Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Separation Distances between Industrial and Sensitive Land Uses

No. 3

June 2005

Western Australia

FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution and environmental harm. The EPA aims to achieve some of this through the development of environmental protection Guidance Statements for the environmental impact assessment (EIA) of proposals and schemes.

This document is one in a series being issued by the EPA to assist proponents, consultants, responsible authorities and the public generally to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for the EPA's evaluation of, and advice on, development proposals and schemes subject to the EIA process. The Guidance Statements are one part of assisting proponents and responsible authorities in achieving an environmentally acceptable outcome. Consistent with the notion of continuous environmental improvement and adaptive environmental management, the EPA expects proponents and responsible authorities to take all reasonable and practicable measures to protect the environment and to view the requirements of this guidance as representing the **minimum** necessary process to achieve an appropriate level of environmental protection.

This document provides advice on the use of generic separation distances (buffers) between industrial and sensitive land uses to avoid conflicts between incompatible land uses.

This Guidance Statement has the status of "**Final**" which means it has been reviewed by stakeholders and the public. The EPA has signed off the Guidance Statement and published it although it will be updated regularly as new information come to hand.

I am pleased to release this document which now supersedes the draft version.

Walter Cox
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

June 2005

Table of Contents

Guidance Statement No. 3

SEPARATION DISTANCES BETWEEN INDUSTRIAL AND SENSITIVE LAND USES

Key Words: buffer, industrial land use, sensitive land use, separation distance

1 PURPOSE

Guidance Statements generally are developed by the EPA to provide advice to proponents, responsible authorities[1], stakeholders and the public, about the minimum requirements for environmental management which the EPA would expect to be met when the Authority considers a proposal or scheme[1] during the EIA process. The generic process for Guidance Statements is set out in Appendix 2.

This Guidance Statement is termed "Final", and thus the EPA expects that proponents will give full attention to the information provided when they submit proposals for assessment.

This Guidance Statement replaces the draft Guidance Statements "Industrial-Residential Buffer Areas (Separation Distances)" released in July 1997, and "Separation Distances between Industrial and Sensitive Land Uses" released in June 2004. It specifically addresses generic separation distances between industrial and sensitive land uses to avoid conflicts between these land uses. It takes into account protection of the environment as defined by the *Environmental Protection Act 1986* (EP Act) with a focus on protecting sensitive land uses from unacceptable impacts on amenity that may result from industrial activities, emissions and infrastructure.

During the EIA process the EPA principally considers impacts to the physical and/or biological environment. In association with the Department of Health, it also considers health risk assessment from predicted emissions under normal operations. Industrial activities may also lead to increased levels of individual risk of fatality. The EPA currently considers off-site individual risk, as outlined in the EPA Guidance Statement No. 2 *Risk Assessment and Management: Off-site*

[1] This term is used in this Guidance Statement in the same way as it is defined in the *Environment Protection Act 1986* (see Section 7 Definitions).

individual risk from Hazardous Industrial Plant, when assessing new hazardous plant. The EPA seeks technical advice regarding off-site individual risk from the Department of Industry and Resources (DoIR), where the proposal relates to petroleum or major hazard facilities under DoIR's statutory regulation. Public risk assessment and management in Western Australia is undergoing review to ensure public safety issues are appropriately addressed by Government. It is expected that this Guidance Statement will need to be updated once the risk review and the legislative amendments to empower the responsible authority(s) has been completed.

Proponents and responsible authorities are encouraged to consider their proposals and schemes in the light of the guidance given. A proponent or responsible authority wishing to deviate from the advice in this Guidance Statement would be expected to put a well-researched, robust and clear justification arguing the need for that deviation.

This document provides the generic buffer (separation) distances referred to in the State Industrial Buffer Policy (Government of Western Australia 1997).

2 THE ISSUE

A number of emissions are generated by industrial, commercial and rural activities and infrastructure. These include noise and air emissions (gases, dust and odours). The levels of emissions may at times exceed amenity levels considered acceptable in residential areas and at other sensitive land uses.

In line with the requirements of the EP Act, it is necessary for individual industrial developers to take all reasonable and practicable measures to prevent or minimise emissions from their premises. It is generally expected that, through appropriate site layout, design of facilities, and the implementation of engineering and process controls, emissions from an individual industrial land use can be prevented from causing an adverse environmental impact beyond the boundaries of the particular site or beyond the boundaries of an industrial estate.

Generally, but not always, impacts on the environment decrease with increasing distance from the source of the emission. If the impacts from a particular industry or industrial estate are considered to be unacceptable at the boundary of the site or estate, then there is usually a need for a buffer area to separate industrial land use and sensitive land use.

The determination of the buffer area is necessary in many situations to avoid or minimise the potential for land use conflict. While not replacing the need for best practice approaches to emission management, the use of buffers is a useful tool in achieving an acceptable environmental outcome.

The EPA's preferred hierarchy for the management of industrial emissions is:

- avoidance of impacts;
- minimise the creation and discharge of waste by implementing best practice (see EPA Guidance Statement 55, *Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process*); or
- ensure environmental impacts from industrial emissions are acceptable and meet the relevant regulations and health criteria beyond the boundary of the site, industrial estate or buffer area.

The area that may be adversely affected by industrial emissions will depend on site- and process-specific factors such as the scale of the operation, plant processes and emission controls, storage of raw material and waste, local wind patterns and topography. The possibility of future expansion will also be relevant in the consideration of an appropriate separation distance.

A sound site-specific technical analysis is generally found to provide the most appropriate guide to the separation distance that should be maintained between an industry or industrial estate and sensitive land use.

However, in recognition that a site-specific study may not be necessary in all situations, generic separation distances have been developed. The generic separation distances in Appendix 1 are based on the experience of the Department of Environment (DoE) and other regulatory authorities (e.g. Environmental Protection Authority, Victoria) and limited site-specific quantitative scientific assessment. The table in Appendix 1 includes industries that historically have been associated with amenity impacts from gaseous, dust, noise and odorous emissions, as well as with elevated levels of off-site risk to the public. For some industries, separation distance ranges are specified. For others, generic distances are not applicable and separation distances need to be determined case by case.

This Guidance Statement provides advice on the use of the generic separation distances that have been developed by the DoE for a range of industrial land uses. The use and application of the generic separation distances is explained in more detail in Section 4 of this Guidance Statement.

2.1 Types of industrial land uses

For the purposes of this Guidance Statement, "industrial land use" is used in a general way to encompass a range of industrial, commercial and rural activities, and infrastructure, associated with off-site emissions that may affect adversely the amenity of sensitive land uses.

The term includes:

- general industry;
- light industry;
- service industry;
- some commercial activities, e.g. service stations;
- rural industry and some forms of agriculture;
- rural intensive land use;
- resource processing industry;
- hazardous industry;
- noxious industry;
- extractive industry;
- technology parks;
- freight terminals;
- waste water treatment plants;
- power generation facilities;
- power distribution terminals and substations;
- solid waste disposal sites;
- resource recovery plants; and
- gas and petroleum pipelines.

The table in Appendix 1 includes a variety of land uses that may require consideration of buffers to manage off-site impacts on the environment. However, the list is not definitive. Other land uses where buffers need to be considered include airports and major sporting facilities, e.g. speedway racing, football and soccer. The principles in Section 4.1 apply to these land uses as well as to those listed in Appendix 1.

2.2 Types of industrial emissions

The generic separation distances are based on the consideration of typical emissions that may affect the amenity of nearby sensitive land uses. These include:

- gaseous and particulate emissions;
- noise;
- dust; and
- odour.

The generic separation distances table also identifies a range of industrial land uses associated with higher levels of risk of injury or death from accidents.

2.3 Types of sensitive land uses

Land uses considered to be potentially sensitive to emissions from industry and infrastructure include residential developments[2], hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds, and some public buildings. Some commercial, institutional and industrial land uses which require high levels of amenity or are sensitive to particular emissions may also be considered "sensitive land uses". Examples include some retail outlets, offices and training centres, and some types of storage and manufacturing facilities.

3 SCOPE OF THE GUIDANCE

This Guidance Statement is intended to provide advice on generic separation distances between specific industry and sensitive land uses to avoid or minimise the potential for land use conflict. The distances outlined in Appendix 1 are not intended to be absolute separation distances, rather they are a default distance for the purposes of:

- identifying the need for specific separation distance or buffer definition studies; and
- providing general guidance on separation distances in the absence of site-specific technical studies.

The separation distances are intended to be used as a tool, supplemented by other appropriate techniques, to assist in the assessment of:

- new individual industries, infrastructure and estates, in the vicinity of existing/proposed sensitive land uses; and
- new individual sensitive land uses or estates, in the vicinity of existing/proposed industry and infrastructure.

The separation distances are also intended to provide assistance to strategic planning studies and processes.

The separation distances outlined are not intended to replace the need for proponents and relevant authorities to take all reasonable and practicable measures to minimise emissions and off-site impacts.

To ensure an appropriate environmental outcome, the generic separation distances will need to be complemented by other assessment tools and the consideration of the full range of environmental factors.

The reader should be aware that the generic distances do not take into account:

[2] Residential development in a planning sense can also mean subdivision.

- cumulative impacts;
- non-typical emissions;
- the protection of natural resources and significant elements of the natural environment; and
- potential health impacts from emissions.

As part of comprehensive environmental impact management, the EPA expects that these will also be considered and managed as appropriate.

3.1 Relationship of the separation distances to codes of practice and management guidelines

A number of environmental codes of practice and management guidelines issued by State Government agencies provide advice on separation distances between specific industries, other land uses and natural resources. The DoE for example has issued codes of practice on turf farms, piggeries, cattle feedlots, the poultry industry, vineyards and dairies. This Guidance Statement has attempted to incorporate advice relating to separation distances from the various codes and guidelines to provide a comprehensive overview.

Some codes and guidelines may contain more detailed information on buffers that may be relevant to the achievement of an acceptable environmental outcome.

3.2 Relationship of the separation distances to the State Industrial Buffer Policy

The Western Australia Planning Commission has prepared a Statement of Planning Policy entitled *State Industrial Buffer Policy* (Government of Western Australia 1997). This is a statutory policy prepared pursuant to the *Town Planning and Development Act 1928.* The Policy is intended to provide a consistent Statewide approach to the definition and securing of buffers for industry and infrastructure, protect industry and infrastructure from the encroachment of incompatible landuses, provide for the safety and amenity of land uses surrounding industry and infrastructure, and provide for the protection of the interests of both landowners affected by buffers, and industry and infrastructure encroached upon by sensitive land uses.

A role of this Guidance Statement is to complement and assist the implementation of the Western Australian Planning Commission's *State Industrial Buffer Policy*. The Policy makes specific reference to the generic buffer (or separation) distances developed by the DoE. At the time of publication of this Guidance Statement, the table in Appendix 1 lists the Department's and the EPA's generic separation distances.

4 THE GUIDANCE

4.1 The EPA approach to protecting the amenity of sensitive land uses from emissions from industrial land uses

As stated in Section 2, the EPA's preferred hierarchy for the management of industrial emissions is:

- avoidance of impacts;
- minimise the creation and discharge of waste by implementing best practice (see EPA Guidance Statement 55, *Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process*); or
- ensure environmental impacts from industrial emissions are acceptable and meet the relevant regulations and health criteria beyond the boundary of the site, industrial estate or buffer area.

To ensure an appropriate level of environmental protection, the EPA expects that individual industrial developers will take all reasonable and practicable measures to prevent or minimise emissions from their premises. This entails not only compliance with all recognised environmental protection criteria but also the adoption of best practicable measures for prevention or minimisation of adverse environmental impacts.

Wherever practicable, it is expected that adverse environmental impacts should not extend beyond the boundary of a particular industrial site. Where this is not possible, adverse environmental impacts should not extend beyond the boundaries of a buffer area, which should contain only compatible land uses. New sensitive land uses are not appropriate in the buffer.

Where a buffer has been agreed to by the relevant authorities, the EPA expects that effective measures will be applied, generally through the land use planning process, to ensure that only compatible land uses are allowed in the buffer area. The EPA also expects that appropriate management and monitoring of industries and the buffer area will be implemented to ensure that emissions do not exceed acceptable levels at the outer boundary of the buffer.

Generally, protection of sensitive land uses from industrial emissions is assisted by the identification of suitable buffers at the strategic and structure planning stages of the land use planning process, and in the early project formulation stages in the case of individual projects.

A sound site-specific technical analysis will provide the most appropriate guide to the separation distance that should be maintained between a particular industry and sensitive land uses, or between industrial precincts and sensitive land uses, to avoid or minimise land use conflicts.

Where a site-specific study is carried out, it should generally include a technical analysis and report on the nature and level of the possible emissions from the

industry, the site context, predicted impacts, acceptable criteria, and proposed management. Guidance on appropriate technical studies for particular circumstances is available from a range of sources including the DoE, other government agencies and the EPA, in the case of proposals and schemes subject to the EIA process.

A site-specific technical study to determine separation distances is generally expected in the case of a major heavy industrial estate, or a general industrial estate where emissions may result in cumulative impacts.

Where a proposal or scheme subject to the EIA process involves industrial development near sensitive development, the EPA will take into account the likelihood of industrial emissions that may affect the amenity of the sensitive land use, the management measures (including monitoring), and the separation proposed. Where separation is proposed, the EPA will consider the ability to apply effective mechanisms for establishing and enforcing the separation distance or buffer area.

Generally, the EPA expects the potential for land use conflicts to be resolved through the land use planning process, following consideration of adequate technical information and advice from the relevant agencies.

Generic separation distances have been developed by the EPA in recognition that a site-specific study to determine a buffer may not always be necessary, and that generic guidelines are a useful tool at the design and planning stages. The generic separation distances are included in this Guidance Statement in Appendix 1.

4.2 When to use the generic separation distances

The generic separation distances are a tool to assist in the determination of suitable distances between industry and sensitive land uses where industry may have the potential to affect the amenity of a sensitive land use.

The data is helpful in the following instances:

- to identify the need for specific buffer definition studies where:
  - a new industrial land use is proposed near an existing or proposed sensitive land use; or
  - a new sensitive land use is proposed near an existing or proposed industrial land use; and
- to provide general guidance on separation distances in the absence of site-specific technical studies, or, where only an estimation of the area that could be subject to land use conflicts is required.

It is not appropriate to use the generic separation distances where the industry involved is very large, utilises non-typical technology, or in some other way the circumstances are not typical.

Further, the separation distances should be used with caution in strategic and structure planning exercises, and in situations where cumulative impacts may result from the co-location of many industries.

4.3 Risk and the generic separation distances table

For some industries, the table indicates the possibility of risk, in the sense of risk of an accident or incident causing injury or death to the public. This is provided for general information only. The EPA's current approach to risk is to identify whether a proposal for a new hazardous plant meets the EPA's off-site individual risk criteria (EPA 2000). The EPA seeks technical advice from DoIR for proposals under DoIR's statutory responsibility.

4.4 How to use the generic separation distances in Appendix 1

The generic separation distances for a range of industrial land uses are listed in Appendix 1. This section addresses the use of the table in the following instances.

4.4.1 A new industrial land use is proposed near existing or proposed sensitive development, OR sensitive development is proposed near an existing/proposed industry

Where the separation between the industrial and sensitive land uses is **greater** than the generic distance, there will not usually be a need to carry out site-specific technical analyses to determine the likely area of amenity impacts due to emissions from the industry. The need for technical analyses is likely to be limited to such instances as major industrial developments, industries using new or non-typical processing techniques, or areas subject to cumulative impacts.

Where the separation distance is **less** than the generic distance, a scientific study based on site- and industry-specific information must be presented to demonstrate that a lesser distance will not result in unacceptable impacts.

If the distance from the industrial land use to the sensitive land use is less than the recommended separation distance, and it cannot be demonstrated that unacceptable environmental impacts are likely to be avoided, then other options should generally be pursued.

These may include:

- modifying the project to reduce emissions via engineering controls such as process design, process enclosure or other means; and
- pursuing land use planning and management controls (e.g. land acquisition, rezoning) to reduce environmental impacts to acceptable levels.

For proposals and schemes subject to the EIA process, where it cannot be demonstrated that there will be acceptable emission levels at present and future residences and other sensitive premises, the EPA is likely to recommend that the proposal or scheme is not environmentally acceptable.

If a referral is made to the EPA, information that will assist the EPA to set an appropriate level of assessment includes information on the location of existing industrial and sensitive premises, land zoning and scheme provisions, the results of any site-specific studies and consultation, and the proposed planning and environmental management measures.

4.4.2 General guidance is required on separation distances in the absence of site-specific technical studies, OR an estimation of the area that could be subject to land use conflicts is required

In most cases, land use conflicts resulting from industrial emissions are not expected where the generic separation distances are maintained. Further investigations should be carried out, however, in non-typical situations, and where cumulative impacts may occur.

Where a separation under consideration is less than in the table, it is recommended that a new project does not proceed in the absence of site-specific investigations and a report demonstrating that the separation distance will meet acceptability criteria and that enforceable management techniques will be applied to ensure an appropriate environmental outcome.

5 APPLICATION

5.1 Area

This Guidance Statement applies to all proposals and schemes subject to the EIA process throughout the State of Western Australia.

5.2 Duration and Review

The duration of this Guidance Statement is for five years unless some unforseen circumstances require it to be revised earlier.

6 RESPONSIBILITIES

6.1 EPA responsibilities

The EPA will apply this Guidance Statement to proposals and schemes that are subject to the EIA process under Part IV of the EP Act.

6.2 DoE responsibilities

The DoE will assist the EPA in applying this Guidance Statement to the EIA of proposals and schemes, and in conducting its functions under Part V of the EP Act.

6.3 Proponent and responsible authority responsibilities

Where proponents and responsible authorities demonstrate to the EPA that the requirements of this Guidance Statement are incorporated into proposals and schemes in a manner which ensures that they are enforced and audited, the assessment of such proposals and schemes is likely to be assisted.

7 DEFINITIONS

In this Guidance, the terms listed have the following definitions.

Amenity – factors which combine to form the character of an area and include the present and likely future amenity. For the purpose of this Guidance Statement, consideration of loss of amenity is limited to unreasonable impact on a person from gaseous, dust, noise and odorous emissions and risk.

Buffer – all the land between the boundary of the area that may potentially be used by an industrial land use, and the boundary of the area within which unacceptable adverse impacts due to industrial emissions on the amenity of sensitive land use are possible. This may be represented by the separation distance.

Emission – discharge of waste, emission of noise, odour or electromagnetic radiation or transmission of electromagnetic radiation.

Industrial land use, industry – a general term used in this Guidance Statement to encompass a range of industrial, commercial and rural land uses and infrastructure associated with emissions that may affect the amenity of sensitive land uses.

Residential development – any permanent structure whose primary use is as a dwelling place.

Responsible authority – as defined in the *Environmental Protection Act 1986*, and

generally, the authority responsible for:

- a town planning scheme, a regional planning scheme, a redevelopment scheme, or an amendment to any of the above;
- a statement of planning policy, or amendment to such a statement; or
- a subdivision or strata plan.

Scheme – as defined in the *Environmental Protection Act 1986*, and generally:

- a town planning scheme, a regional planning scheme, a redevelopment scheme, or an amendment to any of the above; or
- a statement of planning policy or an amendment to such a statement.

Sensitive land use – land use sensitive to emissions from industry and infrastructure. Sensitive land uses include residential development, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds and some public buildings. Some commercial, institutional and industrial land uses which require high levels of amenity or are sensitive to particular emissions may also be considered "sensitive land uses". Examples include some retail outlets, offices and training centres, and some types of storage and manufacturing.

Separation distance – the shortest distance between the boundary of the area that may potentially be used by an industrial land use, and the boundary of the area that may be used by a sensitive land use.

8 REFERENCES

Environmental Protection Authority 1997 *Industrial-Residential Buffer Areas (Separation Distances*) Draft Guidance No. 3, Environmental Protection Authority, Perth Western Australia

Environmental Protection Authority 2000 *Guidance for Risk Assessment and Management: Offsite individual risk from Hazardous Industrial Plant* Guidance No. 2, Environmental Protection Authority, Perth Western Australia

Environmental Protection Authority 2004 *Separation Distances between Industrial and Sensitive Land Uses* Draft Guidance No. 3, Environmental Protection Authority, Perth Western Australia

Western Australian Planning Commission 1997 *State Industrial Buffer Policy: Statement of Planning Policy No. 4* Government of Western Australia, Perth Western Australia

Status	Signed-off by the EPA
Citation	This document can be cited as the Guidance Statement for Separation Distances between Industrial and Sensitive Land Uses
Contact officer	Mr Ray Claudius Phone: 9222 7121 email: ray.claudius@environment.wa.gov.au

Appendix 1: Separation Distances between Industrial and Sensitive Land Uses

Note:

These generic guidelines do not take into account:

- cumulative impacts;
- non-typical emissions;
- the protection of natural resources and significant elements of the natural environment; and
- potential health impacts from emissions.

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Abattoir	killing of animals for human consumption or pet food – no rendering	√ (15) (Reg. 1)	DAWA, WRC, local gov't	CoP - Aug 1996. Regs. in Sept 1996		√	√	√		500-1000, depending on size
Abrasive blasting operations	metal or other material is cleaned or abraded by blasting with any abrasive material	√ (Reg. 5)	local gov't	CoP - 1993. Regs. in Sept 1996		√	√			case by case
Aluminium production	using electrolytic fusion technique	√ (44)	DoIR		√	√	√		√	1500-2000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Ammonia importation	unloading ammonia from ships and storage		DoIR, DPI		√ NH_3				√	case by case
Ammonium nitrate import/export	transfer of chemical from ship to land-based transport and vice versa	√ (58, 86)	DoIR, DPI						√	case by case
Ammunition production	includes explosives and fireworks		DoIR						√	1000
Animal feed manufacturing	manufacture of animal feed from grain and other food products	√ (23)	DAWA, local gov't			√	√	√		500
Animal feedlot	intensive rearing of cattle (in rural zone, away from towns)	√ (1, 68)	DAWA, WRC, local gov't	Cattle Feedlots Guidelines - 2002		√	√	√		1000-2000, depending on size
Animal feedlot	other intensive rearing, e.g. sheep (in rural zone, away from towns)	√	DAWA, WRC, local gov't			√	√	√		1000-2000, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Aquaculture – ponds or tanks & natural waters included	propagation or rearing of aquatic fauna, with supplementary feeding	√ (3, 4)	Fisheries, WRC, local gov't	Fisheries, & WRC guidelines		√		√		100-300, depending on size
Asphalt works	asphalt is mixed and prepared	√ (35)	local gov't	CoP - 1991		√	√	√		1000
Automotive spray painting	liquid paint is directed onto automotive surfaces by airless, compression, electrostatic or other methods		local gov't	CoP - Oct 1997		√	√	√		200
Bakeries	day-time operations		local gov't			√		√		100-200, depending on size
	large night-time operations		local gov't			√		√		500
Bauxite refining	premises on which alumina is produced	√ (46)	DoIR			√	√	√		case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Beverage manufacturing – alcoholic	alcoholic beverages are manufactured – brewery, distillery or winery	√ (25)	WRC		√	√	√	√		200-500, depending on size & type of product
– non-alcoholic	non-alcoholic beverages are manufactured, processed or packaged	√ (24)	WRC			√	√	√		200-500, depending on size
Boat building and maintenance – vessels are built,	organotin compounds **are not** used or removed from vessels	√ (82)	DPI, local gov't		√	√	√	√		200-500, depending on size
maintained or refurbished	organotin compounds **are** used or removed from vessels	√ (49)	DPI, local gov't		√	√	√	√		500-1000, depending on size
Briquettes manufacture	compressed coal-dust or wood-dust production		local gov't			√	√	√		300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Bulk material loading or unloading	clinker, coal, ore, ore concentrate or any other bulk granular material is loaded/unloaded from vessels	√ (58, 86)	DoIR, DPI			√	√		√	1000-2000
Calcium-based compounds production, other than lime	calcium compounds are produced, mixed, blended or packaged (see cement works for lime manufacture)	√ (31, 33, 72, 74, 75)	DoIR, WRC		√	√	√	√	√	500-1000, depending on size & type of product
Carbon stripping	reprocessing of carbon granules (gold extraction)	√ (79)	local gov't		√ acid fume			√		200-300
Carpet backing	process using latex		local gov't		√	√		√		500
Cattery zones	in urban areas		local gov't			√		√		200
Cement product manufacturing works	concrete or cement is mixed, prepared or treated – up to 5000 tonnes per year	√ (77)	DoIR, WRC, local gov't	√		√	√			300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	concrete or cement is mixed, prepared or treated – from 5000 to 150 000 tonnes per year	√ (77)	DoIR, WRC, local gov't	√		√	√			500-1000, depending on size
	concrete or cement is mixed, prepared or treated – greater than 150 000 tonnes per year	√ (77)	DoIR, WRC	√		√	√			1000-1500, depending on size
Cement or lime manufacturing works – use of furnace or kiln	Production of cement clinker or lime or cement clinker, clay, limestone or similar is ground or milled	√ (43)	DoIR, WRC, local gov't		√	√	√	√		1000-2000, depending on size
Ceramic goods manufacturing	premises on which ceramic kitchen or table ware or other non-refractory ceramic products are made	√ (76)	DoIR, WRC, local gov't		√	√	√	√		300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Charcoal production	wood, carbon material or coal is charred to produce a fuel or material of enriched carbon content	√ (37)	DoIR, local gov't		√	√	√		√	1000
Chemical blending or mixing	chemicals or chemical products are blended, mixed or packaged	√ (33, 74, 75)	DoIR, WRC, local gov't	draft - on hold	√	√	√	√	√	300-500, depending on size & type of chemicals involved
Chemical fertilizers	manufacture of artificial fertilizers	√ (31, 72)	DoIR, WRC, Water Corp.		√ HF, NH_3, SO_2	√	√	√	√	1000-2000, depending on size
Chemical manufacturing	chemical products are manufactured by a chemical process	√ (31, 72)	DoIR, WRC, Water Corp.		√	√	√	√	√	300-1000, depending on size & type of chemicals involved
	inorganic industrial chemical manufacture (other than listed elsewhere)	√ (31, 72)	DoIR, WRC, local gov't		√	√	√	√		300-1000, depending on size & type of chemicals involved

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	organic industrial chemical manufacture (other than listed elsewhere)	√ (31, 72)	DoIR, WRC, local gov't		√	√	√	√	√	500-1500, depending on size & type of chemicals involved
Chemicals – non-industrial	production – other than listed elsewhere		WRC, Water Corp.			√	√			300-1000, depending on size & type of chemicals involved
Chemical or oil recycling	waste liquid hydrocarbons or chemicals are refined, purified, reformed, separated or processed	√ (39)	DoIR, WRC, Water Corp.		√ VOCs			√	√	500-1000, depending on size
Chemicals storage – minor	non-bulk storage of chemicals	√	WRC, Water Corp.	draft in preparation	√			√	√	200-300
– bulk/major	bulk storage of acids, alkalis or chemicals	√ (73)	DoIR, WRC, Water Corp.		√				√	500-1000, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Chlor-alkali works	manufacture of caustic soda and chlorine	√ (31, 72)	DoIR, WRC		√ Cl_2	√		√	√	2000-3000
Clay bricks or ceramic/refractory products works	premises on which fired-clay bricks, tiles, pipes or pottery are manufactured	√ (41)	DoIR, DAWA, WRC		√ HF, HCl, SO_2	√	√	√		300-1000, depending on size
Clay extraction or processing	Mining, extraction or processing of clay	√ (80)	DoIR, WRC			√	√			500-1000, depending on size & processing
Coal mine	extraction of coal – open cut method	√ (9)	DoIR, WRC			√	√			1000-2000
Coke production	coke is produced, quenched, cut, crushed and graded	√ (38)	DoIR, WRC		√	√	√	√	√	1000-2000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Composting facility	outdoor uncovered, regularly turned windrows	√ (67A)	WRC, local gov't	draft Organic Wastes Guidelines - Dec 1997		√	√	√		1000 for manures, mixed food/putrescible & vegetative food waste; 500 for biosolids & 150 for green waste
	outdoor covered, turned windrows	√ (67A)	WRC, local gov't	draft Organic Wastes Guidelines - Dec 1997		√	√	√		750 for manures, mixed food/putrescible & vegetative food waste; 250 for biosolids & 150 for green waste
	outdoor covered windrows with continuous aeration	√ (67A)	WRC, local gov't	draft Organic Wastes Guidelines - Dec 1997		√	√	√		500 for manures, mixed food/putrescible & vegetative food waste; 250 for biosolids & 150 for green waste

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	enclosed windrows with odour control	√ (67A)	WRC, local gov't	draft Organic Wastes Guidelines - Dec 1997		√	√	√		250 for manures, mixed food/putrescible & vegetative food waste; 150 for biosolids
	in-vessel composting with odour control	√ (67A)	WRC, local gov't	draft Organic Wastes Guidelines - Dec 1997		√	√	√		150 for manures, mixed food/putrescible & vegetative food waste; 150 for biosolids
Concrete batching plant or cement products (bricks) manufacture	concrete is made (batched) and loaded for transport or cement products are made	√ (77)	local gov't	CoP - 1991. Regs. 1998		√	√			300-500, depending on size
Cosmetics production	manufacture of cosmetics and toiletries		local gov't			√		√		100
Crematoria			local gov't		√	√			√	200-300

