# NSW Weed Risk Management system - Background information

There is never going to be enough money or time to do everything that needs to be done. We therefore need to prioritise the most important things to do.

It is the same with weeds. There are too many weeds, there is too little money and too few of us to get rid of all the weeds. We need to know which weeds are the most important and to aim our management at them and then work back gradually to the lesser important ones.

The NSW Weed Risk Management (NSW WRM) system is one way of doing this. It is similar to the prioritisation system that Rod Randall put together that many of you may have seen or used. While the Randall system is a good system for assessing risks, it is limited when it comes to assessing feasibility of control. For this reason, a range of experts in Australia and New Zealand put their heads together to come up with some better systems.

There are a few different systems now in use but they all comply with The Australian and New Zealand Standard, that is the National Post-Border Weed Risk Management Protocol. Not only is this protocol best practice in Australia and New Zealand, it has been adopted by the Food and Agricultural Organisation of the United Nations and is being rolled out throughout Central and South America, South-east and Central Asia, Northern Africa and the Mediterranean region.

The NSW WRM system uses a series of questions to arrive at a score for weed risk and feasibility of coordinated control.

The weed risk (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/weed-risk) section is broken down into three subsections, these being:

- Invasiveness
- Impacts
- Potential distribution.

The feasibility of coordinated control (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/feasibility-of-coordinated-control) section is also broken down into three subsections, these being:

- Control costs
- Persistence
- Current distribution.

Once scores are determined for weed risk and feasibility of coordinated control, a table comparing these scores directs the assessor to what management actions may be needed for the weed. These scores are an estimate not an absolute score. The range of scores for weed risk and feasibility of coordinated control that determine any management action are reflected in the matrix (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/guiding-principles-for-management#wmatrix).

The NSW WRM system will be used in parallel with the current NSW noxious weed declaration for a short time. After this time the NSW WRM system will be the sole system used to evaluate declaration requests and changes. An entirely different process is used for the prioritisation and allocation of any grant funding.

## Background

The WRM system has been developed by the NSW Department of Industry and Investment, and collaboratively with various stakeholders including those represented on the Noxious Weeds Advisory Committee. The system was developed by reviewing WRM systems currently in use throughout Australia and adopting relevant components of these. This WRM system is consistent with the National Post-Border Weed Risk Management Protocol (Virtue *et al.* 2006). Along with that protocol, this guide was written using the South Australian (Virtue 2004) and draft Northern Territory (NTG 2009) systems, with modification as needed for NSW.

## Relevance

The NSW WRM system aims to provide a standard, nationally accepted and transparent process to help make decisions about the introduction, prioritisation and declaration of weed species. It has been designed as a decision support tool for:

- deciding which plants should be approved for release in NSW
- identifying which plants require further research prior to release in NSW
- prioritising weeds for the allocation of limited management resources
- determining the appropriate legislative status for undeclared naturalised plants
- reviewing the legislative status of currently declared weeds.

The NSW WRM system has been designed so that it can be applied to a number of geographic scales, for example it can be applied to the state of New South Wales, to regions or catchments, or to individual Local Control Areas, and may even be applied to individual land management units, for example a farm or a National park.

New South Wales contains a vast diversity of primary industries, biogeographic regions and differing population centres. It is crucial that each of these are protected from the negative impact of weeds so that economic, environmental and social values are retained, and even enhanced for the future. The NSW WRM system seeks to provide a framework in which decisions can be made to achieve this goal.

This guide provides information to assist in filling out the electronic form (XLS, 241.5 KB)

(https://www.dpi.nsw.gov.au/__data/assets/file/0019/304723/NSW-WRA.xls).

# Overview of the Weed Risk Management process

The New South Wales Weed Risk Management (WRM) system is a Post Border WRM process. The main elements of this process are outlined in this section (Figure 1). The following information is based on the National Post Border Weed Risk Management Protocol (Virtue *et al*. 2006).

## Communication and consultation

Throughout any WRM process there should be appropriate communication and consultation with all stakeholders. This communication should be amongst the steering committee driving the process, and with internal and external stakeholders who will be affected by the outcomes of the process. Appropriate communication and consultation will ensure that participation, understanding, trust and ownership of the process is developed. The working group of stakeholders and experts who conducted the assessments should be recorded in the WRM form.

## Establishing the WRM context

It is important to establish the context in which the WRM process will take place.

