat/Value combination in each Receiving Waterway reach. From the list of relevant water quality parameters, those that have the greatest impact on the highest priority water quality Value are chosen as KPIs.

Both receiving waterway and drainage system outfall monitoring requirements are investigated in **Step 6** to determine the relative priority of existing and potential monitoring sites. A staged process has been adopted that relies on the outputs of Step 8. Therefore, Step 6 is undertaken and then revisited and refined after Step 8 is completed.

Step 7 takes each monitoring site from Step 6, identifies KPI target sites and benchmark sites, and sets the monitoring form and frequency.

Step 8 takes the outputs of Steps 6 and 7 and adds indicative monitoring costs. The cost is then compared to available funds and used to determine the scope for additional monitoring and/or changes to existing monitoring. This process takes into consideration mandatory monitoring requirements, and any sites that are rendered redundant through the proposed monitoring regime. This step may propose that current monitoring of low priority DSS sites is discontinued, however is primarily aimed at any additional budget being available for high priority sites without necessarily taking funding away from those already monitored.

Step 9 sets interim KPI targets for each KPI parameter at the relevant Priority monitoring sites (excludes benchmark site). These include Aspirational, Full Plan Implementation (20-30 year targets) and 5 year targets. These KPI targets are temporary targets only and will be reviewed when Management Action targets are set within each drainage catchment (Step 10 – 14). It should be noted that benchmark sites require monitoring to determine the concentration and load of the KPI parameter upstream of all irrigation drain outfalls.

Step 10 provides the initial link between implementing irrigation related Management Actions and achieving a Resource Condition outcome. It details all Management Actions that have been historically used and/or could be used on a CMA regional basis and their relationships with the Resource Condition outcomes.

Management Action related resource condition outcomes on irrigation drainage water quality parameters have been identified in a Management Actions Assumption Paper for both the North Central and Goulburn Broken CMA regions.

Step 11 develops an unrestricted package of Management Actions without considering financial, social or physical constraints to determine what actions could be put in place to meet the interim KPI target set in Step 9. The unrestricted package is also used to determine if the achievement of the interim KPI targets is possible given the current Management Actions available.

In **Step 12** Management Actions that will be used as Performance Indicators (PIs) are chosen. Performance Indicators can only be chosen from those Management Actions with an unrestricted implementation target (from Step 11), and that can be feasibly implemented and monitored. The social, physical and environmental consequence of implementing each of the Management Action PIs is considered in Step 12 and the package of actions modified until a satisfactory level of risk has been obtained. This package forms the 50 year (Aspirational) interim 'Restricted' Management Action package. At this step the package is not limited by budget.

Step 13 involves documenting the change in Resource Condition expected from the interim package of Management Actions, comparing the resulting KPI outcomes to the interim KPI targets set in Step 9 and then modifying the package of irrigation related Management Actions and/or the interim KPI targets for the catchment as required (using a risk based determination tool). This may involve repeating Steps 9 to 13. At the end of this step, targets for 5 year, 20 year and 50 year Management Action PI and Resource Condition KPI are adopted.

The last step of the DSS (**Step 14**) allows the comparison of Management Action PI and Resource Condition KPI targets to ensure consistency across the catchment and the CMA region and finally the formal adoption of the PI and KPI target package.

At the end of the DSS a set of irrigation drainage water quality targets are produced that are adopted by the CMA and incorporated into the regional catchment strategies and plans. The intention is that each catchment will be regularly reviewed and updated using the DSS with the acquired monitoring data to reassess the suitability of the KPI and PI targets.

CASE STUDY
Following a trial application of both stages of the DSS on the Lower Broken Creek and Barr Creek catchments, the DSS was then applied to the full Broken Creek catchment.

The Broken Creek catchment is located in the Goulburn Broken CMA region (GBCMA) and is made up of four drainage sub catchments; Barmah-Nathalia and Muckatah to the north and Tallygaroopna and Invergordon to the south. The catchment extends from Rice's Weir in the west to approximately Katamatite in the east comprising approximately 95,200 ha of irrigated land and 56,300 ha of dryland.

Upstream of Katamatite there is an additional 193,500 ha draining to Rice's Weir. The average and peak flows over Rice's Weir are 302 ML/d and 2150 ML/d respectively. The Broken Creek catchment is shown in **Figure 3**.

