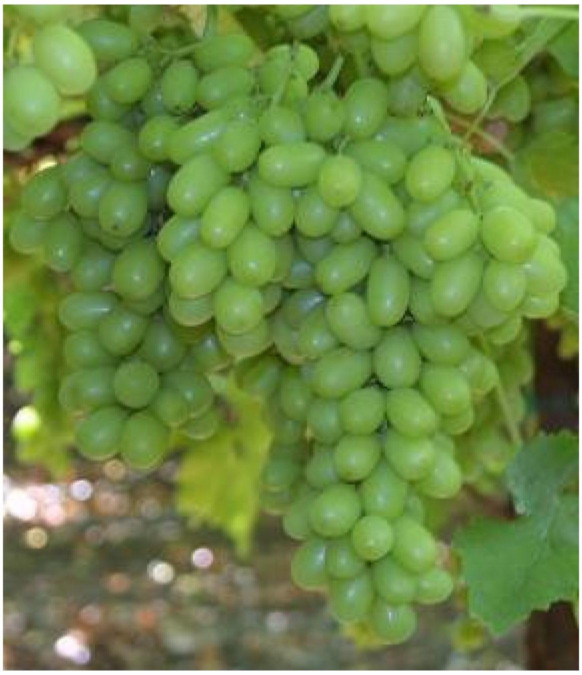
Australian Government

Department of Agriculture, Fisheries and Forestry

Final non-regulated analysis of existing policy for Californian table grapes to Western Australia



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Cover image: Table grapes from California (University of California 2013d).

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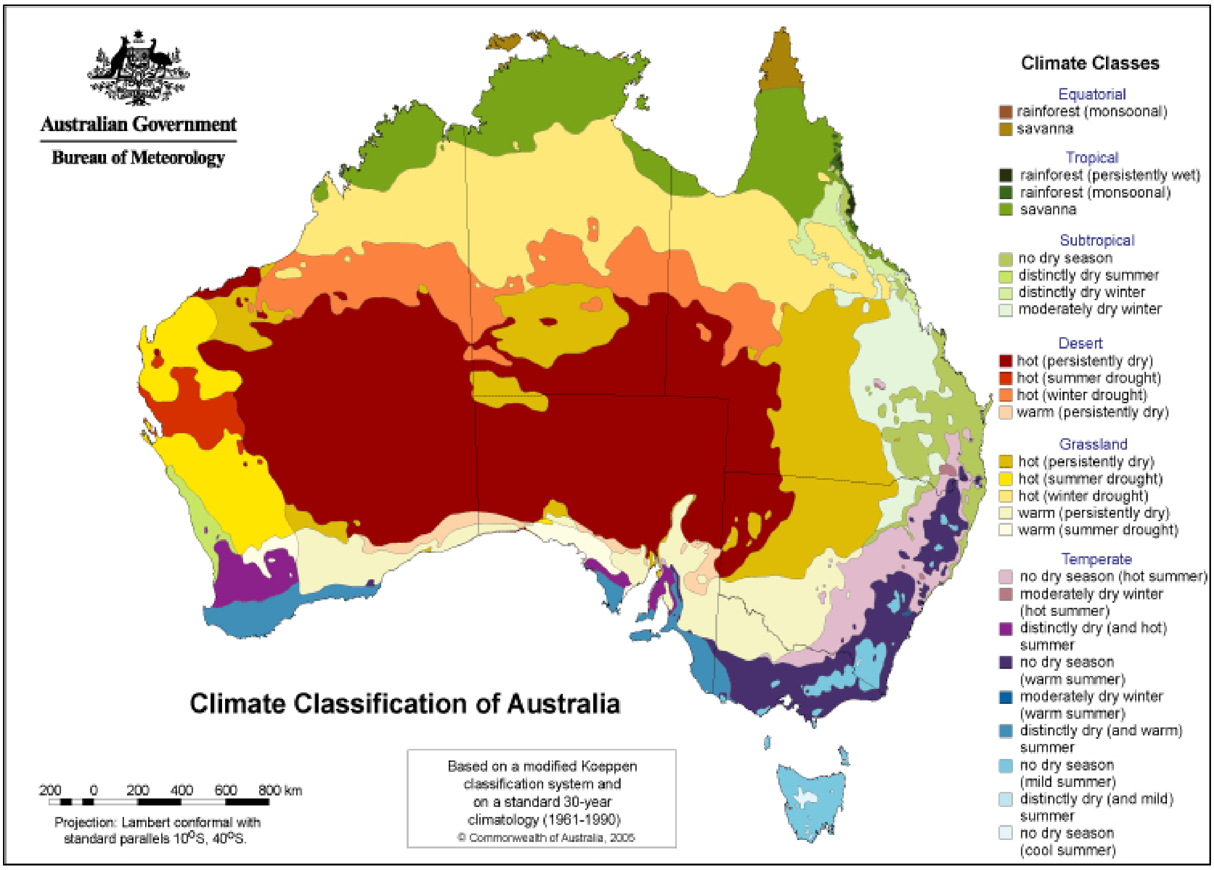

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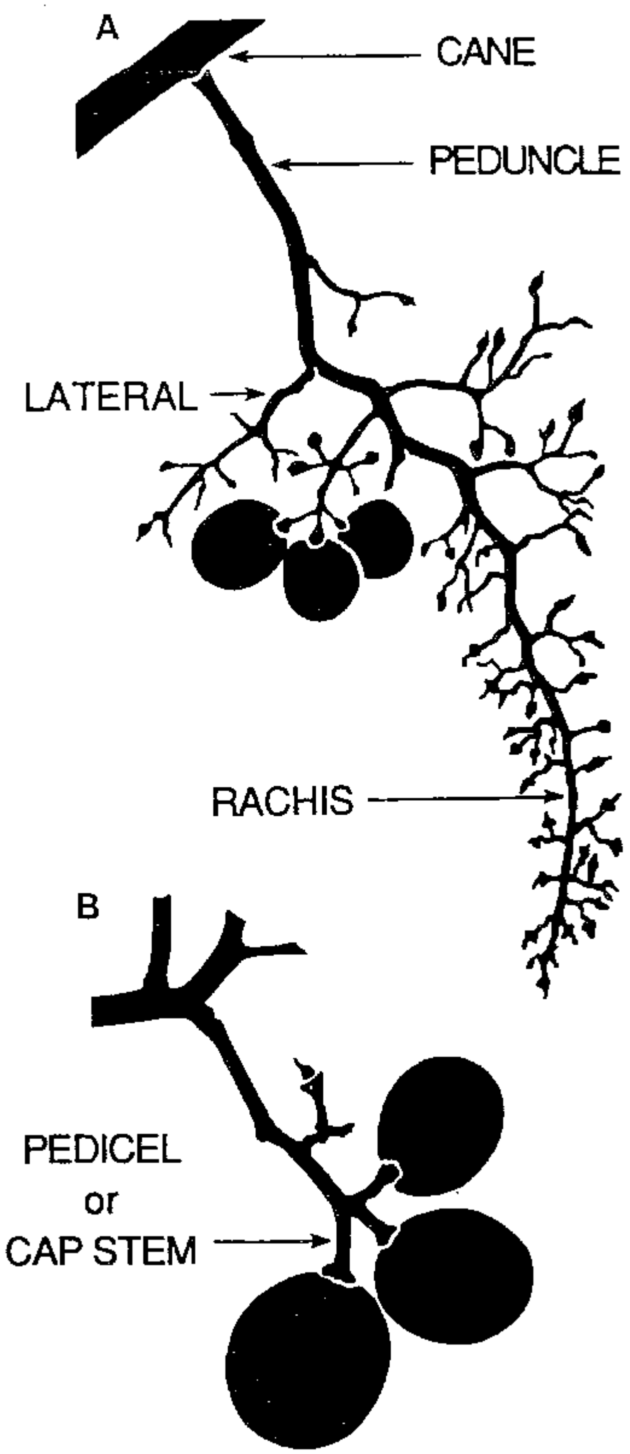

Source: (Pratt 1988)

Figure 3 – Diagram of table grape bunch or cluster
Part A: main parts of a table grape bunch or cluster
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Acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
ALOP	Appropriate level of protection
AQIS	Australian Quarantine and Inspection Service
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Australian Government Department of Agriculture, Fisheries and Forestry
DAFWA	Western Australian Government Department of Agriculture and Food
DSEWPC	Australian Government Department of Sustainability, Environment, Water, Population and Communities
EP	Existing policy
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practice
GHP	Good Handling Practices
ICON	Import conditions database
IPC	International Phytosanitary Certificate
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
ISPM	International Standard for Phytosanitary Measures
NSW	New South Wales
NPPO	National Plant Protection Organisation
NT	Northern Territory
OIE	World organisation for animal health
OPI	Offshore preshipment inspection
PRA	Pest risk analysis
Qld	Queensland
SA	South Australia
SO_2/CO_2	Sulfur dioxide plus carbon dioxide fumigation treatment
SOP	Standard Operating Procedure
SPS	Sanitary and Phytosanitary
SSOP	Sanitation Standard Operation Procedure
Tas.	Tasmania
USDA-APHIS	United States Department of Agriculture - Animal and Plant Health Inspection Service
Vic.	Victoria
WA	Western Australia
WTO	World Trade Organization

Abbreviations of units

Term or abbreviation	Definition
ºC	Degree Celsius
ha	Hectare
cm	Centimetre
g	Gram
kg	Kilogram
km	Kilometre
m	Metre
mm	Millimetre
s	Second

Summary

The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) has prepared this final report to assess the proposal by the United States of America (US), to extend market access for table grapes from California to Western Australia.

Australia has permitted entry of table grapes from California into all other Australian states and territories since 2002, provided they meet Australian quarantine requirements.

The final report considers pests of regional concern to Western Australia.

This final report proposes that the importation of table grapes from California be permitted into Western Australia, subject to a range of quarantine conditions.

This final report identifies pests that require phytosanitary measures to manage risks to a very low level in order to achieve Australia's appropriate level of protection (ALOP).

This final report proposes that the phytosanitary measures already used for imports of table grapes from California to all other states and territories of Australia be used to manage pest risks for entry to Western Australia. These measures are considered to reduce the risk associated with the importation of table grapes from California into Western Australia to achieve Australia's ALOP. The pests identified as requiring phytosanitary measures for entry to all other Australian states and territories under the existing policy for Californian table grapes are also quarantine pests for Western Australia.

One additional pest was identified in this final report that also requires phytosanitary measures, the harlequin ladybird (*Harmonia axyridis*). The final report proposes to manage the harlequin ladybird through visual inspection and remedial action (if found).

Grapevine redblotch associated virus (GRBaV) has recently been confirmed in North America and stakeholders have raised their concerns about its possible association with imported table grape bunches. The final report includes additional information on this virus at Appendix D and DAFF continues to monitor the status of this virus in the US. This virus is associated with planting material and DAFF has put in place measures to manage this virus on the nursery stock pathway.

Prior to this final report, DAFF issued a draft report for stakeholder comment and received 13 submissions. DAFF has made changes in this final report after considering stakeholders' comments on the draft report.

1 Introduction

1.1 Australia's biosecurity policy framework

Australia's biosecurity policies aim to protect Australia against the risks that may arise from exotic pests[1] entering, establishing and spreading in Australia, thereby threatening Australia's unique flora and fauna, as well as those agricultural industries that are relatively free from serious pests.

The risk analysis process is an important part of Australia's biosecurity policies. It enables the Australian Government to formally consider the risks that could be associated with proposals to import new products into Australia. If the risks are found to exceed Australia's appropriate level of protection (ALOP), risk management measures are proposed to reduce the risks to an acceptable level. But, if it is not possible to reduce the risks to an acceptable level, then no trade will be allowed.

Successive Australian Governments have maintained a conservative, but not a zero-risk, approach to the management of biosecurity risks. This approach is expressed in terms of Australia's ALOP, which reflects community expectations through government policy and is currently described as providing a high level of protection aimed at reducing risk to a very low level, but not to zero.

Australia's risk analyses are undertaken by DAFF using technical and scientific experts in relevant fields, and involve consultation with stakeholders at various stages during the process.

DAFF's assessment of risk may take the form of an IRA (import risk analysis), a non-regulated analysis of existing policy or technical advice.

Further information about Australia's biosecurity framework is provided in Appendix C of this report and in the *Import Risk Analysis Handbook 2011* located on the DAFF website www.daff.gov.au.

1.2 This non-regulated analysis of existing policy

1.2.1 Background

The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) formally requested to extend market access for fresh table grapes from California to include Western Australia in May 2005.

On 29 March 2012, DAFF formally announced the commencement of this import risk analysis, advising that it would be progressed as a non-regulated analysis of existing policy.

[1] A pest is any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products.

1.2.2 Scope

This report presents an assessment of biosecurity risks associated with commercially produced table grapes (*Vitis vinifera* L.) from the Californian counties of Fresno, Kern, Kings, Madera, Riverside and Tulare, free from trash, for human consumption in Western Australia.

In this report, table grapes are defined as table grape bunches or clusters, which include the peduncles, rachises, laterals, pedicels and berries (Pratt 1988) but not other plant parts (see Figure 3).

In the pest risk assessment chapter of this final report (Chapter 4), the pest risk analysis (PRA) area is defined as the state of Western Australia. The likelihoods of entry, establishment and spread and the consequence that pests may cause have been assessed for Western Australia.

This report covers all commercially produced table grapes from the six approved counties in the state of California that are currently permitted entry to the rest of Australia.

1.2.3 Existing policy

International policy

Import policy exists for table grapes imported into all other Australian states and territories from: California (AQIS 1999; AQIS 2000a; AQIS 2000b; Biosecurity Australia 2002; Biosecurity Australia 2003; Biosecurity Australia 2006); Chile (Biosecurity Australia 2005); New Zealand (AQIS 2012); the People's Republic of China (Biosecurity Australia 2011a); and Korea (Biosecurity Australia 2011b).

The import requirements for these commodity pathways can be found at DAFF's import conditions database: http://www.aqis.gov.au/icon.

Current import conditions for Californian table grapes require a combination of risk management measures and operational systems that reduce the risk associated with the importation of table grapes from California into all other Australian states and territories to achieve Australia's ALOP, specifically:

- permitted entry into Australia only from six approved counties in California: Fresno, Kern, Kings, Madera, Riverside and Tulare
- fumigation of all packed table grapes with a mixture of sulfur dioxide (SO_2) and carbon dioxide (CO_2) for grape phylloxera (*Daktulosphaira vitifoliae*) and regulated non-plant pests that are of concern to human health in Australia: the black widow spider (*Latrodectus mactans*); and two species of yellow sac spider (*Cheiracanthium inclusum* and *C. mildei*)
- fumigation of all packed table grapes with a a mixture of sulfur dioxide (SO_2) and carbon dioxide (CO_2) followed by 6 days cold treatment with a pulp temperature of -0.50°C ± 0.50°C or below for spotted wing drosophila (*Drosophila suzukii*)
- pre-export phytosanitary inspection and certification by the USDA-APHIS, offshore preshipment inspection (OPI) or on arrival inspection, remedial action if required, and clearance by DAFF

- suspension of all exports upon a detection of a live glassy-winged sharpshooter (GWSS) during DAFF inspection until the problem is investigated. If a dead GWSS is found during inspection, an investigation will be conducted to evaluate the relationship of GWSS to the table grape pathway
- a supporting operational system to maintain and verify the phytosanitary status of consignments. DAFF will verify that the required phytosanitary measures have been applied.

Domestic arrangements

The Commonwealth Government is responsible for regulating the movement of plants and plant products into and out of Australia. However, the state and territory governments are responsible for plant health controls within Australia. Legislation relating to resource management or plant health may be used by state or territory government agencies to control interstate movement of plants or their products.

Currently, the importation of grape fruit, seeds and plants into Western Australia from any source is prohibited due to the absence of grape phylloxera (*Daktulosphaira vitifoliae*), grapevine fanleaf virus and phomopsis cane and leaf spot (*Phomopsis viticola*) in that state (DAFWA 2013b). Machinery previously used in the growing or processing of grapes is also prohibited unless it satisfies quarantine requirements that include heat treatment and washing.

On 15 September 2011, the Western Australian Government Department of Agriculture and Food (DAFWA) announced the formal commencement of a pest risk analysis considering the importation of fresh table grapes into Western Australia. That process is still underway.

1.2.4 Contaminating pests

In addition to the pests of fresh table grapes from California that are assessed in this report, there are other organisms that may arrive with the imported commodity. These organisms could include pests of other crops or predators and parasitoids of other arthropods. DAFF considers these organisms to be contaminating pests that could pose sanitary and phytosanitary risks. These risks are addressed by existing procedures including fumigation; a 600 unit inspection of all consignments; and investigation of any pest that may be of quarantine concern to Australia.

The risk of contaminating weed seeds is also addressed by the procedures detailed in Section 5.3.

1.2.5 Consultation

On 29 March 2012, DAFF notified stakeholders in Biosecurity Advice 2012/06 of the formal commencement of a non-regulated analysis of existing policy to consider a proposal from APHIS to extend the importation of fresh table grapes from approved Californian counties into Western Australia.

DAFF consulted with DAFWA during the preparation of the draft report and then released the draft report for a 30 day stakeholder comment period on 9 April 2013. DAFF received 13 submissions on the draft report. All submissions were considered in developing the final report, and where relevant, changes were made to the final report. DAFF also met with

DAFWA and Table Grapes Western Australia Inc (TGWA) in Perth on 17 and 18 June 2013 to discuss their submissions on the draft report. In response to the concerns of TGWA about the presence of red blotch associated virus in the US, DAFF provided them with additional information on the association of this pest with table grape bunches from California. This information is presented at Appendix D. DAFF also briefed the Australian Table Grape Association (ATGA) on grapevine red blotch associated virus at a board meeting in Mildura on 4 July 2013.

TGWA also raised concerns about *Phomopsis viticola* and DAFF provided them with additional information on climate in the US and Australia which underpins the assessment.

2 Method for pest risk analysis

This chapter sets out the method used for the pest risk analysis (PRA) in this report. DAFF has conducted this PRA in accordance with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2007) and ISPM 11: *Pest risk analysis for quarantine pests, including analysis of environmental risks and living modified organisms* (FAO 2004) that have been developed under the SPS Agreement (WTO 1995).

A PRA is 'the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, if a pest should be regulated and the strength of any phytosanitary measures to be taken against it' (FAO 2012). A pest is 'any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products' (FAO 2012).

Quarantine risk consists of two major components: the probability of a pest entering, establishing and spreading in Australia from imports; and the consequences should this happen. These two components are combined to give an overall estimate of the risk.

Unrestricted risk is estimated taking into account the existing commercial production practices of the exporting country and that, on arrival in Australia, DAFF will verify that the consignment received is as described on the commercial documents and its integrity has been maintained.

Restricted risk is estimated with phytosanitary measure(s) applied. A phytosanitary measure is 'any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests' (FAO 2012).

A glossary of the terms used is provided at the back of this report.

The PRA was conducted in the following three consecutive stages: initiation, pest risk assessment and pest risk management.

2.1 Stage 1: Initiation

Initiation identifies the pest(s) and pathway(s) that are of quarantine concern and should be considered for risk analysis in relation to the identified PRA area.

Appendix A of this report lists the pests and diseases with the potential to be associated with exported table grapes produced using commercial production and packing procedures. The pests associated with the crop and the exported commodity were tabulated from information from DAFF's existing policy on Californian table grapes, a domestic pest list provided by DAFWA and literature and database searches.

For this report, the 'PRA area' is defined as the state of Western Australia.

The existing policy for Californian table grapes to the rest of Australia includes measures for quarantine pests. Pests identified in the pest categorisation in this report as pests of quarantine concern for Western Australia that are already identified as quarantine pests for the rest of Australia and for which phytosanitary measures are in place for trade in Californian table grapes were not reassessed in the pest risk assessment. A judgement was made to apply the current quarantine measures for Californian table grapes to the rest of Australia to pests of quarantine concern identified in the pest categorisation for Western Australia. These pests are identified in the pest categorisation.

2.2 Stage 2: Pest risk assessment

A pest risk assessment (for quarantine pests) is: 'the evaluation of the probability of the introduction and spread of a pest and of the likelihood of associated potential economic consequences' (FAO 2012).

For pests that have been considered by DAFF in previous pest risk assessments for other commodities or other source areas, the previous assessment was used in this report. The likelihood of importation, and sometimes the likelihood of distribution, of the pest on the commodity was reassessed, but the likelihood of establishsment and spread and the consequences that those pests may cause were not reassessed as these relate specifically to events that would occur in Western Australia and are independent of the importation pathway. This method is indicated in pest risk assessments where this has been applied.

In this report, the pest risk assessments were divided into the following interrelated processes:

2.2.1 Pest categorisation

Pest categorisation identifies which pests with the potential to be on the commodity are pests of quarantine concern for Western Australia and require pest risk assessment.

The pests identified in Stage 1 were categorised using the following primary elements to identify the pests of quarantine concern for the commodity being assessed:

- identity of the pest
- presence or absence in the PRA area and the rest of Australia
- regulatory status
- potential for establishment and spread in the PRA area
- potential for economic consequences (including environmental consequences) in the PRA area.

The results of pest categorisation for the pests considered in this PRA are set out in columns 4-7 in Appendix A. The steps in the categorisation process are considered sequentially, with the assessment terminating with a 'Yes' in column 4 or the first 'No' in columns 5 or 6. The pests of quarantine concern identified during pest categorisation were carried forward for pest risk assessment and are listed in Table 4.2.

2.2.2 Assessment of the probability of entry, establishment and spread

Details of how to assess the 'probability of entry', 'probability of establishment' and 'probability of spread' of a pest are given in ISPM 11 (FAO 2004). A summary of this process is given below, followed by a description of the qualitative methodology used in this report.

Probability of entry

The probability of entry describes the probability that a quarantine pest will enter Western Australia as a result of trade in a given commodity, be distributed in a viable state in the PRA area and subsequently be transferred to a host. It is based on pathway scenarios depicting necessary steps in the sourcing of the commodity for export, its processing, transport and storage, its use in Western Australia and the generation and disposal of waste. In particular, the ability of the pest to survive is considered for each of these various stages.

The probability of entry estimates for the quarantine pests for a commodity are based on the use of the existing commercial production, packaging and shipping practices of the exporting country. Details of the existing commercial production practices for the commodity are set out in Chapter 3. These practices are taken into consideration by DAFF when estimating the probability of entry.

For the purpose of considering the probability of entry, DAFF divides this step into two components:

- **Probability of importation**: the probability that a pest will arrive in Western Australia when a given commodity is imported.
- **Probability of distribution**: the probability that the pest will be distributed, as a result of the processing, sale or disposal of the commodity, in the PRA area and subsequently transfer to a susceptible part of a host.

Factors considered in the probability of importation include:

- distribution and incidence of the pest in the source area
- occurrence of the pest in a life-stage that would be associated with the commodity
- mode of trade (e.g. bulk, packed)
- volume and frequency of movement of the commodity along each pathway
- seasonal timing of imports
- pest management, cultural and commercial procedures applied at the place of origin
- speed of transport and conditions of storage compared with the duration of the lifecycle of the pest
- vulnerability of the life-stages of the pest during transport or storage
- incidence of the pest likely to be associated with a consignment
- commercial procedures (e.g. refrigeration) applied to consignments during transport and storage in the country of origin, and during transport to Western Australia.

Factors considered in the probability of distribution include:

- commercial procedures (e.g. refrigeration) applied to consignments during distribution in Western Australia
- dispersal mechanisms of the pest, including vectors, to allow movement from the pathway to a host
- whether the imported commodity is to be sent to a few or many destination points in the PRA area
- proximity of entry, transit and destination points to hosts
- time of year at which import takes place
- intended use of the commodity (e.g. for planting, processing or consumption)
- risks from by-products and waste.

Probability of establishment

Establishment is defined as the ‘perpetuation for the foreseeable future, of a pest within an area after entry’ (FAO 2012). In order to estimate the probability of establishment of a pest, reliable biological information (lifecycle, host range, epidemiology, survival, etc.) is obtained from the areas where the pest currently occurs. The situation in the PRA area can then be compared with that in the areas where it currently occurs and expert judgement used to assess the probability of establishment.

Factors considered in the probability of establishment in the PRA area include:

- availability of hosts, alternative hosts and vectors
- suitability of the environment
- reproductive strategy and potential for adaptation
- minimum population needed for establishment
- cultural practices and control measures.

Probability of spread

Spread is defined as ‘the expansion of the geographical distribution of a pest within an area’ (FAO 2012)(FAO 2004). The probability of spread considers the factors relevant to the movement of the pest, after establishment on a host plant or plants, to other susceptible host plants of the same or different species in other areas. In order to estimate the probability of spread of the pest, reliable biological information is obtained from areas where the pest currently occurs. The situation in the PRA area is then carefully compared with that in the areas where the pest currently occurs and expert judgement used to assess the probability of spread.

Factors considered in the probability of spread include:

- suitability of the natural and/or managed environment for natural spread of the pest
- presence of natural barriers
- potential for movement with commodities, conveyances or by vectors
- intended use of the commodity
- potential vectors of the pest in the PRA area
- potential natural enemies of the pest in the PRA area.

Assigning qualitative likelihoods for the probability of entry, establishment and spread

In its qualitative PRAs, DAFF uses the term ‘likelihood’ for the descriptors it uses for its estimates of probability of entry, establishment and spread. Qualitative likelihoods are assigned to each step of entry, establishment and spread. Six descriptors are used: high; moderate; low; very low; extremely low; and negligible (Table 2.1). Descriptive definitions for these descriptors are given in Table 2.1. The standardised likelihood descriptors provide guidance to the risk analyst and promote consistency between different risk analyses.

Table 2.1 – Nomenclature for qualitative likelihoods

Likelihood	Descriptive definition
High	The event would be very likely to occur
Moderate	The event would occur with an even probability
Low	The event would be unlikely to occur
Very low	The event would be very unlikely to occur
Extremely low	The event would be extremely unlikely to occur
Negligible	The event would almost certainly not occur

The likelihood of entry is determined by combining the likelihood that the pest will be imported into the PRA area and the likelihood that the pest will be distributed within the PRA area, using a matrix of rules (Table 2.2). This matrix is then used to combine the likelihood of entry and the likelihood of establishment, and the likelihood of entry and establishment is then combined with the likelihood of spread to determine the overall likelihood of entry, establishment and spread.

For example, if the probability of importation is assigned a likelihood of ‘low’ and the probability of distribution is assigned a likelihood of ‘moderate’, then they are combined to give a likelihood of ‘low’ for the probability of entry. The likelihood for the probability of entry is then combined with the likelihood assigned to the probability of establishment (e.g. ‘high’) to give a likelihood for the probability of entry and establishment of ‘low’. The likelihood for the probability of entry and establishment is then combined with the likelihood assigned to the probability of spread (e.g. ‘very low’) to give the overall likelihood for the probability of entry, establishment and spread of ‘very low’. A working example is provided below;

P [importation] x *P* [distribution] = *P* [**entry**] e.g. **low x moderate = low**

P [entry] x *P* [establishment] = *P* [**EE**] e.g. **low x high = low**

P [**EE**] x [spread] = ***P* [EES]** e.g. **low x very low = very low**

Table 2.2 – Matrix of rules for combining qualitative likelihoods

	High	Moderate	Low	Very low	Extremely low	Negligible
High	High	Moderate	Low	Very low	Extremely low	Negligible
Moderate		Low	Low	Very low	Extremely low	Negligible
Low			Very low	Very low	Extremely low	Negligible
Very low				Extremely low	Extremely low	Negligible
Extremely low					Negligible	Negligible
Negligible						Negligible

Time and volume of trade

One factor affecting the likelihood of entry is the volume and duration of trade. If all other conditions remain the same, the overall likelihood of entry will increase as time passes and the overall volume of trade increases.

DAFF normally considers the likelihood of entry on the basis of the estimated volume of one year's trade. This is a convenient value for the analysis that is relatively easy to estimate and allows for expert consideration of seasonal variations in pest presence, incidence and behaviour to be taken into account. The consideration of the likelihood of entry, establishment and spread and subsequent consequences takes into account events that might happen over a number of years even though only one year's volume of trade is being considered. This difference reflects biological and ecological facts, for example where a pest or disease may establish in the year of import but spread may take many years.

The use of a one year volume of trade has been taken into account when setting up the matrix that is used to estimate the risk and therefore any policy based on this report does not simply apply to one year of trade. Policy decisions that are based on DAFF method that uses the estimated volume of one year's trade are consistent with Australia's policy on appropriate level of protection and meet the Australian Government's requirement for ongoing quarantine protection.

In assessing the volume of trade in this PRA, DAFF assumed that a substantial volume of trade will occur. This is based on the historical trade that has occurred in table grapes from California to the rest of Australia since 2002. The estimated volume is given in Chapter 1.

2.2.3 Assessment of potential consequences

The objective of the consequence assessment is to provide a structured and transparent analysis of the likely consequences if the pests or disease agents were to enter, establish and spread in Western Australia. The assessment considers direct and indirect pest effects and their economic and environmental consequences. The requirements for assessing potential consequences are given in Article 5.3 of the SPS Agreement (WTO 1995), ISPM 5 (FAO 2012) and ISPM 11 (FAO 2004).

Direct pest effects are considered in the context of the effects on:

- plant life or health
- other aspects of the environment.

Indirect pest effects are considered in the context of the effects on:

- eradication, control, etc.
- domestic trade
- international trade
- environment.

For each of these six criteria, the consequences were estimated over four geographic levels, defined as:

Local: an aggregate of households or enterprises (a rural community, a town or a local government area).

District: a geographically or geopolitically associated collection of aggregates (generally a recognised section of a state or territory, such as 'Far North Queensland').

Regional: a geographically or geopolitically associated collection of districts in a geographic area (generally a state or territory, although there may be exceptions with larger states such as Western Australia).

National: Australia wide (Australian mainland states and territories and Tasmania).

For each criterion, the magnitude of the potential consequence at each of these levels was described using four categories, defined as:

Indiscernible: pest impact unlikely to be noticeable.

Minor significance: expected to lead to a minor increase in mortality/morbidity of hosts or a minor decrease in production but not expected to threaten the economic viability of production. Expected to decrease the value of non-commercial criteria but not threaten the criterion's intrinsic value. Effects would generally be reversible.

Significant: expected to threaten the economic viability of production through a moderate increase in mortality/morbidity of hosts, or a moderate decrease in production. Expected to significantly diminish or threaten the intrinsic value of non-commercial criteria. Effects may not be reversible.

Major significance: expected to threaten the economic viability through a large increase in mortality/morbidity of hosts, or a large decrease in production. Expected to severely or irreversibly damage the intrinsic 'value' of non-commercial criteria.

- The estimates of the magnitude of the potential consequences over the four geographic levels were translated into a qualitative impact score (A-G) using Table 2.3.
- For example, a consequence with a magnitude of 'significant' at the 'district' level will have a consequence impact score of D.

Table 2.3 – Decision rules for determining the consequence impact score based on the magnitude of consequences at four geographic scales

		Geographic scale			
		Local	**District**	**Region**	**Nation**
Magnitude	Indiscernible	A	A	A	A
	Minor significance	B	C	D	E
	Significant	C	D	E	F
	Major significance	D	E	F	G

The overall consequence for each pest is achieved by combining the qualitative impact scores (A–G) for each direct and indirect consequence using a series of decision rules (Table 2.4). These rules are mutually exclusive, and are assessed in numerical order until one applies.

Table 2.4 – Decision rules for determining the overall consequence rating for each pest

Rule	The impact scores for consequences of direct and indirect criteria	Overall consequence rating
1	Any criterion has an impact of ‘G’; or more than one criterion has an impact of ‘F’; or a single criterion has an impact of ‘F’ and each remaining criterion an ‘E’.	Extreme
2	A single criterion has an impact of ‘F’; or all criteria have an impact of ‘E’.	High
3	One or more criteria have an impact of ‘E’; or all criteria have an impact of ‘D’.	Moderate
4	One or more criteria have an impact of ‘D’; or all criteria have an impact of ‘C’.	Low
5	One or more criteria have an impact of ‘C’; or all criteria have an impact of ‘B’.	Very Low
6	One or more but not all criteria have an impact of ‘B’, and all remaining criteria have an impact of ‘A’.	Negligible

2.2.4 Estimation of the unrestricted risk

Once the above assessments are completed, the unrestricted risk can be determined for each pest or groups of pests. This is determined by using a risk estimation matrix (Table 2.5) to combine the estimates of the probability of entry, establishment and spread and the overall consequences of pest establishment and spread. Therefore, risk is the product of likelihood and consequence.

When interpreting the risk estimation matrix, note the descriptors for each axis are similar (e.g. low, moderate, high) but the vertical axis refers to likelihood and the horizontal axis refers to consequences. Accordingly, a ‘low’ likelihood combined with ‘high’ consequences, is not the same as a ‘high’ likelihood combined with ‘low’ consequences – the matrix is not symmetrical. For example, the former combination would give an unrestricted risk rating of ‘moderate’, whereas, the latter would be rated as a ‘low’ unrestricted risk.

Table 2.5 – Risk estimation matrix

Likelihood of pest entry, establishment and spread						
High	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Moderate	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Low	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
Very low	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
Extremely low	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
Negligible	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk
	Negligible	**Very low**	**Low**	**Moderate**	**High**	**Extreme**
	Consequences of pest entry, establishment and spread					

2.2.5 Australia's appropriate level of protection (ALOP)

The SPS Agreement defines the concept of an 'appropriate level of sanitary or phytosanitary protection (ALOP)' as the level of protection deemed appropriate by the WTO Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory.

Like many other countries, Australia expresses its ALOP in qualitative terms. Australia's ALOP, which reflects community expectations through government policy, is currently expressed as providing a high level of sanitary or phytosanitary protection aimed at reducing risk to a very low level, but not to zero. The band of cells in Table 2.5 marked 'very low risk' represents Australia's ALOP.

2.3 Stage 3: Pest risk management

Pest risk management describes the process of identifying and implementing phytosanitary measures to manage risks to achieve Australia's ALOP, while ensuring that any negative effects on trade are minimised.

The conclusions from pest risk assessment are used to decide whether risk management is required and if so, the appropriate measures to be used. Where the unrestricted risk estimate exceeds Australia's ALOP, risk management measures are required to reduce this risk to a very low level. The guiding principle for risk management is to manage risk to achieve Australia's ALOP. The effectiveness of any proposed phytosanitary measures (or combination of measures) is evaluated, using the same approach as used to evaluate the unrestricted risk, to ensure it reduces the restricted risk for the relevant pest or pests to meet Australia's ALOP.

ISPM 11 (FAO 2004) provides details on the identification and selection of appropriate risk management options and notes that the choice of measures should be based on their effectiveness in reducing the probability of entry of the pest.

Examples given of measures commonly applied to traded commodities include:

- options for consignments – e.g., inspection or testing for freedom from pests, prohibition of parts of the host, a pre-entry or post-entry quarantine system, specified conditions on preparation of the consignment, specified treatment of the consignment, restrictions on end-use, distribution and periods of entry of the commodity
- options preventing or reducing infestation in the crop – e.g., treatment of the crop, restriction on the composition of a consignment so it is composed of plants belonging to resistant or less susceptible species, harvesting of plants at a certain age or specified time of the year, production in a certification scheme
- options ensuring that the area, place or site of production or crop is free from the pest – e.g., pest-free area, pest-free place of production or pest-free production site
- options for other types of pathways – e.g., consider natural spread, measures for human travellers and their baggage, cleaning or disinfestations of contaminated machinery
- options within the importing country – e.g., surveillance and eradication programs
- prohibition of commodities – if no satisfactory measure can be found.

Risk management measures are identified for each quarantine pest where the risk exceeds Australia's ALOP. These are presented in the pest risk management chapter of this report (Chapter 5).

3 California's commercial production practices for table grapes

This chapter provides information on the pre-harvest, harvest and post-harvest practices in California for the production of fresh table grapes for export. The export capability of California is also outlined.

3.1 Assumptions used in estimating unrestricted risk

Production and processing procedures described in this chapter are standard commercial production practices for table grapes in California. DAFF officers and contractors have visited table grape production areas, before and after the importation of table grapes from California into the rest of Australia commenced in 2002, to observe or verify commercial production practices related to pest management in vineyards and packinghouses, and during storage and transportation. The most recent visit took place in June 2012.

In estimating the likelihood of pest introduction, it was assumed that the pre-harvest, harvest and post-harvest production practices for table grapes, as described in this chapter, are implemented for all areas and for all grape cultivars within the scope of this report.

3.2 Climate in production areas

Californian table grapes are permitted access into Australia only from the Californian counties of Fresno, Kern, Madera, Kings, Tulare and Riverside (AQIS 2012), which are located in the southern half of the state (see Figure 5). For comparison, climate information for eastern US grape producing regions (see Figure 6) and for Australia (see Figure 7) are provided.

Figure 4 – Map of California showing counties and their boundaries

Source: http://www.digital-topo-maps.com/county-map/california.shtml

The majority of Californian table grape production occurs in warm, dry inland valleys, with about 85 percent of production occurring in the southern San Joaquin Valley, including Fresno, Kern, Kings, Madera and Tulare counties, and about 14 percent in the Coachella Valley, including Riverside County (USDA 1999).

The San Joaquin Valley has an arid-to-semiarid climate with hot summers and mild winters (USGS 2011). Fresno County, for example, experiences high temperatures and sunshine hours with little rainfall throughout summer and the period following grape berry ripening (Gladstones 1992). From June to October, Fresno has a total average rainfall of 22 mm and an average maximum temperature of 33°C (World Climate 2011). However, the climate is milder during early spring, with a total average rainfall of 81 mm and an average maximum temperature of 21.5°C between March–April (during bud burst)(World Climate 2011). The average total rainfall from April to May (during bloom) is 39 mm and the average maximum temperature is 26°C (World Climate 2011). Fresno’s dry, hot weather and low rainfall, provide good conditions for table grape and drying grape production.

The counties of Madera, Kings, Kern, and Tulare experience similar average temperatures to those of Fresno from May to December, although Riverside County experiences a slightly higher average temperature for the same months (University of California Cooperative Extension 2012). The graphs presented in Figure 5 provide an indication of average daily maximum and minimum temperatures as well as average rainfall for these counties.

Average climate data for some viticultural areas in eastern US (Wooster, Ohio and Fredonia, New York), for which the climate is discussed in individual PRAs, are provided in Figure 6. In comparison, these eastern US regions experience cooler, wetter weather than the arid climate of the export counties. Wooster experiences an average annual rainfall of 936 mm and New York of 965 mm. Importantly, this rainfall predominantly occurs during the vine growing season.

For comparison, similar data for a sample of viticultural regions in Australia is presented in Figure 7. Average rainfall is higher in the Australian regions than in the Californian export counties, but is lower than in New York or Ohio. The mid north coast (NSW) has the highest rainfall, particularly during the growing season, of the Australian regions shown and is similar to New York or Ohio. Of the major Australian regions presented, those in Western Australia are slightly warmer than those in eastern Australia. Margaret River and the Swan Valley have a similar rainfall pattern to the Adelaide Hills, with high winter rainfall and low summer rainfall.

While average climate data has been discussed in this section, it is recognised that climate varies from year to year. Information available from the Australian Bureau of Meteorology (Bureau of Meteorology 2012) indicates that a one in ten year high rainfall for Carnarvon (367.9 mm) is significantly lower than eastern Australian growing regions. For the Swan Valley (Perth Airport, 1179 mm), a one in ten year high rainfall is comparable to an average season in the Adelaide Hills (1010 mm) although the Swan Valley is drier through the growing season. A one in ten year high rainfall in Margaret River (Witchcliffe, 1494 mm) is wetter than an average year in the Adelaide Hills. A one in ten year rainfall in Adelaide Hills (1726 mm) is wetter again. Climate trends show that in general, rainfall is decreasing and temperature increasing in table grape regions of Western Australia (Bureau of Meteorology 2013a; Bureau of Meteorology 2013b).

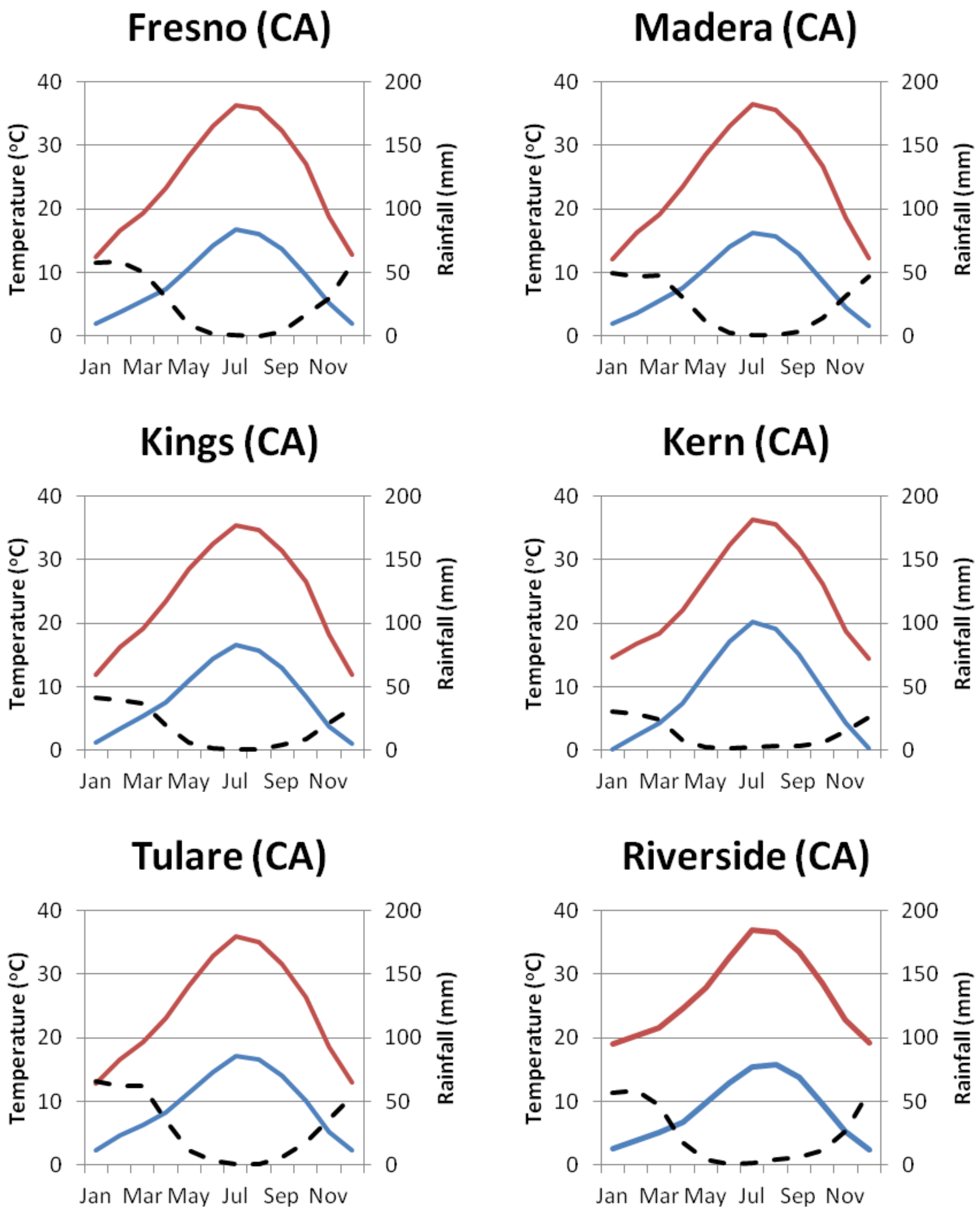

Figure 5 – Climate averages for export regions in the US.

Mean maximum (——) and minimum (——) temperatures and mean rainfall (- - - -) for the Californian table grape-producing counties of Fresno, Madera, Kings, Kern, Tulare, and Riverside and Fredonia New York and Wooster Ohio (World Climate 2011).

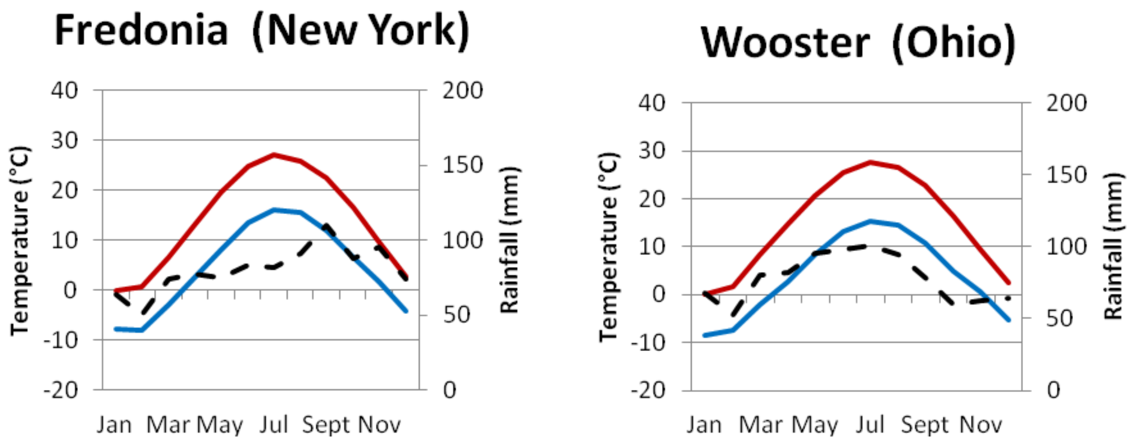

Figure 6 – Climate averages for non-export grape growing regions in the US.

Mean maximum (——) and minimum (——) temperatures and mean rainfall (- - - -) for the eastern US grape producing regions of Fredonia (New York) and Wooster (Ohio) (World Climate 2011).

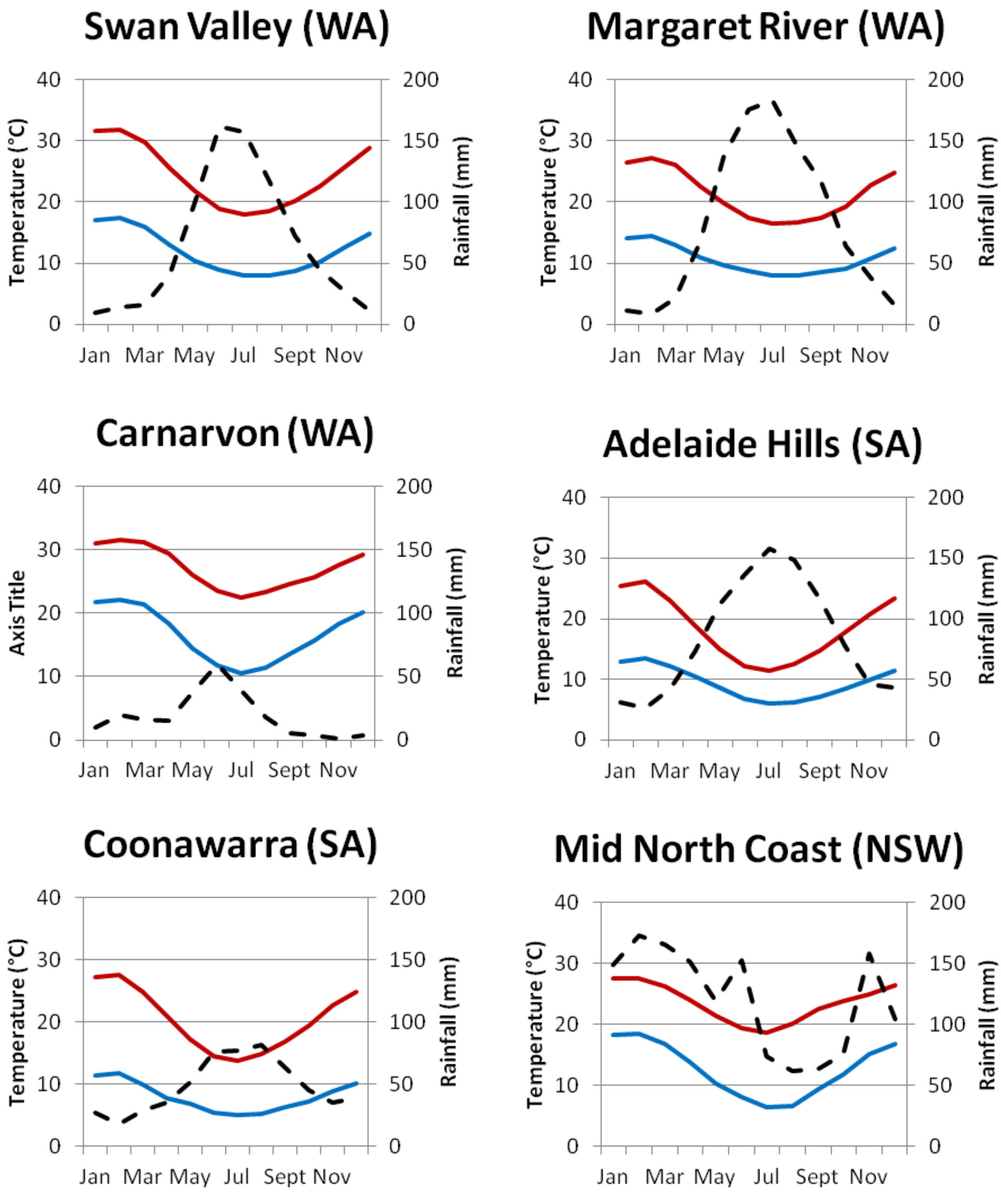

Figure 7 – Climate averages for grape growing regions in Australia.
Mean maximum (——) and minimum (——) temperatures and mean rainfall (- - - -) for the Australian grape-producing states Western Australia, New South Wales and South Australia (Bureau of Meteorology 2012)

3.3 Pre-harvest

3.3.1 Cultivars

Grapes have been cultivated in California for over two centuries (California Table Grape Commission 2012a). Grape production began to boom in California after 1839 when the first commercial table grape vineyard was planted in Los Angeles (California Table Grape Commission 2012b). There are now over 70 varieties of table grapes grown in California (California Table Grape Commission 2012b).

The major varieties of table grape by area planted are Flame Seedless, Crimson Seedless, Red Globe and Sugraone (Table 3.1).

Table 3.1 – Growing area for major table grape varieties in California in 2011
Source:(CDFA 2012a).

Major varieties	Growing area (ha) in 2011
Autumn King	1,021
Autumn Royal	1,813
Crimson Seedless	5,388
Flame Seedless	7,645
Perlette	611
Princess	1,360
Red Globe	4,638
Ruby Seedless	1,217
Scarlet Royal	1,279
Sugraone	2,036
Summer Royal	380
Other varieties	7,899
All varieties	**35,287**

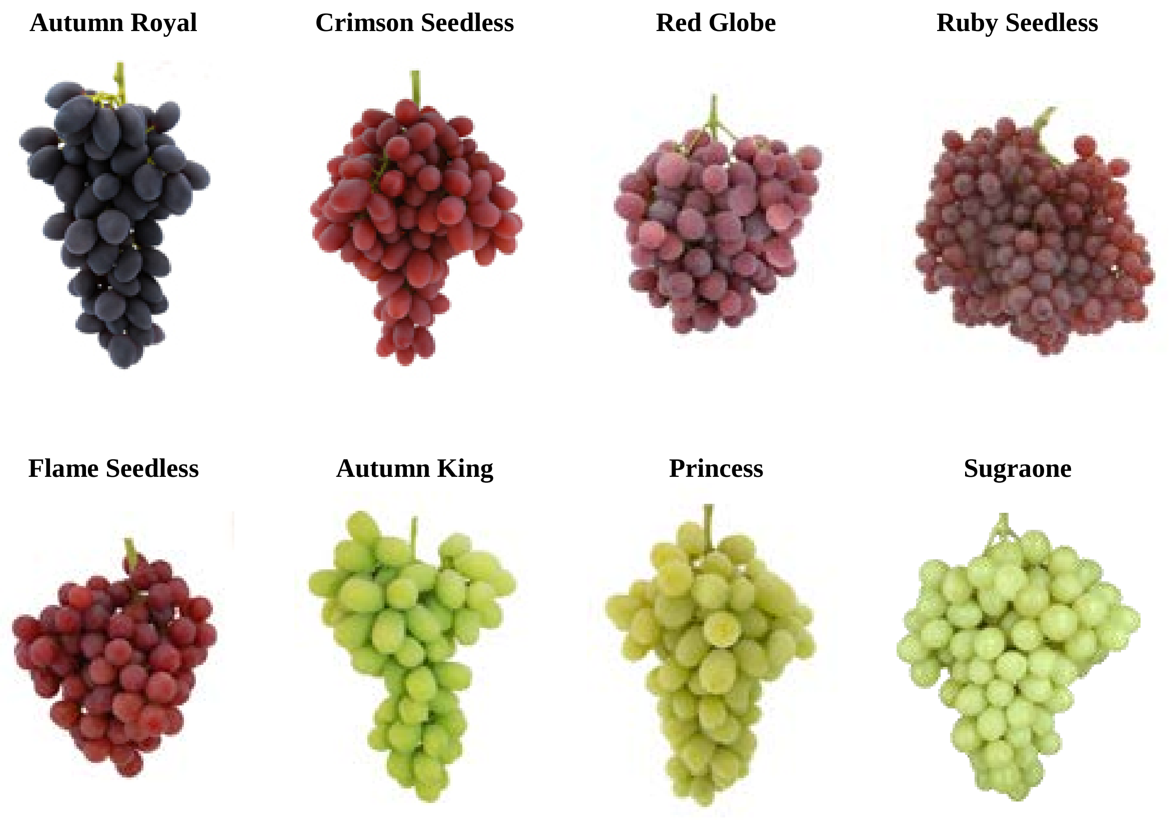

Figure 8 – Popular table grape varieties grown in California
Source: California Table Grape Commission (2012c)

3.3.2 Cultivation practices

Planting

Appropriate site preparation is conducted prior to planting in spring (Peacock *et al.* 1994). Many popular varieties including Autumn Royal and Crimson Seedless adapt to a wide range of soil types and conditions, although moderate vigour sites may be preferred to limit excessive vegetative growth (Dokoozlian *et al.* 2000a; Dokoozlian *et al.* 2000b). Irrigation and nitrogen fertilisation are also controlled to limit extreme canopy growth (Dokoozlian *et al.* 2000b). Cultivars may be grafted onto rootstocks, with Harmony and Freedom being the most commonly used rootstock for table grape production in the San Joaquin Valley (Dokoozlian *et al.* 2000a). Some cultivars are frequently spaced 2.1 to 2.4 metres between vines and 3.7 metres between rows, with in-row spacing being reduced to 1.8 metres if vine vigour is expected to be moderate (Dokoozlian *et al.* 2000a; Dokoozlian *et al.* 2000b).

Trellis systems

The 'T' trellis system has been the standard set-up used over the past 60 years with only minor modifications made through time (Peacock *et al.* 1994). Due to its simplicity and effectiveness, 'T' trellis systems with a single crossarm and two or three foliage support wires have become the industry norm for table grape producers throughout California (Peacock *et al.* 1994). The set-up for the 'T' trellis system normally involves a 0.9 to 1.2

metre crossarm (2 to 5 wires) arranged at the top of a 2.1 metre stake, driven into the ground to a depth of approximately 60 cm (Peacock *et al.* 1994). Other systems including the 'Y' and the Gable trellis set-ups have also been used in Californian vineyards (Peacock *et al.* 1994).

Pruning

Throughout the first year, vineyards in the San Joaquin Valley are allowed to grow unhindered for maximum leaf area and root system development (Christensen 1999). Vines are pruned back to two buds at the end of the growing season (Christensen 1999). In California, vines are either cane pruned or spur pruned (University of California 2008a). Cane pruning in California involves cutting back shoots from the previous season's growth to one or two buds to produce the following season's canes (Olmstead 2007). Spur pruning involves cutting back spurs along a permanently trained cordon (Olmstead 2007).

In California, some table grape cultivars, such as Autumn Royal, are most productive under a quadrilateral cordon system with spur pruning (Dokoozlian *et al.* 2000a). Other cultivars, such as Crimson Seedless, may produce adequate yields under either a cane pruning system or a quadrilateral cordon/spur pruning system (Dokoozlian *et al.* 2000b).

Irrigation

Irrigation is applied to Californian grapevines to ensure berries grow to a satisfactory size, to provide enough leaf area for healthy vine growth, and for the development of a canopy that provides sufficient shade to minimise sunburn to berries (Williams 2012). Irrigation requirements for table grapes in the San Joaquin Valley typically range from 450 to 500 mm between bud break and harvest (Williams 2012). Slightly higher volumes of water use are required in the Coachella region as a result of higher evaporation rates (Williams 2012).

3.3.3 Pest management

A year round checklist is used to ensure pest management covers all stages of table grape growth. Table 3.2 details the chemicals used, the timing of application and the pests targeted throughout California.