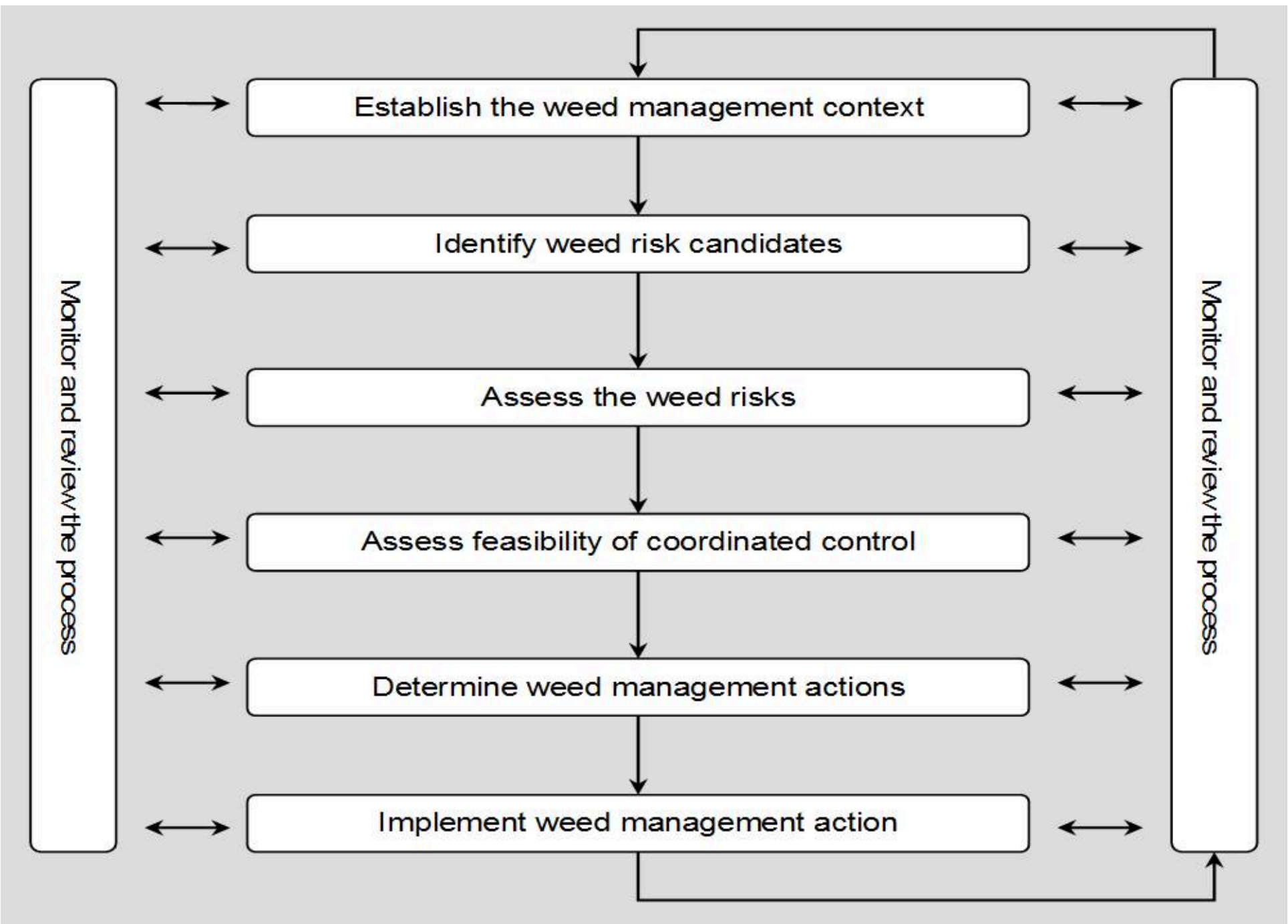
This will include the:

- overall goals
- geographic and land use scopes
- relevant stakeholders
- existing policies and legislation that may affect the process.

The resources that are available to both undertake the WRM process and to implement its outcomes should be identified here. In many cases the geographic scope will be specific local government areas, but the system may be used for:

- regions or catchments of New South Wales
- the state of New South Wales
- individual land management units such as a farm or a national park.

The methodologies for the following stages, overall project management and final outputs and outcomes should also be agreed upon.




Weed Risk Management process diagram

## Identification of the weed risk candidates

The plant species for weed risk assessment are determined at this stage. This will depend on the WRM context and could involve collating existing weed lists, surveillance to detect new weed species and/or likely weed incursions.

All weed candidates must be correctly identified. The initial list may be screened or refined to select candidates for formal analysis.

### Weed Risk Assessment

Existing weed management practices used are to be documented. These influence the relative risks that are posed by different weed species. Comparative weed risks are analysed and evaluated using a weed risk assessment system that incorporates the three key criteria of Invasiveness, Impacts and the Potential distribution of the weed.

### Assessment of Feasibility of Coordinated Control

Management methods for individual species are identified at this stage. Comparative feasibility of coordinated control is then analysed and evaluated using a system that incorporates the three key criteria of Control costs, Persistence of the weed and the Current distribution.

### Determination of weed management actions

A comparison of Weed Risk versus Feasibility of Coordinated Control will indicate the priorities for various weed management actions. These actions may vary anywhere from eradication and preventing entry to containment, to improving targeted management techniques or monitoring.

### Implementation of weed management actions

This is the transition stage from the strategic planning of WRM to operational and on-ground programs.

### Monitoring and reviewing

It is important to monitor the effectiveness of all stages of the WRM process. To facilitate this, adequate records need to be made at each stage of the process so that continual improvement can be made. New information on weed risks and the effectiveness of management for the existing species needs regular review. Priorities will change with time.

This guide focuses on the Weed Risk and Feasibility of Coordinated Control assessments before suggesting a framework to determine priorities for weed management actions.

Further information on other stages of the weed risk management process can be found in Virtue *et al.* (2006).

## Sourcing information

It is important to use accurate information to complete the questions outlined in this guide. Useful information sources are listed in the Information Sources (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/further-information#infos) section. Since the quality of information used is crucial, information from reviewed publications (generally sources a., c., e.-g. described in list below) is most desirable. Guidelines on how to deal with uncertainty in answering questions are outlined in the Uncertainty Index section.

You are asked to supply the source of the information used to answer the question in the box next to the 'Source' heading, found at the bottom of each questions table. Comments can also be written in this section. Similarly, the source and any comments will need to be recorded along with the response in the electronic form. There are several ways to quickly note this information as outlined below. Copies of original information will be requested when the assessment is submitted.

Information from the following sources can be quickly noted alongside the question as follows.

### a. Books

#### What to record

Record the source by including the surname of the authors or editors, publishing year and page number.

#### Example

Information that has been sourced from the 2001 edition of the book 'Noxious Weeds of Australia' on page xx.
Parsons and Cuthbertson (2001), pg. xx.

You may use the notation '*et al.*' if there are more than two authors. The following example would be used to indicate that the information has been sourced from the 1997 edition of the book 'Plants of Western New South Wales' on page zz.
Cunningham *et al.* (1997), pg. zz.

Aside from the books already mentioned, Groves *et al.* (1995), Panetta *et al.* (1998) and Panetta (2009) provide excellent reviews on the biology of various weeds in Australia (originally published as articles in the journal Plant Protection Quarterly).

### b. Internet

#### Example

Information that was taken from a species description accessed from the Royal Botanic Gardens, Sydney webpage would be recorded as:
PlantNET (2009) http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm

Information that has been sourced from a NSW DPI webpage would be recorded as:
NSW DPI (2009) http://www.dpi.nsw.gov.au/biosecurity/weeds

Specific internet sources are outlined in more detail at point g. and h. below.