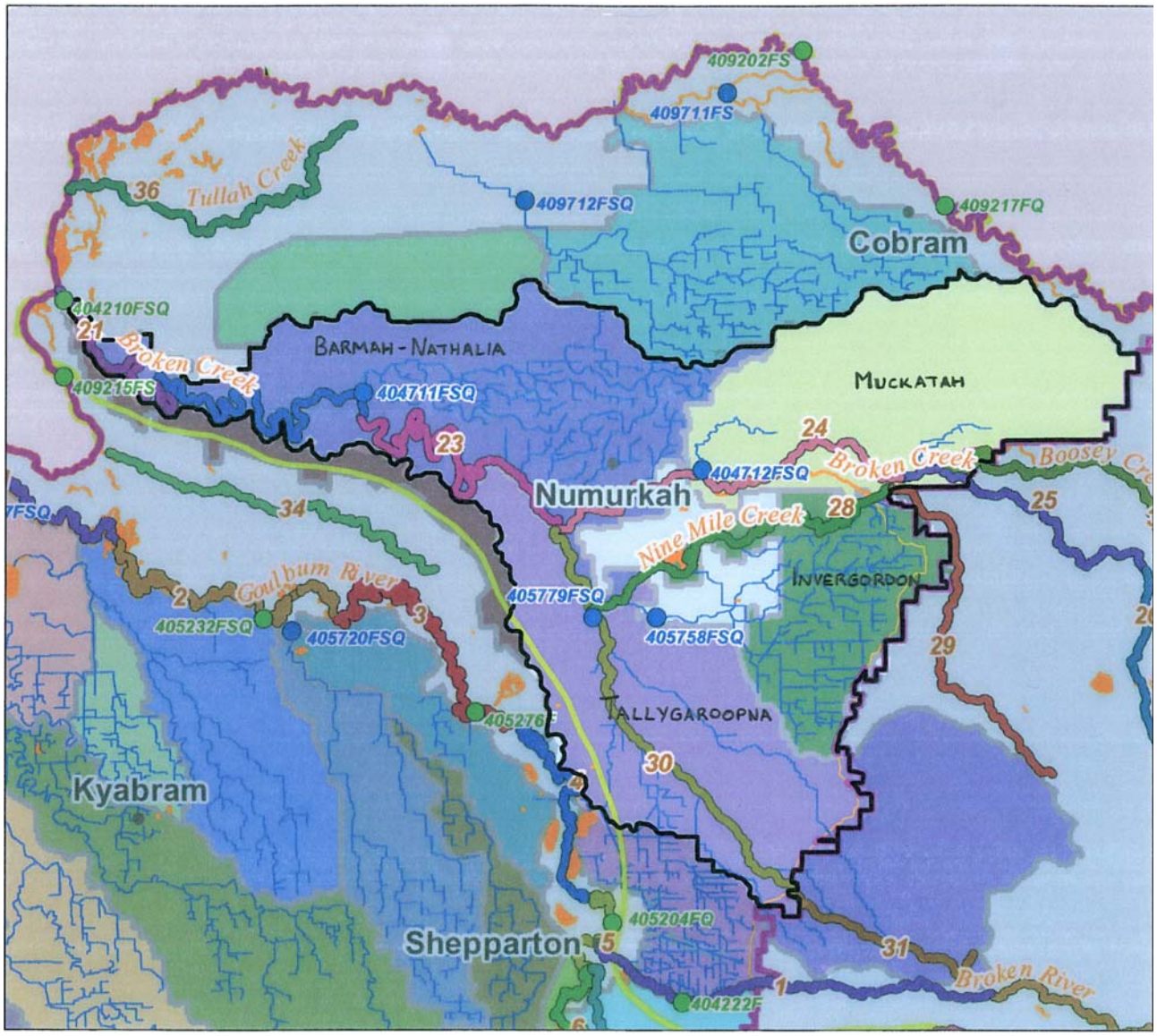

Figure 3: Location of Broken Creek catchment

Six reaches (defined in the Index of Stream Condition) were identified in applying the RRC DSS. These reaches are Broken Creek reaches 21-25 and Nine Mile Creek reach 28. The priority values determined for these reaches were related to fish (mainly Murray Cod) and water supply delivery. The main threats to these values were identified, and using the conceptual models, it was determined that Total Phosphorus in the lower reaches and Suspended Solids in the upper reaches would be appropriate parameters to choose as Key Performance Indicators (KPIs).