Table 3.2 – Integrated pest and disease management for Californian table grapes

Lifecycle stage	IPM activity	Example treatment options
Delayed dormant	• Monitor vines for mealybugs, European lecanium scale, spider mites, cutworm and manage if necessary • Place pheromone traps for omnivorous leafroller and sticky traps for glassy-winged sharpshooter	• Imidacloprid 7–14 fl oz/acre (490-980 mL/ha); insecticidal soaps; spinosad 1.25–2.5 oz/acre (87.5-175 g/ha)
Budbreak	• Continue monitoring vines for mealybugs, European lecanium scale, spider mites, cutworm and manage if necessary • Monitor vines for powdery mildew and treat if necessary • Consider treating for phomopsis if rain is forecast • Check traps for omnivorous leafroller and glassy-winged sharpshooter • Survey weeds and form management plan	• Imidacloprid 7–14 fl oz/acre (490-980 mL/ha); insecticidal soaps; narrow range oil; spinosad 1.25–2.5 oz/acre (87.5-175 g/ha) • Tebuconazole 4 oz/acre (280 g/ha); *Bacillus pumilis* 2–4 qt/acre (4.7-9.4 L/ha) • Kresoxim-methyl 3.2–4.8 oz/acre (224-336 g/ha); mancozeb; ziram; 3–4 lb/acre (3.4-4.5 kg/ha)
Rapid-shoot growth	• Monitor leafhoppers • Place pheromone traps for mealybugs • Continue checking traps for omnivorous leafroller and glassy-winged sharpshooter • Continue monitoring vines for powdery mildew and manage if necessary • Monitor for diseases including bot canker, eutypa dieback, measles and Pierce's disease • Check for wilting caused by Botrytis shoot blight and branch and twig borer • Monitor vines for spider mites, western grape, skeletonizer, leafrollers and other pests	• Remove basal leaves or lateral shoots; imidacloprid 7–14 fl oz/acre (490-980 g/ha) • Tebuconazole 4 oz/acre (280 g/ha); azoxystrobin 11–15.4 fl oz/acre (770-1050 mL/ha); *Bacillus pumilis* 2–4 qt/acre (4.7-9.4 L/ha) • Canker removal, vine removal, cultural practices to maintain vine vigour, and some fungicide applications may be used
Bloom to veraison	• Monitor for western flower thrips and manage if necessary • Monitor leafhoppers, spider mites, mealybugs, European fruit lecanium scale, Botrytis bunch rot, powdery mildew and for other pest and disease damage • Continue monitoring traps for vine mealybug, omnivorous leafroller and glassy-winged sharpshooters • Check for summer rot, Botrytis bunch rot and leafhopper populations	• Spinosad 1.25–2.5 oz/acre (87.5-175 g/ha); narrow range oil 1–2 gal/acre (9.4-18.7 L/ha) • Imidacloprid 7–14 fl oz/acre (490-980 mL/ha); narrow range oil; and other appropriate pesticides • Remove basal leaves and lateral shoots in the fruit zone at berry set
Veraison	• Monitor for pests and check traps, as above • Check for bird damage	• Manage with netting or scare devices
Harvest	• Check traps for glassy-winged sharpshooter and continue managing birds	
Postharvest	• Continue monitoring mealybugs, scale and western grapeleaf skeletonizer, and continue checking traps	
Dormant	• Prune vines, remove dried grape clusters and survey weeds	

Source: University of California (2012c)

3.4 Harvesting and handling procedures

Timing of harvest is largely determined by the fruit’s appearance, flavour, texture and sugar-acid ratio. Table grapes are harvested when they are ready to be consumed as they do not ripen after they have been picked (Rosenstock 2007). To determine the appropriate time to harvest, growers monitor the percentage colouration in the clusters and quantify soluble solid levels in a random selection of berries (Rosenstock 2007). In California, a soluble solids concentration of 14 to 17.5 per cent is normally used to identify fruit which are ready for harvest (Crisosto and Smilanick 2004). A minimum colour requirement is also applied to red and black table grape varieties to ensure adequate colour in the cluster prior to harvest (Crisosto and Smilanick 2004).

The majority of Californian table grapes are packed in the field, with few being shed packed (Crisosto and Smilanick 2004). Field packed grapes are commonly picked and placed into a picking container (Crisosto and Smilanick 2004). The cluster may be trimmed to remove any defective fruit, including sunburnt, decayed, undersized, cracked or irregular-shaped berries (Rosenstock 2007). Defective clusters are either completely discarded or included in low grade category (Rosenstock 2007). Clusters may be defective if they are too compact to examine the interior, filled with shot berries, too small, have an excess of defective berries, or have inadequate colouring (Rosenstock 2007). The picking container is then moved to a packer working in a portable stand in the avenue between vineyard blocks (Crisosto and Smilanick 2004). Packed containers are subject to quality inspection and weight checking (Crisosto and Smilanick 2004) according to the standards prescribed in the Code of Federal Regulations (as discussed in Section 3.6). The packer places the grape bunches into boxes. After packing, grapes are arranged onto pallets and sent to packing sheds and/or treatment facilities.

3.5 Post-harvest

After harvest, fruit is pre-cooled to remove field heat, reduce respiration, slow growth of decay and minimise water loss (Rosenstock 2007). Pre-cooling commences as soon as possible. Once the grapes have been pre-cooled, pallets are placed in a storage room until transportation occurs (Crisosto and Smilanick 2004). Under current export conditions, table grapes destined for the Australian market are fumigated with a combination sulfur dioxide (SO_2) and carbon dioxide (CO_2) treatment before they are cooled. This is because the fumigation treatment must occur at 15.6°C (60°F) or greater. After fumigation the table grapes are then cooled to undergo at least 6 continuous days of cold treatment at a pulp temperature of –0.50°C ± 0.50°C. After cold treatment they may then be moved into storage until they are transported for export.

Optimum refrigeration conditions for table grapes in storage are between –1 and 0 °C with relative humidity levels of 90 to 95 percent (Crisosto and Smilanick 2004). It is recommended that the pulp temperature of the berries should range from –0.5 to 0 ^{o}C during post-harvest storage (Crisosto and Smilanick 2004).

Optimum storage conditions for table grapes in transit range from –1 to –0.5 ^{o}C with relative humidity of 90–95% (Welby and McGregor 2004). Under these conditions, grapes may have an approximate storage life of 2–6 months (Welby and McGregor 2004). Figure 9 summarises the post-harvest packing house, storage and distribution steps for Californian table grapes. Table grapes destined for export to Australia are subject to the conditions detailed in Section 5.1.2.

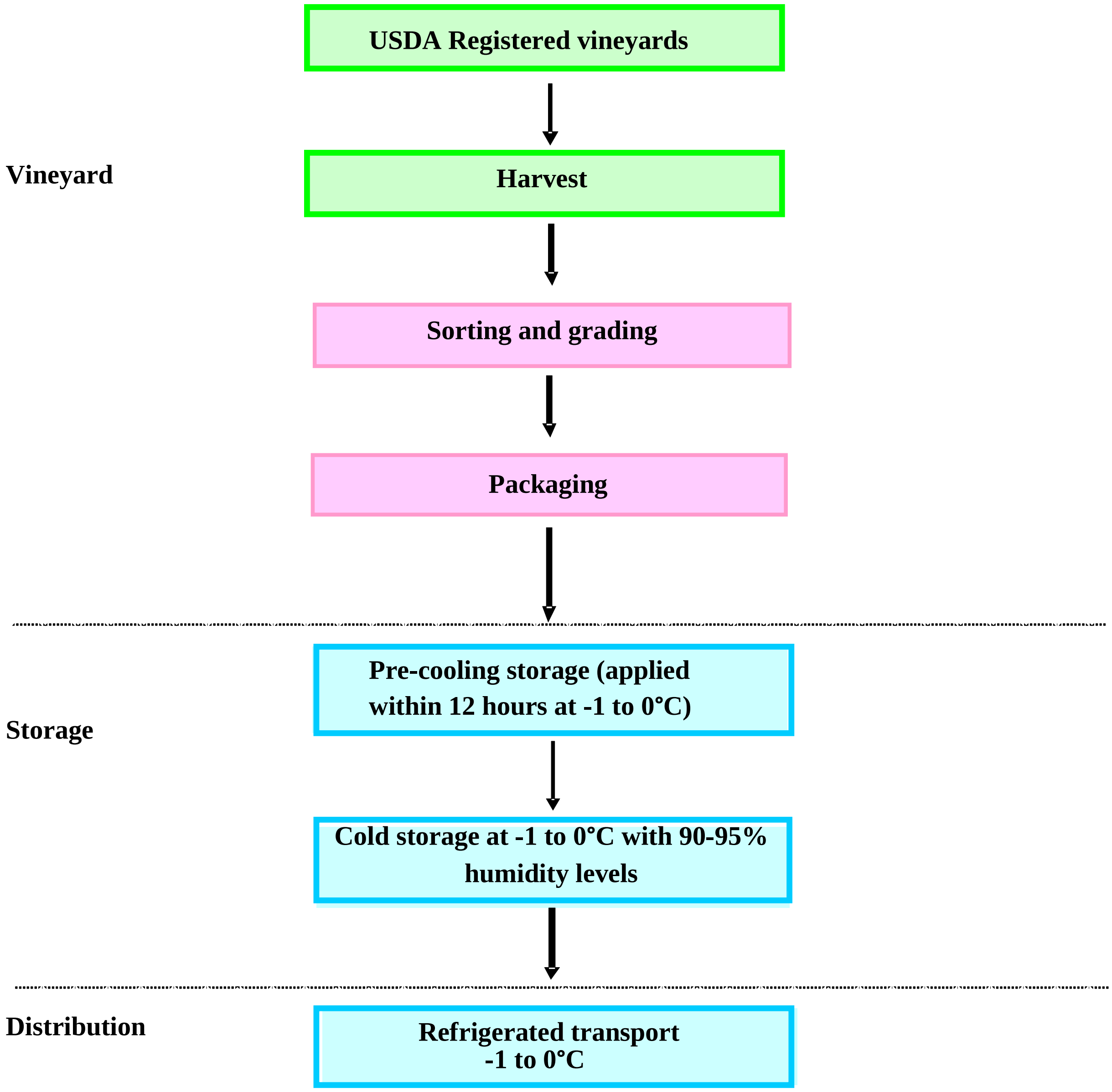

Figure 9 – Summary of vineyard and post-harvest packing house, storage and distribution steps for Californian table grapes

3.6 Fruit quality

Table grape fruit standards in the US are controlled under the Regulations of the Department of Agriculture, which are part of the Code of Federal Regulations (CFR). Specifically, Title 7, Subtitle B, Chapter 1, Subchapter C, Part 51, Subpart – United States Standards for Grades of Table Grapes (European or Vinifera Type). The CFR Title 7, Subtitle B, Chapter 1, Subchapeter A, Part 35, Section 35.11 requires that US table grapes for export meet the 'US No.1 Table' standard.

The US standard includes requirements for maturity (based on total soluble solids) and quality. Quality specifications include requirements for berries to be firmly attached to the capstem, not shattered, split or crushed, free from decay or damage by any other cause within defined tolerances. The maturity and quality requirements in the US are very similar to those specificied by major retails chains in Australia (Woolworths 2011). A copy of the relevant US table grape commercial standards is presented in Appendix E.

3.7 Commercial production and export information

3.7.1 Production statistics

California is the largest producer of table grapes in the US. The majority of Californian table grapes are produced in the San Joaquin Valley, with most production occurring in Kern, Tulare and Fresno counties (USDA 2010a). In 2011, Kern had approximately 15,500 ha of bearing and non-bearing vines, Tulare had over 10,000 ha and Fresno had approximately 5,000 ha (CDFA 2012a). Riverside County has the largest table grape plantings outside the San Joaquin Valley, with approximately 2,800 ha of bearing and non-bearing vines (CDFA 2012a).

In 2010, California had over 34,000 bearing hectares of table grape vines. The California Department of Food and Agriculture (CDFA 2012a) reported production of over 900,000 tonnes of grapes with a value of US$385.6 million (Table 3.3). Whilst production of table grapes in California steadily increased between 2006 and 2010, the prices for fresh grapes declined, contributing to a lower value of production compared to previous years (Table 3.3).

Table 3.3 – Production statistics for table grapes in California from 2000 to 2010

Year	Production (tonnes)	Value of production (US$M)
2000	702,161	437.4
2001	646,823	435.2
2002	674,038	457.6
2003	664,059	407.6
2004	698,532	535.0
2005	791,065	385.1
2006	650,452	643.8
2007	717,583	622.9
2008	882,691	394.5
2009	792,880	406.0
2010	914,442	385.6

Source: California Department of Food and Agriculture (CDFA 2012a)

3.7.2 Export statistics

The US is the second largest exporter of table grapes in the world after Chile (USDA 2010a). California is the top export state, followed by New Jersey, New York and Pennsylvania (USDA 2010a). Approximately 35 per cent of the US's table grape crop is exported (USDA-APHIS 2011). In 2009, the United States Department of Agriculture reported that the US exported 303,000 tonnes of table grapes valued at US$586 million to 86 countries (USDA 2010a). Canada was the largest importer, taking 33 per cent of the crop, followed by Hong Kong (11 per cent) and Australia (8 per cent) (Table 3.4). Other major export markets include the Philippines, Indonesia, Taiwan, Mexico, the United Kingdom, Malaysia, New Zealand, Thailand and Vietnam (USDA 2010a). Table 3.4 summarises table grape exports from the US to its main markets for selected years over the period 2005 to 2009 as reported by the United States Department of Agriculture (2010a).

Table 3.4 – Fresh table grape exports from the US to major markets 2005 to 2009 (US$ millions)

			(US$ millions)			% share
Country	**2005**	**2006**	**2007**	**2008**	**2009**	**2009**
Canada	158	150	185	169	194	33%
Hong Kong	44	43	45	59	63	11%
Australia	16	16	34	47	48	8%
Philippines	11	12	15	18	24	4%
Indonesia	15	11	17	26	24	4%
Taiwan	26	17	20	24	21	4%
Mexico	51	49	51	60	19	3%
United Kingdom	13	12	17	23	19	3%
Malaysia	63	40	20	16	15	3%
New Zealand	8	8	13	13	14	2%
Thailand	10	10	12	15	13	2%
Vietnam	5	5	7	9	12	2%
Other	120	124	116	130	120	20%
Total	540	497	552	609	586	100%

Source: United States Department of Agriculture (2010a)

3.7.3 Volume of trade to Australia and Western Australia

Californian table grapes have been imported into Australia, excluding Western Australia, since 2002. Export volumes have increased since that time; however they have somewhat stabilised after 2007, although there are still year-to-year fluctuations (Table 3.5). This data has been used to estimate possible trade volumes to Western Australia for consideration in the pest risk assessment in Chapter 4.

In 2012, based on the resident population at the June quarter, the population of Western Australia was around 12 per cent of the combined population of the other states and territories of Australia (2,430,300 and 20,253,300 respectively) (ABS 2012). If trade volumes to the other states and territories could be expected to fluctuate around 11,500 tonnes per year, based on trade volumes since 2007, then it is assumed that the volume exported to Western Australia could be about 1,400 tonnes per year (12% of 11,500 tonnes).

Table 3.5 – Imports of Californian table grapes to Australia (excluding Western Australia)

Year	Volume (tonnes)
2002	921
2003	1043
2004	3909
2005	4198
2006	4314
2007	10889
2008	14787
2009	15898
2010	5762
2011	10571

Source: Trade Map Australia (2011)

3.7.4 Export and harvest season

In California, the table grape season begins around May with the earliest varieties being Perlette, Flame Seedless and Sugraone. Flame Seedless has a very long season in California usually lasting until around December, whereas Perlette and Sugraone varieties last only until August (Pollack and Perez 2007). Thomson Seedless also has a long season in California starting in June and ending in January (Pollack and Perez 2007). Red Globe is available from July through January, and Ruby Seedless and Crimson Seedless from August through January. Calmeria is available only from September, but lasts through to January of the following year (Pollack and Perez 2007).

Since exports of fresh table grapes from California to Australia began in 2002, the export season to Australia has been from June to November (with one exceptional year where consignments were also shipped in December).

4 Pest risk assessments for pests of quarantine concern

Pests of quarantine concern associated with table grapes from California to Western Australia were identified in the pest categorisation process (Appendix A). This chapter assesses the probability of the entry, establishment and spread of these pests and the associated potential economic, including environmental, consequences.

This report builds on previous policy for table grapes from California to the rest of Australia (AQIS 1999; AQIS 2000a; AQIS 2000b; Biosecurity Australia 2002; Biosecurity Australia 2003; Biosecurity Australia 2006).

Pest categorisation identified 14 pests of quarantine concern associated with table grapes from California to Western Australia that do not have risk management measures in the existing policy for Californian table grapes to other Australian states and territories. Table 4.1 identifies these pests, and full details of the pest categorisation are given in Appendix A. Additional pest data are given in Appendix B.

No pest risk assessments were conducted for those pests with risk management measures already in place under the existing policy for Californian table grapes to the rest of Australia. These risk management measures have been audited during the course of existing trade. Any existing measures for those pests will be applied to imports to Western Australia.

Assessments of risks associated with the 14 pests of quarantine concern are presented in this chapter. Pests are listed or grouped according to their taxonomic classification, consistent with Appendix A and Appendix B.

For each pest, the PRA area is defined as the state of Western Australia. The likelihood ratings given for entry, establishment and spread and the associated consequences are for Western Australia.

Pest risk assessments were completed to determine whether the risk posed by each pest exceeds Australia’s ALOP and thus whether phytosanitary measures are required to manage the risk.

For some of the 14 pests identified, pest risk assessments have already been completed for other commodities or other source countries. For these pests, the likelihood of importation and/or the likelihood of distribution may be reassessed due to the differences in the commodity and growing region assessed. The likelihood of establishment and spread and the consequences the pests may cause have been based on the outcomes from the previous assessment. If previous policy has been considered, this will be stated in the introduction for the pest.

Table 4.1 – Pests of quarantine concern for table grapes from California identified in the report but which do not have risk management measures in the existing policy for Californian table grapes into Australia

Pest	Common name
Harmonia axyridis	Harlequin ladybug
Lygus hesperus	Western plant bug
Lygus lineolaris	Tarnished plant bug
Parthenolecanium corni	European fruit lecanium scale
Pseudococcus calceolariae	Citrophilus mealybug
Planococcus kraunhiae	Japanese mealybug
Marmara gulosa	Citrus peel miner
Phomopsis viticola	Phomopsis cane and leaf spot
Grapevine fanleaf virus	
Tomato ringspot virus	
Grapevine yellow speckle viroid 1	
Grapevine yellow speckle viroid 2	
Hop stunt viroid	
Citrus exocortis viroid	

In the following pest risk assessments DAFF considered several matters that were common for most pests and pathogens. These included the possibility that:

- imported Californian table grapes will contain seeds and that those seeds may germinate
- consumers will discard Californian table grapes in environments suitable for pest or pathogen distribution to a host or for seed germination in the case of seed transmitted pathogens (including household compost)
- a seedling from a Californian table grape seed will survive and establish and that a pathogen of quarantine concern may infect that seedling.

California exports both seeded and seedless table grape varieties to Australia. DAFF assumes that some viable grapevine seed from fruit consumed by the public will be discarded into natural and unmanaged environments as well as household composts. However, out of the top fourteen varieties of table grapes grown in California, only one variety, Red Globe, has seeded berries (California Table Grape Commission 2012d). Red Globe represents the third top variety by volume shipped from California (Anonymous 2011). As such, some seeded table grapes are expected to be exported from California to Australia, however the majority of table grapes are likely to be seedless varieties which have no risk of seed transmission of pathogens.

In general, grapevines are grown from vegetatively propagated cuttings that are grafted onto rootstock or, less commonly, self-rooted (Zohary 1996). Vineyards are not established using vines propagated from seed as these vines are likely to produce inferior berries and are unlikely to be true to type after genetic segregation (Zohary 1996). This aspect of grapevine propagation, along with the relatively long time taken to grow a productive vine from seed, will likely deter members of the public from deliberately growing grapevines from the seed of imported fruit (Olmo 1976). The wide availability of grafted vines will also reduce the incentive to grow vines from seed.

The proportion of grapevine seed that germinates depends on the cultivar, seed maturity, storage, stratification and planting conditions (Doijode 2001). Most grapevine seed is dormant and will not germinate unless it has been stratified. Successful stratification is usually achieved by storing seed at 0–5 °C for two months or longer (Ellis *et al.* 1985; Doijode 2001). Low germination rates of seed from fresh untreated berries or room temperature stored seed has been reported in the literature, although longer storage periods after ripening positively correlated with germination rates (Scott and Ink 1950; Singh 1961).

The timing of exports of Californian table grapes to Australia is another important consideration because discarded seed may be stratified by low temperatures in winter. Although table grapes are harvested in California from May to January (Pollack and Perez 2007), exports to Australia occur between June and November. This coincides with winter, when seed are more likely to stratify naturally in low temperatures (in some parts of Australia) and spring, when conditions are more favourable for growth of seedlings.

Germination of some untreated seed is reported to be slow and some seedlings grown from untreated seed are stunted (Scott and Ink 1950; Mamarov *et al.* 1958). However, grapevine seedlings sometimes occur in vineyards (Office of the Gene Technology Regulator 2003). In Europe, volunteer grapevines grow as weeds in small numbers. Most of these weedy vines are probably rootstocks that have escaped vegetatively or have grown from seed, although some may be escaped cultivars of grapevine that have grown from seed (Zohary 1996; Arrigo and Arnold 2007; Ocete *et al.* 2008).

Grapevine is not a common weed in Australia (Office of the Gene Technology Regulator 2003), but there are reports of grapevine growing as a weed on roadsides and in disturbed areas in NSW, Victoria and Western Australia (Richardson *et al.* 2006) and vines have been found near established vineyards and water-courses (Conn 2010). Grapevine has been recorded as naturalised in Western Australia (Conn 2010) and thus climatic conditions are suitable for the establishment of wild grapevines in some parts of Western Australia.

There is some risk of consumers discarding grape seed into household compost piles. One study which investigated food-related behaviours of Australians found that half of respondents composted their food waste often (Lea and Worsley 2008), but the proportion of grape seeds that are discarded as compost is not known. If conditions were right, grapevine seed could germinate, but as discussed, untreated seed has variable rates of germination. Given that most Californian table grapes are seedless, the risk of a Californian table grape seed germinating in a household compost pile is low.

The likelihood that table grape waste may be discarded close to other suitable hosts for the pests and pathogens concerned was also considered for *Vitis* spp. specific pests. Most households in Australia do not grow table grapes; the highest proportion occurs in Western Australia, South Australia and the Australian Capital Territory with about 1 in 10 private dwellings growing grapes (Cross and Taylor 1996). Other suitable hosts may be present in backyards, but this depends on the pest or pathogen considered and is discussed, when relevant, in the pest risk assessments below.

Likewise, depending on the pest or pathogen of concern, the proximity of discarded table grape waste to vineyards is also considered in individual PRAs. In some areas of Western

Australia, vineyards are located near urban areas or areas of tourist activity. For example, the Swan Valley region holds the ‘Spring in the Valley’ festival in October encouraging tourists to visit wineries and eat at restaurants or bring your own picnic (Spring in the valley 2010). It is possible that some imported grape material could be brought into a vineyard. Material disposed in rubbish bins or removed by tourists is unlikely to present a significant risk. Imported grape material disposed of in the vineyard would present a risk for pests to transfer to a new host in Australia.

Given the available evidence, DAFF considers that some waste from imported table grapes will be disposed of in household compost or other natural or unmanaged environments. There is a low likelihood that this will be adjacent to a suitable host for the quarantine pests and pathogens considered. The biology of each pest and pathogen will determine how close a suitable host needs to be for distribution to occur. Also, a very small proportion of seed from imported table grapes may germinate when table grapes are discarded in compost or somewhere such as on a road side. A seedling may establish given that grapevines are known to grow wild in some parts of Australia. But given the barriers to successful seed germination discussed above, and the fact that only some Californian table grapes contain seeds, this would be unlikely to occur.

4.1 Harlequin ladybird [Coleoptera: Coccinellidae]

Harmonia axyridis EP

The Harlequin ladybird is not known to occur in Western Australia and is a pest of quarantine concern for that state. It is also considered to be absent from the rest of Australia.

Harmonia axyridis is a beetle from the Coccinellidae family and is a voracious predator of plant pests, especially of aphids but also of other soft bodied insects. Its native range includes China, Japan and eastern Russia but it has since become established in Europe and the Americas following its introduction as a biocontrol agent. Its current wide distribution is indicative of the invasiveness of this species and it is now recorded from the US, Canada and Mexico (Koch *et al.* 2006), Argentina and Brazil in South America (de Almeida and da Silva 2002), and throughout Western Europe, Scandinavia and Great Britain (Roy and Roy 2008; Brown *et al.* 2008). It is also spreading eastwards, and is now present in Poland, Serbia, Hungary, Romania, Slovakia and Ukraine (EPPO 2009a).

During the 1960s to the 1990s, the United States Department of Agriculture attempted to establish *H. axyridis* to control agricultural pests, particularly of pecans and apples (Potter *et al.* 2005). However, some scientisits believe that the current infestations in the US are a result of the unintentional introduction of beetles from a Japanese freighter in New Orleans (Potter *et al.* 2005). Since its establishment in North America, it has become the dominant ladybird species in much of the US and Canada (Kenis *et al.* 2008) and inhabits ornamental and agricultural crops throughout the US (Potter *et al.* 2005). It is currently reported from much of the continental US with the exception of Montana, Wyoming and parts of the southwest (Koch 2003).

In addition to being a pest of commercial fruit production, it is known as a human nuisance, is threatening native biodiversity in some areas and it has also become of significant concern in wine production, where beetles may be crushed along with grapes during processing. When crushed, the beetles release a foul smell that taints the wine, adversely affects its taste, and has caused millions of dollars in losses to the wine industry in the eastern US and southern Canada (Galvan *et al.* 2006). There have been anecdotal accounts that approximately 5% of wines have been affected in some areas (Kovach 2004).

The risk scenario of concern for *H. axyridis* is the presence of adults and potentially larvae and pupae within bunches of table grapes from California.

Harmonia axyridis was assessed in the existing import policy for table grapes from the People's Republic of China (Biosecurity Australia 2011a). The assessment presented here builds on this previous assessment.

The probability of distribution, establishment and spread of *H. axyridis* in Western Australia and the consequences it may cause will be comparable for table grapes imported from any country as these probabilities relate specifically to events that occur in Western Australia and are independent of the importation pathway. Furthermore, the timing of imports from California and China overlap as they are both in the Northern Hemisphere. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences as set out for *H. axyridis* in the import risk analysis report for table grapes from the People's Republic of China (Biosecurity Australia 2011a) will be adopted for this assessment.

4.1.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *Harmonia axyridis* will arrive in Western Australia with the importation of table grapes from California is: **MODERATE**.

Supporting information for this assessment is provided below:

- Since its introduction into North America, *Harmonia axyridis* population levels have dramatically increased and it is now the dominant ladybird species in the US and Canada (Kenis *et al.* 2008).
- *Harmonia axyridis* is often reported as a pest of fruit production in North America (Kenis *et al.* 2008); feeding has been reported on grapes, apples peaches, and raspberries (Kovach 2004).
- Larvae complete their development on plants where aphids, their primary food source, are abundant (Potter *et al.* 2005).
- As aphids become scarce in late summer and autumn, the ladybirds become attracted to soft fruit orchard crops as a late-season food source (Roy and Roy 2008). On grapes, the beetles tend to aggregate on grape clusters just prior to harvest and some beetles may remain within the bunch following harvest (Galvan *et al.* 2006). In wine production systems, it has been reported that it can be difficult to separate this pest from the grapes and they are sometimes processed when making wine (Roy and Roy 2008).
- *Harmonia axyridis* is generally reported as a contaminant pest and feeds only on berries which have been previously damaged by other insects, birds, diseases or from ‘splitting’ (Galvan *et al.* 2006; Kenis *et al.* 2008). However, there are also accounts from growers that undamaged fruit can be affected (Kovach 2004), which suggests that adult beetles are associated with fruit that is not damaged. While it is present in California, *H. axyridis* is not reported in association with vineyards and table grapes in California (USDA 2013).
- Females have been reported to produce up to 3819 eggs (25.1 eggs/day) under laboratory conditions and typically oviposit batches of around 20–30 eggs at a time (Koch 2003) on leaves or stems of host plants (Mahr 1996; Biosecurity Australia 2011a). Given the potential high fecundity of this pest and its use as a biocontrol agent, relatively large numbers of *H. axyridis* are potentially available at the time of harvest.
- Although some control strategies have been implemented or are currently being studied to manage *H. axyridis* populations in commercial fruit production, these are limited given the role of *H. axyridis* as a beneficial insect in commercial orchards.
- Adults typically live for 30 to 90 days but can live up to 3 years (Koch 2003) and are likely to survive transit times to Western Australia following harvest.
- Watanabe (2002) reported on the cold tolerance of *H. axyridis* in overwintering adults. Although some mortality is experienced at sub-freezing temperatures, more than 90% of males and females survived winter ambient temperatures in Japan, with temperatures often recorded below zero. The lowest ambient temperature recorded was –3.5°C. Watanabe (2002) also reported on seasonal changes in cold hardiness of *H. axyridis*, where adults moderate levels of cryoprotective agents in response to climatic cues to better enable winter survival. Table grapes are harvested in the warmer summer months;

although beetles are unlikely to have accumulated peak levels of cryoprotective substances, the cold temperatures used to treat, store and transport table grapes for export are unlikely to kill all *H. axyridis* if they are present.

The wide distribution and abundance of *H. axyridis* in California (and the US), its association with grape bunches, its longevitiy and its cold tolerance, moderated by the lack of reports of association of the beetle with vineyards in California support a likelihood estimate for importation of ‘moderate’.

Probability of distribution

The probability of distribution for *Harmonia axyridis* in Western Australia is being based on the assessment for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The rating from that assessment was: **HIGH**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *Harmonia axyridis* will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **MODERATE**.

4.1.2 Probability of establishment and spread

As indicated above, the probability of establishment and of spread for *Harmonia axyridis* is being based on the assessment for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment are:

Probability of establishment:	**HIGH**
Probability of spread:	**HIGH**

4.1.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Harmonia axyridis* will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **MODERATE**.

4.1.4 Consequences

The consequences of the establishment *Harmonia axyridis* in Australia have been estimated previously for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from that analysis is provided below:

Plant life or health	**C**	Minor significance at the district level
Any other aspects of the environment	**D**	Significant at the district level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**E**	Significant at the regional level
International trade	**D**	Significant at the district level
Environment	**E**	Significant at the regional level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are **'E'**, the overall consequences are estimated to be **MODERATE**.

4.1.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Harmonia axyridis*	
Overall probability of entry, establishment and spread	Moderate
Consequences	Moderate
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *Harmonia axyridis* has been assessed as 'moderate', which is above Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.2 Plant bugs [Hemiptera: Miridae]

Lygus hesperus EP and *Lygus lineolaris* EP

Lygus hesperus (western plant bug) and *Lygus lineolaris* (tarnished plant bug) are not present in Western Australia and are therefore pests of quarantine concern for that state. The biology and taxonomy of these two species are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term 'plant bugs' is used to refer to these two species unless otherwise specified.

The family Miridae includes a large number of species, most of which feed on plants. Mirids are also referred to as plant bugs and are characterised as generalist plant feeding insects that use needle-like mouthparts to extract plant juices from their hosts at all stages of their life, from nymph to adult (University of Missouri 2000; CABI 2011). They may feed upon the fruit of their hosts as well as other reproductive plant parts such as flowers and buds (CABI 2011).

Plant bugs overwinter as adults in dead plants, leaf litter/plant debris and uncultivated areas outside the orchard (CABI 2011; Bentley *et al.* 2012a). During spring, females will lay eggs in a wide variety of plants that hatch into nymphs that undergo a number of nymphal phases (instars) before becoming adults. Adults are very active and mobile with a short life cycle, which for *L. lineolaris* is around 30 days with 2–5 generations per year (CABI 2011). Within California, there have been reports of up to ten overlapping generations in a year for some plant bug species (Bentley *et al.* 2012a).

Plant bugs lay eggs and feed on both commercial and weedy host plants. The presence of weeds is an important factor that influences the number of plant bugs that may be found in a commercial crop, so control of weeds is usually recommended (CABI 2011).

The risk scenario of concern for *L. hesperus* and *L. lineolaris* is the presence of eggs in the imported commodity. As plant bugs are highly mobile (Fleury *et al.* 2010; CABI 2011) and easily disturbed, it is unlikely that nymphal or adult plant bugs would remain associated with imported table grapes.

Lygus hesperus and *L. lineolaris* have been assessed in the existing import policy for stone fruit from the United States (Biosecurity Australia 2010). The assessment of *L. hesperus* and *L. lineolaris* presented here builds on this previous assessment.

Differences in the host status between table grapes and stone fruit for *L. hesperus* and *L. lineolaris* make it necessary to assess the likelihood that *L. hesperus* and *L. lineolaris* will be imported into Western Australia with table grapes from California.

The probability of distribution, establishment and spread of *L. hesperus* and *L. lineolaris* in Western Australia and the consequences they may cause will be comparable for any commodity from which these species are imported into Western Australia, as these probabilities relate specifically to events that occur in Western Australia and are independent of the importation pathway. Furthermore, the risk scenario of concern is the presence of eggs on fruit and DAFF considers the likelihood of distribution of eggs to be comparable between stone fruit and table grapes. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences, as set out for *L.*

hesperus and *L. lineolaris* in the existing import policy for stone fruit from the United States (Biosecurity Australia 2010), will be adopted for this assessment.

4.2.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *L. hesperus* and *L. lineolaris* will arrive in Western Australia with the importation of table grapes from California is: **VERY LOW**.

Supporting information for this assessment is provided below:

- Both *L. hesperus* and *L. lineolaris* are widely distributed across North America. *Lygus hesperus* is predominantly reported in the west of North America, ranging from southern British Columbia to northern Mexico (Zhou *et al.* 2012). In the western United States, it is reported as the dominant plant bug species in a complex that includes *L. elisus*, *L. shulli* and *L. lineolaris* (Zhou *et al.* 2012). *Lygus lineolaris* was originally recorded from the eastern United States but has since been reported to be one of the most widely distributed plant bug species in North America (Summers 2001; Mueller *et al.* 2012).
- Both species are highly polyphagous with *L. lineolaris* reported to feed on more than 385 host plant species (Young 1986) and *L. hesperus* from over 100 plant species (Godfrey 2000; Zhou *et al.* 2012).
- In California, plant bugs are considered major pests of cotton, fruit, vegetable and seed crops (Godfrey 2000). *Lygus hesperus* is a key pest of several agricultural crops in California, particularly in the San Joaquin Valley (Godfrey 2000). Its principal hosts include cotton, strawberry, alfalfa and dry beans (Godfrey 2000). *Lygus lineolaris* is also reported from California (Mueller *et al.* 2012) and is mainly a pest of apples, carrots, cherries, cotton, lima beans, seed alfalfa, green beans, soybeans, peaches, pears, strawberries, tomatoes and nursery stock (Dixon 2009), although infestation of grapes is also known (Bostanian *et al.* 2003; Fleury *et al.* 2006; Fleury *et al.* 2010). Despite its polyphagy, *L. lineolaris* mostly feeds on young apples and weeds (Fleury *et al.* 2010).
- Plant bugs are associated with grapevines in the field. There have been reports of *L. lineolaris* in vineyards of Pennsylvania and in southwestern Quebec, Canada (Bostanian *et al.* 2003; Fleury *et al.* 2010). Adults feed on reproductive parts of their host plant (i.e. buds or flowers) or rapidly growing meristematic tissues (Bostanian *et al.* 2003). Grapevines produce meristematic tissues throughout the growing season which provides material for *L. lineolaris* generations to feed on throughout the season (Fleury *et al.* 2006; Fleury *et al.* 2010).
- Laboratory studies have shown that adults of *L. lineolaris* are capable of feeding on all phenological stages of grapevines (Fleury *et al.* 2006). Most feeding in the berry development stages of grapevine growth occurs in the grape bunch on the upper part of the pedicel (Fleury *et al.* 2006).
- Although eggs may be laid into fruit from around mid May until late in the season, females preferentially deposit eggs in stems, leaf parts and flowers of orchard weeds such as *Amaranthus* spp. (pigweed), *Brassica* spp. (wild mustard), *Capsella bursa-*

pastoris (shepherd's-purse), *Centaurea solstitialis* (yellow starthistle), *Chenopodium album* (lambsquarters), *Hemizonia* spp. (tarweed), *Melilotus officinalis* (sweet clover), *Raphanus raphanistrum* (wild radish), *Salsola tragus* (Russian thistle), and *Vicia* spp. (vetch) (Anthon 1993; Fleury *et al.* 2010; CABI 2011; Caprile *et al.* 2011). For *L. hesperus*, winter and early spring weeds serve as a reservoir and provide a link to summer crops in the Central Valley of California (Godfrey 2000).

- It is noted that nymphs are not commonly seen in orchards, suggesting that eggs are preferentially laid into other hosts. The availability and sequence of flowering in weedy hosts is thought to be a critical factor in their population dynamics (CABI 2011). The presence of adult plant bugs in orchards is linked to the drying up of primary host material around the orchard, at which time the adults migrate to the irrigated areas (Bentley *et al.* 2012a).
- Adult and nymphal plant bugs are highly mobile (CABI 2011) and easily disturbed. Adults of *L. lineolaris* can easily and rapidly move between crops, and have been shown to fly over 12km in 12h, and 5km without interruption (Fleury *et al.* 2010). The process of harvesting table grapes is likely to disturb or dislodge any plant bugs associated with the fruit, but if any eggs are present, they may not be affected.
- Unless fruit damage or other symptoms of infestation are obvious, fruit infested with eggs would not be expected to be removed by harvest and post-harvest quality control operations, particularly given the enclosed nature of table grape bunches.
- Plant bugs overwinter as adults beneath weeds, on the orchard floor or in bordering uncultivated areas (Anthon 1993). *Lygus lineolaris* overwinters as diapausing adults beneath plant litter (Fleury *et al.* 2006) and resumes activity in spring when temperatures are greater than 8^{o}C (Anthon 1993; Bostanian *et al.* 2003).
- Eggs are the life stage that could be associated with the imported commodity. It has been shown that eggs can survive temperatures of 10^{o}C for 15 days without any notable level of mortality (Snodgrass and McWilliams 1992). However, there was no evidence found describing mortality at colder temperatures, such as those experienced during cold treatment and in-transit cold storage under commercial conditions.

L. hesperus and *L. lineolaris* can be found in table grape vineyards but their primary hosts are the weedy species that grow around irrigated areas. Adults and nymphs may migrate into irrigated crops when their primary hosts dry out, but there are limited reports citing infestation of table grapes. During harvest, any adults and nymphs that are in the vineyard are not likely to remain on table grape bunches because they are highly mobile. Furthermore, eggs and nymphs are predominantly associated with weedy hosts not grapevines, and table grape bunches are very unlikely to be infested with *L. hesperus* and *L. lineolaris* eggs or nymphs. This supports a likelihood estimate for importation of 'very low'.

Probability of distribution

The probability of distribution for *L. hesperus* and *L. lineolaris* is being based on the assessment for stone fruit from the United States (Biosecurity Australia 2010). That assessment used the same methodology as described in Chapter 2 of this report. The rating from the previous assessment was: **MODERATE**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *L. hesperus* and *L. lineolaris* will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **VERY LOW**.

4.2.2 Probability of establishment and spread

The probability of establishment and of spread for *L. hesperus* and *L. lineolaris* is being based on the assessment for stone fruit from the United States (Biosecurity Australia 2010). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment were:

Probability of establishment:	**HIGH**
Probability of spread:	**MODERATE**

4.2.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *L. hesperus* and *L. lineolaris* will enter Western Australia as a result of trade in table grapes from the United States, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **VERY LOW**.

4.2.4 Consequences

The consequences of the establishment *L. hesperus* and *L. lineolaris* in Western Australia have been estimated previously for stone fruit from the United States (Biosecurity Australia 2010). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from that analysis is provided below:

Plant life or health	**E**	Significant at the regional level
Other aspects of the environment	**B**	Minor significance at the local level
Eradication, control etc.	**D**	Significant at the district level
Domestic trade	**C**	Significant at the local level
International trade	**C**	Significant at the local level
Environment	**B**	Minor significance at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are ‘E’, the overall consequences are estimated to be **MODERATE**.

4.2.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *L. hesperus* and *L. lineolaris*	
Overall probability of entry, establishment and spread	Very low
Consequences	Moderate
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *L. hesperus* and *L. lineolaris* has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.3 European fruit lecanium scale [Hemiptera:Coccidae]

Parthenolecanium corni EP

Parthenolecanium corni is not present in the state of Western Australia and is therefore a pest of quarantine concern for that state. It is present in Victoria, Tasmania (Plant Health Australia 2001c; CSIRO 2005) and New South Wales (CSIRO 2005).

Parthenolecanium corni is divided into two sub species, *P. corni* ssp. *corni* and *P. corni* ssp. *apuliae* (Ben-Dov *et al.* 2010). *Parthenolecanium corni corni* has a wide geographic distribution, being found extensively across the Palaearctic, Nearctic, Neotropical, Oriental and Australasian regions, while *P. corni apuliae* is found exclusively on grapevines in Italy (Ben-Dov *et al.* 2010). To date, research of this scale has only been conducted to species (*P. corni*) level. Due to the comparatively narrow distribution of *P. corni apuliae*, the remainder of this assessment assumes research to be based on *P. corni corni* and will use *P. corni* interchangeably with this sub-species.

Parthenolecanium corni belongs to the soft scale insect family Coccidae (Ben-Dov *et al.* 2010). Soft scales are small, often inconspicuous and are covered with a wax secretion that provides protection (Smith *et al.* 2012). There are three life stages: egg, nymph and adult. The life cycle of female *P. corni* includes an egg stage, two nymph stages and an adult stage (David'yan 2009). Adult females are small (3–6.5 mm long, 2.0–4.0 mm in width and 4.0 mm in height) (David'yan 2009) and covered in a shiny brown, leathery domed shell (Bentley *et al.* 2009). The male scale has one egg stage, four nymph stages and an adult stage which is winged (David'yan 2009). Adult male scales have a short life span and are rarely observed (Smith *et al.* 2012). Adult males are 1.7 mm long (David'yan 2009).

In Californian vineyards, *P. corni* overwinter as second instar nymphs, moulting to the third instar stage in early spring, then developing into adult females that start laying eggs in April and May (Bentley *et al.* 2009). Females lay between 1000–3000 eggs under their body (David'yan 2009), which shrinks against the outer body wall to house the eggs (Flaherty *et al.* 1992). Eggs hatch from May to July (Flaherty *et al.* 1992) (in the northern hemisphere). The emerging crawlers (first instar nymphs) move to grapevine shoots and leaves, and moult to second instars from June to July (Bentley *et al.* 2009). Second instar nymphs move back to the woody part of the vine in late summer where they overwinter, re-emerging in the following spring to become third instars and mature into egg laying females (Bentley *et al.* 2009). There is generally only one generation each year in California, although there can be two generations in north coast vineyards (Bentley *et al.* 2009).

Scales cause major problems in agricultural and ornamental ecosystems and are commonly transported on plant materials (Miller *et al.* 2007). Due to their small size and habit of feeding in concealed areas, they are frequently an invasive species causing billions of dollars in damage annually in the US (Miller *et al.* 2007). Soft scales, such as *P. corni*, are serious pests especially as invasive species (Miller *et al.* 2007). In the US there are 42 introduced species of soft scales and 41 of them are pests (Miller *et al.* 2007).

Parthenolecanium corni damages plants through direct feeding damage (CABI 2011). Severe infestations can stunt vine growth (Bentley *et al.* 2009) and cause twig and limb death (Virginia Tech 2012). However, sooty mould growth is a more common problem associated with *P. corni* infestations (Virginia Tech 2012). *P. corni* excretes honeydew as it feeds, which serves as a substrate for sooty mould growth (CABI 2011). This results in blackened areas on leaves and fruit, which can reduce photosynthetic capacity and the marketability of produce (CABI 2011).

The risk scenario of concern for *P. corni* is that imported bunches of table grapes from California may contain adult females, eggs and nymphs.

Parthenolecanium corni has been assessed in the existing import policies for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and the People's Republic of China (Biosecurity Australia 2011a). These reports based their assessment on the existing import policy for table grapes from Chile (Biosecurity Australia 2005). The assessment of *P. corni* presented here builds on these previous assessments.

The probability of distribution, establishment and spread of *P. corni* in Western Australia and the consequences they may cause will be based on the assessments in the reports for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and table grapes from the People's Republic of China (Biosecurity Australia 2011a). The table grape harvest and export periods in Korea and China overlap those in California as they are all in the northern hemisphere and imports to Australia would occur at about the same time of year. For this reason, DAFF considers the likelihood estimates given in the reports for table grapes from Korea and China for distribution, establishment and spread and consequences to be equivalent to table grapes imported from California. Furthermore, these stages relate specifically to events that occur in Australia and are independent of the importation pathway.

The risk ratings for distribution, establishment, spread and consequences as set out for *P. corni* in the reports for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and table grapes from the People's Republic of China (Biosecurity Australia 2011a) have been adopted for this assessment.

4.3.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *Parthenolecanium corni* will arrive in Western Australia with the importation of table grapes from California is: **MODERATE**.

Supporting information for this assessment is provided below:

- *Parthenolecanium corni* occurs in the US, including in California (Golino *et al.* 2002; Ben-Dov *et al.* 2010) where it is sometimes abundant (Dreistadt *et al.* 2007). It is a pest of grapevine in California (Bentley *et al.* 2009). This suggests that it is likely to be associated with the pathway.
- On grapevine, adult females are generally found on shoots or wood less than three years old (Flaherty *et al.* 1992). Flaherty *et al.* (1992) state that they may also be found on grape bunches, but no further comment is made. The crawlers move to grapevine shoots, and moult to second instars from June to July and the second instar nymphs don't move back to the woody part of the vine until late summer, where they overwinter (Bentley *et al.* 2009). Eggs, nymphs and adults could be present on table grape bunches when exports to Australia occur (June to November), but *P. corni* seem to be mainly the associated with shoots and wood (Flaherty *et al.* 1992).

- Due to the small size of adults, nymphs and eggs, it may be difficult to detect them in grape bunches, especially at low population levels. Additionally, the shape and colour of adult females varies according to age and host plant, which may make detection more difficult. As such, table grape sorting, grading and packing processes may not remove them effectively from the export pathway.
- *Parthenolecanium corni* overwinters under grapevine bark as second instar nymphs (Bentley *et al.* 2009). The ability to overwinter may demonstrate an ability to tolerate cold storage during transport of table grapes from California to Western Australia.

The small size of the eggs, nymphs and adults; sessile nature of most life stages; cold tolerance; and reported abundance of this pest suggest that there may be a high risk of importation, but the importation likelihood is reduced because *Parthenolecanium corni* are mainly associated with shoots and wood and not grape bunches. This supports a likelihood estimate for importation of ‘moderate’.

Probability of distribution

The probability of distribution for *Parthenolecanium corni* is being based on the assessment for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and table grapes from the People’s Republic of China (Biosecurity Australia 2011a). Those assessments used the same methodology as described in Chapter 2 of this report. The distribution rating from these previous assessments was: **LOW**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *Parthenolecanium corni* will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.3.2 Probability of establishment and spread

As indicated above, the probability of establishment and of spread for *Parthenolecanium corni* is being based on the assessment for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and table grapes from the People’s Republic of China (Biosecurity Australia 2011a). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessments are presented below:

Probability of establishment: **HIGH**

Probability of spread: **MODERATE**

4.3.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Parthenolecanium corni* will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **LOW**.

4.3.4 Consequences

The consequences of the establishment *Parthenolecanium corni* in Western Australia have been estimated previously for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and table grapes from the People's Republic of China (Biosecurity Australia 2011a). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from those assessments can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from these analyses is provided below:

Plant life or health	**D**	Significant at the district level
Any other aspects of the environment	**B**	Minor significance at the local level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**C**	Minor significance at the district level
International trade	**C**	Minor significance at the district level
Environment	**B**	Minor significance at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D**', the overall consequences are estimated to be **LOW**.

4.3.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Parthenolecanium corni*	
Overall probability of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *Parthenolecanium corni* has been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.4 Mealybug [Hemiptera: Pseudococcidae]

Pseudococcus calceolariae[EP], *Planococcus kraunhiae*[EP]

Pseudococcus calceolariae (citrophilus mealybug) and *Planococcus kraunhiae* are not present in Western Australia and are therefore pests of quarantine concern for that state. The biology and taxonomy of these species is considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term 'mealybug' is used to refer to these two species unless otherwise specified.

Pseudococcus calceolariae and *Pl. kraunhiae* belong to the mealybug family, Pseudococcidae, which consists of small, soft-bodied insects that are covered with a mealy wax secretion (Charles *et al.* 2000). Mealybugs can rapidly increase to large numbers and cause significant damage by extracting plant sap, excreting toxic salivary compounds, and secreting honeydew which serves as a substrate for the development of sooty moulds (El-Sayed *et al.* 2010; RBG 2012b).

Pseudococcus calceolariae is native to Australia (RBG 2012b) and is a serious pest of citrus in South Australia (Smith *et al.* 1997; Gullan 2000) and a minor pest of citrus in Victoria and New South Wales (Gullan 2000). Eggs are laid in a cottony sack containing up to 500 eggs (Smith *et al.* 1997). Female mealybugs develop from an egg through three nymphal (instar) stages before undergoing a third moult into the adult form (Smith *et al.* 1997). Adult females are slow moving, oval-shaped and 3–4 mm long (Smith *et al.* 1997). Males develop from eggs through first and second instar stages, form pupa, and undergo a third and fourth moult into small, winged adults with long tail filaments (Smith *et al.* 1997). Females, prior to egg laying, and males, after the second instar stage, stop feeding and find protected locations under vegetation or bark (CABI 2011). In Australia, the lifecycle takes around 2 months in summer and 3–4 months in winter (Smith *et al.* 1997).

Planococcus kraunhiae is not recorded from Australia. It is a polyphagous pest of 20 plant families (Ben-Dov 2013) and has been recorded on leaves, branches and fruit of grapevines in Asia (Narai and Murai 2002; NPQS 2007). *Planococcus kraunhiae* has four life stages; adult, egg, nymphs and pupa (Narai and Murai 2002). No record of the life cycle on grapes could be found but in general the biology and taxonomy of mealybugs are similar.The risk scenario of concern for *P. calceolariae* and *Pl. kraunhiae* is the presence of nymphs or adults on table grapes from California.

Pseudococcus calceolariae has been assessed in the existing import policy for table grapes from Chile (Biosecurity Australia 2005). *Planococcus kraunhiae* has been assessed in the existing import policy for table grapes from the Republic of Korea (Biosecurity Australia 2011b). The commercial production practices in Chile, Korea and California are similar, and although table grapes are harvested at different times of year, this mealybug does not overwinter and the risk of distribution is comparable for table grapes from both regions being imported to Australia at any time of year. The wide climatic variation across Australia means that conditions are suitable for entry, establishment and spread somewhere in Australia all year round. Furtheremore, the probability of distribution, establishment and spread of *P. calceolariae* and *Pl. kraunhiae* in Australia and the consequences they may cause will be comparable for table grapes imported into Australia from any country as these probabilities relate specifically to events that occur in Australia and are independent of the importation pathway. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences, as set out for *P. calceolariae* and *Pl. kraunhiae* in the final import risk analysis report for table grapes from Chile (Biosecurity Australia 2005) and Korea (Biosecurity Australia 2011b) will be used for this assessment.

4.4.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *P. calceolariae* and *Pl.* kraunhiae will arrive in Western Australia with the importation of table grapes from California: **LOW**.

Supporting information for this assessment is provided below:

- *Pseudococcus calceolariae* and *Pl. kraunhiae* have a wide host range, infesting plants belonging to 40 families and 20 families respectively (Ben-Dov *et al.* 2010).
- *Pseudococcus calceolariae* is present in the state of California (Smith *et al.* 1997; Waterhouse and Sands 2001; Daane *et al.* 2008; Ben-Dov *et al.* 2010). It was first detected in California in 1913 and had become a serious pest by 1928. Effective control of the pest was achieved when two parasitoids, *Coccophagus gurneyi* and *Tetracnemoidea brevicornis*, were introduced from the Sydney area (Waterhouse and Sands 2001). Although these parasitoids reduced the pest to low numbers (Waterhouse and Sands 2001), it is still considered to be a pest of citrus in California (Grafton-Cardwell *et al.* 2012) and could therefore be present on table grapes grown in California.
- Although *P. calceolariae* is present in the USA and is a pest of citrus in California (Grafton-Cardwell *et al.* 2012), it is reported to be rarely found in North American vineyards (Daane *et al.* 2011).
- Juvenile and adult stages of *P. calceolariae* seek out fruit and sheltered sites (Smith *et al.* 1997). On grapevine, mealybugs are most prevalent in dense canopies and tend to be located in sheltered positions such as the underside of leaves, inside curled leaves, between bud scales, under bark, and inside grape bunches (Furness and Charles 1994). If *P. calceolariae* or *Pl. kraunhiae* are present in sheltered locations inside grape bunches, such as between touching fruit, they are likely to be overlooked during pre-export sorting and packing processes.
- Although native to eastern Australia (Smith *et al.* 1997; RBG 2012b), *P. calceolariae* has invasively spread and now has a world-wide distribution due to trade in plants and plant products.
- *Planococcus kraunhiae* has also been reported from the state of California (Miller *et al.* 2005; Ben-Dov *et al.* 2010). The accuracy of early records for *Pl. kraunhiae* in California from 1919 has been questioned and is thought to be a misidentification of *Planococcus ficus* (syn. *Pseudococcus citri*) (Ferris 1950). However, a subsequent identification from 1943 is thought to be reasonably definite (Ferris 1950). In California, *Pl. kraunhiae* has been reported from wisteria, persimmon and citrus (Ferris 1950). Although *Pl. kraunhiae* has been reported on grapevine in Asia (Narai and Murai 2002; NPQS 2007), it has not been reported in association with grapevine in California, where other species of mealybugs, including *P. maritimus*, *P. viburni* and *P. longispinus*, are considered to be more prevalent (Bentley *et al.* 2009).

The presence of these mealybugs in California, their association with grapevines and their cryptic nature are moderated by low pest prevalence in California, infrequent detections in

North American vineyards and no reports of *Pl. kraunhiae* in Californian vineyards. This supporst a likelihood estimate for importation of 'low'.

Probability of distribution

The probability of distribution for *P. calceolariae* and *Pl. kraunhiae* is being based on the assessment for table grapes from Chile (Biosecurity Australia 2005) and Korea (Biosecurity Australia 2011b). Those assessments used the same methodology as described in Chapter 2 of this report. The rating from the previous assessments are **MODERATE**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *P. calceolariae* and *Pl. kraunhiae* will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.4.2 Probability of establishment and spread

The probability of establishment and of spread for *P. calceolariae* is being based on the assessment for table grapes from Chile (Biosecurity Australia 2005) and Korea (Biosecurity Australia 2011b). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessments are:

Probability of establishment:	**HIGH**
Probability of spread:	**HIGH**

4.4.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *P. calceolariae* and *Pl. kraunhiae* will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **LOW**.

4.4.4 Consequences

The consequences of the establishment *P. calceolariae* and *Pl. kraunhiae* in Western Australia have been estimated previously for table grapes from Chile (Biosecurity Australia 2005) and Korea (Biosecurity Australia 2011b). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from those assessments can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from those assessments are provided below:

Plant life or health	**D**	Significant at the district level
Any other aspects of the environment	**A**	Indiscernible at the local level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**D**	Minor significance at the regional level
International trade	**D**	Minor significance at the regional level

Environment	**A**	Indiscernible at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are **'D'**, the overall consequences are estimated to be **LOW**.

4.4.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Pseudococcus calceolariae* and *Pl. kraunhiae*	
Overall probability of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *P. calceolariae* and *Pl. kraunhiae* have been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.5 Citrus peelminer [Lepidoptera: Gracillariidae]

Marmara gulosa

Marmara gulosa is not recorded from Western Australia and so is a pest of quarantine concern for that state.

Marmara gulosa is a moth native to the southwestern US and has become an economic pest in California, Arizona, Cuba and Mexico (Guillén *et al.* 2001; Jones 2001). It was first misidentified as *M. salictella* on the young twigs of willow in the Atlantic states but was subsequently described as *M. gulosa* (Guillén *et al.* 2001). It probably initially attacked willow, but has undergone a host shift to various plants not native to the US including citrus and oleander (Jones 2001).

In California, *M. gulosa* was first reported on citrus in 1917 and as a sporadic pest up until the 1970s (Kirkland 2009). High populations were recorded from the Coachella Valley in the mid 1980s and mid 1990s, and in 1999 *M. gulosa* was reported from the southern San Joaquin Valley with high infestations apparent by 2000 (Kirkland 2009). It is recorded throughout southern and central California, including desert areas (Jones 2001; Grafton-Cardwell *et al.* 2008).

Marmara gulosa is a highly polyphagous pest which is reported to feed on hosts from up to 31 plant families including fruit and vegetable crops; ornamentals; and weeds (Grafton-Cardwell 2002; Kirkland 2009). In commercial production, it is primarily a pest of citrus, especially grapefruit and navel oranges; however, infestations have been observed on cotton, cowpeas, eggplant, grape, capsicum, plum, pumpkin and zucchini (Stelinski 2007).

In the San Joaquin Valley, citrus, table grapes and nursery stock have been most affected by *M. gulosa* (Grafton-Cardwell *et al.* 2003). It has been found heavily infesting table grapes, in which it attacked stems and fruit of varieties with large berries (Grafton-Cardwell *et al.* 2003). It has also been reported on petioles, tendrils and bunch rachises (Eichlin and Kinnee 2001).

Larvae of *M. gulosa* cause economic damage by feeding on the upper epidermal layers of the fruit, creating a silvery white serpentine surface mine (Kirkland 2009). Under high pest pressures, mining of leaves is observed also (Grafton-Cardwell *et al.* 2012). Fruit damage is considered cosmetic but the occurrence of a single mine can render the fruit unacceptable for sale (Grafton-Cardwell *et al.* 2012). In citrus, it can cause from 5 to 80% loss of marketable fruit in susceptible varieties (Grafton-Cardwell *et al.* 2012). An outbreak of *M. gulosa* in the Coachella Valley in 1995 caused 80–90% marketable fruit losses in some areas (Stelinski 2007).

The risk scenario of concern for *M. gulosa* is the presence of eggs, larvae or adults within bunches of imported table grapes.

4.5.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *Marmara gulosa* will arrive in Western Australia with the importation of table grapes from California is: **MODERATE**.