## c. Extension publications

### What to record

Record the name of the author and date (if known), otherwise record a shortened version of the title. Please record the page numbers in both cases.

### Example

Information that has been taken from the NSW DPI Primefact 240 on Hudson Pear would be recorded as:
Holtkamp (2006), pg. 3.

Information that has been taken from page 2 of the 2003 Weeds CRC publication titled 'Weed management guide. Lagarosiphon – *Lagarosiphon major*' can be recorded as:
Weeds CRC (2003), pg. 2. or Lagarosiphon, pg. 2.

## d. Personal observations / communications and unpublished data

This includes information that is not published in books or the internet, for example, from personal observations, from personal communication (or experience), or unpublished data (this may include trials that have been conducted but not published)

### What to record

The authors name, work affiliation and the words pers. obs., pers. comm. or unpublished data, as relevant.

### Example

A. Smith, Faraway Council, pers. obs. (for observations with no information collected).
B. Jones, Nearside Council, pers. comm. (for recording information someone has told you).
C. Weston, Seaside Shire, unpubl. data (for recording trial work that has not been published).

## e. Conference books (proceedings)

### What to record

Use the format as for books.

### Example

To indicate that the information comes from page 10 of M. McMillan's paper in the '10th Biennial Noxious weeds conference proceedings', you would write:
McMillan (1999), pg, 10.

## f. Journal papers

### What to record

Again use the format for books.

### Example

To indicate that the information comes from page 435 of S. Johnson's paper in the journal Plant Protection Quarterly, you would record:
Johnson (2007), pg. 435.

## g. Published weed risk assessments (books)

A number of published weed risk assessments can be found in book form on the internet. It is important to check that these assessments (including those from NSW) are accurate for your situation.

The largest group of these publications are from the Queensland Government (https://www.qld.gov.au/index.html).

A review on the declaration of Lantana species in NSW is also available.

### What to record

Use the format for internet. A copy of information outlined in this point is not required with the assessment.

## h. Weed Risk Management systems and assessments (including data sets)

There are a number of Weed Risk Management assessments or Weed Risk Assessments for individual weed species. It is important to check that these assessments (including those from NSW) are accurate for your situation. For example, aspects of weed biology, or even the relative importance of means of spread can vary in different climatic zones, for example if a species is found in both temperate and tropical areas.

The range of systems and assessments has been recorded below.

1 The **NSW government** has used this Weed Risk Management system (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/wrm-system) to assess and publish a number of assessments.
2 The **South Australian government** uses a very similar Weed Risk Management system to that used in NSW. Because of this general similarity, much of the information and data from South Australian (SA) assessments can be used for NSW assessments. A comparison of the NSW and SA WRM systems is contained in section A1 of the Appendix.
3 Weed risk management information can generally be found for a range of species in this spreadsheet. This information has been categorised by different land uses. To find weed risk management information on species that have been reviewed by the South Australian government, select one of the land use tabs along the bottom of the excel worksheet, for example, 'crop-pasture rotations' for weeds that are problematic in Dryland cropping or modified grazing pastures. Weeds are listed alphabetical order.
4 The **Northern Territory government** use a partially similar Weed Risk Management system (https://denr.nt.gov.au/land-resource-management/rangelands/publications/weed-management-publications#heading3) to that used in NSW. Because of the partial similarities, information and data from Northern Territory (NT) assessments can be used for NSW assessments. A comparison of the NSW and NT WRM systems is contained in section A2 of the Appendix. It is important to remember that the NT system only assess weeds in one land use, that is native vegetation.
5 There are some similarities between the NSW system and **Victorian Government** Weed Risk Assessment system. As such, information and data from the Victorian (Vic) system can be used for NSW assessments. A comparison of the NSW WRM and the Vic Weed Risk Assessment systems is contained in section A3 of the Appendix.
6 Various plant categories, for example "Aquatic Weeds", "Trees", "Shrubs", or a "Full Listing of Weeds (http://vro.depi.vic.gov.au/dpi/vro/vrosite.nsf/pages/invasive_plants_common_a)" contain information on species. Once a species is selected, for example Arrowhead, information on Invasiveness and Impacts assessments may be available.
7 There are some similarities between the questions used in prioritisation system used by **Randall** (2000) and the NSW WRM system. A comparison of the NSW and 'Randall' systems is contained in section A4 of the Appendix.

### What to record

Any information used from the above sources should be noted by the relevant State or Territory government that created the information (in bold above), as well as the webpage that the assessment information is taken from, for example, Victorian Government (http://www.dpi.vic.gov.au/vro/weeds). Copies of this information are not required with the assessment.

## Copies of sourced information

### For published sources

You are asked to supply a photocopy of the relevant pages of the reference with the weed assessment.

You need to include the:

- title of the publication
- author
- date
- page numbers used

This information should be clearly marked on the first page of the photocopy.

### For unpublished sources, data and personal sources

For personal communication, observations and unpublished data, you need to provide details of each person supplying this information. You need to include details on the:

- current contact telephone
- email address
- postal address

Original information from the Weed Risk Management systems and assessments outlined in h. above is the only information that need not be supplied.

# Uncertainty index

There are three broad areas of uncertainty that may occur in weed risk management systems (Hayes *et al.* 2007). These are:

- **Linguistic uncertainty**, for example where the language used may be ambiguous, dependent on context, underspecified or vague.
- **Variability**, for example a weed may behave differently depending on the time, the environment or its genetic structure (different populations may behave differently).
- **Incertitude**, for example measurement error, bias, and missing or limited scientific information.

Linguistic uncertainty has been reduced in the NSW WRM system by extensively testing the wording while variability is partially accounted for by allowing multiple choice questions and by thinking in averages.

Incertitude, and in particular limited information, is accounted for in the uncertainty index.