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Crude oil extraction	oil or gas production from wells	√ (10)	DoIR		√	√		√	√	case by case
Crushing of building material	crushing or cleaning of waste building or demolition material	√ (13)	local gov't			√	√			1000
Dairies	milking shed operations		DAWA, WRC, local gov't	CoP - March 1998		√	√	√		500
Dog kennels	in rural zones		local gov't			√		√		500
	in or near urban areas		local gov't			√		√		1000
Dry-cleaners	dry-cleaning operations		local gov't			√		√		100
Edible oil or fat processing (vegetable oil production)	vegetable oil, oil seed or animal fat is processed – includes seed crushing and use of solvents to refine oils	√ (19)	WRC, Water Corp., local gov't			√	√	√		500

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Electric power generation	generating electricity – 20 megawatts or more (total) for natural gas & 10 megawatts or more (total) for other fuels	√ (52)	DoIR, WRC		√ NO_X, SO_X	√	√			3000-5000, depending on location & size
	natural gas-fuelled electricity production – more than 10, but less than 20, megawatts total	√ (84)	DoIR, WRC		√ NO_X	√				2000-3000
Extractive industries – hard rock, Darling Scarp	quarrying (including blasting), crushing and screening	√ (5, 12, 70)	DoIR, WRC	CoP - 1990, revised in 1995		√	√		√	1000
– not hard rock	blasting, grinding and milling works – material processed by grinding, milling or separated by sieving, aeration etc	√ (5, 12, 70)	DoIR, WRC	CoP - 1990, revised in 1995		√	√		√	case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
– no blasting conducted	grinding and milling works – material processed by grinding, milling or separated by sieving, aeration etc	√ (5, 12, 70)	DoIR, WRC	CoP - 1990, revised in 1995		√	√			case by case
– sand and limestone extraction	no grinding or milling works		WRC, local gov't			√	√			300-500, depending on size
Fellmongering	animal skins or hides are dried, cured or stored	√ (83)	WRC, Water Corp., local gov't			√		√		500
Fibreglass reinforced plastic manufacturing	using Low Styrene Emission (LSE) resins	√ (Reg. 3)	DoIR, local gov't	CoP - 1993. Regs. in Sept 1996			√	√		200
	using non-LSE resins	√ (Reg. 3)	DoIR, local gov't	CoP - 1993. Regs. in Sept 1996			√	√		500
Flour mill	grain or seed milling premises		local gov't			√	√			300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Fly ash disposal	premises on which fly ash is disposed	√ (53)	WRC, local gov't				√			case by case
Foam products manufacturing	resin is used to prepare or manufacture plastic foam or foam products using MDI or TDI	√ (51)	DoIR, local gov't		√			√	√	500
Food processing	fruit, vegetables or meat is cooked, dried, preserved, bottled, canned or processed	√ (18)	WRC, Water Corp., local gov't			√	√	√		200-500 for fruit & vegetables, 500 for meat
Food or beverage products	manufacture of food and beverage products not categorised	√ (18, 24, 25)	WRC, local gov't			√		√		100-300, depending on size & type of product
Formaldehyde	Formaldehyde production	√ (31)	DoIR, local gov't		√	√		√	√	500
Foundries – metal melting or casting	ferrous metals (alloys)	√ (45)	DoIR, local gov't	CoP - 1992		√	√	√		300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	non-ferrous, aluminium	√ (45)	DoIR, local gov't	CoP - 1992		√	√	√		300-500, depending on size
	non-ferrous, other than aluminium	√ (45)	DoIR, local gov't	CoP - 1992	√ fume	√	√	√	√	500-1000, depending on metal & size
Fuel burning	any boiler(s) capable of consuming 500 kg or more per hour of combustible material, either alone or aggregate, for the supply of steam or in power generation equipment	√ (67, 87)	DoIR, WRC		√ NO_X, SO_X	√	√	√	√	200-500, depending on type of fuel used & size
Fuel importation	fuel unloading from ships, storage and despatching		DoIR, DPI						√	1000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Fuel storage – crude oil and petroleum products in tanks or vessels exceeding 2000 tonnes capacity	Fixed Rooves	√ (73)	DoIR	draft in house				√	√	300-500, depending on type of fuel stored & size
	Floating Rooves	√ (73)	DoIR	draft in house				√	√	200-1000, depending on fuel stored & size
Gas distribution	works to supply mains		Alinta Gas					√	√	300
Gasworks	premises on which coal, coke and oil (mixtures or derivatives of) are processed to produce combustible gas	√ (11, 34)	DoIR		√	√	√	√	√	1000-2000, depending on raw materials used, odorising process used & size
Glass or glass fibre works	premises on which glass or glass fibre is produced	√ (40)	DoIR, local gov't		√	√	√			500

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Gold ore	grinding and milling works – rocks ore etc processed by grinding, milling or separated by sieving, aeration etc	√ (5, 12, 70)	DoIR, WRC			√	√			1000-2000, depending on location, process used & size
Gold roaster	gold extraction from sulphide ores	√ (44)	DoIR		√ SO_2	√	√	√		5000
Grain cleaning (no milling)	premises on which grain or seed is cleaned, graded, sorted or processed		local gov't			√	√	√		300-500, depending on size
Grain elevator	grain transfer using conveyor belts etc		local gov't			√	√		√	500
Greenhouse/ hothouse	using manure		local gov't			√		√		200-300
	using compost		local gov't			√		√		200-300
Hay processing plant	hay processing, handling or storage premises		local gov't			√	√	√	√	500-1000, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Heavy industrial site	proposals for "greenfield" sites	√ various	√ various		√	√	√	√	√	case by case
Horse stables	keeping horses		local gov't	draft in preparation		√	√	√		100-500, depending on size
Incineration	for biomedical, chemical or organic waste	√ (59, 60)	local gov't		√	√	√	√	√	500-1000, depending on size
	for plastic or rubber waste	√ (60)	local gov't		√	√	√	√		1000
	for waste wood	√ (60)	local gov't			√	√	√		300
Industrial gases	production, processing, refining or storage of industrial gases	√ (31, 72)	DoIR, local gov't		√	√		√	√	500-1000, depending on size & type of gases
	commercial/retail outlets		local gov't		√	√			√	50
Iron ore smelting	production of iron from iron ore	√ (44)	DoIR		√	√	√	√		1000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Joinery & wood working premises	production of wooden furniture & household items such as doors, kitchen fittings, flooring & mouldings		local gov't	CoP - 1995, being revised		√	√	√		100-300, depending on size
Liquid Petroleum (LP) gas retailing – above ground tanks – up to 8000L tank – 8000L to 16 000L tank	LP gas storage & handling at automotive retail outlets		DoIR, local gov't	AS 1596 Supplement No.1 - 1994				√	√	55 for sensitive uses & up to 8000L tank, 85 for sensitive uses & from 8000L to 16 000L 15 for residential uses
– underground tanks – up to 65 000L tank	LP gas storage & handling at automotive retail outlets		DoIR, local gov't	AS 1596 Supplement No.1 - 1994				√	√	55 for sensitive uses & 15 for residential uses
Livestock saleyard or holding pen	holding of live animals pending sale, shipment or slaughter	√ (55)	DAWA, WRC, local gov't			√	√	√		at least 1000, depending on size
Malt-works	malt production from grain		local gov't			√	√	√		500

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Market gardens	broad-scale operations		WRC, local gov't	draft in house	√	√	√	√		300-500, depending on size
Metal coating	metal products are powder-coated or enamelled	√ (81)	local gov't	Powder coating - July 1994. Regs. 1998		√	√	√		200
Metal coating – industrial spray-painting	site on which spray-painting is conducted inside a spray booth	√ (81)	local gov't	CoP - Sept 1995. Regs. 1998		√	√	√		200
	work is conducted in the open (no spray booth)	√ (81)	local gov't	CoP - Sept 1995. Regs. 1998		√	√	√		500
Metal fabrication	sheet metal, structural metal and iron and steel products – up to 50 000 tonnes per year		DoIR, local gov't			√	√			500-1000, depending on size
Metal finishing	galvanizing	√ (48A)	DoIR, WRC, local gov't		√ acid fume	√	√	√		500

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	other than galvanizing	√ (48)	DoIR, WRC, local gov't		√ acid fume	√	√	√		200
Metal leaching – vat or *in situ*	metal extraction from ore with a chemical solution	√ (7)	DoIR, WRC			√	√	√		500
Metal smelting, refining, melting, casting, fusing, roasting or processing works	where metal, metal ores, concentrates or wastes are treated to produce metal (other than iron & aluminium)		DoIR, local gov't							
	• up to 100 tonnes per year				√	√	√	√		100-200
	• between 100 & 1000 tonnes per year	√ (45)			√	√	√	√		300-500
	• greater than 1000 tonnes per year	√ (44)			√	√	√	√	√	case by case, depending on process

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Milk processing	milk is separated, evaporated or a dairy product is manufactured	√ (17)	WRC, local gov't			√		√		200-500, depending on size, wastewater treatment & disposal system
Mine dewatering, tailings or residue disposal	water extracted and discharged to allow mining of ore; or mining or processing of ore occurs and tailings or residue are discharged into a dam	√ (6)	DoIR, WRC			√	√			case by case
Mineral sands – dry processing only	grinding and milling works – material processed by grinding, milling or separated by sieving, aeration etc	√ (8)	DoIR		√ H_2S	√	√	√		1000-2000
– secondary treatment plant	treatment of primary concentrate from mine – zircon, rutile/leucoxene and ilmenite	√ (8)	DoIR, WRC			√	√	√		1000-2000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
– synthetic rutile plant	mining of mineral sands and processing to produce concentrate	√ (8)	DoIR, WRC		√ H_2S SO_2	√	√	√		3000-5000
Mineral wool or ceramic fibre	manufacture of mineral wool or ceramic fibre	√ (42)	DoIR, WRC		√	√	√	√		500
Motor body works	including panel beaters		local gov't	CoP - Oct 1997		√	√	√		200
Mushroom farm	using on-site blended soils or compost	√ (67A)	WRC, local gov't			√		√		500-1000, depending on size
Nurseries	no composting		local gov't			√				100
Oil or gas extraction from land or offshore	production from wells involving primary separation or treatment	√ (10)	DoIR, DPI		√	√		√	√	2000
Oil or gas production (other)	production of oil or gas, including gas reforming	√ (11)	DoIR		√	√		√	√	2000
Oil or gas refineries	crude oil or condensate is refined or processed	√ (34)	DoIR		√	√		√	√	2000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Open cut mining (large operations)	other than coal	√ (5, 6, 12, 70)	√ various	√		√	√		√	1500-3000
Orchards	broad-scale operations		DAWA, local gov't		√	√				500
Paints and inks	blending and mixing	√ (33, 74)	WRC, Water Corp.		√ VOCs	√		√		200 for water-based, 300 for solvent-based
	manufacturing	√ (31, 72)	DoIR, WRC, Water Corp.		√ VOCs	√		√	√	500 for water-based, 1000 for solvent-based
Pesticides manufacturing	herbicide, insecticide or pesticide manufacture by a chemical process	√ (32)	DoIR, WRC, Water Corp.		√	√	√	√	√	300-1000, depending on size
Pharmaceuticals	Production – including veterinary products	√ (31, 72)	WRC, Water Corp.			√		√	√	300-1000, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Piggery – intensive, – 5000 pigs or more – 500 to 5000 pigs – 50 to 500 pigs – less than 50 pigs	premises on which pigs are fed, watered and housed in indoor pens	√ (2, 69)	DAWA, WRC, local gov't	DAWA Guidelines for New & Existing Piggeries - May 2000		√		√		5000 for piggeries with more than 5000 pigs, 3500 for piggeries with 500 to 5000 pigs, 2000 for piggeries with 50 to 500 pigs, and 500 for piggeries with less than 50 pigs
Piggery – extensive (all premises)	premises on which pigs are fed, watered and housed in outside paddocks or enclosures		DAWA, WRC, local gov't	DAWA Guidelines May 2000			√	√		1000 for all extensive piggeries
Plaster manufacturing	plaster, plasterboard, gyprock or other products comprised wholly or mostly of gypsum are made	√ (78)	local gov't			√	√		√	200

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Ports	bulk material that is loaded or unloaded onto a vessel		local gov't			√	√		√	case by case
Poultry industry	intensive farming		DAWA, WRC, local gov't	CoP - 1999		√	√	√		300-1000, depending on size
Pulp, paper or paperboard manufacturing	manufacture of paper pulp, wood pulp, kraft paper, kraft paperboard, cardboard paper or paperboard	√ (30)	DoIR, WRC, Water Corp.		√ H_2S, SO_2	√	√	√		1000-1500, depending on process used, wastewater treatment system & size
Quicklime plant	clay, limesand or limestone material fired in a furnace or kiln to produce quicklime	√ (43)	DoIR, local gov't		√	√	√			500 for no quarrying on the premises, 1000 if quarrying is conducted
Rabbitries	intensive husbandry		local gov't	1995 flyer			√	√		500
Raceways for motor vehicles	Speedways and drag strips	√	local gov't	draft in preparation		√	√			case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Rendering works	animal matter is processed or extracted for use as fertilizer, stock food or other purposes	√ (16)	WRC, Water Corp., local gov't	CoP - 1991, revised in Oct 1995		√		√		1000-1500, depending on wastewater treatment/disposal system, location & size
Resins manufacturing	polyester resins manufacture	√ (31, 72)	DoIR		√	√	√	√	√	500-1000
Resins manufacturing	rubber & synthetic resins manufacture	√ (31, 72)	DoIR		√	√	√	√	√	1000
Rockwool manufacturing	mineral wool or ceramic fibre manufacture	√ (42)	DoIR, WRC			√	√	√		500
Rubber products manufacturing	using either organic solvents or carbon black		DoIR, local gov't		√ VOCs	√	√	√		300-500
Sawmill	timber (tree) milling		local gov't			√	√			500-1000, depending on location & size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Scrap metal recycling works	scrap metal is fragmented or melted to recover metal (including lead battery reprocessing)	√ (45, 47)	DoIR, WRC, local gov't	CoP - 1992		√	√	√		300-500
Screening works	screening or sieving of sand, rocks, chemicals and minerals	√ (12, 70)	DoIR, local gov't			√	√			500
Seafood processing	fish or other seafood is processed or packaged	√ (22)	WRC, Water Corp., local gov't					√		500
Service stations, involving vehicle cleaning/detailing facilities & the retailing of spare parts & foodstuffs	for premises operating during normal hours, i.e. Monday - Saturday from 0700-1900 hours		DoIR, local gov't	draft in house	√	√		√	√	50
	freeway service centre (24 hour operations)		DoIR, local gov't		√	√		√	√	100

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	all other 24 hour operations		DoIR, local gov't	draft in house	√	√		√	√	200
Silicon refining	silicon smelter operations	√ (44)	DoIR		√	√	√		√	1500-2000
Smallgoods	not including abattoir facilities or rendering works		Water Corp., local gov't			√		√		100
Smoking, drying or curing operations	meat or other edible products are smoked, dried or cured	√ (Reg. 2)	Water Corp., local gov't	Regs. in Sept 1996	√	√		√		200-300, depending on size
Sodium cyanide manufacturing	production of sodium cyanide	√ (31, 72)	DoIR		√ HCN, NO_X	√	√		√	1000-2000
Sodium silicate manufacturing	production of sodium silicate	√ (31, 72)	DoIR			√	√	√	√	1000
Solar salt manufacturing	salt is produced by solar evaporation	√ (14)	DoIR			√	√			1000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Starch manufacturing	starch or gluten is manufactured	√ (20)	WRC, local gov't			√	√	√		300-500, depending on size
Straw pulp and paper mill	processing cereal straw and mixing with waste paper to produce container board	√ (30)	WRC, local gov't		√ H_2S, SO_2	√		√		1000-1500, depending on process used, wastewater disposal system & size
Sugar milling or refining	sugar cane is crushed or sugar is refined	√ (21)	DoIR, WRC			√	√	√		1000-1500, depending on wastewater disposal system & size
Sulphuric acid plant	production of sulphuric acid	√ (31, 72)	DoIR, WRC		√ SO_2, SO_3	√	√	√		2000-3000
Tailings disposal	containing cyanide	√ (5)	DoIR, WRC				√	√	√	case by case
	not containing cyanide – (fly ash, red mud)	√ (5)	DoIR, WRC				√	√		case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Tannery	treatment and drying of animal skins, leather and artificial leather – using sulphide process	√ (50)	WRC, Water Corp., local gov't		√ H_2S	√		√		1000-2000, depending on process used, wastewater treatment system & location
Tannery	treatment and drying of animal skins, leather and artificial leather – small premises, non-sulphide	√ (50)	WRC, Water Corp., local gov't			√		√		200-300, depending on size & wastewater treatment & disposal system
Textile production – artificial & synthetic fibre manufacturing or treatment	cellulose nitrate, viscose fibre, cellophane, artificial rubber or other man-made textiles manufacture	√ (26, 31, 72)	DoIR, local gov't			√	√	√		500

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
– carpet making & other forms of manufacturing, ginning, milling or production of natural fibres	manufacture, bleaching, dyeing or finishing of cotton, linen, woollen yarns & other natural textiles	√ (26)	DoIR, WRC, Water Corp.			√		√		200-300, depending on type of fibre & wastewater treatment & disposal system
Textile operations – chemical or physical processes	using carbon disulphide (CS_2) as a solvent	√ (26, 31, 72)	WRC, Water Corp., local gov't		√ CS_2	√		√		500-1000, depending on wastewater treatment & disposal system
– chemical or physical processes	using other substances	√ (26, 31, 72)	WRC, Water Corp., local gov't			√		√		200-500, depending on process used & wastewater treatment & disposal system
Timber preserving premises	timber preservation by chemical means, including chromated copper arsenate (CCA)	√ (29)	WRC, local gov't			√	√	√		300-500, depending on size

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Titanium dioxide pigment plant	production of titanium dioxide (Cl_2 process)	√ (31, 72)	DoIR, WRC		√ Cl_2, $TiCl_4$	√	√	√	√	2000-3000
Transport vehicles depot	buses, trucks and other heavy vehicles depot		DoIR, local gov't		√	√	√	√		200
Turf farms and lawns	broad-scale turf production		WRC, local gov't	Guidelines - Dec 2001		√	√	√		500
Used tyre storage – general – tyre fitting	premises on which used tyres are stored	√ (56, 57)	WRC, local gov't				√		√	100-200, depending on size
– recycling	premises on which used tyres are crumbed, granulated or shredded	√ (56, 57)	WRC, local gov't		√	√	√	√	√	500-1000

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Vanadium mine	extraction and processing of vanadium	√ (5, 12, 70)	DoIR		√	√	√	√	√	1500-3000
Vineyards (viticulture)	broad-scale operations (including winery)	√ (25)	DAWA, WRC, local gov't	CoP - 2002	√	√	√	√		500
Waste disposal industrial liquid waste	site on which liquid waste from other premises is stored, reprocessed, treated or irrigated/discharged	√ (61)	DoH, WRC, local gov't			√		√		case by case
inert landfill site (Class 1)	site only accepting inert waste, contaminated solid waste (meeting criteria for Class 1), special wastes (type 1), as specified, for burial	√ (63)	WRC, local gov't	Draft CoP - May 1997. Guidelines for Acceptance of Solid Waste to Landfill - Jan 2001		√	√			150 for residential uses & an internal buffer of 25 from boundary

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
putrescible landfill site (Class 2 & 3)	site accepting inert, putrescible, contaminated solid waste (meeting criteria for Class 2 & 3), special wastes (type 1 & 2), as specified, for burial	√ (64, 89)	WRC, local gov't	Guidelines for Acceptance of Solid Waste to Landfill - Jan 2001. Regs (Rural Landfill) 2002. Draft Rural Landfill Management CoP	√	√	√	√		500 for sensitive uses (subdivisions), 150 for single residences & an internal buffer of 35 from boundary
secure landfill site (Class 4)	site accepting inert waste, contaminated solid waste (meeting criteria for Class 2, 3 & 4) and special wastes (type 1 & 2), as specified, for burial	√ (65)	DoH, WRC, local gov't	Guidelines for Acceptance of Solid Waste to Landfill - Jan 2001	√	√	√	√	√	case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
intractable waste landfill site (Class 5)	site only accepting intractable waste, as specified, for burial	√ (66)	DoH, WRC, local gov't	Guidelines for Acceptance of Solid Waste to Landfill - Jan 2001		√	√	√	√	case by case
waste depot	premises on which waste is stored or sorted, pending final disposal or re-use	√ (62)	DoH, WRC, local gov't	Guidelines for Acceptance of Solid Waste to Landfill - Jan 2001		√	√	√		200
waste – resource recovery plant	premises on which solid waste is stored, reprocessed, treated or discharged	√ (60, 61A, 67)	DoH, WRC, local gov't		√	√		√	√	case by case

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Wastewater treatment plant	sewage treatment facility (including Mechanical/Biological and Pond Systems and Facultative Pond Systems) 20-100 m^3 per day >100 m^3 per day	√ (85) (54)	Water Corp., Fisheries, WRC, local gov't		√	√		√	√	buffer studies in progress to determine appropriate separation distances
Wastewater disposal site (treated sewage)	site from which treated sewage is discharged (including by Spray irrigation and Flood/Channel Irrigation): 20-100 m^3 per day >100 m^3 per day	√ (85) (54)	Water Corp., Fisheries, WRC, local gov't DoH					√	√	case by case
Wastewater pumping stations	vacuum pumping station		local gov't	√	√	√		√	√	20
	wastewater pumping station (</= 40L/s)		local gov't	√	√	√		√	√	10

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
	wastewater pumping station (</= 90L/s)		local gov't	√	√	√		√	√	20
	wastewater pumping station (</= 180L/s)		local gov't	√	√	√		√	√	30
	wastewater pumping station (</= 350L/s)		local gov't	√	√	√		√	√	50
	wastewater pumping station – major		Water Corp., WRC		√	√		√	√	150
Wastewater tanking manhole	used as a temporary measure – buffer primarily for visual amenity		Water Corp., local gov't	√	√			√	√	100
oxygen injection site	with a storage tank		DoIR			√			√	10 (under review)
oxygen injection site	with an on-site generator		DoIR			√				20 (under review)

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
odour control facility	varying process		DoIR			√				30 (under review)
Water treatment plants	including chemical dosing facilities for potable water	√ (Reg. 4)	DoIR, WRC	Regs. in Sept 1996	√	√		√	√	case by case – (under review)
Water pumping stations	minor		local gov't	√		√				20 (under review)
	major		local gov't	√		√				25 (under review)
Water supply regulating valves	>/= 300mm diameter		local gov't	√		√				16 (under review)
Cathodic protection ground beds	induced electrical current to protect pipes from corrosive soils		local gov't	√					√	case by case – (under review)
Wood-board manufacturing – (including MDF plants)	premises on which particleboard or chipboard is fabricated or manufactured	√ (28)	DoIR, WRC			√	√	√		1000-2000, depending on size and location

Industry	Description of industry	DoE Licence or Registration category (*)	Key Government agencies for advice or approvals	Code of Practice (CoP) / environmental requirements	Impacts					Buffer distance in metres and qualifying notes
					Gaseous	Noise	Dust	Odour	Risk	
Woolscouring	scouring and primary treatment of wool	√ (27)	DoIR, WRC			√	√	√		500-1000, depending on wastewater treatment & disposal system & size
Wreckers (automotive)	vehicle parts recycling		local gov't	CoP - Oct 1997		√	√			300

Notes on table

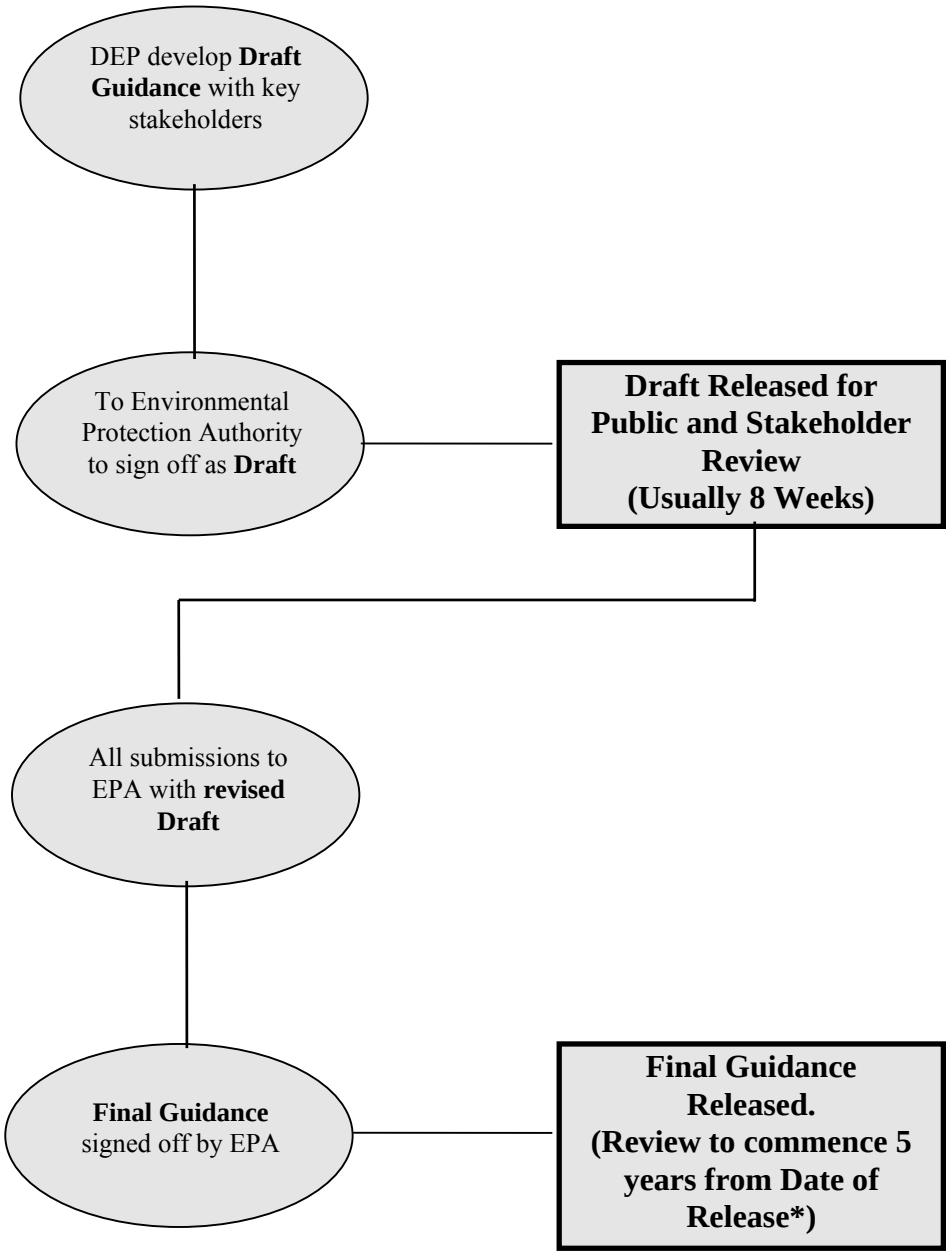
DAWA	Department of Agriculture Western Australia
DoE	Department of Environment
DoH	Department of Health
DoIR	Department of Industry and Resources
DPI	Department for Planning and Infrastructure
Fisheries	Department of Fisheries
WRC	Water and Rivers Commission (to become the Department of Environment)

* Certain industries with the potential to pollute the environment (prescribed premises) must hold a Works Approval (for construction) and a Licence or Registration (for operation) under the *Environmental Protection Act 1986*. The *Environmental Protection Regulations 1987* set out the categories for prescribed premises.

Prescribed premises must hold a Works Approval prior to commencing any work or construction on a premises that would cause the premises to become prescribed. Prior to operating these premises a Licence must be obtained for some categories of prescribed premises (covered under Schedule 1, Part 1 of the Regulations). The remainder of the categories of prescribed premises may be registered instead of holding a Licence but still require a Works Approval to construct (Schedule 1, Part 2). A further five categories of premises require a registration only and do not require a Works Approval (Schedule 2).

The Department of Environment can refer any proposal that needs a Works Approval, Licence or Registration to the EPA. Usually the Department refers a proposal to the EPA if it has the potential to cause significant environmental impacts. This is generally the case if the siting is inappropriate, i.e. too close to residential areas, coastal areas, wetlands or areas protected by Environmental Protection Policies.

Appendix 2: Generic Flow Diagram for the Guidance Statement Process



* Guidance may be reviewed earlier if circumstances require it.