Supporting information for this assessment is provided below:

- *Marmara gulosa* is native to the US and has become an economically important pest in California, particularly of citrus in the Coachella and San Joaquin Valleys (Stelinski 2007; Grafton-Cardwell *et al.* 2012).
- Anecdotal evidence suggest that *M. gulosa* has entered California from Mexico on shipments of citrus and caused outbreaks of the pest in California (Kirkland 2009). This suggests that the pest can be spread through trade of horticultural products, although this was not on table grapes.
- Often, *M. gulosa* populations build in grape or cotton crops and disperse into neighbouring citrus orchards when the fruit begins to senesce (Grafton-Cardwell *et al.* 2003).
- On grapes, infestation has been reported on the stem, petiole, tendril, bunch rachis and berries (Eichlin and Kinnee 2001; Grafton-Cardwell *et al.* 2003).
- In California, citrus, table grapes and nursery stock have been most affected by *M. gulosa*; and in 2001 citrus and table grape shipments from California were rejected by trading partners due to interceptions of *M. gulosa* (Grafton-Cardwell *et al.* 2003).
- There have been no detections of *M. gulosa* during phytosanitary inspection by DAFF officers.
- Eggs are deposited on stems and fruits and the larvae feed on the upper epidermal layers of fruit (Grafton-Cardwell *et al.* 2008). Eggs can be present on grape bunches and go undetected.
- The mining caused by *M. gulosa* larvae blemishes the surface of fruit (Grafton-Cardwell *et al.* 2008). Where symptoms of infestation are obvious, these fruit would likely be culled during standard harvest and post-harvest quality assurance procedures as well as be detected during routine in-field pre-harvest surveillance programs. Where the damage is not visible from the outside of the bunch, it may go undetected.
- Just before pupating, the larvae leave their mines and spin a cocoon on a twig, leaf, bark crevice, amongst trash on the ground or fruit where they pupate (Kerns *et al.* 2004a; Grafton-Cardwell *et al.* 2008). Cocoons are decoarated with small white silk balls, which makes them conspicuous (Grafton-Cardwell *et al.* 2008); if present on grape bunches they are likely to be detected unless they are secreted within the bunch.
- In the San Joaquin Valley, there may be 7 generations per year (Grafton-Cardwell *et al.* 2008) although up to 13 generations are also reported (Jones 2001). Development continues throughout the year and no overwintering stage is observed (Grafton-Cardwell *et al.* 2008). When plants such as citrus are dormant, the pest probably survives on adjacent plants in gardens, road side plantings and natural areas. Oleander, which is common in California, is an alternative host for this pest (Guillén *et al.* 2001) from which *M. gulosa* may invade orchards.
- Under laboratory conditions, average fecundity was reported as 48.5 eggs per female with an average of 4.5 eggs laid per day (Guillén *et al.* 2001). Howeber, females are reported to lay between 10 and 50 eggs generally (Kerns *et al.* 2004a). Given the potential fecundity and multiple generations, *M. gulosa* are likely to be present at the time of harvest in all life stages.
- The eggs are only 0.41 mm long and 0.28 mm wide (Guillén *et al.* 2001), and may be difficult to detect on a grape bunch.

- Development is temperature-dependent and can range from two to four weeks (Kirkland 2009). O'Neal et al. (2011) reported that temperatures of 17°C and 21°C resulted in around 70% mortality, but required 27 and 49 days respectively to achieve this level of mortality. Similarly, the authors reported that at 17°C or 33°C, *M. gulosa* experienced greater than 10% mortality during the egg, first larval instar and second larval instar stages. The majority of grapes imported to Australia from California arrive by sea freight, however air freight may also occur. The total time in transport, from orchard until arrival in Australia, is therefore expected to be from a few days to several weeks. Although some mortality to egg and larval stages may be experienced during cold treatment storage and transport, it is possible that viable *M. gulosa* eggs, larvae, pupae or adults could arrive in Western Australia if they are present on table grape bunches when packed in California. Longer transit periods could result in a higher mortality rate but would not likely preclude the potential import of viable *M. gulosa* life stages.

The presence of the pest in California throughout the year, its demonstrated association with table grape bunches, adult longevity and probable history of spread into California on citrus from Mexico are moderated by the conspicuous nature of the larval damage and cocoons, and lack of any official detection records during inspection of table grapes from California into eastern Australia. This supports a likelihood estimate for importation of 'moderate'.

Probability of distribution

The likelihood that *Marmara gulosa* will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from California and subsequently transfer to a susceptible part of a host is: **HIGH**.

Supporting information for this assessment is provided below:

- Any eggs, larvae or pupae present on table grapes imported from California would be distributed with the commodity to destination points. Following pupation, adults are capable of independent flight and could potentially locate a suitable host from markets, repacking facilities, retailers, during transportation, or wherever they are taken by consumers. However, a review of the literature did not indicate the dispersal range of adult *M. gulosa* moths.
- The entire life cycle takes around 30 days for completion (Kerns *et al.* 2004a), although development is temperature-dependent and can range from two to four weeks (Kirkland 2009). Larvae pass through 4-5 instar stages which each require around 3 days for completion (Kerns *et al.* 2004a). Adult females survive for an average of 10.9 days and males 9.3 days (Guillén *et al.* 2001). This suggests that they could be distributed alive on table grapes after introduction.
- *Marmara gulosa* is highly polyphagous and feeds on a range of fruit and vegetable crops, ornamentals and weeds in up to 31 plant families (Grafton-Cardwell 2002; Kirkland 2009). Grafton-Cardwell *et al.* (2002) documented 67 hosts based on observations from infestations in Fresno, Tulare and Kern counties and Kirkland (2009) reported a host plant list of 69 species. The species is also considered to have shifted from willow to plants such as citrus and oleander (Jones 2001) indicating an ability to expand its host plant range in new environments.
- As discussed in the introduction to this chapter, consumers may discard the waste from Californian table grapes onto household compost piles. Given that the adults of this pest can fly, there is some risk that adults could distribute to a suitable host via this pathway. However, the proportion of table grape bunch waste going to household

compost is low. Consumers may also discard waste onto roadsides or other uncontrolled environments, where distribution to suitable hosts could occur.

This pest has a wide host range, life stage could potentially complete development, the adults can fly and their life cycle can take up to around 30 days. This supports a likelihood risk estimate for distribution of 'high'.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *Marmara gulosa* will enter Western Australia as a result of trade in table grapes from the California and be distributed in a viable state to a susceptible host is: **MODERATE**.

4.5.2 Probability of establishment

The likelihood that *Marmara gulosa* will establish within Western Australia, based on a comparison of factors in the source and destination areas that affect pest survival and reproduction is: **HIGH**.

Supporting information for this assessment is provided below:

- The wide host range of *M. gulosa* suggests that it is likely, if the pest has been distributed to a suitable part of a host plant, that the host would be suitable for egg laying and larval development. As indicated, this species has probably shifted from native hosts such as willow to plants such as citrus and oleander (Jones 2001). It may be able to move to other hosts in new environments.
- *Marmara gulosa* is native to southern US and has been reported from California, Texas, Arizona, Florida, Northern Mexico and Cuba (Stelinski 2007). Many of the areas where *M. gulosa* has been reported share similar climates to parts of Western Australia. It is likely that warmer areas in Western Australia would be suitable for the establishment of this species.
- *Marmara gulosa* can have up to 13 generations per year (Jones 2001). On average, females lay between 10 and 50 eggs (Kerns *et al.* 2004a). The generation time varies from two to four weeks (Kirkland 2009), although it generally takes about 30 days (Kerns *et al.* 2004a). Given the fecundity of females, a population could establish from a single gravid female. In addition, the rapid generation times would favour the establishment of *M. gulosa* in Western Australia should it be introduced.
- There are currently only limited biological and cultural control measures available to manage *M. gulosa*. Chemical coverage can be incomplete due to: *M. gulosa* entering an orchard or vineyard in waves; fruit expanding rapidly leaving untreated surfaces for egg deposition; eggs being preferentially laid on low lying internal fruit; and the limited ability to penetrate inside the mines of larvae (Grafton-Cardwell *et al.* 2003; Grafton-Cardwell *et al.* 2012). Biological control has shown some success with the native eulophid wasp (*Cirrospilus coachellae*) in the Coachella Valley, but the wasp is unable to survive the colder winters in northern regions such as the San Joaquin Valley (Stelinski 2007; Grafton-Cardwell *et al.* 2012) and efforts to establish it there have been unsuccessful (Grafton-Cardwell *et al.* 2008). If *M. gulosa* was introduced, it is unlikely that suitable controls could be applied in urban areas. Also, existing IPM strategies applied in rural and horticultural areas are unlikely to be effective in limiting the establishment of this pest in Western Australia.

The wide host range, current geographic distribution across a range of climates, including climates similar to Western Australia's, high reproductive potential, and limited effectiveness of current control methods support a likelihood estimate for establishment of 'high'.

4.5.3 Probability of spread

The likelihood that *Marmara gulosa* will spread within Western Australia, based on a comparison of factors in the source and destination areas that affect the expansion of the geographic distribution of the pest is: **MODERATE**.

Supporting information for this assessment is provided below:

- The polyphagous nature of *M. gulosa* would enable it to locate suitable hosts in new areas and facilitate the spread of this pest should it be introduced and become established. It may also be able to spread to new hosts, as probably occurred in California with the shift from willow to citrus (Jones 2001).
- The current geographic distribution of *M. gulosa* includes California, Texas, Arizona, Florida, northern Mexico and Cuba (Stelinski 2007). Many of these areas share similar climates to parts of Western Australia and *M. gulosa* could spread through areas with a suitable climate; probably warmer regions of Western Australia.
- The first collections of *M. gulosa* in the US were made in 1915 from California according to Jones (2001) and 1917 according to Kirkland (2009). Only sporadic occurrences were reported in California up to the mid 1990s and *M. gulosa* was considered a minor pest of citrus in the San Joaquin Valley (Grafton-Cardwell *et al.* 2003; Kirkland 2009). Since that time, *M. gulosa* has spread throughout the San Joaquin Valley and to additional regions of California and the US, infesting not only citrus, but a wide range of hosts that it had previously only rarely attacked (Grafton-Cardwell *et al.* 2003). This change coincides with shipments of citrus fruit from northern Mexico in response to shortages in fruit production in California in the late 1990s (Kirkland 2009). Although *M. gulosa* has managed to spread throughout California, the limited and disparate spread of *M. gulosa* in the US and the Americas suggest there may be additional factors outside of pest management practices that impede the widespread dispersal of this pest, particularly across the southern states of the US which may relate to host availability and climate.
- *Marmara gulosa* adult moths are capable of independent flight and could disperse locally. Natural barriers such as deserts, mountains or large areas where hosts are not present would limit its ability to disperse between some areas. The long distances between production areas in Western Australia may reduce the likelihood that *M. gulosa* would disperse unaided from one agricultural region to another.
- Long distance spread would probably rely on facilitated distribution with commodities or conveyances. The small size of eggs and larvae could enable the spread of *M. gulosa* to new areas undetected. However, where obvious symptoms of infestation are apparent, interstate control measures may restrict spread in a commercial context.
- The potential fecundity of gravid females, many generations per year and potential persistence year round, would favour the spread of *M. gulosa* in Western Australia.

The wide host range, possible history of spread on Mexican citrus, capacity for flight, and high fecundity are moderated by the history of limited spread of outbreaks in south western parts of the US. This supports a likelihood estimate for spread of 'moderate'.

4.5.4 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' are shown in Table 2.2.

The likelihood that *Marmara gulosa* will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **LOW**.

4.5.5 Consequences

The consequences of the establishment of *Marmara gulosa* in Western Australia have been estimated according to the methods described in Table 2.3.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are 'D', the overall consequences are estimated to be **LOW**.

Reasoning for these ratings is provided below:

Criterion	Estimate and rationale
Direct	
Plant life or health	**D – Significant at the district level** • *Marmara gulosa* can cause direct damage to crops in the form of mines on the surface of fruit. Although the presence of mines causes only a cosmetic effect and does not damage the internal flesh, it can render fruit unmarketable in some crops. Mining damage can also cause secondary infections such as bunch rot in table grapes (Kirkland 2009). Whilst the damage is cosmetic and the interior fruit flesh remains unaffected, the presence of a single mine can render the fruit unmarketable in some commodities such as citrus (Grafton-Cardwell *et al.* 2008; Grafton-Cardwell *et al.* 2012). • In citrus, significant economic impacts have been recorded in the US, with up to 80-90% losses on marketable fruit reported in some varieties (Jones 2001; Stelinski 2007). Susceptible citrus varieties can experience damage in the range of 5-80% with other varieties rarely incurring losses of more than 3% (Grafton-Cardwell *et al.* 2012). *Marmara gulosa* is rarely considered an economic problem with other hosts (Grafton-Cardwell *et al.* 2012). • In contrast to citrus, larval mining in crops such as cotton or grapes can cause little to no economic damage (Grafton-Cardwell *et al.* 2008). • There are currently only limited biological and cultural control measures available to manage *M. gulosa* populations. Chemical coverage can be incomplete due to: numerous generations of *M. gulosa* entering an orchard or vineyard in waves; fruit expanding rapidly leaving untreated surfaces for egg deposition; eggs being preferentially laid on low lying internal fruit; and the limited ability to penetrate inside the mines and kill larvae (Grafton-Cardwell *et al.* 2003; Grafton-Cardwell *et al.* 2012). Biological control has shown some success, particularly with the native eulophid wasp (*Cirrospilus coachellae*) in the Coachella Valley, but it is unable to survive the colder winters in northern regions such as the San Joaquin Valley (Stelinski 2007; Grafton-Cardwell *et al.* 2012) and efforts to establish it there have been unsuccessful (Grafton-Cardwell *et al.* 2008).
Other aspects of the environment	**A – Indiscernible at the district level** • There are no documented direct impacts of *M. gulosa* on any other aspect of the environment. Their introduction into a new environment may lead to competition for resources with native species, but there is no documented history of this occurring. • The potential for some impact on plant health suggests that there may be impacts on amenity plants and ecological communities, but as stated, this has not been documented.

Indirect	
Eradication, control etc.	**D – Significant at the district level** • Current pest management practices and biological control activities have had only limited success in controlling *M. gulosa* in the US. Additional control programs may be required to minimise the impact of *M. gulosa* on host plants. • Existing domestic programs may provide some effectiveness for some hosts such as in cases where broad spectrum pesticide applications are utilised. However, this may not be the case for all hosts, particularly where specific integrated pest management programs are in place. In addition, potential biological control species may not be present in Western Australia. • Existing IPM programs may be disrupted because of the need to re-introduce or increase the use of certain pesticides. This may result in increased production costs which may be incurred by the producer.
Domestic trade	**D – Significant at the district level** • The presence of *M. gulosa* in commercial production areas may have a significant effect at the district level due to any resulting interstate trade restrictions on potentially a wide range of commodities. These restrictions may lead to either a loss of markets or require additional measures to facilitate ongoing trade.
International trade	**C – Significant at the local level** • The presence of *M. gulosa* in commercial production areas of a range of commodities that are hosts may limit access to overseas markets where *M. gulosa* is absent.
Environmental and non-commercial	**B – Minor at the local level** • While existing pest management practices may contain *M. gulosa*, additional pesticide applications and other control activities would be required to manage *M. gulosa* on susceptible crops. Any additional insecticide usage may affect the environment.

4.5.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Marmara gulosa*	
Overall probability of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *Marmara gulosa* has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.6 Phomopsis cane and leaf spot [Diaporthales: Diaporthaceae]

Phomopsis viticola EP

Phomopsis viticola is not present in the state of Western Australia and is a pest of quarantine concern for that state.

Phomopsis cane and leaf spot, or dead arm, is caused by the fungus *Phomopsis viticola* and is an important disease in several viticultural regions of the world (Nair *et al.* 1994), especially where rain following bud break keeps grapevines wet for several days (Hewitt and Pearson 1988). *Phomopsis viticola* is established in New South Wales, Queensland, South Australia, Tasmania and Victoria (Mostert *et al.* 2001; Plant Health Australia 2001c) but is not known to be present in Western Australia.

Phomopsis viticola infects leaves, young shoots, rachises, petioles and fruit (Hewitt and Pearson 1988). Grapevines are susceptible throughout the growing season. After infection of juvenile fruit, symptoms do not appear until the fruit matures. On the fruit, the early symptoms are browning and shrivelling (Ellis and Erincik 2005). On rachises, the symptoms are chlorotic spots with dark centres (Hewitt and Pearson 1988). These spots enlarge to form dark brown streaks and blotches that turn black (Hewitt and Pearson 1988). Rachises may become brittle from numerous infections and break, resulting in loss of fruit (Hewitt and Pearson 1988). Pycnidia (fruiting structures) are subepidermal. Yellowish spore masses are exuded and then the berries shrivel and mummify (Gubler and Leavitt 1992). *Phomopsis viticola* conidia are splash dispersed and usually spread only short distances, i.e. within a vine or adjacent vines. Long distance spread is usually by movement of infected or contaminated propagation material (Hewitt and Pearson 1988).

There has been considerable confusion around the taxonomy of Phomopsis disease in grapevines, particularly as a number of species of *Phomopsis* have been isolated (Melanson *et al.* 2002). Previous taxonomic classifications have relied solely on host association, symptom expression, morphological features, mycelia growth and in vitro sporulation (Melanson *et al.* 2002; Van Niekerk *et al.* 2005; Schilder *et al.* 2005; Udayanga *et al.* 2011). A number of putative species of *Phomopsis* on grapevine have been characterised. Based on sequencing of the ITS1 and ITS2 regions of the nuclear ribosomal DNA internal transcribed spacers, the Australian *P. viticola* isolate clusters with *P. viticola* isolates from other regions of the world, including the US (Mostert *et al.* 2001).

Phomopsis viticola was assessed in the existing policies for table grapes from the People's Republic of China (Biosecurity Australia 2011a), table grapes from the Republic of Korea (Biosecurity Australia 2011b), and table grapes from Chile (Biosecurity Australia 2005). The assessment presented here builds on these previous assessments.

Assessments for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and the People's Republic of China (Biosecurity Australia 2011a) found the probability of importation to be high and the probability of distribution to be low for those countries. Assessment for table grapes from Chile (Biosecurity Australia 2005) found the probability of importation to be low and the probability of distribution to be very low. Because the risk ratings for *P. viticola* on table grapes from these three countries differ, DAFF considers that new assessments should be made for the probabilities of importation and distribution for *P. viticola* with table grapes from California. All three previous assessments contain information applicable to California and no one assessment is necessarily more relevant to California in its entirety.

The probability of establishment and spread of *P. viticola* in Western Australia and the consequences it may cause will be comparable for table grapes sourced from any area and imported into Western Australia, as these probabilities relate only to events that occur in Western Australia. The ratings given for establishment, spread and consequences in the reports for table grapes from Korea, China and Chile are also the same, unlike the ratings for importation and distribution. Accordingly, there is no need to reassess these components and the previous ratings will be adopted for this assessment.

This assessment is a contemporary review of the scientific literature that builds on the evidence given in previous assessments. It includes sources used in those previous assessments and any new evidence which has emerged about the biology of phomopsis cane and leaf spot. Consideration has also been given to data obtained from ten years of trade of Californian table grapes into other Australian states and territories.

The risk scenario of concern for *Phomopsis viticola* is the presence of the fungus on mature bunches of grapes.

4.6.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that *P. viticola* will arrive in Western Australia with the importation of table grapes from California is: **LOW**.

Supporting information for this assessment is provided below:

Association of the pathogen with the crop

- Phomopsis cane and leaf spot disease of grape is common in viticultural regions around the world including the US (Mostert *et al.* 2001; Nita 2005; Nita *et al.* 2006). In California, the disease was first reported near Sacramento in 1935 and has since been consistently present in the Central Valley (Cucuzza and Sall 1982). It is most prevalent in the northern grape growing regions of the North Coast and the northern San Joaquin Valley where spring rains are common (Gubler *et al.* 2009).
- Despite the application of both calendar-based and predictive warning system spraying regimes, Phomopsis cane and leaf spot disease can be prevalent in many vineyards where climatic conditions are suitable (Anco *et al.* 2012). However, predictive systems can result in significantly less disease incidence and severity (Nita *et al.* 2006) and Pscheidt and Pearson (1989b) noted that spray applications during bloom significantly reduced fruit rot and rachis lesions in New York.
- *Phomopsis viticola* can infect most parts of a grapevine including the shoots, leaves, rachises and fruits, with young immature tissues being most susceptible (Erincik *et al.* 2001; Nita *et al.* 2006). Phomopsis cane and leaf spot infection can cause breaking of the shoots, stunting, dieback, reduced vigour, reduced bunch set, and fruit rot (Van Niekerk *et al.* 2005). Leaf symptoms include small irregular or round pale green to yellow spots with dark centres (Nita 2005). On canes and rachises, brown to black necrotic irregular

shaped lesions develop, causing girdling which weakens the plant and can cause premature fruit drop (Rawnsley *et al.* 2004; Nita 2005).

- Symptoms of cane and leaf infection are usually observed from the first through third internode or leaf (Erincik *et al.* 2001). Cane infections can result in some damage and are likely the primary source of inoculum (Erincik *et al.* 2001). Symptoms are rarely observed on parts of the plant that develop late in the season, suggesting that maybe these tissues do not tend to carry viable inoculum and/or the timing coincides with unfavourable weather conditions (Erincik *et al.* 2001). This highlights the importance of early season infections in the disease pathogenesis (Erincik *et al.* 2001). The significance of late-season infection of the rachis and berries under natural field conditions remains unknown (Erincik *et al.* 2001).
- Rawnsley and Wicks (2002) report that at least 10 hours of rain in combination with low temperatures are necessary for spore production and an additional 8-10 hours of moist conditions are required for infection.
- Erincik *et al.* (2003) observed that 7.4 h of wetness was required for leaf infection at 18°C and noted similar results by previous authors.
- Temperature limits for infection range from 5 to 35°C and the optimum temperature for leaf and cane infection was reported between 16°C and 20°C (Erincik *et al.* 2003). Rawnsley and Wicks (2002) report that the optimum temperature for spore germination and fungal growth is 23°C. Anco *et al.* (2013) found 21°C to be the optimum temperature for sporulation. Variance in the reported optimum values may be accounted for by differences in cultivar and/or pathogen isolate(s) used (Erincik *et al.* 2003).
- In the field, the incidence and severity of disease caused by *P. viticola* is strongly influenced by weather conditions, inoculum density and host growth stage (Rawnsley and Wicks 2002; Erincik *et al.* 2003). Importantly, the occurrence of early-season infections in combination with prolonged rain periods and low temperatures early in the season favour disease development (Rawnsley and Wicks 2002; Erincik *et al.* 2003). It is suggested that the fungus is predominantly active at lower temperatures (Erincik *et al.* 2003), again highlighting the significance of early-season infections in the pathogenesis of the disease before summertime temperatures increase. Further, disease development tends to be more prominent in spring when higher inoculum levels are present and are in close proximity to susceptible young tissues (Nita *et al.* 2006).
- Some regions of California experience a hot and dry climate which may not be favourable for the development of Phomopsis cane and leaf spot disease, particularly fruit infection. Access for Californian table grapes into Australia is permitted only from the counties of Fresno, Kern, Kings, Madera, Riverside and Tulare (AQIS 2012), which are located in the southern half of the state.
- Gladstones (1992) notes that the county of Fresno, California experiences high temperatures and sunshine hours with little rainfall throughout the whole summer and the period following ripening. For Fresno, the total average rainfall from June to October is 22.3 mm and the average maximum temperature for the same period is 32.9°C (World Climate 2011). However, during early spring, Fresno has a milder climate where total rainfall during bud burst (March–April) is 80.8 mm on average and the average maximum temperature is 21.3°C (World Climate 2011). These early spring conditions indicate that in some years, vegetative tissue infection could be supported when temperature and duration of wetness are suitable for pycnidia formation and sporulation.

- The weather records for the counties with existing market access to Australia were reviewed. This included temperature and precipitation data from a selection of weather stations. The counties of Madera, Kings, Kern, Fresno and Tulare experience similar average temperatures from May to December, although Riverside County, which is located in the very south of California, experiences a slightly higher average temperature for the same months (World Climate 2011). Average precipitation is similar for all counties from May to September, although Tulare County was slightly higher at 22.5 mm (World Climate 2011). However, from October through to December (late autumn to early winter), more precipitation is encountered across the export counties, ranging from 47.4 to 108.4 mm (World Climate 2011).
- There are indications from the literature that *P. viticola* is present in the approved exporting counties. Úrbez-Torres *et al.* (2006) surveyed cankers from 166 vineyards across 21 counties in California. Úrbez-Torres *et al.* (2006) reported *P. viticola* as the most commonly isolated pathogen from cankers taken from trunks, cordons and spurs in Fresno and Tulare counties, with isolations also noted from, Madera, Kern and Riverside counties, but they did not sample in Kings County. The study only sampled cankers but did not test vines free of disease symptoms. Úrbez-Torres *et al.* (2006) found that the incidence of *P. viticola* in cankers varied greatly from zero in some counties to 52% in Fresno County. The overall incidence of *P. viticola* in vineyards was not reported. However, *P. viticola* is more prevalent on the north coast of California and the northern San Joaquin Valley and is economically important during wet years when spring rains are common (Gubler *et al.* 2009; Bay *et al.* 2010). Gubler and Leavitt note in Flaherty *et al.* (1992) that it has been recorded to infect canes and leaves in the most northerly export counties of California after heavy and prolonged rainfall in late March to April.
- A number of studies have reviewed the occurrence of Phomopsis cane and leaf spot disease in the eastern US. Nita *et al.* (Nita *et al.* 2008) surveyed vineyards in Ohio over a three year period and reported a relatively high disease incidence which ranged from 4-86% and with a mean incidence of 48%. Critically, it is important to note that Ohio is located in the north eastern US and experiences cooler and wetter conditions than the relatively arid climate of Fresno, Madera, Kings, Kern, Tulare and Riverside counties. By way of example, Wooster (Ohio) has a continental climate and during bud burst (April-May), total rainfall is 177 mm on average, and the average maximum temperature is 17.6°C. From June to October total rainfall is 431 mm on average and the average maximum temperature is 23.7°C (World Climate 2011). Accordingly, the conditions in Ohio are likely to be far more conducive to Phomopsis cane and leaf spot disease. Whilst *P. viticola* has been found in the Californian export counties, environmental conditions are far less favourable for disease development.

Association of the pathogen with the commodity pathway

- *Phomopsis viticola* can infect most parts of the vine including rachises and fruits, with young immature tissues being most susceptible (Erincik *et al.* 2001; Nita *et al.* 2006). Berry infection is favoured by 20-30 hour wetting periods and high humidity during bloom (Rawnsley and Wicks 2002; Nita *et al.* 2008).
- Mostert *et al.* (2000) showed that *P. viticola* mainly colonised the node and internode tissues of grapevine in South Africa. Of the 51 isolates obtained across nodes, internodes, leaf and leaf petiole, tendril and bunch peduncle, 48 were isolated from the nodes and internodes, two from the leaf petiole and one from the leaf (Mostert *et al.* 2000). The

grape cluster was not included in this study as no berry rot had been observed in South Africa. Leavitt (2000) states that fruit infections of *P.viticola* rarely occur in California.

- Where berry infection occurs, infection of the pedicel or rachis in cool climates is most likely to cause yield loss (Rawnsley and Wicks 2002). From a lesion, the infection advances into the berry from the pedicel and pycnidia are produced in the epidermis of the fruit (Rawnsley and Wicks 2002).
- Pscheidt and Pearson (1989b) reviewed historical data for the western New York grape region from the years 1958 and 1986 to determine which years Phomopsis fruit rot occurred. Based on that review, fruit rot was only observed in 1972, 1984 and 1986. These periods of infection were linked to above average rainfall experienced during the two week period of bloom. In the year of 1972, Hurricane Agnes hit the state during bloom (Pscheidt and Pearson 1989b) and for the years 1984 and 1986, significant rainfalls (>130 mm) were recorded over a two week period around the time of bloom (Pscheidt and Pearson 1989b).
- Pscheidt and Pearson (1989a) investigated the effect of cultivation practices on the occurrence of Phomopsis cane and leaf spot disease in both experimental and commercial vineyards from various locations in New York. One of the sites, Fredonia, experiences a total rainfall of 159 mm on average during bloom (May-June) and an average maximum temperature of 22°C for the same period (World Climate 2011). In those trials, the authors reported the number of berries with symptoms of fruit rot at up to 4.7%. However, for one year in particular, 1986, disease development was high due to heavy rains from budbreak until bloom, totalling 238.5 mm (1989a). In addition, there was significant cane wetness (up to 37.7 hours) that coincided with low temperatures (10.9°C to 20.2°C).
- Anco *et al.* (2012) reported on the temporal sporulation potential of *P. viticola* on grape shoots, canes and rachises at a research vineyard in Wooster, Ohio. Climate data for Wooster, Ohio shows that during bloom (May-June), total rainfall is 193 mm on average and the average maximum temperature is 23°C (World Climate 2011). The authors found that the sporulation potential on rachises peaked around mid-May, but that sporulation was not apparent prior to spring or after bloom. This study shows that rachis material can carry viable inoculum however, it is important to note that: these vineyards experienced high levels of naturally occurring Phomopsis cane and leaf spot disease; the vines were inoculated with a wild-type *P. viticola* at 10^7 α-conidia on the shoots and inflorescences until runoff; overhead irrigation was utilised to supplement natural rainfall to ensure sufficient wetness periods; and, sampled tissues were incubated in chambers at 100% relative humidity to maintain free water on samples.
- The climatic averages for both New York and Ohio, where fruit rot has been shown, indicate that conditions in many years are theoretically likely to support rachis and berry infections. In practice, it appears that environmental conditions (temperature and wetness duration) are appropriate for the development of Phomopsis fruit rot only in very limited circumstances. This relatively low incidence of fruit rot in states with climates far more conducive to Phomopsis cane and leaf spot disease than in the exporting counties of California, suggests more arid environments will support a significantly lower incidence of Phomopsis cane and leaf spot disease, and that fruit infection is unlikely to occur.
- In Australia, the first occurrence of bunch rot by *P. viticola* was reported during surveys of the Hastings Valley located in northern coastal New South Wales during the period of 2004-2006 (Savocchia *et al.* 2007). Hastings Valley has a coastal climate (see Figure 7)

which is more suitable for the development of Phomopsis cane and leaf spot than the counties in the southern San Joaquin Valley.

- The weather in the counties in California approved to export to Australia is very dry during bloom and would limit vegetative tissue infection. In Fresno, the average total rainfall during bloom (April-May) is 39.2 mm and the average maximum temperature is 25.8°C (World Climate 2011). In considering the higher total rainfalls and average maximum temperatures in the eastern US (e.g. New York and Ohio) where fruit infections are practically low to nil in years of average rainfall (Pscheidt and Pearson 1989b), the climate in the export counties of California is significantly drier and are typically not conducive to fruit rot. This is supported by the lack of reports of fruit infection from export counties (lower Central Valley and Coachella Valley) and the rest of California where fruit infection is considered to occur only occasionally (Flaherty *et al.* 1992), with the disease considered only to be economically important along the north coast and in the north of the San Joaquin Valley during wet years (Bay *et al.* 2010).
- When bunches do become infected in California during wet years, symptoms are localised with only isolated bunches affected on any one vine (Flaherty *et al.* 1992). This is consistent with reports from Rawnsley and Wicks (2002) which also notes that fruit symptoms tend not to be extensive and infected bunches are generally limited to a single vine (Rawnsley and Wicks 2002). Similarly, Nita (2005) investigated the spatial distribution of Phomopsis cane and leaf spot disease in Ohio vineyards and showed that where disease occurred, it tended to only spread within a single vine, with spread between vines rarely occurring. Accordingly, there is a limited potential for undetected or asymptomatic fruit rots to spread to other grape bunches.
- Rachis lesions develop after inoculation at 12.7 cm of shoot growth or at bloom and the rachis remains susceptible to infection from bud break until bloom (Erincik *et al.* 2001). The infection of late season developing tissues is less prevalent. Pscheidt and Pearson (1989b) showed that under laboratory conditions, inoculated berries were less susceptible to infection and colonisation as the berries mature from pea-size to the fully ripe stage.
- For the period 2007–2009, approximately 39,000 tonnes of fresh grapes were imported into Australia from California (USITC 2013). In 2010 alone, over 400,000 berries (or over 100,000 bunches) were inspected by DAFF inspectors during offshore preshipment inspections (OPIs) (USDA 2010b). There are no recorded detections of *P. viticola* on table grapes from California during OPIs for trade into eastern Australia since the commencement of trade in 2002. The lack of detection of fruit or bunch rots, or *P. viticola*, on table grapes from California supports the case that the climatic conditions in the exporting counties of California limits the incidence of *P. viticola* infection and Phomopsis cane and leaf spot disease.

Ability of the pest to survive harvesting, packing, transport and storage conditions

- Infection of the rachis generally develops within 3 to 4 weeks of inoculation and is considered to be an important phase of the disease (Erincik *et al.* 2001). Lesions that develop on the rachises can result in premature withering of the cluster stem and the infected clusters that survive until harvest will often produce poor quality fruit or fall from the vine before harvest (Erincik *et al.* 2001; Anco *et al.* 2011). The likely rapid and obvious symptom development on rachises would allow for affected bunches to be removed during quality assurance procedures (quality standards used in California are outlined in Section 3.6) and affected fruit culled before, during and after harvest.

- Berry infections can remain latent in green fruit until close to harvest (Erincik *et al.* 2001) and cluster symptoms generally show as the fruit begins to ripen (Schilder *et al.* 2005). Infected rachises become necrotic and affected berries become shrivelled with detectable pycnidia, rotting and fruit falling to the ground (Schilder *et al.* 2005; Nita *et al.* 2006).
- *Phomopsis viticola* overwinters as mycelia in the woody parts of infected canes, spurs, pruned shoots and dormant buds, or as immature pycnidia in the cortex of diseased vine canes, suggesting these are likely important sites for winter survival (Mostert *et al.* 2000; Rawnsley and Wicks 2002; Nita 2005; Nita *et al.* 2006). Although it is unknown how well *P. viticola* could overwinter on rachises or berries, it is likely that cold storage and transportation conditions would not significantly impact on the survival of *P. viticola* associated with infected rachis or cluster material.
- The long distance spread of *P. viticola* to new areas has largely been attributed to the movement of propagation material (budwood, cane cuttings and nursery stock) and contaminated vineyard equipment (Rawnsley and Wicks 2002; Clarke *et al.* 2004) rather than fresh fruit.
- In a study to investigate micromycetes in imported fruits and vegetables into Lithuania during the period of 2003-2004 imported produce were sampled from two wholesale centres, *Phomopsis viticola* was found, among other pathogens, on table grapes imported from South Africa (Raudoniene and Lugauskas 2005).

Conclusion on probability of importation

The information presented indicates that *P. viticola* is predominantly associated with vegetative tissues in cool wet seasons in temperate climates. Mature tissues are more resistant to infection and bunch infection occurs at economic levels only when very wet periods (>130mm of precipitation) coincide with blooming. While *P. viticola* is known from California, it is typically only an economic issue to the north of the counties permitted to export to Australia. The hot and arid climate of the Californian export counties lowers the incidence of Phomopsis cane and leaf spot disease and the likelihood of bunch rot infection is even lower. Where seasons with abnormally high wet periods occur and temperatures are suitable for the development of fruit rot, symptoms are typically observed prior to harvest, are localised and would generally be associated with a high incidence of disease on the vegetative tissues. Under these circumstances, infected bunches would not meet commercial requirements and would be culled during quality assurance operations. The poor climate for bunch rot infection is supported by the lack of detection of *P. viticola* bunch rots during 10 years of phytosanitary inspection during the trade of Californian table grapes into eastern Australia. Accordingly, the evidence supports a likelihood estimate for importation of ‘low’.

Probability of distribution

The likelihood that *P. viticola* will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from California and subsequently transfer to a susceptible part of a host is: **VERY LOW**.

Supporting information for this assessment is provided below:

Distribution of the imported commodity in the PRA area

- Distribution of the commodity would be for retail sale as the intended use of the commodity is human consumption. Fungi present on the surface of fruit could potentially be distributed via wholesale and retail trade and waste material would also be generated.

- Table grape bunches with any obvious symptoms of infection would be unmarketable and would not be sold within Western Australia. Fruit without symptoms, or with only minor symptoms, could still be distributed for sale.
- Most of the bunch will be eaten but the rachises will remain and would be discarded as waste. Waste generated through retail and food service industry distribution pathways is likely to be disposed of in municipal tips and would therefore pose little risk of exposure to a suitable host.
- Consumer generated waste could result in small quantities of fruit waste being discarded in urban, rural and natural localities including domestic composts, along roadsides or in other environments. There is some potential for consumer waste being discarded near commercially grown, household or wild host plants. In some areas of Western Australia, commercial vineyards (e.g. Swan Valley) are located near urban areas.
- In the PRA area, the majority of the population lives in the Perth metropolitan area and the majority of imported grapes would be distributed there. However, most of the waste generated would be managed through metropolitan disposal facilities.
- Some waste could enter the environment via composts. Composting will either bury the rachis, preventing any spore dispersal, or eventually cause discarded material to rot. Only discarded material that remains uncovered and does not degrade or dessicate is likely to produce spores.

Availability of hosts

- *Phomopsis viticola* has a restricted host range which includes *Vitis* spp. (*Vitis vinifera*, *Vitis rupestris*, *Vitis aestivalis*, *Vitis labrusca*, *Vitus rotundifolia*) and *Parthenocissus quinquefolia* (Virginia creeper) (Punithalingam 1964; Galet and Morton 1988). There is a report of *P. viticola* being isolated from *Vaccinium* spp. but not being pathogenic (Espinoza *et al.* 2008). The restricted host range limits the likelihood that imported bunches infected with *P. viticola* will be distributed to a location near a suitable host.
- *Vitis* spp. hosts (for both table and wine grapes) are grown commercially and domestically in Western Australia. Also, a number of *Vitis* spp. are recorded as weeds in Australia (Randall 2007) and could be potential wild hosts in Western Australia. Domestic garden plantings, both maintained and abandoned, occur in Perth and in most Western Australian towns and by many farmhouses.
- Approximately 300 Western Australian commercial table grape vineyards were reported from near the Western Australian coast in 2006, extending from the Gascoyne region (Carnarvon) to the South-West region (Harvey, Donnybrook, Margaret River and Busselton) (DAWA 2006b). With respect to wine grape production, the main vineyards span from Gingin just north of Perth, extending through the south-west and across to the Porungurup’s near Mount Baker (DAFWA 2006).

Risks from by-products and waste

- The primary inoculum sources for *P. viticola* in vineyards are the canes and dormant buds (Erincik *et al.* 2001; Rawnsley and Wicks 2002; Nita 2005) and Mostert *et al.* (2000) showed that *P. viticola* most often colonised the node and internode tissues. These plant parts, rather than rachises and berries, are important in the maintenance of viable populations which can then result in new infections (Erincik *et al.* 2001; Rawnsley and Wicks 2002; Nita 2005).

- Most species of *Phomopsis* are considered to be hemibiotrophic, subsisting on living tissues for parts of its life cycle and becoming nectrotrophic at least for the latent phase of infection (Udayanga *et al.* 2011). *Phomopsis* species can also grow saprophytically on synthetic media (Punithalingam 1964) although this is not representative of field conditions. The ability to grow nectrotrophically, and potentially saprophytically, would allow *P. viticola* to remain in a viable state on discarded table grape bunches.
- As presented in the probability of importation, Anco *et al.* (2012) demonstrated the potential for the rachis and fruit cluster, when attached to the plant, to maintain viable *P. viticola* over winter and produce conidium in spring (Anco *et al.* 2012). However, the vineyards included in the study: experienced high levels of naturally occurring Phomopsis cane and leaf spot disease; had shoots and inflorescences that were inoculated with wild-type *P. viticola* at 10^7 α-conidia until runoff; used overhead irrigation to ensure sufficient wetting periods; and, had the isolations incubated in chambers at 23°C for 14 days at 100% humidity to maintain free water on the samples. It is unclear to what degree any life stages of *P. viticola* living saprophytically on imported bunches could survive and sporulate at sufficient inoculum pressures to initiate new infections on susceptible host tissues under natural conditions. But, it is likely to be less than the experimental conditions adopted by Anco *et al.* (2012).
- Once a bunch is detached from the plant it starts to lose moisture. Table grapes are well known to be subject to serious water loss following harvest (Crisosto and Smilanick 2004). Waste material discarded into the environment would continue to desiccate and additional external moisture may be required for *P. viticola* to produce pycindia and then sporulate. Early in the import season, in some of the PRA area, winter rainfall may be sufficient to prevent desiccation, but low temperatures may prevent sporulation until spring when rainfall tends to decrease in many Western Australian grape growing regions. Alternatively, in warmer areas, sporulation could occur during winter rain but prior to widespread budburst when host material is unlikely to be available.
- Discarded bunches would be colonised by specialist saprophytic fungi and bacteria that would compete with *P. viticola* for suitable substrate.
- Table grapes from California are imported into Australia from June through to November (Australian winter to early summer). Any *P. viticola* present on imported table grapes would need suitable material to survive on until conditions were appropriate for re-sporulation and continuation of the disease cycle. Early season imported fruit infected with *P. viticola* could sporulate during winter when rainfall is suitable, but winter temperatures may limit the ability of the fungus to produce pycnidia. Alternatively, *P. viticola* would need to survive on infected waste material until spring when temperatures are warmer but rainfall is decreasing, which then decreases the ability of the fungus to develop pycnidia. However, rainfall variation year to year indicates there are years when rainfall is higher and temperatures suitable during spring for pycnidia to develop (see section 3.2 for further details).
- Anco *et al.* (2012) reported that *P. viticola* sporulation occurred from bud break until shortly after the end of bloom, at which time its ability to sporulate ceased. Depending on the timing of importation, this window would limit the ability of *P. viticola* to survive until suitable climatic conditions allowed conidia production.

Ability of the pest to move from the pathway to a suitable host

- Natural spread is limited and occurs via the growth of mycelium from diseased to healthy parts of the vine (Rawnsley and Wicks 2002) and via rain splashed conidia. Since imported grape bunches are detached and subject to desiccation and saprophytic competition, the likelihood of mycelial growth infecting new host material is considered negligible. Conidia are considered the only plausible means of dispersal.
- *Phomopsis viticola* requires suitable periods of moisture and temperature to produce pycnidia and then conidia. Rawnsley and Wicks (2002) report that at least 10 hours of rain in combination with low temperatures are necessary for spore production.
- Nita (2005) conducted a spatial distribution analysis of Phomopsis cane and leaf spot disease in Ohio vineyards, and under favourable climatic conditions, showed aggregation at the vine level, with dissemination between vines within the same row or across rows occurring in only a few situations. The ability of disease to spread within a single vine, but not across multiple vines, indicates that *P. viticola* has a limited ability to spread naturally, even in close proximity to host material. In this study, the primary source of inoculum was on older canes well above ground level (Nita 2005). Older canes are located near the main trunk, with 2-3m spacing typically between vines and rows (Nita 2005). Given that natural spread occurs via rain splashed conidia, the spacing of 2-3m between vines and rows suggests that the fungus has only a limited ability to spread from vine-to-vine.
- As the natural spread of *P. viticola* is almost limited to within a vine and rarely occurs between vines (Nita 2005), infected grape berries or rachises must be discarded in very close proximity to a susceptible host for the fungus to move from imported material to a new host.
- Anco *et al.* (2012) reported that *P. viticola* sporulation occurred from bud break until shortly after the end of bloom, after which time its ability to sporulate ceased. Depending on the timing of importation, this window would limit the ability of *P. viticola* to survive until suitable climatic conditions allowed conidia production.
- No studies have demonstrated that insect vectors are important in the epidemiology of the disease. The spread of water-borne spores of another fungal pathogen, black spot, by insects onto young vine foliage and bunches has been reported but no data was presented to support the claim (Emmett *et al.* 1992). Also Moyo (2013) reported the potential for arthropods associated with fresh pruning wounds to play a role in the vectoring of Petri disease and esca. However, the relevance and importance to the etiology of Phomopsis cane and leaf spot disease in-field was not explored. Although there exists the potential for insect spread, the relatively confined disease distribution profile for Phomopsis cane and leaf spot disease, as well as the absence of studies to support insect vectoring as a significant mode of spread, suggest that other dispersal mechanisms are likely more important in the dispersal of the disease. The spatial distribution of Phomopsis cane and leaf spot disease observed in the study conducted by Nita (2005) would have included any effect of insects on the dispersal of conidia. The limited dispersal recorded in this study was from source inoculum that was located on cane tissue above ground height and would maximise rain splash dispersal. If infected table grape bunches imported from the US were disposed into the PRA environment, most likely at ground level, they would need to be located in very close proximity to a susceptible host to allow any conidia produced the chance to transfer to a new host.

- There is limited information on mechanical transmission of *P. viticola*, such as via pruning equipment, which suggests that it does not play an important role in the spread of the pathogen. Van Niekerk (Van Niekerk *et al.* 2011) found that pruning wounds were susceptible to infection by *P. viticola* but did not study the transmission of the pathogen by pruning equipment.

Ability of the pest to initiate infection of a suitable host

- *Phomopsis viticola* is considered to be monocyclic and infections primarily occur early in the growing season (Erincik *et al.* 2003; Anco *et al.* 2012).
- Rawnsley and Wicks (2002) report that at least 10 hours of rain, in combination with low temperatures, are necessary for spore production and then an additional 8-10 hours of moist conditions are required for infection.
- After conidia have been successfully produced and transferred to a new host, suitable infection sites need to be available.
- Table grapes from California are imported into Australia from June through to November. Precipitation in Western Australia could be favourable for Phomopsis distribution early in the import season but temperatures may be too low for new infections to occur. In most regions, vines will be dormant until September (DAFWA 2013a). The major exception is the Carnarvon region where chemicals are applied to break dormancy and bud burst can occur from late June to July (Campbell-Clause 2005; DAFWA 2013a). In the table grape and wine grape region of the Swan Valley, mean bud burst across a range on varieties (table and wine) is 10 September (Due *et al.* 1993). Bud burst is affected positively by temperature (Due *et al.* 1993) and a warming climate may promote earlier budburst. More recent information indicates most varieties typically commence bud burst from mid August to late September in the Swan Valley and later in other growing regions further south (DAFWA 2013a). It is recognised that bud burst can occur over a broader range of times, although this level of bud burst is considered to be small campared to that typically recorded for the majority of grapevines varieties across growing regions.
- Budburst can be assisted through vines grown in tunnel houses. These vines are not directly exposed to discarded waste (unless directly taken into the tunnel house structure) or exposed to rainfall.
- At bud burst, the available shoot material for infection will initially be very small. However, as the season progresses the foliage will grow and develop into a full canopy over several weeks (Coombe 1988; Davidson 1995), presenting more host material for possible infection under suitable climatic conditions.
- It is likely that infected grape bunches imported early in the season would need to survive until bud burst when climatic conditions are suitable and susceptible young grape tissues are available to be infected. At this time, suitable temperatures and extended periods of free moisture would be needed for conidia production and to allow spores to germinate and initiate an infection. Precipitation, temperature and host susceptibility must all be suitable for there to be a chance of infection.
- It is unclear from the literature what minimum inoculum loads are required for infection. Under natural conditions, a critical mass of spores would be needed to ensure sufficient inoculum was available so that the probability of spores distributing to a susceptible host tissue was high enough for infection to occur. Cucuzza and Sall (1982) found that disease severity was a function of inoculum load (pycnidia/cm^2). However, in one year of their

study, they observed more than a twofold increase in disease severity despite only half the inoculum load. Cucuzza and Sall (1982) cited rainfall patterns as a potential causal factor to account for the difference. A number of authors, cited throughout this pest risk assessment, report on the importance of temperature, humidity, total rainfall and sufficient wetting periods as critical factors for *Phomopsis* infection and disease development. Although it is theoretically possible that a single conidium present on imported table grapes could initiate an infection, in practice, many environmental factors affect the likelihood that *P. viticola* will infect, and cause disease on, new host tissues.

- Field experiments have shown that dispersal can occur from infected cane material detached from the vine (Pscheidt and Pearson 1989a). Infected canes ranging in weight from approximately 200–900 grams were bundled and suspended above vines prior to bud burst. Each bundle produced between 1721 and 3773 pycnidia under field conditions, and then post sporulation, new vine growth was sampled directly below the infected canes. In this experiment disease incidence on sampled new growth ranged from approximately 2–40% (Pscheidt and Pearson 1989a).
- The experiment by Pscheidt and Pearson (1989a) shows that even when large inoculum sources are produced in the field, directly above susceptible host tissue, the majority of sampled tissue was not infected (based on incubation for 60 hours at 22°C). The ability of *P. viticola* to disperse from an infected rachis, most likely below a host, to receptive host tissue would be considerably less. It is important to note that these field experiments were conducted in New York vineyards during significant bloom rains with sufficient cane wetness and suitable low temperatures. Therefore, should any viable conidia produced on infected table grape bunches be transferred to susceptible host material, it is likely that there is a relatively lower chance of initiating an infection under the Western Australian climate, which is warmer and drier than that of New York.
- As was presented in the probability of importation, *P. viticola* can infect most parts of the vine including the shoots, leaves, rachises and fruits, with young immature tissues being most susceptible (Erincik *et al.* 2001; Nita *et al.* 2006). However, the late season developing tissues are rarely symptomatic, indicating that climatic conditions are unfavourable during these latter developmental stages, or that these tissues do not tend to carry viable inoculums (Erincik *et al.* 2001). Similarly, Mostert *et al.* (2000) showed that *P. viticola* preferentially colonised the node and internode tissues. This would suggest that to initiate a new infection, *P. viticola* contaminated imported bunches would need to be transferred to vegetative host tissues early in the growing season.
- Once transferred to suitable host material, appropriate temperatures and moisture would be required to initiate infection in the canes and leaves. Erincik *et al.* (2003) reported that 7.4 h of wetness was required for leaf infection at 18^{o}C and that the optimum temperature for leaf and cane infection was between 16^{o}C and 20^{o}C.
- For waste discarded in commercial vineyards existing pest management would influence the ability of a spore to infect a new host. Black spot (*Elsinoe ampelina*) and downy mildew (*Plasmopara viticola*) are present in Western Australia and both pathogens are associated with wet weather (Ash 2000; Plant Health Australia 2001c; Taylor 2012). There are several fungicides registered for the control of black spot, downy mildew and *Phomopsis viticola* in Western Australia (DAFWA 2011) and the application of these fungicides are recommended to manage *Phomopsis viticola* (Rawnsley 2012). Vineyards that apply fungicides to manage black spot and downy mildew would also limit the ability of *Phomopsis viticola* to infect a new host.

- As presented in the introduction to this chapter, seeded table grape varieties imported into Australia could be used by consumers to intentionally grow grapes from seed. Where this is the case, new infections could potentially occur on seedlings through germination of seeds from an infected imported bunch. However, the majority of imported varieties do not have seeds, with seeded varieties accounting for a very small proportion of table grapes grown in California (CDFA 2012b). In addition, the ability of seed to germinate without effective stratification methods can be extremely difficult, but varies with variety. Natural germination can occur to varying degrees depending on the cultivar and length of time since berry ripening, although longer storage periods after ripening are positively correlated with germination rates (Scott and Ink 1950; Singh 1961).
- Ellis *et al.* (1983) reported on the use of a combination stratification treatment (H_2O_2 + GA_3 + pre-chill) in achieving greater germination rates. Potentially, the temperatures encountered during cold treatment, storage and transport could allow for susceptible seeds to become stratified. Conversely, other authors have reported on the difficulties in breaking seed dormancy and generating viable seedlings even when applying a range of available stratification methods. Using seeds collected in the field from 1967–71, Ottenwaelter *et al.* (1974) reported that of 1278 seeds subject to stratification at 2–4^{o}C for 75 days only 17 germinated and of these, only 6 managed to establish seedlings.
- For new infections to initiate on seedlings germinated from imported seeded table grape bunches, a viable infection/conidia on the berry or rachis material would need to remain viable on a suitable substrate; the seed would need to break dormancy and germinate; the germinated seedling would need to survive to a suitable life stage that is susceptible to infection; the fungus would need to remain in close proximity to the emerging seedling and an assisted dispersal method would need to move the fungus onto susceptible host tissue; and climatic conditions (temperature and moisture) would need to be amenable for infection to occur. Given the low predominance of imported seeded table grape varieties, the potential difficulties with effectively growing grape from seed, the requirement for a Phomopsis life stage to remain viable and in close proximity to an emerging seedling and transfer to susceptible host tissue under suitable climatic conditions, this pathway for initiating new infections is likely to be of a very low or negligible risk. Moreover, depending on the time of import, any contaminant fungi may need to survive until the following season when conditions are suitable for growing seedlings.
- The south-western regions of Western Australia experience a temperate climate with warm dry summers, cooler winters and high rainfalls during the winter months and could provide suitable climatic conditions for infection by *P. viticola* and disease development. Areas north of Perth into the Gascoyne region and up to Carnarvon experience typically more desert and tropical climates with hot summers, warm winters and lower rainfall (see section 3.2) which is less likely to be conducive to the development of Phomopsis cane and leaf spot disease.

Conclusion for the probability of distribution

The evidence presented suggests that the spread of *P. viticola* is very limited and field observations show that transmission, even between vines, occurs in very few circumstances. Long distance spread has largely been attributed to facilitated distribution with propagative material and contaminated machinery. *Phomopsis viticola* has a narrow host range limited practically to *Vitis* spp. The majority of waste would be managed through municipal waste facilities and while some waste could be discarded directly into the environment (e.g. roadsides, composts etc.), infected imported bunches would need to be discarded in very close proximity to commercial or backyard vines, or potentially to wild *Vitis* spp. plants, prior to dessication of the rachis and/or fruit for any chance of distribution. *Phomopsis viticola* is monocyclic and after importation significant bloom rainfalls, low spring temperatures and susceptible early season green tissues would be required for infection. Depending on the time of import, this may limit the opportunities for infection to occur in the same season. Otherwise, the fungus would need to remain viable until the following year on a suitable overwintering substrate. The evidence presented supports a risk rating of ‘very low’ for the probability of distribution.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *P. viticola* will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **VERY LOW**.

4.6.2 Probability of establishment and spread

As indicated above, the probability of establishment and of spread for *P. viticola* is being based on the assessment for table grapes from the People’s Republic of China (Biosecurity Australia 2011a), table grapes from the Republic of Korea (Biosecurity Australia 2011b), and table grapes from Chile (Biosecurity Australia 2005). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessments are presented below:

Probability of establishment:	**HIGH**
Probability of spread:	**MODERATE**

4.6.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *P. viticola* will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **VERY LOW**.

4.6.4 Consequences

The consequences of the establishment *P. viticola* in Western Australia have been estimated previously for table grapes from the People’s Republic of China (Biosecurity Australia 2011a), table grapes from the Republic of Korea (Biosecurity Australia 2011b), and table grapes from Chile (Biosecurity Australia 2005). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from those assessments can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from these analyses is provided below:

Plant life or health	**C**	Minor significance at the district level
Any other aspects of the environment	**A**	Indiscernible at the local level
Eradication, control, etc.	**D**	Significant at the district level

Domestic trade	**B**	Minor significance at the local level
International trade	**B**	Minor significance at the local level
Environment	**B**	Minor significance at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are **‘D’**, the overall consequences are estimated to be **LOW**.

4.6.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Phomopsis viticola*	
Overall probability of entry, establishment and spread	Very low
Consequences	Low
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for *P. viticola* has been assessed as ‘negligible’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.7 Grapevine fanleaf virus [Comoviridae: Nepovirus]

Grapevine fanleaf virus [EP]

Grapevine fanleaf virus (GFLV) has not been recorded in Western Australia (DAWA 2006a) and is a pest of quarantine concern for that state. It is one of the most significant and widespread viruses of grapevine (CIHEAM 2006). In Australia, it is present in New South Wales (Plant Health Australia 2001c), South Australia (Stansbury *et al.* 2000; Habili *et al.* 2001) and Victoria (Habili *et al.* 2001).

GFLV is a member of the Nepovirus genus of the Comoviridae family (Varadi *et al.* 2007). It causes disease in most cultivars of *Vitis vinifera*, including some hybrids as well as in other *Vitis* spp. (Brunt *et al.* 1996a; Martelli *et al.* 2001; Andret-Link *et al.* 2004; Varadi *et al.* 2007). The virus has also been isolated from bemuda grass, *Chenopodium quinoa* and other weedy species (Izadpanah *et al.* 2003).

The virus is transmitted and disseminated by several mechanisms. It is transmitted through soil between grapevines by the root-feeding ectoparasitic dagger nematodes *Xiphinema index* and *X. italiae* (Brunt *et al.* 1996a; Martelli *et al.* 2001), and transmission by *X. vuittenezi* has also been suspected but not proven (CIHEAM 2006). *Xiphinema index* has not been detected in Western Australia (Plant Health Australia 2001c; Walker 2004; Lantzke 2004; Walker and Stirling 2008), and there are also no detection records for *X. italiae* and *X. vuittenezi* in Western Australia. The virus is also transmitted by grafting and is likely commonly introduced into vineyards and disseminated through infected scion wood and rootstock (Murant 1981; Martelli *et al.* 2001; Habili *et al.* 2001; Andret-Link *et al.* 2004; CABI 2011). It may be maintained in soil contaminated with viruliferous nematodes or roots (Murant 1981; Martelli *et al.* 2001). The virus can be transmitted though seed (Mink 1993) and has been detected in endosperm of grape seed (Cory and Hewitt 1968). GFLV may occasionally be transmitted to seedlings of hosts (Martelli *et al.* 2001); however, there are conflicting reports on seed transmission in grapevine (CIHEAM 2006). The virus can be transmitted through seeds of other hosts, including soybean (CIHEAM 2006).

Severe symptoms occur, although not exclusively, when GFLV co-infects with grapevine yellow speckle viroid 1 or 2 (GYSVd-1, GYSVd-2) (Szychowski *et al.* 1995; Little and Rezaian 2003). GYSV-1 and GYSVd-2 are present in grapes in California (Wolpert *et al.* 1996; Szychowski *et al.* 1998). Both of these viroids are also present in Australia (Koltunow *et al.* 1989) but are not reported from Western Australia (DAWA 2006a).

The risk scenario of concern is the importation of fruit infected with GFLV, germination of infected seed, seed transmission of the virus to those seedlings, and then transmission of GFLV from the seedlings to other grapevines in Western Australia.

GFLV was assessed in the existing import policy for table grapes from the People's Republic of China (Biosecurity Australia 2011a). The assessment of GFLV presented here builds on this previous assessment.