Every effort should be made to accurately answer the questions from the best possible information sources, preferably from journal papers, books, risk assessments, conference proceedings, extension publications and the internet (listed in general order of decreasing reliability). It is important to record these sources and provide a copy of the relevant information with the assessment where relevant (see Sourcing information).

In some cases the information may not be available to you, or may not be known because there has not been adequate research performed on the species. In these cases, it is appropriate to answer the 'do not know' response/s.

You should then seek further information from other sources, for example, a wider internet search, larger libraries, other weeds officers, or by consulting NSW DPI regional staff (https://www.dpi.nsw.gov.au/biosecurity/weeds/contacts) who may be able to identify any other published or unpublished information.

Answering questions in a working group of relevant stakeholders and experts is better as this will ensure many information sources are brought to the assessment process. A group approach will help eliminate individual subjectivity in responses.

When answering the 'do not know' question an average score is automatically allocated to the response. This avoids bias and minimises error. Some degree of uncertainty is therefore introduced when one or more questions are answered as 'do not know' responses.

A degree of uncertainty is common in life, in research and in particular in predicting the behaviour of any living thing, including a weed. Keep in mind that too much uncertainty will compromise the risk assessment.

The uncertainty index has been designed to encourage accurate assessments, while allowing some degree of uncertainty to exist. Calculation of the uncertainty index for the Weed Risk (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/weed-risk) Assessment section and for the Feasibility of Coordinated Control (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/feasibility-of-coordinated-control) section are both outlined. An overall Uncertainty Score is calculated based on these calculations.

The overall Uncertainty Score will be considered in submitted assessments. There are three levels of response. Assessments with a high level of uncertainty will generally be returned to you for further research before they are accepted.

# Analysis and evaluation of weed risks and the feasibility of coordinated control

## Weed Risk Management

A Weed Risk Management (WRM) system involves the use of a standard set of questions to assess and compare the relative risks posed by different plants and the feasibility of managing these plants through coordinated control programs.

Weed risk analysis involves using standard, technical criteria to determine the relative weed threat posed by different plants. In general terms, risk analysis involves analysing 'how likely' something is to occur (the likelihood) and 'how much' (the size or magnitude) of the consequences of that event occurring.

## Weed Risk Assessment

In weed risk assessment, the term Invasiveness is used instead of likelihood. The consequences or magnitude refers to the types of Impacts a weed could have and where these could occur (that is the Potential Distribution, or the area the weed could spread to). There are therefore three key criteria for determining weed risk, these being:

- Invasiveness
- Impacts
- Potential Distribution.

Questions are posed in separate sections detailing Invasiveness, Impacts and Potential Distribution to help determine the relative risk a weed poses.

## Feasibility of Coordinated Control

There are also three key criteria for determining the Feasibility of Coordinated Control. These are:

- Control costs
- Persistence
- Current Distribution.

Questions are also posed in separate sections detailing Control costs, Persistence and Current Distribution to help determine the relative feasibility of coordinated control that can be done.

## Questions

The questions used in each of these sections have the following format:

- the question
- why the question is important
- an explanation of factors relevant to the question and any assumptions.

The question as it appears in the Weed Risk Management (WRM) form is then outlined after the question text. Each question is multiple choice and the most appropriate answer needs to be chosen. In limited circumstances you may feel that two answers fit the species in different circumstances within the land use. If this occurs, it may be useful to select both answers and then take these through to completion to compare the results.

Every effort should be made to answer the questions accurately instead of using the default 'do not know' answer. To help in this, we request that you add the source of the information in the box next to the 'Source' heading at the bottom of each questions table, or beside the response in the electronic form, as relevant.

Examples of different weed species that may fit some of these responses are generally given in the 'Explanation and assumptions' sections of each question. Both common and scientific names of weeds are used throughout this guide to avoid confusion.

A number of assumptions need to be recorded before the questions are answered.

Answers to the questions can be entered directly into the electronic form (XLS, 241.5 KB) (https://www.dpi.nsw.gov.au/__data/assets/file/0019/304723/NSW-WRA.xls).

## How to calculate scores

### Section scores

The raw score for each section, that is for the Invasiveness, Impacts, Potential Distribution, Control Costs, Persistence and Current Distribution questions is calculated by adding the scores for each question in that section. For example, the raw score for Control Costs section is the addition of the scores from questions 1-4. In the case of part questions, for example Control Costs question 3, add the part question scores (3a-c) to determine a 'total score' for that question. The score for question 3 is then determined by referring to the text beside or below the table that converts the 'total score' to the question score.

Raw scores may then need to be 'corrected' manually for Invasiveness, Impacts and Potential Distribution (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/weed-risk#cwrscore), or for the Control costs, Persistence and Current Distribution (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/feasibility-of-coordinated-control#cfcscore). A comparative weed risk score is calculated by multiplying the 'corrected' scores for Invasiveness, Impacts and Potential distribution together. A comparative feasibility of coordinated control score is calculated by multiplying the 'corrected' scores for Control Costs, Persistence and Current Distribution together. Alternatively, the electronic form does this for you.

### Uncertainty scores

Raw uncertainty scores are determined by adding the 'do not know' answer scores that have been recorded for each section, that is for Invasiveness, Impacts, Potential Distribution, Control Costs, Persistence and Current Distribution. These are then converted to a percentage.

In the case of part questions, for example Invasiveness Question 3 the individual uncertainty scores from each 'do not know' response are recorded and then added to determine the total uncertainty score for each section. Do not combine the uncertainty scores from each 'do not know' question to calculate a total question score as was done to calculate the question score.

If Invasiveness Questions 2 and 3 were the only recorded 'do not know' scores in the Invasiveness section, the raw uncertainty score is 1.5 (Question 2) + 1 (Question 3b) + 1 (Question 3c) = 3.5

Raw uncertainty scores need to be 'corrected' manually for weed risk (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/weed-risk#wruscore) (Invasiveness, Impacts and Potential Distribution), or feasibility of coordinated control (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/feasibility-of-coordinated-control#fccscore) (Control costs, Persistence and Current Distribution).

