Review of the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002

Discussion paper

You are invited to provide feedback on this discussion paper

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Have your say

This discussion paper:

- explains why the EPA is reviewing the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002 (the Regulation)
- provides a scope and framework for the review of the Regulation, and
- provides focus questions and outlines key issues with the Regulation and the Hunter River Salinity Trading Scheme (the Scheme) that have been identified, and how they could be addressed.

You are invited to provide a submission or comment on this discussion paper. Your feedback on any of the focus questions or specific issues outlined in this discussion paper is welcome, together with any other matters relevant to the scope of the review.

This discussion paper is available at: www.epa.nsw.gov.au/licensing/hrsts/regreview.htm.

Please provide your comments to the EPA by:

- emailing HRSTS.Review@epa.nsw.gov.au
- phoning 131 555
- posting your submission to:

  POEO (HRSTS) Regulation Review
  Reform and Compliance Branch
  Environment Protection Authority
  PO Box A290
  Sydney South NSW 1232.

Submissions close at 5 pm on 7 February 2014.

Definitions and abbreviations

EC	Electrical conductivity – a measure of the ability of water to pass an electrical current, measured in microsiemens per centimetre (μS/cm). It is a way of measuring salinity (see Section 2.1.1, Box 1).
EPA	NSW Environment Protection Authority
MERF	Managed Envelope of Residual Flows
μS/cm	Microsiemens per centimetre, which is the electrical conductivity (EC) of water
OEH	Office of Environment and Heritage
Operations Committee	Stakeholder representative committee established under the Regulation to advise the EPA on the operation of the Scheme
POEO Act	*Protection of the Environment Operations Act 1997*
The Regulation	Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002
The Scheme	Hunter River Salinity Trading Scheme
TAD	Total allowable discharge

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1 Introduction and overview

The Hunter River Salinity Trading Scheme (the Scheme) operates within the Hunter River catchment, New South Wales (NSW), to minimise the impact of saline water discharges from industry on Hunter River water users and the environment. The Scheme does this by only allowing industry participants to discharge saline water when there is a lot of low salt, fresh water in the Hunter River, and it uses a system of tradeable salinity credits to limit the amount of salt that can be discharged at any one time.

The Scheme was established under the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002 (the Regulation)[1] on 1 December 2002, following a successful pilot. The NSW Environment Protection Authority (EPA) administers the Scheme.

Appendix A provides a history and overview of how the Scheme operates.

The Regulation requires the Minister for the Environment to undertake a review of the Regulation after it has been in force for ten years. This is now due.

1.1 Purpose and objectives of the Regulation review

The purpose of the review is to:

- undertake the statutory ten year review of the Regulation
- improve the Regulation to make it a more effective and efficient tool for managing discharges of saline water into the Hunter River catchment under the Scheme.

The objectives of the review are to:

1. review the Regulation and the components of the Scheme set out in the Regulation
2. examine the effectiveness of the Scheme in managing the impact of saline water discharges in the Hunter River catchment
3. examine the efficiency, equity and ease of use of the Scheme for its participants and for the EPA.

1.2 Scope and timeframe for the review

This review is *not* a review of the fundamental basis of the Scheme. This was considered at the time the Regulation was first developed and is outlined in the Regulatory Impact Statement (EPA 2001).

This review will start with the premise that the Scheme (as established by the Regulation) is the overall preferred mechanism for controlling saline water discharges in the Hunter River catchment and the focus will be on how the Regulation can be improved.

This review has a strong focus on the Regulation and the components of the Scheme that are set out in the Regulation, rather than the broader day-to-day operational elements of the Scheme (the following sections further explain this distinction).

However, it is anticipated that general operational improvements to the Scheme will be identified via the review. This review may also recommend further investigations that might be conducted to improve the Scheme in the longer term. This is illustrated in Figure 1 below.

The EPA is committed to finalising the review of the Regulation (including legislative amendments) by the end of 2014.

[1] The Regulation can be accessed by browsing the 'in-force regulations' on the Legislation NSW website www.legislation.nsw.gov.au

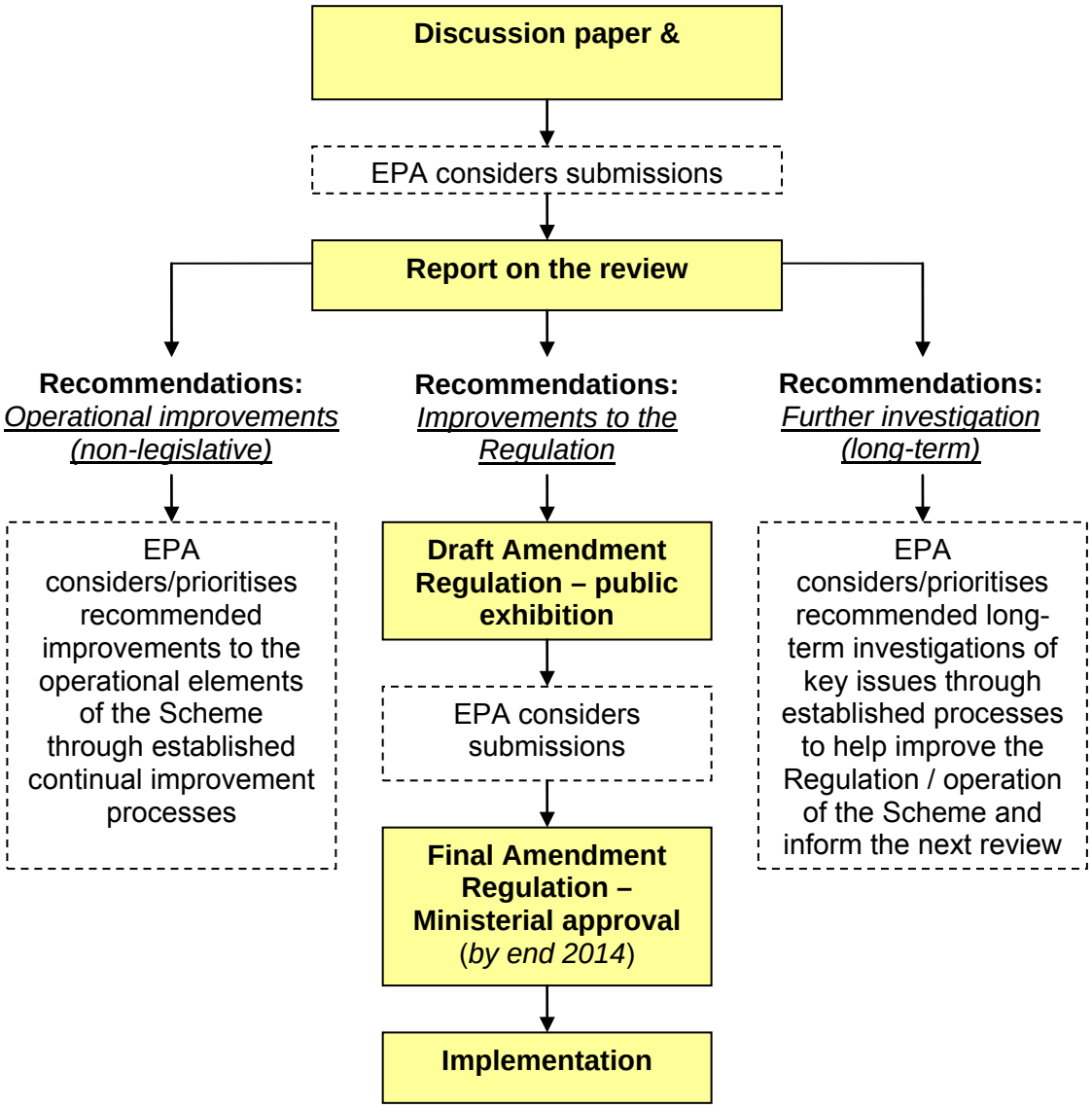

Figure 1: The process for reviewing the Regulation (indicated with yellow shading)

Note: The review allows sufficient scope for recommendations to be made for general improvements to the operational elements of the Scheme (non-legislative) and for longer-term investigation of key issues, however these will be considered separately from the main review.

1.3 What is covered by the Regulation?

The Regulation establishes the higher-level aspects of the Scheme, allowing much of the general operational, day-to-day elements of the Scheme to be determined by the EPA and refined over time as needed (see Section 1.4 below).

For example, the Regulation requires the establishment of various tools for managing and administering the Scheme such as: a River Register, a Credit Register, an online credit trading facility and regular credit auctions. However, the form, operation and maintenance of these tools are not specified by the Regulation.

The Scheme Operations Committee is also established under the Regulation to advise the EPA on the operation of the Scheme. The Operations Committee is appointed by the EPA and is made up of representatives of: licence holders (industry), the Catchment Management Authority, irrigators, environmental interests and the NSW Office of Water. Appendix A provides a list of current committee members (see Table A3).

The process for improving the Regulation that underpins the Scheme involves a formal Regulation-amendment process (see Figure 1 above – yellow shaded steps). This discussion paper represents the first step in this process.

Depending on the significance of the proposed amendments, a Better Regulation Statement may also be required. Formal public consultation is required for significant proposals.

1.4 What are the 'operational elements' of the Scheme that sit outside the Regulation?

As mentioned above, the Regulation allows the EPA to determine the form, operation and maintenance of many of the Scheme tools established in the Regulation, such as the River Register, the online credit trading facility, and auctions. Since the Regulation commenced in 2002, these elements have been developed, implemented and progressively improved by the EPA with advice from the Operations Committee.

Some examples of improvements made to the Scheme through this process include:

- improved information technology – moved from a paper-based to an online credit trading system
- improved service delivery – moved to 24/7 delivery of flow modelling and River Register notification
- improved communication equipment – currently moving from radio to digital telemetry
- improved accountability and transparency – publication of auction reports and annual summary brochures of the Scheme's performance
- improved education – delivery of training for new staff at existing facilities and for new Scheme entrants
- improved auctions – review of the auction design to improve auction efficiency (due for implementation in 2014).

These types of operational improvements do not typically require amendments to the Regulation.

1.5 Purpose and structure of this discussion paper

The purpose of this discussion paper is to engage stakeholders in the review of the Regulation. The EPA developed this discussion paper, including the focus questions and key issues, in consultation with the Operations Committee (see Section 1.3 above).

This paper is structured as follows:

Section 1 an introduction and overview of the review and the development of this discussion paper

Section 2 the main discussion, including focus questions and discussion of key issues already identified

Appendices further detailed background information and in-depth discussion of some elements of key issues.

1.6 Hunter Catchment Salinity Assessment 2013

The EPA commissioned the Office of Environment and Heritage (OEH) to undertake a Hunter Catchment Salinity Assessment to inform this discussion paper and the review generally. It was a desk-top review and gap-analysis of available water quality data (primarily salinity/conductivity) and aquatic ecological health data in the Hunter River catchment upstream of Singleton, to assist in the evaluation of the effectiveness of the Scheme.

The results of the Assessment have influenced the discussion around many of the issues raised in this discussion paper.

The Assessment report is available at: www.epa.nsw.gov.au/licensing/hrsts/regreview.htm. An overview of the key findings of the Assessment is provided in Appendix B.

1.7 Next steps

The EPA invites stakeholder feedback on the questions and issues outlined in this discussion paper. The issues raised will be considered by the EPA in consultation with the Operations Committee.

Based on stakeholder feedback, and the EPA's own review of some technical aspects of the Regulation (see Section 2.3, **Other technical improvements**), the EPA will prepare and publish a report on the review. This report will set out recommendations for improving the Regulation and for non-legislative improvements to the Scheme, including where longer-term investigations and analysis may be warranted (see Figure 1 above).