CREDC
ECONOMIC DEVELOPMENT

Columbia River Economic Development Council
805 Broadway, Suite 412 | Vancouver, WA 98660
(360) 694-5006
credc.org
Accelerating Business Growth and Innovation

Tuesday, April 5, 2016

The Honorable Marc Boldt, Chair
The Honorable Julie Olson
The Honorable Jeanne Stewart
The Honorable David Madore
The Honorable Tom Mielke
Board of Clark County Councilors
P.O. Box 5000
Vancouver, WA 98666-5000

Dear Clark County Councilors:

The Columbia River Economic Development Council (CREDC) supports policy recommendations that ensure Clark County has an adequate supply of employment-ready land consistent with the strategies outlined in the 2011 Clark County Economic Development Plan.

To that end, CREDC supports the preservation and development of office- and industrial-zoned land in the County. In particular, rail-served industrial employment lands remain in high demand and short supply in the Greater Portland Metropolitan Statistical Area, resulting in lost opportunities to attract and retain regionally significant employers.

Particularly, the addition of the Lagler and Ackerland properties will represent a size and character of site not available elsewhere in Clark County. The designation will allow CREDC to provide a competitive response to inquiries that would provide significant job growth and other positive economic gains for the County. Over the past few years, the area has lost several specific opportunities within our target sector industries because large sites were not available to meet the development-ready timelines necessary to make the investment.

The designation of a rural industrial land bank will help to support the development of industrial and rail-served land in the County and is consistent with CREDC's employment land policy. We appreciate your attention to this important economic development matter and appreciated the opportunity to weigh in on this issue.

Sincerely,

Mike Bomar
President, CREDC

Guidelines for Establishing Effective Buffers Between Rural Agricultural and Urban Uses

(June 6, 2006)

Prepared by the
Resource Lands Review Committee (RLRC)
of the
Rogue Valley Regional Problem Solving process

TABLE OF CONTENTS

APPENDICES

Guidelines For Establishing Effective Buffers Between Rural Agricultural and Urban Uses

I – INTRODUCTION

Good quality rural agricultural land is a finite and steadily shrinking state and regional resource that must be conserved and managed for the long term. A crucial element of Oregon=s Statewide Planning Goals and Guidelines, developed out of Senate Bill 10 in 1969, is to "preserve and maintain rural agricultural lands@(Goal 3). The Oregon Legislature subsequently adopted policies (ORS 215.243 and 215.700) to further define how to preserve "the maximum amount of the limited supply of rural agricultural land@and the Department of Land Conservation and Development has developed numerous Administrative Rules in further support. Current state policies and law overwhelmingly mirror public opinion concerning rural agricultural land, with the most common reasons for preserving farmland having to do with its significant role in diversifying the regional economy, the important contribution it makes to the area=s quality of life and culture, its ability to provide wildlife corridors, the protection it can provide to riparian areas, and even the temporizing effect it can have on the local microclimate.

One unintended consequence of the clear demarcation between rural and urban uses created by the statewide land use system in Oregon is the conflict often created by the sharpness of the transition from many urban uses to farming practices. Chemical spray drift, noise, dust, odor, and chemical run-off from the rural agricultural side affect new urban residents, and sediment, stormwater run-off, residential chemical spray drift, trespass, and vandalism impact the rural agricultural side. The closer the two uses are to each other, the more dramatic and long-term the problems are likely to be.

The most effective means of lessening the potential for conflict is separating the two uses. Although there are a variety of ways in which to achieve this separation, the most elemental is distance. The greater the distance, the greater the buffering effect. Unfortunately, land is at a premium in the Rogue Valley, and buffer areas that are practical for this relatively narrow and densely populated valley will not totally eliminate all impacts of rural agricultural activities. This region does not have the luxury of setting aside 1,000 feet or more of buildable urban land to mitigate potential conflicts between urban and rural uses. The education of residents and farm operators, the employment of deed restrictions, siting requirements, construction standards, fencing, minimal separation distances, vegetative elements, and the use of best farming practices, including systems of spray notifications, are all useful mechanisms in avoiding as much conflict as possible.

II – PURPOSE

The purpose of establishing a regionally applicable set of guidelines for buffering urban development from rural agricultural lands is to provide consistent technical guidance on reducing the potential for conflict between farming activities and urban uses (principally residential and institutional development). This purpose is in accordance with the Planning Guidelines of Statewide Planning Goal 3 (Agricultural Lands), which states that urban growth should be separated from rural agricultural lands by buffer or transitional areas of open space. The guidelines in this document are intended to assist local governments, developers, landholders, and consultants in arriving at the best buffering solution for urbanizing areas in juxtaposition to rural agricultural land.

III – OBJECTIVES

These buffering guidelines seek to achieve the following objectives:

1. To ensure the continued use of farmland for farm uses.
2. To minimize potential conflict by developing, where possible, a well-defined boundary between rural agricultural and urban uses. The best boundary will be one that provides a sound transition in both directions, from rural to urban and urban to rural.
3. To minimize the impacts of urban development on rural agricultural production activities and land resources.
4. To minimize the potential for complaints about rural agricultural activities from urbanized areas.

IV – WORKING PRINCIPLES

The buffering guidelines herein have been developed around the following considerations:

1. Adequate consideration of potential conflict between existing rural agricultural zoned lands and proposed urban levels of development is necessary during development assessment. **Significant conflict is assumed to be likely in all cases where urbanization is proposed within 500 feet of Class I - IV rural agricultural land. In addition, some lesser level of conflict is assumed possible within the next 500 feet from the urban/ rural boundary.** Agricultural buffers that are appropriate to the realities of the region will not be successful in completely negating these potential conflicts, but can lessen their severity, frequency, and negative impact on both agriculture and urban quality of life.
2. Those individuals seeking to buy, rent, or lease urban properties within 1,000 of rural agricultural land should be informed in writing of the consequences of being located within a "rural agricultural impact zone."
3. Local or regional long-range planning should avoid, as far as is practicable, locating urban sensitive receptors, primarily residential development, in proximity to rural agricultural land. Where urban sensitive receptors must be located near rural agricultural land, buffering mechanisms should be used to minimize potential conflicts.
4. The central concept in buffering is adequate separation between conflicting uses. There are a number of strategies for achieving this separation through planning decisions and the use of planning controls:
    - A well-designed vegetative buffering element will reduce the amount of land required for an effective buffer.
    - Man-made or natural features should be incorporated in buffers whenever possible, such as infrastructure rights-of-way, roads, non-residential structures, watercourses, wetlands, ridge lines, rock outcrops, forested areas, and steep slopes.
    - A buffer area can provide public open spaces or purpose-designed buffer areas (public recreational/natural areas) if the location is appropriate for satisfying a portion of the community's open space needs, the use of the buffer area as public open space is compatible with adjoining uses, the buffer area is not the community's principle provider of recreational opportunities, and the impacts from the adjoining rural agricultural use do not overly restrict the planned recreational use of the open space.
    - Existing areas of rural residential zoning can provide the required buffering if and when the rural residential lots provide a minimum of 200 ft. of separation between the urbanizing and rural agricultural land.
    - Existing small-acreage farms (5 acres or less) can provide the required buffering if and when the small acreage farms provide at least 200 ft of separation between the nearest farmable land (including animal enclosures) on the small-acreage farm land and the nearest planned urban sensitive receptor. The owners of these small-acreage farms must agree to the use of their property as a buffering mechanism.

- ♦ There is a publicly owned right of way that could be incorporated as part of the buffer.

5. It is unreasonable for new urban uses to require a modification of rural agricultural activities practiced according to recognized industry standards, especially if those modifications would hamper efficient rural agricultural operations. The existing use has precedence.
6. Buffering mechanisms should be provided/funded by the proponent of the urban development. The buffering mechanisms will be physically located entirely on the ubanizing property, unless:
   - ♦ there is a publicly owned right of way that could be incorporated as part of the buffer;
   - ♦ there is a naturally occurring area on the rural agricultural land that is permanently incapable of being farmed (rock formation, riparian area, etc.), is of sufficient depth, and is contiguous with the border of the urbanizing land or a publicly owned right of way;
   - ♦ the proponent of development purchases from the farm owner an easement on agricultural land of the appropriate length and depth, and pays for the establishment of whatever vegetative buffer, fencing, or irrigation system that would have been required on the urbanizing land; or
   - ♦ title to the area providing the physical portion of the buffer is transferred to the farm being buffered. If a vegetative buffer is indicated, it is installed by the developer. Whether a vegetative buffer is installed or not, the buffer is henceforth the responsibility of the farmer, and must be maintained as a buffer as long as the property remains zoned for resource use.
7. The buffering mechanisms must be included in the development application and must be approved by the city **before or concurrent with** final approval for the development project.
8. The city is responsible for enforcing compliance with all matters pertaining to the implementation of planned and approved buffering plans. The city shall permit developers flexibility in scheduling the establishment of the approved buffering mechanisms due to factors such as water availability, weather, and general logistics, although the buffer plan shall establish a sequencing of buffer mechanism implementation that demonstrates completion prior to either final plat sign off or final building inspection (for larger lot buffers and in the event no land division occurs).
9. Although flexibility in the nature and design of buffering mechanisms can be provided for in the event of significant localized circumstances, customized (flexed) buffer designs must be at least as effective as the buffering options established herein. Proposed flexed buffer designs must be clearly justified, with the burden of proof being on the proponent of urban development to show that the flexed buffer design will not reduce the intended level of protection.
10. Class I – IV rural agricultural land is presumed to be of "high potential impact" due to the fact that it can be and often is used for a wide variety of different rural agricultural uses, and because new and as yet unforeseen uses and practices are likely to surface in the future. Therefore, these rural agricultural lands are assumed to require buffering mechanisms that mitigate the most likely high impact rural agricultural land use, regardless of present use. The only exception to this would be those class I – IV rural agricultural lands that have a long and essentially unbroken history of rural agricultural inactivity or grazing use. These, as well as all Class VI rural agricultural lands, would be considered of "low potential impact" (see Element A - Chemical Spray Drift).
11. To mitigate a reduction of overall residential densities resulting from urban land dedicated to buffering mechanisms, a city shall permit the proponent of urban development to maintain planned densities through lot size averaging, clustering, planned development criteria, or similar techniques. The objective is to maintain minimum density across the development.
12. Where conflicts already exist between rural agricultural and urban land uses, mechanisms including mediation, source controls, and public outreach are encouraged.

V – APPLICABILITY OF THE GUIDELINES

Although these buffering guidelines were developed to be applied to urbanizing lands originally selected as urban reserve lands identified through the Regional Problem Solving process "NOW X 2", they can also be applied to future urban growth boundary expansions into non-urban reserve lands, should

changing conditions cause that to occur.

These guidelines can also be used by cities to buffer urban development occurring within already established urban growth boundaries from rural agricultural land outside the UGB (whether that rural land part of or not part of an Urban Reserve Area). The single greatest potential difficulty in applying these guidelines (which are generally more comprehensive than those presently in force in the region's cities) within existing UGBs is the possibility that there are single lots on the urbanizing side, not part of a larger development and less than 300 ft. in depth, which could suffer disproportionately from the economic impacts of the buffer requirements. In those cases, depending on the width of the lot, a proportionate buffering distance should be determined. Jackson County's **Alternative Setback Reduction Rules** (Jackson County 2004 Land Development Code chapter 8, Section 8.5.3(F)) provide an example of how such a proportionate distance could be calculated. An alternate means of buffering these relatively shallow parcels could be the use of a scaled-back bamboo-based vegetative buffer reduced to a minimum of 30′ in width (a single rather than double row of bamboo spaced 10 ft. apart at planting), with an additional 5′ width for a climb-resistant fence. Flexibility of this type is only permissible when applied to parcels within UGBs established prior to January 1, 2006.

VI – BUFFER LONGEVITY

Depending on the location of the urbanization, whether it borders rural agricultural land that is either outside of the UGB but within an Urban Reserve, or wholly outside of an Urban Reserve, buffering mechanisms can be expected to have a shorter or longer useful life. There are two categories of buffers based solely on their projected longevities – **long-term and mid-term** buffers.

Long-term Buffer: Buffers providing protection to rural agricultural lands outside of Urban Reserve Areas. The rural agricultural lands being buffered are resource lands not identified for future urbanization in any state-recognized plan, either regional or municipal.

Mid-term Buffer: Buffers providing protection to rural agricultural lands within a city's Urban Reserve Area.

Long-term and mid-term buffers are closely related in their requirements, and both must be designed to preserve longer-term functionality. Nonetheless, because the rural agricultural land being protected by mid-term buffers is destined for conversion to urban uses within a distinct planning horizon, albeit a relatively long one, mid-term buffers must be designed for eventual conversion to urban uses. The specific buffering mechanism used in a mid-term buffer will depend on a number of factors: what is the most likely time period it will remain as a buffer; what are the important financial considerations affecting the proponent of development; and to what specific use will the buffer eventually be put once the rural agricultural land is urbanized – will the physical buffer eventually be converted to housing or to roads, or will it be used to provide a recreational use for the community?

For some mid-term buffers, **the simplest yet most effective solution to providing the buffer may be to defer the development of an appropriate portion of the urbanizing land bordering rural agricultural land until such time as that rural agricultural land is made urbanizable through its eventual incorporation into the UGB and subsequent annexation.**

VII – MAJOR BUFFERING ELEMENTS

For the purposes of providing options for addressing the major potential sources of conflict between rural agricultural and urban lands, these sources of conflict have been grouped as follows:

Chemical Spray Drift – Principally directed at mitigating rural agricultural chemical use, but can also be effective in protecting agricultural production from careless homeowner use of agrochemicals. Separation between urban and rural agricultural uses is the preferred tool,

employing either simple distance or a combination of distance and a vegetative buffer.

Noise – Noise is an impact arising from rural agricultural operations. A reasonable level of mitigation can be achieved through community design and construction standards for individual structures.

Sediment and Stormwater Run-off – These impacts arise from both the urban and agricultural sides, and can severely impact rural agricultural operations as well as urban health and livability. These negative impacts can be avoided or significantly reduced by appropriate erosion prevention and control measures during construction, and by an adequate stormwater master plan for the development that takes into account impacts from and on the adjoining rural agricultural land.

Trespass and Vandalism – Trespass and vandalism are considered by most farmers to be the most serious issue facing agricultural operations in proximity to urban areas. Climb-resistant fences and/or trespass-inhibiting shrubbery are means of reducing these impacts, as is placing the buffer into private ownership (the option of allowing larger urban lots with strict setback requirements).

Odor – One of the less important agriculture-related impacts in the Rogue Valley. Unless there are compelling, site specific reasons why this would be especially critical (such as the presence of a livestock feed lot), the occasional issues with odor should be sufficiently addressed by requiring that the owners, renters, and those leasing urban properties within 1,000 ft. of rural agricultural land receive notice through an explicitly worded restrictive deed covenant of the negative impacts to which they will likely be exposed as a result of living within 1,000 ft. of farm land (see Appendix 3).

Dust, Smoke, and Ash – Like odor, a less important agriculture-related issue in this region, and, like odor, addressed by the use of a restrictive deed covenant.

ELEMENT A – Chemical Spray Drift

Problem Overview

The off-target movement of rural agricultural chemicals can be a cause for concern to urban residents in proximity to farming areas based on fears of exposure, and/or due to associated odors. Currently there is no acceptable ambient air standard for rural agricultural chemical spray drift, which, along with noise and dust, is considered a common by-product of farming practices under Oregon=s Right to Farm statute.

In Oregon, research and field trials have shown that spray drift from orchard airblast type sprayers over open ground can cover distances up to 500 feet, with most falling to earth within a 200 to 300 foot distance (less when applied under optimal conditions). Spray drift from tractor-mounted boom-type sprayers is usually significantly less. Although these Rogue Valley guidelines assume that farmers, as well as their employees and contractors, will use rural agricultural chemicals in accordance with reasonable and practicable measures as set out in the EPA-approved label and pesticide regulations of the state of Oregon, chemical spray drift can and will be affected by a variety of factors:

chemical composition/formulation;
method of application/release height;
use of surfactants or other spray additives;
spray technology;
applicator experience;
frequency of application;
ability of target vegetation to capture spray droplets;
target structure;
weather conditions;
microclimate;
topography; and
natural and man-made landscape features.

Major Buffer Design Considerations

There are several major considerations affecting the design of buffers meant to mitigate chemical spray drift:

- Whether the adjoining agricultural land qualifies as "high potential impact" or "low potential impact";
- Whether the buffer will incorporate a vegetative element or not; and
- If a vegetative element is included in the buffer, whether it is designed to buffer "existing higher intensity" or "existing lower intensity" agricultural land.

Differing Levels of Potential Impact - The majority of the Class I – IV rural agricultural land to be buffered is considered to be of "high potential impact" due to the fact that it can be and often is used for a wide variety of different rural agricultural uses, and because new and as yet unforeseen uses and practices are likely to surface in the future. Nonetheless, there is a recognition that some rural agricultural land, by virtue of suitability and history, is of comparatively "low potential impact". The standards for buffering these rural agricultural lands are lower, based primarily on the reduced impacts of the rural agricultural practices on these lands – 50 to 100 ft. of separation between usable farmland and sensitive receptors, no vegetative buffers required, and just 50 ft. of separation for commercial and industrial uses, also without a requirement of vegetative buffers.

When is Rural Agricultural Land Considered of "Low Potential Impact"?

Rural agricultural lands can be considered of low potential impact if they:

1) are composed of greater than 50% Class IV soils, can demonstrate an unbroken or essentially unbroken 25-year history of rural agricultural inactivity (fallow land) or grazing use, **and** which have one or more of the following (as determined by a certified soil scientist):
   - greater than 50% hydric soils;
   - greater than 50% shallow soils (surface to bedrock or permanent cemented hardpan) of less than 2 ft. in depth.

OR

2) are composed of greater than 50% Class VI or worse soil.

OR

3) are outside of an irrigation district's zone of influence (defined as the area within an irrigation district's present boundary, as well as areas presently lying outside, which cannot be considered ineligible on reasonable technical grounds – as determined by the most appropriate irrigation district - for a future expansion of an existing irrigation district).

Buffers Without Vegetative Elements - Buffers without vegetative buffers rely on sheer distance to control spray drift. In general in the Rogue Valley, in open ground conditions (without a vegetative buffering element), minimally effective buffers between urban sensitive receptors and high potential impact rural farmland should separate the two uses by between 100 and 200 ft. For non-sensitive receptors (commercial, professional, and industrial), that distance can be between 50 and 100 ft. While more land is necessary for a buffer without a vegetative element than for a buffer with one, the cost and complications associated with vegetative buffers, plus the long-term maintenance, can be avoided. Additionally, future urbanization is simplified.

There is flexibility in what can be included in a buffer to satisfy the required linear distances. For non-vegetative buffers, distance can be achieved by including one or more of the following components:

- Developable land devoted to buffering use;
- Man-made or natural features, such as infrastructure rights-of-way, roads, non-residential structures, watercourses, wetlands, ridge lines, rock outcrops, forested areas, and steep slopes;
- Non-farmable areas of the farmland being buffered (including yards, storage areas, roads, and all structures);
- Publicly owned land without significant present or projected public use (as determined by the public entity owning the land);
- Existing developed rural residential, rural commercial, or rural industrial parcels, within the urban reserve, and of at least 200′ in depth as measured from a shared property line with EFU-zoned land (these parcels to be used for buffering, if contiguous with the urban reserve/rural border, must be at least 300 ft. in depth to ensure future developability);
- A purchased easement (at least 200 ft. in depth) on agricultural land;
- A portion (at least 200 ft. in depth) of the proponent of development's land temporarily withheld from development to provide a mid-term buffer. This temporarily withheld land (which could be zoned under any of the county's designations) would be eligible for development upon the annexation of the rural agricultural land it buffers;

Buffers With Vegetative Elements - Research and field trials have shown well-designed vegetative buffers can be effective in capturing up to 80% of pesticide spray drift from an application upwind of even a single row of appropriate species of trees. The better designed the planting, the better the protection, and the more likely the effectiveness of the planting would be able to withstand the damage or death of individual trees. Where a vegetative buffer element can be satisfactorily established and maintained, or where one exists that is of acceptable width, composition, density (or optical porosity), and location, a minimum total width of 75 ft. to 100 ft. for urban sensitive receptors, and 50 ft. for commercial and industrial uses, will suffice.

A major advantage to the proponent of development in establishing a vegetative element is the ability to halve or more than halve the separation distance (50, 75, or 100 ft. instead of 100 to 200 ft.), which represents a savings to development. There can be further cost reductions in plant materials, labor, and material depending on whether the vegetative element is designed to buffer "existing higher intensity" or "existing lower intensity" agricultural land.

Existing Higher Intensity

Rural agricultural land would qualify for an "existing higher intensity buffer" if it includes existing plantings (or scheduled plantings within one year of projected buffer completion date, as determined by documented consultation with the owner/operator of the farming operation) of long-term crops with a height at maturity exceeding 4 ft. In the Rogue Valley, these are primarily vineyards and orchards (fruit or nut trees), but may also include other higher intensity crops as determined by the local Extension Serivce or the Oregon Department of Agriculture.

Design Summary (see Sections A and B of Appendix 1 for full details):

Tree-based buffer – 3 rows

Bamboo-based buffer – 2 rows (20 ft. between rows, 10 ft. between plants)

Existing Lower Intensity

Rural agricultural land would qualify for an "existing lower intensity buffer" if it includes fallow land, land of potential high impact presently being used for grazing, or crops of any type with a height at maturity below 4 ft. In the Rogue Valley these are primarily row crops and hay fields, and all uses other than those falling under the definitions of "Existing Higher Intensity".

Design Summary (see Sections A and B of Appendix 1 for full details):

Tree-based buffer – 2 rows

Bamboo-based buffer – 2 rows (20 ft. between rows, 15 ft. between plants)

While the presumption is that any rural agricultural lands of high potential impact could establish crops and institute practices of higher intensity in the future (such as orchards), and thus buffers appropriate for these lands must all eventually be capable of buffering higher intensity rural agricultural practices, present use is a good indicator of near-future practices. Existing higher intensity practices require a more robust buffer earlier than lower intensity uses, while buffers designed for initial lower intensity will suffice to serve less intense uses during their early development. At or near functional maturity, lower intensity buffers will also suffice to provide adequate mitigation of spray drift from higher intensity uses (should those eventually occur).

The primary advantage in allowing these initial differences in buffer design is a reduction in short-term (and some long-term) costs. In tree-based buffers, it is a reduction of one row of trees, from three rows in the higher intensity buffer to two rows in the lower intensity buffer (although spacing between trees is reduced slightly in the two-row buffer). In bamboo-based lower intensity buffers, there is a reduction of approximately 35% in the initial plant material required by allowing greater spacing between plants.

For tree-based vegetative elements of buffers of any intensity, the requirements can be partially or fully satisfied by existing areas of trees and brush, as long as their buffering effect is essentially the same as that intended by the requirements in Appendix 1. If the characteristics of the existing vegetation do not meet the requirements in Sections A – D of Appendix 1, and so cannot substitute in full or in part for an adequate vegetative buffer, then the area can either be incorporated into the buffer design at half its "value" (for example, a 20 ft. wide riparian area would be calculated as 10 ft. of vegetative buffer), or it can be left out of the vegetative element and calculated at its original width (20 ft. of existing vegetation would be considered as 20 ft. of bare land).

Due to the fact that structures, solid walls, and other impermeable or very dense objects force air flow around or over themselves, these are not considered substitutes for vegetative buffer elements – in fact, depending on their location and characteristics, their effects may actually be counterproductive.

In all cases, and under all conditions, the vegetative buffer must be designed, installed, and signed off on by licensed or certified professionals such as landscape architects, landscape contractors, arborists, irrigations systems contractors, and reforestation experts. Each buffer should be designed with consideration for the unique characteristics of each site, especially aspect, existing vegetation, soil quality and depth, topography, adjacent land uses, and the microclimate. Also important will be the local availability of plant materials and the use of native plants.

Element A – Chemical spray drift

Objective: To locate new urban development so that the impact of rural agricultural chemical spray drift on health and amenity is avoided and complaints from residents regarding the use of rural agricultural chemicals is minimized.

Performance Criteria: Urban development to be located or incorporate measures such that chemical spray drift does not adversely affect community public health and safety, and does not lead to significant levels of complaints concerning adjacent rural agricultural operations.

Solution Options

HIGH Potential Impact Agricultural Land
SENSITIVE Receptors

(1) 100 ft of separation between the outermost urban sensitive receptor and the nearest farmable rural agricultural land, with an adequate tree-based vegetative buffering element. The buffer must incorporate the criteria in Appendix 1**,** with the appropriate design keyed to the adjoining present use – higher or lower intensity. The vegetative element must be located between the urban sensitive receptors and adjacent rural agricultural land, preferably closer to the spray source than the receptor. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

The buffer must be:

- provided with a suitable watering system;
- composed of plant species that will not harbor pests or diseases damaging to the local agriculture (Appendix 1, the Extension Service, or the Oregon Departments of Agriculture or Forestry are the primary sources of information for determining this);
- acceptable to the owners of the adjoining rural agricultural land;
- provided with a legally enforceable long-term maintenance plan; and
- composed of native or locally acclimatized plants to the extent practicable.

or:

(2) 75 ft of separation between the outermost urban sensitive receptor and the nearest farmable rural agricultural land, with an adequate bamboo-based vegetative buffering element. The buffer must incorporate the criteria in Appendix 1, with the appropriate design keyed to the adjoining present use –

higher or lower intensity. The vegetative element must be located between the sensitive receptor and adjacent rural agricultural land, preferably closer to the spray source than the receptor. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

The buffer must be:

- provided with a suitable watering system;
- composed of plant species that will not harbor pests or diseases damaging to the local agriculture. (Appendix 1, the Extension Service, or the Oregon Departments of Agriculture or Forestry should be the primary sources of information for determining this);
- acceptable to the owners of the adjoining rural agricultural land;
- provided with a legally enforceable long-term maintenance plan; and
- composed of native or locally acclimatized plants to the extent practicable.

or:

(3) 200 ft of separation between the outermost urban sensitive receptor and the nearest farmable rural agricultural land without the presence of an adequate vegetative buffering element. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

or:

(4) 100 ft of separation with a vegetative buffer between the outermost sensitive receptor and the nearest farmable rural agricultural land through setbacks on larger individual urban lots adjoining the Urban Reserve Boundary where buffering is anticipated to be long-term. Lots should be designed to provide the appropriate separation, while allowing sufficient area available for normal residential use, and shall be possible only if their use will not cause the development's average density to drop below the zone's minimum. Additionally, this option shall be subject to the following:

- A minimum building setback of 100 feet from the agricultural land, within which structures such as living quarters, decks, patios, gazebos, carports, pools or children's play areas cannot be located. Fences may be located within this area, as may garages or storage outbuildings, provided they do not include workshop or living spaces.
- Except for fences and garden-related apparatus, no structures shall be located within 50 feet of the adjacent agricultural land. This area shall otherwise contain only a vegetative buffer of trees that meets the density and size requirements for lower intensity specified in Appendix 1. The buffer must be composed of plant species that will not harbor pests or diseases damaging to the local agriculture (Appendix 1, the Extension Service, or the Oregon Departments of Agriculture or Forestry are the primary sources of information for determining this), and must be provided with a suitable watering system. To the extent practicable, the buffer should be composed of native or locally acclimatized plants. Maintenance of the vegetative buffer is the responsibility of the urban property owner.
- The vegetated buffer shall be planted no later than the final inspection.
- An adequate watering system shall be installed no later than the final inspection.
- A fence with a minimum height of six feet and meeting the minimum specifications in Section G of Appendix 1 shall be constructed along the property line separating the urban and rural properties. The fence shall be constructed prior to final inspection. Maintenance of the fence is the responsibility of the urban property owner.
- The larger lots must be part of a development large enough that the loss in density can be compensated for in another portion of the development. In no circumstances shall the larger lot buffers cause the overall density of the development to fall below the minimum zone density.
- At the time of subdivision, restrictive covenants and/or plat notes shall provide notice of the above setbacks and buffering requirements through a statement similar to the following: "Lots _____ adjoin an Urban Reserve Boundary, separating urban and agricultural land. In order to preserve and protect the viability of the adjacent agricultural land, these lots are subject to additional restrictions as follows:...(reference to restrictions if a plat note or actual restrictions here if in covenants)..." Covenants shall also include the following: "These provisions are regulations of the City of _____, who may take enforcement action relative thereto. They may be modified or eliminated only through the recording of document(s) signed by appropriate representatives of the City of

_____ and Jackson County. Modifications may occur only if appropriate to reflect changed regulations of the city, and termination shall take place only if the subject lots no longer adjoin agricultural land."