To calculate the total uncertainty score (percentage) for the Invasiveness section, the raw uncertainty score 3.5 is divided by 14, multiplied by 100 and rounded to the nearest whole number, that is (3.5/14) x 100 = 25%

An overall uncertainty (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/further-information#calscore) score is then calculated.

If no other 'do not know' answer scores are recorded in the other sections, the overall uncertainty score would be calculated as
25 (Invasiveness) + 0 + 0 + 0 + 0 + 0 (for the five other sections) = 25/6 = 4%

Alternatively, the electronic form (XLS, 241.5 KB) (https://www.dpi.nsw.gov.au/__data/assets/file/0019/304723/NSW-WRA.xls) does this for you.

## Land use

Land use can be most simply defined as the purpose or activity that the land is used for by the landholder and/or the community. Examples of land use can be diverse, for example dryland cropping (wheat) or a natural environment (a National Park). All land uses that occur within the geographic area should be considered.

Different types of weeds occur in different land uses. For example annual weeds such as Ryegrass (*Lolium rigidum*) may be problem in dryland wheat crops, while Lantana (*Lantana camara*) may be a problem in native sclerophyll forest found in a National park. Comparing the risk of weeds between different land uses means that the relative importance of land uses must also be compared. Although possible, this can be difficult and contentious to do. An easier approach is to compare weeds within a land use only and to allocate existing resources appropriately, keeping in mind legislative responsibilities.

Land uses based on the Australian Land Use Mapping classification system, version 6 (AG BRS 2009) are suggested. These land uses are used widely by the State/Territory and Federal Governments. Primary levels of land use classification are indicated by the numbers 1-6. Secondary levels of classification are indicated below these, for example, 1.1, 1.2, and 1.3. Most secondary levels have a description in brackets to help clarify what is

included in the secondary level (each category mentioned in the brackets is yet another level of classification). It should not be necessary to use any classification below the secondary level.

| Land uses based on the Australian Land Use Mapping Classification System V6 | |
|---|---|
| **1. Conservation and natural environments** | |
| 1.1. | Nature conservation (National parks, nature reserves and other legally protected areas). |
| 1.2. | Managed resource protection (land other than nature conservation areas managed for biodiversity or landscape values such as water catchments and traditional indigenous use). |
| 1.3. | Other minimal use (defence land, stock routes, remnant native vegetation and rehabilitation). |
| **2. Production from relatively natural environments** | |
| 2.1. | Grazing natural vegetation (intact native vegetation used for grazing). |
| 2.2. | Production forestry (native forest and vegetation managed for timber and other production). |
| **3. Production from dryland agriculture and plantations** | |
| 3.1. | Plantation forestry (soft and hard wood, and other products). |
| 3.2. | Grazing modified pastures (native and/or exotic species of woody fodder and/or pasture legumes and/or sown grasses). |
| 3.3. | Cropping (cereal, oil seeds, sugar, cotton, legumes, hay and silage, tobacco, beverage and spice crops). |
| 3.4. | Perennial horticulture (plants living more than two years such as tree fruits, olives, vine fruits, tree nuts, shrub nuts, flowers, bulbs, vegetables and herbs). |
| 3.5. | Seasonal horticulture (plants living less than two years such as fruits, nuts, flowers, bulbs, vegetables and herbs). |
| 3.6. | Land in transition (degraded, abandoned, rehabilitation or other). |
| **4. Production from irrigated agriculture and plantations** | |
| 4.1. | Irrigated plantation forestry (irrigated, but otherwise as for 3.1). |
| 4.2. | Irrigated modified pastures (woody fodder and/or pasture legumes and/or sown grasses). |
| 4.3. | Irrigated cropping (irrigated, but otherwise as for 3.3). |
| 4.4. | Irrigated perennial horticulture (irrigated, but otherwise as for 3.4). |
| 4.5. | Irrigated seasonal horticulture (irrigated, but otherwise as for 3.5). |
| 4.6. | Irrigated land in transition (irrigated, but otherwise as for 3.6). |
| **5. Intensive uses** | |
| 5.1. | Intensive horticulture (shade and glasshouses). |
| 5.2. | Intensive animal production (dairy, cattle, sheep, poultry, pigs and aquaculture). |
| 5.3. | Manufacturing and industrial. |
| 5.4. | Residential (urban, rural residential and rural living). |
| 5.5. | Services (areas for commercial, public, recreation, defence and research use). |
| 5.6. | Utilities (electricity transmission and generation, gas treatment, storage and transmission). |
| 5.7. | Transport and communication (roads, railways, airports/aerodromes, ports, water transport, navigation and communication). |
| 5.8. | Mining (mines, quarries and tailings). |
| 5.9. | Waste treatment and disposal (stormwater, landfill, solid garbage, sewage and incinerators). |
| **6. Water** | |
| 6.1. | Lakes (for conservation, production or intensive uses). |
| 6.2. | Reservoirs/dams (reservoirs, water storage for intensive uses, farm dams, evaporation basins, effluent ponds). |
| 6.3. | Rivers (for conservation, production or intensive uses). |
| 6.4. | Channels/aqueducts (supply and drainage channels/aqueducts). |
| 6.5. | Marshes/wetlands (for conservation, production or intensive uses). |
| 6.6. | Estuary/coastal waters (for conservation, production or intensive uses). |

It may be necessary to use two or more secondary levels for established production systems, for example cereal cropping and pasture rotations in crop/pasture rotations in central and southern NSW.

The NSW WRM system is designed to be applied on a number of geographic scales, for example to the state of New South Wales, to regions or catchments, to individual Local Control Areas (LCA), and may even be applied to individual land management units, for example a farm or a National park. There is likely to be a number of land uses within the geographic area being considered, for example within the LCA, region, catchment, or across the state. These land uses will vary in terms of what crops, pastures and other vegetation is managed. However, to keep the scoring system relatively simple and to answer at the level of the geographic area under consideration, it is generally necessary to think in averages.

There are three main aspects to keep in mind.