2 Discussion

2.1 Environmental effectiveness

2.1.1 Overview

Salt is a natural component of the water in our waterways and is present in all water systems at varying levels. Many of the streams and drainages in the Hunter River catchment have naturally high salinity levels due to the underlying marine and estuarine sedimentary rock, which contains significant amounts of salt. However, human-induced elevated salinity levels in river systems (e.g. through industrial emissions, dry land salinity, etc.), as has been the case in the Hunter, can upset the natural water chemistry and ecosystem balance causing measurable negative environmental and social impacts (Muschal 2006).

Further information on the Hunter River catchment, the nature of the salinity problem and a history and overview of the Scheme, can be found in Appendix A.

The Scheme works on the principle that saline water discharges from industry can be adequately diluted by large amounts of fresh water in the Hunter River system. The Scheme works to allow controlled discharges of saline water during high flows and flood flows (see Appendix A, Table A1 for flow categories). No discharges are allowed during low flow as there is not enough fresh water in the system for dilution.

Under the Scheme, saline water discharges are managed so that they do not cause salinity levels in the Hunter River (measured as electrical conductivity) to exceed 600 microsiemens per centimetre (μS/cm) at Denman and 900 μS/cm at the Glennies Creek confluence and at Singleton during high flows (see Appendix A, Table A2 for more detail on the targets). These targets were agreed in consultation with stakeholders because:

- they were believed not to exceed the long-term natural averages that would occur in the absence of point-source discharges, and
- water users would not accept further deterioration of water quality beyond those levels (EPA 2001).

Box 1: Why was electrical conductivity chosen to measure salinity under the Scheme?

Electrical conductivity is a measure of the ability of water to pass an electrical current and is a collective measure of the amount of dissolved ions present in the water. Electrical conductivity was chosen as the preferred measure of salinity because it can be measured precisely and accurately, is relatively easy to measure (using a probe or meter) and the measurements can be automated so that monitoring occurs at high frequency (hourly or less). This has significant advantages for monitoring conductivity in streams in near-real time and for later use in salinity models. Conductivity is affected by temperature (i.e. the warmer the water, the higher the conductivity). For this reason, electrical conductivity (in μS/cm) is usually reported as electrical conductivity at 25 degrees Celsius.

Since the Scheme commenced, salinity targets have not been exceeded, except when salinity was primarily sourced from diffuse or natural (e.g. groundwater) processes (EPA 2013a).

This review is considering the extent to which the Scheme, including these salinity targets, is working to manage the impacts of saline water discharges on the health of aquatic ecosystems and on water users in the Hunter River catchment.

The ongoing success of the Scheme has led to an increased stakeholder interest in how the coverage and benefits of the Scheme could be extended beyond the current boundaries. There is also concern about external factors that may impact on the future success of the Scheme.

2.1.2 Overarching focus questions

Focus question 1: Is the Scheme (including salinity targets) working to manage the impacts of saline water discharges on aquatic ecosystems in the Hunter River catchment? What improvements could be made to the Regulation?

Focus question 2: Is the Scheme (including salinity targets) working to manage the impacts of saline water discharges on irrigators and other water users in the Hunter River catchment? What improvements could be made to the Regulation?

In your response, you can address these questions directly and/or respond to the discussion of key issues identified below.

2.1.3 Identified key issues

Issue 1: Altering salinity targets

Since commencement of the Scheme, the 900/600 μS/cm salinity targets in the Hunter River have not been exceeded, except where salinity was primarily sourced from diffuse or natural (e.g. groundwater) processes (see Appendix A, **River salinity levels before and during the Scheme**).

However, do these targets remain appropriate for protecting water quality for aquatic ecosystems and agriculture? Should the targets be lowered? Or is there scope to raise them?

The Salinity Assessment (EPA 2013a), sought to assess the overall effectiveness of the Scheme on surface water quality. The results of the Assessment indicate that the Scheme has:

- had little effect on flows and electrical conductivity levels in the Hunter River upstream of Denman
- reduced electrical conductivity levels at (and immediately upstream of) Singleton and Greta
- potentially reduced electrical conductivity levels at monitoring stations between Denman and Singleton.

The Salinity Assessment also found that there was little evidence that groundwater levels or the electrical conductivity of groundwater have been rising in recent times (except perhaps in some very localised areas). However, available monitoring data is scattered and limited, which makes it challenging to determine trends over time and space.

If future trends in groundwater level and conductivity are to be undertaken and related back to the impact of the Scheme (or mining or power generation), then a more comprehensive and representative groundwater monitoring program is required for the catchment.

Participant discharges have, over the life of the Scheme, represented approximately 10% of the entire salt load of the Hunter River at Singleton. However, recent averages are in the order of 13–20% of total annual salt load (EPA 2013a). This demonstrates that the

Scheme is working to allow a greater discharge of salt into the catchment, without exceeding salinity targets.

Ecosystem impacts

What sort of impact are salinity levels in the Hunter River having on aquatic ecosystems?

The Salinity Assessment (EPA 2013a) considered ecological health in terms of the health of the macroinvertebrate community, which is the most commonly used indicator of stream health worldwide.

The findings of the Assessment include the following:

- The available data suggests that throughout the catchment, macroinvertebrate 'health' is on average good, but there are some areas where this is quite poor.
- Although salinity is one of several factors affecting stream macroinvertebrate communities in the Hunter River catchment, salinity appears to be a relatively important factor.
- The weight of scientific evidence suggests that current Scheme salinity targets should not be raised. Further scientific analysis and modelling would be required to support altering the existing Scheme salinity targets in the future, in order to better understand existing salinity impacts on ecosystem health in the Hunter River and its tributaries.
- Experimental studies are recommended in order to fully understand the environmental effects of the different components of saline water discharged to the Hunter River catchment (e.g. ionic composition, metals/metalloid contamination, etc.) (further discussed under Issue 5 below).

An overview of the Salinity Assessment and key findings is at Appendix B.

Impacts on agriculture and other water users

What sort of impact are salinity levels in the Hunter River having on the agriculture sector and other water users?

The Scheme was primarily driven by increases in industrial salt water releases (from coal mines and power stations) during the late 1980s to early 1990s, that threatened the viability of irrigation enterprises along the Hunter River. The reported impacts on agriculture included reduced pasture growth and crop failure. This in turn also threatened the future expansion of the coal mining industry in the Hunter Valley (see Appendix A for more detail on the history of the Scheme).

As mentioned above, the 900/600 μS/cm salinity targets were set in consultation with stakeholders, and on the advice of irrigators, which was that they would not accept deterioration beyond those levels (EPA 2001).

The EPA is considering not raising salinity targets at this time, based on the findings of the Salinity Assessment (EPA 2013a).

Would a Regulation amendment be required?

Yes. Since salinity targets for the Scheme are set out in the Regulation, any alteration of these targets (now or in the future) would require an amendment to the Regulation.

Further investigations, including scientific analysis and modelling, would be required in order to support any deviation from the current salinity targets. This analysis would also need to consider that current discharge opportunities are not being fully utilised (see Issue 2 below). It is unlikely that this work can be completed within the timeframe set for the review of the Regulation (see Section 1.2).

Issue 2: Increasing discharge opportunities

There have been requests from some Scheme participants that the EPA investigate whether it would be possible to increase discharge opportunities under the Scheme, without compromising the current salinity targets, the health of the river or the integrity of the Scheme.

The Salinity Assessment found that, on average over the life of the Scheme, participants have utilised approximately 25% of the given opportunities to discharge [i.e. of the 'total allowable discharge' (TAD)]. However, recent averages are in the order of 40–50% of the TAD.

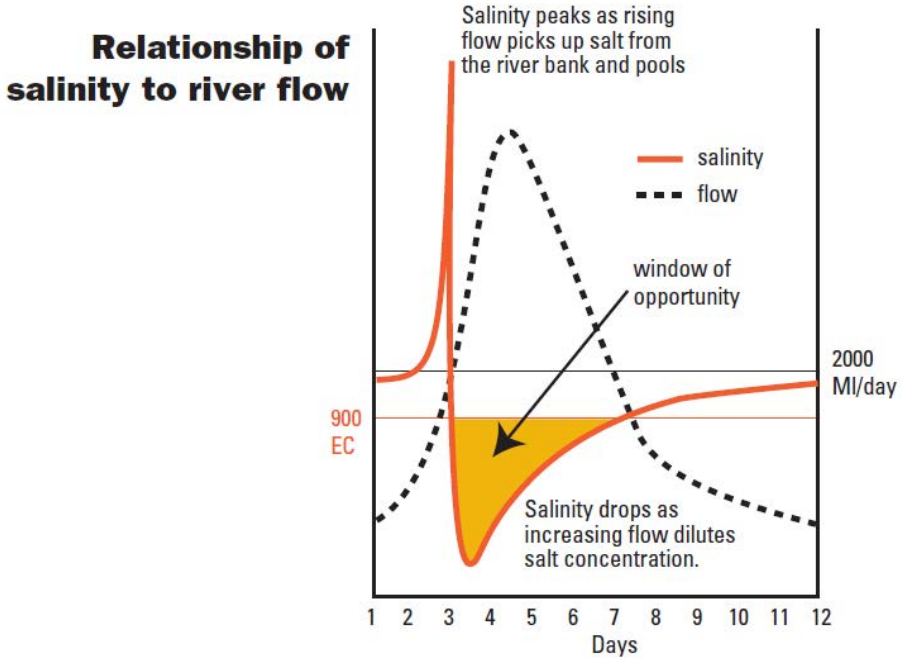

Figure 2: Relationship of salinity to river flow – showing the discharge opportunity (shaded orange)

Source: DEC 2006.

The most likely reasons why participants have not been able to make full use of discharge opportunities have been considered. These include:

- A participant(s) who holds credits does not want / need to discharge during a given event (e.g. their water storage has plenty of capacity; they are inclined to retain water for beneficial re-use on-site; or they can transfer water between premises for use or storage). They decide not to trade their credits.
- A participant(s) who holds credits is unable to discharge during an event because they did not have enough lead-in time to organise the discharge or the opportunity to discharge was at an inconvenient time (e.g. in the Upper Sector during a relatively short high flow event). They have no time to trade credits and/or discharge.
- A participant(s) who holds credits is unable to discharge the full volume of saline water they would have liked within the designated discharge period because of infrastructure limitations or water discharge volume limits on their environment protection licence.

Once the barriers to full utilisation of the current TAD are understood, possible ways to address these barriers can then be explored. For example, whether the Scheme could better facilitate temporary trades for a specific discharge event, or make better use of the latest communication technologies.

Finally, if these barriers cannot be adequately addressed, options for increasing discharge opportunities under the current salinity targets could then be explored, such as:

- allowing some discharge under low flow conditions (e.g. allow discharge where the discharge water quality is the same or better than the ambient water quality)
- changing the definition of a 'high flow' event so an event is triggered at a lower flow
- removing restrictions during flood flows.

It is crucial that any options explored seek to ensure that the salinity targets are not compromised and can demonstrate there will be no negative downstream impacts.

Questions to aid consideration of this issue:

- What challenges are participants facing with discharging under the current Scheme arrangements?
- Are there specific challenges being faced by the upper, middle or lower sectors? How could these be addressed?
- What is preventing the full utilisation of the current discharge opportunities under the Scheme?
- What other ways could we increase discharge opportunities without compromising the existing salinity targets?
- How could the Regulation be improved?

Would a Regulation amendment be required?

Depending on what is proposed, increasing discharge opportunities under the Scheme could be achieved either through amending the Regulation (e.g. changing the definition of a high flow event), or through simply making operational improvements to the Scheme (e.g. better facilitation of temporary credit trades), which would not require a change to the Regulation.

Further investigations or analysis may be required before a change can be implemented and the timing of this work would need to be considered (see Section 1.2).