HIGH Potential Impact Agricultural Land
NON-SENSITIVE Receptors

(1) 50 ft of separation between the outermost urban industrial or commercial structure or area of regular concentrations of individuals on industrially or commercially zoned land and the nearest farmable rural agricultural land. A vegetative buffer designed for lower intensity use must be included within the buffer. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed. The buffer must incorporate the criteria in Appendix 1, and must be:

- provided with a suitable watering system;
- composed of plant species that will not harbor pests or diseases damaging to the local agriculture (Appendix 1, the Extension Service, or the Oregon Departments of Agriculture or Forestry should be the primary sources of information for determining this);
- acceptable to the owners of the adjoining rural agricultural land;
- provided with a legally enforceable long-term maintenance plan; and
- composed of native or locally acclimatized plants to the extent practicable.

or:

(2) 100 ft of separation between the outermost urban industrial or commercial structure or area of regular concentrations of individuals on industrially or commercially zoned land and the nearest farmable rural agricultural land. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

LOW Potential Impact Agricultural Land
SENSITIVE Receptors

(1) 100 ft of separation between the outermost urban sensitive receptor and the nearest portion of low potential impact land suitable for any rural agricultural use. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

or:

(2) 50 ft of separation between the outermost urban sensitive receptor and the nearest portion of low potential impact land suitable for any rural agricultural use through setbacks on larger individual lots immediately adjacent to the rural farmland being buffered. The lots must be of sufficient size to allow a minimum setback of 50 ft., within which structures such as living quarters, decks, patios, gazebos, carports, pools or children's play areas cannot be located. Fences may be located within this area, as may garages or storage outbuildings, provided they do not include workshop or living spaces.

LOW Potential Impact Agricultural Land
NON-SENSITIVE Receptors

(3) 50 ft. of separation between the outermost urban industrial or commercial structure or area of regular concentrations of individuals on industrially or commercially zoned land and the nearest portion of low potential impact land suitable for any rural agricultural use. The buffer can include or be entirely composed of rural agricultural land on which an easement has been purchased, and on which no agricultural activity that could lead to complaints from adjoining urban uses would be allowed.

ELEMENT B – Noise

Problem Overview

There are several sources of noise generally associated with rural agricultural activity in the Rogue Valley that may lead to land use conflict. These are noises associated with intensive livestock facilities, constant or very long-term noise from fixed installations (e.g. pumps, refrigeration and processing plants), and occasional or intermittent noise from tractors, wind-generating frost control equipment, spray equipment, and other machinery. Of these, the most important are occasional or intermittent noises from wind machines, tractors, and spray equipment (especially airblast sprayers).

The recommendations that follow are designed to mitigate the most serious noise impacts, but will not fully resolve the issue. Noise from rural agricultural activities, especially the relatively occasional noise from wind machines, tractors, and spray equipment are part of the reality of rural life. Individuals choosing to live in proximity to rural agricultural land must understand that this proximity exposes them to inconveniences that are endemic to the area in which they have chosen to live.

Many noise-generating activities associated with agriculture are intermittent and may affect a particular adjacent residence for only a few hours several times a year (e.g. wind machines in orchards; bird cannons in berries or grapes). **However, it should be noted that many farm activities require operation of equipment in the evening or very early morning hours due to crop or livestock conditions or critical temperature and wind condition parameters that, despite the personal wishes of the farmer, effectively dictate the necessity and timing of such activities.** It should also be noted that the nighttime or very early morning operation of rural agricultural equipment on a given parcel can and will differ from year to year, depending on climatic conditions and the type of crop.

Due to the comparatively intensive settlement of the Rogue Valley, and the high level of urban intrusion into rural agricultural areas, the most effective and basic means of mitigating for noise—through separation distances that might have to measure in the several thousands of feet—is not feasible. On the other hand, noise from rural agricultural operations is one of the most controversial and polarizing issues within the residential/rural agricultural interface, and must be addressed as an issue in effective buffer designs. A reasonably effective, financially feasible means of buffering for noise in the Rogue Valley must be a compromise between cost and results.

Assumptions

One strategy in addressing the issue of noise is a strong, explicit restrictive deed covenant directed at the owners of urban land in proximity to rural agricultural land. As stated previously, individual urban land owners must be informed, in detail, of the range of impacts they will be exposed to living within 1,000 feet of rural farmland, with noise being one of the most potentially significant of these. This notification is critical because noise from rural agricultural operations cannot be cost-effectively mitigated to the degree that spray drift can, and therefore will likely remain a contentious issue in the future in some parts of the valley.

One major reality of cost-effective noise buffering is a focus on "interior noise exposure" as the measure of noise level acceptability, rather than a combination of interior and exterior and/or day and night noise levels. The control of interior noise levels is practical with the use of strategies such as structure orientation, construction standards, noise mitigating materials, the distribution of rooms within the house, the use of auxiliary structures such as garages to block sound, and the use of terrain and natural features to affect the intensity of sound that reaches and is transmitted through the structure. While it is true that some of these, such as the orientation of structures, and the use of terrain and natural features of the area can also mitigate exterior noise levels, the effect will probably

not be as consistent across a property or in all situations.

The major reason that mitigating for exterior noise levels is not feasible is the cost-benefit of addressing rural agricultural noises that are intermittent at best, usually not exceeding 150 – 200 hours per year, and that are inherently and technically difficult to address. The few potential strategies to address exterior noise – distance, barriers, and reduction of source machine output - all present significant constraints to reasonable mitigation.

Relying on distance is not a viable option for much the same reason that it wasn't the mechanism of choice for spray drift – too land intensive. To achieve an exterior noise level of just a typical quite daytime urban area would require approximately 1,500 ft. It could take another 500 ft. or more to reach the level of a quiet urban nighttime.

An alternative to distance in mitigating exterior noise levels would be a sound barrier of the type used alongside highways. Not only are the aesthetic drawbacks of such construction considerable (especially since most people locating on the urban fringes are doing so <u>because</u> of the attraction of the rural landscape), but the cost of such walls would be considerable. In addition, they are only effective if they interfere with the line of sight of receptor and source — taller buildings from the urban side, wind machines from the rural side, and significant slopes on either side would reduce the effectiveness of the barrier. Finally, because of its height and lack of permeability, a sound barrier could actually be counterproductive for spray drift mitigation.

The last major potential mechanism in noise mitigation would be the reduction of the source machines' output. To date, the only real effective means of mitigating noise source directly is the construction of a containment building, such as a pump house or a building for a generator, for fixed noise producers. Because the most significant agricultural noise producers are not small, fixed machines, but rather are large and fixed (such as a wind machine) or mobile (such as a tractor with or without spray equipment), the potential for direct noise mitigation is not significant.

The main advantage of using interior noise levels as a measure of adequate noise mitigation is the fact that the vast majority of complaints about rural agricultural noise occur when that noise is generated at night and in the early morning, between the hours of 10:00 PM and 6:00 AM, at which time potential complainants are invariably attempting to sleep. This means that the individuals to be buffered from the noise are usually in a controllable space that is relatively easily engineered. The main disadvantage of relying on interior noise levels is the human factor. For a noise mitigation strategy that incorporates a number of measures to reduce the total sound transmission into a living space to be effective, people must cooperate. Just one open window can defeat even the costliest noise mitigation measures. Nonetheless, it is a reasonable assumption that individuals with full knowledge that they are choosing to live in an area in which they will be exposed to certain noise levels on an intermittent basis (at any time of night and day), and who are provided with the means (such as their windows) to mitigate these occasional unacceptable levels of noise, should be expected to do so when it becomes necessary.

<u>Noise Levels and Buffering Strategies</u>

In all circumstances in which buffering from chemical spray drift is required, noise mitigation is indicated for urban sensitive receptors within the first 500 feet of the rural/urban boundary. These 500 feet are divided into four Noise Zones (see section F of Appendix 1 for details). Each Noise Zone specifies Sound Transmission Class (STC) ratings for the exterior envelope sufficient to mitigate agricultural noise to an approximate interior nighttime level of 45 d(B)A. For all noise mitigating solution options, an agricultural noise source of 90 dB(A), of mid to higher frequencies, is used as the most likely higher-level rural agricultural noise. The agricultural noise source is assumed to be located

25 ft. from the rural/urban boundary, and is assumed to have attenuated (lessened) to 90d(B)A at the urban/rural boundary. The use of this noise standard of 90 dB(A) compares favorably with readings conducted in the Rogue Valley on the most commonly complained-about noise producers—tractors, airblast sprayers, and wind machines.

Element B – Noise from rural agricultural activities

Objective: To mitigate the interior noise impacts of rural agricultural activities.

Performance Criteria: Sensitive receptors to be located or incorporate measures such that rural agricultural noise does not adversely affect community public health and safety, and does not lead to significant levels of complaints concerning adjacent rural agricultural operations.

Solution Options

HIGH or LOW Potential Impact Agricultural Land
SENSITIVE Receptors

(1) Construction and placement of urban sensitive receptors within 500 ft. of the rural/urban boundary will comply with the following criteria for the acoustic design of the exterior building envelope and for the ventilating system and its parts (see details in Section F of Appendix 1).

Noise Zone 1	0 to 50 ft. from rural/urban boundary	no new sensitive receptors
Noise Zone 2	51 to 175 ft. from rural/urban boundary	exterior walls = STC-45 exterior windows = STC-38 exterior doors = STC-33 roof/ceiling assembly = STC-49 ventilation = see F2 in Appendix 1 for details
Noise Zone 3	176 to 375 ft. from rural/urban boundary	exterior walls = STC-40 exterior windows = STC-33 exterior doors = STC-33 roof/ceiling assembly = STC-44 ventilation = see F2 in Appendix 1 for details
Noise Zone 4	376 to 500 ft. from rural/urban boundary	exterior walls = STC-35 exterior windows = STC-28 exterior doors = STC-26 roof/ceiling assembly = STC-39 ventilation = see F2 in Appendix 1 for details

or:

(2) Design measures from a qualified acoustic consultant will be incorporated in community and individual structure design to achieve a sound transmission loss sufficient to reduce exterior noise levels to a maximum of 45 dB(A) within sensitive receptor structures. A standard agricultural noise source of 90dB(A) of mid to higher frequencies, measured at the rural/urban growth boundary, and originating 25 ft. into the rural property, is assumed.

ELEMENT C – Sediment and Stormwater Run-off

Overview

Urban development affects land surface characteristics and the hydrological balance, with the impacts often occurring on farmland located lower in the landscape. The increase of impermeable surfaces and changes to drainage patterns can accelerate soil erosion, siltation and sedimentation; and increase the risk of flooding. Techniques to alleviate conflict due to downstream effects of residential development highlight suitable erosion, sediment, and stormwater control during the construction and operational stages of a development.

Buffering Considerations

Whenever possible, the 50 to 200 ft. width of the spray drift buffers should be considered an important option for mitigating sediment and stormwater run-off. Options can include provisions for erosion controls during the construction and operation phases of the development, and permanent management of stormwater run-off. If the use of the buffer areas is not possible, all erosion control and permanent stormwater management must take place within the built portion of the development. **Ongoing maintenance and enforcement must be identified and incorporated into the conditions of approval prior to the start of construction.**

Element C – Sediment and stormwater run-off from development

Objective: To design new urban development so that the impact of run-off and sediment from urban development areas onto rural agricultural land is minimized.

Performance Criteria: Urban development to be located or incorporate measures to minimize the impact of urban-derived sediment and storm water run-off onto rural agricultural land.

Solution

HIGH or LOW Potential Impact Agricultural Land
SENSITIVE or NON-SENSITIVE Receptors

Urban development proposals to include the following:

(1) Urban development proposals to include the following:
an erosion control and prevention plan for the construction and operation phases of the development that meet current federal, state, and local standards, especially as concerns the conveyance of stormwater run-off from all hard surfaces (including roads, roofs, driveways etc.) to stable waterways, and measures such as water detention and retention implemented within the buffer area and/or the built area to reduce peak flow during runoff events to levels acceptable for the existing stream.

ELEMENT D – Trespass and Vandalism

Overview

One of the most damaging effects of urban proximity to farmland is the issue of trespass and vandalism. Trespass is important not just because it is the necessary precursor to vandalism, but because of the significant liability issues connected with the accidental exposure of trespassers to chemicals and the danger of heavy machinery. Vandalism itself may be the single most common reason given by many agriculturists with land adjacent to urban areas for claiming that their land is no longer agriculturally viable. Interestingly, vandalism is often highest in areas with elevated levels of complaints from nearby residents about noise and chemical spray.

Buffering Considerations

Although important in creating a physical separation between development and rural agricultural land, the width of the spray drift buffers themselves, even with a vegetative element, will not prevent trespass. In fact, without the inclusion of some element to frustrate trespass, buffers could be the object of vandalism themselves, thus potentially compromising their ability to appropriately mitigate spray drift. Unless there is a significant natural barrier to trespass incorporated into the buffer, such as a steep draw, a deep, permanent creek, a very dense, established stand of blackberries, a cliff, or something similar, a fence or other man-made barrier will have to be incorporated. As specified in Section G of Appendix 1, the recommended man-made barrier is a minimum 6 ft. chain link fence designed to be difficult to scale. If the fence is to be added to a larger lot residential setback buffer, it may be of other materials, but must be of the same minimum height and must be climb resistant. With the residential setback buffers, the fence is to be established at the urban/rural property line; with all other non-vegetative, non-setback buffers the fence should be on the development/buffer boundary (or, if there is some community use of part of the buffer, then between the community use and the rest of the buffer), and with vegetative buffers, on the development side of the vegetative element (or, if there is some community use of part of the buffer, then between the community use and the rest of the buffer). See Section G of Appendix 1 for potential fence placements. In lieu of a fence, trespass-inhibiting shrubs may be planted. These shrubs would become part of the buffer, and would have to be established at the same time the buffer is.

Element D – Trespass and vandalism from urban development

Objective: To provide protection for rural agricultural land from trespass and vandalism.

Performance Criteria: Natural or man-made barriers to be incorporated in buffers to provide protection for rural agricultural land from trespass and vandalism originating from urban development.

Solution Options

HIGH or LOW Potential Impact Agricultural Land
SENSITIVE or NON-SENSITIVE Receptors

(1) Incorporate significant natural barriers in buffer areas;

or:

(2) Establish a minimum 6 ft climb-resistant fence of durable materials either on the rural/urban property line of residential setback buffers, on the buffer/development boundary of non-vegetative, non-setback lot buffers (or, if there is some community use of part of the buffer, then between the community use and the rest of the buffer), and with vegetative buffers, on the development side of the vegetative element (unless there is an agreed-upon need for access to the vegetative element from the development side). See Section G of Appendix 1 for details.

or:

(3) Establish a planting of trespass inhibiting shrubs. These shrubs can be incorporated in a vegetative element, or can be stand-alone. They must adhere to the criteria in Section G of Appendix 1**.**

ELEMENT E – Odor

Overview

Odor has been determined to be of lesser importance in the majority of cases in the Rogue Valley. Odor in rural areas can arise from use of rural agricultural chemical sprays, fertilizers, effluent disposal, intensive livestock operations, and composting plants. Such odors can have a negative impact on urban residential quality of life, but rarely have the potential to affect public health. Confined animal feeding operations (CAFOs) are subject to their own set of regulations.

Odor is often a major factor in many complaints about off-site chemical spray drift where there is actually no real toxic exposure. Some rural agricultural chemicals contain >markers=(strong odors) to allow easy identification, so it is these markers or mixing agents that are often detected at some distance from the target area and cause concern, even though in many instances only extremely low levels of the active ingredients may be present. Residents=association of the odor with the chemical is sufficient to raise fears of exposure.

Factors affecting complaints from odor are influenced by the frequency, intensity, duration and offensiveness of the odor. An objectionable odor may be tolerated if it occurs infrequently at a high intensity; however, a similar odor may not be tolerated at lower levels if it persists for a longer duration or more frequently. In addition, tolerance of rural agricultural odors is highly subjective and varies greatly among individuals.

Odor can be emitted from a variety of sources and is dispersed by the atmosphere, and typically seems worse during hot weather. Ground level concentrations of odor have been reported as being inversely related to wind speed and atmospheric conditions, i.e. the lower the wind speed and the more stable the conditions, the higher the concentration. The subjective nature of conflict resulting from exposure to odor makes the determination of design goals difficult. Unlike chemical spray drift that is in the form of liquid droplets, odors are in the form of gases and can thus travel and be detected at greater distances. Other than relying on the restrictive covenant, no feasible cost effective measures are available to the developing urban areas for mitigating most odor issues.

Element E – Odor

Objective: Odor as a by-product of rural agricultural operations will have a minimal negative effect on rural agricultural operations.

Performance Criteria: Awareness of the probability of rural agricultural operations causing odor, and of their right to do so under Oregon law, will be emphasized.

Solution

HIGH or LOW Potential Impact Agricultural Land
SENSITIVE or NON-SENSITIVE Receptors

(1) All urban properties within 1,000 ft. of rural agricultural lands will have a restrictive covenant attached to their deeds clearly stating that urban residents in proximity to rural agricultural land will likely be exposed to a variety of odors from agricultural operations.

ELEMENT F – Dust, Smoke, and Ash

Overview

Dust, smoke, and ash, like odor, have been determined to be of lesser importance in the Rogue Valley. Although some rural agricultural activities, including cultivation prior to planting, tractor and transport movements, crop harvest, legal frost protection heaters, and prescribed fires for disease control can generate dust, smoke, and ash, this is considered to be of little importance as a rural/urban antagonist in the Rogue Valley. As with odor, above, the inclusion of the probability of exposure to dust, smoke, and ash in the restrictive covenant is considered sufficient mitigation.

Element F – Dust, smoke, and ash

Objective: Dust, smoke, and ash, as a by-product of rural agricultural operations will have a minimal negative effect on rural agricultural operations.

Performance Criteria: Awareness of the probability of rural agricultural operations causing dust, smoke, and ash, and of their right to do so under Oregon law, will be emphasized.

Solution

HIGH or LOW Potential Impact Agricultural Land
SENSITIVE or NON-SENSITIVE Receptors

(1) All urban properties within 1,000 ft. of rural agricultural lands will have a restrictive covenant attached to their deeds clearly stating that urban residents in proximity to rural agricultural land will likely be exposed to dust, smoke, and ash from agricultural operations.

Buffering Design Criteria Summary Tables

HIGH Potential Impact Agricultural Land
SENSITIVE Receptors (all residential uses, hotels, motels, schools, places of worship, medical centers, etc)

	CHEMICAL SPRAY DRIFT				TRESPASS AND VANDALISM	NOISE			SEDIMENT / STORMWATER RUN-OFF	ODOR, DUST, SMOKE, & ASH
	tree-based buffer	bamboo buffer	larger lot tree-based buffer	non-vegetative buffer	fencing / shrubbery	noise zone 2 criteria	noise zone 3 criteria	noise zone 4 criteria	erosion control and prevention plan	restrictive deed covenant
Option 1										
0 to 100 ft	✔				✔				✔	
101 to 175 ft						✔			✔	✔
176 to 375 ft							✔		✔	✔
376 to 500 ft								✔	✔	✔
500 to 1000 ft										✔
Option 2										
0 to 75 ft		✔			✔				✔	
76 to 175 ft						✔			✔	✔
176 to 375 ft							✔		✔	✔
376 to 500 ft								✔	✔	✔
500 to 1000 ft										✔
Option 3										
0 to 100 ft			✔		✔				✔	✔
101 to 175 ft						✔			✔	✔
176 to 375 ft							✔		✔	✔
376 to 500 ft								✔	✔	✔
500 to 1000 ft										✔
Option 4										
0 to 200 ft				✔	✔				✔	
201 to 375 ft							✔		✔	✔
376 to 500 ft								✔	✔	✔
500 to 1000 ft										✔

NOTES:

- The distances in this chart are linear distances from the rural/urban boundary, and assume that all buffering takes place on urbanizing land. If all or part of a buffer is located on rural land, distances will be measured from the beginning of the buffer, and not from the beginning of the boundary.
- Vegetative buffer elements will be maintained and protected through a variety of different agreements. If a restrictive covenant is used for this purpose, it would be in addition to the restrictive covenant used to mitigate odor, dust, smoke, & ash, chemical spray drift, and noise.
- Noise Zone 1 does not appear in this chart because no new sensitive receptors are permitted in that zone.
- Larger lot tree-based buffers are only allowed on urban lands adjacent to the outermost urban reserve boundary.

HIGH Potential Impact Agricultural Land
NON-SENSITIVE Receptors (commercial, industrial)

	CHEMICAL SPRAY DRIFT		TRESPASS AND VANDALISM	SEDIMENT / STORMWATER RUN-OFF	ODOR, DUST, SMOKE, & ASH
	tree or bamboo-based buffer	non-vegetative buffer	fencing / shrubbery	erosion control and prevention plan	restrictive deed covenant
Option 1					
0 to 50 ft	✔		✔	✔	
51 to 175 ft				✔	✔
176 to 375 ft				✔	✔
376 to 500 ft				✔	✔
501 to 1000 ft					✔
Option 2					
0 to 100 ft		✔	✔	✔	
101 to 175 ft				✔	✔
175 to 375 ft				✔	✔
376 to 500 ft				✔	✔
501 to 1000 ft					✔

NOTES:

- The distances in this chart are linear distances from the rural/urban boundary, and assume that all buffering takes place on urbanizing land. If all or part of a buffer is located on rural land, distances will be measured from the beginning of the buffer, and not from the beginning of the boundary.
- Vegetative buffer elements will be maintained and protected through a variety of different agreements. If a restrictive covenant is used for this purpose, it would be in addition to the restrictive covenant used to mitigate odor, dust, smoke, & ash, chemical spray drift, and noise.

LOW Potential Impact Agricultural Land
SENSITIVE Receptors (all residential uses, hotels, motels, schools, places of worship, medical centers, etc)

	CHEMICAL SPRAY DRIFT / TRESPASS AND VANDALISM		TRESPASS AND VANDALISM	NOISE			SEDIMENT / STORMWATER RUN-OFF	ODOR, DUST, SMOKE, & ASH
	non-vegetative buffer	larger lot non-veg. buffer	fencing / shrubbery	noise zone 2 criteria	noise zone 3 criteria	noise zone 4 criteria	erosion control and prevention plan	restrictive deed covenant
Option 1								
0 to 50 ft		✔	✔				✔	✔
51 to 175 ft				✔			✔	✔
176 to 375 ft					✔		✔	✔
376 to 500 ft						✔	✔	✔
501 to 1000 ft								✔
Option 2								
0 to 100 ft	✔		✔				✔	
101 to 175 ft				✔			✔	✔
175 to 375 ft					✔		✔	✔
376 to 500 ft						✔	✔	✔
501 to 1000 ft								✔

NOTES:

- The distances in this chart are linear distances from the rural/urban boundary, and assume that all buffering takes place on urbanizing land. If all or part of a buffer is located on rural land, distances will be measured from the beginning of the buffer, and not from the beginning of the boundary.
- Vegetative buffer elements will be maintained and protected through a variety of different agreements. If a restrictive covenant is used for this purpose, it would be in addition to the restrictive covenant used to mitigate odor, dust, smoke, & ash, chemical spray drift, and noise.
- Noise Zone 1 does not appear in this chart because no new sensitive receptors are permitted in that zone.
- Larger lot tree-based buffers are only allowed on urban lands adjacent to the outermost urban reserve boundary.

LOW Potential Impact Agricultural Land
NON-SENSITIVE Receptors (commercial, industrial)

	CHEMICAL SPRAY DRIFT / TRESPASS AND VANDALISM	TRESPASS AND VANDALISM	SEDIMENT / STORMWATER RUN-OFF	ODOR, DUST, SMOKE, & ASH
	non-vegetative buffer	fencing / shrubbery	erosion control and prevention plan	restrictive deed covenant
Option 1				
0 to 50 ft	✔	✔	✔	
51 to 175 ft			✔	✔
176 to 375 ft			✔	✔
376 to 500 ft			✔	✔
501 to 1000 ft				✔

NOTES:

- The distances in this chart are linear distances from the rural/urban boundary, and assume that all buffering takes place on urbanizing land. If all or part of a buffer is located on rural land, distances will be measured from the beginning of the buffer, and not from the beginning of the boundary.
- Vegetative buffer elements will be maintained and protected through a variety of different agreements. If a restrictive covenant is used for this purpose, it would be in addition to the restrictive covenant used to mitigate odor, dust, smoke, & ash, chemical spray drift, and noise.

VIII – DEVIATING FROM THE GUIDELINES

Should the proponent of development elect to pursue a buffer design that proposes less linear separation or less of a vegetative element than specified in the minimally acceptable solutions, or that differs materially in other ways (other than increasing the linear distance or the amount of vegetative element) the buffer would be considered a "flexed" design.

When is a Buffer Design Not Considered Flexed?

A buffer design is not considered flexed when existing elements consistent with the purpose of the buffer are incorporated in the buffer.

For buffers without vegetative buffer elements, the requirements of linear distance can be achieved by elements such as the following:

- Man-made or natural features such as infrastructure rights-of-way, roads, non-residential structures, watercourses, wetlands, ridge lines, rock outcrops, forested areas, and steep slopes.;
- Non-farmable areas of the farmland being buffered (including yards, storage areas, roads, and all structures);
- Publicly owned land without consistent present or projected public use (as determined by the public entity owner):
- An easement on agricultural land purchased by the proponent of development;
- Rural residential, commercial, or industrial land without a significant history of complaints related to adjoining farm use, whose owners agree in writing to the use of their land as part of the required buffer area; and
- Other open areas (except undeveloped rural residential, commercial, or industrial parcels) that are considered appropriate to the purpose of the buffer.

For buffers with vegetative elements, the requirements can be partially or fully satisfied by existing areas of trees and brush, as long as their buffering effect is essentially the same as that intended by the requirements in Appendix 1. If the characteristics of the existing vegetation do not meet the requirements in Appendix 1, and cannot substitute in full or in part for an adequate vegetative buffer, then the area can either be incorporated into the buffer design at half its "value" (for example, a 20 ft. wide riparian area would be calculated as 10 ft. of vegetative buffer), or it can be left out of the vegetative element and calculated at its original width (20 ft. of existing vegetation would be considered as 20 ft. of bare land).

Whenever the proposed buffer design varies from the minimum buffering options described in these guidelines, the proponent of development is responsible for the preparation of a **Conflict Assessment and Buffer Study (CABS)**. **If no material variation is sought from the minimum buffering guidelines, the CABS is not necessary**.

What must be included in the CABS?

The CABS must:

a. Determine the present and likely future agricultural land use activities with the potential of causing problems for adjacent urban development. The determination of likely agricultural practices should be based on factors such as soil type; topography; parcel size, shape, and location; infrastructure; microclimatic conditions; regional rural agricultural practices and crops; and the farming history of the parcel and surrounding similar parcels.
b. Determine how the proposed urban development will likely impact the management and

operation of nearby farmlands. All owners of resource land within 1,000 ft of the land proposed for development will be interviewed, and full transcripts of those interviews will be attached to the CABS.

c. Identify the elements that may cause conflict and the extent of the conflict, from both the urbanizing as well as from the rural agricultural. The elements should be quantified, where possible, in terms of frequency and duration of activities to determine the element's impacts. As part of this evaluation, the CABS must consider the likely future uses determined in (a) above. The buffering mechanisms that are proposed must be sufficient to accommodate these potential future uses. NOTE: The current financial viability of a particular crop will not be considered an important limiting factor in determining potential future use.
d. Propose a set of buffering measures that will achieve acceptable buffering outcomes – these may include, but not be limited to, the siting of residences, size and geometry of lots, separation widths, communal open space, vegetation, natural landscape features, acoustic features, etc.
e. Propose the means by which the proposed buffering measures will be monitored and maintained. This should include responsibility for implementing and maintaining specific features of the buffer areas to ensure continued effectiveness. Acknowledgment of the authority responsible for ensuring compliance with any agreement will be plainly cited.
f. Establish a timeline for the development that establishes when the buffer will be installed. It shall be assumed that the buffer will be established prior to either final plat sign off or final building inspection (for larger lot buffers and in the event no land division occurs).

The CABS must be prepared by appropriate experts under contract with the proponent of development, and upon completion of a final draft, must be submitted to the owners and operators of rural agricultural land within 1,000 ft of the boundary between the rural and proposed urban uses. These owners and operators will be given a month to provide input on the CABS, and such input will be attached to the CABS. All costs incurred in the preparation of the CABS will be the responsibility of the proponent of development. The non-refundable base fee for the CABS, payable to Jackson County to offset the costs of the Agricultural Buffering Committee, is $1,000. Starting in 2010, this base fee will be increased annually for inflation or as deemed appropriate by the Jackson County Commissioners to offset real costs.

The draft CABS must be reviewed and a recommendation forwarded to the appropriate city planning commission by the Agricultural Buffering Committee, which will be comprised of appropriate experts appointed by the Jackson County Board of Commissioners. The Agricultural Buffering Committee shall be considered an ad hoc advisory committee to the city planning commission in whose jurisdiction the development is proposed.

The Agricultural Buffers Committee

The 10 to 15 members of the Agricultural Buffering Committee shall have expertise in as many of the following fields as possible:

Soil Science; Agronomy; Dendrology and/or Forestry; Agrochemicals; Landscape Architecture; Animal Husbandry; Orchard Management; Horticulture; Farming; Ranching; and Parks and Recreation.

In addition, there shall be a permanent member of the Jackson County Planning Department or Planning Commission, and an open non-voting position to be filled on an as-needed basis by a member of the affected city's planning department or planning commission. The Committee shall elect co-chairs from the non-jurisdiction membership.

Should the Agricultural Buffering Committee fail to recommend the CABS, a mediated solution between the city, county, proponent of development, and the co-chairs of the Agricultural Buffering Committee will be required before the planning and application process can proceed. The proponent is responsible for meeting the expenses of the mediation process. If a mediated settlement is not successful, the Agricultural Buffering Committee will forward a negative recommendation on the CABS to the city planning commission with the Committee's recommended changes to the flexed buffer design.