- **Where the weed is only prevalent at certain phases in the land use.** For example, a typical dryland cropping rotation throughout central and southern NSW may include cereal, canola, pulse and pasture phases. In answering the questions, average the Invasiveness and Impacts of a weed amongst these four 'vegetation' types. This means that if a weed is only a problem in cereal crops, then it will score less than a similar weed that is a problem in all crops and pastures. In the Potential Distribution section these two weeds will get the same score as they will occupy the same area.
- **Where a weed only occurs in certain parts of a land use.** For example, the irrigated perennial horticulture land use in the geographic area being considered may contain citrus, stone fruit, olives and vines. For a weed that only occurs in citrus and vines, average the Invasiveness and Impacts of a weed amongst the two 'vegetation' types only. Then in the Potential Distribution section, the weeds score may be reduced because they are not a problem in all irrigated perennial horticulture crops in the geographic area.
- **Where a weed species behaves differently in different land uses, or in different situations in the one land use.** One example of a weed behaving differently in different land uses would be that more individuals of Noogoora burr (*Xanthium occidentale*) will emerge in irrigated compared to dryland cropping. In this case answer the question with only the specific land use in mind. One example of a weed behaving differently in the one land use is when one flush of seedlings of Noogoora burr (*Xanthium occidentale*) emerge after early spring rains while another emerges after late summer rains. The two groups of plants are different ages in autumn but both flower at the same time due to a photoperiod requirement (in this case a decreasing length of day light). In this case, consider the average age of the plant at flowering.

### Decide what land uses apply to your geographic area.

Then decide which weeds cause problems in which land uses.

There is no need to assess every weed in every land use although it may be useful to consider weeds that are not yet widespread in addition to those commonly found.

Assumptions (https://www.dpi.nsw.gov.au/biosecurity/weeds/strategy/nsw-weed-risk-management-system/weed-risk) on land use can be recorded directly into the electronic form (XLS, 241.5 KB) (https://www.dpi.nsw.gov.au/__data/assets/file/0019/304723/NSW-WRA.xls).

## Appendix

Comparisons between the NSW WRM and other WRM systems

This appendix contains information comparing the NSW WRM system to four other commonly used post-border WRM systems in Australia. Comparisons between the NSW and other WRM systems have been outlined in table form with relevant comments.

Section A1 compares the NSW and South Australian (SA) WRM systems, Section A2 compares the NSW and Northern Territory (NT) WRM systems, Section A3 compares the NSW and Victorian (VIC) system and Section A4 compares the NSW and 'Randall' system, commonly used for regional prioritisation of weeds in NSW.

Information from each of the WRM systems can be used to help complete the NSW WRM. Further reference in made to the SA, NT and VIC systems in the Sourcing information section.

### A1 Comparison of the NSW and South Australian WRM systems

There is a large degree of similarity between the NSW and SA WRM systems with only minor differences in wording for the sections covering Invasiveness, Impacts and Persistence (Table A1).

While the Control costs section shares many similarities, the scoring system for Q1 in the NSW WRM system differs slightly from the SA system and Q3a in the SA system has been split into two questions in the NSW system.

Although there are similarities in the way questions are asked in the Potential and Current distribution sections, information for the SA system is not specifically applicable to the distribution of the species in NSW.

Two additional questions have been added to the end of NSW WRM system when compared to the SA system. The Positive impacts question will help determine known positive impacts while the Further comments question allows any further comments to be made.

### A2 Comparison of the NSW and Northern Territory WRM systems

There is a moderate amount of similarity between the NSW and NT WRM systems. Having said this, it is important to remember that the NT system only assess weeds in one land use, that is native vegetation.

There are only minor differences in wording or questions that have not been asked in the sections covering Invasiveness, Control costs and Persistence (Table A2).

While the NSW Impacts section shares some similarities with the NT system, many questions are only partly comparable.

While there are some broad similarities in the way the NSW systems asks questions in the Potential and Current distribution sections, the questions themselves, and the information for the NT system is not specifically applicable to the distribution of the species in NSW.

Again, two additional questions have been added to the end of NSW WRM system when compared to the NT system. The Positive impacts question will help determine known positive impacts while the Further comments question allows any further comments to be made.

## A3 Comparison of the NSW WRM and Victorian Weed Risk Assessment systems

There is a moderate degree of similarity between the NSW and VIC systems (Table A3).

There are a range of comparable or partly comparable questions in the VIC Weed Risk Assessment (WRA) system that are applicable to questions in the Invasiveness and Impacts sections of the NSW WRM system. There is generally limited comparability between questions in the VIC WRA system and questions in the Control costs and Persistence sections of the NSW WRM system. Data used for the VIC WRA distribution section is not applicable to NSW.

Three questions asked in the Victorian WRA system have not been posed in the NSW system. These are the impact of weeds on agricultural land value, change in land use and the extent to which weeds act as an alternative host or vector for diseases. Information from these questions may be reported in the Comments section of the NSW WRM system.

## A4 Comparison of the NSW WRM and 'Randall' systems

There is a limited degree of similarity between the NSW WRM and 'Randall' systems (Table A4).

Questions in the 'Randall system are comparable or partly comparative to questions relating to the Invasiveness and Impacts sections of the NSW WRM system. Having said this, there are no comparable questions in the 'Randall' system that relate to the Control costs, Current and Potential distribution questions and only minimal relationship between the 'Randall' system questions and the NSW WRM Persistence questions.