Issue 3: Other significant sources of salt within the Scheme area

Participation in the Scheme is mandatory for all licensed premises in the area of the Scheme that are authorised, via their environment protection licence, to discharge saline water into the Hunter River catchment. Saline water is defined in the Regulation as water with an electrical conductivity of >400 μS/cm.

Current participants include licensed coal mines and coal-fired power stations. Participants must abide by the Scheme rules (the Regulation) and the conditions on their environment protection licence (see Appendix A, **Scheme participants**).

If there are other significant non-licensed sources of salt entering the Hunter River, this may compromise the effectiveness of the Scheme and/or limit opportunities for existing participants to discharge.

Possible sources of saline water within the area of the Scheme could include:

- industrial point-source discharges (e.g. sedimentation dams, sewage treatment plants)
- other point-source discharges (e.g. farm dams, effluent ponds, manufacturing)
- diffuse sources (e.g. saline water runoff from cleared areas within the catchment suffering from dryland salinity, excessive fertiliser application), and/or
- natural sources (e.g. groundwater).

These possible sources of salt could be further investigated in order to examine whether the source of salt:

a) is significant

b) is/has potential to compromise the effectiveness of the Scheme

c) is able to be adequately controlled, managed or mitigated, and/or

d) could/should be brought into the Scheme.

As mentioned previously, the current trigger for participation in the Scheme is an environment protection licence that authorises the discharge of saline water into the area of the Scheme. Therefore, it may be possible to bring newly identified significant industrial point sources of salt into the Scheme by simply using the existing licensing regime.

Where a licence already exists, the EPA could vary it to capture the saline water discharge. If there is no existing licence (and no scheduled activity being carried on at the premises), the EPA could issue a specific water pollution licence. However, the limitations of this approach are that the EPA cannot direct or force a person to apply for a water pollution licence, and a variation to an existing licence may be appealed by the licensee (under the POEO Act).

If the existing licensing regime does not provide a suitable solution for capturing identified significant sources of salt, the EPA could explore whether the Regulation could be changed to capture these sources.

Both approaches would require thorough consideration.

Questions to aid consideration of this issue:

- Are there any additional significant sources of salt within the area of the Scheme that should be investigated for possible inclusion in the Scheme?
- Could these sources be brought into the Scheme?
- If not, what other measures could be used to control, manage or mitigate these sources of salt?
- How could the Regulation be improved?

Would a Regulation amendment be required?

Depending on what is proposed, capturing other significant sources of salt within the Scheme area could be achieved either through amending the Regulation or through simply making operational improvements to the Scheme (e.g. varying existing licences, or issuing new water pollution licences), which would not require a change to the Regulation.

Further investigations or analysis may be required before a change can be implemented and the timing of this work would need to be considered (see Section 1.2).

Issue 4: Salt from the Goulburn River subcatchment

The Goulburn River is a major tributary that converges with the Hunter River below Denman (i.e. in the middle sector of the Scheme). However, the Scheme only operates in the Goulburn River tributary downstream of Kerrabee. The upper Goulburn River is not captured by the Scheme (see map in Appendix A, Figure A5).

Three coal mines (Ulan, Wilpinjong and Moolarben) currently have environment protection licences in the Goulburn River subcatchment and further mining and coal seam gas exploration and production is proposed in this area. These mines are not part of the Scheme.

At times, the Goulburn River subcatchment contributes relatively high salinity water to the Hunter River. Salt loads, while highly variable, can at times be greater than the salt load measured in the Hunter River at Denman. This is due to both natural salt inputs and saline water discharges from mining operations (EPA 2013a).

During low flows, saline water tends to accumulate in the lower Goulburn River. Then, when there is a high rainfall event and this saline water is mobilised, it can cause a spike in salinity levels in the Hunter River. This in turn can limit the discharge opportunities for Scheme participants in the Hunter.

The primary reason the upper Goulburn River subcatchment is not captured by the Scheme is that it is not possible to give these mines adequate advanced warning of discharge opportunities, as they are high up in the catchment. High flows at the headwaters of the Goulburn River catchment following rainfall are also relatively short in duration. These mines would need to start discharging their saline water before there is any actual flow data, by relying on weather forecasting to predict what is going to happen in the rest of the catchment. This is technically difficult and risky because the high flows may not eventuate.

While it may be technically impractical to extend the Scheme into the upper Goulburn River subcatchment, alternative complementary strategies could be explored.

There are salt management plans associated with all of the existing mine licences in the Goulburn River subcatchment and the EPA works closely with these mines to ensure that discharges do not compromise the Hunter Scheme. However, with increased mining development and coal seam gas exploration and production in the area, the pressure for appropriate ways of discharging saline water will increase.

The Salinity Assessment identified that there is currently limited water flow and salinity monitoring in the upper Goulburn River catchment. Further strategic real-time monitoring of flow and salinity in the subcatchment is recommended (EPA 2013a).

Recent investigations by the coal mining industry and the NSW Office of Water have produced some preliminary work characterising salinity and flow data in the Goulburn River subcatchment, and have also highlighted the need for a representative water quality monitoring network.

There is also current work underway by the NSW Office of Water to improve the reliability of existing real-time salinity monitors across the Hunter River catchment, including the Goulburn River subcatchment.

More investigation and analysis of this issue would be required to determine how best to manage inputs of salt from mines in the Goulburn River subcatchment. Such analysis could include:

- assessment of discharge opportunities and limits for Goulburn River mines
- assessment of the feasibility of different discharge models
- assessment/modelling of potential downstream implications within the Goulburn River subcatchment and for the Hunter River (for water users, Scheme participants and the environment)
- the extent to which discharges from Goulburn River mines currently limit the ability of Hunter participants to discharge under the Scheme
- how mine expansion and development and coal seam gas development in the Goulburn River subcatchment may impact on the Hunter Scheme.

Questions to aid consideration of this issue:

- What opportunities exist for managing saline water discharges from Goulburn River mines?
- How could the Regulation be improved?

Would a Regulation amendment be required?

Formally capturing salt sources from the Goulburn River subcatchment under the Scheme would require an amendment to the Regulation. However, any complementary measures that are proposed (e.g. improving current discharge models) would not be likely to require a change to the Regulation.

As mentioned above, more investigation and analysis of this issue would be needed in order to determine how best to manage inputs of salt from mines in the Goulburn River subcatchment. This may require consideration beyond the timeframe set for this review of the Regulation (see Section 1.2).

Issue 5: Other pollutants present in saline water discharges

A range of pollutants can be present in mine waste water due to the liberation of naturally occurring salts and minerals (including metals/metalloids) as the mining process exposes rock and soil to weathering and leaching. Fuels, oils and other additives used in the mining process can also end up in the waste water. In power generation, leachate and discharges from ash dams often contain a range of contaminants, including salts and trace metals.

Some stakeholders have voiced concerns about potential pollutants (other than salts) present in water that is discharged in accordance with the Scheme and that the Scheme should be broadened to cover these pollutants (e.g. metals/metaloids, pH). There is certainly a desire from some stakeholders, particularly water users, to better understand these water quality issues and to have better access to water quality data for the catchment (see Issue 10).

The management of the cumulative impact of industrial saline water discharges is a major issue for the Hunter River and was the source of significant community tension (see Appendix A). The EPA introduced the Scheme to specifically deal with these cumulative impacts.

However, the Scheme is only one of the tools the EPA uses to regulate water quality in the Hunter River catchment. The existence of the Scheme in no way limits the ability of the EPA to regulate and seek to manage the localised and cumulative impacts of other pollutants through requirements placed on environment protection licences.

For example, current Scheme participants have discharge limits on their licences relating to pH (typically limited to within pH 6.5 – 9.5) and total suspended solids (TSS) (typically limited to a concentration of 120 mg/L) (see Appendix A, Table A4).

It is also the responsibility of licence holders to be aware of the pollutants discharged from their premises, to understand the environmental impacts and to ensure that their licence provides them with appropriate defences.

See Appendix C for more detailed information about how the EPA uses licences to regulate water pollution.

In addition, a fundamental principle of the Scheme is that the impact of saline water on the environment can be managed through adequate dilution with fresh water. The Scheme has been designed to only allow saline water to be discharged under high or flood flow conditions, which allows for this dilution. When considering the impact of other pollutants, the dilution effect of the Scheme should also be considered.

However, while the Scheme provides an effective and efficient framework for the management of the cumulative impacts of salt discharges into the Hunter River, this is largely based on an assessment of salinity expressed as either total dissolved solids (mg/L) or as electrical conductivity (μS/cm) (EPA 2013a). See also Box 1 in section 2.1.1.

Recent research suggests that the different ions that make up salinity can have varying degrees of toxicity (e.g. high levels of bicarbonate ions have recently been shown to be a problem). That research also suggests that other contaminants within mine water (e.g. dissolved metals/metalloids) can have their own negative impacts (EPA 2013a).

A recommendation of the Salinity Assessment is that further experimental studies would be useful to fully understand the environmental effects of the different components of saline water discharged to the Hunter River catchment by Scheme participants (e.g. ionic composition, metals/metalloid contamination, etc.) (EPA 2013a). The dilution effect that is already a part of the Scheme's design should also be taken into account when considering how to manage the potential impacts.

Would a Regulation amendment be required?

A proposal to formally capture other pollutants under the Scheme would require an amendment to the Regulation. However, other proposals to improve the way that other pollutants are considered (e.g. through improving the transparency of data or through improving licensing) would not require a change to the Regulation.

Further investigations or analysis may be required before a change can be implemented and the timing of this work would need to be considered (see Section 1.2). The proposed study (if conducted) on the composition and impacts of saline water discharges (described above) would require consideration beyond the timeframe set for the review of the Regulation.

2.2 Cost-effectiveness

2.2.1 Overview

One of the benefits of market-based environmental regulation (such as pollutant trading schemes) is that it can provide greater flexibility and has the potential to reduce emissions at substantially lower cost than the traditional command-and-control approach to regulation (USEPA 2003; Tietenberg 2006).

The goal of a credit-based market should be the cost-effective allocation of those credits to those who value them the most. Different participants typically will have different costs associated with directly controlling their emissions at their premises, based on a variety of site-specific technological, operational and economic issues. The benefits of having transferable emissions credits is that those premises that can control their emissions at the lowest overall cost will find it in their interest to do so because they can then sell their excess credits to those participants who find it cheaper to buy credits than to install on-site emission-control equipment (Tietenberg 2006).

The review of the Regulation is considering the extent to which the Scheme is operating in an efficient and cost-effective manner and whether it provides an ongoing financial incentive for participants to better manage their saline water discharges or to discharge only in conditions that will minimise environmental impacts.

As mentioned in Section 1.2, this review will not be considering whether the Scheme is the most cost-effective option for managing salt in the Hunter River, as this was considered at the time the Regulation was made (see Regulatory Impact Statement: EPA 2001). Rather, this review focuses on how the Regulation can be improved, including improvements to make it more cost-effective to run for Government and participants.

Improving the cost-effectiveness of the Regulation and the operation of the Scheme can be achieved by considering the critical administrative and governance elements of the Scheme, such as the efficiency of the credit auction and trading processes.

2.2.2 Overarching focus questions

Focus question 3: Is the Scheme operating efficiently and cost-effectively? What improvements could be made to the Regulation?

Focus question 4: Is the Scheme providing an ongoing incentive for Scheme participants to reduce the environmental impact of their saline water discharges? What improvements could be made to the Regulation?

In your response, you can address these questions directly and/or respond to the discussion of key issues identified below.

2.2.3 Identified key issues

Issue 6: Removing the flood flow exemption

Under the existing Scheme rules for flood flows, participants can discharge under flood flows without credits, provided that overall salinity targets are not breached. Discharges under flood flows are, however, still limited to the discharge volume limit specified in each environment protection licence (e.g. tributary protection limit or other discharge limit). See Table A4, Appendix A.