The probability of distribution, establishment and spread of GFLV in Western Australia, and the consequences it may cause, are comparable for table grapes imported from any country into Western Australia, as these probabilities relate specifically to events that occur in Western Australia and are independent of the importation pathway. Furthermore, the table grape season in China and California overlap as they are both in the northern hemisphere and table grapes would be imported from both sources around the same time of year. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences, as set out for GFLV in the import risk analysis report for table grapes from the People's Republic of China (Biosecurity Australia 2011a) will be adopted for this assessment.

4.7.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that grapevine fanleaf virus will arrive in Western Australia with the importation of table grapes from California is: **HIGH**.

Supporting information for this assessment is provided below:

- GFLV is present in California, where it is a major viticultural problem (University of California 2013c). Golino (1992) reported that in San Joaquin County, California, 25 of the 44 vineyards tested were positive for GFLV-infected vines. GFLV is also present in other viticultural regions of the US including Washington State (Mekuria *et al.* 2008) and Missouri (Qiu *et al.* 2007).
- Most long distance spread occurs via infected propagation material (BC Ministry of Agriculture 2010).
- GFLV has been found in the endosperm of grape seed (Cory and Hewitt 1968; Mink 1993; Martelli *et al.* 2001).
- There are over 60 varieties of fresh grapes grown in California, however out of the top fourteen varieties, only one variety, Red Globe, has seeded berries (California Table Grape Commission 2012d). Red Globe represents the third top variety by volume exported from California (Anonymous 2011). Although the most popular varieties are seedless, some seeded table grapes would be imported into Western Australia. There is some risk that these could be infected with GFLV.
- The leaves of infected vines may become chlorotic, canes and leaves may grow abnormally, fewer grape bunches may develop, and bunches may be smaller and ripen irregularly (Stansbury *et al.* 2000; Martelli *et al.* 2001). Some infected fruit and bunches showing symptoms may be culled during harvesting, grading and packing. However some cultivars and rootstocks can show tolerance to infection and display few symptoms (CIHEAM 2006). Some infected, asymptomatic fruit may therefore evade culling processes.

The distribution of the virus in multiple grape growing regions of California, the potential for asymptomatic fruit to carry the virus as well as the importation of at least some seeded grape varieties from California supports a likelihood estimate for importation of 'high'.

Probability of distribution

The probability of distribution for grapevine fanleaf virus is being based on the assessment for table grapes from the People's Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The rating from that previous assessment was **MODERATE**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that grapevine fanleaf virus will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **MODERATE**.

4.7.2 Probability of establishment and spread

The probability of establishment and of spread for grapevine fanleaf virus is being based on the assessment for table grapes from the People's Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are:

Probability of establishment:	**LOW**
Probability of spread:	**VERY LOW**

4.7.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that grapevine fanleaf virus will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **VERY LOW**.

4.7.4 Consequences

The consequences of the establishment grapevine fanleaf virus in Western Australia have been estimated previously for table grapes from the People's Repiblic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from that analysis is provided below:

Plant life or health	**E**	Significant at the regional level
Any other aspects of the environment	**A**	Indiscernible at the local level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**B**	Minor significance at the local level
International trade	**A**	Indiscernible at the local level
Environment	**A**	Indiscernible at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**E'**, the overall consequences are estimated to be **MODERATE**.

4.7.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for grapevine fanleaf virus	
Overall probability of entry, establishment and spread	Very low
Consequences	Moderate
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for grapevine fanleaf virus has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.8 Tomato ringspot virus [Comoviridae: Nepovirus]

Tomato ringspot virus [EP]

Tomato ringspot virus (ToRSV) has not been found in Western Australia and is a pest of quarantine concern for that state. It was reported more than two decades ago in *Pentas lanceloata* (Egyptian starflower) in South Australia (Chu *et al.* 1983), however the infected plants were removed and it has not been detected since that time in South Australia (Cartwright 2009), suggesting it has not spread and is probably now absent from Australia. As a result, ToRSV is also a pest of national quarantine concern for Australia.

ToRSV is a member of the Nepovirus genus, Comoviridae family (Brunt *et al.* 1996c). It causes disease in grapevine as well as a range of other hosts (Bitterlin and Gonsalves 1988; Golino *et al.* 1992) including deciduous fruit hosts such as peaches, blueberries, apples, elderberries, raspberries and cherries, and weedy plants such as dandelions, sheep sorrel, common chickweed, red clover and narrow-leaved plantain (Gonsalves 1988).

ToRSV is probably transmitted and disseminated by several mechanisms. It is transmitted through soil between host plants by root-feeding ectoparasitic dagger nematodes of the *Xiphinema americanum* group (Stace-Smith 1984; Brunt *et al.* 1996c). It is transmitted by grafting (Stace-Smith 1984; Brunt *et al.* 1996c) and may be introduced to orchards and vineyards with infected propagation material (Gonsalves 1988). It may be maintained in soil contaminated with viruliferous nematodes for long periods of time (Murant 1981; Gonsalves 1988; Pinkerton *et al.* 2008) as well as in contaminated weeds (Uyemoto 1975; Gonsalves 1988) and seeds (Gonsalves 1988). Uyemoto (1975) reported that ToRSV is seedborne in grapes, and can also be transmitted from seed to seedling.

ToRSV was assessed in the existing import policy for table grapes from the People's Republic of China (Biosecurity Australia 2011a). The assessment of ToRSV presented here builds on this previous assessment.

The probability of distribution, establishment and spread of ToRSV in Western Australia, and the consequences it may cause, are comparable for table grapes imported from any country into Western Australia, as these probabilities relate specifically to events that occur in Western Australia and are independent of the importation pathway. Furthermore, the table grape season in China and California overlap as they are both in the northern hemisphere. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences, as set out for ToRSV in the table grape from China risk analysis report (Biosecurity Australia 2011a) will be adopted for this assessment.

The risk scenario of concern is the importation of fruit infected with ToRSV, germination of contaminated seed, survival of infected seedlings and the transmission of ToRSV to other host plants in Australia.

4.8.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that tomato ringspot virus will arrive in Western Australia with the importation of table grapes from California is: **MODERATE**.

Supporting information for this assessment is provided below:

- ToRSV has a wide distribution in North America and can infect both wild and cultivated plants (CABI 2011). Host plants in the US include commercial crops such as grapevine (Golino *et al.* 1992), peach, raspberry, sweet cherry, prune, blueberry and apple, and weeds such as dandelion (*Taraxacum officinale*), sheep sorrel (*Rumex acetosella*) and common chickweed (*Stellaria* spp.) (Powell *et al.* 1984).
- ToRSV is indigenous to California (Adaskaveg *et al.* 2012). It is broadly distributed in the coastal areas and the Sacramento Valley, and it is also found in the San Joaquin Valley (Adaskaveg *et al.* 2012).
- Although the virus is widespread in some Californian fruit crops such as peach, apple and cherry, it has not often been reported in Californian vineyards (Golino *et al.* 1992). Golino *et al.* (1992) did not detect the grapevine yellow strain of ToRSV using ELISA on samples taken from 44 Californian vineyards, and concluded that the strain does not account for most of the nepovirus disease observed in San Joaquin County. However, the authors noted that several serologically distinct strains of ToRSV exist, and that there were a number of potential sources of error with the ELISA testing (Golino *et al.* 1992). However, the virus is known to occur in Californian vineyards (Gonsalves 1988; Bitterlin and Gonsalves 1988; Li *et al.* 2011).
- ToRSV symptoms include spots or chlorotic mottling of leaves, abnormal cane growth, small leaves, small grape bunches, uneven berry development, and lack of fruit production (Gilmer and Uyemoto 1972; Dias 1977). Symptom severity can vary between vines (CABI 2011) and disease symptoms can be limited during the first year of infection (Gonsalves 1988). Additionally, symptoms are also more pronounced in colder climates, with vine growth in California being much less affected by the virus than the colder Northeast (Gonsalves 1988). Differences in cultivars and strains of the virus may also affect the severity of disease symptoms (Gonsalves 1988). As such, although reports addressing the incidence of ToRSV in Californian vineyards are limited, the virus may be more widely distributed than is known due to asymptomatic infections. It can spread to new areas when floods and cultural operations transport the infective dagger nematodes (*Xiphinema* spp.), or by wind-dispersed seeds of infected plants such as dandelion that germinate in areas where the dagger nematode is present (Adaskaveg *et al.* 2012). Dagger nematodes occur throughout California, although they are more prevalent in the northern part of the state (Adaskaveg *et al.* 2012).
- ToRSV has been shown to be transmitted through the seed of infected grapevine (Uyemoto 1975). There are over 60 varieties of fresh grapes grown in California, however out of the top fourteen varieties, only one variety, Red Globe, has seeded berries (California Table Grape Commission 2012). Red Globe represents the third top variety by volume shipped from California (Anonymous 2011), so it is possible that seeded table grapes with ToRSV-infected seeds may be imported into Western Australia.
- Fruit showing obvious symptoms of infection would likely be detected and culled during standard harvest and post-harvest quality assurance operations. However,

infected asymptomatic grape bunches may go undetected during inspection procedures and could potentially be imported into Australia.

The presence of grapevine-infecting strains of ToRSV in California and the possible asymptomatic infection of grapevine and production of normal looking grapes carrying the virus, moderated by intermittent reports of infected vineyards in California and Red Globe being the only seeded variety grown in large volumes in California, support a likelihood estimate for importation of ‘moderate’.

Probability of distribution

The probability of distribution for tomato ringspot virus is being based on the assessment for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The rating from the previous assessment was **MODERATE**.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that tomato ringspot virus will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.8.2 Probability of establishment and spread

The probability of establishment and of spread for tomato ringspot virus is being based on the assessment for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are:

Probability of establishment: **LOW**

Probability of spread: **MODERATE**

4.8.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that tomato ringspot virus will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **VERY LOW**.

4.8.4 Consequences

The consequences of the establishment of tomato ringspot virus in Australia have been estimated previously for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from that analysis is provided below:

Plant life or health	**E**	Significant at the regional level
Any other aspects of the environment	**A**	Indiscernible at the local level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**C**	Significant at the local level
International trade	**C**	Significant at the local level
Environment	**B**	Significant at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**E'**, the overall consequences are estimated to be **MODERATE**.

4.8.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for tomato ringspot virus	
Overall probability of entry, establishment and spread	Very low
Consequences	Moderate
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for tomato ringspot virus has been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.9 Grapevine yellow speckle viroid–1 and –2 [Pospiviroidae: Aspcaviroid]

Grapevine yellow speckle viroid–1 [EP], grapevine yellow speckle viroid–2 [EP]

Grapevine yellow speckle viroid-1 (GYSVd-1) and grapevine yellow speckle viroid-2 (GYSVd-2) are not present in the state of Western Australia and are pests of quarantine concern for that state (DAWA 2006a). These viroids are present in other states and territories of Australia (Koltunow *et al.* 1989).

Both GYSVd-1 and GYSVd-2 belong to the Apscaviroid genus within the Pospiviroidae family (Little and Rezaian 2003). The biology and taxonomy of GYSVd-1 and GYSVd-2 is considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term ‘grapevine yellow speckle viroid’ or ‘GYSVd’ is used to refer to these two viroids unless otherwise specified.

GYSVd causes yellow speckle disease in grapevine and grapevine is the only known host of GYSVd (Singh and Ready 2003; Singh *et al.* 2003b). GYSVd-1 and GYSVd-2 cause grapevine yellow speckle disease when present individually, although the two viroids often occur in combination (Krake *et al.* 1999b). The intensity of yellow speckle symptom expression can vary greatly, and may depend on the grapevine cultivar, the sequence variant of the viroid and environmental factors (Little and Rezaian 2003). Often no disease symptoms are present except in very hot weather (Singh and Ready 2003).

Although grapevines infected with GYSVd may show yellow speckle disease symptoms, there is no published evidence of a significant adverse effect due to infection (Krake *et al.* 1999b). One study did not detect any effect in grape yield, although grape juice from infested plants was lower in titratable acidity, slightly higher in pH, and had reduced vegetative growth as measured by pruning weight (Wolpert *et al.* 1996). It has also been suggested that severe cases of yellow speckle disease could possibly reduce growth and yield due to reduced photosynthesis from infected leaves (Little and Rezaian 2003). Additionally, grapevines may produce vein-banding disease symptoms when concurrently infected with both GYSVd and grapevine fanleaf virus (GFLV) (Little and Rezaian 2003).

GYSVd is disseminated by vegetative propagation and transmitted by grafting (Krake *et al.* 1999b). Spread within vineyards has been reported and may involve mechanical transmission by contaminated tools (Krake *et al.* 1999b). Transmission of GYSVd-1 (Wan Chow Wah and Symons 1997; Wan Chow Wah and Symons 1999) and GYSVd-2 (Wan Chow Wah and Symons 1997) in grape seeds has also been shown.

GYSVd-1 and GYSVd-2, as well as grapevine yellow speckle viroid-3, were assessed in the existing import policy for table grapes from the People’s Republic of China (Biosecurity Australia 2011a). The assessment of GYSVd presented here builds on this previous assessment.

The probability of distribution, establishment and spread of GYSVd in Western Australia and the consequences they may cause are comparable for table grapes imported from any country into Western Australia, as these probabilities relate specifically to events that occur in Australia and are independent of the importation pathway. However, in this review, DAFF has revised the likelihood estimate for distribution from ‘moderate’ to ‘low’ based on closer examination of the biology of these viroids. This alteration to the probability of distribution would not change the unrestricted risk estimate (URE) for GYSVd in the report for table grapes from the People's Republic of China (Biosecurity Australia 2011a), which would remain 'negligible'. The reasons for this change are given in the *Probability of distribution* section below.

The risk scenario of concern for GYSVd is the importation of grape bunches infected with one or both of the viroids, germination of infected seed, survival of infected seedlings and the transmission of one or both of the viroids to other grapevines.

4.9.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that GYSVd-1 and/or GYSVd-2 will arrive in Western Australia with the importation of table grapes from California is: **HIGH**.

Supporting information for this assessment is provided below:

- Both GYSVd-1 and GYSVd-2 have been detected in California (Rezaian *et al.* 1992) and GYSVd occurs in at least 12 grapevine cultivars (Singh *et al.* 2003a). They can occur individually in grapevines, although they are often found in combination (Krake *et al.* 1999b).
- Viroids are thought to be ubiquitous in grapevines from California (Singh *et al.* 2003a). Yet despite the presence of GYSVd and other viroids, grapevine certification programs in California do not test for viroids (Singh *et al.* 2003a). As such, GYSVd might be more widely distributed than is documented due to asymptomatic infections. This may be compounded by the fact that GYSVd is spread by vegetative propagation and grafting (Krake *et al.* 1999b).
- The level of yellow speckle disease symptoms resulting from GYSVd infection can vary greatly, depending on factors such as the grapevine cultivar, the sequence variant of the viroid and environmental conditions (Little and Rezaian 2003). Leaves may develop small yellowish flecks scattered along the major and minor veins, which may result in a vein banding pattern (Little and Rezaian 2003). However, disease symptoms are often absent except in very hot weather (Singh and Ready 2003). In California, GYSVd can be present as an asymptomatic infection in grapevines (Singh *et al.* 2003a; Szychowski *et al.* 2012). Furthermore, there is no published evidence of a significant adverse effect on grapevines resulting from GYSVd infection and infected vines typically continue to give acceptable commercial yields (Krake *et al.* 1999b).
- No report of symptoms on fruit was found. Where fruit bunches carry GYSVd, asymptomatic infections could allow for affected fruit to be harvested and exported, facilitating the import of grapevine yellow speckle viroid infected seed into Western Australia.

The widespread presence of GYSVd in grapevines in California, the capacity for asymptomatic infection and reported seed transmission support a likelihood estimate for importation of 'high'.

Probability of distribution

The probability of distribution for GYSVd-1 and GYSVd-2 is being based on the assessment for table grapes from the People's Republic of China (Biosecurity Australia 2011a). The rating from that assessment was 'moderate'. However, with further consideration of the biology of these pathogens, DAFF has reassessed the likelihood rating for distribution to **LOW**.

Supporting information not presented in the existing policy for table grapes from the People's Republic of China (Biosecurity Australia 2011a) is provided below:

- There are no known natural vectors of GYSVd-1 and GYSVd-2, so transfer from an infected imported table grape bunch to a susceptible host would not occur via natural means. Notwithstanding that, grapevine is the only known host of GYSVd-1 and GYSVd-2 (Singh and Ready 2003) thereby limiting the potential for distribution to susceptible host material post-entry.
- Distribution from an imported Californian table grape bunch would need to occur either via mechanical means (such as grafting or contaminated pruning tools) or seed transmission. Table grape bunches are not used as grafting material, precluding this as a viable distribution pathway for GYSVd.
- GYSVd-1 (Wan Chow Wah and Symons 1997; Wan Chow Wah and Symons 1999) and GYSVd-2 (Wan Chow Wah and Symons 1997) can be seed transmitted in grape seeds. The most plausible risk scenario for distribution of GVYSd is via infected seed. However, this would require successful stratification and germination of a GYSVd-infected Californian grape seed; seedlings would need to survive from stratified/germinated seeds; and the infection would need to survive and persist in the host as the planting matures. As discussed in the introduction to this chapter, the risk of imported infected grapevine seed germinating and establishing from an imported Californian table grape bunch is very low due to the following:
    - Most of the table grapes grown in California are seedless.
    - Untreated table grape seeds have variable rates of germination, although stratification is easier in some varieties. Consumers could deliberately attempt to artificially germinate seed, but grapevines grown from seed produce inferior fruit and are less vigorous compared to grafted plants, which are readily available.
- Some table grape bunches may be discarded as waste in composts. Although possible, successful stratification, germination and seedling development from an infected imported seeded bunch under these conditions is considered to be highly unlikely.

As raised above, the likelihood estimate for distribution of GYSVd given in the existing import policy for table grapes from the People's Republic of China (Biosecurity Australia 2011a) is 'moderate'. That rating has been reduced in consideration of the following - there are no known natural vectors of GYSVd, the viroids can only be transmitted mechanically or via seed transmission; imported table grape bunches are not utilised for the purposes of grafting; distribution is only likely to occur through seed transmission which would not occur easily and the predominant imports are seedless varieties. This supports a likelihood estimate for distribution of 'low'.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that GYSVd-1 and/or GYSVd-2 will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.9.2 Probability of establishment and spread

The probability of establishment and of spread for GYSVd-1 and GYSVd-2 is being based on the assessment for table grapes from the People's Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are:

Probability of establishment: **LOW**

Probability of spread: **LOW**

4.9.3 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probability of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that GYSVd-1 and GYSVd-2 will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **VERY LOW**.

4.9.4 Consequences

The consequences of the establishment of GYSVd-1 and GYSVd-2 in Australia have been estimated previously for table grapes from the People's Republic of China (Biosecurity Australia 2011a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from that assessment can be used in this review for Western Australia because the geographic level in the consequence impact scores did not exceed *Regional*. The estimate of impact scores from that analysis is provided below:

Plant life or health	**C**	Significant at the local level
Any other aspects of the environment	**A**	Indiscernible at the local level
Eradication, control, etc.	**D**	Significant at the district level
Domestic trade	**A**	Indiscernible at the local level
International trade	**B**	Minor significance at the local level
Environment	**A**	Indiscernible at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D'**, the overall consequences are estimated to be **LOW**.

4.9.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for GYSVd-1 and GYSVd-2	
Overall probability of entry, establishment and spread	Very low
Consequences	Low
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for GYSVd-1 and GYSVd-2 has been assessed as ‘negligible’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.10 Hop Stunt Viroid [Pospiviroidae: Hostuviroid]

Hop Stunt Viroid

Hop stunt viroid is not present in Western Australia (DAWA 2006a) and is a pest of quarantine concern for that state. In Australia it is known to be present in South Australia and Victoria (Koltunow *et al.* 1988).

HSVd is a single stranded covalently closed RNA molecule of 295-303 nucleotides (European Food Safety Authority 2008). Like other members of the family *Pospiviroidae*, its genome contains a Central Conserved Region (CCR) and a Terminal Conserved Hairpin (TCH) located in the left terminal domain, which are presently used for taxonomical classification of viroids (European Food Safety Authority 2008). There are around 120 HSVd sequence entries in biological databases (Matoušek *et al.* 2003).

The disease hop stunt was first observed in hops (*Humulus lupulus*) cultivated in Japan in the 1950s (Little and Rezaian 2003) and it was hypothesised that hops planting material imported mainly from Germany and the US was the likely source (Hadidi *et al.* 2003a). The HSVd isolates identified in hops from Japan form a single clade with the isolates recovered from grapevines (Sano 2003a) and the emerging consensus was that the viroid was transmitted from grapevines into hops. The molecular work of Sano *et al.* (1986), testing viroid isolates from grapevines imported into Japan, suggested that grapevines were indeed the source of hop stunt disease in Japan. However, it was not until Kawaguchi-Ito *et al.* (2009) published their work, that the transmission of HSVd from grapevine to hop was confirmed. They showed that 15 years of persistent infection in hops resulted in the evolution of HSVd-grapevine variants into HSVd-hop variants identical to those responsible for the hop stunt epidemic in Japan.

Although originally thought to be limited to hops in Japan, HSVd was introduced into Korea with hops rhizomes from Japan (Lee *et al.* 1988). It has also been isolated from hops in China (Guo *et al.* 2008) and is known to be widespread in hop production areas of Washington state, suggesting that it has been present there for some time (Eastwell and Nelson 2007). The origin of HSVd infected hop plants in China and the US has not been investigated. Given that HSVd is thought to occur in grapevines worldwide (Little and Rezaian 2003), the viroid could have transferred from grapevine to hops in China and the US via mechanical means like it did in Japan, although this has not been studied.

Despite the name, HSVd is actually associated most commonly with fruit trees, especially stone fruit (or drupes), where it tends to remain symptomless (Pallas *et al.* 1998; Osman *et al.* 2012). Some sequence variants of HSVd cause plant diseases in certain hosts, which affects agronomic quality. In hops it causes hop stunt disease (Little and Rezaian 2003). In citrus it has been associated with the diseases cachexia (Alavi *et al.* 2006), yellow corky vein (Bagherian and Izadpanah 2009) and split bark disorder (Bagherian and Izadpanah 2009). In plums and peaches it is associated with dapple fruit disease (Sano *et al.* 1989) although the symptoms vary with the species and cultivar (Sano 2003a; Pallás *et al.* 2003a). Its other hosts are thought to carry the viroid latently; including almond, apricot, grapevine (Astruc *et al.* 1996; Little and Rezaian 2003; Pallás *et al.* 2003a), jujube (Zhang *et al.* 2009), cherry (Osman *et al.* 2012) and pomegranate (Astruc *et al.* 1996).

The risk scenario of concern for hop stunt viroid is the presence of the viroid in grape bunches, which includes the fruit and seed, and the woody parts of the bunch which are the penduncle, rachis, laterals and pedicels.

4.10.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that hop stunt viroid will arrive in Western Australia with the importation of table grapes from California is: **HIGH**.

Supporting information for this assessment is provided below:

- HSVd is present in California (Osman *et al.* 2012), but its prevalence in Californian vineyards is not documented. However, the viroid is considered to be widespread in areas where it occurs. Work on hops by Eastwell and Nelson (2007) in Washington state suggests that the viroid has probably been present there for some time because it was so widespread in the hop gardens that they surveyed. Likewise, Osman *et al.* (2012) found that it was one of the most prevalent viruses or viroids when they surveyed *Prunus* species trees at the national clonal germplasm repository in California.
- Hop stunt viroid is known to infect plants systemically as the viroid has been isolated from the leaves of various plants, hops cones (Yagushi 1984) and fruit (Astruc *et al.* 1996). HSVd is also seed transmitted in grapes (Kawaguchi-Ito *et al.* 2009). As a result, infected grapevines could potentially harbour HSVd throughout host tissues including harvested grape bunches, berries, seeds and woody parts of the bunch.
- No disease symptoms have been observed in grapevines as a result of HSVd infection (Little and Rezaian 2003). The viroid is not reported to affect crop quality or yield and accordingly, no specific control practices are undertaken for HSVd in the field. Therefore, any grapes infected by HSVd that meet export standards and phytosanitary conditions could be harvested, packed and exported.
- HSVd remains stable in infected plant materials kept indoors or under refrigeration. The viroid was found to survive in hop plant leaves and cones for at least 6 months when kept refrigerated at 4°C or indoors (Yaguchi and Takahashi 1984). Cold storage and transport conditions for exported table grape bunches are unlikely to have any significant mitigating effect on the viability of the viroid.

The potential presence of HSVd systematically host tissues, the capacity for asymptomatic infectionin grapevine, its likely widespread distribution on the west coast of the US and its ability to persist in a viable state in its hosts for prolonged periods of time, support a likelihood estimate for importation of ‘high’.

Probability of distribution

The likelihood that hop stunt viroid will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from California and subsequently transfer to a susceptible part of a host is: **LOW**.

Supporting information for this assessment is provided below:

- Currently there are no known natural vectors of HSVd (European Food Safety Authority 2008). As a result, the transfer of HSVd from an imported infected table grape bunch to a susceptible host via a vector would not occur through natural mechanisms.
- Seed transmission in HSVd has been reported (Wan Chow Wah and Symons 1999). Therefore, the most plausible risk scenario for the distribution of HSVd is via the import of infected seeded table grape bunch cultivars. However, this would require successful stratification and germination of HSVd-infected Californian grape seed; survival of the germinated seedling; successful transfer of HSVd from the seed to the seedling; and persistence of the viroid in the mature plant. As discussed in the introduction to this chapter, the risk of imported infected grapevine seed germinating and establishing from an imported Californian table grape bunch is very low due to the following:
    - Most of the table grapes grown in California are seedless.
    - Untreated table grape seeds have variable rates of germination, although stratification is easier in some varieties. Consumers could deliberately attempt to artificially germinate seed, but grapevines grown from seed produce inferior fruit and are less vigorous compared to grafted plants, which are readily available.
- Some table grape bunches may be discarded as waste in composts. Although possible, successful stratification, germination and seedling development from an infected imported seeded bunch under these conditions is considered to be highly unlikely. As was raised in the introduction, HSVd was found to survive in hop plant leaves and cones for at least 6 months when kept refrigerated at 4°C or indoors (Yaguchi and Takahashi 1984). HSVd is likely to remain viable during distribution to retail outlets.
- HSVd can be transferred to a suitable host by graft-propagation of infected budwood and mechanically by cutting and pruning tools (European Food Safety Authority 2008). Table grape bunches are not used for grafting material, precluding this as a viable distribution pathway for HSVd and transfer by cutting or pruning tools from imported table grape bunches is unlikely in either a domestic or commercial context.

The possible long term viability of HSVd in cold-stored table grapes and the potential for seed transmission in grapes, moderated by the probability of propagating HSVd-infected seedlings from imported infected seed, that the predominant imported varieties are seedless, the lack of known vectors for HSVd and negligible risk of mechanical transmission, supports a likelihood estimate for a distribution of ‘low’.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that hop stunt viroid will enter Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.10.2 Probability of establishment

The likelihood that hop stunt viroid will establish within Western Australia, based on a comparison of factors in the source and destination areas that affect pest survival and reproduction is: **HIGH**.

Supporting information for this assessment is provided below:

- HSVd has been associated with the following host species: grapevine (Little and Rezaian 2003), hops (Sano 2003a), apricots (Pallas *et al.* 2003), peach (Sano *et al.* 1989; Hassan *et al.* 2003), plum (Sano *et al.* 1989; Yang *et al.* 2006), almond (Pallás *et al.* 2003), sweet cherry (Gazel *et al.* 2008), sour cherry (Gazel *et al.* 2008), jujube (Zhang *et al.* 2009), *Citrus* spp., pomegranate (Astruc *et al.* 1996) and common fig (Yakoubi *et al.* 2007). Many of these hosts are present in Western Australia and suitable host material would be likely to be available for the establishment of HSVd.
- HSVd has a wide geographic distribution. It is currently known to occur across Europe and the Mediterranean {Amari, 2007 77201 /id;Bennett, 2009 77234 /id;Mandic, 2008 77382 /id;Matic, 2005 69416 /id;Hassan, 2003 77328 /id;EPPO, 2009 77833 /id;Pallas, 1998 70922 /id}, the Middle East and north Africa (Pallas *et al.* 1998; Choueiri *et al.* 2002; Ghanem-Sabanadzovic and Choueiri 2003; Hassen *et al.* 2004; Gazel *et al.* 2008; Mandic *et al.* 2008), North America (Michelutti *et al.* 2004; Bennett *et al.* 2009) and Asia (Lee *et al.* 1988; Guo *et al.* 2008; Zhang *et al.* 2009; Bennett *et al.* 2009; Kawaguchi-Ito *et al.* 2009). It is also found in Australia in Victoria and South Australia (Koltunow *et al.* 1988). The wide geographic range as well as known Australian distribution records, suggests that climatic conditions in Western Australia would be suitable for the establishment of HSVd.
- Following HSVd infection, the viroid replicates in its host and is distributed systemically throughout plant host tissues. Establishment in any given susceptible host is therefore considered highly likely following a successful infection event.
- Latent infection by HSVd can occur in its hosts without obvious symptoms of disease (Astruc *et al.* 1996; Little and Rezaian 2003; Pallás *et al.* 2003a). The potential for infected host material to remain asymptomatic, in conjunction with its capacity for systemic infection throughout the plant and mechanical transmission, would facilitate further establishment of HSVd locally in areas of Western Australia where it is introduced.

The broad host range and availability of hosts in Western Australia, wide geographic range worldwide, likely suitability of the Western Australian climate, and likely replication and distribution within a host following infection, supports a likelihood estimate for establishment of ‘high’.

4.10.3 Probability of spread

The likelihood that hop stunt viroid will spread within Western Australia, based on a comparison of factors in the source and destination areas that affect the expansion of the geographic distribution of the pest is: **MODERATE**.

Supporting information for this assessment is provided below:

- There are no reported vectors of HSVd (European Food Safety Authority 2008). As a result, HSVd is confined to the host plant and can only spread via seed or human-assisted means. This may limit the potential for HSVd spread.
- Mechanical transmission is known to occur via contaminated cutting or pruning tools (Hadidi *et al.* 2003a; European Food Safety Authority 2008). This mechanism of spread would facilitate the local dissemination of HSVd, but would likely confine spread within smaller geographic units i.e within a farm but not between farms (Sano 2003a).

- The long distance spread of HSVd has been largely attributed to the movement of infected cuttings and grafting material. Domestic quarantine procedures targeted to the movement of nursery stock would be important in mitigating the spread of HSVd in Western Australia. However, unless an outbreak is identified, restrictions on the movement of nursery stock may not be applied for HSVd. Further, given that systemic spread in infected hosts may take some time and/or infected hosts may remain symptomless, HSVd infected material may go undetected, further enabling its spread.
- As was raised in the probability of distribution, seed transmission of HSVd is reported in grapevine (Wan Chow Wah and Symons 1999). Notwithstanding the potential difficulties of propagating from seed, as raised earlier, the viroid may spread in circumstances where new plantings are generated from infected seed.
- Luigi et al (Luigi *et al.* 2010) reported HSVd in pollen of plum and Kryczyński *et al.* (1988) noted Cucumber pale fruit viroid (= hop stunt viroid - cucumber strain) in the pollen of tomato. While the importance of HSVd in pollen for the spread of the virus is unknown, the potential for pollen transmission of HSVd in some hosts is potentially another mode by which HSVd could spread.
- As was raised in the probability of establishment, HSVd is reported across a range of hosts. This includes grapevine (Little and Rezaian 2003), hops (Sano 2003a), apricots (Pallas *et al.* 2003), peach (Sano *et al.* 1989; Hassan *et al.* 2003), plum (Sano *et al.* 1989; Yang *et al.* 2006), almond (Pallás *et al.* 2003), sweet cherry (Gazel *et al.* 2008), sour cherry (Gazel *et al.* 2008), jujube (Zhang *et al.* 2009), *Citrus* spp., pomegranate (Astruc *et al.* 1996) and common fig (Yakoubi *et al.* 2007). This broad host range, which consists of many commercially important crops, will assist in the spread of HSVd following establishment in Western Australia.
- HSVd is reported worldwide with accounts from Europe, the Mediterranean, the Middle East, North Africa, Asia, North America, as well as from Australia. In Washington State, HSVd is reported as being widespread in hop production areas (Eastwell and Nelson 2007) and is thought to occur in grapevines worldwide (Little and Rezaian 2003). This wide distribution profile, particularly in association with key crops, suggests that the Western Australian environment would be suitable for the spread of HSVd.

The broad host range, worldwide distribution profile, and capacity for transmission via mechanical means, seed, pollen and propagative material moderated by the absence of vectors and limited spread within Australia where HSVd has been reported supports a likelihood estimate for spread of ‘moderate’.

4.10.4 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of ‘rules’ are shown in Table 2.2.

The likelihood that hop stunt viroid will enter Western Australia as a result of trade in table grapes from California be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **LOW**.

4.10.5 Consequences

The consequences of the establishment of hop stunt viroid in Western Australia have been estimated according to the methods described in Table 2.3.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D**', the overall consequences are estimated to be **LOW**.

Reasoning for these ratings is provided below:

Criterion	Estimate and rationale
Direct	
Plant life or health	**C – Significant at the local level:** • HSVd latently infects grapevines (Little and Rezaian 2003), apricot, almond (Pallás *et al.* 2003a), jujube (Zhang *et al.* 2009), cherry (Osman *et al.* 2012) and pomegranate (Astruc *et al.* 1996). Only some of its hosts show symptoms of disease that affect agronomic quality. These include: hop stunt disease in hops (Little and Rezaian 2003); cachexia (Alavi *et al.* 2006), yellow corky vein (Bagherian and Izadpanah 2009) and split bark disorder (Bagherian and Izadpanah 2009) in citrus; and dapple fruit disease in peaches and plums (Sano *et al.* 1989). Symptoms in its hosts range from unappreciable in mild climates to severe in hot areas (European Food Safety Authority 2008). Given that many of these crops are grown commercially, there could potentially be agronomic impacts as a result of HSVd establishing and spreading Western Australia.
Other aspects of the environment	**A – Indiscernible at the regional level:** • In parts of Australia where HSVd is known to exist (it infects grapevines in Victoria and South Australia (Koltunow *et al.* 1988) no other environmental consequences have been reported.
Indirect	
Eradication, control etc.	**D – Significant at the district level:** • The control of HSVd is through cultural practices and the registration and supply of viroid free nursery stock. However, this is only for species in which HSVd infection results in disease symptoms, which are hops, citrus, plum and peach. The presence of HSVd in grapevine in Australian eastern states has not resulted in the need for eradication or control measures in any species. If it was to jump to a susceptible host species, then eradication and control measures could be necessary. • In the event of an incursion, eradication and control measures may be implemented to protect Western Australia's fruit production industry. • When an epidemic occurs in species that are susceptible to disease, such as in hops in Japan, then measures may be taken to control the viroid. In Japan, diseased hops were surveyed, removed and replanted with healthy plants. Once infected stock is found, several nearby plants, including the infected individuals are replanted (Sano 2003a).
Domestic trade	**A – Indiscernible at the district level:** • HSVd is already known to be present in Australian eastern states. Its establishment in Western Australia would have no negative impact on domestic trade.
International trade	**C – Minor significance at the district level:** • HSVd can infect a variety of commercially grown species. International trade in any of those species from Western Australia to areas where HSVd is not known to occur, could be affected. However, HSVd already occurs in Victoria and South Australia, but it is limited to grapevine. The presence of HSVd in grapevine in eastern states has not affected international trade from the eastern states. The broader host range of HSVd compared to grapevine yellow speckle viroid, which is limited to grapevine, has resulted in a higher consequence rating for international trade.
Environmental and non-commercial	**A – Indiscernible at the district level:** • Eradication and control of HSVd is through cultural practices and there would be no increase in the use of pesticides on farms as a result of HSVd infection. • HSVd is not likely to infect native species. Its known host range is limited to grapevines, hops, pomegranate and drupes (including almond, apricot, peach, plum and jujube). • Backyard and other non-commercial hosts are unlikely to become infected as HSVd would be unlikely to spread beyond commercial crops as its major mode of transmission is mechanical.

4.10.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for hop stunt viroid	
Overall probability of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very Low

As indicated, the unrestricted risk estimate for hop stunt viroid has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.11 Citrus exocortis viroid [Pospiviroidae: Pospiviroid]

Citrus exocortis viroid

Citrus exocortis viroid (CEVd) is not known to occur in Western Australia (DAWA 2006a) and is a pest of quarantine concern for that state. In Australia, CEVd is known to be present in New South Wales, Queensland and South Australia (Barkley and Büchen-Osmond 1988) and has been detected in grapevine in South Australia (Wan Chow Wah and Symons 1997).

Citrus exocortis viroid (CEVd) belongs to the *Pospiviroid* genus, *Pospiviroidae* family (Duran-Vila and Semancik 2003). CEVd is the causal agent of exocortis disease in citrus. The disease is characterised by bark scaling, yellow blotching of twigs and severe stunting of susceptible citrus varieties (Duran-Vila and Semancik 2003). CEVd is symptomless in most citrus varieties, however disease symptoms occur on susceptible rootstocks including *Poncirus trifoliata*, Rangpur lime, Swingle citrumelo and citrange (Hardy *et al.* 2008). CEVd can also infect tomato (Verhoeven *et al.* 2004) and carrot (Fagoaga and Duran-Vila 1996); and has been detected in symptomless grapevine (Little and Rezaian 2003), broad bean (Fagoaga *et al.* 1995), eggplant, turnip (Fagoaga and Duran-Vila 1996), and *Impatiens* and *Verbena* varieties (Singh *et al.* 2009).

Citrus exocortis viroid consists of 371 to 375 nucleotides (Singh *et al.* 2009) with a number of sequence variants reported (Duran-Vila and Semancik 2003). The viroid associates with host membranes and nuclei (Semancik 1980). In tomato, it has been detected in both vascular tissues and the nuclei of mesophyll cells, with the highest viroid concentrations reported to be in the leaves (Bonfiglioli *et al.* 1996). In citrus, CEVd is found in the plant sap and is spread via mechanical means through budding, grafting, pruning and hedging (Hardy *et al.* 2008). Transmission of CEVd to citrus seeds has not been demonstrated (Duran-Vila and Semancik 2003; Hardy *et al.* 2008). However, in grapevine, CEVd transmission from seed to seedling has been observed using reverse transcription PCR (Wan Chow Wah and Symons 1997). CEVd has also been detected in seeds and seedlings of *Impatiens* and *Verbena* plants (Singh *et al.* 2009), and in tomato seedlings (Mink 1993). There are no known insect vectors of CEVd (Hardy *et al.* 2008).

In Australia, exocortis disease in citrus has largely been controlled by the use of viroid-free citrus budwood (Hardy *et al.* 2008). Exocortis of citrus in California has also been controlled by regulations on budwood sources to ensure new plantings are CEVd-free (Adaskaveg 2008).

Citrus exocortis viroid was included in the final import risk analysis for fresh Unshu mandarin fruit from Shizuoka Prefecture in Japan (Biosecurity Australia 2009a). In that assessment, the potential for establishment and/or spread in the pest risk assessment area was assessed as ‘not feasible’ as the viroid is not reported to be vectored or seed transmitted in citrus. As a result, no pest risk assessment was required. The assessment of CEVd presented here differs in that there are reports for seed transmission of CEVd in grapevine (Wan Chow Wah and Symons 1997). Accordingly, the potential for establishment and/or spread in Western Australia is deemed to be ‘feasible’ and a pest risk assessment is required for table grapes from California into Western Australia.

The risk scenario of concern is the importation of grape bunches infected with CEVd, germination of infected seed disseminated in fruit waste, seed-transmission of the viroid, survival of infected seedlings, and the transmission of CEVd to other host plants in Australia.

4.11.1 Probability of entry

The probability of entry is considered in two parts, the probability of importation and the probability of distribution, which consider pre-border and post-border issues, respectively.

Probability of importation

The likelihood that citrus exocortis viroid will arrive in Western Australia with the importation of table grapes from California is: **HIGH**.

Supporting information for this assessment is provided below:

- CEVd is present in grapevine in California (Little and Rezaian 2003). Wan Chow Wah and Symons (1997) detected CEVd in ten grapevine cultivars, five red and five white, using RT-PCR.
- CEVd can be seed transmitted. Wan Chow Wah and Symons (1997) detected the viroid in an *in vitro* germinated Emperor red table grape seedling. The seedling had been included as a putative negative control, however it was determined to be positive for CEVd. This was the first report of CEVd transmission via seeds in grapevine. The result was confirmed on a second Emperor seedling (Wan Chow Wah and Symons 1997).
- CEVd is spread to new areas by budding, grafting, pruning and hedging activities (Hardy *et al.* 2008). It is also spread by propagation of infected budwood and exchange of infected plant materials (Duran-Vila and Semancik 2003).
- As CEVd infects grapevines asymptomatically (Little and Rezaian 2003), the viroid may be more widely distributed in Californian vineyards than is documented and may spread in California without detection.
- Infected, symptomless grape bunches would go undetected during harvesting and inspection procedures.
- Given that infection can occur systemically, grape bunches harvested from CEVd-infected plants, could potentially carry the viroid in both the stem and berry.
- Out of the top fourteen varieties of fresh grapes grown in California, only one variety, the Red Globe, has seeded berries (California Table Grape Commission 2012d). However, Red Globe represents a significant proportion of production, estimated as the third top variety by volume in 2010 (Anonymous 2011). It is therefore likely that some seeded grape berries would be exported from California to Australia. It is possible that these berries may contain CEVd-infected seed.
- No records of the rate and importance of seed transmission for CEVd in grapevine were found, however reports of rates of seed transmission in other host species are known. After a two-year storage period of *Impatiens walleriana* and *Verbena* x *hybrid* seeds at 4^{o}C, CEVd was detected in both the non-germinated seeds and, once germinated, in the seedlings (Singh *et al.* 2009). The transmission rates in *Impatiens walleriana* seeds and seedlings were 6% and 26%, respectively, and the transmission rates in *Verbena* x *hybrid* seeds and seedlings were 5% and 45%, respectively (Singh *et al.* 2009). The long-term survival of CEVd in *Impatiens* and *Verbena* seeds at 4^{o}C (Singh *et al.* 2009) and the transmission of CEVd via grape seed, as demonstrated in two Emperor table grape

seedlings (Wan Chow Wah and Symons 1997), indicates that the viroid may also be present and remain viable in Californian grape seeds during the period from harvest to arrival in Australia, including a period of cold storage. The majority of grapes imported to Australia from California arrive by sea freight, however transport may also be by air freight. The total time in transport, from orchard until arrival in Australia, is therefore expected to be from a few days to several weeks.

The presence of CEVd in California, the asymptomatic infection of grapevine, the ability of the viroid to be seed transmitted to seedlings, its stability for long periods and during cold storage support a likelihood estimate for importation of 'high'.

Probability of distribution

The likelihood that citrus exocortis viroid will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from California and subsequently transfered to a susceptible part of a host is: **LOW**.

Supporting information for this assessment is provided below:

- There are no known insect vectors of CEVd (Hardy *et al.* 2008). As a result, CEVd is confined to the host plant and cannot spread without assisted means. Accordingly, it is unlikely that CEVd would be transferred from an infected Californian table grape bunch imported into Western Australia to a suitable host without a vector.
- Seed transmission of CEVd in grapevine in known (Wan Chow Wah and Symons 1997). Therefore, the most plausible risk scenario for the distribution of CEVd is via the import of infected seeded table grape bunch cultivars. However, this would require successful stratification and germination of a CEVd-infected Californian grape seed; the seedling would need to survive from stratified/germinated seeds; and the CEVd infection would need to remain viable and persist in the host as the plant matures. The risk of imported infected grapevine seed germinating and establishing from an imported Californian table grape bunch is considered unlikely due to the following:
    - Most of the table grapes grown in California are seedless.
    - Untreated table grape seeds have variable rates of germination, although stratification is easier in some varieties. Consumers could deliberately attempt to germinate seed under controlled conditions, but grapevines grown from seed produce inferior fruit and are less vigorous compared to grafted plants, which are readily available.
    - Some table grape bunches may be discarded as waste in composts. Although possible, successful stratification, germination and seedling development from an infected imported seeded bunch under these conditions is considered to be highly unlikely. Furthermore, viroids are not always transmitted from infected seeds to seedlings. Singh *et al.* (2009) studied transmission rates of CEVd in seed of *Impatiens walleriana* and *Verbena* x *hybrida* and found the transmission rate from infected seeds to seedlings was 66% and 28% respectively, and these rates were further reduced after seed was stored for two years.
- Table grape bunches would be kept refrigerated during distribution to retail outlets. As CEVd was detected in *Impatiens walleriana* and *Verbena* x *hybrida* seeds after a two-year storage period at 4°C (Singh *et al.* 2009), it is probable that the viroid would also remain viable during the distribution of table grapes for retail sale.

- CEVd can be mechanically transferred to a susceptible host via pruning activities (Hardy *et al.* 2008). Table grape bunches are not used for grafting material, precluding this as a viable distribution pathway for CEVd, and transfer by cutting or pruning tools from imported table grape bunches is unlikely in either a domestic or commercial context.

The possible long term viability of CEVd in cold-stored seeded table grapes (as indicated by the survival of CEVd in *Impatiens* and *Verbena* seeds) and the potential for seed transmission in table grapes moderated by the absence of vectors, difficulties in generating seedlings from imported bunch seed, effective transmission of CEVd from seed to seedling, negligible risk of mechanical transmission and the predominant imported cultivars being seedless, supports a likelihood estimate for distribution of 'low'.

Overall probability of entry (importation × distribution)

The overall probability of entry is determined by combining the probabilities of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that citrus exocortis viroid will enter Western Australia as a result of trade in table grapes from California and be distributed in a viable state to a susceptible host is: **LOW**.

4.11.2 Probability of establishment

The likelihood that citrus exocortis viroid will establish within Western Australia, based on a comparison of factors in the source and destination areas that affect pest survival and reproduction is: **HIGH**.

Supporting information for this assessment is provided below:

- CEVd has been detected in grapevine (Little and Rezaian 2003); citrus (Duran-Vila and Semancik 2003); annual crops such as tomato (Verhoeven *et al.* 2004), carrot (Fagoaga and Duran-Vila 1996), broad bean (Fagoaga *et al.* 1995), eggplant and turnip (Fagoaga and Duran-Vila 1996); and ornamentals such as *Impatiens* and *Verbena* varieties (Singh *et al.* 2009). A range of these hosts are grown in Western Australia, including grapevine (Gladstones 1992), citrus (DAFWA 2007), tomatoes (Graham 2005), carrots (McKay and Pasqual 2006) and broad bean (Burt 2005). This wide host range demonstrates that there would be suitable hosts available in Western Australia for establishment of CEVd.
- CEVd has a worldwide distribution (CABI 2011) and is found in Australia in New South Wales, Queensland and South Australia (Barkley and Büchen-Osmond 1988). This suggests that climatic conditions in parts of Western Australia would be suitable for the establishment of CEVd.
- Following CEVd infection, the viroid replicates in its host and is distributed systemically throughout plant host tissues. Establishment in any given susceptible host is therefore considered highly likely following a successful infection event.
- Latent/asymptomatic infection by CEVd can occur in some hosts including grapevine (Little and Rezaian 2003), broad bean (Fagoaga *et al.* 1995), eggplant, turnip (Fagoaga and Duran-Vila 1996), and *Impatiens* and *Verbena* varieties (Singh *et al.* 2009). This may facilitate the establishment of CEVd locally in areas of Western Australia where it has been introduced.

The wide host range, worldwide distribution, latent/asymptomatic infection, replication within its host and systemic infection supports a likelihood estimate for establishment of ‘high’.

4.11.3 Probability of spread

The likelihood that citrus exocortis viroid will spread within Western Australia, based on a comparison of factors in the source and destination areas considered pertinent to the expansion of the geographic distribution of the pest is: **MODERATE**.

Supporting information for this assessment is provided below:

- It has been suggested that CEVd may have originally been associated with cultivated grapevine in the Middle East, and only spread to citrus once citrus plants were introduced to that region (Bar-Joseph 2003). This indicates that CEVd may spread from grapevine to other host plants via, for example, contaminated pruning tools.
- As there are no known insect vectors of CEVd (Hardy *et al.* 2008), natural spread of this viroid occurs through natural grafting of plant roots (Hardy *et al.* 2008) and via seed transmission in some species, including grapevine. It is unlikely that a rogue grapevine would grow in close proximity to a susceptible plant in an orchard or vineyard so that CEVd is able to spread to new commercial plantings via root grafting.
- CEVd has been detected in a range of hosts including grapevine (Little and Rezaian 2003); citrus (Duran-Vila and Semancik 2003); annual crops such as tomato (Verhoeven *et al.* 2004), carrot (Fagoaga and Duran-Vila 1996), broad bean (Fagoaga *et al.* 1995), eggplant and turnip (Fagoaga and Duran-Vila 1996); and ornamentals such as *Impatiens* and *Verbena* varieties (Singh *et al.* 2009). The distribution of these hosts throughout Western Australia could facilitate the spread of CEVd.
- As was raised in the probability of establishment, the worldwide distribution of CEVd (CABI 2011) as well as from a number of Australian states (Barkley and Büchen-Osmond 1988) suggests that that the Western Australian environment would be suitable for the spread of CEVd.
- CEVd is primarily spread via contaminated pruning and hedging tools, as well as through budding and grafting activities (Hardy *et al.* 2008). In Australia, citrus budwood testing for graft transmissible pathogens helps control the spread of CEVd (Hardy *et al.* 2008). Prior to these activities, CEVd was a major disease of Australian citrus trees (Hardy *et al.* 2008). The need for a budwood testing program, as well as the presence of CEVd in New South Wales, Queensland and South Australia (Barkley and Büchen-Osmond 1988), indicates that the viroid has the ability to spread in Australia. However, it is unlikely that budwood would be sourced from seedlings grown from CEVd-infected seed. It is also unlikely that pruning and hedging tools would be used on such plants and subsequently used on other susceptible hosts.
- Additional spread could occur through seed transmission from infected plants (likely limited to grapevine), or via mechanical transmission. Therefore, any CEVd outbreak resulting from these spread pathways is likely to be localised. However once present in a vineyard, or commercial crop of another host, infections could be disseminated more widely.

The broad host range, worldwide distribution, known Australian distribution, transmission via seed, propagative and mechanical pathways moderated by the lack of natural vectors and existing CEVd certification programs supports a likelihood estimate for spread of 'moderate'.

4.11.4 Overall probability of entry, establishment and spread

The overall probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' are shown in Table 2.2.

The likelihood that citrus exocortis viroid will enter Western Australia as a result of trade in table grapes from California, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **LOW**.

4.11.5 Consequences

The consequences of the establishment of citrus exocortis viroid in Western Australia have been estimated according to the methods described in Table 2.3.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D**', the overall consequences are estimated to be **LOW.**

Reasoning for these ratings is provided below:

Criterion	Estimate and rationale
Direct	
Plant life or health	**B – Minor significance at the local level:** • CEVd has been detected in symptomless grapevine (Little and Rezaian 2003), broad bean (Fagoaga *et al.* 1995), eggplant, turnip (Fagoaga and Duran-Vila 1996), *Impatiens* and *Verbena* (Singh *et al.* 2009). Symptomless plants may serve as reservoirs for the disease (Hammond and Owens 2006). • CEVd causes exocortis disease in susceptible citrus varieties. The disease is characterised by bark scaling, yellow blotching of twigs and severe stunting (Duran-Vila and Semancik 2003). Susceptible rootstocks include *Poncirus trifoliata*, Rangpur lime, Swingle citrumelo and citrange varieties (Hardy *et al.* 2008). Trees grown on *P. trifoliata* rootstock are the most severely affected, with significant symptoms developing when trees are about 4-years-old (Hardy *et al.* 2008). There can be reductions in yield due to stunting of the tree, but fruit quality is not affected (Hardy *et al.* 2008). • In citrus, the economic impact of CEVd depends on the susceptibility of the specific scion/rootstock combinations used (Duran-Vila and Semancik 2003). Where susceptible varieties are used, strategies to provide growers with viroid-free planting material are necessary (Duran-Vila and Semancik 2003). The only means of controlling viroid diseases is via prevention measures such as through the provision of viroid-free budwood sources, and treating hedging and harvesting tools with sodium hypochlorite (Duran-Vila and Semancik 2003). In Australia, growers can already obtain citrus budwood and rootstock seed that has a high health status through a citrus industry organisation (Hardy *et al.* 2008). • Tomato plants and *Gynura aurantiaca* inoculated with CEVd have also been shown to produce disease symptoms including stunting, epinasty and leaf rugosity 3-to-4 weeks post inoculation (Duran-Vila *et al.* 1988). CEVd has also been reported to cause bunchytop or leaf chlorosis in tomato (Singh *et al.* 2009). Carrots inoculated with CEVd produced smaller leaves after three months, but still flowered and produced viable seed (Fagoaga and Duran-Vila 1996). • Any CEVd outbreak is likely to be localised as, if transmission does occur, the most likely means would be through mechanical transmission.
Other aspects of the environment	**A – Indiscernible at the regional level:** • There are no known other direct impacts of CEVd on the environment.

Indirect	
Eradication, control etc.	**D – Significant at the district level:** • In the event of an incursion in Western Australia, control measures are likely to be implemented to minimise exocortis disease spreading from grapevine to susceptible citrus scion/rootstock combinations. Where susceptible citrus varieties are used, strategies to provide growers with viroid-free planting material are necessary (Duran-Vila and Semancik 2003). • In Australia, citrus growers can already obtain budwood and rootstock seed that has a high health status through a national industry organisation (Hardy *et al.* 2008). Citrus exocortis disease symptoms are now rarely observed in Australia due to the use of pathogen-free budwood (Hardy *et al.* 2008).
Domestic trade	**A – Indiscernible at the district level:** • CEVd is already known to be present in New South Wales, Queensland and South Australia (Barkley and Büchen-Osmond 1988).As there are no domestic restrictions based on CEVd, its establishment in Western Australia would have no negative impact on domestic trade.
International trade	**C – Minor significance at the district level:** • CEVd can infect a variety of commercially grown species including citrus and grapevine (Singh *et al.* 2009). International trade in those species from Western Australia to areas where CEVd doesn't occur could be affected. However, CEVd already occurs in New South Wales, Queensland and South Australia. The presence of CEVd in citrus in those states has not affected international trade. The broader host range of CEVd compared to grapevine yellow speckle viroid, which is limited to grapevine, has resulted in a higher consequence rating for international trade.
Environmental and non-commercial	**A – Indiscernible at the district level:** • There would be no increase in the use of pesticides that may have environmental consequences as a result of CEVd infection, as CEVd is controlled via prevention measures such as the use of viroid-free budwood and cultural practices such as treating hedging and harvesting equipment with sodium hypochlorite (Duran-Vila and Semancik 2003). • CEVd is unlikely to infect native plant species. It is present in other Australian states and does not infect native plants in these states. • Backyard and other non-commercial hosts are unlikely to become infected as a result of a CEVd outbreak in a commercial crop as CEVd would be unlikely to spread beyond commercial crops as its major mode of transmission is through the exchange of propagation material and mechanical transmission.

4.11.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for citrus exocortis viroid	
Overall probability of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very Low

As indicated, the unrestricted risk estimate for citrus exocortis viroid has been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.12 Pest risk assessment conclusions

Key to Table 4.2 (next page)

Genus species EP	pests for which policy already exists; the PRA in this analysis will be based on the risk ratings given in the previous assessments
Genus species region	PRA area for which quarantine pests have been identified

Likelihoods for entry, establishment and spread

N	negligible
EL	extremely low
VL	very low
L	low
M	moderate
H	high
P[EES]	overall probability of entry, establishment and spread

Assessment of consequences from pest entry, establishment and spread

PLH plant life or health
OE other aspects of the environment
EC eradication, control etc.
DT domestic trade
IT international trade
ENC environmental and non-commercial
A-G consequence impact scores are detailed in Chapter 2.2.3
- A Indiscernible at the local level
- B Minor significance at the at the local level
- C Significant at the local level
- D Significant at the district level
- E Significant at the regional level
- F Significant at the national level
- G Major significance at the national level

URE unrestricted risk estimate. This is expressed on an ascending scale from negligible to extreme.

Table 4.2 – Summary of unrestricted risk estimates for pests of quarantine concern associated with Californian table grapes to Western Australia

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	P[EES]	Direct	Indirect					Overall	
	Importation	Distribution	Overall				PLH	OE	EC	DT	IT	ENC		
Order Coleoptera														
Harmonia axyridis [EP]	M	H	M	H	H	M	C	D	D	E	D	E	M	**M**
Order Hemiptera														
Lygus hesperus [EP] *Lygus lineolaris* [EP]	VL	M	VL	H	M	VL	E	B	D	C	C	B	M	**VL**
Parthenolecanium corni [EP]	M	L	L	H	M	L	D	B	D	C	C	B	L	**VL**
Planococcus kraunhiae	L	M	L	H	H	L	D	A	D	D	D	A	L	**VL**
Pseudococcus calceolariae [EP]	L	M	L	H	H	L	D	A	D	D	D	A	L	**VL**
Order Lepidoptera														
Marmara gulosa	M	H	M	H	M	L	D	A	D	D	C	B	L	**VL**
Order Diaporthales														
Phomopsis viticola [EP]	L	VL	VL	H	M	VL	C	A	D	B	B	B	L	**N**
Viruses														
Grapevine fanleaf virus [EP]	H	M	M	L	VL	VL	E	A	D	B	A	A	M	**VL**
Tomato ringspot virus [EP]	M	M	L	L	M	VL	E	A	D	C	C	B	M	**VL**
Viroids														
Grapevine yellow speckle viroid-1 [EP] Grapevine yellow speckle viroid-2 [EP]	H	L	L	L	L	VL	C	A	D	A	B	A	L	**N**

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	P[EES]	Direct		Indirect				Overall	
	Importation	Distribution	Overall				PLH	OE	EC	DT	IT	ENC		
Hop stunt viroid	H	L	L	H	M	L	C	A	D	A	C	A	L	**VL**
Citrus exocortis viroid	H	L	L	H	M	L	B	A	D	A	C	A	L	**VL**

5 Pest risk management

This chapter provides information on the management of quarantine pests identified in the pest risk assessment with an unrestricted risk exceeding Australia's appropriate level of protection (ALOP). The recommended phytosanitary measures are described below. Information is also provided on the existing import conditions for quarantine pests and pathogens associated with Californina table grapes for all other Australian states and territories.