| Question in NSW WRM Guide (and form) | Comparative question in SA WRM system | Comments |
|---|---|---|
| **Invasiveness** | | |
| Q1 | Invasiveness Q1 | Same question |
| Q2 | Invasiveness Q2 | Same question |
| Q3a | Invasiveness Q3a | Same question |
| Q3b | Invasiveness Q3b | Same question |
| Q3c | Invasiveness Q3c | Same question |
| Q4a | Invasiveness Q4a | Same question |
| Q4b | Invasiveness Q4b | Same question |
| Q4c | Invasiveness Q4c | Same question |
| Q4d | Invasiveness Q4d | Same question |
| Q5a | Invasiveness Q5a | Same question |
| Q5b | Invasiveness Q5b | Same question |
| Q5c | Invasiveness Q5c | Same question |
| Q5d | Invasiveness Q5d | Same question |
| **Impacts** | | |
| Q1 | Impacts Q1 | Same question |
| Q2 | Impacts Q2 | Same question |
| Q3 | Impacts Q3 | Same question |
| Q4 | Impacts Q4 | Same question |
| Q5 | Impacts Q5 | Same question |
| Q6a | Impacts Q6a | Same question |
| Q6b | Impacts Q6b | Same question |
| Q6c | Impacts Q6c (partly) | Similar question |
| Q6d | Impacts Q6d | Same question |
| Q6e | Impacts Q6e | Same question |
| Q6f | Impacts Q6f | Same question |
| **Potential distribution** | Potential distribution | Similar question but data not applicable to NSW |
| **Control costs** | | |
| Q1a | Control costs Q1c | Same question |
| Q1b | Control costs Q1b | Same question |
| Q1c | Control costs Q1a | Same question |

| | | |
|---|---|---|
| Q1d | Control costs Q1d | Same question |
| Note: total scoring in SA WRM system different for this question | | |
| Q2 | Control costs Q2 | Same question |
| Q3a | Control costs Q3a (partly) | Similar question (Control cost category B only) |
| Q3b | Control costs Q3b | Same question (Control cost category B only) |
| Q3c | Control costs Q3a (partly) | Similar question (Control cost category B only) |
| Q4 | Control costs Q4 | Same question |
| **Persistence** | | |
| Q1 | Persistence Q1 | Same question |
| Q2 | Persistence Q2 | Similar question |
| Q3 | Persistence Q3 | Same question |
| Q4a | Persistence Q4a | Same question |
| Q4b | Persistence Q4b (partly) | Similar question |
| **Current distribution** | | |
| Q1 | Current distribution Q1 | Similar question but data not applicable to NSW |
| Q2 | Current distribution Q2 | Similar question but data not applicable to NSW |
| **Positive impacts** | No comparison | Question not asked in SA |
| **Further comments** | No comparison | Question not asked in SA |

*Table A1. A comparison of the NSW and SA WRM systems*

| Question in NSW WRM Guide (and form) | Comparative question in NT WRM system | Comments |
|---|---|---|
| **Invasiveness** | | |
| Q1 | Invasiveness Q1 | Similar question |
| Q2 | No comparison | Question not asked in NT |
| Q3a | Invasiveness Q2a | Same question |
| Q3b | Invasiveness Q2b | Same question |
| Q3c | Invasiveness Q2c | Same question |
| Q4a | Invasiveness Q3a | Similar question |
| Q4b | Invasiveness Q3b | Similar question |
| Q4c | Invasiveness Q3c | Similar question |
| Q4d | Invasiveness Q3d | Similar question |
| Q5a | Invasiveness Q4a | Same question |
| Q5b | Invasiveness Q4b | Same question |
| Q5c | Invasiveness Q4c | Same question |
| Q5d | Invasiveness Q4d | Same question |
| **Impacts** | | |
| Q1 | Impacts Q1 | Partly comparable question |
| Q2 | Impacts Q1 | Partly comparable question |
| Q3 | Impacts Q5 | Partly comparable question |
| Q4 | Impacts Q3 | Same question |
| Q5 | Impacts Q4 | Similar question |
| Q6a | No comparison | Question not asked in NT |
| Q6b | Impacts Q2 | Partly comparable question |
| Q6c | No comparison | Question not asked in NT |
| Q6d | Impacts Q6a | Partly comparable question |

| | | |
|---|---|---|
| Q6e | Impacts Q6a | Partly comparable question |
| Q6f | Impacts Q6c | Partly comparable question |
| **Potential distribution** | Potential distribution Q1-3 | Partly comparable questions but data not applicable to NSW |
| **Control costs** | | **Note: *the opposite scoring in NT system as compared to NSW system** |
| Q1a | Control costs Q1c | Same question* |
| Q1b | Control costs Q1b | Same question* |
| Q1c | Control costs Q1a | Same question* |
| Q1d | No comparison | Question not asked in NT |
| Q2 | Control costs Q2 | Same question* |
| Q3a | Control costs Q3a | Similar question* |
| Q3b | Control costs Q3b | Similar question* |
| Q3c | Control costs Q3c | Similar question* |
| Q4 | Control costs Q4 | Partly comparable question* |
| **Persistence** | | |
| Q1 | No comparison | Question not asked in NT |
| Q2 | Persistence Q2 | Similar question* |
| Q3 | Persistence Q3 | Same question* |
| Q4a | Persistence Q4a | Same question* |
| Q4b | Persistence Q4b | Similar question* but note scoring differences |
| **Current distribution** | | |
| Q1 | No comparison | Question not asked in NT |
| Q2 | Current distribution Q1 | Question not asked in NT |
| **Positive impacts** | No comparison | Question not asked in NT |
| **Further comments** | No comparison | Question not asked in NT |

*Table A2. A comparison of the NSW and NT WRM systems*

| **Question in NSW WRM Guide (and form)** | **Comparative question in VIC WRA system** | **Comments** |
|---|---|---|
| **Invasiveness** | | |
| Q1 | Invasiveness – all 3 Establishment, growth rate and stress tolerance questions | Partly comparable questions |
| Q2 | Invasiveness – herbivory pressure | Partly comparable question |
| Q3a | Invasiveness – reproductive maturity | Comparable question |
| Q3b | Invasiveness - propagules produced | Comparable question |
| Q3c | Invasiveness – reproductive system | Partly comparable question |
| Q4a | Invasiveness – both Dispersal questions | Comparable questions |
| Q4b | Invasiveness – both Dispersal questions | Comparable questions |
| Q4c | Invasiveness – both Dispersal questions | Comparable questions |
| Q4d | Invasiveness – both Dispersal questions | Comparable questions |
| Q5a | Invasiveness – both Dispersal questions | Comparable questions |
| Q5b | Invasiveness – both Dispersal questions | Comparable questions |
| Q5c | Invasiveness – both Dispersal questions | Comparable questions |
| Q5d | Invasiveness – both Dispersal questions | Comparable questions |
| **Impacts** | | |