In all conditions (i.e. during flood or high flows), saline water is only permitted to be released from the licensee's Scheme discharge point(s), as specified on their environment protection licence. Saline water must not be released in any other manner or from any other point, licensed or not.

The daily volume limits that apply at these discharge points range from 17 to 700 megalitres (ML) per day (see Appendix A, Table A4). These volume limits are indicative of the flow volume upper limit necessary to protect tributaries from erosion and/or the practical limitations of the discharge infrastructure.

The rules of the Scheme allow the EPA to publish a 'trading rules order' in the Government Gazette if participants exceed the salinity targets during a flood flow event. The trading rules order would abolish the flood flow exemption from the Scheme from that point forward.

The salinity targets have never been exceeded during flood flows. This is probably due to the fact that participants generally do not utilise the full discharge opportunity during flood flow events, which is largely due to licence and/or discharge infrastructure limitations.

However, as the Salinity Assessment found, the use of the TAD is increasing over time (EPA 2013a). In addition, tributary protection limits on licences, while providing some protection, are not designed to provide protection against the salinity targets being exceeded.

Participants self-regulate during flood events by operating the industry-run Managed Envelop of Residual Flows (MERF) process, which closely mirrors the operation of the formal Scheme. The TAD is distributed by an industry-based group (coordinated by the NSW Minerals Council), to ensure that a trading rules order is not invoked.

The EPA considers that the flood flow exemption in the Regulation offers no advantage to participants and that the existence of the MERF process represents an unnecessary layer of complexity and financial burden on participants. However, the EPA acknowledges that there is a perception amongst participants that the existence of the flood flow exemptions in the Scheme allows greater discharge opportunities and that this justifies keeping flood flows in the Regulation.

Reasons for removing the flood flow exemptions from the Scheme include:

- Removing the flood flow exemption will simplify the Scheme, remove unnecessary duplication, reduce costs to participants, reduce confusion and increase transparency.
- The total amount of salt that could be discharged collectively by all participants would not change if flood flow rules were replaced by high flow rules.
- Tributary protection (volume) limits on licences do not provide protection against the salinity targets being exceeded.
- Unlimited discharges during flood flows allow participants to discharge salt without holding any credits (or insufficient credits) and potentially without contributing financially to the costs of operating the Scheme. This potentially undermines the value of credits.
- Where auction revenue covers the running costs of the Scheme, those who do not own credits do not pay the participant contribution. This is potentially inequitable.
- The Government is absorbing some costs associated with running the MERF process, including calculating the TAD during flood flows to support the operation of the MERF process. To date this has been provided at no charge, so the true costs of running the MERF process are not immediately apparent.

Questions to aid consideration of this issue:

- Are there any benefits in retaining the flood flow exemptions that have not been considered?
- Are there other potential benefits (or drawbacks) of removing the flood flow exemption?

Would a Regulation amendment be required?

Yes. Removing the flood flow exemption from the Scheme would require an amendment to the Regulation.

Issue 7: Improving the auction process

Auctioning of credits was introduced under the Regulation when the Scheme was formalised (following the pilot Scheme) to provide a transparent mechanism to ensure ongoing availability of credits to new participants and an efficient credit market (EPA 2001).

There are 1000 credits in the Scheme which have a 10 year life span. Every two years 200 credits expire and 200 new credits are created and sold at auction. This represents 20% of total credits, auctioned every two years.

The Regulation requires the EPA to 'make arrangements' for the sale of 20% of credits by auction every two years. However, the EPA is given discretion on how the auction process should be established and how it is run. A total of five credit auctions have been held between 2004 and 2012 and these have all been run as multi-round open auctions by an auctioneer hired by the EPA.

The average price paid per credit has greatly increased over the life of the Scheme, (see Appendix A, Figure A5). This indicates that credits are being seen as increasingly valuable by participants.

Improvements are currently being made to the auction process. Following the 2010 auction, concerns were raised by auction participants regarding the format of the auction. They felt that the process was overly complex, time consuming and that large increases in the final bids made by some participants reduced the number of credits allocated to others.

The EPA sought expert economic advice on the existing auction format and is considering implementing an online, single-bid Vickery auction process in time for the 2014 auction. The proposed change aims to help ensure that the auction process distributes credits to those who value them the most and provides an ongoing incentive to reduce the impacts of saline water discharges on water users and the environment.

Removing auctions

Some participants have suggested that the Scheme should move away from the regular auctioning of salinity credits, and instead simply have a system of credits owned in perpetuity by Scheme participants, and a system for trading.

Appendix D explains in more detail why an auction process was built into the Scheme. In summary, the auction process was included to:

- assist new participants to enter the Scheme
- assist the market by signalling price information
- avoid potential monopolistic behaviour by Scheme participants
- provide a 'polluter pays' mechanism, and
- provide a financial incentive for participants to invest in abatement activities.

The EPA's view is that there were compelling reasons for including an auction process when the Scheme was designed (see Appendix D) and that these reasons remain valid.

Would a Regulation amendment be required?

Most improvements to the auction process could be implemented through changing the operational elements of the Scheme, without requiring a change to the Regulation. However, a proposal to remove the auction process completely, or significantly alter how the auction process works would require an amendment to the Regulation.

A proposal to remove the auction process from the Scheme would require significant economic analysis and re-design of the Scheme architecture. It is unlikely that this work could be completed within the timetable set for the review of the Regulation.

Issue 8: Improving the credit trading process

The review of the Regulation is considering how effective the existing rules and arrangements for credit trading are and if improvements could be made. It is important that the credit trading rules and trading administration (including the online credit trading facility) enables and promotes efficient trading.

Improvements have been made to the credit trading process over time, including moving from a paper-based system of trading credits to a publically available, online trading system that allows trades to occur 24 hours a day, seven days a week.

Scheme participants are actively making use of online credit trading between auctions (see Appendix A, Figure A6).

The price of traded credits

The Regulation sets out the rules of credit trading and requires the EPA to provide an online credit trading facility. The credit register does not currently include the price that was paid for the credit when traded. The Regulation is silent on this issue.

The Scheme is a market-based instrument introduced to control salinity levels in the Hunter River. It uses a price-based mechanism with salinity credit prices obtained via auctions held every two years, with trading of credits also occurring outside of auctions.

While the price paid for credits at auction is made public, the price of credits traded in the after-auction market is not.

Participants report that often a nil or token price is paid for credits – particularly where trades occur between mines which are part of a common corporate entity. This is an underestimation of the actual value of the credits traded.

The EPA's view is that the price paid for credits when traded should be made publically available. The rationale for this is twofold:

- Visible credit prices make it easier to detect any anti-competitive behaviour in the market, increasing the opportunities for all participants to trade and discharge, and thereby improving economic efficiency.
- A visible price signal enables goods and services to be efficiently exchanged. Prices enable scarce resources – in this case, the ability to discharge salt – to be rationed to those who value them the most. Without a visible and transparent price signal, the credit market is unlikely to operate optimally.

Credit prices could be provided through the credit exchange facility. The most effective mechanism for mandating the reporting of credit prices would need to be considered, however, this may not necessarily require a change to the Regulation.

Other potential improvements to the credit exchange facility

Although many of the technical and administrative aspects of the online credit exchange facility are not governed by the Regulation, there have been some suggestions by participants for improving the facility and encouraging trade, including:

- installing functionality that prevents trades that are not consistent with the Scheme rules (e.g. does not allow trades to occur after the discharge period has started)
- improved public accessibility (see Issue 10 below).

These suggestions would not necessarily help encourage trading, but may assist participants to comply with the Regulation, reducing the risk of unintended environmental impacts.

Questions to aid consideration of this issue:

- How could the credit exchange facility be improved to make it more efficient and encourage trading?
- What are other barriers to trading? How could they be overcome?

Would a Regulation amendment be required?

Most improvements to the credit trading process (e.g. improvements to the credit exchange facility) could be implemented through changing the operational elements of the Scheme, without requiring a change to the Regulation.

However, if it was considered necessary to add legal weight to an improvement (e.g. including a visible price for traded credits), the Regulation could be amended to make this mandatory.

2.3 Other improvements

2.3.1 Overview

There may also be other improvements that could be made to either the Regulation or the Scheme more broadly that are not necessarily related to how effective the Scheme is in meeting its environmental and economic goals.

For example, the Regulation requires the EPA to establish an Operations Committee comprised of representatives of key stakeholder groups, to advise the EPA on the operation of the Scheme (see Appendix A, Table A3 for a list of current members).

In addition, much of the day-to-day operation of the Scheme actually sits outside the Regulation, such as how auctions are run and how the online credit exchange facility operates.

As explained in Appendix A, the POEO Act contains the overarching power for the Scheme's Regulation to be made. This Act also sets out the specific requirements for the elements of any emissions trading Scheme, such as requirements for reviews, powers for penalties to be prescribed and other actions to be taken by the EPA, powers for cost recovery and the establishment and use of Scheme funds (see Part 9.3A of the Act).

While an amendment to the POEO Act is not proposed, nor is it within the scope of the review of this Regulation, it is important to understand the overall governance of the Scheme and where the limitations may be in making substantial changes to the Scheme.

2.3.2 Overarching focus questions

Focus question 5: Are there other improvements that could be made to the Regulation?

Focus question 6: Are there other non-legislative proposals for improving the operation of the Scheme?

In your response, you can address these questions directly and/or respond to the discussion of key issues identified below.

2.3.3 Identified key issues

Issue 9: Additional uses for revenue generated via auctions

As explained under Issue 7, the revenue raised during credit auctions has been increasing with the life of the Scheme. The 2012 auction raised over $1.147 million (inc. GST) (EPA 2012a), which was about 300% higher than in 2010 (see Appendix A, Figure A5). The EPA expects that the demand for credits is likely to continue to increase.

Also explained in Issue 7 and in Appendix D, is that the auction process was built into the Scheme as a mechanism for returning revenue to the community. This means that the funds generated through auctions should be used as a way for participants to compensate the community for the use of the 'public good' that is the privilege of discharging salt and other pollutants to the Hunter River.

As the revenue generated from the auctioning of credits increases, more funds will become available for potential beneficial use within the catchment.

The current rules on the use of Scheme funds are set out in section 295I of the POEO Act. It states that the funds may go towards management and administration, compliance activities and other costs related to the Scheme. Where the auction revenue fully covers these costs and an excess remains, the EPA would like to be able to use these funds for other beneficial uses within the catchment.

For example, to:

- investigate dryland salinity and establish remediation programs
- investigate and implement salt management options for the Goulburn River subcatchment
- investigate other water quality issues within the Hunter River catchment.

These issues are not directly related to the running of the Scheme, but they are likely to impact on the ability of participants to discharge saline water under the Scheme.

Questions to aid consideration of this issue:

- Should the current allowable uses of Scheme funds be expanded?
- How could excess Scheme funds be used beneficially within the catchment?

Would a Regulation amendment be required?

Depending on what is proposed, the EPA will consider whether the current regulatory framework allows the funds to be used in the ways proposed, or whether an amendment to the Regulation would be required.

Issue 10: Increasing public transparency, access to information and representation

There may be opportunities for aspects of the Scheme to be more transparent and accessible to stakeholders and the general public.

While there is a large amount of information on the Scheme already publicly available, some of it is not simple to find or is located in different places.

For example, licensees are required to publically report their pollution monitoring data (i.e. if a requirement of their licence) on their corporate websites, however, the general public may not be aware of this. Note that all Scheme participants are required via their licences to monitor and report publically on pollutants discharged via their Scheme discharge point (typically electrical conductivity, pH and total suspended solids) (see Appendix A, Table A4 for a list of pollutants monitored under each licence).

Making it easier for the public to access a range of information on the Scheme, may help generate greater public interest and promote confidence in the Scheme.