5.1 Pest risk management measures and phytosanitary procedures

Pest risk management selects options for measures to reduce the risk of entry, establishment or spread of quarantine pests for Australia where they have been assessed to have an unrestricted risk above Australia's ALOP. In calculating the unrestricted risk, existing commercial production practices in California have been considered, as have post-harvest procedures.

In addition to California's existing commercial production practices for table grapes and minimum border procedures in Australia, specific pest risk management measures are proposed to achieve Australia's ALOP.

This non-regulated analysis builds on the existing policy for fresh table grapes from California to Australia (excluding Western Australia) (AQIS 2000a; AQIS 2000b; Biosecurity Australia 2006; Biosecurity Australia 2009b). The existing policy for Californian table grapes already includes measures for the pests listed in Table 5.2 and Table 5.3. The pest categorisation in Appendix A found that those pests are also quarantine pests for Western Australia. It is proposed that all measures required under the existing policy for Californian table grapes also be applied for imports into the state of Western Australia. An outline of the current conditions is given in Section 5.1.2.

Additional pests requiring risk management measures that were identified in the process of conducting this report are discussed in Section 5.1.1.

Finalisation of the quarantine conditions may be undertaken with input from the Australian states and territories as appropriate.

5.1.1 Pest risk management for quarantine pests identified in this report

The pest risk analysis identified a quarantine pest listed in Table 5.1 as having an unrestricted risk above Australia's ALOP.

Table 5.1 – Phytosanitary measures proposed for quarantine pests for Western Australia for fresh table grapes from California

Pest	Common name	Measures
Arthropods		
*Harmonia axyridis***	Harlequin ladybird	Visual inspection and remedial action*
* Remedial action may include: treatment of the consignment to ensure that the pest is no longer viable (if detected during phytosanitary inspection by US authorised officers or during offshore or on arrival inspection by DAFF) or withdrawing the consignment from export to Australia (if detected pre-export during phytosanitary inspection by US authorised officers or during offshore inspection by DAFF). ** This pest has been identified as above ALOP for all Australian states and territories (including Western Australia); this measure will apply to table grapes imported into all Australian states and territories.		

Management for *Harmonia axyridis* (harlequin ladybird)

DAFF proposes the following approach based on visual inspection and remedial action to reduce the risks associated with this arthropod pest to meet Australia's ALOP[2].

Visual inspection and remedial action

The objective of visual inspection is to ensure that any consignments of table grapes from California infested with this pest are identified and subjected to appropriate remedial action. The remedial action will reduce the risk associated with ladybirds to a very low level to meet Australia's ALOP.

Adult ladybirds are external pests, 5-8 mm long with light orange or red elytra and black spots. The conspicuous nature of the beetles aids in their detection by trained biosecurity inspectors using optical enhancement where necessary (such as a hand lens). The standard 600 unit quarantine inspection undertaken by APHIS will be effective in identifying consignments infested with these pests.

Remedial action, if required, could include any treatment known to be effective against the target pest. Currently, standard methyl bromide fumigation rates for external pests are recognised (as per T9030). However, DAFF would also consider any other treatment that APHIS proposes, if it is found to provide an equivalent level of protection.

The consignment would not be passed for export (if the detection was pre-export) or from quarantine (if detected on arrival in Australia) until the remedial action has been undertaken.

The objective of these measures is to reduce the likelihood of importation for this pest to at least 'very low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

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[2] Visual inspection and remedial action will be undertaken in addition to the current commercial production, and packing and treatment practices already in place for Californian table grapes to the rest of Australia.

Policy for table grapes from the People's Republic of China

The *Final import risk analysis report for table grapes from the People's Republic of China* (Biosecurity Australia 2011a) recommends for the management of *Harmonia axyridis* for table grapes from China:

- systems approach – vineyard and packing management; and
- visual inspection and remedial action.

DAFF considers that the commercial production and packing practices for table grapes in the Californian counties approved for export to Australia achieve the same outcome and are therefore equivalent to the requirements of the systems approach recommended for table grapes from the People's Republic of China.

Additionally, Californian table grapes have been exported to all other states and territories of Australia since 2002 and during this time DAFF officers have not detected *Harmonia axyridis* on the import pathway during inspection.

5.1.2 Pest risk management for pests under the existing policy

Under the existing policy for the importation of Californian table grapes to all other Australian states, the pests listed in Table 5.2 and Table 5.3 have an unrestricted risk above Australia's ALOP. Measures are currently applied to manage the risks associated with these pests so that the restricted risk meets Australia's ALOP.

Table 5.2 – Quarantine, sanitary and contaminant pests for Australia with existing phytosanitary measures under the current Californian table grape policy for other Australian states and territories

Pest	Common name	Measures
Arthropods		
Colomerus vitis – strain c	Grape erineum mite – leaf curl strain	▪ Visual inspection and remedial action*
Eotetranychus carpini	Hornbeam spider mite	
Eotetranychus williamettei	Williamette mite	
Tetranychus pacificus	Pacific mite	
Euschistus conspersus	Consperse stink bug	
Homalodisca vitripennis	Glassy-winged sharpshooter	
Planococcus ficus	Vine mealybug	
Pseudococcus maritimus	Grape mealybug	
Amyelois transitella	Navel orangeworm	
Argyrotaenia citrana	Orange tortrix	
Desmia funeralis	Grape leaffolder	
Estigmene acrea	Salt marsh moth	
Harrisina brillians	Western grapevine skeletoniser	

Pest	Common name	Measures
Platynota stultana	Omnivorous leafroller	
Caliothrips fasciatus	Bean thrips	
Drepanothrips reuteri	Grape thrips	
Frankliniella occidentalis	Western flower thrips	
Frankliniella minuta	Thrips	
Scirtothrips citri	Californian citrus thrips	
Drosophila suzukii	Spotted wing drosophila	▪ Sulfur dioxide/carbon dioxide fumigation (1:6%) followed by cold treatment for 6 days at –0.50°C ± 0.50°C
Daktulosphaira vitifoliae	Grapevine phylloxera	▪ Sulfur dioxide/carbon dioxide fumigation (1:6%)
Sanitary and Contaminant Pests		
Cheiracanthium inclusum	Yellow sac spiders	▪ Sulfur dioxide/carbon dioxide fumigation (1:6%)
Cheiracanthium mildei		
Latrodectus hesperus	Black widow spider	
*: Remedial action may include: treatment of the consignment to ensure that the pest is no longer viable (if detected during phytosanitary inspection by US authorised officers or during offshore or on arrival inspection by DAFF) or withdrawing the consignment from export to Australia (if detected pre-export during phytosanitary inspection by US authorised officers or during offshore inspection by DAFF).		

Table 5.3 – Quarantine pests for other Australian states and territories absent from areas designated as a pest free area or for which non-host status applies with existing phytosanitary measures under the current Californian table grape policy

Pest	Common name	Measures
Arthropods		
Ceratitis capitata	Mediterranean fruitfly	▪ Pest free area
Craponius inaequalis	Grape curculio	
Eulithis diversilineata	Grape looper	
Fidia viticida	Grape root worm	
Polychrosis viteana	Grape berry moth	
Tetranychus mcdanieli	McDaniel spider mite	▪ Non-host status
Scirtothrips perseae	Avocado thrips	
Lobesia botrana	European grapevine moth	▪ Pest free area (county freedom)
Pathogens		
Guignardia bidwellii	Black rot	▪ Pest free area
Mycosphaerella angulata	Angular leaf spot	
Physopella ampelopsidis	Rust	

Pest	Common name	Measures
Pseudopezicula tetrapsora	Angular leaf scorch	

Summary of existing policy

The *Final import risk analysis for the importation of fresh table grapes from the state of California in the United States of America* (AQIS 2000b) (pages 28 – 35) provides detail of the original phytosanitary measures recommended for the importation of table grapes to all other Australian states and territories. This was supplemented by the policy determination released in 2002 (Biosecurity Australia 2002), after which trade commenced.

Since the policy determination, several reviews of the import conditions have been conducted. These were based on research supporting different treatment methods, knowledge gained through experience of the trade in Californian table grapes to Australia, better knowledge of quarantine pests, and the emergence of new pests associated with table grapes in California.

In 2006, DAFF released a policy memorandum (Biosecurity Australia 2006) for the removal of mandatory methyl bromide fumigation subject to the continuing application of other quarantine conditions. This change in policy considered the fact that routine inspections of table grapes in California since the commencement of trade in 2002 and the results of intensive destructive sampling in October 2005 did not identify any pests which routinely require mandatory methyl bromide fumigation, including glassy winged sharpshooter.

In 2009, DAFF released a Biosecurity Advice (Biosecurity Australia 2009b) reviewing management measures for *Daktulosphaira vitifoliae* (grapevine phylloxera). The review assessed and supported a request to recognise combined sulfur dioxide/carbon dioxide (SO_2/CO_2) fumigation as effective in managing the risk of grapevine phylloxera, removing the requirement for the inclusion of sulfur pads in export consignments.

The current phytosanitary measures for Californian table grapes to all Australian states and territories (excluding WA) are provided on the Department's Import Conditions Database (ICON) (AQIS 2012). The following is a summary of the current conditions:

Permitted counties, vineyards, packers and treatment facilities

- Grapes are permitted into Australia only from approved counties in the Central and Coachella valley regions of the State of California. These counties are:
    - Fresno, Kern, Kings, Madera, Riverside and Tulare
- Only fresh field grown table grapes from United States Department of Agriculture (USDA) registered growers and packers are permitted entry.
- Fumigation and cold treatments can only be conducted in USDA registered facilities.

Treatment

- Mandatory SO_2/CO_2 fumigation followed by cold treatment
    - All packed table grapes must undergo mandatory preshipment fumigation with 1% sulfur dioxide (SO_2) and 6% carbon dioxide (CO_2) by volume for 30 minutes, delivered using forced air at a pulp temperature of 15.6°C (60°F) or greater. The chamber load must not exceed 30%. The SO_2/CO_2 treatment must be completed prior to cold treatment and phytosanitary inspection and must be supervised by

APHIS or an accredited certifying official. The quarantine services of the US will follow their normal standard operating procedures to measure gas concentrations during the fumigation with SO_2/CO_2 gas.

- Cold treatment can only commence once the fruit pulp temperature reaches –0.50°C or below.
- Cold treatment must be undertaken for at least 6 continuous days at a pulp temperature of –0.50°C ± 0.50°C. Cold treatment can be performed at temperatures lower than the set temperature range. Cold treatment can be performed in the US prior to shipment or as an in-transit treatment before grapes are presented for DAFF inspection.

USDA-APHIS inspection

- Sufficient boxes will be selected at random from the nominated inspection lot to ensure a 600 bunch inspection can be completed. If the consignments or the inspection lots have less than 1000 bunches, a 450-bunch inspection rate will be applied.
- For mandatory preshipment SO_2/CO_2 fumigation followed by preshipment cold treatment.
    - Inspection will be undertaken by USDA-APHIS, or officers authorised and certified by USDA-APHIS, after successful completion of the fumigation and cold treatment but prior to DAFF inspection.
- For mandatory preshipment SO_2/CO_2 fumigation followed by intransit cold treatment.
    - Inspection will be undertaken by USDA-APHIS, or an agent certified by USDA-APHIS, after successful completion of the fumigation but prior to loading the consignment into the container. USDA-APHIS, or the agent, must verify that the cold treatment has commenced.

DAFF inspection

- DAFF inspection can be undertaken as Offshore Pre-shipment Inspection in California or on arrival in Australia.
- Sufficient boxes will be selected at random from the consignment (on arrival inspection) or the nominated inspection lot (for offshore preshipment inspection or OPI) to ensure a 600 bunch inspection can be completed. If the consignments or the inspection lots have less than 1000 bunches, a 450-bunch inspection rate will be applied.

Timing of DAFF inspection

- For mandatory preshipment SO_2/CO_2 fumigation followed by preshipment cold treatment.
    - DAFF inspection will be undertaken after successful completion of the fumigation and cold treatment, either as OPI in US or as an on arrival inspection.
- For mandatory preshipment SO_2/CO_2 fumigation followed by intransit cold treatment.
    - If DAFF inspection is undertaken as OPI in US, this will occur post SO_2/CO_2 fumigation but prior to fruit proceeding to cold treatment in transit. In this instance the in transit cold treatment will be verified on arrival in Australia, prior to the containers of fruit being cleared.
    - If DAFF inspection is undertaken on arrival in Australia, then this will occur after assessment of intransit cold treatment and verification of documents certifying

that SO_2/CO_2 fumigation has occurred prior to shipping as part of the combination of measures for *Drosophila suzukii*.

Actions for pest interceptions

- If live life stages of *Drosophila suzukii* are found during APHIS or DAFF inspection after treatment completion, the consignment will not be eligible for export/or allowed entry into Australia. DAFF may direct USDA-APHIS to suspend the packing facility/treatment provider until the cause of the non-compliance is investigated and corrective actions are implemented to DAFF's satisfaction.
- The detection of a live glassy-winged sharpshooter (GWSS) during APHIS or DAFF inspection will result in the suspension of all exports until the problem is investigated. If a dead GWSS is found during the pre-clearance inspection, then an investigation will be conducted by DAFF and APHIS to evaluate the relationship of GWSS to the table grape pathway.
- If pests are detected at inspection that are managed by 'Pest Free Area' (PFA) or 'Non Host Status' (NHS) (pests listed in Table 5.3), which includes *Lobesia botrana*, at the DAFF inspections, then table grape imports from California will be suspended, pending further investigation by both DAFF and APHIS.
- The detection of spider egg sacs will lead to a quarantine hold and determination of the pest status and viability. However, during OPI if the inspection lot presented in the Notice of Intention to Export (NOI) is from more than one fumigation lot and if the detection of egg sacs was on fruit from a specific fumigation lot then this can be removed and the rest of the inspection lot can be represented for another DAFF inspection under a new NOI. Inspection lots/consignments detected with confirmed non-viable egg sacs can be released.
- Consignments must be free of soil, contaminant seeds and trash (splinters, twigs and leaves). Consignments detected with trash or prohibited weed seeds at OPI or on arrival inspections by DAFF must be held pending investigation and determination of remedial action as directed by DAFF.
- Appropriate remedial actions for detection of trash, soil and contaminant seed at OPI include either sorting the specific grower lot to remove contaminants and reinspection of the inspection lot under the same NOI or withdrawal of the specific grower lot from export to Australia and reinspection of the remaining inspection lot under a different NOI.
- Appropriate remedial actions for detections at on arrival inspections include either sorting the consignment to remove contaminants and reinspection of the inspection lot or re-export or destruction.
- If live quarantine pests are detected during inspections of treated table grapes, DAFF may direct APHIS to suspend the treatment facility responsible.

Post treatment security of fruit

  - Table grapes that have completed quarantine treatments or have passed OPI by DAFF must be securely stored in an approved cold storage facility prior to loading and shipping, and must be segregated from any other domestic or export produce at all times. The quarantine integrity and traceability of passed lots must also be maintained throughout storage, transport and on-arrival clearance in Australia and be labelled with grower lot and treatment facility references for traceability.

Packaging, labelling and identification

- Grapes must be packed in clean new packages.
- Timber packaging and pallets must be treated in accordance with a DAFF approved method or be ISPM15 compliant.
- The table grapes must be packed in perforated transparent polyvinyl bags or equivalent wrapping (e.g. perforated plastic punnets or clamshells) that does not impede fumigant penetration, and then placed into new packages. Package types that are approved for fresh Californian table grapes are: Toyon Kraft Veneer (TKV) boxes, plastic boxes, expanded polystyrene (EPS) boxes, and fully plastic coated cardboard packages. The wooden slats for the TKV boxes must be made out of processed wood, wood veneer or chipboard, or comply with the timber packaging requirements noted above. No unprocessed packing material is permitted.
- Palletised product must be identified by attaching a uniquely numbered pallet card to each pallet or part pallet. Pallet cards must be marked with the grower lot reference and the treatment facility reference.

On arrival verification of fruit that has undergone OPI in US

- All consignments may be cleared on presentation of conforming documentation (except for those containers under intransit cold treatment), which must include the phytosanitary certificate and a copy of the NOI. However, DAFF may undertake random verification and inspection of consignments.
- The physical verification ensures continued compliance with the OPI procedures and container numbers and seal numbers will be checked where applicable.
- Any consignment with incomplete phytosanitary certification, or for which seals of the containers are damaged or missing, or documentation that does not align with the physical labelling, will be held pending clarification and decision by DAFF in consultation with APHIS. Any consignment that cannot be verified as having undergone OPI may require on–arrival inspection, re-export or destruction.
- Any consignment that cannot be verified as having undergone the quarantine treatments will require re-export or destruction.

5.1.3 Consideration of alternative measures

Consistent with the principle of equivalence detailed in ISPM 11: *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms* (FAO 2004), DAFF will consider any alternative measure proposed by USDA-APHIS, providing that it achieves an equivalent level of quarantine protection. Evaluation of such measures or treatments will require a technical submission from USDA-APHIS that details the proposed measures or treatments, including data from suitable trials to demonstrate efficacy.

5.2 Operational system for the maintenance and verification of phytosanitary status

A system of operational procedures are already in place to maintain and verify the phytosanitary status of table grapes from California. This ensures that risk management measures have been met and are maintained.

Details of the operational system, or equivalent, will continue to be determined by agreement between DAFF and USDA-APHIS, prior to the season commencement.

5.2.1 Registration of export orchards by USDA-APHIS

The objective of this procedure is to ensure that table grapes are sourced from registered export orchards producing export quality fruit, as the pest risk assessments are based on existing commercial production practices.

This procedure provides DAFF with assurance that USDA-APHIS can trace consignments back to the vineyard should any non-compliance be found.

5.2.2 Registration of processing facilities and auditing of procedures

The objectives of this procedure ensure that:

- packed table grapes are stored and treated in USDA-APHIS registered facilities, processing export quality fruit,
- references to the packing house (by registration number or reference code and packing house name) are clearly stated on crates destined for export of table grapes to Australia for trace-back and auditing purposes.

USDA-APHIS must provide DAFF with a list of registered facilities prior to season commencement each year and inform DAFF of any changes to registrations during the season. This list must be maintained as current by USDA-APHIS in order to facilitate trace-back of any consignment.

USDA-APHIS, or an authorised officer, is required to audit these facilities at the beginning of each season to ensure that they are suitably equipped to carry out the specified phytosanitary tasks and are able to conduct acceptable treatments. Records of USDA-APHIS audits are to be made available to DAFF on request.

5.2.3 Packaging and labelling

The objectives of this procedure ensure that:

- table grapes recommended for export to Australia and all associated packaging is not contaminated by quarantine pests or regulated articles (e.g. trash, soil and contaminant seeds),
- unprocessed packing material (which may vector pests not identified as being on the pathway) is not imported with fresh table grapes,
- timber packaging and pallets are treated in accordance with a DAFF approved method (or are ISPM15 compliant),

- secure packaging is used during storage and transport for export to Australia and must meet Australia's general import conditions for fresh fruits and vegetables (C6000 General requirements for all fruit and vegetables, available at http://www.aqis.gov.au/icon/),
- the packaged table grapes are labelled with the packing house name for the purposes of trace-back.

5.2.4 Storage and movement

The objectives of this procedure ensure that:

- product for export to Australia that has been treated and/or inspected is kept secure and segregated at all times from any fruit for domestic or other markets, untreated product to prevent mixing or cross-contamination elsewhere,
- the quarantine integrity of the commodity during storage and movement is maintained.

5.2.5 Freedom from trash

All table grapes must be free from trash (e.g. extraneous materials, twigs/stem and leaf material, seeds, soil, animal matter/parts or other extraneous material), foreign matter and pests of quarantine concern to Australia. Freedom from trash will be confirmed by the inspection procedures. Export lots or consignments found to contain trash, foreign matter, or pests of quarantine concern to Australia are withdrawn from export unless approved remedial action is available and applied to the export consignment.

5.2.6 Pre-export phytosanitary inspection and certification by USDA-APHIS

The objectives of this procedure ensure that:

- all consignments have been inspected in accordance with official procedures for all visually detectable quarantine pests and other regulated articles (including soil, animal and plant debris) at a standard 600 unit sampling rate per inspection lot,
- consignments that contain live quarantine pests or trash will be rejected,
- an international phytosanitary certificate (IPC) is issued for each consignment upon completion of inspection and treatment to verify that relevant measures have been undertaken,
- each IPC includes:
    - a description of the consignment (including quantity, grower lot reference, packing house details);
    - details of disinfestation treatments (e.g. fumigation) which includes date, concentration, temperature, duration, and/or the fumigation certificate (as appropriate); and cold treatment details when undertaken offshore.
    - any additional declarations required.

5.2.7 Phytosanitary inspection by DAFF

The objectives of this recommended procedure are to ensure that:

- all consignments comply with Australian import requirements,

- consignments are as described on the phytosanitary certificate and quarantine integrity has been maintained.

To ensure that phytosanitary status of consignments of table grapes from California meet Australia's import conditions DAFF completes a verification inspection of all consignments of table grapes.

On-arrival in Australia, DAFF undertakes a documentation compliance examination to verify that the consignment is as described on the phytosanitary certificate and that the required phytosanitary actions have been undertaken and that product security has been maintained.

If the cold treatment is undertaken in-transit, DAFF will verify the treatment has been successfully applied for that consignment on-arrival in Australia.

If OPI has not been undertaken, DAFF will conduct a phytosanitary inspection once the cold treatment has been verified.

5.2.8 Remedial action(s) for non-compliance

The objectives of remedial action(s) for non-compliance are to ensure that:

- any quarantine risk is addressed by remedial action, as appropriate
- non-compliance with import requirements is addressed, as appropriate.

Any consignment that fails to meet Australia's import conditions must be subject to a suitable remedial treatment, if one is available, re-exported from Australia, or destroyed.

Separate to the corrective measures mentioned above, there may be other breach actions (i.e. investigation of possible treatment failures or post-treatment security) necessary depending on the specific pest intercepted and the risk management strategy put in place against that pest in the protocol.

If product repeatedly fails inspection, DAFF reserves the right to suspend the export program and conduct an audit of the risk management systems. The program will recommence only when DAFF is satisfied that appropriate corrective action has been taken.

5.3 Uncategorised pests

If an organism, including contaminant pests/pathogens, is detected on table grapes either in California or on-arrival in Australia that has not been categorised, it will require assessment by DAFF to determine its quarantine status and whether phytosanitary action is required. Assessment is also required if the detected species was categorised as not likely to be on the import pathway. If the detected species was categorised as on the pathway but assessed as having an unrestricted risk that achieves Australia's ALOP due to the rating for likelihood of importation, then it would require reassessment. The detection of any pests of quarantine concern not already identified in this report may result in remedial action (treatment, reshipment or destruction) and/or temporary suspension of trade while an analysis is conducted to ensure that existing measures continue to provide the appropriate level of protection.

5.4 Review of Processes

5.4.1 Audit of protocol

The phytosanitary system for table grapes may be audited by DAFF from time to time. Audits have, and would, include export production, field packing, packing facility operations, mandatory SO_2/CO_2 fumigation, cold treatment and pre-export inspection and certification. As Californian table grapes have been exported to all other Australian states since 2002, DAFF proposes that all existing measures and operational systems continue for trade to Western Australia. DAFF has previously audited operational systems for Californian table grape exports to Australia (the latest in 2012), and as a result, there is no requirement for DAFF to conduct an audit prior to the commencement of exports to Western Australia. Audits may, however, be conducted at the discretion of DAFF on the entire production cycle.

5.4.2 Review of policy

DAFF reserves the right to review the import policy at any time.

USDA-APHIS must inform DAFF immediately on detection in California of any new pests of table grapes that are of potential quarantine concern to Australia or a significant change in the application of existing commercial practices considered in this report.

5.5 Import conditions

The risk management measures recommended in this final report will be taken into account in formulating import requirements. The details of the import conditions will be made available on the DAFF website (www.daff.gov.au/iconsearch), once the import policy is finalised and DAFF is satisfied that the phytosanitary systems meet Australia's requirements.

5.6 Meeting Australia's food standards

Imported food for human consumption must satisfy Australia's food standards. Australian law requires that all food, including imported food, meets the standards set out in the Australia New Zealand Food Standards Code (hereafter referred to as 'the Code'). Food Standards Australia New Zealand (FSANZ) is responsible for developing and maintaining the Code, including Standard 1.4.2, Maximum Residue Limits (MRLs), available at www.comlaw.gov.au/Details/F2012C00822. The standards apply to all food in Australia, irrespective of whether it is grown domestically or imported.

If a specific chemical is used on imported foods to control pests and diseases, then any resulting residues must not exceed the specific MRLs in Standard 1.4.2 of the Code for that food.

If there is no MRL listed in the Code for a specific food (or a composite, processed food), then there must be no detectable residues in that specific food.

Where an exporting country uses a chemical for which there is no current listed Australian MRL, there are mechanisms to consider establishing an Australian MRL by harmonising with an MRL established by the Codex Alimentarius Commission (Codex) or by a regulatory authority in a recognised jurisdiction. The mechanisms include applications, submissions or consideration as part of a FSANZ proposal to vary the Code. The application process, including the explanation of establishment of MRLs in Australia, is described at www.foodstandards.gov.au/foodstandards/changingthecode/.

Appendices

Appendix A Initiation and categorisation for pests of fresh table grapes from California[3]

Initiation (columns 1 – 3) identifies the pests of table grapes that have the potential to be on table grapes produced in California using commercial production and packing procedures.

Pest categorisation (columns 4 - 7) identifies which of the pests with the potential to be on table grapes are quarantine pests for Western Australia and require a pest risk assessment.

The steps in the initiation and categorisation processes are considered sequentially, with the assessment terminating at the first 'No' for columns 3, 5 or 6 or 'Yes' for column 4.

Details of the method used in this analysis are given in Chapter 2: Method for pest risk analysis.

For pests and pathogens with existing policy for Californian table grapes to the other Australian states and Territories, only column 4 was assessed to determine if it is of quarantine concern for Western Australia

Insects and pathogens that have been found as contaminants of consignments of Californian table grapes have been included in this list. These are not considered to be present on the pathway where there is no documented host association with table grape fruit or bunches. Management of contaminating pests is considered in Section 5.3.

Table A Initiation and pest categorisation

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
DOMAIN BACTERIA						
Class Alphaproteobacteria:						
Order Rhizobiales (Agrobacterium, Rhizobium)						
Rhizobium rhizogenes **(**Riker et al. 1930) Young et al. 2001 Synonym: *Agrobacterium tumefaciens* Conn [Rhizobiaceae] Crown gall	**Yes** Present in California (Bradbury 1986; Flaherty *et al.* 1992; CABI 2011).	**No** Causes crown gall disease, infecting roots, trunks and canes (Ellis 2008; Vizitiu and Dejeu 2011).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Rhizobium vitis (Ophel & Kerr 1990) Young *et al.* 2001 Synonym: *Agrobacterium vitis* Ophel & Kerr 1990 [Rhizobiaceae] Crown gall of grapevine	**Yes** Present in the US (CABI 2011).	**No** This bacterium is found in the soil, roots and near the base of the vine (Nicholas *et al.* 1994).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

[3] This pest categorisation table does not represent a comprehensive list of all the pests associated with the entire plant of an imported commodity. Reference to soilborne nematodes, soiborne pathogens, wood borer pests, root pests or pathogens, and secondary pests have not been listed or have been deleted from the table, as they are not directly related to the export pathway of fresh table grapes and would be addressed by Australia's current approach to contaminating pests.

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Class Gammaproteobacteria						
Order Pseudomonadales (Pseudomonas)						
Pseudomonas syringae pv. *syringae* van Hall 1902 [Pseudomonadaceae] Bacterial canker	**Yes** Present in California (Little *et al.* 1998).	**Yes** May cause blossom blight by infection of stalks and/or cause lesions on fruit (Bradbury 1987).	**Yes for WA** Present in WA (Shivas 1989; Plant Health Australia 2001c). **Yes for other states** Present in NSW, Qld, Tas., Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Order Xanthomonadales						
Xylella fastidiosa [Xanthomonadaceae] Pierce's disease	**Yes** First described in 1892 from southern California (Pearson and Goheen 1988) and is responsible for Pierce's disease, alfalfa dwarf disease and almond leaf scorch in California (Gubler *et al.* 2009).	**No** Vectored by xylem feeding insects such as sharpshooters and spittlebugs in North America. Spreads systemically through xylem vessels in its hosts and can be present where ever these tissues occur (Pearson and Goheen 1988). There is limited information on the distribution of the bacterium in host vines, but it is feasible that grape bunch material could pose a potential risk pathway for the disease.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**[4]

[4] *Xylella fastidiosa* has been subject to rigorous assessment in context with the Glassy wing sharpshooter (GWSS) review of policy in 2002, and with significant trade of table grapes into eastern Australian states since that time. Should new information suggest there is a change in the risk profile of this disease and/or its vectors, this would initiate a further review process to ensure appropriate measures are in place to reduce the risks posed to meet Australia's appropriate level of protection.

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
DOMAIN EUKARYA						
ANIMALIA (Animal Kingdom)						
ARTHROPODA: Arachnidia: Acari (Phylum: Class Sub-class)						
Order Araneae						
Existing California table grape policy *Cheiracanthium inclusum* (Hentz 1847) [Miturgidae] Yellow sac spider			**No records found**			
Existing California table grape policy *Cheiracanthium mildei* Koch 1864 [Miturgidae] Yellow sac spider			**No records found**			
Existing California table grape policy *Latrodectus hesperus* Chamberlin & Ivie 1935 [Theridiidae] Black widow spider			**No records found**			
Sassacus spp. [Salticidae] Jumping spider	**Yes** Present in the US (Richman 2008).	**No** Spiders in this genus are predators not plant pests. However, they have been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. Due to their size and external habit they would be detected during inspection.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Misumena spp. Latreille, 1804 [Thomisidae] Crab spiders	**Yes** Several species are present in California, including *M. californica*, *M. pictilis* (Banks 1896) and *M. vatia* (Hogg *et al.* 2010).	**No** Spiders in this genus are predators not plant pests. However, they have been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. Due to their size and external habit they would be detected during inspection.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Neoscona oaxacensis Keyserling 1864 [Araneidae] Western spotted orbweaver	**Yes** Present in the US (Costello and Daane 2005).	**No** This species is a predator not a plant pest. However, it has been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. Due to its size and external habit it would be detected during inspection.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Trombidiformes						
Brevipalpus lewisi McGregor, 1949 [Tenuipalpidae] Grape bunch mite	**Yes** Present in California (Flaherty *et al.* 1992).	**Yes** *Brevipalpus lewisi* is a pest of grapevine in California (Flaherty *et al.* 1992) and is known to feed on leaves and fruit on grape (Buchanan *et al.* 1980; Zhang 2005).	**Yes for WA** Present in WA (Poole 2008). **Yes for other states** Present in NSW, SA and Vic (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Calepitrimerus vitis (Nalepa, 1905) Synonym:*Epitrimerus vitis, Phyllocoptes vitis* [Eriophyidae] Grape rust mite	**Yes** Present in California (Flaherty *et al.* 1992)	**Yes** *Calepitrimerus vitis* is considered to be rarely a pest of grapevine in California (Flaherty *et al.* 1992). Typically feeds on the surface of the leaves although external feeding on the grape berries is noted (CABI 2013).	**Yes for WA** Present in WA (Plant Health Australia 2001b). **Yes for other states** Present in NSW, SA and Vic (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**
Colomerus vitis Pagenstecher 1857 [Eriophyidae] Grape erineum mite	**Yes** Present in California (CABI 2011).	**No** The *Colomerus vitis* erineum strain forms galls on upper surfaces of leaves; the bud mite strain results in blisterlike growths on buds; and the leaf-curl strain causes downward curling of leaves (Flaherty *et al.* 1992).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Eotetranychus carpini* (Oudemans) [Tetranychidae] Hornbeam spider mite			**No records found**			
Existing California table grape policy *Eotetranychus williamettei* [Tetranychidae] Williamette mite			**No records found**			
Polyphagotarsonemus latus Banks 1904 [Tarsonemidae] Broad mite	**Yes** Present in California (CABI 2011).	**No** *Polyphagotarsonemus latus* feeds on leaves (Li 2004; Zhang 2005; AQSIQ 2006a).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Tetranychus mcdanieli* McGregor [Tetranychidae] McDaniel spider mite			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Existing California table grape policy *Tetranychus pacificus* [Tetranychidae] Pacific mite			**No records found**			
Tetranychus urticae Koch, 1836. Koch (1836) [Tetranychidae] Two spotted spider mite	**Yes** Present in California (Bentley *et al.* 2009).	**Yes** Occasionally found on grapes in California (Bentley *et al.* 2009).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, NT, QLD, SA, Vic. and Tas. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
ARTHROPODA: Insecta (Phylum: Class)						
Order Coleoptera						
Altica torquata (LeConte) [Chrysomelidae] Flea beetle	**Yes** Present in California, New Mexico, Arizona and Texas (Flaherty *et al.* 1992; Bentley *et al.* 2005; Galvan *et al.* 2013).	**No** Larvae damage occurs on the foliage of grapevines whilst adult beetles feed primarily on primary grape buds (Flaherty *et al.* 1992; Galvan *et al.* 2013). It is found in the desert areas of Kern County and is rarely reported as a pest of grapes (Flaherty *et al.* 1992).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Anthicus ephippium LaFerté-Sénectère 1849 Synonyms: *Anthicus confusus* LeConte 1852; *Anthicus difficilis* LeConte 1850; *Anthicus luteolus* LeConte 1851; *Anthicus pinguescens* Casey 1895; *Anthicus simiolus* Casey 1895 [Anthicidae] Antlike flower beetle	**Yes** Present in the US (Pfeiffer and Axtell 1980). It is widespread in North America (Hilburn and Gordon 1989).	**No** Interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. However, these beetles are a contaminant and are not pests of table grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Blapstinus sp. [Tenebrionidae] Darkling ground beetle	**Yes** Present in California (Flaherty *et al.* 1992).	**No** Damages young vines only on rare occasions by feeding on wounds on the trunk (Flaherty *et al.* 1992). The larvae live in the soil and feed on the roots of grasses and occasionally damage truck crops; they do not damage to grapevine roots (Flaherty *et al.* 1992). Only adults can damage the vine (Flaherty *et al.* 1992). Unlikely to be associated with fresh table grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Bromius obscurus (L.) [Chrysomelidae] Western grape root worm	**Yes** Present in California (Flaherty *et al.* 1992; Bentley *et al.* 2005).	**No** This species feeds on leaves, shoots and young fruit of grapevine (Zhang 2005). Adults emerge from the soil in May and feed for about two weeks on vine foliage. If defoliation occurs, adults can cut shallow grooves in grape berries (Flaherty *et al.* 1992). The larvae of this species feed on vine roots (Flaherty *et al.* 1992). Eggs are laid in the bark of vines (Flaherty *et al.* 1992). Considered to be of only minor importance in California and so scarce that damage is negligible (Flaherty *et al.* 1992). It is therefore unlikely to be associated with harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Carpophilus hemipterus Linnaeus, 1758 [Nitidulidae] Dried fruit beetle	**Yes** Present in California (Flaherty *et al.* 1992; Arnett Jr 1993).	**Yes** May infest damaged grapes (Buchanan *et al.* 1984), ripe grapes and overripe grapes (Flaherty *et al.* 1992).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in QLD, NSW, NT, SA, Vic. and Tas. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Craponius inaequalis* Say 1831 [Curculionidae] Grape curculio			**No records found**			
Cryptolestes pusillus Schönherr 1878 Synonym: *Laemophloeus pusillus* Schönherr [Laemophloeidae] Flat grain beetle	**Yes** Present in California (CABI 2011).	**No** *C. pusillus* is a common pest of stored grain (PaDIL 2010). It has been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states as a contaminant rather than a pest of grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Fidia viticida* Walsh 1867 [Chrysomelidae] Grape root worm			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Glyptoscelis squamulata Crotch [Chrysomelidae] Grape bud beetle	**Yes** Present in California, including the Central Valley and the Coachella Valley (Bentley *et al.* 2009).	**No** Adult beetles feed on newly opening buds, with feeding damage becoming negligible once shoots reach 26 to 38 mm. They feed at night, hiding during the day in bark and cracks in wooden stakes. Immature stages are found in the soil and feed on grapevine roots. Eggs are laid under bark or between layers of bark (Flaherty *et al.* 1992).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Harmonia axyridis Pallas 1773 [Coccinellidae] Harlequin ladybird	**Yes** Present in California (Lucas *et al.* 2002; CABI 2011).	**Yes** Adults of *H. axyridis* can attack ripe fruit and aggregate in clusters during harvest and wine processing. This insect cannot directly damage, or penetrate grape skins. *Harmonia axyridis* only feed on berries that have been previously damaged by other insects, birds, diseases, or "splitting". (Kovach 2004; Missouri State University 2005; Galvan *et al.* 2006; Kenis *et al.* 2008).	**No for WA** **No for other states** Not present in Australia (Walker 2008)	**Yes** *H. axyridis* was introduced as a biological control agent of aphids and coccids in Europe, North America, Africa and South America (Koch *et al.* 2006; Brown *et al.* 2008). It has a wide host range and is able to establish and disperse in new environments. In Europe, *H. axyridis* is considered to be an invasive alien species (Brown *et al.* 2008). Many parts of Europe, Africa and North and South America have similar climates to parts of Australia which suggests that this beetle would be able to establish in Australia.	**Yes** Even small numbers of beetles inadvertently processed along with grapes can taint the flavor of wine due to their noxious odour. Tainted wine has reportedly resulted in millions of dollars in losses to the wine industry throughout the Eastern US and Southern Canada (Potter *et al.* 2005; Galvan *et al.* 2006). As a predator, *H. axyridis* can impact native species (Brown *et al.* 2008) Recent studies suggest that infestations can cause allergies in some individuals, ranging from eye irritation to asthma which may incur medical costs. *H. axyridis* has also invade buildings, incurring cleanup and pest control costs (Potter *et al.* 2005).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hoplia spp. Illiger [Scarabaeidae] Hoplia beetles	**Yes** There are twelve *Hoplia* spp. in North America (Arnett Jr 1993). *H. dispar* LeConte (brown chafer) and *H. callipyge* Leconte (grapevine Hoplia) are present in California (Arnett Jr 1993). *H. callipyge* is recorded from the San Joaquin Valley (Bentley *et al.* 2009).	**No** Eggs are laid in pastures and other undisturbed vegetation, and larvae feed on decaying vegetation and plant roots (Perry 2010). Adults emerge from the soil and fly to feeding sites that include buds, flowers and leaves of a range of plants (Perry 2010). They may feed on grape berry clusters (Molinar and Norton 2003; Bentley *et al.* 2009), however they feign death and fall to the ground when disturbed (University of California 2012a). They are therefore unlikely to be associated with grape bunches, but may be a contaminating pest.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Hypurus bertrandi Perris 1852 [Curculionidae] Leaf mining weevil	**Yes** Present in California (McFadyen 1994) including the Central Valley (Norris 1997).	**No** *H. bertrandi* only has one reported host, *Portulaca oleracea* (Waterhouse 1994). Larve feed on leaves and adults feed on leaf margains, stems and developing seed capsules (Waterhouse 1994). Eggs are laid singly in leaf tissue and pupation takes place in the soil (Awadallah *et al.* 1980). No evidence of an association with *Vitis vinifera* could be found.	**Assessment not required**	**No assessed**	**No assessed**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Limonius canus LeConte [Elateridae] Pacific coast wireworm (Click beetle)	**Yes** Present in California vineyards (Flaherty *et al.* 1992).	**No** The eggs and larval stages are soil-borne (Andrews *et al.* 2008); (Bentley *et al.* 2009) with the larvae living for periods of 2-5 years in the soil feeding on seeds and plant roots (Andrews *et al.* 2008). Following pupation, adults emerge in late spring through summer to feed on the buds (Bentley *et al.* 2009). Not known as a pest of grape bunches. Seldom occurs in sufficient numbers to warrant any specific management measures (Flaherty *et al.* 1992). Given their size, mobility, prevalence, and the predominant larval stages which remain below ground, it is unlikely to be associated with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Melalgus confertus Dejean 1833 [Bostrichidae] Branch and twig borer	**Yes** Present throughout California (Bentley *et al.* 2009).	**No** *M. confertus* eggs are laid in cracks of the trunck or on bark (Hamman Jr *et al.* 1998). Both adults and larvae injure grapevines (Bentley *et al.* 2009). Larvae bore into dead or dying wood and adults bore into fruiting canes at the base of the bud or shoot, or at the crotch (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Otiorhynchus sulcatus Fabricius 1775 [Curculionidae] Black vine weevil	**Yes** Present in California (Bentley *et al.* 2009).	**No** Larvae feed on roots and pupate in the soil (Bentley *et al.* 2009). Adults feed at night on buds, flowers and the cluster rachis (Bentley *et al.* 2006). Most adult activity occurs 3 to 4 hours after sunset and they will often drop to the ground if disturbed during feeding (Moorhouse *et al.* 1992). They hide during the day in the soil and in cracks at the base of petioles (Moorhouse *et al.* 1992). As picking of grape bunches occurs during the day, *O. sulcatus* would not be associated with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Paracotalpa ursina (Horn 1867) [Scarabaeidae] Little bear beetle	**Yes** Present in California (Bentley *et al.* 2005) in southern San Joaquin Valley (Flaherty *et al.* 1992) and desert-edge localities in southern and central California (Kaufman and Jameson 2009).	**No** Adult beetles are reported to attack only young, tender shoots of grapevine (Flaherty *et al.* 1992) and also feed on blossoms, buds and leaves of various shrubs and trees particularly those in the Rosaceae (Kaufman and Jameson 2009). No reports have been found on attacks by the larvae on grapevines (Flaherty *et al.* 1992). Eggs are laid in the soil where grubs spend their entire lives feeding on the roots of grasses. Unlikely to be associated with fresh mature table grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Philonthus Stephens, 1829 [Staphylinidae] Rove beetle	**Yes** There are 134 species in North America, including *P. politus* Linnaeus in California (Arnett Jr 1993).	**No** Rove beetles in the Staphylinidae family may occur in vineyards but are typlically found under rocks and vegetation on the vineyard floor, or in foliage and bark (Ontario Grape IPM 2009). They are nocturnal and mostly feed on other insects and decaying vegetation, but some species are parasitic (Ontario Grape IPM 2009). A *Philonthus* sp. has been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. However, these beetles are likely to be present only as a contaminant and, due to their size and external habit, would be detected during inspection.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Popillia japonica Newman 1838 [Coleoptera: Scarabaeidae] Japanese beetle	**No** Widespreead east of the Missippi River and highly invasive. Several incursions have been eradicated from California and it has not established in California (Potter and Held 2002; Summers 2005).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Scobicia declivis LeConte 1860 [Bostrichidae] Leadcable borer	**Yes** Present in California, including in San Joaquin County and North Coast vineyards (Bentley *et al.* 2009).	**No** Adults bore into wood to make egg tunnels and larvae feed on trunk or cordon wood (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Trogoderma variabile Ballion 1879 [Dermestidae] <u>Warehouse beetle</u>	**Yes** Present in California (Von Ellenrieder 2004).	**No** *T. variabile* attacks foodstuffs in stores and homes, infesting cereals and seeds. It can also be found in packaging materials such as corrugated cardboard (Emery 1999). *T. variabile* has been interecepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. However, these beetles are likely to be present only as a contaminant and, due to their size and external habit, would be detected during inspection.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Xanthogaleruca luteola Müller 1766 Synonym: *Pyrrhalta luteola* Müller, 1766*; Pyrrhalta luteola* Müller 1766 – invalid [Chrysomelidae] <u>Elm leaf beetle</u>	**Yes** Present in California (Arnett Jr 1993; Dreistadt *et al.* 2004).	**No** *X. luteola* feeds only on elm trees (OSU 2012) although it may overwinter in crevises near elm trees (DPIPWE 2012), houses, sheds and other protected places (OSU 2012).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Xyleborus dispar Fabricius 1792 [Scolytinae] <u>Pear blight beetle</u>	**Yes** Present in California (Wood 1982).	**No** Adults and larvae bore and mine injured limbs and holes (5-20 cm diameter or larger) of host trees (Wood 1982).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Diptera						
Existing California table grape policy *Ceratitis capitata* (Wiedemann 1824) Synonyms: *Ceratitis citripeda* Efflatoun 1924, *Ceratitis citriperda* Macleay 1829, *Ceratitis hispanica* Breme 1842, *Pardalaspis asparagi* Bezzi 1924, *Tephritis capitata* Wiedemann 1824, *Trypeta capitata* (Wiedemann 1824) [Tephritidae] Mediterranean fruit fly			**Yes for WA** Under official control **No for other states** Medfly is not present in the eastern states of Australia (Hancock *et al.* 2000).			
Drosophila melanogaster [Drosophilidae] Common fruit fly	**Yes** Present in California (Nunney 1996).	**No** Associated with rotted and fermenting fruit with no evidence that intact fruit can be infested (CABI 2011).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Drosophila simulans Sturtevant 1919 [Drosophilidae] Vinegar fly	**Yes** Present in California (Schlenke and Begun 2004; Bentley *et al.* 2009).	**Yes** Eggs are oviposited in damaged berries and larvae feed on the berries (Bentley *et al.* 2012b).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in Vic. (Plant Health Australia 2001c), NSW and QLD (Evenhuis 2007).	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Drosophila suzukii* Matsumara 1931 [Drosophilidae] Spotted wing drosophila			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eristalinus aeneus Scopoli 1763 Synonym: *Conops aeneus* Scopoli, 1763 [Syrphidae] Hover fly	**Yes** Present in California (North Carolina State University 2012).	**No** Larvae feed on decaying organic matter, and adult flies are attracted by flowers and the odour of decay (North Carolina State University 2012). Some species within the Syrphidae family prey on other insects such as aphids (University of California 2011). This insect has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states as a contaminant rather than a pest of grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Limonia maculate (Meigen) Synonym: Rhipidia maculate Meigen 1818 [Tipulidae] Small cranefly	**Yes** Present in California (Usinger 1956).	**No** Crane flies are mainly associated with freshwater environments (Salmela 2010). Feeding is predominantly confined to the larval stage which feed on detritus in habitats such as streams and forest floors (Fetzner Jr 2008). Additional habitats include marshes, springs, meadows, seeps, tree holes, algal growth or mosses, mud, and decaying vegetable debris surrounding streams and ponds (Fetzner Jr 2008). Adults are poor fliers, are most active around dusk, and usually live near moist woodlands and around water, where larval life is spent (Fetzner Jr 2008). Has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states as a contaminant rather than a pest of grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Psychoda alternata Say [Psychodidae] Moth fly	**Yes** Present in California (Ebeling 2002).	**No** Larvae live in moist areas around sewage plants and drain pipes. Adults may infest buildings and are often found in showers (Barnes 2009). Has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states as a contaminant rather than a pest of grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Hemiptera						
Amphigonalia severini Synonyms: *Neokolla severini; Neokolla severini hamula* [Cicadellidae]	**Yes** Present in California (Dmitriev 2013).	**No** No records found of an association with grape bunches. Economically important as a potential vector of Pierce's disease (CDFA 1999).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Aphis gossypii Glover, 1877 [Aphididae] Cotton aphid	**Yes** Present in California (CABI 2011) including the San Joaquin Valley (Grafton-Cardwell *et al.* 2012).	**Yes** It is associated with foliage, clustering on the underside of leaves. Its hosts include citrus, cucurbits, cotton and a range of weeds (Natwick *et al.* 2012). It has been recorded as a grape pest in Israel (Barjadze and Ben-Dov 2011). Adult and nymph stages may be present as contaminants on the fruit and stems during trade (CABI 2011).	**Yes for WA** Present in WA. **Yes for other states** Present in NSW, NT, QLD, SA, Tas., Vic. (Plant Health Australia 2001c; CSIRO 2005).	**Assessment not required**	**Assessment not required**	**No**
Aphrophora angulata (Ball) [Cercopidae]	**Yes** Present in California (DeLong and Severin 1950; Redak *et al.* 2004).	**No** No evidence to suggest *Aphrophora angulata* is a pest of commercial table grape production. Economically important as a potential vector of Pierce's disease (CDFA 1999).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aphrophora permutata (Uhler) [Cercopidae]	**Yes** Present in California (DeLong and Severin 1950; Hamilton 1982; Tipping and Mizell III 2012).	**No** No evidence to suggest *Aphrophora permutata* is a pest of commercial table grape production. Economically important as a potential vector of Pierce's disease (CDFA 1999).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Clastoptera brunnea (Ball) [Cercopidae]	**Yes** Present in California (Hamilton 1982).	**No** Economically important as a potential vector but there is no evidence to suggest it is a pest of commercial table grape production.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Coccus hesperidum Linnaeus, 1758 [Coccidae] Brown soft scale	**Yes** Present in California (Ben-Dov *et al.* 2012; Carroll 2013).	**Yes** Reported as a pest of grapevine in California (Flaherty *et al.* 1992). First instars are capable of independent movement, however remaining instar life stages are sessile and typically associated with the leaves and twigs (Bethke *et al.* 2009).Non-sessile life stages could potentially move to or be blown to table grape bunches.	**Yes for WA** Present in WA (Plant Health Australia 2001b)(Poole, 2008) **Yes for other states** Present in ACT, NSW, NT, Qld., SA, Tas., Vic. (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Daktulosphaira vitifoliae* Fitch 1855 Synonym: As *Viteus vitifolii* Fitch 1855 in AQSIQ (2006b); As *Phylloxera vitifolli* Fitch in Li (2004) [Phylloxeridae] Grapevine phylloxera			**No for WA** No records found for WA. **Yes for other states** Present in NSW and Vic. (CSIRO 2005), but it is under official control and measures are in place regulating the movement of grapevine materials including fruit.			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Draeculacephala minerva Ball 1927 [Cicadellidae] Green sharpshooter	**Yes** Present in California (Redak *et al.* 2004; Bentley *et al.* 2009).	**No** Economically important as a potential vector of Pierce's disease and is most abundant in riparian habitats in association with weeds, shrubs and trees (Redak *et al.* 2004). *D. Minerva* feeds on pastures, and *Vitis vinifera* is only an occasional host (Purcell and Frazier 1985; Cabrera-La Rosa *et al.* 2008; Bentley *et al.* 2009). Furthermore, given the large size and mobility of sharpshooter species, they are easily detected and disturbed during harvest and packing house operations.	**No records found**	**Assessment not required**	**Assessment not required**	**No**
Empoasca fabae (Harris, 1841) Synonym: *Empoasca mali* (Baron, 1853) [Cicadellidae] Potato leafhopper	**Yes** Present in California (CABI 2013).	**No** Empoasca fabae has a broad host range which includes grapes, but is mainly a pest of alfalfa and clover (Cook *et al.* 2004). (Integrated Pest Management Center 2007). Nymphs and adults feed in the vascular tissue of its hosts, predominantly on young tissues at the shoot tip (Isaacs 2007) and females lay eggs on the underside of leaves (Gill 2013). Injury to fruit trees is typically to the foliage/leaf margins (Cook *et al.* 2004). Adults are winged whilst nymphs are wingless and when disturbed, readily jump or fly away (Cook *et al.* 2004). Given that all life stages are associated with leaves and the high mobility of both adult and nymphal stages, this pest is unlikely to be associated with imported table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Erythroneura variabilis Beamer [Cicadellidae] Variegated leafhopper	**Yes** Present in California (Bentley *et al.* 2009).	**No** Eggs are laid on the underside of leaves and the adults and nymphs feed on the contents of leaf cells (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Erythroneura elegantula Osborn [Cicadellidae] Grape leafhopper	**Yes** Present in California (Bentley *et al.* 2009).	**No** Eggs are laid on the underside of leaves and the adults and nymphs feed on the contents of leaf cells (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Erythroneura ziczac (Walsh) [Cicadellidae] Virginia creeper leafhopper	**Yes** Present in California (University of California 2012b).	**No** Although leafhoppers in the genus *Erythroneura* are known to be associated with grapevines in California (Costello 2008), both feeding and egg deposition occurs on the leaves (Hollingsworth 2008; Ministry of Agriculture 2010). First generation nymphs tend to feed on the basal leaves early in the season and second generation nymphs feed on outer canopy leaves (Hollingsworth 2008). Both nymphs and adults are capable of independent movement and would likely be easily disturbed during harvest procedures. In addition, this pest is not known to occur in export counties. It is therefore unlikely it would be associated with imported commercial table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Euschistus conspersus* (Uhler) [Pentatomidae] Consperse stink bug			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Ferrisia virgata Cockerell 1893 [Pseudococcidae] Striped mealy bug	**Yes** Present in California (Ben-Dov 1994; CABI 2011).	**Yes** *Vitis vinifera* is a host of *F. virgata* (Ben-Dov 1994) and it infests the fruit, leaves, shoots and, in dry conditions, roots of its hosts (Schreiner 2000).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in QLD, NT (Ben-Dov 1994; Plant Health Australia 2001c; CSIRO 2005) and NSW (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Friscanus friscanus (Ball) [Cicadellidae]	**Yes** Present in California (Redak *et al.* 2004).	**No** *Friscanus friscanus* feeds by sucking the sap of vascular plants. No records found of association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Graphocephala atropunctata (Signoret, 1854) [Cicadellidae] Blue-green sharpshooter	**Yes** Found in coastal regions of California and is most abundant on cultivated grape (Bentley *et al.* 2009).	**No** This pest is most abundant in riparian habitats in association with weeds, shrubs and trees (Redak *et al.* 2004). Sharpshooters feed on the succulent new growth of shoots, not fruit (Redak *et al.* 2004). Furthermore, given the large size and mobility of sharpshooter species, they are easily detected and disturbed during harvest and packing house operations.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Helochara delta (Oman) [Cicadellidae]	**Yes** Present in California (Redak *et al.* 2004; Dmitriev 2013).	**No** Economically important as a potential vector but there is no evidence to suggest it is a pest of commercial table grape production.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hemiberlesia lataniae Signoret 1869 Synonym: *Aspidiotus lataniae* Signoret 1869 [Diaspididae] Latania scale	**Yes** Present in California (Faber *et al.* 2011).	**Yes** *H. lataniae* can be associated with fruit and is known to occur on *Vitis vinifera* (CABI 2011). However, *V. vinifera* is only an occasional host and infestations are light; occurring mostly on twigs and branches (Brimblecombe 1962).	**Yes for WA** Present in WA (Plant Health Australia 2001c; CSIRO 2005). **Yes for other states** Present in QLD, NSW (Plant Health Australia 2001c; CSIRO 2005), NT and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Homalodisca vitripennis* Germar 1821 Synonym: *Homalodisca coagulata* Say 1832 [Cicadellidae] Glassy-winged sharpshooter			**No records found**			
Icerya purchasi (Maskell, 1876) [Monophlebidae] Cottony cushion scale	**Yes** Present in California (Gill 1993; Ben-Dov *et al.* 2012).	**Yes** Predominantly a pest of citrus and is typically associated with larger twigs, branches and the trunk although fruit association is noted (Kerns *et al.* 2004b; Hamon 2005) This species is reported in association with the leaves, branches and fruit of grapevine in Korea (NPQS 2007) and could potentially be present on the import pathway.	**Yes for WA** Present in WA (Plant Health Australia 2001b). **Yes for other states** Present in NSW, NT, Qld, SA, Tas and Vic (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Ilnacorella sulcata Knight 1925 [Miridae] Mirid plant bug	**Yes** Present in the US (ITIS 2009). And has been intercepted by DAFF operational staff on Californian table grapes.	**No** Has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. As no records could be found that associate *I. sulcata* with *Vitis vinifera*, it is likely that this pest was intercepted as a contaminant rather than a pest of grapes.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Lygus hesperus Knight 1917 [Miridae] Western plant bug	**Yes** Present in California (Zalom *et al.* 2012) including the San Joaquin Valley (Mills 2012).	**Yes** A literature search did not reveal any records that showed an association with *Vitis vinifera*. However, a live *L. hesperus* specimen was intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. Furthermore, another species in the genus, *L. lineolaris*, has been associated with *V. vinifera* (Jubb, Jr. *et al.* 1979) and grape bunches (Fleury *et al.* 2006). This suggests that *L. hesperus* may be associated with grape bunches despite the lack of records in the literature.	**No records found**	**Yes** *L. hesperus* is highly polyphagous and has been reported from over 100 plant species in 24 families (Scott 1977). It is found in California, the Pacific Northwest and arid southwest of the US (Seymour *et al.* 2005; Naranjo and Stefanek 2012). Its polyphagy and current geographic distribution suggest that there is a risk that it could establish and spread in similar parts of Australia.	**Yes** *Lygus hesperus* is an important pest of fruit, vegetable, fibre, tree and seed crops in North America (Day *et al.* 2012). This is the most important pest of the alfalfa seed industry in California and the Pacific Northwest. Applications of insecticides to control this pest impacts on beneficial insects such as bees reducing crop yields even further. Insecticide resistant populations of Insecticide resistant populations of *Ligus* sp. have also been reported (Seymour *et al.* 2005).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Lygus lineolaris (Palisot 1818) [Miridiae] Tarnished plant bug	**Yes** Commonly reported in the San Joaquin Valley (Mueller 2003; Mueller *et al.* 2012) and is the most widely distributed *Lygus* species in North America (CABI 2011). It is found in all states of the continental US and from all agricultural areas in North America (CABI-EPPO 2000; CABI 2011).	**Yes** *Lygus lineolaris* is highly polyphagous and attacks a wide range of economic hosts including herbaceous plants, vegetable crops, commercial flower plants, fruit trees and nursery stock (Dixon 2009). More than half of cultivated plant species in the US are reported as hosts for *L. lineolaris* (Dixon 2009). It is the principal mirid pest in the eastern and southern US and is primarily reported in association with cotton; canola; mustard; seed lucerne; vegetable crops such as *Phaseolus vulgaris* and *P. lunatus*; fruit crops such as strawberry, apple and peach; and from nursery stock (CABI 2011). An association with grapes is also reported (Jubb, Jr. *et al.* 1979; Fleury *et al.* 2006). It feeds on all aerial plant parts, but favours leaf and flower buds, flowers, fruits and seeds (CABI 2011).	**No records found**	**Yes** *Lygus lineolaris* is found throughout North America in climates which share similarities to that of Australia, indicating it is likely to establish and spread should it be introduced into the Australian environment. Its wide host range, small size, and relatively quick reproductive cycles would facilitate its ability to establish and spread in Australia also.	**Yes** *Lygus lineolaris* has caused economic damage to fruit and vegetable crops in North America. Significant damage has been reported on apples, strawberries and peaches, with fruits developing 'catfacing' injuries around feeding sites and fruit development can be affected (CABI 2011). In New York State, 67% fruit damage and a 30% reduction in berry weight was observed with strawberry (CABI 2011).	**Yes**
Macrosiphum euphorbiae Thomas 1878 [Aphididae] Potato aphid	**Yes** Present in California (CABI 2011; Godfrey and Haviland 2012).	**Yes** *M. euphorbiae* has been reported to attack *Vitis vinifera* in Italy and is associated with grape bunches (Kryczynski *et al.* 1988; Ciampolini and Maiulini 1990).	**Yes for WA** Present in WA (Plant Health Australia 2001c; CSIRO 2005). **Yes for other states** Present in QLD, NSW, Vic., SA, Tas. (Plant Health Australia 2001c; CSIRO 2005) and NT (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Metcalfa pruinosa Say 1830 [Flatidae] Frosted moth bug	**No** Although reported as being present in California (Wilson and McPherson 1981; CABI 2011) these records reference authorities from before 1960 (van Duzee 1917; Metcalf and Bruner 1948; Metcalf 1957). According to Wilson and Lucchi (2000; 2012) the records from California are unreliable because features of the genetalia of both sexes may not have been used to identify the specimens. With no contemporary records to confirm this insect's occurrence in California, DAFF considers the species to be absent from California.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Myzus persicae (Sulzer, 1776) [Aphididae] Green peach aphid	**Yes** Present in California (Flaherty *et al.* 1992).	**Yes** Although reported from grapes in spring, *M. persicae* is likely to be present only as transients (Flaherty *et al.* 1992). Watson (1923) reported *M. persicae* on the leaves and tender stems of grapevine, but did not consider the aphid to be a berry feeder. *Myzus persicae* has been reported on grapevine flower clusters in California on one occasion (Flaherty *et al.* 1992). It has not been reported feeding on grape bunches but has been reported on the fruit of other hosts (Gildow *et al.* 2004). Given the enclosed nature of table grape bunches; some transients could be associated with the pathway. *Myzus persicae* can also vector Broad bean wilt virus 1 and Broad bean wilt virus 2, potential viruses of grapevines (Martelli 1999; Zhou 2002; Belliure *et al.* 2011).	**Yes for WA** Present in WA (Plant Health Australia 2001b). **Yes for other states** Present in NSW, NT, Qld., SA, Tas. and Vic. (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Nysius raphanus Howard, 1872 [Lygaeidae] False chinch bug	**Yes** Present in California including the San Joaquin Valley (Bentley *et al.* 2009).	**No** *Nysius raphanus* is a pest of cruciferous weeds (Bentley *et al.* 2009) in Europe and the US. However, population pressures can cause the nymphs and adults may migrate from their weedy hosts to grapevine in search of new green growth (Flaherty *et al.* 1992; Bentley *et al.* 2009). This is associated with undercutting of weeds in and around vineyards when vines are leafing out (Barnes 1970). *N. raphanus* does not prefer grapevine as a host and is only associated with grapevine leaves (Bentley *et al.* 2005). Eggs are also laid in the soil (Flaherty *et al.* 1992) and are therefore not associated with the fruit. Despite *N. raphanus* not being associated with grape bunches in the field, a single live *N. raphanus* insect has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. *N.raphanus* will be adequately managed by DAFF's contaminant pest policy Section 5.3 Uncategorised pests from California.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Paragonia confusa (Oman) [Cicadellidae]	**Yes** Present in California (Redak *et al.* 2004).	**No** Economically important as a potential vector but there is no evidence to suggest it is a pest of commercial table grape production.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Parasaissetia nigra Nietner 1861 [Coccidae] Pomegranate scale	**Yes** Present in California (Ben-Dov *et al.* 2010).	**Yes** *Vitis vinifera* is a host of *P. nigra* (Ben-Dov *et al.* 2010) and may be present on plant stems (CABI 2011). As such, the pest may be associated with grape bunches.	**Yes for WA** Present in WA (Plant Health Australia 2001c; CSIRO 2005). **Yes for other states** Present in QLD, NSW, Vic., NT (Plant Health Australia 2001c; CSIRO 2005) and SA (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Parthenolecanium corni Bouché 1844 [Coccidae] European fruit lecanium	**Yes** Present in California (Golino *et al.* 2002; Ben-Dov *et al.* 2010).	**Yes** *P. corni* is a pest of *Vitis vinifera* (Ben-Dov *et al.* 2010) and can be found on grape bunches (Flaherty *et al.* 1992).	**No for WA** No records found for WA. **Yes for other states** Present in Vic., Tas. (Plant Health Australia 2001c; CSIRO 2005) and NSW (CSIRO 2005).	**Yes** This pest is widely distributed in temperate and subtropical regions in North, Central and South America; Oceania; Asia and Europe (Ben-Dov *et al.* 2010). It is highly polyphagous with host plants in at least 40 families. Host genera include: *Acer*, *Pistacia*, *Acacia*, *Mentha*, *Asparagus*, *Pinus, Malus*, *Prunus*, *Pyrus* and *Vitis*. Could establish and spread in WA.	**Yes** Frequent and severe attacks on avocado in the Canary Ilands, also an important pest of avocado in the Caribbean (Swirski *et al.* 1997). It is mainly a pest of plum, raspberry, grape and sometimes apple, pear, apricot, peach and cherry (amongst others). Infested trees lose leaves and decrease their annual growth. Heavy infestations lead to fungal growth on the honeydew secretions (David'yan 2008). Also transmits viruses (Ben-Dov *et al.* 2010).	**Yes**
Parthenolecanium pruinosum (Coquillett, 1891) [Coccidae] Frosted scale	**Yes** Present in California (Ben-Dov *et al.* 2012; Carroll 2013).	**Yes** *Parthenolecanium pruinosum* is reported as a pest of grapevine in California (Flaherty *et al.* 1992) and damages the fruit of its hosts by depositing honeydew (Carroll 2013).	**Yes for WA** Present in WA (Poole and Hammond 2011b). **Yes for other states** Present in NSW, SA, Tas and Vic (Poole and Hammond 2011b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Philaenus leucophthalmus (L.) [Cercopidae] Meadow spittlebug	**Yes** Present in California Present throughout US (Redak *et al.* 2004).	**No** Economically important as a potential vector but there is no evidence to suggest it is a pest of commercial table grape production.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Philaenus spumarius Linnaeus1758 [Aphrophoridae] Meadow froghopper	**Yes** Present in California (CABI 2011).	**No** *P. spumarius* is a xylem feeding insect (Crews *et al.* 1998) that attacks the leaves of *Vitis vinifera* (Bournier 1977). No association was found with fruit. Eggs are oviposited into crevices such as leaf sheafs (CABI 2011).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Existing California table grape policy *Planococcus ficus* (Signoret) Synonyms: *Coccus vitis* (Nedzilskii 1869, *Dactylopius vitis* (Lichtenstein 1870), *Pseudococcus citri* (Balachowsky & Mesnil 1935) [Pseudococcidae] Vine mealybug			**No records found**			
Planococcus kraunhiae (Kuwana 1902) [Pseudococcidae] Synonyms: *Dactylopius kraunhiae* Kuwana 1902, *Planococcus siakwanensis* Borchsenius 1962*, Dactylopius krounhiae* Kuwana 1917, *Planococcus kraunhiae* Ferris 1950, *Pseudococcus kraunhiae* Fernald, 1903 Japanese mealybug	**Yes** Present in California (Miller *et al.* 2005; Ben-Dov 2013).	**Yes** *Planococcus kraunhiae* has been reported from grapevine in Japan (Narai and Murai 2002) and from the leaves, branches and fruit of grapevines in Korea (NPQS 2007). More generally, mealybugs dislike low humidity and are commonly found in sheltered locations such as the underside of leaves, inside curled leaves, grape bunches, between bud scales and under bark (Furness and Charles 1994). It is possible that *P. kraunhiae* populations could be present within exported table grape commodities.	**No for WA** No records found. **No for other states** No records found.	**Yes** *Planococcus kraunhiae* is a polyphagous species which has established in areas with a wide range of climatic conditions (Ben-Dov 2013). Host plants and climatic conditions in parts of Australia may be suitable for its establishment and spread.	**Yes** *Planococcus kraunhiae* is a polyphagous species and has been reported as a pest of important commercial crops including grapevine, pear, persimmon and citrus (NPQS 2007; Ben-Dov 2013). Mealybugs produce honeydew that causes the development of sooty mould which discolours the fruit and reduces its marketability (Furness and Charles 1994; CABI 2013).	**Yes**
Pseudococcus calceolariae Maskell 1879 [Pseudococcidae] Citrophilus mealybug	**Yes** Present in California (Ben-Dov 1994).	**Yes** *P.calceolariae* is a pest of *Vitis vinifera* (Ben-Dov 1994). Mealybugs are commonly found in sheltered locations such as grape bunches (Furness and Charles 1994).	**No for WA** No records found for WA. **Yes for other states** Present in QLD, NSW, Vic., Tas. and SA (Plant Health Australia 2001c; CSIRO 2005).	**Yes** This insect has a wide host range and is recorded from hosts in 40 plant families (Ben-Dov 2009) most of which occur in Australia. Its wide host range, global distribution and presence in eastern Australia and Tasmania suggests potential for establishment and spread in WA (Gullan 2000; CABI 2011).	**Yes** This mealybug is a highly polyphagous species, reported as a pest of citrus and grapevines (CABI 2011). Mealybugs produce honeydew that causes the development of sooty mould which discolours the fruit (CABI 2011).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pseudococcus longispinus (Targioni Tozzetti, 1867) [Pseudococcidae] Long-tailed mealybug	**Yes** Cosmopolitan species known to be in California since 1933 and is limited to Central Coast vineyards (Daane *et al.* 2008).	**Yes** Although primarily reported in association with the bark of the trunk, cordons, spurs and leaves (Bentley *et al.* 2009), infestation of grape bunches is known (Charles 1982).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in ACT, NSW, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Pseudococcus maritimus* (Ehrhorn, 1900) [Pseudococcidae] Grape mealybug			**No records found**			
Pseudococcus viburni (Signoret, 1875) [Pseudococcidae] Obscure mealybug	**Yes** Commonly found in Central Coast Californian vineyards (Daane *et al.* 2008; Bentley *et al.* 2009).	**Yes** In late spring, obscure mealybugs begin feeding on leaves, with the majority remaining hidden under bark or within grape clusters (Bentley *et al.* 2009).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, QLD, SA and Tas. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Rhizoecus falcifer Kunckel d'Herculais, 1878 [Rhizoecidae] Ground mealybug	**Yes** Present in California (Ben-Dov *et al.* 2012).	**No** Considered only a minor pest of grapes having an occasional association with home or backyard plantings and not commercial vineyards (Flaherty *et al.* 1992). The ground mealybug lives its life entirely subterranean, feeding on plant roots (Flaherty *et al.* 1992). It is unlikely to be associated with fresh mature commercial table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Rhizoecus kondonis Kuwana, 1923 [Rhizoecidae] Citrus root mealybug	**Yes** Present in California (Tadauchi and Inoue 2006; Ben-Dov *et al.* 2012).	**No** Considered only a minor pest of grapes having an occasional association with home or backyard plantings and not commercial vineyards (Flaherty *et al.* 1992). The ground mealybug lives its life entirely subterranean, feeding on plant roots (Flaherty *et al.* 1992). It is unlikely to be associated with fresh mature commercial table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Saissetia coffeae Walker 1852 [Coccidae] Hemispherical scale	**Yes** Present in California (Ben-Dov 1993).	**Yes** *S. coffeae* may be found on leaves, twigs, branches and fruit (CABI 2011). It is a pest of *Vitis vinifera* (Ben-Dov 1993). Some scales are found on grape bunches (Flaherty *et al.* 1992).	**Yes for WA** **Yes for other states** Present in all states and territories (Plant Health Australia 2001c; CSIRO 2005).	**Assessment not required**	**Assessment not required**	**No**
Saissetia oleae (Olivier, 1791) [Coccidae] Black scale	**Yes** Present in California (Ben-Dov *et al.* 2012).	**Yes** Reported as a pest of grapevine in California (Flaherty *et al.* 1992). First instars are capable of independent movement, however remaining instar life stages are sessile and typically associated with the leaves and twigs (Bethke *et al.* 2009). Non-sessile life stages could potentially move to or be blown to table grape bunches.	**Yes for WA** Present in WA (Plant Health Australia 2001b). **Yes for other states** Present in ACT, NSW, Qld., Tas., Vic. (Plant Health Australia 2001b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Scaphoideus titanus Ball Synonym: *Scaphoideus littoralis* [Cicadellidae]	**Yes** Present in California (CABI 2011).	**No** All life stages of this pest have been collected on *Vitis vinifera* in the US (Maixner *et al.* 1993). The eggs are found under the bark; adults and fourth and fith instar nymphs can feed on green shoots and stems (Lessio and Alma 2006). A direct association with fruit was not found.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Spissistilus festinus Say, 1830 [Membracidae] <u>Three-cornered alfalfa hopper</u>	**Yes** Present in California (Flaherty *et al.* 1992).	**No** *Spissistilus festinus* feeds on the branches, leaves and stems of grapevine (Flaherty *et al.* 1992). Eggs are deposited on young tender shoots early in spring on its hosts (Flaherty *et al.* 1992). Reported as only being occasionally found in North Coast vineyards and is generally only an economic pest of leguminous crops. It is unlikely to be associated with fresh mature harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Trialeurodes vittatas (Quaintance) [Homoptera] Grape whitefly	**Yes** Native to California (Flaherty *et al.* 1992)	**No** Although native to California, *Trialeurodes vittatas* isconsidered only a sporadic pest of commercial grape (Flaherty *et al.* 1992) . Adults lay eggs on both upper and lower surfaces of grape leaves. When eggs hatch, larvae crawl a short distance and settle down to a motionless nymphal stage (Flaherty *et al.* 1992). Injury of commercial grapes is chiefly caused by sticky excrement soiling fruit (Flaherty *et al.* 1992). Unlikely to be associated with commercial harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Xyphon fulgida Nottingham Synonym: *Carneocephala fulgida* [Cicadellidae] Red-headed sharpshooter	**Yes** Present in California (Redak *et al.* 2004; Bentley *et al.* 2009).	**No** *C. fulgida* feeds on pastures, and *Vitis vinifera* is only an occasional host (Purcell and Frazier 1985; Bentley *et al.* 2009). Furthermore, given the large size and mobility of sharpshooter species, they are easily detected and disturbed during harvest and packing house operations.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Hymenoptera						
Formica aerata Francoeur 1973 [Formicidae] Gray field ant	**Yes** Present in California, including San Joaquin Valley (Bentley *et al.* 2009).	**No** No records found of association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Formica perpilosa Wheeler 1913 [Formicidae]	**Yes** Present in California, including Riverside County (Tollerup *et al.* 2007).	**No** No records found of association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Linepithema humile Mayr 1868 [Formicidae] Argentine ant	**Yes** Present in California (Bentley *et al.* 2009).	**No** No records found of association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Solenopsis molesta Say 1836 [Formicidae] Fourmi ravisseuse, Thief ant	**Yes** Present in California (Bentley *et al.* 2009).	**No** No records found of association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Solenopsis xyloni McCook [Formicidae] Southern fire ant	**Yes** Native to the US and Mexico, present on the Pacific coast of California (Harris 2012; Lubertazzi and Alpert 2012).	**No** Primarily a ground nesting pest (Harris 2012), but it does feed on honeydew excreted by the European fruit lecanium scale and mealybugs (Bentley *et al.* 2009). However, it is not a pest of grapevines. Given its size, colouring, mobility, and aggressive behaviour, it is unlikely to be present as a contaminant pest on harvested table grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Tetramorium caespitum Linnaeus 1758 [Formicidae] Pavement ant	**Yes** Present in California (University of California 2008b).	**No** No records found of an association with grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Vespula germanica Fabricius [Vespidae] European wasp	**Yes** Present in California (Spradbery P and P & Dvorak L 2010).	**No** Although recorded as a pest of grapevine (Ward 2001), it is believed that no stage of the wasp's life cycle would be present on the commodity after harvesting and grading. The larvae feed on insects and meat (Department of Primary Industry 2011). Adults feed on nectar and ripe fruits but are aggressive when disturbed (Department of Primary Industry 2011; INRA 2012).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Lepidoptera						
Existing California table grape policy *Amyelois transitella* (Walker 1863) Synonym: *Paramyelois transitella* (Walker 1863); *Emporia cassiae* Dyar 1917; *Myelois duplipunctella* Ragonot 1887; *Nephopterix notatalis* Walker 1863; *Myelois solitella* Zeller 1881; *Myelois venipars* Dyar 1914 [Pyralidae] Navel orangeworm			**No records found**			
Existing California table grape policy *Argyrotaenia citrana* Fernald 1889 Synonym: *Argyrotaenia franciscana* Walsingham 1879; *Eulia citrana* Fernald 1889; *Argyrotaenia kearfotti* Obraztsov 1961 [Tortricidae] Orange tortrix			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cnephasia longana (Haworth) [Tortricidae] Omnivorous leaf roller or Omnivorous leaf-tier	**Yes** First recognised in California in 1948 (Pritchard and Middlekauff 1950). Occurs throughout the United States (Hollingsworth 2008).	**No** A literature search found two papers listing *Vitis vinifera* as a host of *Cnephasia longana* (Hill 1987; Plantwise 2012). However, these authors do not provide an authority for the host association. All other papers reviewed did not give *V. vinifera* as a host although at least 20 host plants have been listed (for example, see Antonelli *et al.* (2004)). This pest has been present in California since the early 20th Century (Powell 1997), but no reports of an association with *V. vinifera* in California have been found.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Desmia funeralis* Hübner 1796 [Pyralidae] Grape leaffolder			**No records found**			
Epiphyas postvittana (Walker) [Torticinae] Light brown apple moth	**Yes** Present in California (APHIS 2011b).	**Yes** *Vitis vinifera* is a host (Venette *et al.* 2003) and it feeds on the leaves, buds, flowers and fruit of its hosts (Gilligan and Epstein 2009). Although regulatory mechanisms and eradication programs have been implemented since its detection in California, reports for some Californian counties persist (APHIS 2011b) and federal orders remain in place for the movement of regulated articles, including table grape commodities (APHIS 2011a).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in ACT, NSW, NT, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Existing California table grape policy *Estigmene acrea* (Drury 1773) [Actiidae] Salt marsh moth			**No records found**			
Euchromius californicalis Packard [Crambidae]	**Yes** Present in California (Capps 1966; Brown 2000).	**No** A single live *E.californicalis* insect has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. No records could be found that associate *E. californicalis* with *Vitis Vinifera*. *E. californicalis* will be adequately managed by DAFF's contaminant pest policy Section 5.3 Uncategorised pests.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eumorpha achemon (Drury) [Sphingidae] <u>Sphinx moth</u>	**Yes** Present in California (Flaherty *et al.* 1992; Bentley *et al.* 2005).	**No** Larvae primarily attacks the foliage of grapevines, including wild grapevines (Flaherty *et al.* 1992; Bentley *et al.* 2005). Eggs are usually deposited on the upper surface of older leaves (Flaherty *et al.* 1992). After hatching, caterpillars feed on the leaves and then migrate to the ground (Flaherty *et al.* 1992). Adults can be as large as a hummingbird with a wing expanse up to 10cm (Flaherty *et al.* 1992). Unlikely to be associated with fresh mature harvested grape bunches for export and given its large size, it would be detected and culled during harvest procedures.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Eulithis diversilineata* (Hübner, 1813) [Geometridae] <u>Grape looper</u>			**No records found**			
Existing California table grape policy *Harrisina brillians* Barnes and McDunnough 1910 [Zygaenidae] <u>Western grapevine skeletoniser</u>			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hyles lineata (Fabricius) [Sphingidae] White lined sphinx moth	**Yes** Present in California and the US (Flaherty *et al.* 1992; Bentley *et al.* 2005).	**No** The larvae primarily attack foliage and are only an occasional pest on grapevines (Flaherty *et al.* 1992). It is most often found on weeds and herbaceous plants (Hyche 2001) but can also be found on apple, azalea, beets, buckwheat, chickweed, collards, currant, pear, plum, elm, evening primrose, fuchsia, gooseberry, bitter dock, prune, purslane, tomato, turnip and many other range, forage, and truck-crop plants (Flaherty *et al.* 1992). Both pupa and adults are large and would be detected during harvest procedures. Caterpillars feed on grape leaves and migrate to the ground after about 25 days of feeding (Flaherty *et al.* 1992). Unlikely to be associated with mature harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Lobesia botrana* (Denis & Schiffermuller 1775) [Tortricidae] European grapevine moth			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Marmara gulosa Guillèn and Davis [Gracillariidae] Citrus peelminer	**Yes** Present in California (Stelinski 2007; Kirkland 2009).	**Yes** Is known to be associated with the stem, petiole, tendril, bunch rachis and berry of grapes (Eichlin and Kinnee 2001).	**No records found**	**Yes** Reported from California, Arizona, Texas, Florida, Mexico and Cuba (Eichlin and Kinnee 2001; Stelinski 2007; Kirkland 2009). Many of the climates in its known range are similar to that of Western Australia. Its wide host range across species of commercial fruit crops, ornamentals and weeds (Eichlin and Kinnee 2001) would also allow it to establish and spread in Western Australia.	**Yes** Infestations have resulted in considerable economic losses to citrus growers (Kirkland 2009). Extensive damage has been recorded in citrus groves in southern California and Arizona and it aggressively feeds on citrus and a range of other commodities in the San Joaquin Valley, with fruit infestation rates of up to 70% reported (Kirkland 2009). In grapes, mining damage can also lead to secondary infections, such as bunch rot (Kirkland 2009).	**Yes**
Orthodes rufula Grotes [Noctuidae] Brassy cutworm	**Yes** Found in both coastal and San Joaquin Valley grape growing areas of California (Donaldson *et al.* 2012).	**No** It is not associated with mature grape bunches. This pest damages grapevines in early spring and is associated with developing buds not fruit (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Peridroma saucia (Hübner, 1808) [Arctiidae] Variegated cutworm, pearly underwing moth	**Yes** Present in California, including the San Joaquin Valley and North Coast (Bentley *et al.* 2009).	**No** *Peridroma saucia* larvae feed on buds on grapevines (MAF Biosecurity New Zealand 2009; Bentley *et al.* 2009). Larvae move to the soil or under bark during the day (Bentley *et al.* 2009) and adults are inactive during the day, remaining under foliage or at the base of the plant (Mau and Martin Kessing 2007).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Platynota stultana* Walsingham [Tortricidae] Omnivorous leafroller			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Plodia interpunctella Hübner 1813 [Pyralidae] Indian meal moth	**Yes** Present in California (Flaherty *et al.* 1992).	**No** Primarily a storage pest of dried fruits, nuts, grains and cereal products with infestations most commonly occurring after 30-60 days of storage (Flaherty *et al.* 1992). It is commonly encountered as a household pest, feeding on stored food products (Fasulo 1998).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Polychrosis viteana* Clemens [Tortricidae] Grape berry moth			**No records found**			
Spodoptera exiqua (Hübner) [Noctuidae] Beet army worm	**Yes** Present in California (Stern 1992; Bentley *et al.* 2005; Capinera 2006; Zheng *et al.* 2011).	**No** Larvae can cause occasional damage on foliage in vineyards (Stern 1992) but is considered only a minor pest (Flaherty *et al.* 1992). It is primarily a defoliator pest of vegetable, field and flower crops (Stern 1992; Capinera 2006). Feeding on grape bunches is rare (Flaherty *et al.* 1992; Stern 1992). Unlikley to be associated with fresh mature harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Spodoptera praefica (Grote 1875) Synonym: *Prodenia praefica* Grote [Noctuidae] Western yellow striped army worm	**Yes** Present in California(Blanchard 1932; Flaherty *et al.* 1992; Bentley *et al.* 2005; Washington State University 2013).	**No** Primarily a pest of alfalfa but larvae may feed on grape foliage in vineyards adjacent to alfalfa (Flaherty *et al.* 1992). Not known to lay eggs on grapes (Flaherty *et al.* 1992). Mature larvae are large, growing up to in excess of 5cm long (Flaherty *et al.* 1992) and would likely be detected during harvest procedures. In alfalfa, first and second instars strip the lower epidermal layer of the leaves and later instars eating all of the leaves (Flaherty *et al.* 1992). Unlikely to be associated with mature grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Xestia c-nigrum (Linnaeus 1758) Synonym: *Amathes c-nigrum* [Arctiidae] Spotted cutworm	**Yes** Present in California (Bentley *et al.* 2009).	**No** This pest is not associated with mature grape bunches. They feed on buds and young foliage during the night and return to the ground to shelter under leaf litter or debris during the day (Pfeiffer 2009). They can also be found under grapevine bark (Bentley *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Mantodea						