No new monitoring sites were proposed but additional monitoring for the KPI parameters was required at two sites. This required no capital expenditure but an additional $2,000 in annual expenditure.

Total phosphorous and suspended solids were identified as the most important reporting parameters. The interim 50 year Total Phosphorus (TP) targets recommended for adoption at Rices Weir was a concentration of 0.21 mg/L and a load of 24.3 t/yr. Due to a lack of monitoring data and specific targets (i.e. SEEP WoV and ANZECC) for suspended solids, a logical 50 year load target could not be set. Rather than set a meaningless target it was recommended that 5 years of monitoring be carried out and a SMART target set in the next cyclic review of the DSS.

The application of the RMA DSS recommended the following 50 year Management Action targets:

- Construction of an additional 1,000 ML capacity of farm irrigation reuse systems;
- An additional 1,500 ML of low flow drainage diversion;
- An additional 2,200 ML of high flow diversion storage;
- Diversion of drainage water to offline wetlands with a total capacity of 116 ML, and
- Construction of 2.8 km of inline wetlands.

Based on this package of works the 50 year KPI target load for Total Phosphorus outfalling to the Murray River at Rice's Weir is 16.3 t/yr.

In addition to the management actions detailed, it is expected that there will be a number of other complementary management actions that will occur in the catchment such as fencing of streamsides and drains, reducing sediment and effluent entering drains. These actions will most likely have a positive effect on the resource condition loads but have not been quantified as part of this application of the DSS.

Throughout the application of the DSS to the Broken Creek catchment, key irrigation and drainage management stakeholders were engaged. Workshops were undertaken with an ecological expert and members of the GBCMA, G-MW, EPA and DSE to clarify the values, risks and threats identified in each reach and the water quality KPI targets for the catchment.

It should be noted that unless data is readily available, this is not a quick process. For the Broken Creek work commenced on Step 1 in March 2006 and Step 14 was completed in February 2008. A large amount of data is required from many varied sources. A lack of data, the need to amalgamate data, and competing demands on data providers added to the time taken to work through the process.

Irrigation system automation and modernisation is being implemented throughout the Goulburn Broken catchment, and it is anticipated that drainage outfalls and nutrient loads will alter with a modernised irrigation system throughout the catchment. Once data from the changed conditions are available, the DSS will need to be re applied and possibly modified to reflect these altered conditions.

SUMMARY

The IDMOU has been operating for four years now and has resulted in a significant improvement in communication and common understanding between stakeholders, has minimised conflict and provided a higher degree of transparency in target setting. Some achievements since implementation of the IDMOU include:

- Completed setting of water quality targets in the Broken Creek catchment and a method developed for setting future irrigation drainage related water quality targets in other catchments
- Planning permit application assessment times for new drains has reduced due to improved communication amongst signatories
- Drainage catchment and asset management plans are being prepared

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AUTHOR BIOGRAPHIES

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Peter Alexander is an experienced agricultural and civil engineer who has been extensively involved with the strategic and detailed design and operation of irrigation water supply, and surface and sub surface drainage systems aimed at improving catchment health.

Peter worked for the Rural Water Authority for 23 years prior. Since then Peter has been a consultant and is currently the Managing Director of Hydro Environmental.

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Meegan Davies is an environmental scientist with 7 years experience in the water and natural resource management industry. Meegan's experience includes project and budget management, reconciling rural water authority's bulk entitlements, organisation and participation in field work for a range of surveys and river health assessments, literature reviews.

Meegan has worked for the Goulburn Broken Catchment Management Authority and later in consulting for Sinclair Knight Merz, and now Hydro Environmental where she is working on IDMOU related issues.

Sam Green – BE (Env), MEngSci, GradIE Aust
Sam Green is an environmental engineer with over 10 years experience in the irrigation and drainage industry. Sam's experience in irrigation drainage includes, design, project management, consultation, water quality monitoring and policy development.

Sam's current role is to ensure that Goulburn-Murray Water and the two Catchment Management Authorities fulfil their obligations under the IDMOU.

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