Should the Agricultural Buffering Committee, in the course of its review of the flexed buffer proposal, require expert assistance, the proponent of development will be notified of the cost of that technical assistance. The proponent of development may suggest an alternative to the identified technical assistance, but the Committee will make the final selection. If the proponent of development does not agree to the cost of the technical assistance, the flexed buffer design will receive a negative recommendation without any further analysis.

Should the city decide to favor the proponent's flexed design over the recommendations of the Agricultural Buffering Committee, a major regional review would then be triggered under the guidelines set forth in the Greater Bear Creek Regional Problem Solving Plan Stakeholders Agreement.

American Farmland Trust

April 4th, 2016

The Honorable Marc Boldt, Council Chair
Clark County Board of County Councilors
PO Box 5000
Vancouver, Washington 98666-5000

Dear Council Chair Boldt and Councilors Madore, Mielke, Olson, and Stewart,

Subject: Comments on the proposed Rural Industrial Land Bank for the County Councilors April 5, 2016 Public Hearing

Thank you for the opportunity to comment on the proposed Rural Industrial Land Bank. **We respectfully urge you to deny the Rural Industrial Land Bank.**

We lose almost an acre of farmland every minute in the United States. American Farmland Trust works to prevent conversion of this precious resource by supporting policies to protect farmland from development. Maintaining our agricultural land base is critical to feeding our growing population and to providing the ecosystem services required for a healthy environment. American Farmland Trust is a membership based organization with members hailing from across Washington, including Clark County.

The agricultural economy is significant in Clark County. In 2012, the market value exceeded $50 million. However between 2007 and 2012, Clark County lost both farms and farmland (decrease of 8% and 5% respectively from 2007 to 2012).[1] **The proposed Rural Industrial Land Bank is a step in the wrong direction. It would result in the loss of even more farmland.** Once farmland is paved over for development, we can never get it back.

According to the County's agricultural lands analysis, 99% of the proposed site contains prime soils.[2] Prime farmland soils have the best physical and chemical properties for most kinds of agriculture, requiring less water, fertilizers, and pesticides. They are the easiest soils to keep healthy, farm profitably, and grow the widest variety of crops with the least environmental impact. These soils are a limited natural resource; they cannot be replaced. Furthermore, The *Clark County Buildable Lands Report* found that the County's urban growth areas have sufficient land to accommodate the County's planned employment growth. It does not make sense, nor does it follow the intent of the Growth Management Act, to convert land that is actively being farmed to industrial use. **We urge the Board of County Councilors to recognize that this land has properties that make it particularly well suited for agricultural use and that it deserves to maintain its current designation. Please deny the proposed Rural Industrial Land Bank.**

Thank you for your consideration. Please do not hesitate to contact us via telephone 206-860-4222 or e-mail kdelavan@farmland.org if you have any questions.

Sincerely,

Kate Delavan
Interim Regional Director

[1] USDA (2012). *2012 Census of Agriculture County Profile, Clark County, Washington*
[2] (2016) *Appendix B, Agricultural Lands Analysis*, (https://www.clark.wa.gov/community-planning/rural-industrial-land-bank)

Date: April 5, 2016

To: The Honorable Marc Boldt, Council Chair, Clark County Board of Councilors
And Councilors Jeannie Stewart, Julie Olson, David Madore and Tom Mielke
From: Heidi Owens, Clark County Resident
Subject: Saving Ag in Clark County; a creative consideration to the RILB

Dear Councilors,

Thank you for the opportunity to comment on the proposed Rural Industrial Land Bank (RILB). I hope this council would Last week, I testified on the importance of a food system in Clark County, and I asked the council to seriously consider some actions, including:

- Preserving farm land.
- Adopting TDRs.
- Looking at ways to build Clark Counties Agriculture, such as creating a food HUB or promoting valued-added AG-production facilities, like a cold storage facility.
- Passing a resolution that this Council will follow GMA.

One fact that I cut from my testimony, due to time, is that the American Farmland Trust estimates that America is losing 50 acres of farmland an hour! Tonight I am here to ask you, as individual council members – what do you want as your legacy? Do you want to be remembered as one of the council members that endorsed a significant loss of prime Ag-land in Clark County? As someone that contributed to food insecurity in our region? There will be winners and losers in this proposed de-designation of Ag-land, and I am of the firm belief that there will be more losers, and that if approved, the decision will hurt our county and rural agriculture, particularly in the Brush Prairie area. I invite you to consider there are other options; ones that allow you to enrich the food system in Clark County.

What really troubles me, is that I am not convinced the county needs this industrial land bank, and I am not alone. Looking around the UGA areas of our county, I see available land, particularly in Vancouver, but other cities too, both vacant land and land/parcels that could be redeveloped. And what happened to discovery corridor along I-5. Ag Land along a major highway seems better suited for industrial uses, especially when it is closer to services and residential areas, than land smack dab in the middle of a concentrated Ag area. A strong case has <u>not</u> been made that the county needs this bank. In fact, it was not even the need for industrial land that brought this process forward was it?

No, this hearing to look at RILB is a reaction to an application by a particular land owner and that reaction is leading to a decision that does not best represent the use for ALL Clark County residents. What about the industrial land owners inside the UGA who have been patiently waiting for the growth and development of their land? Doesn't adding over 600 acres of additional industrial land bring a surplus to the market, depressing prices? It seems to me adding this acreage violates the good faith promise made to those who are now inside the UGA.

And, I also worry about some of the permitted uses under light industrial that could allow for chemicals, heavy metals, or petroleum based products to get into the air or ground water and ultimately the soil which would dramatically impact the crops that are grown on adjacent properties.

But, mostly I worry about the loss of the ag-resource land and what it means to Clark County and our Food System. Did you see the article in the Seattle Times about how Costco's demand for Organic food exceeds supply? HMMMM? The opportunities are right here in our own back yard, and that of our neighbors. Clark County sits in the center of the I-5 Pacific NW corridor; we have productive farm land. Please be brave and save this ag-land! Plus rea history of this parcel and rulings from both the growth management hearing board and the courts that a RILB on this property will make it through an appeal process? This proposal didn't start with a need; how can it be justified when there is no case for needing this additional land. A recent land inventory is in the works; I don't see how approval of this RILB can be defended without having a case that industrial land is in short supply.

That said, however, I think the council has an opportunity here to make a difference for Clark County while supporting Agriculture and our Food System and increase the odds of gaining approval from the Growth Management Hearing Board. Consider that RCW 36.70a.367(4)(a) highlights placement of an industrial land development that is "resource-based" near the resource lands it serves. This could be win-win for the County, its residents, and the industry.

What if this council recommends to staff and ultimately approves an overlay that focuses on the resource this application replaces, such as "FOOD SYSTEM" Overlay. Such an overlay and use would fit in the rural area supporting value-added agriculture in Clark County and bring product to Clark County for additional processing. This direction would bring jobs and fits with GMA. Your direction of focusing an overlay on our Food System would allow for many, many different types of businesses involved in the production, processing, support, distribution, manufacturing of food and/or Ag products. Some examples below would MORE than fill up the proposed land bank site, add many jobs to Clark County, promote the starting of small and micro businesses in the county, support our local food system, provide jobs for rural residents, increase the export of products from our county, and bring products to our county for processing. Some examples include:

- Businesses that process raw food commodities, such as bakeries, canners, creameries, frozen food processor, oil production, milling, etc.
- Beverage manufacturers.
- Businesses that store food, including a badly needed cold storage site in the region.
- Packagers.
- Dairy Waste recycler.
- Businesses that create labeling and packaging materials.
- A land trust that can lease land to small farmers to grow crops or raise farm animals.
- Businesses the focus on production and supply (feed manufacturing, equipment, seed packaging, green house manufacturing, bee keeping manufacturing, irrigation, organic farming supplies).
- Businesses that process other agricultural commodities, like fiber, dried flowers, basket weaving.
- Businesses that manufacture products for urban gardeners/food production.
- A food/Ag-based Research Park, in cooperation with WSU that includes labs for Ag study, food safety research, nutrition, soil testing, etc.
- Professional kitchens for local microbusiness to lease and develop products.
- Business that support the marketing and distribution of products from Clark County.

- Warehouse/distribution center.
- A business/organization that supports the sharing of farm equipment.
- Businesses that support the Ag-industry (soil testers, consultants, insurance).
- Small scale meat processor.

I ask this council to please consider what this loss really means for Clark County residents. Sure people say it is just dairy and hay, but it is more than that – it is the long term potential of these lands should food security become an issue, it is about enhancing the food system in our county, it is about supporting our rural neighbors, it is about meeting demand locally for quality food. Please do not give this application a blanket acceptance that allows for the potential of pollutants and conflicts to impact our areas agriculture communities. Instead, look at how to support Ag in this county before you approve this RILB, and if and when you do approve it, do it in a way that is best for all residents and strengthens resource production in our county.

Thank you.

Heidi Owens

816 Second Ave
Suite 200
Seattle, WA 98104

future wise

(206) 343-0681 Ext. 118
fax (206) 709-8218
futurewise.org

April 4, 2016

The Honorable Marc Boldt, Council Chair
Clark County Board of County Councilors
PO Box 5000
Vancouver, Washington 98666-5000

Dear Council Chair Boldt and Councilors Madore, Mielke, Olson, and Stewart:

Subject: Comments on the proposed Rural Industrial Land Bank for the Board of County Councilors April 5, 2016 public hearing.
Sent via email to: boardcom@clark.wa.gov; comp.plan@clark.wa.gov

Thank you for the opportunity to comment on the proposed Rural Industrial Land Bank. We urge the Board of County Councilors to deny the Rural Industrial Land Bank because it is unneeded and will pave over working farmland.

Futurewise is working throughout Washington State to create livable communities, protect our working farmlands, forests, and waterways, and ensure a better quality of life for present and future generations. We work with communities to implement effective land use planning and policies that prevent waste and stop sprawl, provide efficient transportation choices, create affordable housing and strong local businesses, and ensure healthy natural systems. We are creating a better quality of life in Washington State together. We have members across Washington State including Clark County.

The Rural Industrial Land Bank is unneeded because land suitable to site the major industrial development is available within Clark County's existing urban growth areas and therefore the Rural Industrial Land Bank violates the Growth Management Act (GMA)

The Growth Management Act (GMA), in RCW 36.70A.365(2)(h), provides that one of the requirements for a "major industrial development" is that "[a]n inventory of developable land has been conducted and the county has determined and entered findings that land suitable to site the major industrial development is unavailable within the urban growth area." RCW 36.70A.367(2)(b)(i) applies this requirement to major industrial developments with master planned locations. The *Addendum* identifies land suitable for major industrial development in the existing urban growth areas.[1] The *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal*, 2-1, does not dispute that there are sites within the

[1] *Clark County Rural Industrial Land Bank Programmatic Environmental Review pursuant to RCW 36.70A.367(2)(b), and Addendum to the Clark County Comprehensive Growth Management Plan Final Environmental Impact Statement* (October 2015) pages 13 and 14 of the *Addendum Part I: Inventory* accessed on April 4, 2016 at: https://www.clark.wa.gov/community-planning/rural-industrial-land-bank. Hereinafter referred to as the *Addendum*.

urban growth areas.[2] They argue that they are have multiple owners or are owned by the Port of Vancouver, but response does not show they do not exist.

Consequently, the Rural Industrial Land Bank cannot be approved at this time and, therefore, a Rural Industrial Land Bank on any of the non-urban growth area sites will violate the Growth Management Act.

There is enough land in the County's UGAs to accommodate the County's planned residential and job projections

The most recent *Clark County Buildable Lands Report* documents that there is more than enough land in the County's urban growth areas (UGAs) to accommodate the County's planned employment growth. The *Clark County Buildable Lands Report* states:

> In 2014, the Board of County Commissioners chose to plan for a total of 91,200 net new jobs. The County has an estimated capacity of 101,153 jobs as follows: The 2015 VBLM [Vancouver Buildable Lands Model], indicates a capacity of 76, 978 jobs. The cities of Battle Ground, La Center, and Ridgefield, have indicated they have additional capacity to accommodate 16, 755 jobs. Publicly owned land is not included in the model, therefore we assume that the 7,400 new public sector jobs estimated by ESD [State of Washington Employment Security Department] will occur on existing publicly owned facilities.[3]

The *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal*, 2-4, does not dispute that there is enough land in the urban growth areas to meet the County's planned residential and job projections.[4] Instead the response argues that the County is not required show that additional land is needed. But that was not our point. Our point is why pave over working farms when there is no need to do so? There is no dispute that there is no need for the Rural Industrial Land Bank. We recommend that the Board of County Councilors should deny this proposal.

---

[2] *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal* p. 4 accessed on April 4, 2016 at: https://www.clark.wa.gov/sites/all/files/the-grid/040516_19%20CC%20RILB_SEPA_Responses_Revised_Tracks_2016_0120_Marked.pdf .
[3] *Clark County Buildable Lands Report* p. 11 (June 2015) accessed on April 4, 2016 at: https://www.clark.wa.gov/sites/all/files/the-grid/061015WS_2015BUILDABLE_LANDS_REPORT.pdf and enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the *Addendum*.
[4] *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal* p. 5.

The Rural Industrial Land Bank is unneeded because Commercial and Light Industrial is already located in this area

Not only is there enough land in the UGAs, but Commercial and Light Industrial land is already located west and south of the proposed Rural Industrial Land Bank. The existing Vancouver urban growth area is also just south of the site. While this proposal is being sold on the grounds that rural residents could easily drive to jobs on the new site, there are already opportunities for jobs in this area. So again, the Rural Industrial Land Bank is unneeded.

The proposed Rural Industrial Land Bank qualifies as agricultural lands of long-term commercial significance and should be conserved

The proposed Rural Industrial Land Bank is Area VB from the County's illegal 2007 attempt to dedesignate this agricultural land.[5] Area VB was found to be illegally dedesignated by both the Growth Management Hearings Board and Clark County Superior Court.[6] The "County passed an ordinance redesignating parcels BC, VB, and the portions of parcels CA–1 and RB–2 that were not purportedly annexed, as [agricultural lands of long-term commercial significance] ALLTCS."[7] So this land qualified, and as the *Addendum's* analysis shows, continues to qualify as agricultural lands of long-term commercial significance.[8] And this land continues to have an Agriculture comprehensive plan designation.[9] The enclosed Google Earth images show in that proposed Bank Industrial Land Bank, outlined in red on two of the images, continues to be farmed as are many nearby parcels.[10]

Agriculture has long-term commercial significance in Clark County. Income from farm-related sources is up sharply in Clark County, increasing from $4.2 million in 2007 to $5.98 million in 2012. This is an increase of 41 percent, a much larger percentage increase than the Washington State increase of 27 percent.[11] Between 2007 and 2013, the average market value

---

[5] See *Comprehensive Growth Management Plan NE Vancouver UGA – Map 1 Deliberation Components* and *Comprehensive Growth Management Plan NE Vancouver UGA – Map 2 Deliberation Components* enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the *Addendum*.
[6] *Clark Cnty. Washington v. W. Washington Growth Mgmt. Hearings Review Bd.*, 161 Wn. App. 204, 220, 254 P.3d 862, 868 (2011) *vacated in part Clark Cnty. v. W. Washington Growth Mgmt. Hearings Review Bd.*, 177 Wn.2d 136, 298 P.3d 704 (2013). This portion of the decision was not vacated.
[7] *Id.*
[8] *Addendum* Appendix B: Agricultural Lands Analysis pages 7 – 10.
[9] County/UGA Comprehensive Plan Clark County, Washington accessed on April 4, 2016 at: https://www.clark.wa.gov/community-planning/maps
[10] See the enclosed file "RILB Vicinity Google Earth 2015 Images for Emailing.pdf."
[11] United States Department of Agriculture, National Agricultural Statistics Service, *2012 Census of Agriculture Washington State and County Data Volume 1* • Geographic Area Series • Part 47 AC-12-A-47 Chapter 2: County Level Data, Table 6. Income from Farm-Related Sources: 2012 and 2007 p. 261 (May 2014) accessed on April 4, 2016 at:
http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/Washin

of products sold per farm increased five percent from $25,079 to $26,367.[12] Clark County farmers rank second in Washington State in the number of "broilers and other meat-type chickens" they are raising.[13] The Clark County Food System Council reports that "in the past 5 years Clark County has seen an increase in the number of Community Supported Agriculture programs, growth in the number of farmers markets, and more interest in locally sourced and organically grown food."[14] So farming and ranching has economic benefits for Clark County.

Washington State Department of Agriculture's *Washington Agriculture Strategic Plan 2020 and Beyond* documents the need to conserve existing agricultural lands to maintain the agricultural industry and the jobs and incomes the industry provides.[15] As the strategic plan concludes "[t]he future of farming in Washington is heavily dependent on agriculture's ability to maintain the land resource that is currently available to it."[16] The *Addendum* discloses that this land is current available to agriculture and in fact is currently being farmed.[17] Globalwise, Inc. concluded that "[o]ne of the key obstacles in Clark County is the limited access to high quality agricultural land at an affordable cost."[18] As both this letter and the *Addendum* have documented, the site of the proposed Rural Industrial Land Bank is high quality agricultural land.[19]

The Rural Industrial Land Bank proposal is simply an attempted end run around the fact that this land qualifies as agricultural land of long-term commercial significance and so cannot be included in the urban growth area. We urge the Board of County Councilors to deny this proposal. If there was a needed to expand the UGA or provide sites outside the UGAs for major industrial developments, which there is not, there are sites that are not agricultural lands of long-term commercial significance that could be paved over.

---

gton/ and a copy of *2012 Census of Agriculture Washington State and County Data Volume 1* was enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the *Addendum*.

[12] US Department of Agriculture National Agricultural Statistics Service, *2012 Census of Agriculture County Profile Clark County, Washington* p. *1 accessed on April 4, 2016 at: http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Washington/cp53011.pdf and enclosed with Futurewise's December 14, 2015, letter to the Clark County Planning Commission.

[13] *Id.*

[14] *Promoting Agricultural Food Production in Clark County*, A proposal developed by the Clark County Food System Council p. 2 (November 2013) accessed on April 4, 2016 at: https://www.clark.wa.gov/sites/all/files/community-planning/Planning%20Commission/2015%20Meetings/FSCProposalDraft.pdf and enclosed with enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the *Addendum*.

[15] Washington State Department of Agriculture, *Washington Agriculture Strategic Plan 2020 and Beyond* pp. 50 – 52 (2009) accessed on April 4, 2016 at: http://agr.wa.gov/fof/ and enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the Addendum.

[16] *Id.* at p. 50.

[17] *Addendum Appendix B: Agricultural Lands Analysis* p. 37.

[18] Globalwise, Inc., *Analysis of the Agricultural Economic Trends and Conditions in Clark County, Washington* Preliminary Report p. 48 (Prepared for Clark County, Washington: April 16, 2007) accessed on April 4, 2016 at: https://www.clark.wa.gov/sites/all/files/community-planning/Rural%20Lands/final_ag_analysis_prelim_report.pdf and enclosed with the paper original of Futurewise's October 16, 2015 letter commenting on the Addendum.

[19] *Addendum* Appendix B: Agricultural Lands Analysis pages 7 – 10.

The proposed Rural Industrial Land Bank qualifies as "Clark County's Best Farm Land" and should be conserved

The Clark County Food System Council has identified all of the proposed Rural Industrial Land Bank and much of the land in its vicinity as "Clark County's Best Farm Land."[20] The Clark County Food System Council identified this land "by looking at characteristics of the land that make it suitable for food production."[21] These included soils with land capability 1 through 4 soils, land that is flat and rolling, lands that have at least four acres outside the buffers around stream habitats, and "lands that are currently zoned for agriculture or rural residences. … [They] excluded lands that are tax exempt because they are owned by churches, land trusts, or governments."[22]

This is another reason that this land should be conserved. The Board of County Councilors should deny this proposal.

The Addendum does not identify reasonable mitigation measures and so violates the Washington State Environmental Policy Act (SEPA) and the Growth Management Act (GMA)

An environmental impact statement (EIS), including an addendum, must identify reasonable mitigation.[23] The GMA, in RCW 36.70A.365(2)(a), requires that the "[n]ew infrastructure is provided for and/or applicable impact fees are paid …" for the Rural Industrial Land Bank. But the *Addendum's* discussion of mitigation measures on page 26 of the *Addendum Part II: Alternative Sites Analysis* includes no information on how the new infrastructure will be provided or how the impact fees the county charges will be updated to include the considerable costs of the needed infrastructure. Nor are any systems development changes discussed for providing water and sewer service is not available at this site.

Similarly, RCW 36.70A.365(2)(f) requires that "[p]rovision" must be "made to mitigate adverse impacts on designated agricultural lands, forest lands, and mineral resource lands[.]" But again, the *Addendum* does not include this required mitigation. Given that these properties are agricultural lands of long-term commercial significance and are adjacent to agricultural lands of long-term commercial significance this is a significant deficiency.

The *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal*, 2-5, seems to argue that the impacts on agricultural land will be migrated by a 100 foot buffer and the fact that agriculture will be an allowed use in the Rural Industrial Land

---

[20] *Promoting Agricultural Food Production in Clark County*, A proposal developed by the Clark County Food System Council p. 4 (November 2013).
[21] *Id.* p. 5.
[22] *Id.*
[23] WAC 197-11-440(6)(a).

Bank.[24] The buffer is required by RCW 36.70A.365(2)(i) to protect rural lands. And a 100 foot wide buffer will not protect urban like uses, such as those in the Rural Industrial Land Bank, from being impacted by agricultural uses, leading to complaints that can drive farmers out of business.[25] Nor is a 100 foot wide buffer sufficient to protect rural residential and agricultural uses from many industries.[26]

RCW 36.70A.365(2)(f)'s requirement to mitigate impacts on agricultural land of long-term commercial significance is a separate requirement from the buffer requirement. If the land in the RILB is converted to industrial and commercial uses, what mitigation will be provided for the loss of 602 acres agricultural land of long-term commercial significance? The answer is apparently none. This violates RCW 36.70A.365(2)(f).

Professor Nelson has written, "[i]t seems that for every acre of prime farmland that is urbanized, up to another acre becomes idled due to the impermanence syndrome."[27] What mitigation is proposed for this loss of the additional 602 acres of other farmland due to the impermanence syndrome? Again, the answer is apparently none. Again, this violates also RCW 36.70A.365(2)(f).

The failure to identify mitigation violates both the Washington State Environmental Policy Act (SEPA) and the GMA. This is other reason the Board of County Councilors should deny the Rural Industrial Land Bank.

Thank you for considering our comments. If you require additional information please contact me at telephone 206-343-0681 Ext. 118 and email tim@futurewise.org

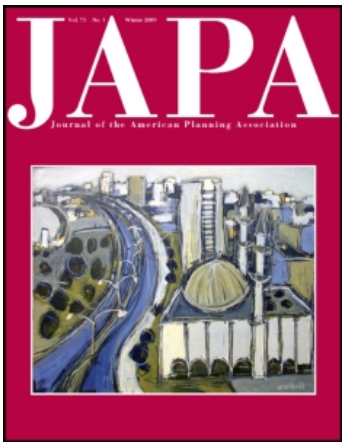
---

[24] *Clark County Rural Industrial Land Bank Responses to SEPA Comments Planning Commission Proposal* p. 6.
[25] Prepared by the Resource Lands Review Committee of the Rogue Valley Regional Problem Solving process, *Guidelines for Establishing Effective Buffers Between Rural Agricultural and Urban Uses* pp. 21 – 23 (June 6, 2006) accessed on April 4, 2016 at: http://rvcog.org/rps_pdf/Ag_buffering_guidelines.pdf and enclosed in a separate email; Department of Natural Resources, Queensland & Department of Local Government and Planning, *Queensland Planning Guidelines: Separating Agricultural and Residential Land Uses* p. 19 (DNRQ 97088: Aug. 1997) accessed on April 4, 2016 at: http://www.dilgp.qld.gov.au/resources/policy/plng-guide-sep-ag.pdf and enclosed in a separate email; and Arthur C. Nelson, *Preserving Prime Farmland in the Face of Urbanization: Lessons from Oregon* 58 JOURNAL of the AMERICAN PLANNING ASSOCIATION 467, p. 468 (1992).
[26] Western Australia Environmental Protection Authority, *Guidance for the Assessment of Environmental Factors: Separation Distances between Industrial and Sensitive Land Uses No. 3* (June 2005) Appendix 1: Separation Distances between Industrial and Sensitive Land Uses accessed on April 4, 2016 at: http://epa.wa.gov.au/EPADocLib/1840_GS3.pdf and enclosed in a separate email.
[27] Arthur C. Nelson, *Preserving Prime Farmland in the Face of Urbanization: Lessons from Oregon* 58 JOURNAL of the AMERICAN PLANNING ASSOCIATION 467, p. 470 (1992) (citation omitted) enclosed with this letter. As enclosed "Instructions for Authors" documents, the Journal of the American Planning Association is a peer reviewed scientific journal.

Very Truly Yours,

Tim Trohimovich, AICP
Director of Planning & Law

Enclosures



Journal of the American Planning Association
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t782043358

Preserving Prime Farmland in the Face of Urbanization: Lessons from Oregon

Arthur C. Nelson

Online Publication Date: 31 December 1992

To cite this Article Nelson, Arthur C.(1992)'Preserving Prime Farmland in the Face of Urbanization: Lessons from Oregon',Journal of the American Planning Association,58:4,467 — 488

To link to this Article: DOI: 10.1080/01944369208975830

URL: http://dx.doi.org/10.1080/01944369208975830

Preserving Prime Farmland in the Face of Urbanization

Lessons from Oregon

Arthur C. Nelson

This article combines theory and a literature review with empirical and descriptive findings to demonstrate that Oregon's mix of policies is effective in preserving prime farmland in the face of urbanization. Exclusive farm use zones preserve farmland for farming; urban growth boundaries limit urban sprawl; exurban districts accommodate the demand for rural residential development without harming commercial farm operations; farm tax deferral and right-to-farm laws create incentives for farmers to keep farming; and comprehensive plans legitimize the entire package. This article proposes a comprehensive scheme for farmland preservation that expands on the experience of Oregon, including its mistakes.

Nelson, ASCE, AICP, has been involved in the formation, implementation, and evaluation of farmland preservation policies for twenty years. He is professor of city planning, public policy, and international affairs at Georgia Institute of Technology.

Journal of the American Planning Association, Vol. 58, No. 4, Autumn 1992.

Only a mix of policies mandated at the state level and implemented by local governments is effective in preserving resource land. Oregon's statewide land use planning program—developed over more than twenty years—exemplifies that mix. This article first reviews the reasons for farmland preservation near urban areas and then the economic impacts of urbanization on farmland. It examines the effectiveness of various farmland preservation policies. The article then describes Oregon's mixed approach to farmland preservation and offers empirical and descriptive evidence of its effectiveness. The article concludes with generalizable lessons for planning policy.

Why Preserve Farmland?

There are three general motivations for preserving prime farmland. First, prime farmland near urban areas is needed for the production of truck and specialty crops (Berry 1978; Sinclair 1967; Zeimetz et al. 1976; Volkman 1987). While some argue that there is no need to preserve farmland near urban areas because there is plenty elsewhere, only about 48 million acres of prime farmland (Soil Capability Class I and II) out of a total of about 250 million acres of cultivated prime farmland (Vining, Plaut, and Bieri 1977) are within fifty miles of the one hundred largest urbanized areas (Furuseth and Pierce 1982). Most prime farmland is located within the suburban and exurban counties of metropolitan areas (Nelson 1990b). Farmland that is most important for its location and productive qualities is also valuable for development (Solomon 1984). Urbanization of prime farmland is presently compensated for by putting lower quality, marginal land into production at greater economic and environmental cost (Platt 1985).

The second purpose of prime farmland preservation is the provision of certain public goods such as flood absorption, air cleansing, and water filtration. The third purpose is open space protection and giving spatial definition to urban areas (Rose 1984). Indeed, it is easy to conclude that the primary motivation behind farmland preservation is open-space preservation.

The Economic Effects of Urbanization on Farmland Value

Some argue that an unregulated land market would result in the most efficient use of land because property owners are best able to determine the appropriate use of their land. This is true only if owners face up to all their marginal social costs. But markets do not operate in an ideal way and so they are imperfect. The purpose of government intervention in the market is to offset many conditions causing inefficiencies (Lee 1979). Interventions can create a complex web that balances public interests with principles of efficiency. But intervention, in the form of economic incentives and disincentives, can sometimes unwittingly cause greater inefficiencies. Examples include underpriced urban facilities and highways

and tax incentives that induce people into buying larger homes on more land than they would without the inducements.

Ironically, land use regulation often aims to correct inefficiencies caused by other public policies.[1] In the absence of market intervention and given the considerable subsidies allocated to urban development relative to those to agricultural production, farmland near urban areas is likely to be overvalued for urban uses and undervalued for agricultural uses. When the land market internalizes those economic advantages into higher values, land is made more valuable for urban uses than would be the case otherwise.[2] This can lead to inefficient speculation of farmland for eventual conversion to urban development.