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Iris oratoria Linnaeus 1758 [Mantidae] Mediterranean Mantis	**Yes** Present in California (Maxwell and Eitan 1998).	**No** Mantids are generalist predators and are not associated with particular plants. A single live *I. oratoria* insect has been intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states. *I. oratoria* will be adequately managed by DAFF's contaminant pest policy Section 5.3 Uncategorised pests.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Neuroptera						
Chrysoperla spp. Steinmann 1964 [Chrysopidae]	**Yes** Species of this genus are known to occur in California (Brooks 1994).	**No** *Chrysoperla* are known to occur on *Vitis vinifera* in California (Costello and Daane 1999). However, species in this genus are not plant pests; they are unselective predators that search freely over the host plant. A single *Chrysoperla* was intercepted by DAFF operational staff during inspections of Californian table grapes for export to Australian eastern states, but they do not have a host relationship with grapes and will be adequately managed by DAFF's contaminant pest policy Section 5.3 Uncategorised pests.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Orthoptera						

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Melanopus devastator [Acrididae] Devastating grasshopper	**Yes** Present in California (Flaherty *et al.* 1992).	**No** This species damage shoots in mid- to late summer in California (Flaherty *et al.* 1992). Winged adults enter the vineyard from their breeding ground to feed on green foliage (Flaherty *et al.* 1992). Eggs are laid in the soil and following egg hatch, nymphs feed on natural vegetation (Flaherty *et al.* 1992). Given that most life stages occur outside the vineyard, its preference for foliage feeding, and its mobility, it is unlikely to be associated with harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Schistocerca alutacea Shoshone (Thomas) [Acrididae] Green valley grasshopper	**Yes** Present in California (Flaherty *et al.* 1992).	**No** Eggs are laid in the soil and following egg hatch, nymphs feed on natural vegetation (Flaherty *et al.* 1992). Adults can migrate into the vineyard and feed on young foliage of young shoots (Flaherty *et al.* 1992). The Green valley grasshopper is large and highly mobile. It is likely that harvest procedures would detect or disturb this pest. Unlikely to be associated with fresh harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Schistocerca nitens nitens (Thunberg) [Acrididae] Vagrant grasshopper	**Yes** Present in California (Flaherty *et al.* 1992).	**No** Eggs are laid in the soil and following egg hatch, nymphs feed on natural vegetation (Flaherty *et al.* 1992). Adults can migrate into the vineyard and feed on young foliage of young shoots (Flaherty *et al.* 1992). The Green valley grasshopper is large and highly mobile. It is likely that harvest procedures would detect or disturb this pest. Unlikely to be associated with fresh harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Thysanoptera						
Existing California table grape policy *Caliothrips fasciatus* (Pergande) Synonyms: *Heliothrips fasciatus* Pergande 1895; *Caliothrips woodworthi* Daniel 1904 [Thripidae] Bean thrips			**No records found**			
Existing California table grape policy *Drepanothrips reuteri* [Thripidae] Grape thrips			**No records found**			
Existing California table grape policy *Frankliniella minuta* (Moulton 1907) Synonyms: *Euthrips minutus* Moulton, 1907; *Euthrips minutus* var. *setosus* Crawford DL, 1909; *Frankliniella minuta* f. *luminosa* Moulton, 1948 [Thripidae]			**No records found**			

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Existing California table grape policy *Frankliniella occidentalis* (Pergande 1895) [Thripidae] Western flower thrips			**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states except NT** Present in ACT, NSW, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c), but is absent from NT (DRDPIFR NT 2008).			
Existing California table grape policy *Scirtothrips citri* (Moulton) Synonyms: *Euthrips citri* Moulton 1909, *Scirtothrips clivicola* Hood 1957 [Thripidae] Californian citrus thrips			**No records found**			
Existing California table grape policy *Scirtothrips perseae* Nakahara [Thripidae] Avocado thrips			**No records found**			
Thrips hawaiiensis Morgan 1913 [Thripidae] Hawaiian flower thrips	**Yes** Present in California (Palmer and Wetton 1987; Nakahara 1994).	**Yes** This is a phytophagous species (Childers and Nakahara 2006) associated with table grapes and fruiting stages of its hosts (CABI 2011). International trade of fruit from contaminated areas is probably the main reason for its spread (Reynaud *et al.* 2008).	**Yes for WA** Present in WA (Plant Health Australia 2001c; Poole 2008; Poole 2010). **Yes for other states** Present in NSW, NT, QLD, SA and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
CHROMALVEOLATA (Kingdom)						
Order Peronosporales (Albugo, Phytophthora)						
Phytophthora cryptogea Pethybr. & Laff. 1919 [Pythiaceae] Phytophthora root rot	**Yes** Present in California (CABI 2011).	**Yes** *P. cryptogea* is primarily soil borne (CABI 2011) and causes canker at or below the ground line in the root-crown area (Jones and Sutton 1996). However zoospores may be splashed onto fruit and cause rot (Jones and Sutton 1996), and fruit and stems may carry hyphae and spores in trade or transport (CABI 2011). *Vitis vinifera* is a host of *P. crytogea* (CABI 2011).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in QLD, NSW, ACT, Vic., SA and Tas. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Plasmopara viticola (Berk. & M.A. Curtis) Berl. & De Toni 1888 Synonym: *Botrytis viticola* Berk. & M.A. Curtis 1848 [Family] Grapevine downy mildew	**Yes** Present in California (Gubler *et al.* 2009).	**Yes** Infects flower clusters, bunches and young berries, however mature fruit is resistant to infection (Magarey *et al.* 1994).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in ACT, NSW, NT, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Order Saprolegniales						
Pythium Nees 1823 [Incertae sedis]	**Yes** A number of *Pythium* spp. are reported from California, including *P. irregular*, *P. splendens* (CABI 2011) and *P. ultimum* (Granett *et al.* 1998).	**No** *Pythium* spp. are soil borne and cause root roots and damping off of seedlings (RBG 2012a).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
DOMAIN FUNGI						
Order Agaricales						

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Armillaria mellea (Vahl : Fr.) P. Kumm. 1871 [Physalacriaceae] Grape root rot	**Yes** Found on a wide range of woody plants in California with pre-plant treatments sometimes required for vineyards in Napa, Sonoma, Santa Clara, Salinas and northern San Joaquin Valley (Flaherty *et al.* 1992).	**No** Survives on diseased wood and roots below ground (Flaherty *et al.* 1992). It infects roots and is not typically soil borne (Pearson and Goheen 1988). Movement between plants occurs through root contact (Pearson and Goheen 1988).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Pleurotus ostreatus (Jacq. : Fr.) P. Kumm. 1871 Anamorph/ Teleomorph: Synonym: *Agaricus ostreatus* Jacq. : Fr. 1774 Note: Sanctioned by Fries, Syst. Mycol. I:182, 1821. [Pleurotaceae] Oyster mushroom	**Yes** Present in California (CABI 2011).	**No** *P. ostreatus* uses living and dead wood as a substrate for growth (Farr and Rossman 2006). *Vitis vinifera* is not listed as a common host of *P. ostreatus* (Hickman *et al.* 2011).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Botryosphaeriales						
Botryosphaeria australis Slippers, Crous & M.J. Wingf. 2004 Anamorph: *Neofusicoccum australe* (Slippers, Crous & M.J. Wingf.) Crous, Slippers & A.J.L. Phillips [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2006).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**Yes for WA** Present in WA (Plant Health Australia 2001c; Taylor *et al.* 2005). **Yes for other states** Present in NSW, SA and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Botryosphaeria corticola A.J.L. Phillips, A. Alves & J. Luque Anamorph: *Diplodia corticola* A.J.L. Phillips, A. Alves & J. Luque 2004 [Botryosphaeriaceae]	**Yes** Present in California (recorded as *Diplodia corticola*) (Gubler *et al.* 2010).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**No records found**	**Yes** Other species of *Botryosphaeria* are already present in Western Australia (Plant Health Australia 2001c) which suggests that new species could establish and spread.	**No** Current management practises for other species of *Botryosphaeria* are likely to control this species.	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Botryosphaeria iberica A.J.L. Phillips, J. Luque & A. Alves 2005 Anamorph: *Dothiorella iberica* A.J.L. Phillips, J. Luque & A. Alves [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2007).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**No for WA** No records found for WA. **Yes for other states** Present in SA and Vic. (Plant Health Australia 2001c).	**Yes** Other species of *Botryosphaeria* are already present in Western Australia (Plant Health Australia 2001c) which suggests that new species could establish and spread.	**No** Current management practises for other species of *Botryosphaeria* are likely to control this species.	**No**
Botryosphaeria lutea A.J.L. Phillips 2002 Anamorph: *Neofusicoccum luteum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2006).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Botryosphaeria obtusa (Schwein.) Shoemaker 1964 Anamorph: *Diplodia seriata* De Not. Synonym: *Sphaeria obtusa* Schwein. 1832 [Botryosphaeriaceae] <u>Dead arm</u>	**Yes** Present in California (Úrbez-Torres *et al.* 2006).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**Yes for WA** Present in WA (Plant Health Australia 2001c; Taylor *et al.* 2005). **Yes for other states** Present in ACT, NSW, QLD, Vic. and SA (Plant Health Australia 2001c)	**Assessment not required**	**Assessment not required**	**No**
Botryosphaeria parva Pennycook & Samuels 1985 Anamorph: *Neofusicoccum parvum* (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2006).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, NT and QLD (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Botryosphaeria rhodina (Berk. & Curtis) Arx Anamorph: *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl. Synonyms: *Physalospora rhodina* Berk. & M.A. Curtis 1889; *Botryodiplodia theobromae* Pat. 1892 [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2006).	**Yes** *Botryosphaeria* species are most commonly associated with wood decay and canker (Úrbez-Torres *et al.* 2007) but can also be associated with bunch rot (Cooperative Research Centre for Viticulture 2005; Wunderlich *et al.* 2010).	**Yes for WA** Present in WA (Plant Health Australia 2001c; Taylor *et al.* 2005). **Yes for other states** Present in NSW, Qld and SA (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Fusarium oxysporum Schltdl. : Fr. 1824 Synonym: *Fusarium angustum* Sherb. 1915 [Nectriaceae] <u>Fusarium wilt</u>	**Yes** Present in California (Farr and Rossman 2006).	**Yes** Mainly found as a soil saprophyte (Booth 1970), however it has been intercepted in Australia on fresh mangosteen fruit from Thailand.	**Yes for WA** **Yes for other states** Present in all states and territories (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Fusarium proliferatum (Matsushima) Nirenberg ex Gerlach & Nirenberg 1982 Synonym: *Cephalosporium proliferatum* Matsush. 1971 [Nectriaceae]	**Yes** Present in California (Farr and Rossman 2006).	**Yes** Occurs widely on grape berries and has been investigated as a biocontrol agent against grapevine downy mildew (Falk *et al.* 1996).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, NT, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Fusarium sacchari (E.J. Butler) W. Gams 1971 [Nectriaceae]	**Yes** Present in California (CABI 2011).	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Gibberella intricans Wollenw. 1930 Anamorph: *Fusarium equiseti* (Corda) Sacc. [Nectriaceae]	**Yes** Present in California (Farr and Rossman 2006).	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Guignardia bidwellii (Ellis) Viala & Ravaz Anamorph*: Phyllosticta ampelicida* (Engelm.) Van der Aa Synonyms: *Sphaeria bidwellii* Ellis 1880; *Botryosphaeria bidwellii* (Ellis) Petr. 1958 [1957]; *Carlia bidwellii* (Ellis) Prunet 1898; *Laestadia bidwellii* (Ellis) Viala & Ravaz 1888. [Botryosphaeriaceae] Black rot	**No** Present in eastern US (Spotts 1977; Becker and Pearson 1996), including Michigan (Ferrin and Ramsdell 1978), New York (Hoffman *et al.* 2002), Virginia (Zhou and Stanosz 2001) and Ohio (Spotts 1980). Not present in western US (Farr and Rossman 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Lasiodiplodia crassispora T. Burgess & Barber 2006 [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2010).	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Neofusicoccum mangiferae (Syd. & P. Syd.) Crous, Slippers & A.J.L. Phillips 2006 Synonym*: Nattrassia mangiferae* (Syd. & P. Syd.) B. Sutton & Dyko 1989 [Botryosphaeriaceae] Leaf spot	**Yes** Present in California (Mayorquin *et al.* 2012).	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Neofusicoccum mediterraneum Crous, M.J. Wingf. & A.J.L. Phillips 2007 Anamorph/ Teleomorph: Synonym: [Botryosphaeriaceae]	**Yes** Present in California (Úrbez-Torres *et al.* 2010).	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Spencermartinsia viticola (A.J.L. Phillips & J. Luque) A.J.L. Phillips, A. Alves & Crous 2008 Anamorph: *Dothiorella viticola* A.J.L. Phillips & J. Luque 2006 Synonym: *Botryosphaeria viticola* A.J.L. Phillips & Luque 2006 [Dothideaceae]	**Yes** Present in California including Riverside County (Úrbez-Torres *et al.* 2007).	**Yes** Has been isolated from berries at harvest (Wunderlich *et al.* 2011).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW and SA (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Capnodiales						
Cladosporium herbarum (Pers.:Fr) Pouzar [Meruliaceae] Summer bunch rot	**Yes** Present in California (Bensch *et al.* 2010).	**Yes** Causes rot on wine grapes in Chile (Briceño and Latorre 2007). *C. herbarum* is common in the San Joaquin Valley of California (Flaherty *et al.* 1992). This pathogen causes secondary infection following mechanical damage to the berries (Flaherty *et al.* 1992). Masses of black, brown or green spores develop on the surface of infected berries (Gubler *et al.* 2009).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Chaetothyriales						
Phaeomoniella chlamydospora (W. Gams, Crous, M.J. Wingf. & Mugnai) Crous & W. Gams 2000 Synonym: *Phaeoacremonium chlamydosporum* W. Gams, Crous, M.J. Wingf. & Mugnai 1996 [Herpotrichiellaceae] Esca and Petri disease	**Yes** Present in California (Crous *et al.* 1996; Whiting *et al.* 2005).	**No** *P. chlamydospora*, in combination with *Phaeoacremonium aleophilum*, is reported as the main causal agent of esca disease and Petri decline of grapevine in California (University of California 2013b), both of which are reported from Western Australia (Plant Health Australia 2001c; Edwards and Pascoe 2004). It is commonly reported as a fungal trunk pathogen and is thought to establish during nursery operations resulting from the use of infected propagation material (Aroca *et al*. 2010). In the field, infection occurs through roots and pruning wounds (Mostert *et al*. 2006) and symptoms typically manifest as vascular streaking, stunted growth and shoot tip dieback (University of California 2013b). Leaf chlorosis and spotting of the berry surfaces has also been reported (University of California 2013b), but these symptoms are predominantly attributed to the translocation of toxic fungal metabolites from the infected parts of the trunk and branches via the xylem stream (Bruno *et al*. 2007). Accordingly, *P. chlamydospora* is unlikely to be associated with commercial grape bunches. This is further supported by official detection records which indicate that *P. chlamydospora* has not been detected during inspection of table grapes from California into eastern Australia since trade commenced in 2002.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Diaporthales						
Greeneria uvicola (Berkley & M.A. Curtis) Punithalingam [Gnomoniaceae] Bitter rot	**No** Present in eastern US, including North Carolina (Longland and Sutton 2008) and Mississippi (Kummuang *et al.* 1996). No records of the pathogen in California were found.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Phaeoacremonium aleophilum W. Gams, Crous, M.J. Wingf. & Mugnai 1996 Teleomorph: *Togninia minima* (Tul. & C. Tul.) Berl. [Togniniaceae] Esca disease complex	**Yes** Present in California (University of California 2013b) including in Riverside County (Scheck *et al.* 1998b). The teleomorph *Togninia minima* is also recorded from California, including Madera and Fresno counties (Rooney-Latham *et al.* 2005a).	**No** *Phaeoacremonium aleophilum*, in combination with *Phaeomoniella chlamydospora*, is reported as the main causal agent of esca disease and Petri decline of grapevine in California (University of California 2013b), both of which are reported from Western Australia (Plant Health Australia 2001c; Edwards and Pascoe 2004). In Australia, for example, *P. aleophilum* was isolated from 19 of 124 samples taken from grapevines showing esca and Petri disease symptoms, and *P. chlamydospora* was isolated in 122 of those samples (Edwards and Pascoe 2006). Petri disease symptoms include streaking of the xylem tissues, stunted growth and dieback, whereas esca symptoms include internal wood deterioration, leaf chlorosis and berries with small, brown to purple spots (Essakhi *et al.* 2008). Although leaf chlorosis and berry spots have been reported, studies on *P. aleophilum* and *Pm. chlamydospora* have associated	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Phaeoacremonium angustius W. Gams, Crous & M.J. Wingf. 1996 [Togniniaceae] Esca disease complex	**Yes** Present in California (University of California 2013b).					
Phaeoacremonium inflatipes W. Gams, Crous & M.J. Wingf. 1996 [Togniniaceae] Esca disease complex	**Yes** Present in California, including Contra Costa, Lake, San Joaquin and Riverside counties (Scheck *et al.* 1998b).					

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phaeoacremonium mortoniae Crous & W. Gams 2001 Teleomorph: *Togninia fraxinopennsylvanica* (T.E. Hinds) Hausner, Eyjólfsdóttir & J. Reid [Togniniaceae] Esca disease complex	**Yes** Present in California (Rooney-Latham *et al.* 2005b).	these symptoms with the translocation of toxic fungal metabolites from the infected parts of the trunk and branches via the xylem stream (Bruno *et al*. 2007). Airborne spores and surface contamination of the aerial parts of the vine have also been reported, however pruning wounds are thought to be the main port of entry for *Phaeoacremonium* spp. into grapevines (Eskalen and Gubler 2001; Eskalen *et al*. 2007a). In addition, esca fungi are also thought to spread and establish during nursery operations as a result of infected propagation material (Aroca *et al*. 2010). Although *P. aleophilum* and *P. chlamydospora* are the main species involved in esca and Petri disease, some additional *Phaeoacremonium* spp. have also been reported from grapevine, however there is some uncertainty regarding their significance in the etiology of the disease in California (these species are listed to the left) (University of California 2013b). In addition, there has been some contention as to the validity of records for these additional species in California, with recent molecular work showing some records are in fact misidentifications of *P. aleophilum*. This has been the case for *P. inflatipes*, and some questions have also been raised in relation to *P. angustius* (Rooney-Latham *et al*. 2005b). For *P. parasiticum* and *P. rubrigenum*, these species have only been recorded as human pathogens in California (Dupont *et al*. 2002; Mostert *et al*. 2005), with no association with commercial grapevine production established. Reports of an additional two species, *P. mortoniae* and *P. viticola*, have been detected from Californian vineyards (Groenewald *et al*. 2001; Eskalen *et al*. 2005a; Eskalen *et al*. 2005b), however following a review				
Phaeoacremonium parasiticum (Ajello, Georg & C.J.K. Wang) W. Gams, Crous & M.J. Wingf. 1996 Teleomorph: *Togninia parasitica* L. Mostert, W. Gams & Crous [Togniniaceae] Esca disease complex	**Yes** Present in California (Dupont *et al.* 2002);(Mostert *et al.* 2005).					
Phaeoacremonium rubrigenum W. Gams, Crous & M.J. Wingf. 1996 Teleomorph: *Togninia rubrigena* L. Mostert, W. Gams & Crous [Togniniaceae] Esca disease complex	**Yes** Present in California (University of California 2013b).					
Phaeoacremonium viticola J. Dupont 2000 Teleomorph: *Togninia viticola* L. Mostert, W. Gams & Crous [Togniniaceae] Esca disease complex	**Yes** Present in California (Eskalen *et al.* 2005a).					
Togninia californica [Togniniaceae] Esca disease complex	**Yes** Present in California (Eskalen *et al.* 2007b).					
Togninia davisiana [Togniniaceae] Esca disease complex	**Yes** Present in California (Eskalen *et al.* 2007b).					

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
		of these records for California as well as from various countries worldwide, these species have only been isolated from wood and vegetative tissue of grapevines, and not from grape bunches (Dupont *et al*. 2000; Groenewald *et al*. 2001; Eskalen *et al*. 2005b; Gramaje *et al*. 2007; Mohammadi 2011; CBS KNAW 2013). The teleomorph stages (*Togninia* spp.) have been identified for a range of *Phaeoacremonium* spp., however there is significant uncertainty regarding its role in esca disease. While there are limited reports on the occurrence of perithecia of *Togninia* species in association with grapevine, *Togninia minimia* (sexual stage of *P. aleophilum*) is the most commonly identified species in the literature, which is reported in Australia from grapevine wood (Edwards *et al*. 2006). Studies in the literature have largely identified perithecia *in vitro* and there are only limited accounts of perithecia being identified under natural conditions, where they are associated with old pruning wounds, cordons and cracks in the trunks (Eskalen *et al*. 2005a; Eskalen *et al*. 2005b), but not on berries or bunches. Moreover, official detection records indicate that *Phaeoacremonium* spp. have not been detected during inspection of table grapes from California into other Australian states and territories since trade commenced in 2002. Accordingly, these species are unlikely to be associated with fresh mature harvested commercial table grape bunches.				

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phomopsis viticola (Sacc.) Sacc. 1915 Teleomorph: *Cryptosporella viticola* Shear Synonym: *Phoma viticola* Sacc. 1880; *Phomopsis ampelopsidis* Petr. 1916; *Fusicoccum viticola* Reddick 1909. [Diaporthaceae] Phomopsis cane and leaf spot	**Yes** Present in California, including the North Coast and the San Joaquin Valley (Gubler *et al.* 2009).	**Yes** *P. viticola* can infect leaves, shoots and canes of *Vitis vinifera* (Flaherty *et al.* 1992). It infects all parts of the grape bunch including rachis, pedicels and berries (Hewitt and Pearson 1988).	**No for WA** Plant Health Australia (2001c) shows distribution records for WA, but these have been shown to be a misidentification. Sequencing of the ITS region has identified these samples as *Diaporthe australafricana* or other species of *Phomopsis* (Poole and Hammond 2011a). **Yes for other states** Present in NSW, QLD, SA and Vic. (Plant Health Australia 2001c).	**Yes** *P. viticola* is established in temperate grape growing regions throughout the world including in Africa, Asia, Australia (except Western Australia), Europe and North America (Hewitt and Pearson 1988). *P. viticola* is dispersed by rain splash and insects within the vineyard. Long distance dispersal occurs by movement of contaminated propagation material, pruning equipment and agricultural machinery (Burges *et al.* 2005).	**Yes** *P. viticola* is a serious pathogen of grapes in several viticultural regions around the world (Hewitt and Pearson 1988) and can cause vine stunting and reduced fruit yield (Burges *et al.* 2005).	**Yes**
*Pilidiella diplodiella (*Speg.) Crous & Van Niekerk Synonyms: *Coniella diplodiella* (Speg.) Petr. & Syd.; *Coniothyrium diplodiella* (Speg.) Sacc. [Schizoparmaceae] White rot	**No** Known to be present in the US (CABI 2011) with specific records for eastern states, Floida and Texas (as *Coniothyrium diplodiella*) (Farr and Rossman 2012). But no records were found for California.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Erysiphales						
Erysiphe necator var. *necator* Schwein. 1834 Anamorph: *Oidium tuckeri* Berk. 1847 Synonyms: *Uncinula necator* (Schwein.) Burrill 1892; *Uncinula americana* Howe 1872 [Erysiphaceae] Grapevine powdery mildew	**Yes** Present in California (USDA 1960).	**Yes** Affects all green tissue of the grapevine, including fruit (CABI 2011).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in Vic., SA, Tas., NT, QLD and NSW (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Eurotiales						
Aspergillus aculeatus Iizuka 1953 Synonyms: *Aspergillus japonicus* var. *aculeatus* (Iizuka) Al-Musallam 1980 [Trichocomaceae]	**Yes** Present in California (as *Aspergillus japonicus* var. *aculeatus*) (Doster *et al.* 1996).	**Yes** This is a wound pathogen of grape berries. It enters the berries through fractures caused by partial detachment of the fruit at the pedicel and through splits and insect punctures (Jarvis and Traquair 1984).	**No for WA** No records found for WA. **Yes for other states** Present in NSW (Plant Health Australia 2001c) and Victoria (Leong *et al.* 2008).	**Yes** *Aspergillus* spores drift on air currents and disperse both short and long distances. When they come into contact with solid or liquid surfaces, if the moisture conditions are right, they germinate. *Aspergillus* disperse easily and grow almost anywhere when food and water are available (Bennett 2010).	**No** *Aspergillus* spp. are secondary invaders of grape berries that have been damaged by insects, pathogens, environmental factors such as rain and wind (Somma *et al.* 2012), or through fractures caused by partial detachment of berries at the pedicel (Jarvis and Traquair 1984). Furthermore, *A. niger* is already present in WA (Plant Health Australia 2001c) and is associated with grape berries (Leong *et al.* 2006). Introduction of this species is unlikely to have significant economic effects.	**No**
Aspergillus carbonarius (Bainier) Thom 1916 Synonyms: *Sterigmatocystis carbonaria* Bainier 1880; *Rhopalocystis carbonaria* (Bainier) Grove 1911 [Trichocomaceae]	**Yes** Present in California (Rooney-Latham *et al.* 2008).	**Yes** Causes rot in grape berries (Leong *et al.* 2004).	**No for WA** No records found for WA. **Yes for other states** Present in NSW (Plant Health Australia 2001c) and Victoria (Leong *et al.* 2008).	**Yes** *Aspergillus* spores drift on air currents and disperse both short and long distances. When they come into contact with solid or liquid surfaces, if the moisture conditions are right, they germinate. *Aspergillus* disperse easily and grow almost anywhere when food and water are available (Bennett 2010).	**No** *Aspergillus* spp. are secondary invaders of grape berries that have been damaged by insects, pathogens, environmental factors such as rain and wind (Somma *et al.* 2012), or through fractures caused by partial detachment of berries at the pedicel (Jarvis and Traquair 1984). Furthermore, *A. niger* is already present in WA (Plant Health Australia 2001c) and is associated with grape berries (Leong *et al.* 2006). Introduction of this species is unlikely to have significant economic effects.	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aspergillus japonicus Saito 1906 Synonyms: *Aspergillus brunneoviolaceus* Bat. & Maia 1955 [Trichocomaceae]	**Yes** Present in California (Doster and Michailides 1994; Doster *et al.* 1996).	**Yes** Assoicated with rotting grape berries (Bejaoui *et al.* 2006; Somma *et al.* 2012).	**No records found**	**Yes** *Aspergillus* spores drift on air currents and disperse both short and long distances. When they come into contact with solid or liquid surfaces, if the moisture conditions are right, they germinate. *Aspergillus* disperse easily and grow almost anywhere when food and water are available (Bennett 2010).	**No** *Aspergillus* spp. are secondary invaders of grape berries that have been damaged by insects, pathogens, environmental factors such as rain and wind (Somma *et al.* 2012), or through fractures caused by partial detachment of berries at the pedicel (Jarvis and Traquair 1984). Furthermore, many species of *Aspergillus* are already present in Australia (Plant Health Australia 2001c) and *A. carbonarius*, *A. niger*, and *A. aculeatus* are all known to be associated with grape berries already (Leong *et al.* 2006).	**No**
Aspergillus niger Tiegh. [Trichocomaceae] <u>Black mould</u>	**Yes** Present in California, including in the San Joaquin Valley (Flaherty *et al.* 1992).	**Yes** Infects berries as a post harvest rot (Perrone *et al.* 2006).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in ACT, NSW, NT, QLD and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Penicillium sp. Link: Fr [Trichocomaceae] Penicillium rots	**Yes** *Penicillium* species are present in California, including in the San Joaquin Valley (Flaherty *et al.* 1992).	**Yes** Ripening and stored grape berries are susceptible to infection and rotting (Flaherty *et al.* 1992). A number of *Penicillium* species can infest grape berries (Duncan *et al.* 1995; Franck *et al.* 2005; Kim *et al.* 2007). Duncan *et al.* (Duncan *et al.* 1995) isolated 18 species of *Penicillium* from grape berries in California, with *P. glabrum* and *P. brevicompactum* being frequently recovered. Furthermore, *P. expansum* has been recorded on grapes (Franck *et al.* 2005) and has also been recorded in California (CABI 2011).	**Yes for WA** **Yes for other states** Many species of *Penicillium* have been recorded from all states and territories in Australia (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Order Helotiales						
Botrytis cinerea Pers.: Fr. 1794 Teleomorph: *Botryotinia fuckeliana* (de Bary) Whetzel [Sclerotiniaceae] Grey mould	**Yes** Present in California, including the Central Valley (Rosslenbroich and Stuebler 2000; Gubler *et al.* 2009).	**Yes** The fungus can grow on damaged or ripe grape berries, as well as flowers, young shoots or dead leaves (Flaherty *et al.* 1992).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in ACT, NSW, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cadophora luteo-olivacea (JFH Beyma) TC Harr. & McNew [Incertae sedis] Synonym: *Phialophora luteo-olivacea* JFH Beyma	**Yes** Present in California (Gramaje *et al.* 2011).	**No** *Cadophora luteo-olivacea* has been isolated from grapevines affected by esca and Petri disease. It is a vascular pathogen of grapevine causing black streaking of xylem tissues and lesions in trunks and pruning wounds (Halleen *et al.* 2007; Gramaje *et al.* 2009). It has been isolated from the wood, rootstocks and graft unions of grapevines (Navarrette *et al.* 2011) and are suggested to be spread via propagation material or through contamination during the grafting process (Halleen *et al.* 2007). Unlikely to be associated with fresh harvested table grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Existing California table grape policy *Pseudopezicula tetraspora* Korf, R.C. Pearson & Zhuang 1986 [1985] [Helotiaceae] Angular leaf scorch			**No records found**			
Order Hymenochaetales						