For example, the EPA could look at ways to make it easier for any member of the public or a potential new Scheme entrant to access information on:

- who the current Scheme participants are (e.g. with links to licences)
- when and where discharges occur
- the nature of those discharges (e.g. with links to licensees' published data)
- ambient water quality in the Hunter River catchment
- who else holds credits (i.e. if there are any non-participant credit-holders)
- when and how credits are traded
- the price paid for credits (when traded and at auction)
- general information on buying and holding credits
- who represents each stakeholder group on the Scheme Operations Committee
- all available water quality data and the results of investigations into water quality and the health of the river system.

Broadening the composition of the Scheme Operations Committee could also be a way of improving stakeholder representation and access to information about the Scheme, if appropriate (Appendix A, Table A3 lists the composition of the Committee and its current members).

Questions to aid consideration of this issue:

- How else could transparency and access to information on the Scheme be improved?
- Is stakeholder representation on the Operations Committee appropriate/adequate?

Would a Regulation amendment be required?

Improving public transparency and access to information may not necessarily require a change to the Regulation (e.g. simply improving the information that is available on the EPA website).

As the Operations Committee is established under the Regulation, altering its composition would require a regulatory amendment.

Issue 11: The Scheme as a model for other trading schemes

The Hunter Scheme has been held up internationally as an outstanding example of a successful and well resourced emissions trading scheme (e.g. Keudel 2005). The EPA is also aware that the Queensland Government is considering developing a salinity trading scheme in the Fitzroy River catchment that is modelled (in part) on the Hunter Scheme.

As part of the review of this Regulation, the EPA will be looking at those components that make the Scheme work well in the Hunter River catchment and whether there are aspects of the Scheme that could be relevant to other emissions trading schemes, whether in salinity trading, for other water pollutants or for trading schemes in general.

Questions to aid consideration of this issue:

- Which aspects/components of the Scheme could be used for any trading scheme?
- Which aspects/components of the Scheme could be used for any river-based trading scheme (any appropriate water pollutant, i.e. which has the potential to contribute to a cumulative effect, as opposed to an acute localised effect)?
- Which aspects/components of the Scheme could be used for any river-based salinity trading scheme?

Considering the suitability of the Scheme as a model for other trading schemes would not result in any changes to the Regulation.

2.3.4 Other technical improvements

A number of other possible minor technical improvements to the Regulation have also been identified, but have not been included in this discussion paper. These issues, which are straightforward improvements and unlikely to be controversial, will be considered by the EPA separately (and if necessary, in consultation with the Operations Committee).

Examples include:

- clarifying the TAD calculations and examples in the Regulation
- allowing more flexibility in the definition of sector reference points
- allowing credits to be linked directly to licensed discharge points rather than premises.

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Appendix A: Overview and history of the Hunter River Salinity Trading Scheme

The Hunter River catchment

The Hunter River catchment is the largest coastal catchment in New South Wales, covering some 22,000 square kilometres. The Hunter River itself flows for 460 km through the catchment to enter the sea at Newcastle (EPA 2001; NSW Office of Water 2012b).

The climate and water flow in the catchment is variable, with periods of severe drought and flood. There has been extensive modification of the Hunter River floodplain and water flow is regulated by two major headwater storages, the Glenbawn and Glennies Creek dams, as well as a number of minor dams. These dams control the supply of fresh water for town water, irrigated agriculture, stock and domestic supplies (EPA 2001).

Water sharing plans in the catchment are prepared and regulated by the NSW Office of Water to establish rules for sharing water between the environmental needs of the river or aquifer and the following water users (NSW Office of Water 2012a):

- Hunter Water Corporation, which supplies Newcastle's drinking water
- a broad range of agricultural activities (including beef, sheep and horse breeding, dairying, cropping and wineries)
- over 20 coal mines
- three coal-fired power stations
- other heavy industry.

River salinity

The Hunter River can carry naturally saline water, largely due to the marine origin of underlying sedimentary rock. As salts are soluble substances that conduct electricity, electrical conductivity (EC, measured in microsiemens per centimetre – µS/cm) is used to determine salinity levels.

Salinity in the Hunter River varies with water flow. It is suggested that prior to river modification, midstream salinity levels would have exceeded 600µS/cm during low flow when dilution is nominal (EPA 2001). Salinity levels peak immediately following heavy rainfall as salt available on the catchment surface, soils, levee or river banks and other sources are mobilised and flushed into the river system. Conductivity levels consequently drop following the initial rise from this 'first flush'.

Over 75% of salinity in the Hunter River is a result of natural processes, with the remainder being anthropogenic activities including 10% attributed to industry operations (David et al. 2004). During the mining process, saline water collects in mine pits and shafts and has to be pumped out to allow mining operations to continue. The discharge of this highly saline water has the potential to significantly shift the salinity of the river from its natural variability. Water from the Hunter River is also extracted by power stations for cooling purposes or steam production in order to generate electricity. These procedures concentrate natural salts and saline water which is then stored in onsite dams (e.g. Macquarie Generation's Lake Liddell) for further use or disposal (EPA 2013b).

According to the *Australian Drinking Water Guidelines*, water of good quality is 80–500 µS/cm and water of fair quality is 500–800 µS/cm (NHMRC 2011). The potential effects of elevated river salt levels are to render water unpalatable for people and stock, reduce agricultural yields, cause accelerated corrosion of domestic and industrial pipework and appliances, and negative effects on aquatic ecosystems (EPA 2001).

History of the Scheme

Trickle discharge

During the 1980s to early 1990s, increased salinity in the Hunter River was causing reduced pasture growth and crop failure, which threatened the viability of irrigation in the catchment (EPA 1999). At that time, industry was licensed by the EPA and its predecessor, the State Pollution Control Commission, to discharge a continuous low volume 'trickle' of saline water into the Hunter River (EPA 1999). Salinity levels were unacceptably high as this licensing strategy failed to take into consideration natural water flows, particularly the increased likelihood of high salinity levels during low flow periods (EPA 2001).

Nil discharge for new licensees

By 1992 conflict had developed between irrigators and mining companies over salinity levels and so the EPA required all new licensees to operate without the need to discharge saline water into the river (EPA 1999).

Looking to alternatives

There was a clear need for innovative salt management in the Hunter River. A number of mechanisms were evaluated (EPA 2001), such as:

- nil discharge, including shutdown of facilities that cannot avoid discharge
- pipeline to the sea
- evaporation basins
- deep well injection
- desalination
- discharge under a traditional licensing approach
- discharges into releases of dilution water
- variations on discharge scheduling.

The merits of these approaches have been reviewed in various studies, for example, Croft and Associates (1983), AGC Woodward-Clyde (1992) and Smith (1995). The EPA considered the merits of each option and determined that discharge scheduling was the most cost-effective method of meeting the environmental objectives for the catchment (EPA 2001).

Discharge scheduling trial

In 1992–93, the NSW Government and representatives of agriculture, environment groups, mining and electricity generation coordinated a discharge scheduling trial. Discharge scheduling permitted licence holders to only discharge saline water when the river flow was high enough to allow for greater dilution of the saline discharges (EPA 2013b). Salinity levels fell by up to 50% during the trial (February 1993), demonstrating the feasibility of using high river flows to absorb planned discharges and avoid potential downstream saline impacts (DWR 1994).

Pilot Hunter River Salinity Trading Scheme

The Pilot Hunter River Salinity Trading Scheme was established in January 1995 following the success of the discharge scheduling trial and the introduction of telemetry systems that allowed for real-time flow and salinity monitoring. All industry members needing to discharge saline water were required to participate in the pilot scheme and obtain discharge credits. The pilot was operational until 2001, after which it was formalised (see below).

The Hunter River Salinity Trading Scheme

In December 2002 following the success of the pilot scheme, the NSW Government implemented the Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002 (the Regulation) to ensure the continued operation and regulation of discharge scheduling in the Hunter River.

The Regulation was established in accordance with Part 9.3A of the *Protection of the Environment Operations Act 1997* (POEO Act), which provides the regulation-making powers for tradable emissions schemes.

How the Scheme operates

The area of the Scheme

The Scheme operates within the Hunter River catchment upstream of Singleton, excluding:

- the Goulburn River upstream of Kerrabee
- any tributary that drains into Lake St Clair, and
- any tributary that drains into Lake Glenbawn.

Refer to the catchment map (Figure A3).

Water flow categories and river sectors

The Scheme controls the timing of discharge events to ensure that saline water entering the river is adequately diluted and that salinity targets (discussed below) are not breached. Low, high and flood flow categories are used to guide saline water discharges. No discharge of saline water is permitted during low flow periods. When the river is in high flow, credit holders are allowed to discharge in accordance with their licence, the Total Allowable Discharge (TAD) limits and the number of credits they hold. Unlimited discharges without credits are allowed during flood flow, as long as the salinity targets are not breached. Members of the scheme coordinate their discharges to achieve this (EPA 2013b).

For the purposes of the Scheme, the Hunter River is divided into upper, middle and lower 'sectors' (see map in Figure A3). There are different water flow volumes (measured in megalitres per day) set for each sector. This accommodates the fact that upstream water flows, discharges and salinity levels affect downstream salinity levels. The river flow categories for each river sector are shown in Table A1.

Table A1: River flow categories for the Hunter River

Sector	Low flow (ML/d)	High flow (ML/d)	Flood flow (ML/d)
Upper	<1,000	1,000 > 4,000	>4,000
Middle	<1,800	1,800 > 6,000	>6,000
Lower	<2,000	2,000 > 10,000	>10,000

Salinity targets

The Scheme uses salinity targets, or limits, to specify the point at which salinity levels become unacceptable for irrigation, other water uses and aquatic ecosystem health. Targets for electrical conductivity for the three sectors of the Hunter River were set following extensive community consultation (NSW Office of Water 2013a). Salinity targets are set for each sector, for both high and flood flow events (see Table A2).

Table A2: Salinity targets for the Hunter River

Sector	Reference point	High flow salinity targets	Flood flow salinity targets*
Upper	Denman	600 µS/cm	900 µS/cm
Middle	Glennies Creek confluence	900 µS/cm	900 µS/cm
Lower	Singleton	900 µS/cm	900 µS/cm

* In addition, the electrical conductivity of any single flood flow block (discussed below) is not at any stage to exceed 1500 µS/cm.

Water blocks, Total Allowable Discharge and discharge credits

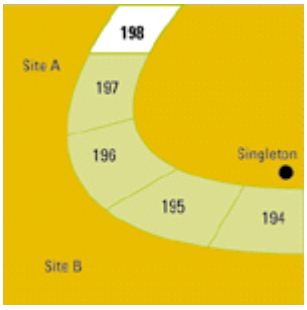
Allowable discharges are set per river block, which is a section of water that flows past Singleton in a day. There are 365 blocks of water in a year and they are numbered accordingly. For each block, the Services Coordinator (NSW Office of Water) continually monitors water flow and salinity levels and calculates how much salt (if any) can be added to the block – the 'Total Allowable Discharge' (TAD) – so that conductivity levels remain below the set targets for each river sector. The TAD is measured in tonnes of salt.

Discharge credits are used to distribute the TAD amongst the Scheme participants. Once the TAD for a block of water has been determined, it is apportioned among the Scheme participants according to the number of credits each holds. There are a total of 1000 credits available under the Scheme each time a discharge is permitted, with one credit representing 0.1% of the TAD.

The following is a worked example of how the TAD would be distributed amongst Scheme participants, given a hypothetical set of circumstances.

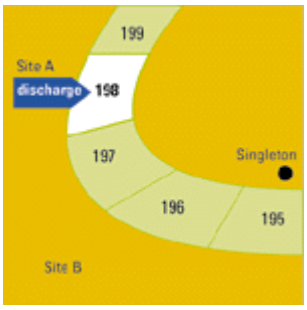
Block '2023–198' is the block of water that will flow past Singleton on the 198th day of 2023 (i.e. 17 July 2023). This block of water will also flow past other points on the river on different days.