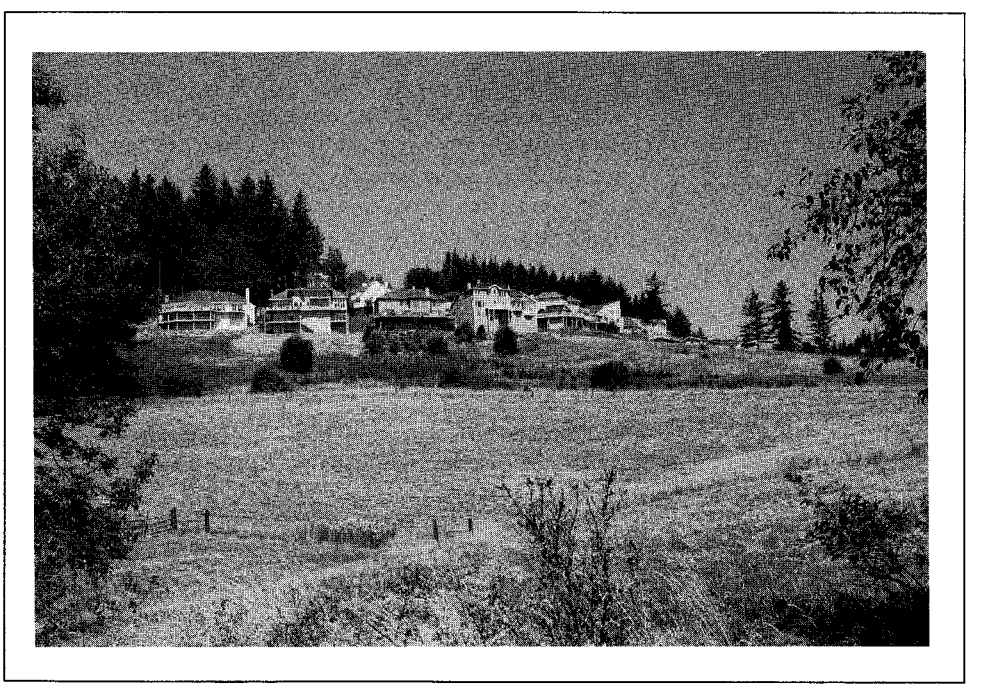
Undervaluation of farmland is also caused when urban development imposes spillovers on nearby farmland. Five common spillover effects are:

- Regulation of farming activities deemed to be nuisances by nonfarm residents in rural areas, including restrictions on fertilizers, manure disposal, smells, and slow-moving farm vehicles on commuter roads; limitations on use of pesticides and herbicides; restrictions on farm noises and hours of operation; restrictions on dust and glare; limitations on irrigation; and restrictions on other activities that may upset the lifestyle of suburban residents (Berry 1978).
- Increased property taxation to pay for schools, roads, services, and facilities intended to serve new residents (Keene et al. 1975).[3]
- Air pollution damage to crops caused by automobiles, industrial activity, and even residential space heating (Prestbo 1975).
- Destruction of crops or equipment or harassment of farm animals by residents of developments in rural areas, and theft of tree crops, berries, and vegetables (Berry, Leonardo, and Bieri 1976).
- Use of eminent domain to acquire at relatively low cost farmland for public uses serving primarily new residential development (Berry and Plaut 1978).

Spillovers reduce the productivity of farmland, thereby making it less valuable for farming and more attractive for speculation. The result of speculation induced by some public policies and by spillovers is that the productive use value of farmland falls the closer it is to urban and other nonfarm development (Sinclair 1967; Boal 1970; Rosser 1978; Nelson 1986a; Meier 1988).

Figure 1 traces several components of farmland value.[4] Raw land value, R_{raw}, is upward sloping to a point to account for the spillover effects that urban development has on farming. The line R_{inv} shows that the higher the investment in land, the more productive farmland is and the more valuable it is for farming. The line is upward sloping with respect to distance from urban development because of spillover effects. The line R_{farm} reflects the total value of farmland. The purpose of farmland preservation policies is to maintain, if not increase, productive value. As the raw value of farmland is fixed with respect to distance from urban development, productive value increases only by investment. Farmland preservation policies are effective only if they result in an increase in farmland investment.

Consumptive value of farmland is sometimes confused with speculative value. Consumptive value, shown as line R_{home}, is the value of farmland if it were "consumed" for nonfarm purposes (Pope 1985). No distinction is made



Urban development is contained by the regional urban growth boundary. The foreground is underutilized farmland within the shadow of urban spillovers.

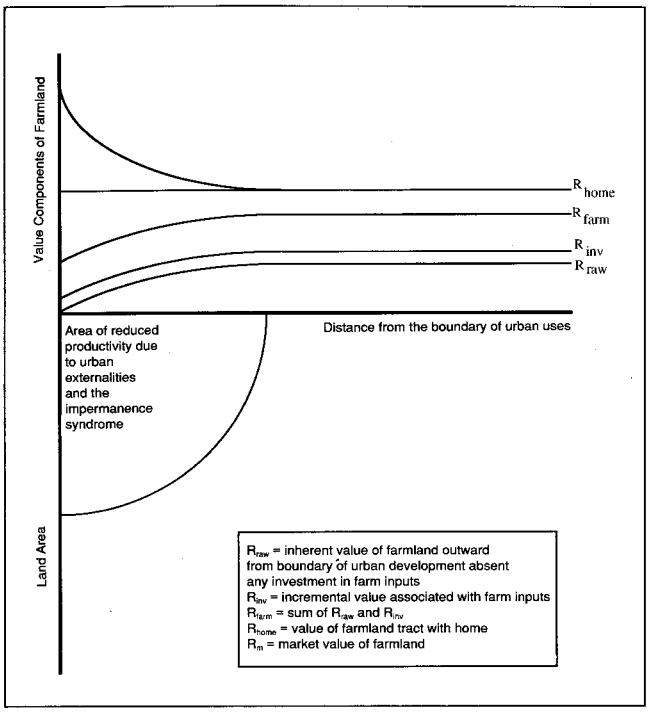


FIGURE 1: Effect of urban development on farmland value.

between the single homesite and subdivision potential values. Every farmland tract with a home has a consumptive value component. Consumptive value is the incremental value of a farmland tract as a single homesite, assuming no further partitioning of the tract can occur.

The difference between R_m and R_{farm} is speculative value. It includes a component called "inefficient speculation," which is the difference between R_m and R_{home}. It arises from distortions created by policies and market imperfections that overvalue land for urban uses and undervalue land for agriculture uses. In the absence of subsidies and urban spillovers, land is more efficiently allocated for farm and urban uses. In Figure 2, the efficient allocation of land occurs where U_1 and R_1 intersect. Land to the left of Q_1 is put to urban uses and land to the right is put to resource uses. The value of land for urban uses increases to U_2, because of subsidies for development, while the value of land for resource uses decreases to R_2 because of urban spillovers. The new equilibrium of land allocation is Q_2. Inefficient allocation of land for urban uses is the difference between Q_1 and Q_2. One aim of planning to preserve farmland in the path of urbanization is to restore the original equilibrium. To be effective, farmland preservation policies must not only eliminate inefficient speculative value, but speculative value that is efficient but for distortions. If speculative value is eliminated, farmland would remain in productive farm use.

There is one more dynamic at work that places farmland in the face of urbanization at a disadvantage. This is the "impermanence syndrome" (Keene et al. 1975; Currier 1978), characterized by the belief among farmers that agriculture in their area has limited or no future and that urbanization will absorb the farm in the not-too-distant future. It is manifested by disinvestment in farming inputs, sale of farmland tracts for hobby farm or acreage development, and shifting of crops from those requiring labor or capital intensity, such as berries and orchards, to those requiring little labor or investment, such as pasture or annual crops. The result can be vast areas of underutilized and idled land near and between urban areas (Gottmann 1961; Berry 1976; Vining, Bieri, and Strauss 1977). It seems that for every acre of prime farmland that is urbanized, up to another acre becomes idled due to the impermanence syndrome (Plaut 1976). When farmers become uncertain about the future viability of agriculture in their area, farmland production falls and so does farming income. Ultimately, the critical mass of farming production needed to sustain the local farming economy collapses (Berry 1976; Daniels and Nelson 1986; Daniels 1986; Lapping and FitzSimmons 1982). The ultimate purpose of a farmland preservation scheme, in the opinion of several researchers, is to remove the impermanence syndrome (Plaut 1976; Berry, Leonardo, Bieri 1976; Berry 1978; NALS 1981; Nelson 1984; 1986a). This occurs only when all speculation for nonfarm purposes is removed.

The Effectiveness of Common Preservation Techniques

Every state has farmland preservation policies. Effective preservation policies, however, must influence the land market in four ways. First, they must increase the productive value of farmland. Second, they must stabilize, reduce, or eliminate consumptive value (value of farmland tracts as a single homesite). Third, they must eliminate inefficient speculative value of farmland, which can happen only if speculative value attributed to urban spillovers, inefficient urban development subsidies, and undervaluation of the public goods provision of resource land, is offset. Fourth, they must eliminate the impermanence syndrome. This is accomplished when the first three objectives are met. Most farmland preservation techniques are ineffective and many have perverse effects. This section reviews why.[5]

Property Tax Relief

When farmland is assessed property taxes to pay for urban services and education mostly benefiting urban residents, farmers bear more than their equitable burden of the tax and they are pushed into developing their land prematurely (Forkenbrock and Fisher 1983). Property tax relief programs reduce the property taxes that farmers would have to pay. To prevent farmers from taking speculative advantage of those programs, most states assess a penalty equal to some of the taxes saved if the farmland tract is developed. No state requires full payback. Many charge no interest or limit the payback period from two

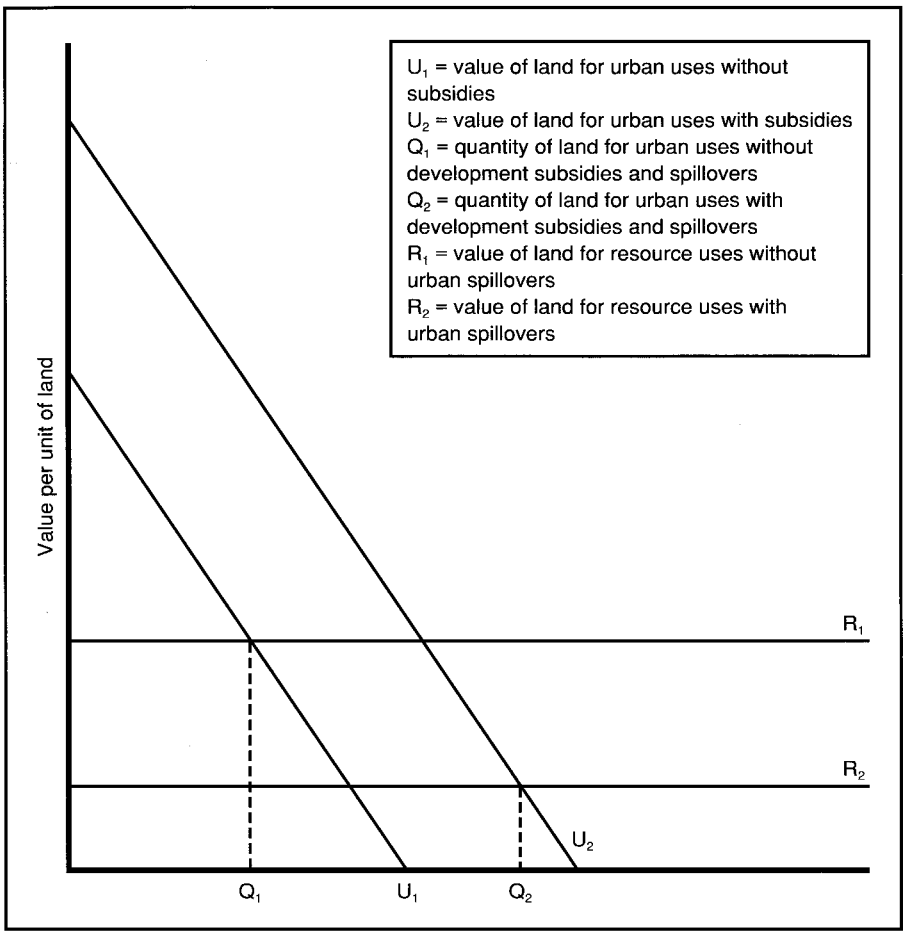


FIGURE 2: Absorption of greater agricultural land area for urban uses because of urban development subsidies and urban spillovers.

to five years. Owners of farmland actually use these programs to speculate, because they never pay 100 percent of the potential payback penalty. These programs have the tendency to induce urban sprawl.[6] In practice, all property tax relief programs create or raise speculative value by distorting land value. All extend the impermanence syndrome farther into the landscape by subsidizing the holding costs of inefficient speculation or turning farmers into speculators.

Right-to-Farm Laws

Suits and the threat of suits can threaten viable commercial farming (Hagman and Juergensmeyer 1987). Right-to-farm laws prevent urban residents from filing nuisance complaints against farmers.[7] All states have right-to-farm laws. At best, they give short-term protection to farmers at the urban-rural fringe. But a farmer could win all the legal battles in court only to lose the proverbial war to expense and wariness. Moreover, the law of trespass has so evolved as to potentially undermine right-to-farm legislation altogether (Leutwiler 1986; Bradbury 1986). The problem is that farmers and urban residents do not coexist. Right-to-farm laws are not likely to be effective in preserving farmland in the long term (Leutwiler 1986; Hagman and Juergensmeyer 1987; Lapping and Leutwiler 1987; Rose 1984; Bradbury 1986; Nelson 1990a).[8]

Acquisition of Development Rights

Some tout transfer of development rights (TDR) and purchase of development rights (PDR) programs as the most effective means of preserving farmland (Rose 1984; NALS 1981; Berry and Plaut 1978). TDR programs, which transfer development to urban areas, preserve farmland at no direct cost to taxpayers. The problem is that the owners of farmland most distant from urban areas are most likely to participate while owners of farmland closest to urban areas anticipate eventual windfalls from development and do not participate. TDR programs do not assure maintenance of the critical mass of farmland needed to sustain the long-term viability of the local farm economy (Lapping and FitzSimmons 1982). Moreover, TDR programs are randomly applied and, thus, do not prevent the scattered subdivision of farmland tracts. Yet, a regional farming economy can be so disrupted by scattered development on land not in PDR programs that it can no longer support the necessary farming infrastructure (Furuseth 1980; 1981; Furuseth and Pierce 1982;

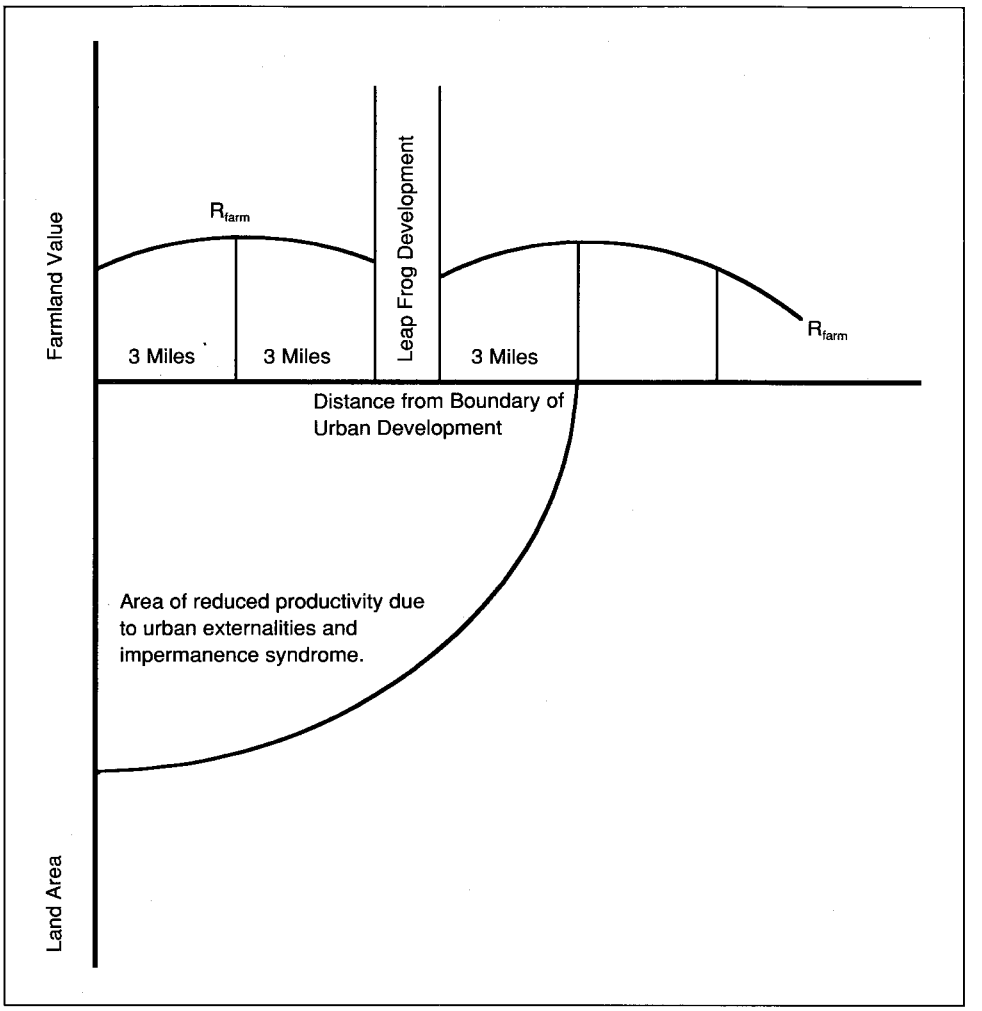


FIGURE 3: Effect of urban sprawl on the productivity of farmland and the impermanence syndrome.

Gustafson, Daniels, and Shirack 1982; Nelson 1983a; 1983b; Daniels and Nelson 1986; Daniels 1986).[9]

PDR programs involve local government purchase of development rights. Taxpayers retire general obligations bonds used to make these purchases to assure the permanent preservation of farmland.[10] Most tracts from which rights are purchased retain single homesite rights or rights in multiples of acres through minimum lot size zoning. Near urban areas, farming districts created by PDR programs can become attractive to affluent households more interested in open space and privacy than in farming (Nelson and Dueker 1989). The preservation of the critical mass of productive farmland is not assured. Moreover, taxpayers pay twice for those rights: once for the infrastructure that creates development value and again for the development value created by infrastructure. Shrewd speculators buy farmland in the path of urban development and then sell development rights at a later time. There are, thus, serious theoretical, practical, equity, and legal problems associated with PDR programs.

At their best, TDR and PDR programs are effective open space measures. At their worst, they are expensive, do not necessarily preserve the local farming economy, and can turn farmland regions into exclusive enclaves of affluent estate holders, while destroying productive farming.

Agricultural Zoning

Agricultural zoning restricts land uses to farming and other kinds of open space activity. It limits subdivision and home construction. It is sometimes used in tandem with regional urban containment planning (Nelson 1985). There are two types of agricultural zoning: nonexclusive and exclusive.

Nonexclusive agricultural zoning restricts lot sizes in agricultural areas from 1 to 160 acres.[11] The higher the density the lower the effectiveness of the minimum lot size approach to preservation. Minimum lot sizing at up to forty-acre densities merely causes rural sprawl—a more insidious form of urban sprawl.[12] However, Napa

County, California, uses 160-acre minimum lot size zoning, coupled with very strict review of building permits in agricultural areas. Perhaps low-density coupled with development review can be effective. Unless very high minimum lot size restrictions are imposed, however, nonexclusive agricultural zoning does little to prevent the development of farmland in the long term. It also does little to increase productive value, but can lead to increasing consumptive and speculative value by stimulating scattered, low-density urban sprawl into the countryside.

Figure 3 shows the effect of urban sprawl on the productivity of farmland. When development leaps over farmland or occurs along corridors bounded on either side by farmland, vastly more farmland is removed from production. Regional farmland productivity declines and the impermanence syndrome is extended deep into the landscape. In this example, the impermanence syndrome would only extend three miles from the boundary of urban development were it not for leapfrog development (Nelson 1986a). Leapfrog development, however, extends the impermanence syndrome nine miles. Leapfrog and radial development can be stimulated by well-meaning farmland preservation policies that distort speculative and development behavior.

Together with property tax relief, minimum lot size zoning can result in pushing the impermanence syndrome farther into the landscape by forcing urban residents to purchase larger tracts than they want or can manage (Fuller and Mage 1975; Archer 1977; Berry, Leonardo, and Bieri 1976; Nelson 1983a; 1983b; 1986a). Voluntary agricultural districting, which combines some of the elements of tax relief programs and of nonexclusive agricultural zoning, provokes similar effects.

Exclusive farm use zoning prevents nonfarm activities in farming districts. True exclusive farm use zoning requires that farmland be devoted to commercial production. Nonetheless, exclusive farm use zoning can also extend the impermanence syndrome by forcing urban residents to purchase farms larger than they want or can manage. This is countered only when all prime farmland is made subject to exclusive farm use zoning and urban households are funneled away from areas explicitly set aside for nonexclusive farming uses.

The Oregon Approach

Oregon's statewide land use planning program is primarily intended to preserve prime farmland in the Willamette Valley, the state's most heavily urbanized area. The valley stretches one hundred miles north to south and about forty miles east to west. With only 10 percent of the state's land base, one-third of the state's entire supply of prime farmland is found there. It produces about 40 percent of the state's agricultural goods and is home to more than two million of the state's three million people. While Oregon's farmland preservation policies affect the entire state, this evaluation of policy effectiveness primarily focuses on the Willamette Valley.

Instead of relying on one principal technique, Oregon's farmland preservation policies work as a package, which includes exclusive agricultural districts, urban growth boundaries, restrictions on development of exurban districts, and, of lesser importance, farm use tax deferral and right-to-farm provisions. Comprehensive plans legitimize the entire scheme (Daniels and Nelson 1986). The result is a regulated landscape where land is explicitly allocated and restricted to specific uses (Knaap and Nelson 1992). Of the state's 61.6 million acres of land, 55 percent is publicly owned, 2 million acres are contained in urban growth boundaries, and 25.8 million acres are restricted to resource, exception, and other rural uses. Only slightly more than 3 percent of all privately owned land is set aside for hobby farming, ranchettes, or other nonresource uses outside urban growth boundaries, and another 3.3 percent is contained within urban growth boundaries. Table 1 illustrates the distribution of land use designations in Oregon.[13]

Oregon's preservation package centers on statewide planning Goal 3, which conveys Oregon's intent to preserve farmland:

> Agricultural lands shall be preserved and maintained for farm use, consistent with existing and future needs for agricultural products, forest, and open space. These lands shall be inventoried and preserved by exclusive farm use zones. . . . Conversion of rural agricultural land to urbanizable lands shall be based upon consideration of the following factors: (1) environmental, energy, social, and economic consequences; (2) demonstrated need consistent with LCDC [Land Conservation and Development Commission] goals; (3) unavailability of an alternative suitable location for the requested

TABLE 1: Distribution of land use designations in Oregon, 1986

Land use category	Acres[a]	% all land	% privately owned land
Total land area	61,587	100.00	
Publicly owned	33,750	54.80	
Privately owned	27,837	45.20	100.00
Inside UGBs	2,048	3.33	7.36
Outside UGBs	25,789	41.87	92.64
Exclusive farm use	16,036	26.04	57.61
Primary forest use	8,771	14.24	31.51
Rural residential	710	1.15	2.55
Commercial	10	0.02	0.04
Industrial	46	0.07	0.17
Rural service centers	29	0.05	0.10
Other	189	0.31	0.69

a. Figures rounded to nearest 1,000 acres.
Source: Adapted from Department of Land Conservation and Development 1986.

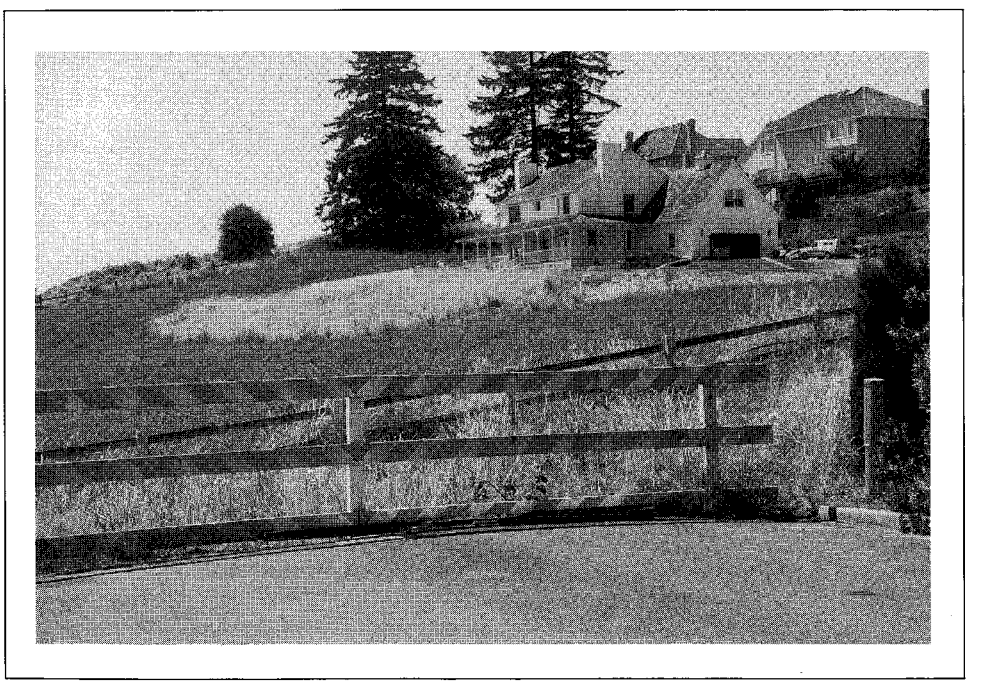
use; (4) compatibility of the proposed use with related agricultural land; and (5) the retention of (Soil Conservation Service–determined) Class I, II, III, and IV soils in farm use. A governing body proposing to convert rural agricultural land to urbanizable land shall follow the procedures and requirements ... for goal exceptions (LCDC 1990, 5).

The policy is administered by the Land Conservation and Development Commission (LCDC), a seven member gubernatorially appointed board and its staff, the Department of Land Conservation and Development (DLCD). All prime agricultural and related land is placed in exclusive farm use (EFU) districts. This land is restricted to farm use unless the impracticability of doing so can be demonstrated in a quasi-judicial proceeding.

Preserving farmland evolved in Oregon from a minimum lot size approach to performance zoning. At first, the LCDC allowed local governments to establish minimum lot size districts to limit parcelization and home construction to large lots. Some eastern Oregon counties created 320-acre minimum lot size districts. Some western Oregon counties attempted five-acre minimums, but most settled on twenty- to forty-acre minimums. This approach, while it prohibited nonfarm uses in theory, did not clearly define acceptable uses. The approach failed largely because many counties attempted to gain the smallest minimums acceptable to LCDC. Owners divided farms and sold the parcels as hobby farms or very large suburban lots. Many critics viewed the minimum lot size restrictions as resulting in worse land use patterns, because they created rural sprawl and the loss of many times more prime farmland than would have resulted from an unrestricted land market (Archer 1977; Nelson 1983a; 1983b; 1990a; Daniels and Nelson 1986). Thus, during the 1980s, the LCDC required counties to create performance-based exclusive farm use (EFU) districts with no minimum lot sizes. Now, the only way to secure a subdivision or home construction approval on such land is to prove in a quasi-judicial setting that the change would improve agricultural production.

In theory, all land outside UGBs is preserved for resource uses. But this is impractical, because some rural land is already built on or committed to nonfarm uses and cannot be converted back to resource use. Other lands simply have soils too poor to sustain reasonable resource practices. Oregon, thus, devised an "exception" category for some rural land.[14]

Oregon's effort to preserve prime farmland is aimed primarily at preventing the occupation of those lands by hobby farmers.[15] "Rural residential areas" are used to attract hobby farmers away from prime farmland. An outgrowth of the exception process, this is an important but often overlooked component of Oregon's farmland preservation program (Gustafson, Daniels, and Shirack 1982).[16] Counties have set aside more than 300,000 acres within the Willamette Valley for rural residential—often called "exurban"—development. Statewide, more than 700,000 acres are set aside for exurban uses. Exurban districts are well suited for hobby farms since their soil is of lower quality and they are situated away from commercial farming areas.



The barricade marks the UGB. Before the boundary was finalized the road was to continue up the hill to a completed subdivision. For two years hobby farmers fought, but lost against a corrected UGB to accommodate subdivision build-out.

Empirical Evidence of Effectiveness

Is Oregon's approach effective in eliminating speculative use value, limiting consumptive use value, sustaining the critical mass of farmland needed to support the regional agricultural economy, and increasing the productive value of farmland? The regional land market can be evaluated to answer these questions (Nelson 1986a).