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Fomitiporia polymorpha M. Fisch. [Hymenochaetaceae]	**Yes** Present in California (Fischer 2006).	**No** *Fomitiporia polymorpha* is isolated from esca-associated white rot in grapevine (Fischer 2006). The fungus infects the woody parts of the grapevine trunk (Fischer 2006). While fruit of grapevines infected with *Fomitiporia* species occasionally show symptoms, they do not carry the fungus (CABI 2013). Symptoms on leaves and berries of grapevines infected with fungi of the genus *Fomitiporia* and other fungi associated with esca disease of grapevine are predominantly attributed to the translocation of phytotoxic fungal metabolites from the infected parts of the trunk and branches via the xylem stream (Sparapano *et al.* 2000; Bruno *et al.* 2007).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Hypocreales						
Cylindrocarpon destructans (Zinssm.) Scholten 1964 Teleomorph: *Neonectria radicicola* (Gerlach & Nilsson) Mantiri & Samuels [Nectriaceae] Black foot	**Yes** Present in California (Kodira 2007); (Scheck *et al.* 1998a).	**No** *C. destructans* is found in soil, roots, wood and herbaceous debris (Farr and Rossman 2012). In grapevine, it may cause necrotic root lesions, discolouration of the trunk and stunted growth (Halleen *et al.* 2006a). Hyphae may be present in the ray cells of the trunk and xylem vessels may become plugged with tyloses (Halleen *et al.* 2006a). A pathogeniciy study showed *C. radicicola* (= *C. destructans*) could infect inoculated green grape berries, but only when the berry skin was first damaged, indicating the fungus is a secondary invader of damaged tissue (Halleen *et al.* 2006a).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Cylindrocarpon liriodendri J.D. MacDon. & E.E. Butler 1981 Teleomorph: *Ilyonectria liriodendri* (Halleen, Rego & Crous) P. Chaverri & C. Salgado 2011 [Nectriaceae] Black foot	**Yes** Present in California (CDFA 2009);(Halleen *et al.* 2006b);(Petit and Gubler 2007).	**No** *C. liriodendri* causes back foot of grapevines (Halleen *et al.* 2006b);(Mohammadi *et al.* 2009). Black foot fungi cause necrotic root lesions and necrosis at the base of the trunk (Petit and Gubler 2005). Xylem vessels may become plugged with tyloses, leaves may appear water-stressed and vines may become stunted (Petit and Gubler 2005).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cylindrocarpon macrodidymum Halleen, Schroers & Crous Teleomorph: *Neonectria macrodidyma* Halleen, Schroers & Crous [Nectriaceae] Black foot	**Yes** Present in California (Petit and Gubler 2005).	**No** In grapevine, *C. macrodidymum* causes necrotic root lesions and necrosis at the base of the trunk (Petit and Gubler 2005). Xylem vessels may become plugged with tyloses, leaves may appear water-stressed and vines may become stunted (Petit and Gubler 2005).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Cylindrocarpon obtusisporum (Cooke & Harkn.) Wollenw. 1926 Teleomorph: *Neonectria tawa* Dingley [Nectriaceae] Black foot	**Yes** Present in Californian debris (Farr and Rossman 2012) including Tulare County (Scheck *et al.* 1998a).	**No** *C. obtusisporum* is a soil and water-borne root rot pathogen (Farr and Rossman 2012). It infects grapevines through openings or wounds on the roots and other below ground parts of the rootstock (Scheck *et al.* 1998a). It has been isolated from roots and trunks of symptomatic grapevines (Scheck *et al.* 1998a).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Fusarium oxysporum Schltdl. : Fr. 1824 Anamorph/ Teleomorph: Synonym: *Fusarium angustum* Sherb. 1915 [Nectriaceae] Fusarium wilt	**Yes** Present in California (Farr and Rossman 2006; CABI 2011).	**Yes** Mainly found as a soil saprophyte (Booth 1970), however it has been intercepted in Australia on fresh mangosteen fruit from Thailand.	**Yes for WA** **Yes for other states** Present in all states and territories (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Fusarium proliferatum (Matsushima) Nirenberg ex Gerlach & Nirenberg 1982 Synonym: *Cephalosporium proliferatum* Matsush. 1971 [Nectriaceae]	**Yes** Present in California (O'Donnell *et al.* 1998).	**Yes** Occurs widely on grape berries and has been investigated as a biocontrol agent against grapevine downy mildew (Falk *et al.* 1996).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, NT, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Fusarium sacchari (E.J. Butler) W. Gams 1971 [Nectriaceae]	**Yes** Present in California (CABI 2011)	**No** No records found of an association with table grape bunches.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Gibberella intricans Wollenw. 1930 Anamorph: *Fusarium equiseti* (Corda) Sacc. [Nectriaceae]	**Yes** Present in California (Farr and Rossman 2006).	**No** No records found of an association with table grape bunches.	**Assessment not required**.	**Assessment not required**	**Assessment not required**	**No**
Order Incertae sedis						
Cryptovalsa ampelina (Nitschke) Fuckel 1870 Anamorph: *Libertella* sp. Synonyms: *Valsa ampelina* Nitschke 1867; *Engizostoma ampelinum* (Nitschke) Kuntze 1898 [Incertae sedis]	**Yes** Present in California (Farr and Rossman 2006; Trouillas *et al.* 2010).	**No** Infects grapevine wood, causing decay of vascular tissues (Trouillas *et al.* 2011). It is not a highly virulent pathogen of grapevines (Mostert *et al.* 2004).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Order Mucorales						
Rhizopus stolonifer (Ehrenb.: Fr.) Vuill. [Mucoraceae] Anamorph: Synonyms: *Mucor stolonifer* Ehrenb. 1818; *Rhizopus artocarpi* Racib. 1959; *Rhizopus necans* Massee 1897; *Rhizopus nigricans* Ehrenb. 1821; *Rhizopus nigricans* var. luxurians J. Schröt. 1886 Fruit rot	**Yes** Present in California (Ogawa 1963; Farr and Rossman 2006).	**Yes** Found on berries at harvest (McLaughlin *et al.* 1992). It is also a storage rot (Li 2004).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, NT, QLD and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Rhizopus arrhizus A. Fischer [Mucoraceae] Anamorph: Synonyms: *Rhizopus oryzae* Went & Prins. Geerl. 1895; *Rhizopus tritici* Saito 1904 Fruit rot	**Yes** Present in California (Ogawa 1963; Farr and Rossman 2006).	**Yes** Can infect berries after injury (Flaherty *et al.* 1992). Can also cause storage rot (Li 2004) and can infect intact berries at low rates (Hewitt 1974).	**No for WA** Not present in WA (DAWA 2006a). **Yes for other states** Present in NSW and Vic. (Plant Health Australia 2001c).	**Yes** Spores are airborne (Nicholas *et al.* 1994).	**No** There are no reports of *R. arrhizus* being of economic significance on grapes in the states of Australia where it is present.	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Mycosphaerellales						
Existing California table grape policy *Mycosphaerella angulata* W.A. Jenkins 1942 [Mycosphaerellaceae] Angular leaf spot			**No records found**			
Order Phyllachorales						
Colletotrichum acutatum J.H. Simmonds 1968 Teleomorph: *Glomerella acutata* Guerber & J.C. Correll [Phyllachoraceae] Anthracnose	**Yes** Present in California (Du *et al.* 2005).	**Yes** Causes ripe rot of berries in field grown grapevines in the US (Shiraishi *et al.* 2007). It can affect most plant parts from the roots, leaves, blossoms, twigs and fruit, causing crown and fruit rots, defoliation and blossom blight (Wharton and Diéguez-Uribeondo 2004). Fruit infection can occur pre- and post-harvest and fruit affected by post-harvest infections can appear asymptomatic at the time of picking due to latent or quiescent infections (Wharton and Diéguez-Uribeondo 2004).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, QLD, SA, Tas. and Vic. (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Order Pleosporales						
Alternaria sp. Nees 1816 [Pleosporaceae]	**Yes** Present in California (Farr and Rossman 2006).	**Yes** *A. alternata* (syn. *A. tenuis*) can be present on mature grape bunches (Swart and Holz 1994; Swart *et al.* 1995).	**Yes for WA** **Yes for other states** Species of this genus are present in all states and territories (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phoma sp. Sacc. 1880 Fruit rot	**Yes** Present in the US (Farr and Rossman 2006).	**Yes** Associated with grape berries (Plant Health Australia 2001c).	**Yes for WA** **Yes for other states** Many *Phoma* species have been recorded in all states and territories of Australia (Plant Health Australia 2001c).	**Assessment not required**	**Assessment not required**	**No**
Order Pucciniales						
Phakopsora euvitis Y. Ono 2000 Anamorph: *Physopella vitis* (Thüm.) Arthur Synonym: *Aecidium meliosmae-myrianthae* Henn. & Shirae [Phakopsoraceae] Grape rust fungus	**No** Although reported as being present in parts of the US (Farr and Rossman 2006; Hennessy *et al.* 2007), there is some uncertainty around these records. Chalkley (2010) notes that only a limited number of telial specimens are reported and its occurrence in the US is largely inferred from *Uredo vitis*. However, records are limited to eastern US with Californian records being based on old specimens, with no recent supplementary records to support its occurrence in California (CABI-EPPO 2007).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Order Russulales						
Stereum hirsutum (Willd. : Fr.) Gray 1938 Synonyms: *Stereum complicatum* (Fr. : Fr.) Fr.; *Stereum rameale* (Schwein.) Burt 1890; *Stereum styracifluum* (Schwein. : Fr.) Fr. 1838 [Stereaceae] Esca disease complex	**Yes** Present in California (Farr and Rossman 2006).	**Yes** Associated with internal wood rot as part of the esca disease complex. The species is not often associated with decay in grapevine wood, but it tends to colonise the wooden stakes used in trellising in vineyards. Wind-borne basidiospores can then reach the grapevines and could therefore be present on the grape bunches (Mugnai *et al.* 1999).	**Yes for WA** Present in WA (Plant Health Australia 2001c). **Yes for other states** Present in NSW, QLD, SA and Vic. (Plant Health Australia 2001c)	**Assessment not required**	**Assessment not required**	**No**
Order Uredinales						
Existing California table grape policy ***Phakopsora ampelopsidis*** Dietel & P. Syd. 1898 Synonyms: *Physopella ampelopsidis* (Dietel & P. Syd.) Cummins & Ramachar 1958 [Phakopsoraceae] Rust			**No records found**			
Order Xylariales						
Cryptosphaeria pullmanensis Glawe 1984 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010; Trouillas and Gubler 2010).	**No** Reported as causing grapevine canker disease on wood, bark, shoots, twigs (Glawe 1984; Trouillas *et al.* 2010; Trouillas and Gubler 2010) and dead branches (Farr and Rossman 2006). Although isolates have been taken from *Vitis vinifera*, *Populus* spp. are the primary host (Farr and Rossman 2006; Trouillas *et al.* 2010). It is unlikely to be associated with fresh harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Diatrype Fr. 1849 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010)	**No** Associated with grapevine cankers (Trouillas *et al.* 2010).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Diatrype oregonensis (Wehm.) Rappaz 1987 Synonym: *Eutypella oregonensis* Wehm. 1930 [Diatrypaceae]	**Yes** Present in California (Farr and Rossman 2006; Trouillas *et al.* 2010; Trouillas and Gubler 2010).	**No** Reported as a wood pathogen in association with trunk disease of grapevine (Trouillas *et al.* 2010; Trouillas and Gubler 2010). Pathogenicity tests have shown low virulence on grapevine and it is suggested that this species is saprophytic rather than pathogenic on grapevine (Trouillas and Gubler 2010).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Diatrype stigma (Hoffm.) Fr. 1849 Synonym: *Sphaeria stigma* Hoffm. 1787 [Diatrypaceae]	**Yes** Present in California (Rolshausen *et al.* 2006; Farr and Rossman 2006; Trouillas *et al.* 2010; Trouillas and Gubler 2010).	**No** Reported from cankered wood of grapevines in California (Trouillas *et al.* 2010; Trouillas and Gubler 2010). Trouillas and Gubler (Trouillas and Gubler 2010) report colonisation of dormant canes/ mature wood causing vascular necrosis (Trouillas and Gubler 2010). Moreover, no perithecia have been found in association with grapevine material, suggesting it may not be capable of completing its life cycle on grapevines (Trouillas and Gubler 2010). It is unlikely to be associated with fresh mature grape bunches harvested for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Diatrype whitmanensis J.D. Rogers & Glawe 1983 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010; Trouillas and Gubler 2010).	**No** Occurs as a wood pathogen on its hosts with stromata developing in decorticated wood or bark (Trouillas *et al.* 2010). Only rarely observed on grapevine (Trouillas and Gubler 2010). Unlikley to be associated with fresh mature harvested grape bunches for export.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Diatrypella (Ces. & De Not.) De Not. 1863 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010).	**No** Associated with grapevine cankers (Trouillas *et al.* 2010).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Diatrypella verruciformis (Ehrh.) Nitschke 1867 Synonym: *Sphaeria verruciformis* Ehrh. 1785 [Diatrypaceae]	**Yes** Present in California (Farr and Rossman 2006; Trouillas and Gubler 2010).	**No** Reported in association with cankered wood of grapevines (Trouillas and Gubler 2010). Isolates were unable to produce lesions experimentally, suggesting it is a saprophyte rather than pathogenic on grapevines (Trouillas and Gubler 2010). Perithecia are rarely observed on grapevines, suggesting it is not capable of completing its life cycle on its grapevine hosts (Trouillas and Gubler 2010).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Eutypa lata (Pers.) Tul. & C. Tul. 1863 Anamorph: *Libertella blepharis* A.L. Sm. Synonym: *Eutypa armeniacae* Hansf. & M.V. Carter [Diatrypaceae] Eutypa dieback	**Yes** Present in California (Munkvold 2001; CABI 2011) and considered one of the most important canker diseases of grapevine in California (Trouillas and Gubler 2010).	**No** Primarily a wood pathogen causing trunk disease in older wood of grapevines (Ellis and Nita 2009). Perithecia develop on infected wood and ascospores are generally discharged in winter or early spring, germinating when contacting newly cut wood (Ellis and Nita 2009). Unlikely to be associated with mature fresh grape berries for harvest.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eutypa leptoplaca (Mont.) Rappaz 1987 Synonym: *Sphaeria milliaria* var. leptoplaca Mont. 1849 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010).	**No** Associated with grapevine cankers (Gubler *et al.* 2009).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Eutypella (Nitschke) Sacc. 1875 [Diatrypaceae]	**Yes** Present in California (Trouillas *et al.* 2010).	**No** Associated with grapevine cankers (Trouillas *et al.* 2010).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Rosellinia necatrix Prill. 1902 Anamorph*: Dematophora necatrix* R. Hartig Synonym: As *Rosellinia nacatrix* Berlese in AQSIQ (2006b) [Xylariaceae] White root rot of trees	**Yes** Has a cosmopolitan distribution (Cline 2005) that includes California (Farr and Rossman 2006; Horst 2008; CABI 2011).	**No** Occurs as a root rot (Walker and Wicks 1994; Cline 2005).	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
DOMAIN VIRUSES						
NEGATIVE SENSE SINGLE-STRANDED RNA						
Tomato spotted wilt virus Synonyms: Tomato spotted wilt tospovirus; Pineapple yellow spot virus [Bunyaviridae: Tospovirus]	**Yes** Present in many US states including California (CABI-EPPO 1999).	**Yes** Associated with fruiting stages of hosts, but seed transmission has not been demonstrated (CABI 2011).	**Yes for WA** Present in WA (CABI-EPPO 1999; CABI 2011). **Yes for other states** Present in NSW, NT, SA, Tas., Vic. (CABI-EPPO 1999; CABI 2011) and QLD (Simmonds 1966; CABI-EPPO 1999; CABI 2011).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
POSITIVE SENSE SINGLE-STRANDED RNA						
Broad bean wilt virus (BBWV) [Secoviridae: Fabavirus]	**Yes** Two distinct species of Broad bean wilt virus are currently recognised - Broad bean wilt virus 1 and Broad bean wilt virus 2 (Zhou 2002). Hereafter, both species will be generically referred to as Broad bean wilt virus (BBWV) for consistency with historic records. In the US, specific distribution records have been reported only from the central and eastern states, including New York, South Carolina, Minnesota, Ohio, Vermont, Wisconsin and Florida (Lockhart and Betzold 1982; Scott and Barnett 1984; Rist and Lorbeer 1991; CABI 2011). Although generic references consider BBWV to be widespread (CABI 2011), no specific reports of BBWV in California have been identified. However, acknowledging that no specific regulatory measures are implemented by the US against BBWV on imported commodities (APHIS 2000), it is feasible that BBWV could be present in California at low levels, but not reported.	**No** While BBWV is reported as an important pathogen of a number of different crops, it is considered to be only a rare virus in grapevine (Martelli 1999). Following a review of the literature, only two records of BBWV in grapevine can be found – one from Bulgaria in 1979 with no specifics provided (Yankulova and Kaitazova 1979); and the other from South Africa in 1983 which reported its isolation from a grapevine leaf extract (du Plessis 1983; Castrovilli *et al.* 1985). Further, Pearson (1993) also noted that BBWV is not known as a disease of grapevine in North America. In addition, no host records for grapevine or any other host can be identified from California. Like many viruses, BBWV may have the potential for systemic infection (Biosecurity Australia 2011a). However, considering the absence of records for California, and the lack of any significant evidence demonstrating an association with grapevine more broadly, it is unlikely that BBWV is associated with the table grape export pathway.	**Assessment not required**.	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine fanleaf virus Synonyms: Grapevine arricciamento virus; Grapevine court noué virus; Grapevine fanleaf nepovirus; Grapevine infectious degeneration virus; Grapevine Reisigkrankheit virus; Grapevine roncet virus; Grapevine urticado virus; Grapevine veinbanding virus; Grapevine yellow mosaic virus [Comoviridae: Nepovirus]	**Yes** Present in California (Hewitt *et al.* 1962).	**Yes** Infects systemically; present in fruit and seed. Associated with the endosperm of grape seeds (Habili *et al.* 2001).	**No for WA** Not recorded in WA (DAWA 2006a). **Yes for other states** Present in NSW (Plant Health Australia 2001c); SA (Stansbury *et al.* 2000; Habili *et al.* 2001) and Vic. (Habili *et al.* 2001).	**Yes** Transmitted occasionally through seed (Martelli *et al.* 2001). Also transmitted by a nematode vector (*Xiphinema index*) and by grafting (Habili *et al.* 2001; CABI 2011).	**Yes** Grapevine fanleaf virus is the most serious virus disease of grapevines (Martelli *et al.* 2001; Andret-Link *et al.* 2004; Varadi *et al.* 2007). The virus causes reduced number and size of bunches (Martelli *et al.* 2001; Habili *et al.* 2001).	**Yes**
Grapevine fleck virus (GFkV) [Tymoviridae: Maculavirus]	**Yes** Present in California (Hewitt *et al.* 1962; Habili and Randles 2008; Cătălina and Elena-Cocupa 2012).	**Yes** GFkV is a phloem-limited non-mechanically transmissible virus (Martelli *et al.* 2002). There are currently no known vectors. GFkV is readily transmitted by grafting (Martelli *et al.* 2002). Due to occurrence of the virus in the vascular tissues of the host plant, there is potential for it to be carried with the importation pathway.	**Yes for WA** **Yes for other states** In a recent survey of grape growing districts of mainland Australia (NSW, SA, Qld, WA and Vic.), GFkV was detected in 69 of 218 (32%) grapevines (Constable and Rodoni 2011a).	**Assessment not required**	**Assessment not required**	**No**
Grapevine leafroll associated virus 1 (GLRaV-1) [Closteroviridae: Ampelovirus]	**Yes** Present in California, New York and Washington (Habili and Randles 2008; Olufemi *et al.* 2011).	**Yes** GLRaVs are restricted to the phloem of its hosts (Volpe *et al.* 2010). Seed transmission has not been reported (Constable and Rodoni 2011b). No information is available which specifically refers to the presence of the virus in the grape bunches. However, due to its occurrence in the vascular tissues of the host plant, there is potential for it to be carried with the importation pathway.	**Yes for WA** Present in WA (Peake *et al.* 2004).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine leafroll associated virus 2 (GLRaV-2) [Closteroviridae: Closterovirus] Synonyms: Grapevine virus C (GVC), Grapevine rootstock stem lesion associated virus (GRSLaV)	**Yes** Present in California as GLRaV-2 (Baraff 2011) and GRSLaV (Uyemoto *et al.* 2001).	**Yes** GLRaVs are restricted to the phloem of its hosts (Volpe *et al.* 2010). Seed transmission has not been reported (Constable and Rodoni 2011b). No information is available which specifically refers to the presence of the virus in the grape bunches. However, due to its occurrence in the vascular tissues of the host plant, there is potential for it to be carried with the importation pathway.	**Yes for WA (strains)** Present in WA as GLRaV-2 (Peake *et al.* 2004; Constable and Rodoni 2011b). No records found of GRSLaV strain.	**No** GLRaVs are transmitted by grafting material (CIHEAM 2006). Some GLRaVs are transmitted by mealybugs and soft scale insect vectors (Martelli 2010; CABI 2013). No records of seed transmission. GLRaVs are unlikely to be co-transported with a vector insect or to be transmitted from imported fruit to a suitable host plant given the very low mobility of scales and mealybugs. Furthermore, no vector has currently been identified for GRBaV-2.	**Assessment not required**	**No**
Grapevine leafroll associated virus 3 (GLRaV-3) [Closteroviridae: Ampelovirus]	**Yes** Present in California (Habili and Randles 2008; Sharma *et al.* 2011).	**Yes** GLRaVs are restricted to the phloem of its hosts (Volpe *et al.* 2010). Seed transmission has not been reported (Martelli *et al.* 2011; Constable and Rodoni 2011b). No information is available which specifically refers to the presence of the virus in the grape bunches. However, due to its occurrence in the vascular tissues of the host plant, there is potential for it to be carried with the importation pathway.	**Yes for WA** Present in WA (Habili and Symons 2000; Peake *et al.* 2004).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine leafroll associated virus 4 (GLRaV-4) [Closteroviridae: Ampelovirus] The taxonomy of some grapevine leafroll associated viruses has recently been revised and GLRaV-5, -6 and -9 are considered variants of GRLaV-4 (Martelli *et al.* 2012).	**Yes** Present in California. Reported as GLRaV-4, -5, -6 and -9 (Baraff 2011; Ghanem-Sabanadzovic *et al.* 2012); (Habili and Randles 2008).	**Yes** GRLaV-4 has been detected in Californian table grape bunches (Habili and Randles 2008). GLRaVs are found in the phloem tissue and infect grapevines systemically (CIHEAM 2006; Martinson *et al.* 2008).	**No for WA (variants)** GLRaV-4 is present in WA (Peake *et al.* 2004).Variants GLRaV-5 and -9 are also reported from WA (Peake *et al.* 2004; Constable 2010). No records found for variant GLRaV-6. **No for other states (variants)** GLRaV-4 is present in other Australian states (Constable and Rodoni 2011b). Variants GLRaV-5 and -9 are also reported from other states (Constable and Rodoni 2011b). No records found for variant GLRaV-6.	**No** GLRaVs are transmitted by grafting material (CIHEAM 2006). Some GLRaVs are transmitted by mealybugs and soft scale insect vectors (Martelli 2010; CABI 2013). No records of seed transmission. GLRaVs are unlikely to be co-transported with a vector insect or to be transmitted from imported fruit to a suitable host plant given the very low mobility of scales and mealybugs. Furthermore, no vector has currently been identified for GRBaV-6 .	**Assessment not required**	**No**
Grapevine leafroll associated virus 7 (GLRaV-7) [Closteroviridae]	Yes Present in California (Golino *et al.* 2012).	**Yes** GLRaV-7 limited to the phloem of its hosts (Castellano *et al.* 2010) . No information is available which specifically refers to the presence of the virus in the grape bunches. However, due to its occurrence in the vascular tissues of the host plant, there is potential for it to be carried with the importation pathway.	**No for WA** No records found. **No for other states** No records found.	**No** GLRaV-7 is not seed transmittable, does not have any known vectors (Mikona and Jelkmann 2010; Al Rwahnih *et al.* 2012b) and is spread through grafting (Golino *et al.* 2012). GLRaV-7 has the potential to spread through parasitic dodder by *Cuscuta* species (Mikona and Jelkmann 2010) . Cuscuta is a plant species and is unlikely to be attached to a grape bunch or to move to a host plant.	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine red globe virus (GRGV) [Tymoviridae: Maculavirus]	**Yes** Present in California (Al Rwahnih *et al.* 2012b).	**Yes** GRGV is part of the fleck complex of grapevines (CIHEAM 2006). This type of virus is only found in the phloem and is transmitted through propagation and grafting (Constable and Rodoni 2011a). Graft transmission can occur from rootstock to scion and vice versa (Constable and Rodoni 2011a). Due to the occurrence of the virus in the phloem, there is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** **No for other states** Not known to occur in Australia (Constable and Rodoni 2011a).	**No** There are no reported vectors for GRGV (Constable and Rodoni 2011a). No records of seed transmission Transmitted by grafting (CIHEAM 2006).	**Assessment not required**	**No**
Grapevine rupestris stem pitting associated virus (GRSPaV) [Betaflexiviridae: Foveavirus]	**Yes** Present in California (Habili and Randles 2008).	**Yes** No natural vector of RSPaV is known, but the presence of the virus in the pollen of infected vines and it's transmission through seeds have been experimentally demonstrated (Gribaudo *et al.* 2006; Lima *et al.* 2006). RSPaV is not mechanically transmissible (Minafra *et al.* 2000).	**Yes for WA** Present in WA (Habili and Symons 2000; Poole and Hammond 2011b).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine rupestris vein feathering virus (GRVFV) [Tymoviridae: Marafivirus]	**Yes** Present in California (Al Rwahnih *et al.* 2009).	**Yes** GRVFV in association with other viruses causes grapevine fleck complex or Syrah Decline (Uyemoto *et al.* 2009; Al Rwahnih *et al.* 2009). This type of virus is only found in the phloem and is transmitted through propagation and grafting (Constable and Rodoni 2011a). Graft transmission can occur from rootstock to scion and vice versa (Constable and Rodoni 2011a). Due to the occurrence of the virus in the phloem, there is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** **No for other states** Not known to occur in Australia (Constable and Rodoni 2011a).	**No** There are no reported vectors for GRVFV (Constable and Rodoni 2011a). No records of seed transmission Transmitted by grafting (CIHEAM 2006).	**Assessment not required**	**No**
Grapevine syrah virus I (GSyV-I) [Tymoviridae: Marafivirus]	**Yes** Present in California (Al Rwahnih *et al.* 2009).	**Yes** GSyV-I belongs to the family *Tymoviridae* (Constable and Rodoni 2011a). This type of virus only found in the phloem and is transmitted through propagation and grafting (Constable and Rodoni 2011a). Graft transmission can occur from rootstock to scion and vice versa (Constable and Rodoni 2011a). Due to the occurrence of the virus in the phloem, there is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** **No for other states** Not known to occur in Australia (Constable and Rodoni 2011a).	**No** There are no records of seed transmission. Transmitted by grafting (CIHEAM 2006). Constable et al. (Constable *et al.* 2010) reports no vectors for GSyV- I however, GSyV- I was detected in the leafhopper *Erythroneura variabili* (Al Rwahnih *et al.* 2009). *Erythroneura variabili* is present in California (Bentley *et al.* 2009). However, it is not on the grape bunch pathway as eggs are laid on the underside of leaves and the adults and nymphs feed on the contents of leaf cells (Bentley *et al.* 2009).	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine virus A Synonyms: Grapevine corky bark virus; Grapevine stem-pitting virus Part of the Rugose Wood Complex [Flexiviridae: Vitivirus]	**Yes** Present in California (Brunt *et al.* 1996b; Osman *et al.* 2008; Martelli 2012)	**Yes** Infects systemically (CIHEAM 2006) There is potential for it to be associated with the vascular tissues in table grape bunches.	**Yes for WA** Present in WA (Habili *et al.* 2009) **Yes for other states** Present in Vic. (Plant Health Australia 2001a), SA (Habili and Symons 2000) and QLD (Poole and Hammond 2011a).	**Assessment not required**	**Assessment not required**	**No**
Grapevine virus B (GVB) *(strains associated with grapevine corky bark)* [Betaflexividae: Vitivirus]	**Yes** Present in California (Brunt *et al.* 1996b; Osman *et al.* 2008; Martelli 2012)	**Yes** Infects systemically (CIHEAM 2006). There is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** No records found. **Other states** Recorded in Vic. and SA (Habili 2009).	**No** Not seed transmitted; transmitted by grafting; transmitted by the mealy bugs *Planococcus ficus*, *Pseudococcus longispinus* and *Ps. affinis* (CIHEAM 2006). Unlikely to be co-transported with a vector insect or to be transmitted from imported fruit to a suitable host plant.	**Assessment not required**	**No**
Grapevine virus D (GVD) [Betaflexividae: Vitivirus]	The University of California has completed studies on GVD (Rosa and Rowhani 2007), indicating that it may be present in California.	**Yes** Infects systemically (CIHEAM 2006) There is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** No records found. **Yes for other states** Endemic in Australia (Constable *et al.* 2010).	**No** No reports of natural spread (CIHEAM 2006). Unlikely to be co-transported with a vector insect or to be transmitted from imported fruit to a suitable host plant.	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine virus E (GVE) [Betaflexividae: Vitivirus]	**No for California** No record found for California. **Yes for US** Present in Washington State (Olufemi *et al.* 2013).	**Yes** Other viruses in the genus *Vitivirus* infect systemically (CIHEAM 2006). There is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** No records found. **No for other states** No records found.	**No** No records of seed or vector transmission. Other members of the genus *Vitivirus* are not known to be seed transmitted.	**Assessment not required**	**No**
Grapevine virus F (GVF) Grapevine rugose wood complex [Betaflexividae: Vitivirus]	**Yes** Present in California (Al Rwahnih *et al.* 2012c).	**Yes** Other viruses in the genus *Vitivirus i*nfect systemically (CIHEAM 2006). T here is potential for it to be associated with the vascular tissues in table grape bunches.	**No for WA** No records found. **No for other states** No records found.	**No** No records of seed or vector transmission. Other members of the genus *Vitivirus* are not known to be seed transmitted.	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Strawberry latent ringspot virus (SLRSV) Synonyms: Aesculus line pattern virus (Schmelzer and Schmidt, 1968); Rhubarb virus 5 [Secoviridae: Unassigned]	**Yes** Detected in strawberry plantings in California (Martin *et al.* 2004).	**Yes** No specific records for SLRSV in grapevines from the US (Oliver and Fuchs 2011) but it is known to occur in strawberry in California (Martin *et al.* 2004). However, SLRSV has been associated with grapevines internationally, including from the Czech Republic (Komínek 2008), Italy (Credi *et al.* 1981), Romania (Eppler *et al.* 1989) and Turkey (Akbas and Erdiller 1993). Like many viruses, SLRSV has the potential for systemic infection and can spread in propagation material (DAFF 2013b). Although not reported in Californian viticulture, its presence in California and known association with grapevine internationally suggests that SLRV could potentially be associated with the table grape export pathway and it is conservatively considered further on this basis.	**No for WA** No records found for WA. **No for other states** Recorded in SA (CABI-EPPO 1997a), but there are no further records, and DAFF considers the virus to be absent from Australia.	**No** Long distance spread occurs via infected propagation material and local dissemination occurs via its root-feeding nematode vectors - *Xiphinema diversicaudatum* and *X. coxi* (Kreiah *et al.* 1994; CABI-EPPO 1997a; Adekunle *et al.* 2006). Both nematode species are considered to be absent from Australia and so no endemic vectors are available to acquire the virus from potentially infected imported table grape bunches. Plant Health Australia (2001c)(2001) lists three detections of *X. diversicaudatum* in Victoria from 1963, however the species has since been eradicated (CABI 2011). SLRSV is seed transmitted in some hosts (Murant 1983) however there is no published evidence to support seed transmission in grapevine (DAFF 2013b). It can be transmitted via grafting (Brunt *et al.* 1996b) but rachis material is not suitable for grafting.	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tobacco necrosis virus (TNV) grape strain [Tombusviridae: Necrovirus]	**No** A grapevine-infecting strain of TNV has been reported from South Africa (Cesati and Van Regenmortel 1969). No host records for grapevine can be identified from California. Further, Pearson (1993) also noted that TNV is not known as a disease of grapevine in North America.	**Assessment not required**	**Assessment not required**	**Assessment not required**	**Assessment not required**	**No**
Tomato ringspot virus Synonyms: Blackberry (Himalaya) mosaic virus; Euonymus chlorotic ringspot virus; Euonymus ringspot virus grape yellow vein virus; grapevine yellow vein virus; Nicotiana 13 virus; peach stem pitting virus; prune brown line virus; Prunus stem pitting virus; red currant mosaic virus; tobacco ringspot virus 2; tomato ringspot nepovirus; winter peach mosaic virus [Comoviridae: Nepovirus]	**Yes** Endemic in California (Hoy and Mircetich 1984).	**Yes** Infects systemically; present in fruit and seed (Uyemoto 1975; Gonsalves 1988).	**No for WA** No records found for WA. **No for other states** Recorded in SA (Chu *et al.* 1983; Cook and Dubé 1989), but there are no further records, the infected plants no longer exist, and the virus is believed to be absent from Australia.	**Yes** Seed transmitted by grapevines occasionally (Uyemoto 1975). Also transmitted by nematodes (*Xiphinema* spp.) and by grafting (Stace-Smith 1984).	**Yes** Tomato ringspot virus causes disease in *Gladiolus* spp., *Malus pumila* (apple), *Pelargonium*, *Prunus* spp. (almond, apricot, nectarine, peach, plum, prune and sweet cherry), *Rubus* spp. (blackberry and raspberry), *Solanum lycopersicum* (tomato) and *Vitis* spp. (grapes) (Kim and Choi 1990; Brunt *et al.* 1996c; CABI 2011). Most of these species are commercially produced in Australia (Horticulture Australia Limited 2004).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
SINGLE-STRANDED DNA						
Grapevine red blotch associated virus (GRBaV) Synonym: *Grapevine cabernet franc-associated virus*; *Grapevine redleaf-associated virus* [Geminiviridae: Unassigned]	**Yes** Present in California with detections in Fresno, Mendocino, Monterey, Napa, Sonoma, San Luis Obispo and Santa Barbara counties (Sudarshana and Wolpert 2012b; Stamp and Wei 2013; Al Rwahnih *et al.* 2013b).	**No** GRBaV infects grapevine systemically and can be transmitted through grafting (Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a). Accordingly, the virus might infect vascular tissue in the grape bunches although no reports were found of the virus being detected in any part of the bunch.	**No for WA** **No for other states** Not known to present in Australia (University of Adelaide 2013).	**No** Geminiviruses are not seed transmitted (Briddon and Stanley 2009; McGarry and Ayre 2012; Sastry 2013). GRVaV is transmitted by grafting (Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a) but rachis material is not suitable for grafting. It is also transmitted by the Virginia creeper leafhopper (*Erythroneura ziczac*) (Poojari *et al.* 2013). Unlikely to be transmitted from imported fruit to a suitable host plant given *E. ziczac* is native to North America (Dmitriev and Dietrich 2007; CABI 2011); there are no species of the genus *Erythroneura* in Australia (NSW Industry & Investment 2013); and endemic leafhopper species are unlikely to feed on discarded bunch material (see Appendix D).	**Assessment not required**	**No** (See appendix D for further information)
VIROIDS						
Australian grapevine viroid [Pospiviroidae: Aspcaviroid]	**Yes** Present in California (Rezaian *et al.* 1992; Hadidi *et al.* 2003a).	**Yes** Infects systemically; present in fruit and seed (Little and Rezaian 2003; Singh *et al.* 2003b; Albrechtsen 2006b).	**Yes for WA** **Yes for other states** Present in all states and territories (Habili 2009).	**Assessment not required**	**Assessment not required**	**No**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine yellow speckle viroid-1 [Pospiviroidae: Aspcaviroid]	**Yes** Present in California (Wolpert *et al.* 1996; Szychowski *et al.* 1998).	**Yes** Infects systemically; present in fruit and seed (Li *et al.* 2006; Albrechtsen 2006b).	**No for WA** Not recorded in WA (DAWA 2006a). **Yes for other states** Present in Australia (Koltunow *et al.* 1989).	**Yes** Transmitted by grafting, abrasion and through seed (Singh *et al.* 2003b; Li *et al.* 2006; Albrechtsen 2006b).	**Yes** *Grapevine yellow speckle viroid 1* is one of the causative agents of Grapevine yellow speckle disease, individually or in combination with *Grapevine yellow speckle viroid 2* (Koltunow *et al.* 1989). There is no published evidence of significant adverse effects due to Grapevine yellow speckle disease, with many infected clones having acceptable yield and quality and not causing degeneration (Krake *et al.* 1999a). Grapevine viroids are not known to cause noticeable economic effects on winegrape production (Randles 2003). No record of economic losses caused by viroids in table grapes found. However, mixed infection of GYSVd-1 or GYSVd-2 and *Grapevine fanleaf virus* causes vein banding that has detrimental effect on the yield of certain varieties (Szychowski *et al.* 1995).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapevine yellow speckle viroid-2 [Pospiviroidae: Aspcaviroid]	**Yes** Present in California (Wolpert *et al.* 1996).	**Yes** Infects systemically; present in fruit and seed (Li *et al.* 2006; Albrechtsen 2006b).	**No for WA** Not recorded in WA (DAWA 2006a). **Yes for other states** Present in Australia (Koltunow *et al.* 1989).	**Yes** Transmitted by grafting, abrasion and through seed (Little and Rezaian 2003; Albrechtsen 2006b).	**Yes** *Grapevine yellow speckle viroid 2* is one of the causative agents of Grapevine yellow speckle disease, individually or in combination with *Grapevine yellow speckle viroid 1* (Koltunow *et al.* 1989). There is no published evidence of significant adverse effects due to Grapevine yellow speckle disease, with many infected clones having acceptable yield and quality and not causing degeneration (Krake *et al.* 1999a). Grapevine viroids are not known to cause noticeable economic effect on winegrape production (Randles 2003). No record of economic losses caused by viroids in table grapes found. However, mixed infection of GYSVd-1 or GYSVd-2 and *Grapevine fanleaf virus* causes vein banding that has detrimental effect on the yield of certain varieties (Szychowski *et al.* 1995).	**Yes**

Pest	Present in California	Potential to be on pathway	Present in Australia	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hop stunt viroid [Pospiviroidae: Hostuviroid]	**Yes** Present in California (Osman *et al.* 2012). It was found in a survey of the USDA National Clonal Germplasm Repository at the University of California, Davis. Also present in hops (*Humulus lupulus*) in Washington state (Eastwell and Nelson 2007).	**Yes** HSVd has been demonstrated to be seed transmitted in grapevines (1999), but not in any other species. Wan Chow Wah and Symons (1999) confirmed that, in grapevines, HSVd can be transmitted by seed to seedlings. (This authority is cited in (Little and Rezaian 2003) which is then cited in (Albrechtsen 2006a). HSVd infects systemically and is present in all parts of the plant (Yaguchi and Takahashi 1984; Li *et al.* 2006).	**No for WA** Not recorded in WA (DAWA 2006a). **Yes for other states** Present in SA and Vic. (Koltunow *et al.* 1988).	**Yes** Hop stunt viroid variants have been detected in grapevine, hops, sweet cherry, sour cherry, citrus, plum, peach, apricot; almond; pomegranate; common fig; and jujube (Sano *et al.* 2001; Zhang *et al.* 2009). The viroid may be transmitted via mechanical means (Sano 2003a), through cuttings and grafting (European Food Safety Authority 2008) or via grape seed (Wan Chow Wah and Symons 1999). Seed transmission has not been demonstrated in any other host and was shown not to occur in hops (Yaguchi and Takahashi 1984) and tomato (Sano *et al.* 1981). It is not pollen transmitted (Yaguchi and Takahashi 1984).	**Yes** No symptoms of disease have been observed when *Hop stunt viroid* infects grapevine (Little and Rezaian 2003) cherry, apricot, almond, pomegranate, fig and jujube (Zhang *et al.* 2009). However hop stunt viroid causes diseases in some hosts including hops (Kawaguchi-Ito *et al.* 2009); citrus (Reanwarakorn and Semancik 1999); and plum and peach (Sano 2003b).	**Yes**
Citrus exocortis viroid [Pospiviroidae: Pospiviroid]	**Yes** Present in California (CABI 2011; Adaskaveg 2012).	**Yes** Grapevine is a host of CEVd (Garcia-Arenal *et al.* 1987) and transmission of the viroid via grape seed has been observed (Wan Chow Wah and Symons 1997).	**No for WA** Not recorded in WA (DAWA 2006a). **Yes for other states** Present in NSW, Qld and SA (Barkley and Büchen-Osmond 1988).	**Yes** Transmitted by grafting, abrasion and through seed (Little and Rezaian 2003; Singh *et al.* 2003b; Albrechtsen 2006a). It can also infect all varieties of citrus (Hardy *et al.* 2008). It can also infect tomatoes, and can be carried asymptomatically in grapevine, broad bean, eggplant, turnip, carrot and ornamental plants including *Impatiens* and *Verbena* species (Singh *et al.* 2009).	**Yes** No record of economic losses caused by CEVd in grapevines was found. However, CEVd causes disease in citrus when infected budwood is grown on susceptible rootsocks (Hardy *et al.* 2008). In Australia, budwood testing for graft-transmissible citrus pathogens has been used to reduce the damage caused by the viroid (Hardy *et al.* 2008). Can also cause disease in tomato (Singh *et al.* 2009).	**Yes**

Appendix B Additional quarantine pest data

Pest assessed	***Harmonia axyridis* Pallas 1773**
Main synonyms and combination changes	*Coccinella axyridis* (Pallas), *Coccinella bisex-notata* (Herbst), *Coccinella conspcua* (Faldermann), *Coccinella aulica* (Faldermann), *Harmonia spectabilis* (Faldermann), *Coccinella succinea* (Hop), *Anatis circe* (Mulsant), *Ptychanatis yedoensis* (Takizawa).
Common name(s)	Harlequin ladybird
Main hosts	Predator of soft bodied insects (e.g. aphids, scales) (Koch 2003; Brown *et al.* 2008) in a wide range of arboreal (broadleaf and conifer) and herbaceous habitats (Ker and Carter 2004; Koch *et al.* 2006). *Cucurbita moschata* (pumpkin), *Malus domestica* (apple), *Pyrus communis* (pear), *Prunus domestica* (plum), *Prunus persica* (peach), *Rubus* sp. (raspberry) and *Vitis vinifera* (grapevine) (Koch and Galvan 2008; EPPO 2009a)
Presence in Australia	No records found
Presence in trading partner	California (Lucas *et al.* 2002; CABI 2011)
Presence elsewhere	Argentina, Austria, Belarus, Belgium, Brazil, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Japan, Jersey, Korea, Luxemburg, Mexico, Netherlands, Norway, Poland, Portugal, Romania, and eastern Russia (Siberia), Serbia, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom (Komai and Chino 1969; de Almeida and da Silva 2002; Koch 2003; Koch *et al.* 2006; Roy and Roy 2008; Brown *et al.* 2008; Su *et al.* 2009; EPPO 2009a)
Pest assessed	***Lygus hesperus* Knight 1917**
Main synonyms and combination changes	
Common name(s)	Western plant bug
Main hosts	Alfalfa, cotton, fruit and vegetables, conifers (Schowalter 2013).
Presence in Australia	No records found
Presence in trading partner	California (Mueller 2003; Mills 2012; Zalom *et al.* 2012).
Presence elsewhere	No records found
Pest assessed	***Lygus lineolaris* (Palisot 1818)**
Main synonyms and combination changes	
Common name(s)	Tarnished plant bug
Main hosts	*Amaranthus cruentus* (redshank), *Apium graveolens* (celery), *Brassica napus* var. *napus* (rape), *Brassica oleracea* var. *botrytis* (cauliflower), *Fragaria ananassa* (strawberry), *Gossypium hirsutum* (Bourbon cotton), *Medicago sativa* (lucerne), *Phaseolus lunatus* (lima bean), *Phaseolus vulgaris* (common bean), *Prunus persica* (peach), *Solanum tuberosum* (potato), *Trifolium incarnatum* (Crimson clover), *Vicia sativa* (common vetch), *Zea mays* subsp. *mays* (sweetcorn) (CABI 2011).
Presence in Australia	No records found
Presence in trading partner	California (Mueller 2003; Mueller *et al.* 2012).
Presence elsewhere	Bermuda, Canada, El Salvador, Georgia, Guatemala, Honduras, Mexico, US (CABI 2011)
Pest assessed	***Parthenolecanium corni* Bouché 1844**

Main synonyms and combination changes	*Coccus rosarum* Snellen van Volenhoven 1862, *C. tiliae* Fitch 1851, *Eulecanium corni corni* (Bouché), *E. fraxini* King 1902, *E. guignardi* King 1901, *E. kansasense* (Hunter) King 1901, *E. rosae* King 1901, *E. vini* (Bouché) Cockerell 1901, *Lecanium* (*Eulecanium*) *armeniacum* Craw; Cockerell & Parrott 1899, *L. (E.) assimile* Newstead; Reh 1903, *L. (E.) aurantiacum* Hunter 1900, *L. (E.) canadense* Cockerell; Cockerell & Parrott 1899, *L. (E.) caryarum* Cockerell 1898, *L. (E.) corylifex* Fitch; Cockerell 1896, *L. (E.) crawii* Ehrhorn Cockerell & Parrott 1899, *L. (E.) cynosbati* Fitch, Cockerell & Parrott 1899, *L. (E.) fitchii* Cockerell & Parrott 1899, *L. (E.) kingii* Cockerell 1898, *L. (E.) lintneri* Cockerell & Bennett; Cockerell 1895, *L. (E.) maclurarum* Cockerell 1898, *L. (E.) ribis* Fitch; Cockerell & Parrott 1899, *L. (E.) rugosum* Signoret; Cockerell 1896, *L. (E.) rugosum* Signoret; Cockerell 1896, *L. (E.) vini* Bouché, King & Reh 1901, *L. adenostomae* Kuwana 1901, *L. armeniacum* Craw 1891, *L. assimile* Newstead 1892, *L. canadense* Cockerell; Cockerell 1899, *L. caryae canadense* Cockerell 1895, *L. corni* Bouché 1844, *L. corni robiniarum* Marchal 1908, *L. coryli* (Linnaeus) Sulc 1908 (misidentification), *L. corylifex* Fitch 1857, *L. crawii* Ehrhorn 1898, *L. cynosbati* Fitch 1857, *L. fitchii* Signoret 1872, *L. folsomi* King 1903, *L. juglandifex* Fitch 1857, *L. kansasense* Hunter 1899, *L. lintneri* Cockerell & Bennett in Cockerell 1895, *L. maclurae* Hunter 1899, *L. obtusum* Thro 1903, *L. persicae crudum* Green 1917, *L. pruinosum armeniacum* Craw; Tyrell 1896, *L. rehi* King in King & Reh 1901, *L. ribis* Fitch 1857, *L. robiniarum* Douglas 1890, *L. rugosum* Signoret1873, *L. tarsalis* Signoret 1873, *L. vini* Bouché 1851, *L. websteri* King 1902, *L. wistariae* Signoret 1873, *Parthenolecanium corni* (Bouché); Borchsenius 1957, *P. coryli* (Linnaeus); Sulc 1908 (misidentification)
Common name(s)	European fruit lecanium
Main hosts	*Parthenolecanium corni* is highly polyphagous, attacking some 350 plant species placed in 40 families. It attacks a wide range of crops, mostly woody fruit trees and ornamentals. Primary hosts are: *Crataegus* (hawthorns), *Malus* (ornamental species apple), *Prunus domestica* (damson plums), *Prunus persica* (peach), *Ribes nigrum* (blackcurrant), *Ribes rubrum* (red currant), *Rosa* (roses), *Vitis vinifera* (grapevine) (CABI 2011).
Presence in Australia	Vic., Tas. (Plant Health Australia 2001c; CSIRO 2005) and NSW (CSIRO 2005).
Presence in trading partner	California (Golino *et al.* 2002; Ben-Dov *et al.* 2010).
Presence elsewhere	Afghanistan, Albania, Algeria, Argentina, Armenia, Austria, Azerbaijan, Belgium, Brazil, Bulgaria, Canada, Chile, China, Czech Republic, Denmark, Egypt, Finland, France, Georgia, Germany, Greece, Hungary, India, Iran, Italy, Japan, Kazakhstan, Korea (North), Korea (South), Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Malta, Mexico, Moldova, Mongolia, Netherlands, New Zealand, Norway, Pakistan, Peru, Poland, Portugal, Romania, Russian Federation, Serbia/Montenegro, Slovakia, Spain, Sweden, Switzerland, Syria, Tajikistan, Turkey, Turkmenistan, Ukraine, United Kingdom, US, Uzbekistan, Yugoslavia (CABI 2011).

Pest assessed	***Planococcus kraunhiae* Kuwana 1902**
Main synonyms and combination changes	*Dactylopius kraunhiae* (Kuwana), *Planococcus siakwanensis* (Borchsenius), *Dactylopius krounhiae* (Kuwana), *Planococcus kraunhiae* (Ferris), *Pseudococcus kraunhiae* (Fernald)
Common name(s)	Japanese mealybug
Main hosts	Reported on a wide range of plants including *Agave americana* (American aloe), *Casuarina stricta* (drooping sheoak), *Cucurbita moschata* (winter squash), *Diospyros kaki* (persimmon), *Rhododendron indicum* (azalea),*Mallotus japonicus* (food wrapper plant), *Wisteria floribunda* (Japanese wisteria), *Magnolia grandiflora* (southern magnolia), *Broussonetia kazinoki* (kozo), *Ficus carica* (common fig), *Morus alba* (white mulberry),*Musa basjoo* (Japanese banana), *Nandina domestica* (nandina), *Olea chrysophylla* (wild olive), *Platanus orientalis* (oriental plane), *Digitaria sanguinalis* (hairy crabgrass), *Portulaca oleracea* (common purslane), *Cydonia sinensis* (mock Chinese quince), *Pyrus ussuriensis* (Manchurian pear), *Coffea arabica* (arabica coffee), *Gardenia jasminoides* (common gardenia), *Citrus junos* (yuzu), *Citrus nobilis* (tangerine), *Citrus paradisi* (grapefruit) (Ben-Dov 2013).
Presence in Australia	No records found.
Presence in trading partner	California (Miller *et al.* 2005; Ben-Dov 2013).
Presence elsewhere	China, Japan, Philippines; South Korea, Taiwan (Ben-Dov 2013).

Pest assessed	***Pseudococcus calceolariae* Maskell 1879**
Main synonyms and combination changes	*Dactylopius calceolariae* Maskell, *Erium calceolariae* (Maskell) Lindinger, *Pseudococcus citrophilus* Clausen, *P. fragilis* Brain, *P. gahani* Green

Common name(s)	European fruit lecanium
Main hosts	*Abutilon* (Indian mallow), *Arachis hypogaea* (groundnut), *Brachychiton*, *Brassica* (including cabbage, cauliflower, broccoli, Brussel sprouts), *Ceanothus*, *Chenopodium* (Goosefoot), *Citrus medica* (citron), *Conium maculatum* (Poison hemlock), *Crataegus* (hawthorns), *Cydonia oblonga* (quince), *Daucus carota* (carrot), *Dodonaea viscosa* (switch sorrel), *Eugenia*, *Ficus* (fig), *Fragaria* (strawberry), *Geranium* (cranesbill), *Hedera helix* (ivy), *Helianthus*, *Heliotropium arborescens* (Cherry-pie), *Hibiscus* (rosemallows), *Juglans regia* (walnut), *Laburnum anagyroides* (laburnum), *Ligustrum*, *Lolium* (ryegrass), *Malus sylvestris* (crab apple), *M.domestica* (apple), *Malva* (mallow), *Musa paradisiaca* (plantain), *Nerium oleander* (oleander), *Pelargonium* (pelargoniums), *Pinus radiata* (radiata pine), *Pisum sativum* (pea), *Pittosporum tobira* (Japanese pittosporum), *P. undulatum* (Australian boxwood), *Polyscias* sp., *Prunus* spp. (including plums, cherries, peaches, nectarines, apricots and almonds), *Pyrus communis* (European pear), *Rheum hybridum* (rhubarb), *Rhododendron*, *Ribes sanguineum* (Flowering currant), *Rosa* (roses), *Rubus* (blackberry, raspberry), *Schinus molle* (California peppertree), *Sechium edule*, *Solanum tuberosum* (potato), *Theobroma cacao* (cocoa), *Vitis vinifera* (grapevine) (CABI 2011).
Presence in Australia	QLD, NSW, Vic., Tas. and SA (Plant Health Australia 2001c; CSIRO 2005).
Presence in trading partner	California (Ben-Dov 1994).
Presence elsewhere	Chile, China, Czechoslovakia, France, Georgia, Ghana, Italy, Madagascar, Mexico, Morocco, Namibia, Netherlands, New Zealand, Portugal, South Africa, Spain, Ukraine, United Kingdom, US (CABI 2011)

Pest assessed	***Marmara gulosa* Guillèn and Davis**
Main synonyms and combination changes	
Common name(s)	Citrus peelminer
Main hosts	Almond, acorn winter squash (*Cucurbita pepo*), angled luffa (*Luffa actuangula*) apple, apricot, avocado, cherry, citrus, cotton, cowpeas, eggplant, fig, grape, kiwi, moqua (*Benincasa hispida*), olive, papaya, peach/nectarine, peppers, pistachios, plum/prune, pomegranate, pumpkin, squash, snake gourd (*Trichosanthes anguina*), walnut, watermelon, zucchini, abutilon, ash (*Fraxinus uhdei*.), bougainvillea, chitalpa (*Chilopsis* X *Catalpa*), *Deutzia gracilis,* english laurel (*Prunus laurocerasus*), euonymus, flowering pear, forsythia, *Gardenia veitchii,* gourd, grecian laurel (*Laurus nobilis*), hibiscus, hydrangea, *Itea,* Japanese maple (*Acer palmatum*), mandevilla, mulberry (*Morus albus*), oleander, pachysandra, photinia, poinsettia, *Poplar* sp., red maple (*Acer rubrum*), rose, saucer magnolia (*Magnolia soulangiana*), star jasmin (*Trachelospermum*), sweet potato "Terrace Lime", sycamore, trumpet vine (*Campsis*), tupelo (*Nyssa sylvtica*), willow, wisteria, *Brunfelsia magnifica,* Green Amaranth (*Amaranthus hybridus*), nettleleaf goosefoot (*Chenopodium murale*), ivyleaf morningglory (*Ipomoea hederacea*), tall morningglory (*Ipomoea purpurea*), cheeseweed (*Malva parviflora*), tree tobacco (*Nicotiana glauca*), purslane (*Portulaca oleracea*) (Grafton-Cardwell 2002).
Presence in Australia	No records found
Presence in trading partner	California (Stelinski 2007; Kirkland 2009)
Presence elsewhere	Mexico, US (University of California 2013a)

Pest assessed	***Phomopsis viticola* (Sacc.) Sacc. 1915**
Main synonyms and combination changes	*Cryptosporella viticola* Shear [teleomorph], *Diaporthe viticola* Nitschke [teleomorph], *Diplodia viticola* Desm., *Fusicoccum viticolum* Reddick, *Phoma flaccida* Viala & Ravaz, *Phoma viticola* Sacc
Common name(s)	Phomopsis cane and leaf spot
Main hosts	*Vitis vinifera* (grapevine) (Flaherty *et al.* 1992)
Presence in Australia	NSW, QLD, SA and Vic. (Plant Health Australia 2001c).
Presence in trading partner	California, including the North Coast and the San Joaquin Valley (Gubler *et al.* 2009).

Presence elsewhere	Algeria, Argentina, Austria, Belgium, Bosnia-Herzegovina, Brazil, Bulgaria, Canada, Chile, China, Croatia, Egypt, France, Georgia, Germany, Greece, Hungary, India, Italy, Japan, Jersey, Kenya, Macedonia, Moldova, Netherlands, New Zealand, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovenia, South Africa, Spain, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, US, Venezuela, Yugosavlia (former), Zimbabwe (CABI 2011)

Pest assessed	**Grapevine fanleaf virus**
Main synonyms and combination changes	Grapevine arricciamento virus; Grapevine court noué virus; Grapevine fanleaf nepovirus; Grapevine infectious degeneration virus; Grapevine Reisigkrankheit virus; Grapevine roncet virus; Grapevine urticado virus; Grapevine veinbanding virus; Grapevine yellow mosaic virus
Common name(s)	Grapevine fanleaf virus
Main hosts	*Vitis vinifera* (grapevine)
Presence in Australia	NSW (Plant Health Australia 2001c); SA (Stansbury *et al.* 2000; Habili *et al.* 2001) and Vic. (Habili *et al.* 2001).
Presence in trading partner	California (Hewitt *et al.* 1962)
Presence elsewhere	Albania, Algeria, Argentina, Armenia, Austria, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, Chile, China, Croatia, Cyprus, Czech Republic, Egypt, France, Germany, Greece, Hungary, Iran, Israel, Italy, Japan, Jordan, Kazakhstan, Lebanon, Macendonia, Madagascar, Malta, Mexico, Moldova, Morocco, New Zealand, Nigeria, Philippines, Portugal, Romania, Russian Federation, Serbia and Montenegro, Slovakia, Slovenia, South Africa, Spain, Switzerland, Syria, Ukraine, US, Venezuela, Tunisia, Turkey (CABI 2011).

Pest assessed	**Tomato ringspot virus**
Main synonyms and combination changes	Blackberry (Himalaya) mosaic virus; Euonymus chlorotic ringspot virus; Euonymus ringspot virus grape yellow vein virus; grapevine yellow vein virus; Nicotiana 13 virus; peach stem pitting virus; prune brown line virus; Prunus stem pitting virus; red currant mosaic virus; tobacco ringspot virus 2; tomato ringspot nepovirus; winter peach mosaic virus
Common name(s)	Tomato ringspot virus, Ringspot and mosaic (in various hosts), Eola rasp leaf (in cherries), yellow bud mosaic (in peaches), yellow vein (in grapes), stunt or stub head (in Gladiolus), decline, crumby berry and yellow blotch curl (in raspberries), chlorosis (in Pelargonium) (English), Tomatenringfleckenkrankheit (German) (CABI-EPPO 1997b).
Main hosts	*Cornus* sp. (dogwood), *Cucumis sativus* (cucumber), *Euonymus* spp., *Fragaria* x *ananassa* (strawberry), *Fraxinus americana* (ash), *Gladiolus* sp., *Glycine max* (soybean), *Hydrangea* sp., *Lotus corniculatus* (birdsfoot-trifoil), *Malus domestica* (apple), *Nicotiana tabacum* (tobacco), Orchidaceae, *Pelargonium* sp., *Pentas lanceolata* (Egyptian starflower), *Phaseolus vulgaris* (common bean), *Prunus* spp., *Ribes nigrum* (black currant), *Ribes rubrum* (red current), *Ribes uva-crispa* (gooseberry), *Rubus* sp. (blackberry), *Rubus idaeus* (raspberry), *Sambucus canadensis* (elderberry), *Solanum lycopersicum* (tomato), *Solanum tuberosum* (potato), *Vaccinium corymbosum* (blueberry), *Vigna unguiculata* (cowpea), *Vitis Vinifera* (grapevine) (Chu *et al.* 1983; Stace-Smith 1984; Sherf and MacNab 1986; Brown *et al.* 1993; CABI-EPPO 1997b; EPPO 2005; Adaskaveg and Caprile 2010; Adaskaveg *et al.* 2012) and weeds, including *Chenopodium berlandieri* (lambsquarters), *Cichorium intyhus* (chicory), *Euphorbia* spp. (spurge), *Malva parviflora* (little mallow), *Medicago lupulina* (black medic), *Picris echioides* (bristly oxtongue), *Plantago* spp. (plaintain), *Prunella vulgaris* (healall), *Rumex acetosell* (sheep sorrel), *Stellaria* spp. (common chickweed), *Taraxacum officinale* (dandelion), *Trifolium repens* (white clover), *Verbascum* spp. (mullein) and *Verbascum blattaria* (moth mullein) (Powell *et al.* 1984; Tuttle and Gotlieb 1985; Adaskaveg *et al.* 2012).
Presence in Australia	Recorded in SA (Chu *et al.* 1983; Cook and Dubé 1989), but there are no further records, the infected plants no longer exist, and the virus is believed to be absent.
Presence in trading partner	Endemic in California (Hoy and Mircetich 1984).
Presence elsewhere	Argentina, Belarus, Canada, Chile, China, Croatia, Egypt, Finland, France, Germany, Greece, Iran, Ireland, Italy, Japan, Jordan, Korea, Lithuania, Mexico, New Zealand, Oman, Pakistan, Peru, Russian Federation, Serbia and Montenegro, Puerto Rico, Slovakia, Slovenia, Taiwan, Togo, Tunisia, Turkey, UK, US, Venezuela (CABI-EPPO 1997b; CABI 2011).