13 July 2023



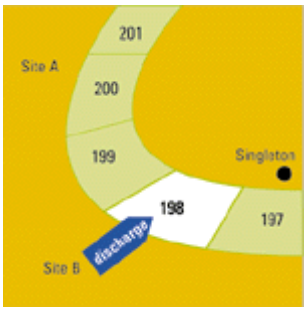
Now supposing it is calculated that block 2023–198 can hold 112 tonnes of salt; this will be the TAD for that block. With 1000 discharge credits available across all Scheme participants, each licence holder could discharge 0.1 x 112 tonnes of salt into the block for every credit they hold. The licence holders are responsible for calculating the salinity levels of their water discharges and ensuring they do not contain more salt than is permitted.

14 July 2023



On 14 July 2023, block 2023–198 will pass Site A. Supposing the licence holder at Site A has 20 credits, they could discharge 2.24 tonnes of salt (112 x 20 x 0.1%) into the block.

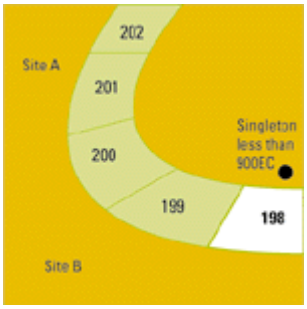
16 July 2023



On 16 July, block 2023–198 passes Site B. With 45 credits, Site B could discharge 5.04 tonnes of salt (112 x 45 x 0.1%).

If the licence holder at Site A did not discharge on 14 July, they could trade 20 credits to Site B, which could then discharge 65 credits of salt or 7.28 tonnes (112 x 65 x 0.1%).

17 July 2023



On 17 July, block 2010–198 passes Singleton with a salt concentration less than the 900 µS/cm salinity target for that reference point on the river.

Figure A1: The flow of water in river blocks and how participants' discharge limits are determined

Original source: DEC 2006

Discharge credits can only be used once for each high flow block. Under existing arrangements, credits are not required for flood flow events; however, industry is still required to manage their discharges to ensure that the EC of any sector remains less than 1500 µS /cm.

Sector Discount Factor

A Sector Discount Factor is an added safety precaution to reduce the chance of salinity targets being breached. The Sector Discount Factor applies when too many credits are acquired by participants in a single sector, rather that being distributed evenly along the river. An overload of credit holders in one sector could result in targets being breached for that sector, or downstream sectors, even when discharges strictly comply with the TAD. This most commonly concerns the upper sector, as the middle and lower sectors receive additional water inputs from the Goulburn River and other tributaries (EPA 2013b; NSW Office of Water 2013a).

The Sector Discount Factor effectively limits the number of credits that a participant may use to discharge into a water block. Once participants determine their share of the TAD in accordance with their discharge credits, they will then multiply this amount by the Sector Discount Factor to determine the final tonnage of salt they may discharge. The Sector Discount Factor is a value from zero to one, with a value of one allowing full use of discharge credits. The lower the discount factor, the more a discharge entitlement is reduced (NSW Office of Water 2013a).

Predicting flow and salinity

Real-time data is collected from approximately 50 sites along the Hunter River. Sensor equipment at selected sites monitors rainfall intensity, water levels and salinity (15 sites record EC) (NSW Office of Water 2013b). This information is relayed to a central location

(Hydrotel) before it becomes publically available online through the NSW Office of Water website and www.waterinfo.nsw.gov.au. The NSW Office of Water has subcontracted State Water Corporation (SWC) to operate the Scheme's salt model software. The SWC operator analyses water information in conjunction with weather reports and surface conditions to predict the timing and extent of high flow events. The operator runs the model to:

- estimate the rate and volume of river flow and in-stream salinity for each river sector and block
- calculate the total tonnage of salt that may be discharged during the event (Total Allowable Discharge), and
- calculate the start and finish times of discharge events.

The River Register

The River Register is used to distribute the TAD, Sector Discount Factor and timing of discharge events to Scheme participants and the EPA. Each participant then calculates their share of the TAD and discharges accordingly. Participants are also responsible for calculating any additional travel time, or lag, between their water storage site and the discharge site, which ensures that discharges comply with the start and stop times listed in the River Register (NSW Office of Water 2013a). Participants are given as much notice as possible of salinity discharge events and it is intended that credit holders in the upper sector receive a minimum of seven hours notice. The River Register is available at: http://waterinfo.nsw.gov.au/hunter/rr.shtml.

Allocation, auction and trading of credits

There are 1000 credits in the Scheme at any one point in time, each with a 10-year lifespan. Every two years, 200 credits expire and another 200 credits are sold at auction. New industry can enter the Scheme by buying credits at auction, or by acquiring credits directly from other Scheme participants through trading (EPA 2013b). More detailed information about the rationale for auctions is at Appendix D.

Operational conditions at each site affect the amount of saline water that needs to be discharged by Scheme participants at any given time. Scheme participants report that during some high flow events they have more saline water to release than their discharge credits allow and at other times they may have spare credits. Credit trading allows credit holders to increase or sell all or part of their allowance as needed, whilst ensuring the TAD is preserved. Trading is performed through an online trading system (www.epa.nsw.gov.au/HRSTSPublicApp/RptTradeHistory.aspx) and Credit Register. Trades can be for a single discharge event, for a set period of days, or until they expire. The EPA has procedures for trading credits and a credit transfer is not valid unless approved by the EPA. Credit holdings and other information on the trading scheme is publicly available at all times (EPA 2013b).

Summary of discharge events

Figure A2 provides a summary of the Hunter River Salinity Trading Scheme process leading up to a discharge event.

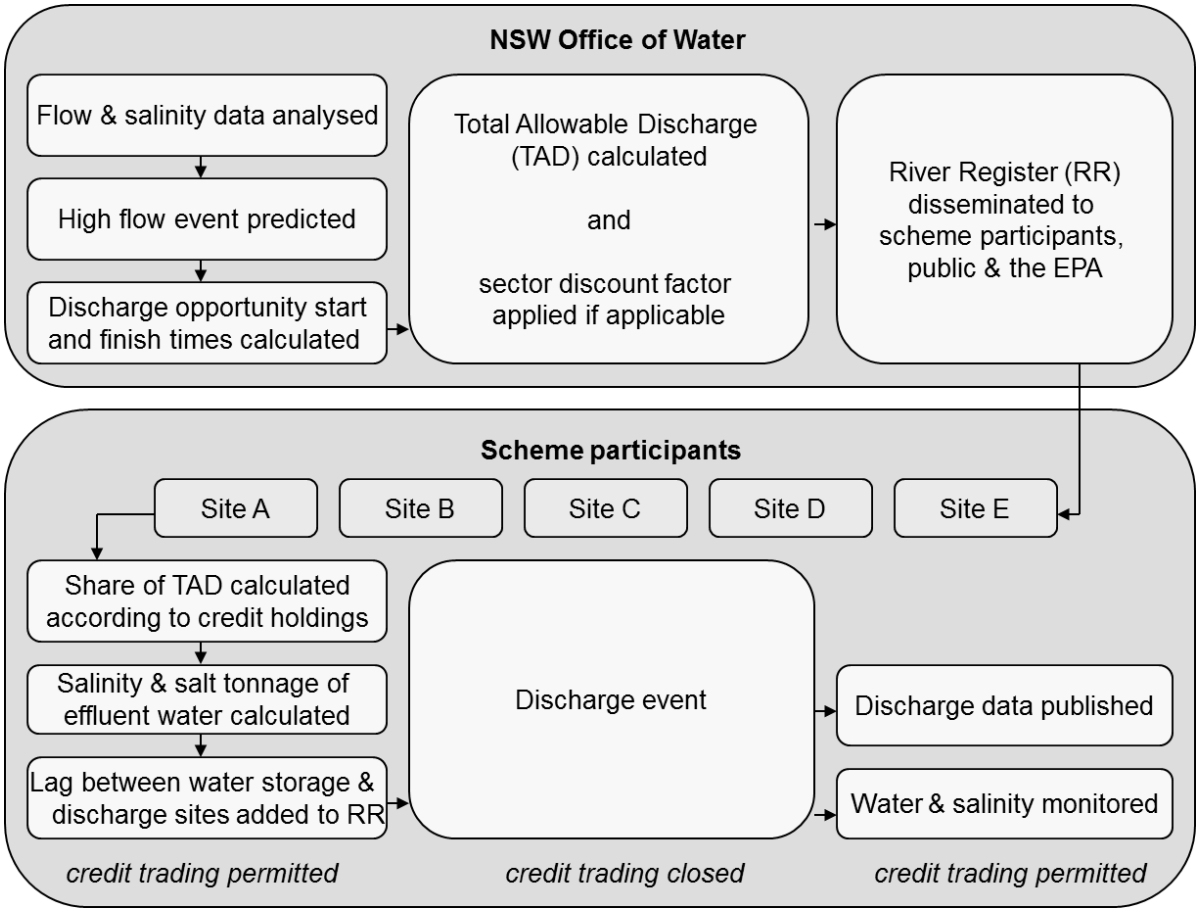


Figure A2: Summary of the process surrounding a discharge event under the Scheme

Administration, management and operation of the Scheme

The administration, management and day-to-day operation of the Scheme is performed by a number of parties: EPA, NSW Office of Water, the Scheme Operations Committee, and the credit (licence) holders themselves. The roles and responsibilities of these parties are outlined below.

Environment Protection Authority

The EPA administers the Scheme, reviews corresponding regulation, ensures that the objectives and aims of the Scheme are attained, and if necessary engages contractors for the operation of the Scheme. The role of the EPA specifically includes:

- issuing, reviewing and enforcing the Regulation
- issuing licences, including monitoring, reporting and enforcement of licences
- imposing penalties for Regulation or licence breaches, including the possibility of suspension of the Scheme
- managing credit auctions and trading, including maintaining the Credit Register, approving trades and preparing supporting documentation and information
- calculating and reviewing annual costs of the Scheme, including allocating funds for the ongoing management of the Scheme.

NSW Office of Water

The NSW Office of Water operates the Scheme under a service agreement with the EPA, as the Services Coordinator for the Scheme. Specifically, the NSW Office of Water coordinates hydrometrics and river operation information and provides a report to the EPA on the annual performance of the Scheme. The NSW Office of Water subcontracts the following activities to State Water Corporation:

- monitoring, modelling and prediction of river flow, salinity levels, discharge allowances, the Discount Factor and the timing of discharge events
- establishment, maintenance and distribution of the River Register, ensuring it is available to the public.

Scheme Operations Committee

The Hunter River Salinity Trading Scheme Operations Committee advises the EPA on the day-to-day operation of the Scheme. The Scheme Operations Committee consists of:

- one member nominated by the Hunter–Central Rivers Catchment Management Authority
- four members to represent the interests of licence holders
- one member to represent the interests of irrigators
- one member to represent environmental interests
- one member from an organisation concerned with the management of a river in the catchment (may be an additional Hunter–Central Rivers Catchment Management Authority Board member or nominee)
- one member from NSW Office of Water.

Table A3: Composition of the Scheme Operations Committee as at November 2013

Member category	Member name	Member organisation
Catchment Management Authority	BURNS, Arthur	Hunter–Central Rivers Catchment Management Authority
Catchment Management Authority	PARADICE, Wej	Nominee of Hunter–Central Rivers Catchment Management Authority
Licence holder	SPEECHLY, Andrew	Rio Tinto Coal Australia – Mt Thorley Warkworth and Hunter Valley Operations
Licence holder	SCOTT, Kieran	Macquarie Generation
Licence holder	WATSON, John	Xstrata Coal NSW – Mt Owen Complex
Licence holder	FITTLER, Jason	Anglo-Dartbrook Coal
Water user	WHITTEN, Bruce	Hunter Valley Water Users Association
Environmental interest representative	CLARKE, Michael	Kurri Kurri TAFE, Waterwatch
NSW Office of Water	HARRIS, Edward	NSW Office of Water

Note that from January 2014, Catchment Management Authorities will be integrated into Local Land Services along with Livestock Health and Pest Authorities. Representation on the Scheme Operations Committee may change after this date.