Urban growth boundaries, exclusive farm use restrictions, and restricted exurban development policies must effect the outcomes shown on Figure 4. First, the regional demand for land to be used for urban purposes must be shifted from rural land to areas contained within urban growth boundaries to the left of U_1 and to exurban enclaves to the right of U_2. The value of land must shift from R_m to R_p, resulting in an increase in the value of urban and exurban land, but a decrease in the value of farmland. Second, because farmland provides nearby urban and exurban land with scenery, privacy, and other benefits, there is an amenity value increment to urban and exurban land, shown as R_a from U_a to U_1 and from U_d to U_2, respectively. Third, because urban and exurban land impose spillovers, or disamenities, on farmland, resulting in reduced productivity along the urban and exurban boundaries, farmland value falls by the increment R_d from U_1 to U_b and from U_2 to U_c, respectively.

With Portland and Salem, Oregon, as the laboratories, the combination of UGBs and EFU districts indeed shifted the demand for urban land to areas inside UGBs. This resulted in higher urban values and lower farmland values (Knaap 1982; 1985; Nelson 1984; 1985; 1986a; Knaap and Nelson 1988). Exurban land values also shifted upward (Nelson 1984; 1986a; 1986b). These studies show that farmland preservation policies, in combination with urban and exurban containment policies of the sort used in Oregon, are effective in realizing the first objective of farmland preservation: shifting regional demand for urban and exurban development away from prime farmland and into targeted areas.

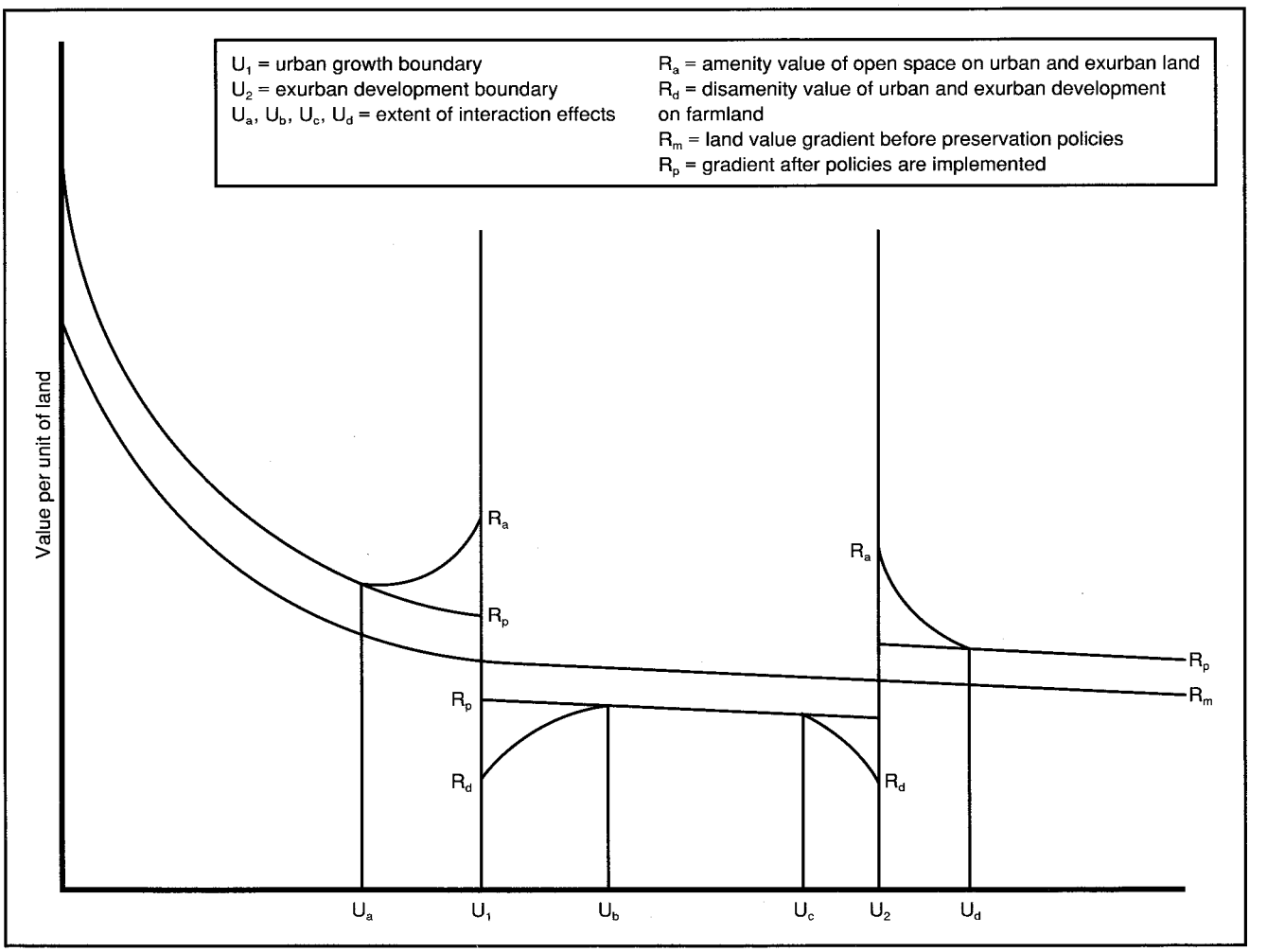


FIGURE 4: Economic objectives of farmland preservation and urban containment policies.

Second, urban and exurban land proximate to farmland must exclusively internalize quasi-public goods, such as privacy and scenery, into higher values the closer the land is to farmland (Correll, Lillydahl, and Singell 1978). The absence of this effect means that the urban and exurban land markets expect urban development of farmland in the near future. The evaluation of Salem, Oregon, shows that the value of urban land rose with proximity to the Salem UGB where that boundary separated urban development from EFU districts (Nelson 1984; 1986). This phenomenon did not occur where the UGB separated urban development from exurban districts.

The effect should also be found along the boundary separating EFU from exurban districts, as exurban households are like urban or suburban households in their pursuit of space and privacy (Davis 1990; Davis, Nelson, and Dueker 1993; Nelson 1991; Nelson and Dueker 1989; 1990). An evaluation of rural Washington County, Oregon, indicated that the value of exurban land rose with proximity to the EFU boundary (Nelson 1988).

Third, speculation of farmland for nonfarm uses, whether urban or exurban, is eliminated only when the market value of farmland falls as it nears urban and exurban land. This is because non–farmland uses will impose all the negative externalities on nearby farmland. If this effect is not detected, then the market for farmland is internalizing expectations of conversion to urban or exurban nonfarm uses.

The Salem analysis revealed that farmland value fell with proximity to the UGB (Nelson 1984; 1986). This indicates the effectiveness of the exclusive farm use restrictions in eliminating speculative use value from farmland. Farmland value seemed unaffected by urban development only three miles away from the UGB.

An analysis of the interaction between farmland and exurban land in Washington County, Oregon, used the same approach (Nelson 1988). The central question was simple: Does farmland value behave at the exurban boundary as it behaves at the urban growth boundary? The original statistical analysis revealed ambiguous interaction, suggesting no statistically meaningful effects. Perhaps exurban and farmland owners coexist principally because exurban landowners consider themselves quasi-farmers and are therefore sympathetic with commercial farming. Perhaps exurban landowners do not impose spillovers on farmland owners. But this analysis is wrong (Nelson 1990c).

A reevaluation asked at what minimum density does exurban development have no adverse influence on farmland values. Proximity to five- or ten-acre exurban districts resulted in rising farmland value, indicating that the farmland market was internalizing the expectation of conversion to exurban development. This would suggest failure of preservation policies to influence the farmland market in intended ways, resulting in the underproduction of farmland, underinvestment in that land, and emergence of the impermanence syndrome among affected farmland owners. Proximity to twenty-acre exurban districts, however, resulted in declining farmland value, indicating that speculation for conversion to twenty-acre exurban development was not evident.[17] Thus, any exurban density less than twenty acres along the exurban and farmland boundary would have undesirable effects in the farmland market.

Finally, the value of farmland in exclusive farm use districts should rise over time as the farming economy has been preserved and farming investments can be made without concern for the impermanence syndrome. While there is as yet no empirical test of this outcome, the descriptive evidence reported below seems compelling. Production is increasing and this should be associated with increasing farmland value.

Descriptive Evidence of Effectiveness

Based on the 1978 and 1982 Census of Agriculture, Daniels and Nelson (1986) concluded that Oregon's farmland preservation policies were working to preserve large blocks of farmland because of large minimum lot size zoning, but they could not determine whether agricultural production had improved or whether hobby farming and commercial farming coexisted. Instead, they found that Oregon led the nation in the formation of hobby farms between 1978 and 1982, and the future viability of commercial agriculture was in doubt.

A recent study prepared by the LCDC indicates that the preservation of prime farmland improved during the late 1980s (1989). Analysis of the period July 1985 through August 1986 and September 1987 through August 1988 indicates that new and replacement dwellings on EFU lands decreased (see Table 2). The average parcel size of new farm dwelling approvals increased: Two-thirds were on parcels greater than twenty acres in 1987 to 1988 in contrast to one-half in 1986 to 1987. New land divisions within EFU districts increased in size: In 1987 to 1988, 84 percent were larger than twenty acres in contrast to 70 percent in 1986 to 1987. Concern over nonfarm dwellings approved for EFU districts continues. Slightly less than one-half of the nonfarm dwellings were approved for the Willamette Valley and another one-quarter in southwestern Oregon. However, 84 percent of the nonfarm dwellings were approved for parcels of less than ten acres and 70 percent of the land affected was of Soil Class IV or worse. Nonfarm dwelling approvals will become more difficult in future years as the legislature, the LCDC, and special interest groups seek to contain this activity.

Recent data from the United States Department of Agriculture, in its 1987 Census of Agriculture, strongly suggests that Oregon's prime farmland preservation policies seem to work despite the continued proliferation of hobby farms. The conclusion is an important milestone for planning policy everywhere: Urban development and farming can coexist but only when certain land use planning policies are employed and strictly enforced.

TABLE 2: New dwellings on EFU lands, 1985–1988

Type of dwelling	Approved		Denied	
	1987–1988	1985–1986	1987–1988	1985–1986
New farm dwellings	205	230	9	0
Replacement farm dwellings	65	79	1	0
New farm worker dwellings	103	97	8	8
Replacement farm worker dwellings	18	21	1	1
New nonfarm dwellings	279	264	36	17
Replacement nonfarm dwellings	34	60	0	1
Total new dwellings	587	591	53	25
Total replacement dwellings	117	160	2	2

Source: Department of Land Conservation and Development 1989.

How Does Oregon Compare to the Northwest and the Nation?

Although there are problems with the use of the census, it is the most reliable source of longitudinal data on changes in the farming economy at the county level. The analysis here compares the performance of Oregon's agriculture with that of Washington State and the United States between 1982 and 1987. Washington State is a reasonable control, because it does not have Oregon's statewide farmland preservation mandate, but is otherwise similar (Daniels and Nelson 1986). Comparison with the U.S. can indicate strengths and weaknesses of the Oregon farming economy relative to national trends. The analysis also evaluates changes in farming performance among the nine Willamette Valley counties. The farmland policies of Oregon are not conclusively related to changes in performance relative to other states, the nation, or periods of time. The evidence presented is only circumstantial, but reasonably compelling.

Between 1982 and 1987, the entire nation lost more than 50,000 farms (see Tables 3 to 5). Oregon lost more one- to nine-acre farms proportionally than Washington or the U.S., but generally lost fewer farms proportionally above ten acres. It actually gained in the number of farms of more than five hundred acres, whereas Washington lost farms in this category. Overall, Oregon lost more smaller farms but gained more larger farms than Washington or the U.S. This is limited evidence that the preservation policies discouraged proliferation of smaller farms and preserved, if not expanded, larger farms. Unfortunately, census data do not allow analysis of what happened to those smaller farms. They may have been taken entirely out of the farmland pool (which may be undesirable) or merged to make larger units (which may be desirable).

During the same period, the nation added almost 18,000 farms reporting more than $10,000 in earnings. They can be considered *commercial* farms (Daniels 1986).[18] Oregon gained proportionately more commercial farms of 1 to 49 acres than Washington or the U.S., lost proportionately fewer commercial farms of 50 to 499 acres than the nation, and gained proportionately more

TABLE 3: Changes 1982–1987 in distribution of farms by size and total farm acreage

	Oregon			Washington			United States[a]		
	1982	1987	% change	1982	1987	% change	1982	1987	% change
Number of farms									
1–9 acres	5,987	5,476	−8.54	6,425	6,040	−5.99	181,712	177,781	−2.16
10–49 acres	12,415	11,448	−7.79	12,717	11,362	−10.66	436,886	400,989	−8.22
50–179 acres	7,662	7,219	−5.78	7,755	7,216	−6.95	704,039	637,630	−9.43
180–499 acres	3,906	3,617	−7.40	4,035	3,796	−5.92	522,660	474,677	−9.18
500 or more acres	4,117	4,254	3.33	5,155	5,145	−0.19	361,740	364,668	0.81
Total, all sizes	34,087	32,014	−6.08	36,087	33,559	−7.01	2,207,037	2,055,745	−6.85
Acreage (thousands) in farm use									
Total, all farms	17,740	17,809	0.39	16,470	16,116	−2.15	996,724	946,662	−5.02

a. Figures adjusted to exclude Oregon for comparability purposes.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

TABLE 4: Number of commercial farms and acreage in commercial farms, 1982–1987

	Oregon			Washington			United States[a]		
	1982	1987	% change	1982	1987	% change	1982	1987	% change
Number of commercial farms[b]									
1–9 acres	476	634	33.19	864	994	15.05	40,128	44,008	9.67
10–49 acres	1,767	1,891	7.02	3,100	3,072	−0.90	75,528	71,574	−5.24
50–179 acres	3,156	3,010	−4.63	3,832	3,697	−3.52	284,171	241,058	−15.17
180–499 acres	2,706	2,479	−8.39	2,982	2,760	−7.44	398,585	353,971	−11.19
500 or more acres	3,658	3,694	0.98	4,843	4,764	−1.63	334,083	340,948	2.05
Total, commercial farms	11,763	11,708	−0.47	15,621	15,287	−2.14	1,132,495	1,051,559	−7.15
Acreage (thousands) in farm use									
Total, commercial farms	15,488	15,441	−0.30	13,017	13,766	5.75	795,792	813,580	2.24

a. Figures adjusted to exclude Oregon for comparability purposes.
b. Farms reporting $10,000 or more in annual sales, not adjusted for current dollars.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

commercial farms of more than 500 acres than Washington. Overall, Oregon lost some commercial farm acres while Washington and the nation gained. On the other hand, the proportion of commercial farms to all farms rose faster in Oregon than in Washington, but fell across the nation.

What accounts for the considerable discrepancy in the proportion of small commercial farms in Oregon relative to Washington and the nation? Reduction of commercial farms of 180 to 499 acres may be partly explained by the rise in small farms. Farmland preservation has possibly induced an increase in commercially active hobby farms in Oregon, because settlement on small farms requires demonstration of commercial production. Has Oregon's farmland preservation program led to the division of large farms into smaller ones, or resulted in declining overall farmland production? The answer to this is based on an evaluation of the Willamette Valley, where hobby farm and land subdivision pressures are the greatest.

Performance in the Willamette Valley

Tables 6 and 7 report performance in the Willamette Valley.[19] The number of farms in the Willamette Valley fell by more than one thousand from 1982 to 1987, while the amount of farmland acreage remained nearly the same, falling by slightly more than 1 percent. The virtually unchanged farm acreage figure suggests that the farmland base stabilized over this period. Considering that in 1973 the valley lost 30,000 acres of farmland to urban uses, it would appear that farmland preservation policies caused stabilization since 1978.

Note that the number of commercial farms in the valley rose by nearly 18 percent and the farm acreage in commercial farms rose by 11 percent, or nearly 130,000 acres. The largest share of commercial farm increases occurred in the one- to nine-acre category, while the largest farm acreage gain occurred in the more than five hundred acre category. The proportion of commercial farms to all

TABLE 5: Ratio of commercial farms to all farms, 1982–1987

	Oregon			Washington			United States[a]		
	1982	1987	% change	1982	1987	% change	1982	1987	% change
1–49 acres	0.122	0.149	22.40	0.207	0.234	12.83	0.187	0.200	6.81
1–9 acres	0.080	0.116	45.62	0.134	0.165	22.38	0.221	0.248	12.09
10–49 acres	0.142	0.165	16.06	0.244	0.270	10.91	0.173	0.178	3.25
50 or more acres	0.607	0.609	0.26	0.688	0.694	0.95	0.640	0.634	−1.01
50–179 acres	0.412	0.417	1.23	0.494	0.512	3.68	0.404	0.378	−6.34
180–499 acres	0.693	0.685	−1.07	0.739	0.727	−1.62	0.763	0.746	−2.22
500 or more acres	0.889	0.868	−2.27	0.939	0.926	−1.44	0.924	0.935	1.24
All sizes	0.345	0.366	5.98	0.433	0.456	5.23	0.513	0.512	−0.31

a. Figures adjusted to exclude Oregon for comparability purposes.
Note: Commercial farms include those reporting $10,000 or more in annual sales, not adjusted for current dollars.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

TABLE 6: Willamette Valley, 1982–1987, distribution of farms by farm size; farm acreage by farm size; and commercial farms by farm size

	Number and percentage change		
	1982	1987	% change
Distribution of all farms by farm size			
1–49 acres	10,986	9,900	−9.89
1–9 acres	3,721	3,256	−12.50
10–49 acres	7,265	6,644	−8.55
50–499 acres	5,076	4,674	−7.92
50–179 acres	3,579	3,301	−7.77
180–499 acres	1,497	1,373	−8.28
500 or more acres	764	791	3.53
All farms	16,826	15,365	−8.68
Distribution of farm acreage by farm size			
1–49 acres	189,129	174,745	−7.61
1–9 acres	18,913	16,315	−13.74
10–49 acres	170,216	158,430	−6.92
50–499 acres	770,047	714,556	−7.21
50–179 acres	330,066	309,182	−6.33
180–499 acres	439,981	405,374	−7.87
500 or more acres	820,547	868,490	5.84
All farms	1,779,723	1,757,791	−1.23
Distribution of commercial farms[a] by farm size			
1–49 acres	1,157	1,490	28.78
1–9 acres	242	391	61.57
10–49 acres	915	1,099	20.11
50–499 acres	2,133	2,248	5.39
50–179 acres	1,323	1,233	−6.80
180–499 acres	810	1,015	25.31
500 or more acres	644	900	39.75
Total, all farms	3,934	4,638	17.90
Total commercial farm acreage	1,196,618	1,326,453	10.85

a. Farms reporting $10,000 or more in annual sales, not adjusted for current dollars.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

farms rose substantially in all major farm size categories during this period.

There has been a general reduction in smaller farms but an increase in commercial farms in all farm size categories. Farmland owners are either taking their land out of production— thereby accounting for reductions in all but the largest of the farm size categories for all farms— or they are making their land commercially productive by merging it with other land through sale, rental, or other agreement. Overall, commercial farm production rose to $909 million in 1987 from $619 million in 1982, or nearly 50 percent. Per farm income among commercial farms rose from $157,000 in 1982 to $196,000 in 1987, or nearly 25 percent. These increases exceed the inflation rate during the period.

Table 8 compares Oregon to Washington and the nation. Oregon lost farms on a pace with the nation and Washington. It gained land in farms, however, while Washington and the nation lost land. Average farm size increased more in Oregon than in Washington and the nation. Oregon lost proportionately slightly more cultivated and irrigated farmland than Washington and the nation. Its average value per farm and per acre fell slightly more relative to Washington and the nation. Yet, its sales of farm products per farm rose at nearly twice the rates of Washington and the nation.

Earlier studies revealed no substantial differences in farming performance between Oregon and Washington, and with most national trends, between 1978 and 1982 (Daniels and Nelson 1986). Evidence now suggests the budding of divergent trends. The Willamette Valley farming economy appears more robust after full implementation of farmland preservation policies. Hobby farms and commercial farms in Oregon, especially in the Willamette Valley, are gaining in economic vitality. There has been some concern that the rise of hobby farms could result in reduced commercial farming productivity. Yet, in the valley, while the total number of smaller farms fell, the rise in productivity of commercial hobby farms (one to forty-nine acres) parallels the rise in productivity of commercial farms. This suggests that in Oregon's regulatory environment, both commercially minded hobby farmers and large-scale farmers not only coexist but mutually benefit. They may add dimensions to the farming economy and infrastructure that are mutually reinforcing. The formation of hobby farms has slowed, and some farms appear to have consolidated. Many hobby farmers have become viable commercial farming operators in their own right. It seems likely that were it not for hobby farmers and their sustenance of the economic infrastructure, the large-scale commercial farming operations might be jeopardized. Firm confirmation of this symbiotic relationship remains an open question. Also mutual coex-

TABLE 7: Willamette Valley, 1982–1987, ratio of commercial farms and acreage to all farms and acreage

	Number and percentage change		
	1982 ratio	1987 ratio	% change
Ratio of commercial[a] farms to all farms			
1–49 acres	0.105	0.151	42.91
1–9 acres	0.065	0.120	84.64
10–49 acres	0.126	0.165	31.34
50–499 acres	0.420	0.481	14.46
50–179 acres	0.370	0.374	1.05
180–499 acres	0.541	0.739	36.63
500 or more acres	0.843	1.138	34.98
Total, all farms	0.234	0.302	29.11
Ratio of total acres in commercial farms to total acres in all farms			
Total commercial farm acreage	0.672	0.755	12.35

a. Farms reporting $10,000 or more in annual sales, not adjusted for current dollars.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

TABLE 8: Farming vitality indicators, 1982–1987, Oregon, Washington, and United States

		Oregon			Washington			United States[a]		
Indicator	Unit	1982	1987	% change	1982	1987	% change	1982	1987	% change
All farms	Number	34,087	32,014	−6.08	36,087	33,559	−7.01	2,207,037	2,055,745	−6.85
Land in farms	Acres, k	17,740	17,809	0.39	16,470	16,116	−2.15	996,724	946,662	−5.02
Average farm size	Acres	520.43	556.29	6.89	456.40	480.23	5.22	451.61	460.50	1.97
Harvested cropland	Acres, k	3,306	2,833	−14.31	5,279	4,597	−12.92	326,306	282,224	−13.51
Irrigated farmland	Acres, k	1,808	1,648	−8.85	1,638	1,519	−7.26	49,002	46,386	−5.34
Nominal value/farm	Dollars	$371,644	$299,755	−19.34	$423,352	$355,976	−15.91	$345,869	$289,387	−16.33
Nominal value/acre	Dollars	$705	$542	−23.12	$933	$739	−20.79	$784	$627	−20.03
Value, sales/farm	Dollars	$48,129	$57,664	19.81	$78,469	$87,000	10.87	$58,858	$65,165	10.72

a. Figures adjusted to exclude Oregon for comparability purposes.
Source: U.S. Department of Agriculture, *1987 Census of Agriculture.*

istence may not work outside Oregon. One of the underpinnings of Oregon policy is that farmland buyers must engage the land in farming, and many exurban districts have land use and development restrictions that aim to minimize potentially adverse interactions between exurban residents and farmers.

Weaknesses in Implementation

Effectiveness is always dictated by implementation. Daniels and Nelson (1986) recount how local government actions through the mid-1980s undermined state resource land preservation policies. Although recent analyses by the LCDC (1989) and the *1987 Census of Agriculture* show improvement in local government implementation, there is room for more rigor. For example, in an analysis of parcelization and dwelling unit approvals in prime agriculture and forest areas, Pacific Meridian Resources (1991) found some evidence of potentially lax enforcement of preservation policies:

- The majority of new dwellings approved in EFU areas were not being used in conjunction with commercial farm use, defined as $10,000 annual income from farming.
- Most farm operations of less than 80 acres on which new dwellings were permitted reported no farming receipts; about 90 percent of farm operations of less than 160 acres reported no farming receipts.
- More than one-half (358) of farm operations approved for new dwelling units statewide (667) were found in the Willamette Valley.
- About one-third of the forest operations that received approval for new dwellings units are not being managed for timber production.

In part because of this analysis, LCDC amended the agricultural and forest land goals in late 1992. By the late 1990s, local plans will identify and regulate "high-value" and "important" farmlands and "small-scale resource lands." High-value farmlands are suitable for commercial scale operations. Small-scale resource lands are suitable for noncommercial scale agriculture and forest operations. Important farmlands are all other rural lands, other than exception lands, suitable for some level of agricultural production. The purpose of the amendments is to put more pressure on local governments to preserve prime (high-value) farmland. Hobby farm activities would be steered into small-scale resource lands and, to a lesser extent, into important farmlands.

Toward Effective Farmland Preservation Policies

Perhaps the most important lesson from Oregon's experience is that successful farmland preservation relies on a package of techniques that reinforce each other. EFU districts preserve farmland for farming in the long run; UGBs prevent urban sprawl; exurban districts accommodate the demand for rural residential lifestyles without harming commercial farm operations; farm tax deferral and right-to-farm laws create incentives for farmers to keep farming, and comprehensive plans legitimize the entire package. This concluding section offers a regional landscape planning scheme that incorporates the best of Oregon's experiences while improving on its shortcomings.

Urban Containment

The argument that urban development ought to be contained within urban growth boundaries, urban service limits, urban stoplines, or other regulatory fixtures on the regional landscape map has been extensively and persuasively made.[20] Urban containment planning begins with estimates of future land use needs by general land use categories. Status quo trends are not simply projected into the future. The whole idea behind containment planning is achieving more efficient use of urban land: more housing units per acre, higher single-family detached dwelling densities, more flexible site planning standards allowing zero lot line and cluster opportunities, more mixed use projects and comprehensively planned communities, and higher density work environments. The

planning horizon may be set at twenty years but the UGB may have a much longer life as redevelopment and in-fill to higher densities occurs after twenty years. Such planning, however, should also include an *ultimate* UGB that establishes for perpetuity the final extent of urban development within a region.

Figure 5 illustrates the regional landscape scheme. Within the ultimate UGB there are three classes of land, each catering to a particular generation of development—the urban and urbanizable, the future urbanizable, and the urban reserve. The intermediate boundary at U_1 marks the area to accommodate immediate urban development needs. Point U_2 marks the near-term urban growth boundary, and U_3 is the ultimate growth boundary. The future urbanizable land would be expected to be developed within twenty years. The urban reserve land would accommodate very low-density uses until redeveloped to higher densities after twenty years.

Future urbanizable land would not be developed until land inside the intermediate boundary was suitably developed. This concept has been used in the urban areas of Portland, Salem, and Eugene. Minimum lot size zoning of at least ten acres would apply to the future urbanizable land to keep it in such sizes and shapes as to accommodate efficient future development.[21] Long-term facility and transportation plans would explicitly include this land. As all future urbanizable land is developed, within twenty years or so, expansion into the urban reserve lands toward the ultimate UGB would occur only if in-fill and redevelopment options failed.

The urban reserve area would contain land that Oregon now places outside the UGBs in "exception" areas. If Oregon has made any mistake in its planning it is in making its UGBs too small and in preventing adjacent or nearby exception lands from being placed within them. The LCDC required all urban areas to include within their UGBs just the amount of land needed to accommodate the urban development needs to the year 2000.[22] Many UGBs are virtually encircled by these exception lands, which are not needed for urban development and are not suitable for resource or open space activities.

These exception lands should have been included inside the UGBs to better manage their development and to improve long-term management of urban development. Under the present arrangement, because exception lands are neither urban nor resource lands, they are routinely developed for large acreage housing subdivisions, churches, convenience stores or centers, and other patently urban uses. Even though many exception lands adjacent to UGBs are subject to five-acre minimum lot size development, there is concern that it is actually easier to develop them than urban lands (Nelson 1992).