Pest assessed	***Grapevine yellow speckle viroid-1***
Main synonyms and combination changes	*Grapevine viroid-f* (GVd-f), *Grapevine viroid-1* (GV-1) (Little and Rezaian 2003)
Common name(s)	Grapevine yellow speckle disease

Main hosts	*Vitis vinifera* (CIHEAM 2006)
Presence in Australia	Yes (Koltunow *et al.* 1989) but not in WA (DAWA 2006a)
Presence in trading partner	California (Rezaian *et al.* 1992)
Presence elsewhere	Worldwide distribution (Martelli 1993; CIHEAM 2006) including France, Italy, Spain, Albania, Bulgaria, Cyprus, Greece, Germany (Pallás *et al.* 2003b), Tunisia (Hadidi *et al.* 2003b), China (Han *et al.* 2003) and Japan (Sano 2003c).

Pest assessed	***Grapevine yellow speckle viroid-2***
Main synonyms and combination changes	*Grapevine viroid-2* (GV-2), *Grapevine viroid-1B* (GV-1B) (Little and Rezaian 2003)
Common name(s)	Grapevine yellow speckle disease
Main hosts	*Vitis vinifera* (CIHEAM 2006)
Presence in Australia	Yes (Koltunow *et al.* 1989) but not in WA (DAWA 2006a)
Presence in trading partner	California (Rezaian *et al.* 1992)
Presence elsewhere	Worldwide distribution (Martelli 1993; CIHEAM 2006).

Pest assessed	**Hop Stunt Viroid**
Main synonyms and combination changes	None
Common name(s)	Hop Stunt Viroid
Main hosts	*Vitis vinifera* (grapevine) (Little and Rezaian 2003); *Humulus lupulus* (hops) (Sano 2003a); *Prunus armeniaca* (apricots) (Pallas *et al.* 2003); *Prunus persica* (peach) (Sano *et al.* 1989; Hassan *et al.* 2003); *Prunus domestica* (plum) (Sano *et al.* 1989; Yang *et al.* 2006); *Prunus dulcis* (almond) (Pallás *et al.* 2003); *Prunus avium* (sweet cherry) (Gazel *et al.* 2008); *Prunus cerasus* (sour cherry) (Gazel *et al.* 2008); *Ziziphus jujuba* (jujube) (Zhang *et al.* 2009); *Citrus spp.*; *Punica granatum* (pomegranate) (Astruc *et al.* 1996); *Ficus carica* (common fig) (Yakoubi *et al.* 2007)
Presence in Australia	Vic. and SA (Koltunow *et al.* 1988)
Presence in trading partner	California (European Food Safety Authority 2008; Osman *et al.* 2012) and Washington (Eastwell and Nelson 2007)
Presence elsewhere	Bosnia and Herzegovina (Matic *et al.* 2005), Canada (Michelutti *et al.* 2004); China (Guo *et al.* 2008; Zhang *et al.* 2009); Cyprus (Pallas *et al.* 1998); Czech Republic (Hassan *et al.* 2003); Finland (EPPO 2009b), Greece (Pallas *et al.* 1998); India , Italy , Jamaica (Bennett *et al.* 2009); Japan (Kawaguchi-Ito *et al.* 2009); Korea (Lee *et al.* 1988); Lebanon (Choueiri *et al.* 2002; Ghanem-Sabanadzovic and Choueiri 2003), Morocco (Pallas *et al.* 1998), Pakistan, Serbia (Mandic *et al.* 2008); Spain {Amari, 2007 77201 /id;Pallas, 1998 70922 /id}; Tunisia (Hassen *et al.* 2004); Turkey (Gazel *et al.* 2008)

Pest assessed	**Citrus exocortis viroid**
Main synonyms and combination changes	
Common name(s)	Citrus exocortis viroid
Main hosts	*Aster grandiflorus*, *Capsicum annum*, *Chrysanthemum morifolium*, *Cucumis sativus*, *Cucurbita pepo*, *Dalia variabilis*, *Datura stramonium*, *Gomphrena globosa*, *Gynura aurantiaca*, *Gynura sarmentosa*, *Lycopersicon esculentum*, *Lycopersicon peruvianum*, *Oscimum basilicum*, *Petunia axillaris*, *Petunia hybrida*, *Petunia violacea*, *Physalis floridana*, *Physalis ixocarpa*, *Physalis peruviana*, *Solanum aculeatiisium*, *Solanum dulcamara*, *Solanum hispidum*, *Solanum integrifolium*, *Solanum marginatum*, *Solanum melongena*, *Solanum quitoense*, *Solanum topiro*, *Solanum tuberosum*, *Tagetes patula*, *Zinnia elegans* (Duran-Vila and Semancik 2003).
Presence in Australia	NSW, Qld. and SA (Barkley and Büchen-Osmond 1988).

Presence in trading partner	California (CABI 2011; Adaskaveg 2012).
Presence elsewhere	Worldwide distribution. Present in Asia, Africa, North America, Central America, South America, Europe and Oceania (CABI 2011).

Appendix C Biosecurity framework

Australia's biosecurity policies

The objective of Australia's biosecurity policies and risk management measures is the prevention or control of the entry, establishment or spread of pests and diseases that could cause significant harm to people, animals, plants and other aspects of the environment.

Australia has diverse native flora and fauna and a large agricultural sector, and is relatively free from the more significant pests and diseases present in other countries. Therefore, successive Australian Governments have maintained a conservative, but not a zero-risk, approach to the management of biosecurity risks. This approach is consistent with the World Trade Organization's (WTO's) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement).

The SPS Agreement defines the concept of an 'appropriate level of protection' (ALOP) as the level of protection deemed appropriate by a WTO Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory. Among a number of obligations, a WTO Member should take into account the objective of minimising negative trade effects in setting its ALOP.

Like many other countries, Australia expresses its ALOP in qualitative terms. Australia's ALOP, which reflects community expectations through Australian Government policy, is currently expressed as providing a high level of sanitary and phytosanitary protection, aimed at reducing risk to a very low level, but not to zero.

Consistent with the SPS Agreement, in conducting risk analyses Australia takes into account as relevant economic factors:

- the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease in the territory of Australia
- the costs of control or eradication of a pest or disease
- and the relative cost-effectiveness of alternative approaches to limiting risks.

Roles and responsibilities within Australia's quarantine system

Australia protects its human[5], animal and plant life or health through a comprehensive quarantine system that covers the quarantine continuum, from pre-border to border and post-border activities.

Pre-border, Australia participates in international standard-setting bodies, undertakes risk analyses, develops offshore quarantine arrangements where appropriate, and engages with our neighbours to counter the spread of exotic pests and diseases.

At the border, Australia screens vessels (including aircraft), people and goods entering the country to detect potential threats to Australian human, animal and plant health.

The Australian Government also undertakes targeted measures at the immediate post-border level within Australia. This includes national co-ordination of emergency responses to pest and disease incursions. The movement of goods of quarantine concern within Australia's

[5] The Australian Government Department of Health and Ageing is responsible for human health aspects of quarantine.

border is the responsibility of relevant state and territory authorities, which undertake inter- and intra-state quarantine operations that reflect regional differences in pest and disease status, as a part of their wider plant and animal health responsibilities.

Roles and responsibilities within the Department

The Australian Government Department of Agriculture, Fisheries and Forestry is responsible for the Australian Government's animal and plant biosecurity policy development and the establishment of risk management measures. The Secretary of the Department is appointed as the Director of Animal and Plant Quarantine under the *Quarantine Act 1908* (the Act).

The Department takes the lead in biosecurity and quarantine policy development and the establishment and implementation of risk management measures across the biosecurity continuum, and:

- **Pre-border** conducts risk analyses, including IRAs, and develops recommendations for biosecurity policy as well as providing quarantine policy advice to the Director of Animal and Plant Quarantine
- **At the border** develops operational procedures, makes a range of quarantine decisions under the Act (including import permit decisions under delegation from the Director of Animal and Plant Quarantine) and delivers quarantine services
- **Post-border** coordinates pest and disease preparedness, emergency responses and liaison on inter- and intra-state quarantine arrangements for the Australian Government, in conjunction with Australia's state and territory governments.

Roles and responsibilities of other government agencies

State and territory governments play a vital role in the quarantine continuum. The Department works in partnership with state and territory governments to address regional differences in pest and disease status and risk within Australia, and develops appropriate sanitary and phytosanitary measures to account for those differences. Australia's partnership approach to quarantine is supported by a formal Memorandum of Understanding that provides for consultation between the Australian Government and the state and territory governments.

Depending on the nature of the good being imported or proposed for importation, DAFF may consult other Australian Government authorities or agencies in developing its recommendations and providing advice.

As well as a Director of Animal and Plant Quarantine, the Act provides for a Director of Human Quarantine. The Australian Government Department of Health and Ageing is responsible for human health aspects of quarantine and Australia's Chief Medical Officer within that Department holds the position of Director of Human Quarantine. DAFF may, where appropriate, consult with that Department on relevant matters that may have implications for human health.

The Act also requires the Director of Animal and Plant Quarantine, before making certain decisions, to request advice from the Environment Minister and to take the advice into account when making those decisions. The Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) is responsible under the *Environment Protection and Biodiversity Conservation Act 1999* for assessing the environmental impact associated with proposals to import live species. Anyone proposing to import such material should contact DSEWPC directly for further information.

When undertaking risk analyses, DAFF consults with DSEWPC about environmental issues and may use or refer to DSEWPC's assessment.

Australian quarantine legislation

The Australian quarantine system is supported by Commonwealth, state and territory quarantine laws. Under the Australian Constitution, the Commonwealth Government does not have exclusive power to make laws in relation to quarantine, and as a result, Commonwealth and state quarantine laws can co-exist.

Commonwealth quarantine laws are contained in the *Quarantine Act 1908* and subordinate legislation including the Quarantine Regulations 2000, the Quarantine Proclamation 1998, the Quarantine (Cocos Islands) Proclamation 2004 and the Quarantine (Christmas Island) Proclamation 2004.

The quarantine proclamations identify goods, which cannot be imported into Australia, the Cocos Islands and or Christmas Island unless the Director of Animal and Plant Quarantine or delegate grants an import permit or unless they comply with other conditions specified in the proclamations. Section 70 of the Quarantine Proclamation 1998, section 34 of the Quarantine (Cocos Islands) Proclamation 2004 and section 34 of the Quarantine (Christmas Island) Proclamation 2004 specify the things a Director of Animal and Plant Quarantine must take into account when deciding whether to grant a permit.

In particular, a Director of Animal and Plant Quarantine (or delegate):

- must consider the level of quarantine risk if the permit were granted, and
- must consider whether, if the permit were granted, the imposition of conditions would be necessary to limit the level of quarantine risk to one that is acceptably low, and
- for a permit to import a seed of a plant that was produced by genetic manipulation – must take into account any risk assessment prepared, and any decision made, in relation to the seed under the Gene Technology Act, and
- may take into account anything else that he or she knows is relevant.

The level of quarantine risk is defined in section 5D of the *Quarantine Act 1908*. The definition is as follows:

> reference in this Act to a *level of quarantine risk* is a reference to:
>
> (a) the probability of:
>
> (i) a disease or pest being introduced, established or spread in Australia, the Cocos Islands or Christmas Island; and
>
> (ii) the disease or pest causing harm to human beings, animals, plants, other aspects of the environment, or economic activities; and
>
> (b) the probable extent of the harm.

The Quarantine Regulations 2000 were amended in 2007 to regulate keys steps of the import risk analysis process. The Regulations:

- define both a standard and an expanded IRA;

- identify certain steps, which must be included in each type of IRA;
- specify time limits for certain steps and overall timeframes for the completion of IRAs (up to 24 months for a standard IRA and up to 30 months for an expanded IRA);
- specify publication requirements;
- make provision for termination of an IRA; and
- allow for a partially completed risk analysis to be completed as an IRA under the Regulations.

The Regulations are available at http://www.comlaw.gov.au

International agreements and standards

The process set out in the *Import Risk Analysis Handbook 2011* is consistent with Australia's international obligations under the SPS Agreement. It also takes into account relevant international standards on risk assessment developed under the International Plant Protection Convention (IPPC) and by the World Organisation for Animal Health (OIE).

Australia bases its national risk management measures on international standards where they exist and when they achieve Australia's ALOP. Otherwise, Australia exercises its right under the SPS Agreement to apply science-based sanitary and phytosanitary measures that are not more trade restrictive than required to achieve Australia's ALOP.

Notification obligations

Under the transparency provisions of the SPS Agreement, WTO Members are required, among other things, to notify other members of proposed sanitary or phytosanitary regulations, or changes to existing regulations, that are not substantially the same as the content of an international standard and that may have a significant effect on trade of other WTO Members.

Risk analysis

Within Australia's quarantine framework, the Australian Government uses risk analyses to assist it in considering the level of quarantine risk that may be associated with the importation or proposed importation of animals, plants or other goods.

In conducting a risk analysis, DAFF:

- identifies the pests and diseases of quarantine concern that may be carried by the good
- assesses the likelihood that an identified pest or disease or pest would enter, establish or spread
- assesses the probable extent of the harm that would result.

If the assessed level of quarantine risk exceeds Australia's ALOP, DAFF will consider whether there are any risk management measures that will reduce quarantine risk to achieve the ALOP. If there are no risk management measures that reduce the risk to that level, trade will not be allowed.

Risk analyses may be carried out by DAFF's specialists, but may also involve relevant experts from state and territory agencies, the Commonwealth Scientific and Industrial

Research Organisation (CSIRO), universities and industry to access the technical expertise needed for a particular analysis.

Risk analyses are conducted across a spectrum of scientific complexity and available scientific information. An IRA is a type of risk analysis with key steps regulated under the Quarantine Regulations 2000. DAFF's assessment of risk may also take the form of a non-regulated analysis of existing policy or technical advice. Further information on the types of risk analysis is provided in the *Import Risk Analysis Handbook 2011*.

Appendix D Additional information on Grapevine red blotch associated virus (GRBaV)

Stakeholders have raised concerns about the detection of grapevine red blotch-associated virus in North America. In response to these concerns, DAFF has included this additional information on the association of the virus with table grape bunches from California.

Grapevine red blotch-associated virus (GRBaV) is a virus recently identified in grapevines in the US (Krenz *et al.* 2012; Al Rwahnih *et al.* 2012a). It is associated with disease symptoms known as red blotch or grapevine red leaf disease (Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013). There have been no reports of the virus or the disease in Australia and tests on ten grapevine varieties from an Australian collection did not detect the virus (University of Adelaide 2013). GRBaV is a quarantine pest for Australia.

The first accounts of the red blotch disease in red wine grape vineyards were in 2007 (Stamp and Wei 2013). However, earlier reports of symptoms similar to those caused by grapevine leafroll-associated viruses may have been linked to GRBaV (Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a). Virtually identical isolates of GRBaV have been reported from New York, named Grapevine cabernet franc-associated virus (GCFaV); California, named Grapevine red blotch-associated virus (GRBaV), Washington, named Grapevine redleaf-associated virus (GRLaV), and British Columbia (Canada) (Krenz *et al.* 2012; Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a). All these detections are considered to be variants of the same species (Poojari *et al.* 2013).

GRBaV is very likely to be the causal agent of the observed red blotch disease symptoms as it is consistently detected in symptomatic plants (Poojari *et al.* 2013; Stamp and Wei 2013). GRBaV has been detected in bark scrapings of dormant canes, leaf petioles, leaves, root tips, rootstock and scion material (Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013; Stamp and Wei 2013; Al Rwahnih *et al.* 2013a). Symptoms of GRBaV appear to be only linked to vines with maturing bunches towards the end of the season but prior to harvest.

GRBaV infects grapevine systemically and can be transmitted through grafting (Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a). Although there are no reports of the virus being isolated from grape berries, rachis material, peduncles or seeds, there is a chance that this systemic virus could be present in all parts of the plant. GRBaV infection has also been reported to reduce the brix levels in the berries, yields and other berry quality attributes (Sudarshana and Wolpert 2012a; Poojari *et al.* 2013). Calvi (2011) and Poojari *et al.* (2013) have suggested that a vascular blockage at the leaf-petiole boundary may affect the translocation of sucrose in the phloem from leaves to fruit in vines with red leaf symptoms.

GRBaV is present in some areas in California and vines have been found to be infected in some Californian wine grape vineyards (PWV 2013; Stamp and Wei 2013). Although the majority of accounts to date associate the virus and the disease with wine grape varieties (Krenz *et al.* 2012; Sudarshana and Wolpert 2012a; Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013; Stamp and Wei 2013; Al Rwahnih *et al.* 2013a), there has been one report of the virus from a cross of Thompson Seedless x Concord (PWV 2013).

GRBaV has been assigned to the family Geminiviridae based on its genetic sequence (Krenz *et al.* 2012; Al Rwahnih *et al.* 2012a; Poojari *et al.* 2013). Geminiviridae is a large and economically important family of plant viruses referred to as geminiviruses, which have single stranded DNA genomes and geminate particles (Timmermans *et al.* 1994; Carrillo-Tripp *et al.* 2006).

If GRBaV can infect imported table grape bunches it can only establish and spread in Australia if it can transfer from that infected bunch to a host plant. Mechanisms for the potential transfer of GRBaV are considered below.

GRBaV is graft transmissible using standard grafting techniques (Poojari *et al.* 2013; Al Rwahnih *et al.* 2013a) and the grapevine rachis is not used for propagation and grafting. Mechanical transmission has been speculated for GRBaV (Stamp and Wei 2013) although there is no evidence to support this mode to transmission for GRBaV. Some geminiviruses are transmitted by mechanical abrasion in laboratory experiments but they are not naturally transmitted in this way (Rojas *et al.* 2005; Briddon and Stanley 2009; Brown *et al.* 2012).

Virus seed transmission is well studied and over 200 plant virus species are known to be seed transmissible (Sastry 2013). However, while there are over 100 species of geminiviruses, none are seed transmitted (Brown and Nelson 1988; Polston *et al.* 1993; Wong *et al.* 1993; Abdel-Salam *et al.* 1998; Sudarshana *et al.* 1998; Rojas *et al.* 2005; Carrillo-Tripp *et al.* 2006; Briddon and Stanley 2009; McGarry and Ayre 2012; Sastry 2013).

For vector transmission of GRBaV to occur, a suitable vector would need to acquire the virus from an infected bunch and transfer the virus to a susceptible host. Transmission by an insect vector is considered in more detail below.

It had been speculated that GRBaV could be spread by sap feeding vectors, with whiteflies and leafhoppers identified as potential candidates because of their known association with geminiviruses (Agri-analysis 2013; PWV 2013; Stamp and Wei 2013). One report from Stamp & Wei (2013) also suggested that aphids could potentially vector the virus but aphids do not vector other geminiviruses. DAFF have contacted the authors and they confirmed that they had no evidence of transmission by aphids.

Experimental work has now shown that the Virginia creeper leafhopper, *Erythroneura ziczac* (Walsh) (Cicadellidae), is a vector of GRBaV after a three day acquisition period on infected host foliage (Poojari *et al.* 2013). Studies are currently underway to investigate the virus-vector relationship for the western grape leafhopper, *Erythroneura elegantula* (Osborn), which is also present in western US vineyards (Poojari *et al.* 2013).

Erythroneura is a genus with many species native to North America (Dmitriev and Dietrich 2007; CABI 2013) and there are no species of the genus *Erythroneura* in Australia (NSW Industry & Investment 2013). There are many leafhopper (Cicadelladae) species in Australia (CSIRO 1991), but it is more likely that GRBaV is transmitted by leafhopper species closely related to *E. ziczac*. The leafhopper genera *Anzygina*, *Empoascanara* and *Pettya* are present in Australia and they are in the same tribe as ***Erythroneura;*** Erythroneurini, (Fletcher and Lariviere 2009; NSW Industry & Investment 2013; CSIRO 2013). There are some species currently classified in the genus *Zygina* although this genus is recognised as needing reclassification in Australia (NSW Industry & Investment 2013).

The relationships between geminiviruses and their insect vectors are typically highly specific with particular virus genera linked to a group of vectors (Timmermans *et al.* 1994; Lett *et al.* 2002; Lopez-Moya 2002; Rojas *et al.* 2005; Briddon and Stanley 2009). This specificity is partly explained by the complex circulative non-propagative mode of transmission (Timmermans *et al.* 1994; Lopez-Moya 2002). Grape vines are reported to be a host for *Bemisia tabaci* (whitefly) (DAFWA 2008). However, no geminivirus transmitted by a leafhopper is also transmitted by a whitefly (Rojas *et al.* 2005; Briddon and Stanley 2009;

Brown *et al.* 2012). If there are other vectors of GRBaV, this information suggests that they are more likely to be leafhoppers in the genus *Erythroneura*.

GRBaV transfer could potentially occur via vectors imported with the table grape bunch. *Erythroneura ziczac* feeds on grapevines in the US and all life stages are associated with leaf material, not table grape bunches (Paxton and Thorvilson 1996; Hollingsworth 2008; Ministry of Agriculture 2010). Species from the *Erythroneura* are quarantine pests for Australia (DAFF 2013a). In over ten years of trade of Californian table grapes, no leafhopper species have been found during phytosanitary inspection.

Since the table grape bunches are purchased for consumption, most berries will be eaten and it is the rachis that is more likely be discarded as waste in a range of environments. Waste disposed via municipal garbage collection will be sent to tips, where it will be commercially composted or disposed in landfill. However, smaller quantities of fruit waste will be discarded in urban, rural and natural localities including domestic composts, along roadsides, and in other environments and this may include commercial vineyards.

Taking account of the vector specificity of geminiviruses and the absence of *Erythroneura* species in Australia, it is less likely that a suitable vector is present in Australia compared to North America. However, given the recent research into GRBaV, the presence of a leafhopper vector in Australia cannot be dismissed. If a suitable vector is present in Australia, it would first need to feed on discarded fruit waste. Leafhoppers in the *Erythroneura* are associated with leaf material with a preference for oviposition and feeding on the lower side of the leaf (Paxton 1990; Paxton and Thorvilson 1996).

There are reports of more than 15 species of leafhoppers recorded in Australian vineyards (Glenn 2000). Several of the species recorded in vineyards were able to survive on vine leaves for nine days under no choice feeding experiments. However, field surveys between years and across multiple sites in Victoria and South Australia did not record any developmental association of leafhoppers with commercially grown vines (Glenn 2000). The presence of the leafhoppers in the vineyards was positively correlated with host weed species growing within and around the vineyards (Glenn 2000). When leafhoppers where collected around the vine, adults were collected in greater numbers near the trunk rather than in the canopy (Glenn 2000). Glenn (2000) does not report any association of Australian leafhoppers with grape bunches.

There are no reports of leafhoppers as pests on grapevine in Australia from state departments of agriculture (such as the 2011/2012 viticulture spray guide, (Loch 2007; DAFWA 2011) or from the peak industry research body (GWRDC 2013a). For example, a survey was conducted by the Grape Wine Research Development Corporation (GWRDC) in 2011 on the pest profile in vineyards that included 354 responses from all grape growing states in Australia (GWRDC 2013b). The respondents note several insects as pests (light brown apple moth, locusts, earwigs, mealy bugs etc) though there are no reports of leafhoppers (GWRDC 2013b). GWRDC website also includes information on pest and diseases of grapevines and there is no information on leafhoppers (GWRDC 2013a).

For a suitable leafhopper vector associated with *Vitis* spp in Australia to transmit GRBaV it would first need to feed on infected table grape bunch material. However, plant material severed from the transpiration stream will lose moisture and sap sucking insects are known to respond negatively to plant tissues under moisture stress (Huberty and Denno 2004). A review of the scientific literature showed chewing insects were not affected by moisture stressed host plant tissue. In contrast, sap-feeding insects, such as leafhoppers, responded negatively to moisture stress (Huberty and Denno 2004). More specifically, egg, nymphal and adult densities of leafhoppers in the *Erythroneura* genus are known to respond negatively when irrigation water deficits are imposed on commercial grapevines (Daane *et al.* 1995; Costello 2008). In a trial conducted in California, the number of adult leafhoppers recorded on moisture stressed vines (no supplementary irrigation during the growing season) decreased by over 90% compared to vines receiving commercial rates of irrigation (Daane *et al.* 1995). In this study, the moisture stressed vines yielded 15.7 tonnes per hectare compared to vines that received commercial rates of irrigation that yielded 48 tonnes per hectare (Daane *et al.* 1995). This level of moisture stress imposed on a living plant, which still yielded fruit, is likely to be significantly less than what would occur in harvested material severed from the transpiration stream of the plant.

Harvested table grape bunches are known to be perishable and begin to desiccate during transport. Well developed cold storage techniques have been developed to minimise this water loss (Litcher *et al.* 2008; (Meng *et al.* 2008; Candir *et al.* 2011). The mechanism that influences the rate of moisture loss is the difference in water potential in the commodity and the atmosphere (water vapour deficit) that is largely influenced by humidity and temperature (Lichter *et al.* 2011). Therefore, commodities lose less moisture at low temperatures and high relative humidity and as temperature increases and humidity decreases, water loss increases. During cold storage conditions (about 1.5 °C and 90% relative humidity), moisture loss from a table grape bunch can be between 0.41 to 6% over 60 days depending on the liner used in the packaging (Ngcobo 2013). Moisture loss is much more severe in the rachis with greater than 40% moisture loss over 60 days (Ngcobo 2013). Grapes purchased at retail outlets and then stored in a refrigerator (at about 5 °C) are considered to have a shelf life of about seven days (USDA 2011).

Once table grape bunches are exposed to ambient temperature at retail sale, moisture loss will increase. Studies have shown that table grape bunches of several varieties, including red globe and Thompson seedless, exposed to 20 °C for 3–4 days result in significant browning of the rachis and pedicles (Guelfat-Reich *et al.* 1975; Lichter *et al.* 2008). Significant browning of the rachis is known to be linked to water loss of about 2 to 3% (Crisosto *et al.* 2001; Lichter *et al.* 2011) and results in cell death (Balic *et al.* 2012). At a higher temperature (28 °C), Thompson seedless bunches recorded a 20% water loss over three days (Lo'ay 2011). Further work details the interaction between temperature and relative humidity and moisture loss in sugarone and Thompson seedless table grape bunches (Lichter *et al.* 2011). At 10 °C and 95– 99% relative humidity, moisture loss from a table grape bunches stored in punnets was recorded to be about 0.5–1% over four days; decreasing relative humidity to about 70%, increased moisture loss to about 2.5–3% (Lichter *et al.* 2011). At 20 °C and 70% relative humidity, moisture losses of about 3.5% were recorded over 4 days and water loss increased with increasing water vapour deficit. Compared to the whole bunch, at 20 °C and 70% relative humidity, moisture loss in the rachis was greater with around 15–25% moisture loss (Lichter *et al.* 2011).

After domestic consumption, any waste discarded in the environment will continue to desiccate under dry conditions. Under wet conditions, moisture loss would be delayed. However, specialist saprophytic micro-organisms will hasten the decay of discarded material under wet conditions. Saprophytes will hasten a loss of cell integrity and this rotting material is unlikely to be conducive to leafhoppers that are associated with living tissue for feeding.

Appendix E United States Standards for Grades of Table Grapes[6]

Grades

51.880 U.S. Extra Fancy Table. 51.881 U.S. Extra Fancy Export. 51.882 U.S. Fancy Table. 51.883 U.S. Fancy Export. 51.884 U.S. No. 1 Table.

51.885 U.S. No. 1 Institutional.

Tolerances

51.886 Tolerances.

Application of Tolerances 51.887 Application of tolerances. **Maturity Requirements**

51.888 Maturity requirements.

Definitions

51.889 Well developed grapes.
51.890 One variety.
51.891 Uniform in appearance.
51.892 Color terms.
51.893 Firm.
51.894 Weak.
51.895 Shriveled at capstem.
51.896 Shattered.
51.897 Wet.
51.898 Decay.
51.899 Waterberry.
51.900 Sunburn.
51.901 Damage.
51.902 Fairly well filled.
51.903 Excessively tight.
51.904 Shot berries.
51.905 Dried berries.
51.906 Well developed and strong.
51.907 Diameter.
51.908 Serious damage.
51.909 Materially shriveled at capstem.
51.910 Straggly.
51.911 Container.
51.912 Export.
51.913 Clusters.

[6] Original information can be found at http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5050367

§51.880 U.S. Extra Fancy Table.

"U.S. Extra Fancy Table" consists of bunches of well developed grapes of one variety, except when designated as assorted varieties, which are uniform in appearance, well colored, and which meet the following requirements:

(a) Basic requirements for berries:
(1) Mature;
(2) Firm;
(3) Firmly attached to capstem;
(4) Not weak;
(5) Not shriveled at capstem;
(6) Not shattered;
(7) Not split or crushed;
(8) Not wet.
(b) Basic requirements for bunches:
(1) Fairly well filled;
(2) Not excessively tight for the variety.
(c) Basic requirements for stems:
(1) Well developed and strong;
(2) Not dry and brittle;
(3) At least yellowish-green in color except for Cardinal, Robin, Exotic, and Beauty Seedless varieties.
(d) Berries free from:
(1) Decay;
(2) Waterberry;
(3) Sunburn;
(4) Almeria Spot.
(e) Stems free from:
(1) Mold;
(2) Decay.
(f) Berries not damaged by:
(1) Any other cause.
(g) Bunches not damaged by:
(1) Shot berries;
(2) Dried berries;

(3) Other defective berries;
(4) Trimming away of defective berries;
(5) Any other cause.

(h) Stems not damaged by:

(1) Freezing;
(2) Any other cause.

(i) Size:

(1) For berries: Exclusive of shot berries and dried berries, not less than 90 percent, by count, of the berries on each bunch shall have the minimum diameters indicated for varieties as follows:

(i) Ribier, Cardinal, Robin, Exotic, Queen, Italia Muscat, and other similar varieties thirteen-sixteenths of an inch.

(ii) Other varieties eleven-sixteenths of an inch.

(2) For bunches:

(i) Not less than one-half pound.

(j) For tolerances see §51.886.

§51.881 U.S. Extra Fancy Export.

"U.S. Extra Fancy Export" consists of grapes which meet the requirements for U.S. Extra Fancy Table and, in addition, meet the packaging requirements set forth in §51.912.

§51.882 U.S. Fancy Table.

"U.S. Fancy Table" consists of bunches of well developed grapes of one variety, except when designated as assorted varieties, which are at least reasonably well colored, uniform in appearance when so specified in connection with the grade, and which meet the following requirements:

(a) Basic requirements for berries:

(1) Mature;
(2) Firm;
(3) Firmly attached to capstem;
(4) Not weak;
(5) Not shriveled at capstem;
(6) Not shattered;
(7) Not split or crushed;
(8) Not wet.

(b) Basic requirements for bunches:

(1) Fairly well filled;
(2) Not excessively tight for the variety.

(c) Basic requirements for stems:

(1) Well developed and strong;
(2) Not dry and brittle.

(d) Berries free from:

(1) Decay;
(2) Waterberry;
(3) Sunburn;
(4) Almeria Spot.

(e) Stems free from:

(1) Mold;
(2) Decay.

(f) Berries not damaged by:

(1) Any other cause.

(g) Bunches not damaged by:

(1) Shot berries;
(2) Dried berries;
(3) Other defective berries;
(4) Trimming away of defective berries;
(5) Any other cause.

(h) Stems not damaged by:

(1) Freezing;
(2) Any other cause.

(i) Size:

(1) For berries: Exclusive of shot berries and dried berries, the following percentages, by count, of the berries on each bunch shall have the minimum diameters indicated for varieties as follows:

(i) For Ribier, Cardinal, Robin, Exotic, Queen, Italia Muscat, and other similar varieties, 90 percent shall be at least twelve-sixteenths of an inch;

(ii)For Thompson Seedless, Perlette, Delight, Beauty Seedless, Sugraone, Flame Seedless and other seedless varieties, 75 percent shall be at least ten-sixteenths of an inch; and,

(iii) For other varieties 90 percent shall be at least ten-sixteenths of an inch.

(2) For bunches:

(i) Not less than one-fourth pound.

(j) For tolerances see §51.886.

§51.883 U.S. Fancy Export.

"U.S. Fancy Export" consists of grapes which meet the requirements for U.S. Fancy Table, except that bunches shall weigh not less than one-half pound, and in addition meet the packaging requirements set forth in §51.912.

§51.884 U.S. No. 1 Table.

"U.S. No. 1 Table" consists of bunches of well developed grapes of one variety, except when designated as assorted varieties, which are at least fairly well colored, uniform in appearance when so specified in connection with the grade, and which meet the following requirements:

(a) Basic requirements for berries:
- (1) Mature;
- (2) Firm;
- (3) Firmly attached to capstem;
- (4) Not weak;
- (5) Not materially shriveled at capstem;
- (6) Not shattered;
- (7) Not split or crushed;
- (8) Not wet.

(b) Basic requirements for bunches:
- (1) Not straggly.

(c) Basic requirements for stems:
- (1) Not weak, or dry and brittle.

(d) Berries free from:
- (1) Decay;
- (2) Waterberry;
- (3) Sunburn.

(e) Stems free from:
- (1) Decay;
- (2) Mold.

(f) Berries not damaged by:
- (1) Any other cause.

(g) Bunches not damaged by:
- (1) Shot berries;
- (2) Dried berries;
- (3) Other defective berries;
- (4) Trimming away of defective berries;
- (5) Any other cause.

(h) Stems not damaged by:
- (1) Freezing;
- (2) Any other cause.

(i) Size:
- (1) For berries: Exclusive of shot berries and dried berries, 75 percent, by count, of the berries on each bunch shall have the minimum diameters indicated for varieties as follows:
  - (i) Thompson Seedless, Perlette, Delight, Beauty Seedless, Sugraone, Flame Seedless and other seedless varieties nine-sixteenths of an inch.
  - (ii) Other varieties ten-sixteenths of an inch.
- (2) For bunches:
  - (i) Not less than one-fourth pound.

(j) For tolerances see §51.886.

§51.885 U.S. No. 1 Institutional.

"U.S. No. 1 Institutional" grapes must have no less than 95 percent of the containers in the lot legibly marked "Institutional Pack." Further requirements for this grade include grapes which consist of clusters and/or bunches of well developed grapes of one variety, except when designated as assorted varieties, which are at least fairly well colored, uniform in appearance when so specified in connection with the grade, and which meet the following requirements:

(a) Basic requirements for berries:
- (1) Mature;
- (2) Firm;
- (3) Firmly attached to capstem;
- (4) Not weak;
- (5) Not materially shriveled at capstem;
- (6) Not shattered;
- (7) Not split or crushed;
- (8) Not wet.

(b) Basic requirements for stems:
- (1) Not weak, or dry and brittle.

(c) Berries free from:
- (1) Decay;
- (2) Waterberry;
- (3) Sunburn.

(d) Stems free from:
- (1) Mold;
- (2) Decay.

(e) Berries not damaged by:

(1) Any other cause.

(f) Bunches not damaged by:

(1) Shot berries;

(2) Dried berries;

(3) Other defective berries;

(4) Any other cause.

(g) Stems not damaged by:

(1) Freezing;

(2) Any other cause.

(h) Size:

(1) For berries: Exclusive of shot berries and dried berries, 75 percent, by count, of the berries on each bunch shall have the minimum diameters indicated for varieties as follows:

(i) Thompson Seedless, Perlette, Delight, Beauty Seedless, Sugraone, Flame Seedless and other seedless varieties nine-sixteenths of an inch.

(ii) Other varieties ten-sixteenths of an inch.

(2) For clusters/bunches: In this grade grapes shall consist of at least a two berry cluster ranging to clusters and/or bunches of grapes not greater than five ounces in weight. See Section 51.913.

(i) For tolerances see Section 51.886.

Tolerances

§51.886 Tolerances.

(a) No tolerances are provided in these standards for grapes which fail to meet the applicable maturity requirements other than the allowances specified in §51.888 or in the sampling and testing procedures of State maturity regulations.

(b) In order to allow for variations incident to proper grading and handling in each of the foregoing grades except U.S. No. 1 Institutional, tolerances, by weight, other than for maturity, are provided as set forth in Tables I and II.

Table I -- Tolerances at Shipping Point[1] [Percent]

Factor	U.S. Extra Fancy Table	U.S. Fancy Table	U.S. No. 1 Table
(A) For bunches failing to meet color requirements	10	10	10
(B) For bunches failing to meet requirements for minimum diameter of berries	10	10	10
(C) For bunches failing to meet stem color requirements	10		
(D) For offsize bunches and for bunches and berries failing to meet the remaining requirements for the grade	8	8	8
Including in (D): (a) For serious damage	2	2	2
And including in (a): (i) For decay	½ of 1	½ of 1	½ of 1

[1]Shipping point, as used in these standards, means the point of origin of the shipment in the producing area or at portof oading for ship stores or overseas shipment, or, in the case of shipments from outside the continental United States, the port of entry into the United States.

Table II Tolerances en Route or at Destination [Percent]

Factor	U.S. Extra Fancy Table	U.S. Fancy Table	U.S. No. 1 Table
(A) For bunches failing to meet color requirements	10	10	10
(B) For bunches failing to meet requirements for minimum diameter of berries	10	10	10
(C) For bunches failing to meet stem color requirements	10		
(D) For offsize bunches and for bunches and berries failing to meet the remaining requirements for the grade	12	12	12
Including in (D): (a) For permanent defects	8	8	8
(b) For serious damage	4	4	4
And including in (b): (i) For serious damage by permanent defects	2	2	2
(ii) For decay	1	1	1

(c) In order to allow for variations incident to proper grading and handling in the U.S. No. 1 Institutional grade only, tolerances, by weight, other than for maturity, are provided as set forth in Tables Ia and IIa of this section.

TABLE Ia – Tolerances at shipping point for U.S. No. 1 Institutional Grade only[1] [Percent]

Factor	U.S. No. 1 Institutional
(A) For clusters/bunches failing to meet color requirements	10
(B) For clusters/bunches failing to meet requirements for minimum diameter of berries	10
(C) For offsize clusters/bunches	4
(D) For clusters/bunches failing to meet the remaining requirements for the grade	8
Including in (D): (a) For serious damage	2
And including in (a): (i) For decay	½ of 1

[1]Shipping point, as used in these standards, means the point of origin of the shipment in the producing area or at portof oading for ship stores or overseas shipment, or, in the case of shipments from outside the continental United States, the port of entry into the United States.

TABLE IIa – Tolerances en route or at destination for U.S. No. 1 Institutional Grade only [Percent]

Factor	U.S. No. 1 Institutional
(A) For clusters/bunches failing to meet color requirements	10
(B) For clusters/bunches failing to meet requirements for minimum diameter of berries	10
(C) For offsize clusters/bunches	4
(D) For clusters/bunches failing to meet the remaining requirements for the grade	12
Including in (D): (a) For permanent defects	4
(b) For serious damage	2
And including in (b): (i) For serious damage by permanent defects	1
(ii) For decay	1

Application of Tolerances

§51.887 Application of tolerances.

The contents of the individual packages in any lot, based on sample inspection, are subject to the following limitations: Provided, That the averages for the entire lot are within the tolerances specified for the grade:

(a) For tolerances of 10 percent or more, individual packages may contain not more than one and one-half times the specified tolerance.
(b) For a tolerance of less than 10 percent, individual packages may contain not more than double the specified tolerance.

§ 51.888 Maturity requirements.

(a) In order the case of grapes grown in Arizona or California, "mature" means grapes in any lot shall meet the maturity requirements for the variety as set forth in the applicable State Agricultural Laws and

Regulations referenced in this section. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from, in the case of Arizona maturity regulations, Arizona Department of Agriculture, Citrus, Fruit and Vegetable Standardization, 1688 W. Adams, Phoenix, AZ 85007 or in the case of California maturity regulations, California Department of Food and Agriculture, Fruit and Vegetable Quality Control, Standardization Section, 1220 N Street, P.O. Box 942871, Sacramento, California 94271-0001 or copies of both regulations may be inspected at USDA, AMS, F&VD, FPB, Standardization Section, Room 2065-S, 14th and Independence Ave., Washington, DC 20250 or at the Office of the Federal Register, Suite 700, 800 North Capitol, Washington, DC.

(1) Arizona maturity regulations are contained in Chapter 4 - Plant Services Division, Article 7. Fruit And Vegetable Standardization, Section R3-4-733 Table Grape Standards, Effective January 6, 1994.

(2) California maturity regulations are contained in The California Code of Regulations, Title 3, Subchapter 4, Fresh Fruits, Nuts and Vegetables, Article 25 Table Grapes and Raisins, February 28, 1992.

(b) Grapes subject to U.S. import regulations shall meet the maturity requirements specified in such regulations.

(c) Grapes produced in States other than Arizona or California, or grapes imported from countries outside the United States during periods in which U.S. import regulations do not apply, shall meet the minimum percentage of soluble solids set forth in Table III as determined by use of a standard hand refractometer.

(d)

Table III

Variety	Percent of Soluble Solids
Muscat	17.5
All varieties not listed in this table	16.5
Cardinal, Emperor, Perlette, Ribier, Olivette, Blanche, Rish Baba, Red Malaga, and similar varieties	15.5

(1) The minimum percentage of soluble solids for any lot shall be determined from the juice of at least 10 percent, by weight, of whole bunches of the least mature grapes in that container which appears to have the least mature grapes. No lot shall be considered as failing to meet these requirements unless samples from two containers which appear to have the least mature grapes test below the required percentage of soluble solids.

Definitions

§51.889 Well developed grapes.

"Well developed" grapes means grapes which are not abnormally small for the variety.

§51.890 One variety.

"One variety" means that the grapes show similar varietal characteristics.

§51.891 Uniform in appearance.

"Uniform in appearance" means that not more than one-tenth of the containers in any lot show sufficient variation in color or size of berries to materially detract from the appearance of the contents of the individual container, and that the stems are well developed and strong.

§51.892 Color terms.

The color terms "well colored," "reasonably well colored," and "fairly well colored" are defined in Table IV.

Table IV

Color terms	Black varieties	Red varieties	White varieties
Well colored (U.S. Extra Fancy).	Each bunch shall have not less than 95 percent, by count, of berries showing good characteristic color.[1]	Each bunch shall have not less than 75 percent, by count, of berries showing good characteristic color.[1]	No requirement.
Reasonably well colored (U.S. Fancy).	Each bunch shall have not less than 85 percent, by count, of berries showing good characteristic color.[1]	Each bunch shall have not less than 66-2/3 percent, by count, of berries showing good characteristic color [1] except the Tokay and Cardinal varieties shall have not less than 75 percent, by count, of berries showing characteristic color.[2]	No requirement.
Fairly well colored (U.S. No. 1).	Each bunch shall have not less than 75 percent, by count, of berries showing characteristic color.[2]	Each bunch shall have not less than 60 percent, by count, of berries showing characteristic color.[2]	No requirement.

[1] Good characteristic color for black varieties means purple to black except that Ribier or similar varieties of grapes shall have at least two-thirds of the surface of the berry showing purple to black color. For red varieties good characteristic color means at least two-thirds of the surface of the berry is light red through dark red color; except, for the Tokay variety pink through dark red, and for the Cardinal variety light red through purple shall be permitted.

[2] Characteristic color for black varieties means reddish-purple to black except that Ribier or similar varieties of grapes shall have at least two-thirds of the surface of the berry showing reddish-purple to black color. For red varieties characteristic color means at least two-thirds of the surface of the berry is pink to dark red; except, for the Tokay variety light pink through dark red and for the Cardinal variety light pink through purple color shall be permitted.

§51.893 Firm.

"Firm" means that the berry does not yield more than slightly to moderate pressure and is not flabby or wilted.

§51.894 Weak.

"Weak" means that individual berries are somewhat translucent, watery and soft, may have relatively low sugar content, inferior flavor, or are of poor keeping quality.

§51.895 Shriveled at capstem.

"Shriveled at capstem" means that the berry shows more than slight wrinkling of the skin surrounding the capstem.

§51.896 Shattered.

"Shattered" means that the berry is separated from the bunch and may or may not have the capstem attached.

§51.897 Wet.

"Wet" means that the grapes are wet from moisture from crushed, leaking, or decayed berries or from rain. Grapes which are moist from dew or other moisture condensation such as that resulting from removing grapes from a refrigerator car or cold storage to a warmer location shall not be considered as wet.

§51.898 Decay.

"Decay" means any soft breakdown of the flesh or skin of the berry resulting from bacterial or fungus infection. Slight surface development of green mold (Cladosporium) shall not be considered decay.

§51.899 Waterberry.

"Waterberry" means a watery, soft, or flabby condition of the berry. Affected berries are low in sugar content, have tender skins, and are easily crushed. This is an advanced or more pronounced stage of the condition referred to as "weak".

§51.900 Sunburn.

"Sunburn" means injury to the berry caused by exposure to the sun, including "sulphur burn," usually occurring as a sunken and discolored or dried area on the exposed surface.

§51.901 Damage.

"Damage" means any specific defect described in this section; or an equally objectionable variation of any one of these defects, or any other defect, or any combination of defects which materially detracts from the appearance, or the edible or marketing quality of the individual berry, the appearance of the bunch as a whole, or the marketing quality of the stems.

(a) The following shall be considered as damage to the individual berry:

(1) Scarring such as that caused by thrips, mildew, rubs, and similar injuries when materially detracting from the appearance of the berry;

(2) Discoloration when any light brown, tan, or darker discoloration of the skin materially detracts from the appearance of the berry: Provided, That "sunkissed" berries of the white Malaga variety which show discoloration of amber or light brown color shall not be considered as damaged. "Buckskin" berries of the Tokay variety, and similar injury to other varieties, shall be considered as damaged by discoloration;

(3) Heat when the flesh of the berry is affected;

(4) Almeria Spot when any spot is distinctly sunken or dark in color;

(5) Mildew when active powdery mildew is present;

(6) Freezing when the berry is frozen or when the flesh of the berry is affected by freezing;

(7) Insect injury when penetrating the skin of the berry or when there is noticeable insect infestation on the bunch; when mealybug residue or aphis honeydew are present in noticeable amounts; or when leafhopper residue materially detracts from the appearance of the individual berry or of the bunch.

(b) The following shall be considered as damage to stems:

(1) Active powdery mildew or any other disease when present on the stems to the extent that it detracts from the appearance of the bunch or when scars caused by mildew or other disease constrict or weaken any part of the main or lateral stems; and,

(2) Freezing when the stems are frozen or the capstems are swollen or dried, or when the main or lateral stems are water-soaked and limp, or dried, as a result of freezing.

§51.902 Fairly well filled.

"Fairly well filled" means that the berries are reasonably closely spaced on main and lateral stems and that the bunch is not very loose or stringy.

§51.903 Excessively tight.

"Excessively tight" means that the berries are so wedged together that the bunch is extremely compact for the variety and resulting distorted berries materially detract from the appearance of the bunch.

§51.904 Shot berries.

"Shot berries" means very small berries resulting from insufficient pollination, usually seedless in those varieties which normally develop seeds.

§51.905 Dried berries.

"Dried berries" means berries which are dry and shriveled to the extent that practically no moisture is present.

§51.906 Well developed and strong.

"Well developed and strong" means that the main and lateral stems are firm, fibrous, and pliable; not distinctly immature or spindly or threadlike at time of packing.

§51.907 Diameter.

"Diameter" means the greatest dimension of the berry taken at right angles to a line running from the stem to the blossom end.

§51.908 Serious damage.

"Serious damage" means any defect or any combination of defects which seriously detracts from the appearance, or the edible or marketing quality of the grapes and includes berries which are split, crushed, wet, affected by decay or waterberry, or affected by heat or freezing. Grapes which show healed cracks at the blossom and shall not be considered as seriously damaged.

§51.909 Materially shriveled at capstem.

"Materially shriveled at capstem" means that the skin of the berry is definitely wrinkled adjacent to the capstem and the surface is materially sunken.

§51.910 Straggly.

"Straggly" means that the berries are so widely spaced on main and lateral stems that the bunch is distinctly open or very stemmy or stringy in structure.

§51.911 Container.

"Container" as used in these standards shall, for the purposes of determining maturity and other factors of grade of grapes in packages containing 5 pounds or less, mean the master container in which the individual packages are packed for shipment.

§51.912 Export.

When designated as Export, grapes shall be packed with any of the customary protective materials such as cushions, liners, or wraps, or properly packed in sawdust or granulated cork. The

so-called "semi-sawdust packs" which are cushioned and/or covered with sawdust are not approved as protective packaging for export.

§51.913 Clusters.

"Clusters" as used in these standards in reference to the U.S. No. 1 Institutional grade only shall be defined as two or more berries sharing a common point of attachment.

Metric Conversion Table

§51.914 Metric conversion table.

Inches	Millimeters (mm)
3/16 equals	4.8
8/16 equals	12.7
9/16 equals	14.3
10/16 equals	15.9
11/16 equals	17.5
12/16 equals	19.1
13/16 equals	20.6
14/16 equals	22.2
15/16 equals	23.8
1 equals	25.4
Pounds	**Grams**
1/4 equals	113.4
1/2 equals	226.8
3/4 equals	340.2
1 equals	453.6
2 equals	907.2
3 equals	1,360.8
4 equals	1,814.4
5 equals	2,268.0
10 equals	4,536.0

CFR, Title 7, Subtitle B, Chapter 1, Subchapter A, Part 35 (Export Grapes and Plums), Section 35.11[7]

Minimum requirements.

No person shall ship, or offer for shipment, and no carrier shall transport, or receive for transportation, any shipment of any variety of vinifera species table grapes unless such grapes meet the following quality and container marking requirements applicable to the variety and destination specified:

(a) Any such variety for export to destinations in Japan, Europe (defined to mean the following countries: Albania, Austria, Belgium, Bosnia, Bulgaria, Croatia, Czech Republic, Denmark, England, Finland, France, Germany, Greece, Herzegovina, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Macedonia, Montenegro, Netherlands, Northern Ireland, Norway, Poland, Portugal, Romania, Scotland, Serbia, Slovenia, Spain, Sweden, Switzerland, Wales), or Greenland shall meet each applicable minimum requirement of the U.S. Fancy Table grape grade as specified in the U.S. Standards for Grades of Table Grapes

[7]Original information can be found at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=76b761 1d096fa4f7089da1515c6afdc7&rgn=div8&view=text&node=7:2.1.1.1.9.0.231.9&idno=7

(European or Vinifera Type) (§§ 51.880-51.912 of this title). The Black Corinth variety shall be exempt from bunch and berry size requirements.

(b) Any such variety for export to any foreign destination, other than destinations in Japan, Europe, Greenland, Canada, or Mexico, shall meet each applicable minimum requirement of the U.S. No. 1 Table grape grade as specified in the U.S. Standards for Grades of Table Grapes (European or Vinifera Type) (§§ 51.880-51.912 of this title), except that an additional 2 percent tolerance for sealed berry cracks on the Ribier variety is allowed. The Black Corinth variety shall be exempt from bunch and berry size requirements.

(c) Each package of any such variety, other than those in packages of 5 pounds or less in master containers, to any destination other than in Canada or Mexico shall be plainly and conspicuously marked with the name and address of the grower or packer, the variety, and the applicable inspection lot stamp number, except that when the packages are unitized, the requirement as to inspection lot stamp marking shall be deemed as met if the exposed box ends on one end of the unit are so marked.

[41 FR 32877, Aug. 6, 1976, as amended at 61 FR 54082, Oct. 17, 1996; 76 FR 14277, Mar. 16, 2011]

Glossary

Term or abbreviation	Definition
Additional declaration	A statement that is required by an importing country to be entered on a phytosanitary certificate and which provides specific additional information on a consignment in relation to regulated pests (FAO 2012).
Anamorph	An asexual stage in the life cycle of a fungus. Also known as the imperfect state of a fungus.
Appropriate level of protection (ALOP)	The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory (WTO 1995).
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2012).
Area of low pest prevalence	An area, whether all of a country, part of a country, or all parts of several countries, as identified by the competent authorities, in which a specific pest occurs at low levels and which is subject to effective surveillance, control or eradication measures (FAO 2012).
Arthropod	The largest phylum of animals, including the insects, arachnids and crustaceans.
Asexual reproduction	The development of new individual from a single cell or group of cells in the absence of meiosis.
Biosecurity Australia	The previous name for the unit, within the Department of Agriculture, Fisheries and Forestry, responsible for recommendations for the development of Australia's biosecurity policy. These functions are undertaken within the Plant Division of the Department.
Calyx	A collective term referring to all of the sepals in a flower.
Cane (grapevine)	A cane is a ripened shoot of a grapevine that has grown from a new bud located on the cordon. A shoot is called a cane when it changes colour from green to brown during veraison. Shoots give rise to leaves, tendrils and grape clusters.
Certificate	An official document which attests to the phytosanitary status of any consignment affected by phytosanitary regulations (FAO 2012).
Consignment	A quantity of plants, plant products and/or other articles being moved from one country to another and covered, when required, by a single phytosanitary certificate (a consignment may be composed of one or more commodities or lots) (FAO 2012).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2012).
Crawler	Intermediate mobile nymph stage of certain Arthropods.
Diapause	Period of suspended development/growth occurring in some insects, in which metabolism is decreased.
Disease	A condition of part or all of an organism that may result from various causes such as infection, genetic defect or environmental stress.
Endangered area	An area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss (FAO 2012).
Endemic	Belonging to, native to, or prevalent in a particular geography, area or environment.
Endocarp	The hard inner layer of the pericarp, such as pit or stone of a cherry, peach or olive.
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO 2012).
Establishment	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2012).
Exocarp	The outer most layer of the fruit wall.
Fecundity	The fertility of an organism.
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2012).
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Genus	A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species
Grape bunch	A bunch or cluster of grapes is attached to a cane (or stem). The bunch is the entire collection of parts which starts at the peduncle and includes the laterals, rachises, pedicels and berries.

Term or abbreviation	Definition
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.
Host range	Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2012).
Hybridisation	The production of offspring of genetically different parents.
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2012).
Import risk analysis	An administrative process through which quarantine policy is developed or analysed, incorporating risk assessment, risk management and risk communication.
Infection	The internal ‘endophytic’ colonisation of a plant, or plant organ, and is generally associated with the development of disease symptoms as the integrity of cells and/or biological processes are disrupted.
Infestation (of a commodity)	Presence in a commodity of a living pest of the plant or plant product concerned. Infestation includes infection (FAO 2012).
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present and/or to determine compliance with phytosanitary regulations (FAO 2009).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced, or used (FAO 2012).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2009).
International Standard for Phytosanitary Measures (ISPM)	An international standard adopted by the Conference of the Food and Agriculture Organization, the Interim Commission on phytosanitary measures or the Commission on phytosanitary measures, established under the IPCC (FAO 2012).
Introduction	The entry of a pest resulting in its establishment (FAO 2012).
Larva	A juvenile form of animal with indirect development, undergoing metamorphosis (for example, insects or amphibians).
Lateral	The part of a grape bunch that subtends from the peduncle and gives rise to the rachises.
Lot	A number of units of a single commodity, identifiable by its homogeneity of composition, origin etc., forming part of a consignment (FAO 2012). Within this reporta ‘lot’ refers to a quantity of fruit of a single variety, harvested from a single production site during a single pick and packed at one time.
Mature fruit	Commercial maturity is the start of the ripening process. The ripening process will then continue and provide a product that is consumer-acceptable. Maturity assessments include colour, starch, index, soluble solids content, flesh firmness, acidity, and ethylene production rate.
Mesocarp	The middle, usually fleshy layer of a fruit wall.
Mortality	The total number of organisms killed by a particular disease.
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2012).
Nymph	The immature form of some insect species that undergoes incomplete metamorphosis, It is not to be confused with larva, as its overall form is already that of the adult.
Official control	The active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests (FAO 2012).
Orchard	A contiguous area of mangosteen trees operated as a single entity. Within this report a single orchard is covered under one registration and is issued a unique indentifying number.
Parthenognesis	Production of an embryo from unfertilised egg.
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2012).
Pedicel	The part of a grape bunch to which the berries are directly attached.
Peduncle	The first part of a grape bunch that is directly attached to the cane. All other parts of the bunch branch from the peduncle.
Pericarp	The tissue that arises from the ripen ovary wall of the fruit.

Term or abbreviation	Definition
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2012).
Pest categorisation	The process for determining whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non-quarantine pest (FAO 2012).
Pest free area (PFA)	An area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained (FAO 2012).
Pest free place of production	Place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period (FAO 2012).
Pest free production site	A defined portion of a place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period and that is managed as a separate unit in the same way as a pest free place of production (FAO 2012).
Pest risk analysis (PRA)	The process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it (FAO 2012).
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the introduction and spread of a pest and of the associated potential economic consequences (FAO 2012).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2012).
Phloem	In vascular plants, the tissue that carries organic nutrients to all parts of the plant where needed.
Phytosanitary certificate	Certificate patterned after the model certificates of the IPPC (FAO 2012).
Phytosanitary measure	Any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO 2012).
Phytosanitary regulation	Official rule to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests, including establishment of procedures for phytosanitary certification (FAO 2012).
Polyphagous	Feeding on a relatively large number of hosts from different plant family and/or genera.
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2012).
Production site	In this report, a production site is a continuous planting of mangosteen trees treated as a single unit for pest management purposes. If an orchard is subdivided into one or more units for pest management purposes, then each unit is a production site. If the orchard is not subdivided, then the orchard is also the production site.
Pupa	An inactive life stage that only occurs in insects that undergo complete metamorphosis, for example butterflies and moths (Lepidoptera), beetles (Coleoptera) and bees, wasps and ants (Hymenoptera).
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO 2012).
Rachis	This is the part of a grape bunch that branches into the pedicels to which the berries are then attached.
Regulated article	Any plant, plant product, storage place, packing, conveyance, container, soil and any other organism, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved (WTO 1995).
Restricted risk	Risk estimate with phytosanitary measure(s) applied.
Saprophyte	An organism deriving its nourishment from dead organic matter.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2012).
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures.
Stakeholders	Government agencies, individuals, community or industry groups or organizations, whether in Australia or overseas, including the proponent/applicant for a specific proposal, who have an interest in the policy issues.
Stamen	The male reproduction organ of a flower.

Term or abbreviation	Definition
Systems approach(es)	The integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests.
Teleomorph	The sexual stage of the life cycle of a fungus. Also called the perfect stage.
Tendril	A slender, coiled modified leaf or part of a leaf. They usually help plants attach to something.
Trash	Soil, splinters, twigs, leaves, and other plant material, other than fruit stalks.
Unrestricted risk	Unrestricted risk estimates apply in the absence of risk mitigation measures.
Vector	An organism that does not cause disease itself, but which causes infection by conveying pathogens from one host to another.
Viable	Alive, able to germinate or capable of growth.

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