Scheme participants

Participants are captured by the Scheme if they hold an environment protection licence that authorises the discharge of saline water within the area of the Scheme (i.e. the Hunter River catchment upstream of Singleton, excluding the Goulburn River upstream of Kerrabee and any tributaries that drain into Lake St Clair or Lake Glenbawn). Saline water is defined in the Regulation as water with an electrical conductivity of >400 μS/cm.

Scheme participants have a number of roles and opportunities under the Scheme and their environment protection licences, including:

- discharging saline water in accordance with their environment protection licence, including monitoring and reporting of discharges
- calculating their allowance under the TAD and discharging saline water in accordance with their credits limits and discharge events
- purchasing and trading credits (NSW Office of Water 2013a).

Table A4 lists the current Scheme participants and Figure A3 shows their location in the catchment.

Table A4: Scheme participants as at November 2013 and their licence requirements

Licence #	Licensee	Premises	Volume limit (ML/day)	pH range limit	TSS conc. limit (mg/L)	Monitoring (EC, pH, TSS)?
529	Wambo Coal Pty Ltd	Wambo Coal	250	6.5 – 9.5	120	Y
563	Bulga Coal Management Pty Ltd	Saxonvale Colliery	55	6.5 – 9.5	120	Y
640	Coal & Allied Operations Pty Ltd	Hunter Valley Operations (HVO)*	100 130 120*	6.5 – 9.5	120	Y
779	Macquarie Generation	Bayswater Power Station	700	6.5 – 8.5	30	Y
1376	Warkworth Mining Ltd	Warkworth Coal Mine	100	6.5 – 9.0	120	Y
1976	Coal & Allied Operations Pty Ltd	Mt Thorley Operations	100	6.5 – 9.0	120	Y
2094	Liddell Coal Operations Pty Ltd	Liddell Coal	100	6.5 – 9.0	120	Y
2652	Ravensworth Operations Pty Ltd	Ravensworth / Narama Mine	400	6.5 – 9.5	120	Y
4460	Xstrata Mt Owen Pty Ltd	Mt Owen Coal Mine	66	6.5 – 9.5	120	Y
4885	Anglo Coal (Dartbrook Management) Pty Ltd	Dartbrook Coal Mine	17	6.5 – 9.5	120	Y
6538	Bengalla Mining Company Pty Ltd	Bengalla Mine	200	6.5 – 9.5	120	Y
11262	Redbank Project Pty Ltd	Redbank Power Station	20	–	–	EC only
11457	Hunter Valley Energy Coal Pty Ltd	Mt Arthur Coal	450	6.5 – 9.0	120	Y

* Hunter Valley Operations (HVO) has three (3) licensed discharge points under the Scheme (refer to Figure A3 for locations).

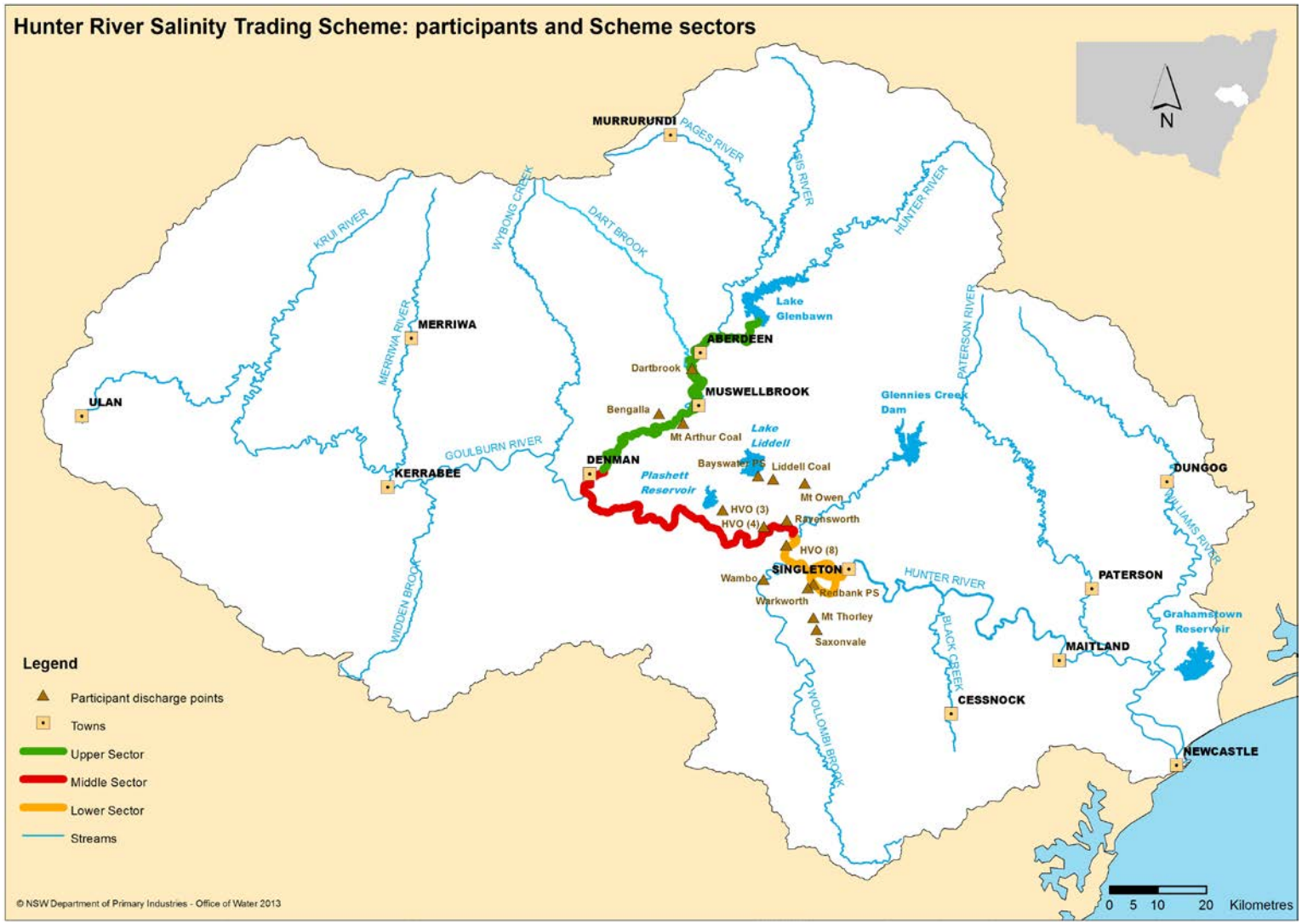


Figure A3: Locations of Scheme participants

Source: Forugh Dorani, NSW Office of Water

How the Scheme has been working

River salinity levels before and during the Scheme

High salinity levels existed during the 1980s and 1990s prior to the introduction of the pilot scheme in 1995. A maximum acceptable salinity level of 900 µS/cm was derived to maintain a healthy ecosystem and balance the needs of irrigators, while still providing opportunity for the mining sector to grow. NSW Office of Water salinity monitoring data indicates that since the pilot scheme commenced, river salinity has dropped considerably and fairly consistently remained below set salinity targets of 900 µS/cm. This is a substantial success, particularly considering that new industry participants have joined the Scheme and salt discharge levels have increased (discussed next). Successful halting of the pre-Scheme increasing salinity levels has also notably occurred during the drought from 2002 to 2007, which had periods of significantly low rainfall and river flow (EPA 2013a). Occasional exceedances of salinity targets have occurred, however these are largely attributed to natural or diffuse sources.

Salt loads and participant discharges during the Scheme

Figure A4 shows that, over the life of the Scheme (from 2002–03 to 2012), the annual rainfall across the catchment ranged between 350 and 900 mm (right axis blue series). This has provided Scheme participants with almost 250 allowable discharge events (EPA 2013a).

During this time, participants discharged approximately 112,500 tonnes of salt (left axis red series) out of a total allowable discharge (TAD) of 422,000 tonnes (left axis orange series).This represents an overall average of 26.7% industry utilisation of the TAD. Overall, a total of 1.1 million tonnes of salt was carried by the Hunter River past the Singleton gauge (left axis green series). Participant saline water discharges therefore contributed to approximately 10% of the entire salt load of the Hunter River (EPA 2013a).

It is worth noting that this period also included one of the most significant drought periods on record, from 2002 to 2007. An increased frequency of rainfall events since 2010 has increased industry discharge and TAD utilisation rates to close to 50% (EPA 2013a). The number of participants in the Scheme has also increased from six during the beginning stages of the pilot to 10 in 2012 (EPA 2001; EPA 2013b).

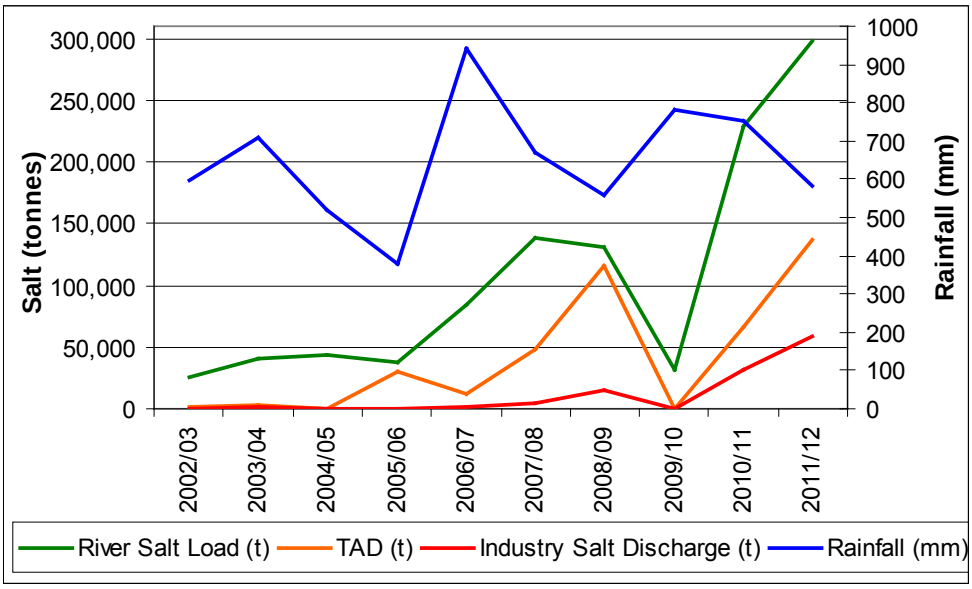


Figure A4: Salt discharge amount by Scheme participants, Total Allowable Discharge and river salt load carried by the Hunter River past Singleton gauge, and rainfall, 2002 to 2012.
Source data provided by NSW Office of Water

Auction prices and credit trade

The first auction of Scheme credits was held on 7 April 2004. All 200 credits were sold at an average value of $507 per credit. A total of $101,467 was raised with the maximum and minimum credit prices being $551 and $478, respectively (DEC 2004). The average auction price of credits has increased exponentially since this first auction. The latest (2012) auction raised $1,147,444, with an average price paid per credit of $5737. This was over three times the average price paid per credit at the 2010 auction. Scheme participants are also actively making use of online credit trading between auctions (see Figure A6).