| | | |
|---|---|---|
| Q1 | Invasiveness – allelopathic properties Impacts – all 3 habitat/flora questions | Partly comparable questions |
| Q2 | Invasiveness – allelopathic properties and herbivory pressure Impacts – all 3 habitat/flora questions and produce yield | Partly comparable questions |
| Q3 | Impacts – tourism, cultural sites, water quality, biomass as carbon sink, and all 3 habitat/flora questions, threatened fauna and non–threatened fauna and agricultural quality | Partly comparable questions |
| Q4 | Impacts – restrict human access, water flow and harvest costs | Partly comparable questions |
| Q5 | Impacts – injurious to people and injurious to fauna | Partly comparable questions |
| Q6a | Impacts – benefits fauna, food source for pests and provides harbor | Comparable questions |
| Q6b | Impacts – fire regime | Comparable question |
| Q6c | No comparison | Question not asked in VIC |
| Q6d | No comparison | Question not asked in VIC |
| Q6e | Impacts – soil erosion | Partly comparable question |
| Q6f | No comparison | Question not asked in VIC |
| Potential distribution | No comparison | Data not applicable to NSW |
| **Control costs** | | |
| Q1a | Invasiveness – life form | Partly comparable question |
| Q1b | Invasiveness – reproductive maturity | Partly comparable question |
| Q1c | Invasiveness – life form | Partly comparable question |
| Q1d | No comparison | Question not asked in VIC |
| Q2 | Invasiveness – life form | Partly comparable question |
| Q3a | No comparison | Question not asked in VIC |
| Q3b | No comparison | Question not asked in VIC |
| Q3c | No comparison | Question not asked in VIC |
| Q4 | No comparison | Question not asked in VIC |
| **Persistence** | | |
| Q1 | No comparison | Question not asked in VIC |
| Q2 | Invasiveness – reproductive period | Partly comparable question |
| Q3 | Invasiveness – reproductive maturity and propagule longevity | Partly comparable questions |
| Q4a | Invasiveness – both Dispersal questions | Partly comparable questions |
| Q4b | Invasiveness – both Dispersal questions | Partly comparable questions |
| **Current distribution** | | |
| Q1 | No comparison | Data not applicable to NSW |
| Q2 | No comparison | Data not applicable to NSW |
| **Positive impacts** | Invasiveness – herbivory pressure | Question may be partly relevant |
| **Further comments** | No comparison Note: disease host/vector, land value and changed land use questions not asked in NSW WRM system | Question not asked in VIC |

*Table A3. A comparison of the NSW WRM and VIC WRA systems*

| **Question in NSW WRM Guide (and form)** | **Comparative question in 'Randall' system** | **Comments** |
|---|---|---|
| **Invasiveness** | | |
| Q1 | Invasiveness Q6 | Partly comparable question |

| | | |
|---|---|---|
| Q2 | No comparison | Except for similarity in Invasiveness Q2iv |
| Q3a | No comparison | Question not asked in Randall |
| Q3b | Invasiveness Q4 | Comparable question |
| Q3c | Invasiveness Q3i, Q3iii, Q4 | Comparable questions |
| Q4a | Invasiveness Q5i, Q5ii | Partly comparable questions |
| Q4b | Invasiveness Q5i, Q5ii | Partly comparable questions |
| Q4c | Invasiveness Q5vi | Comparable question |
| Q4d | Invasiveness Q5iii | Comparable question |
| Q5a | No comparison | Question not asked in Randall |
| Q5b | Invasiveness Q5i, Q5v | Partly comparable questions |
| Q5c | Invasiveness Q5iv | Partly comparable question |
| Q5d | Invasiveness Q5i, Q5ii | Partly comparable questions |
| **Impacts** | | |
| Q1 | Impacts Q1, Q3 | Partly comparable questions |
| Q2 | Impacts Q1, Q2ii | Partly comparable questions |
| Q3 | Impacts Q2i, Q2iii | Same questions (excepting diversity) |
| Q4 | Impacts Q4 | Same question |
| Q5 | Impacts Q5ii-Q5v | Same questions |
| Q6a | Impacts Q5i, Q6iii | Partly comparable questions |
| Q6b | Impacts Q6ii | Same question |
| Q6c | No comparison | Question not asked in Randall |
| Q6d | No comparison | Question not asked in Randall |
| Q6e | Impacts Q6i | Same question |
| Q6f | No comparison | Question not asked in Randall |
| **Potential distribution** | No comparison | Question not asked in Randall |
| **Control costs** | | |
| Q1a | No comparison | Question not asked in Randall |
| Q1b | No comparison | Question not asked in Randall |
| Q1c | No comparison | Question not asked in Randall |
| Q1d | No comparison | Question not asked in Randall |
| Q2 | No comparison | Question not asked in Randall |
| Q3a | No comparison | Question not asked in Randall |
| Q3b | No comparison | Question not asked in Randall |
| Q3c | No comparison | Question not asked in Randall |
| Q4 | No comparison | Question not asked in Randall |
| **Persistence** | | |
| Q1 | No comparison | Question not asked in Randall |
| Q2 | No comparison | Question not asked in Randall |
| Q3 | Invasiveness Q6 | Partly comparable question |
| Q4a | No comparison | Except for Invasiveness Q5 |
| Q4b | No comparison | Except for Invasiveness Q5 |
| **Current distribution** | | |
| Q1 | No comparison | Question not asked in Randall |
| Q2 | No comparison | Question not asked in Randall |
| **Positive impacts** | No comparison | Question not asked in Randall |

| | | |
|---|---|---|
| **Further comments** | No comparison | Question not asked in Randall |

*Table A4. A comparison of the NSW WRM and 'Randall' systems*