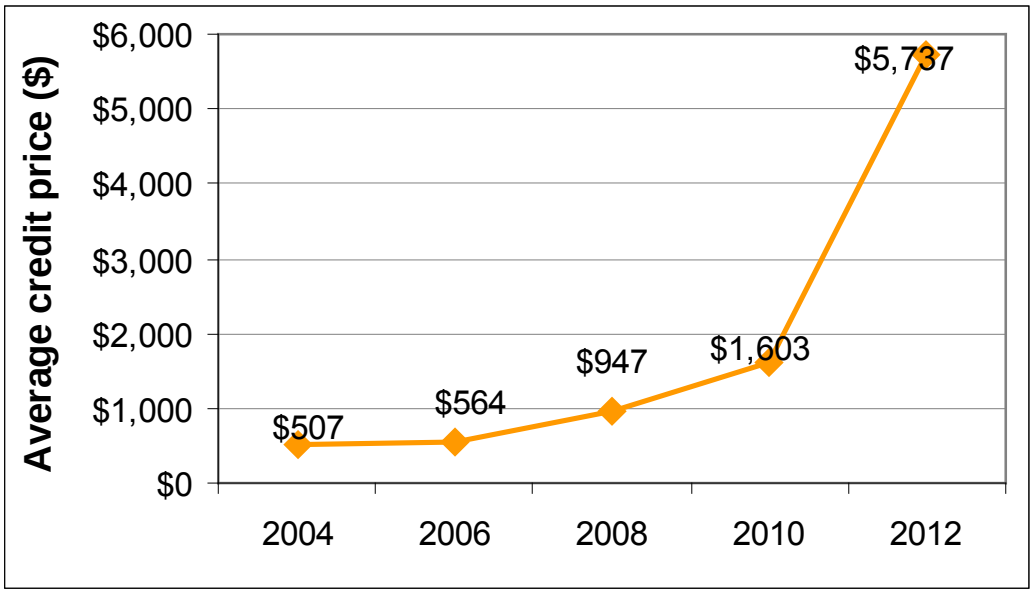


Figure A5: Average price paid for credits at each auction, 2004–2012

Source data: EPA Credit Auction Reports: www.epa.nsw.gov.au/licensing/hrsts/auctions.htm

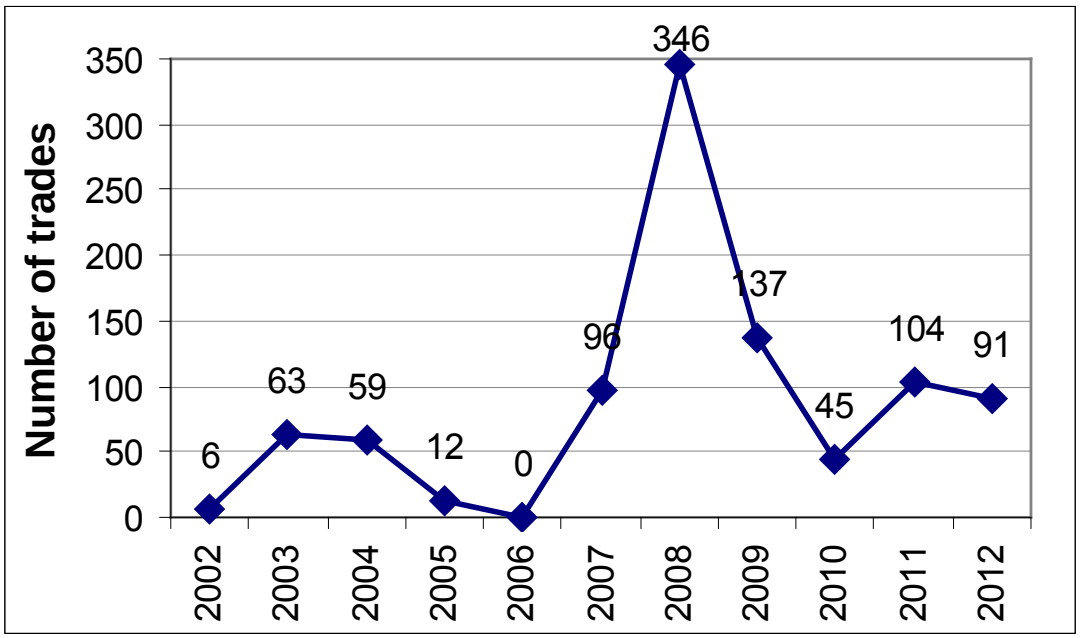


Figure A6: Number of credit trades, 1 September 2002 – 31 December 2012.

Source data: Scheme Online Credit Exchange Facility: www.epa.nsw.gov.au/HRSTSPublicApp/RptTradeHistory.aspx

Appendix B: Overview – Hunter Catchment Salinity Assessment 2013

The Hunter Catchment Salinity Assessment was identified as a priority preliminary task for the Regulation review. The Assessment is a desk-top review and gap-analysis of available water quality data (primarily salinity/conductivity) and aquatic ecological health data in the Hunter River catchment upstream of Singleton, to assist in the evaluation of the effectiveness of the Scheme.

The EPA commissioned the Office of Environment and Heritage (OEH) to undertake the Assessment.

The final report is available at: www.epa.nsw.gov.au/licensing/hrsts/regreview.htm.

The key results of the Hunter Catchment Salinity Assessment (EPA 2013a) are:

- There was little evidence that groundwater levels or the electrical conductivity (EC) of groundwater have been rising in recent times. However, this conclusion is affected to some degree by limited temporal sampling and a bias to current monitoring bores being located in alluvial areas often well away from the areas of major mining operations.
- If future trends in groundwater level and conductivity are to be undertaken and related back to the impact of the Scheme (or mining and power generation), then a more comprehensive and representative groundwater monitoring program is required for the catchment.
- The major impact of the Regulation on EC levels is likely to have been the continued restriction of saline water discharges to periods of high and flood flows when the potential for dilution is at its greatest (as opposed to continuous or intermittent discharges regardless of flow conditions).
- The assessment of the overall effectiveness of the Scheme on surface water quality suggests that the Scheme has:
    - had little effect on flows and electrical conductivity levels in the Hunter River upstream of Denman
    - reduced electrical conductivity levels at (and immediately upstream of) Singleton and Greta, and
    - potentially reduced electrical conductivity levels at monitoring stations between Denman and Singleton.
- The available data suggests that throughout the catchment macroinvertebrate ‘health’ is on average good, but there are some areas where this is quite poor.
- Although salinity is one of several factors affecting stream macroinvertebrate communities in the Hunter River catchment, salinity appears to be a relatively important factor.
- The weight of scientific evidence suggests that current Scheme salinity targets should not be raised. Further scientific analysis and modelling would be required to support altering the Scheme salinity targets in the future, in order to better understand existing salinity impacts on ecosystem health in the Hunter River and its tributaries.
- On average over the life of the Scheme, participant discharges contributed approximately 10 per cent of the entire salt load of the Hunter River at Singleton. However, recent averages are in the order of 13–20 per cent of total annual salt load.
- On average over the life of the Scheme, participants have utilised approximately 25 per cent of the given opportunities to discharge [the ‘total allowable discharge’ (TAD)]. However, recent averages are in the order 40–50 per cent of the TAD.

Experimental studies are recommended in order to fully understand the environmental effects of the different components of saline water discharged to the Hunter River catchment (e.g. ionic composition, metals/metalloid contamination, etc.).

- The increasing discharge demand, salt load and TAD usage under the Scheme will need careful ongoing monitoring and assessment in order to assess the potential for future trends or changes to impact aquatic ecosystems and environmental values.
- Hunter River salt loads can also be affected by the major tributaries such as the Goulburn River and Wollombi Brook.
- The Goulburn River subcatchment contributes relatively high salinity water to the Hunter River and is not currently captured by the Scheme upstream of Kerrabee. Further strategic real-time monitoring of flow and salinity in the subcatchment is recommended considering the likely expansion of mining and development of coal seam gas extraction. This monitoring is currently limited.
- The at times high EC levels in the Wollombi Brook at Warkworth in the mid to late 2000s (not related to flow) warrant further investigation.

Appendix C: How EPA licences regulate discharges to water

Discharges under the Scheme are licensed

Scheme participants hold environment protection licences issued by the EPA, which specify the water discharge point(s) they are allowed to discharge saline water from for the purposes of the Scheme. The release of other pollutants is also typically authorised (and limited) from these Scheme discharge point(s) and from other discharge points on their licence.

Each discharge point has specific pollution concentration limits, volume limits and monitoring requirements for water discharges.

Limits on saline water discharges

The discharge of saline water is specifically limited in the participant's licence via a special condition (usually E1.1), which states that saline water must only be discharged in accordance with the Regulation (i.e. the rules of the Scheme).

Limits on other pollutants in the saline water

All saline water discharges under the Scheme are also constrained by other licence conditions:

- condition L2.4 specifies concentration limits for other pollutants – typically total suspended solids (TSS) and pH, and
- licence condition L3 limits the total volume of the discharge (in megalitres per day).

See Appendix A, Table A4, for a list of the licence requirements of current Scheme participants.

What is currently monitored during a discharge event?

Environment protection licences typically require that discharges under the Scheme be monitored for conductivity, TSS and pH. This monitoring must be reported to the EPA and also published on the licensee's corporate website (see *Requirements for publishing pollution monitoring data*: www.epa.nsw.gov.au/legislation/20120263reqpubpmdata.htm).

Further information about licences and water pollution

For more information, see also the EPA Licensing Fact Sheet: Using environment protection licensing to control water pollution: www.epa.nsw.gov.au/resources/licensing/130119eplswater.pdf.

Appendix D: Why was a regular credit auction built into the Scheme?

1. To assist new entrants

- Auctions are an essential mechanism to provide regular opportunities for new operations to enter the Scheme. The auction process was designed to provide equal access for all bidders, including new entrants to the market.
- Without an auction process (i.e. with credit trading alone), new entrants would have to negotiate directly with potential competitors in order to obtain credits. This would put the new entrants at a cost disadvantage.
- Ensuring the availability of credits via a regular auction also limits the capacity of existing participants to exercise market power and exclude new participants by withholding credits.

2. To avoid monopolistic behaviour

- The two-yearly expiry of 20% of credits (reissued by auction) means that acquiring sufficient credits for market dominance is likely to span a number of auction periods and entail significant risk of losing the position of dominance at each subsequent auction.
- The credits held by any would-be monopolist will also expire at the end of their lifespans and be reissued via auction.
- Open auctions enable and encourage an increase in the number of Scheme participants, thereby reducing the risk of monopolistic behaviour.

3. To assist the market

- The auction process was designed to distribute credits to those who value them most.
- Auctions help to ensure a greater 'liquidity', meaning that participants can be more assured of accessing credits to meet their desired discharge management strategy.
- Auctions help to signal price information to the market and remove uncertainty about the value of credits.
- Staggered credit auctions mean that the market is better able to identify realistic price levels in a shorter period of time, rather than risk a wide range of bids at the first auction, followed by a 10-year wait for new price information at another auction.

4. The polluter pays

- Credits under the Scheme are owned by the community, as represented by the State of NSW. The State of NSW effectively leases these credits out to credit holders.
- Credits are not a property right; rather a credit is simply an authority to discharge salt into the Hunter River for a set period and in accordance with specified conditions.
- The environment that receives pollution (i.e. the Hunter River) is a 'public good' in economic terms. Retention of auction revenue by the Government is 'revenue recycling', where polluters are paying the NSW community in exchange for allowing the use of the public good (i.e. the privilege of polluting the environment).
- Without an auction process (i.e. with credit trading alone), the industry dischargers would retain the revenue, rather than the Government or the community.

5. To encourage investment in abatement activities

- Auctioning of credits provides a financial incentive for Scheme participants to invest in abatement activities that are more cost-effective than buying credits.

(Sources: EPA 2001 & EPA 2012b)