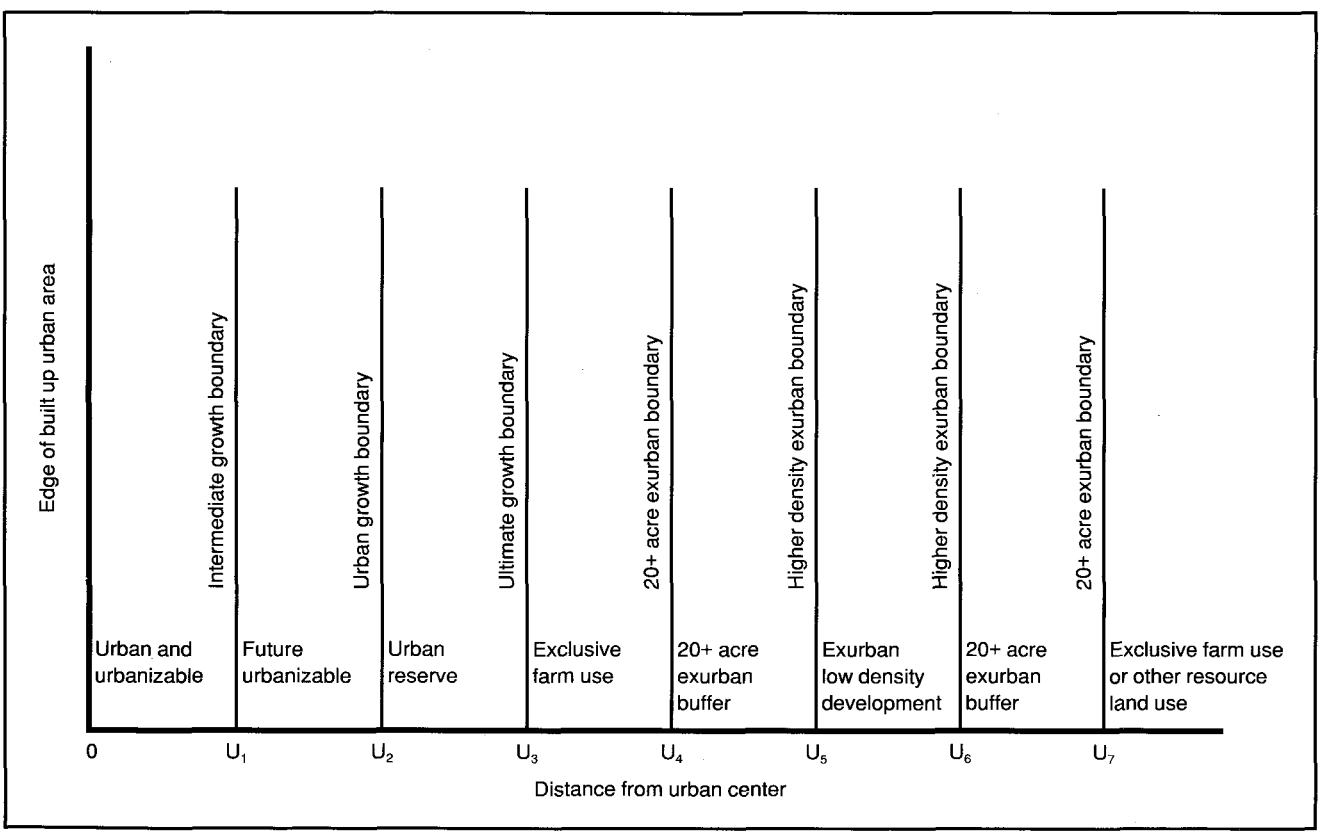


FIGURE 5: Regional planning scheme to preserve farmland.

Portland's Buddhist community could not receive a conditional use permit to build their temple in the city. Instead, they built it outside the UGB on prime farmland, as EFU zoning in Oregon allows churches as conditional uses.

What will happen when urban development under Oregon's scheme hits the twenty-year UGB? The assumption is that urban development will be accommodated through in-fill and redevelopment. But this may not take care of all needs. In some situations, the UGB must be expanded. One logical place for expansion would be the exception areas already abutting UGBs. However, by the time UGB expansion into those areas becomes necessary, they will have been developed and occupied by affluent households capable of mounting serious opposition. This is already happening (Nelson 1990b). Is UGB expansion the NIMBY of the future?[23]

A corollary mistake was that Oregon ignored the demand for hobby farms and exurban development (Nelson 1983a; 1983b; Daniels and Nelson 1986). While prospective hobby farmers or pursuers of rural living require only one to two acres, most exception areas are limited to five-, ten-, and twenty-acre minimum lot sizes. As those seeking small tracts are forced into buying larger tracts, more, not less, land is absorbed to accommodate this demand. It would have been far better for the LCDC to have allowed for the accommodation of the demand for small, one- to two-acre tracts within prescribed areas. Those areas should have been within UGBs to the maximum extent possible, and actual development of those sites should be subject to site planning restrictions requiring large setbacks—one hundred feet or more—from nearby resource lands, placement of homes to enable efficient resubdivision into single-family detached sites at some time far into the future, and prohibitions against covenants and deed restrictions that prevent future land assembly or resubdivision. Much of the legitimate demand for five- to ten-acre tracts should be accommodated in the same way.

Exurban Land Outside Urban Growth Boundaries

Even if much of the exception land could be placed inside UGBs there would remain pockets of exception land, classified as antiquated rural subdivisions, five- to ten-acre hobby farms, and twenty acre or more buffer areas.

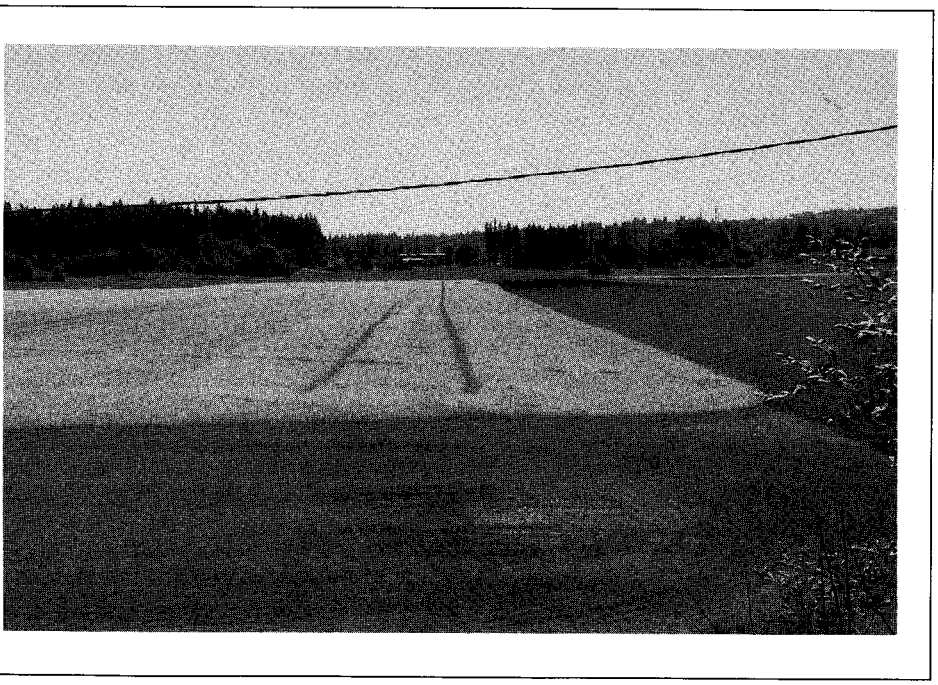
Antiquated rural subdivisions were approved prior to modern planning review. Many are already developed or committed to residential uses, but these areas can be better managed to preserve the integrity of nearby resource lands. For example, site planning restrictions should require home construction at least one hundred feet away from nearby or abutting resource lands. Owners of those sites should waive remonstrances against resource land use practices as a condition of receiving a building permit. In cases where antiquated subdivision plats are largely undeveloped but nonetheless committed, planning review should result in identifying those portions of the plat that may be reasonably used for resource or buffer activities (Nelson and Recht 1988).

Small-acre hobby farms on exception land outside the UGB should not abut EFU districts to avoid the expectation of conversion to exurban development. The exception lands abutting EFU districts should be subject to higher minimum lot sizes, of at least twenty acres. Development restrictions should be imposed to have those lands used for legitimate resource purposes as a condition of receiving building permits. In the case of forest land, the state forester could review and approve a small woodlot plan set aside by the homebuilder, where forest uses are proposed. The local county assessor could attest to the property being eligible for farm and forest use tax deferral. With these assurances the building permit could

Only a small strip of land is mowed around this hobby farm in an exception area bounded by EFU restrictions. The unmowed areas contain plants toxic to livestock.

be issued. Failure to carry out the pledge would result in zoning violations. Only in rare cases where land is clearly unusable for resource activities, such as developed or committed antiquated plots, would these requirements not apply. In all cases, home construction would also be subject to site plan review, which would require the maximum possible distance from farmland or other primary resource lands.

Where possible, twenty plus acre exurban districts would be placed between EFU and other primary resource land, and higher density exurban land or the UGB. At twenty and more acres, land can be used for a variety of resource activities, which would be required as a condition of building approval. By placing twenty plus acre tracts next to and near farmland and other primary resource districts, operators on those districts can more



A large farm adjacent to an exception area operates only two miles from the UGB. Onions are the dominant crop in this area.

easily rent the tracts for a variety of resource uses. Moreover, owners of these buffer tracts are more likely than owners of higher density exurban land to consider themselves like farmers and should be more tolerant of farming, forestry, and other resource practices.

Summary Scheme: Toward Regional Urban Form

The planning scheme divides the regional landscape beyond the ultimate urban growth boundary into twenty plus acre minimum lot size exurban districts buffering EFU lands from small acreage exurban districts. Regardless of regional urban development pressures, the ultimate UGB would remain fixed to preserve farmland and other resource lands. The twenty plus acre exurban buffer districts would also remain fixed, although low-density urban-type development could possibly invade selected exurban districts. The ideal regional urban form is achieved through regional landscape planning that includes the creation and rigid enforcement of development boundaries supplemented by rigidly enforced land use restrictions on exurban and resource land.

Figure 6, which combines elements of Figures 4 and 5, shows what the regional economic landscape must look like. If these relationships are not observed, farmland preservation policies may not be effective and perverse outcomes may be at work. Failure may be caused by uniquely local circumstances that require refinement of the scheme. Failure may also be attributable to lax enforcement in issuing development approvals.

First, the regional landscape planning scheme must affect the regional land market in predictable ways. The regional demand for urban land must be shifted from the regional landscape to areas inside the UGB. Actually, the near-term regional demand should be entirely shifted to the area within the intermediate growth boundary and the long-term demand should be shifted to the area between the intermediate and the twenty-year UGB. The regional demand for exurban land uses should be shifted principally from all rural land to areas either between the twenty-year and ultimate UGBs or within exurban districts located outside UGBs.

Second, there should be no interaction of land value along the intermediate growth boundary. Owners of urban land just inside and owners just outside the intermediate boundary should expect the boundary to be moved outward and urban development to occur in the new space in the near future. Similarly, there should be no interaction effect between land just inside and outside the twenty-year UGB.

Along the ultimate UGB there should be interaction effects. Land just inside the ultimate UGB should rise in value the closer it is to the UGB, because it should capitalize the quasi-public goods or benefits that it exclusively enjoys. Just outside the ultimate UGB, farmland or other resource land value should fall the closer it gets

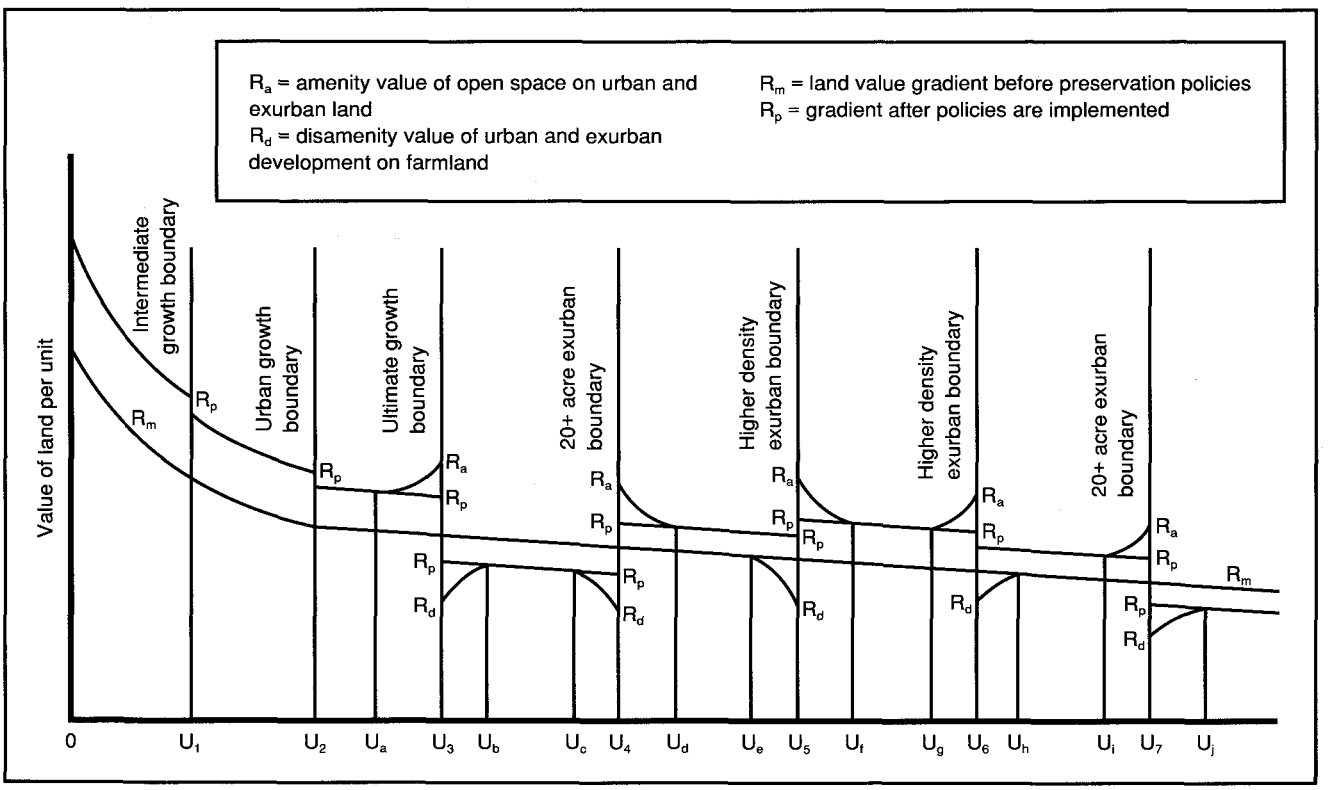


FIGURE 6: Regional economic landscape that preserves farmland in the face of urbanization.

to the UGB, because urban spillover effects dampen productivity and therefore reduce the value of this land for resource production. It is possible that these effects would not be detected until exurban or urban development came to the UGB.

Along the boundary separating farmland and the exurban twenty acre plus buffer districts there should be similar effects. Through site development review home and work structures could be so removed from the boundary that they would not necessarily impose spillovers on farmers. If home construction in this district required putting land into resource activities and waiving remonstrances against farming activities, spillovers could be prevented. Farmers could lease these tracts for farm use. Avoiding the internalization of spillovers is a desirable outcome that is limited to twenty plus acre exurban buffer districts. In any event, the value of the exurban buffer land would rise the closer it gets to farmland, because it will exclusively enjoy the quasi-public goods and benefits of farmland proximity. However, public policy must be firm in maintaining the integrity of the exurban buffer district to avoid undesirable interactions between owners of those tracts and farmers.

Along the boundary separating the exurban twenty plus acre buffer districts from higher density exurban districts, the interactions are much more fluid and problematic, even ambiguous. If public policy is firm in maintaining the integrity of the twenty acre plus buffer districts, the value of the buffer land will fall the closer it gets to higher density exurban districts because of spillovers. On the other side of the boundary, the value of higher density exurban land would rise the closer it is to the exurban buffer districts because it should capitalize the quasi-public benefits that those districts offer. This is the desirable interactive outcome. Undesirable outcomes would be revealed if exurban buffer land values increased closer to the boundary, reflecting expectations by landowners of conversion to higher density exurban uses.

Cultivating the Preservation Hybrid

Fully effective farmland preservation policies have eluded local and state governments. Many have unwittingly accelerated the conversion of farming districts to hobby farms or low-density urban subdivisions. There is evidence that urban land is overvalued through government development subsidies, inefficient utility provision, and other market distortions induced by policy and inherent market imperfections. Farmland is undervalued for the same reasons and because of urban spillovers. In result, vastly more farmland is removed from production than should occur. Moreover, just a small reduction in farmland productivity can undermine the critical mass of farming infrastructure needed to sustain viable operations in a region. Perhaps, as Daniels (1990) observes, the best way to preserve farmland is to generate greater income for farmers. Sweden guarantees prices for farmers so they can outbid urban developers for the best farmland (Lapping 1979). Sweden also employs sophisticated new town and urban expansion planning. But the U.S. lacks a clear national policy toward the preservation of prime farmland, especially in the face of urbanization, and, therefore, state and local governments are left to their own devices to protect their long-term interests in farmland.

State and local governments are limited in their economic and legal capabilities. They cannot alter food prices. They cannot interfere with federal policies that raise or lower commodity supports. They cannot afford the purchase of the development rights of farmland—nor should they. The most effective farmland preservation tools available to state and local governments are land use planning and development regulation. The most effective mix are those used by Oregon plus the modifications proposed here.

NOTES

1. See Brown and Roberts (1978) on the role of local, state, and federal policies in stimulating inefficient land owner behavior and, implicitly, the need for land use regulatory mechanisms to compensate for these inefficiencies. See also Harvey and Clark (1965), Clawson (1962), and Nelson (1990a).
2. It is not known the extent to which farm subsidy policies offset urban subsidies. While total federal government commodity support policies totaled less than $20 billion in 1989, federally backed mortgage loans issued in 1989 exceeded $150 billion. According to the *1991 Statistical Abstract of the United States*, more federally backed home loans were delinquent in 1989 than all commodity price support policies in 1989 combined.
3. Farmers pay for those new facilities and services on the basis of land value, but not on whether they use them.
4. This figure is adapted from Nelson 1986a, 1990a.
5. For an extensive review of all common farmland preservation techniques see Nelson (1990a), a reply by Daniels (1990), and a rejoinder (Nelson 1990c).
6. Some farmers who enroll in those programs produce less than farmers who do not. While farmers realize a reduction in the cost of operations and this raises net revenues, it does not pressure them into making their land more productive (Bahl 1968; Goldberg and Chinloy 1984; Mills and Hamilton 1988). When urban development leapfrogs over farmland enrolled in a property tax relief program, the volume of land made underproductive increases.
7. Most right-to-farm laws also limit the ability of public agencies to condemn farmland for public works projects that can adversely affect the viability of farming districts.
8. At the heart of right-to-work laws is the desire to protect innocent farmers from land use actions or restrictions over which they have little or no control (Leutwiler 1986). These laws make it difficult for

nearby nonfarm residents to restrict operations through nuisance suits. There are many shortcomings, however. Right-to-farm laws do not prevent farmers from converting their land to an urban use or prevent the sale to speculators; may not apply to the operations of new owners; and do not protect changes in agricultural practices (Lapping and Leutwiler 1987). Farmland that is fallow during the year in which new development occurs nearby may not be protected when actively farmed.

9. If these programs can succeed in protecting a critical mass of land, they can help sustain the agricultural infrastructure. In Montgomery County, Maryland, for example, the TDR program may have transferred sufficient development rights from large areas considerable distances to create the necessary critical mass to sustain agriculture into the long-term future.
10. PDR programs, because they are voluntary, suffer from the same limitations as TDR programs. They do not assure preservation of prime farmland in quantities and in locations suitable to sustain a viable agricultural economy. Nonparticipants remain free to farm or subdivide their land.
11. Incredibly, some farmers in Florida claim that one-acre minimum lot size zoning is perfectly acceptable in farming districts. They argue that higher minimum lot size zoning reduces land value, which reduces the amount they can borrow for agricultural purposes. The argument is specious. Farm loans do not exceed more than a certain percentage of the value of land for agricultural purposes. Moreover, with one-acre zoning, large-lot residential subdividing could not be prevented. Ironically, some farmers say they will volunteer not to subdivide and develop in return for the zoning. This promise would be difficult to enforce at best. Would a foreclosing lender be prevented from subdividing? Studies show that restrictive farm use zoning has not prevented farmers from securing agricultural loans in the amounts they would have received anyway (Coughlin 1984).
12. Nonexclusive agricultural zoning usually includes large minimum lot sizes; entitlement to single-family home construction on any preexisting and newly created but conforming lot; no requirement to demonstrate the effects on farm production of land partitioning at the minimum lot size; and conditional use permits allowing commercial recreation, smaller than minimum lot size developments, patently nonfarm dwelling units, agriculturally related industrial activities, and planned developments sometimes at higher densities.
13. The distribution has changed slightly since 1986 through continual fine tuning and plan revisions required by Oregon planning law.
14. The original criteria for determining whether land qualified for exception status were difficult to meet and carried a heavy burden of judicial review. Consequently, most plans failed to meet LCDC approval. Acceding to legislative demands, the LCDC replaced the original test with the impracticability test, which allows more flexibility in classifying rural land for exception status. One result has been a scattered and pervasive pattern of exception lands throughout the state.
15. Lapping (1980), Healy and Short (1981), and Buttel (1982) observe that hobby farmers often purchase more land than they are able to put to productive use; are generally unwilling or unable to make the investment in farm equipment and labor necessary to produce a commercial volume of farm products; compete with commercial farms for the same land, causing fragmentation of land holdings, driving land prices upward beyond what can be paid for out of a farm income; are a source of vandalism on nearby commercial operations and a cause of legal attempts to limit commercial farming practices; and create in commercial farmers questions of the future viability of farming, making them less willing to undertake long-term investments. As commercial farmers go out of business, an area can lose the "critical mass" of farms and farmers needed to maintain agricultural support services.
16. The framers of Oregon's farmland preservation program did not anticipate the magnitude of the demand for hobby farms. Between 1978 and 1982, Oregon led the nation in the formation of hobby farms and many analysts expressed concern that the trend would undermine Oregon's farmland preservation policies (Nelson 1983a; 1983b; Daniels and Nelson 1986; Daniels 1986).
17. The finding also indicates that even at twenty-acre minimum lot size restrictions, exurban development can be expected to impose negative spillovers onto farmland. The question now becomes: At what minimum density should we expect no statistically meaningful impacts of exurban development on farmland value? Would it be forty acres? Eighty acres?
18. Census tabulations do not adjust for inflation.
19. Willamette Valley includes Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington, and Yamhill counties.
20. Proper urban containment planning results in public facility and service savings (Nelson and Knaap 1987; Nelson 1987); improved delivery of social services; more efficient transportation systems (Newman and Kenworthy 1989); improved interaction among economic activities; lower housing package costs, although with possibly higher density and lower housing space (Real Estate Research Corporation 1974; Frank 1989); lower energy costs (Keyes and Peterson 1977); more efficient government management, assuming flexible management schemes such as interlocal cooperative agreements (Nelson 1991b); improved interaction between social classes (Jacobs 1961); improved sense of place (Lynch 1983); and, of course, preservation of open spaces outside urban development for farming, forestry, recreation, flood

control, air cleansing, watershed, and related purposes.

21. Alas, all urban areas allow subdivision of future urbanizable land into one- to two-acre tracts. Although subdivision plans must include homesite locations that theoretically enable wise redivision in later years, the practical effect is to condemn future development in these areas to hodgepodge in-fill that residents are likely to oppose.
22. Some larger urban areas received approval for more land inside UGBs than strictly needed for development, arguing that more land was needed to prevent monopolistic behavior among landowners and to provide adequate locational choices for developers. The Portland UGB contained 15.8 percent more land than strictly needed and Salem's UGB contained 25 percent more than needed.
23. In mid-1992, the LCDC adopted the "urban reserve" rule, which would effect a few of the points argued in this article. By the mid-1990s, seven urban areas, including metropolitan Portland, will identify areas for UGB expansion, mostly on exception lands but also on selected prime farm and forest lands. Although not to be included in the UGB initially, lands placed into the urban reserve would be managed in such a way as to make urban expansion more efficient. In effect, this rule creates a longer term UGB, somewhat akin to the ultimate UGB proposed here.

REFERENCES

Archer, R. W. 1977. Policy and Research Issues in Subdivisions for Rural Residences, Hobby Farms, and Rural Retreats. Paper presented at the 48th ANZAAS Congress, Melbourne, Australia.

Bahl, Roy W. 1968. A Land Speculation Model: The Role of the Property Tax as a Constraint to Urban Sprawl. *Journal of Regional Science* 8, 2.

Berry, David. 1976. *Idling of Farmland in the Philadelphia Region, 1930–1970.* Regional Science Research Institute Discussion Paper Series No. 88. University of Massachusetts, Amherst.

Berry, David. 1978. Effects of Urbanization on Agricultural Activities. *Growth and Change* 9, 3: 2–8.

Berry, David, Ernest Leonardo, and Kenneth Bieri. 1976. *The Farmer's Response to Urbanization.* Regional Science Research Institute Discussion Paper Series No. 92. University of Massachusetts, Amherst.

Berry, David, and Thomas Plaut. 1978. Retaining Agricultural Activities Under Urban Pressures: A Review of Land Use Conflicts and Policies. *Policy Sciences* 9: 153–78.

Boal, Frederick W. 1970. Urban Growth and Land Value Patterns. *Professional Geographer* 22, 2: 79–82.

Bradbury, Dana Ann. 1986. Suburban Sprawl and the Right to Farm. *Washburn University Law Review* 22: 448–68.

Brown, H. James, and Neal A. Roberts. 1978. *Landowners at the Urban Fringe.* Discussion Paper D78–10. Cambridge, MA: Harvard University, Department of City and Regional Planning.

Buttel, F. H. 1982. The Political-Economy of Part-Time Farming. *GeoJournal* 6: 293–300.

Clawson, Marion. 1962. Urban Sprawl and Speculation in Suburban Land. *Land Economics*: 99–111.

Correll, Mark R., Jane H. Lillydahl, and Larry D. Singell. 1978. The Effects of Greenbelts on Residential Property Values. *Land Economics* 54, 2: 207–17.

Coughlin, Robert. 1984. *Evaluation of the Effect of Farm Use Zoning on the Ability of Farmers to Secure Farm Loans.* Philadelphia: University of Pennsylvania, Regional Science Research Institute.

Currier, Barry A. 1978. An Analysis of Differential Taxation as a Method of Maintaining Agricultural and Open Space Land Uses. *University of Florida Law Review* 30, 5: 821–42.

Daniels, Thomas L. 1986. Hobby Farming in America: Rural Development or Threat to Commercial Agriculture? *Journal of Rural Studies* 2, 1: 31–40.

———. 1990. Policies to Preserve Prime Farmland in the USA: A Comment. *Journal of Rural Studies* 6: 331–6.

Daniels, Thomas L., and Arthur C. Nelson. 1986. Is Oregon's Farmland Preservation Program Working? *Journal of the American Planning Association* 52, 1: 22–32.

Davis, Judy S. 1990. *Commuting Patterns of Exurban Households.* Center for Urban Studies, Portland State University, Portland, OR.

Davis, Judy S., Arthur C. Nelson, and Kenneth J. Dueker. 1993. The New 'Burbs. *Journal of the American Planning Association.* Forthcoming.

Forkenbrock, David J., and Peter S. Fisher. 1983. Tax Incentives to Slow Farmland Conversion. *Policy Studies Journal* 11: 25–37.

Frank, James E. 1989. *The Costs of Alternative Development Patterns.* Washington, DC: Urban Land Institute.

Fuller, Anthony M., and Julius A. Mage, eds. 1975. *Part-Time Farming.* Proceedings of the First Rural Geography Symposium. Guelph, Ontario: University of Guelph.

Furuseth, Owen J. 1980. The Oregon Agricultural Protection Program: A Review and Assessment. *Natural Resources Journal* 20: 603–14.

———. 1981. Update on Oregon's Agricultural Protection Program: A Land Use Perspective. *Natural Resource Journal* 21: 57–70.

Furuseth, Owen J., and John T. Pierce. 1982. *Agricultural Land in Urban Society.* Chicago, IL: Association of American Geographers.

Goldberg, Michael, and Peter Chinloy. 1984. *Urban Land Economics.* New York: John Wiley and Sons.

Gottmann, Jean. 1961. *Megalopolis.* New York: Twentieth Century Fund.

Gustafson, Greg C., Thomas L. Daniels, and Rosalyn P. Shirack. 1982. The Oregon Land Use Act. *Journal of the American Planning Association* 48, 3: 365–73.

Hagman, Donald C., and Julian Conrad Juergensmeyer. 1987. *Urban Planning and Land Development Control Law.* St. Paul, MN: West Publishing.

Harvey, Robert O., and W. A. V. Clark. 1965. The Nature and Economics of Urban Sprawl. *Land Economics* 41, 1.

Healy, Robert G., and James L. Short. 1981. *The Market for Rural Land: Trends, Issues, Policies.* Washington, DC: The Conservation Foundation.

Jacobs, Jane. 1961. *The Death and Life of Great American Cities.* New York: Random House.

Keene, John C. et al. 1975. *Untaxing Open Space.* Washington, DC: Council on Environmental Quality.

Keyes, Dale L., and George R. Peterson. 1977. *Metropolitan Development and Energy Consumption.* Washington, DC: The Urban Institute.

Knaap, Gerrit J. 1982. The Price Effects of an Urban Growth Boundary. Dissertation, University of Oregon, Eugene.

_____. 1985. The Price Effects of an Urban Growth Boundary in Metropolitan Portland, Oregon. *Land Economics* 61, 1: 26–35.

Knaap, Gerrit J., and Arthur C. Nelson. 1988. The Effects of Regional Land Use Control in Oregon: A Theoretical and Empirical Review. *The Review of Regional Studies* 18, 2: 37–46.

_____. 1992. *The Regulated Landscape.* Cambridge, MA: Lincoln Institute of Land Policy.

Land Conservation and Development Commission (LCDC). 1986. *Oregon Lands.* Salem, OR: Department of Land Conservation and Development.

_____. 1989. *Report to the Oregon Legislature.* Salem, OR: Department of Land Conservation and Development.

_____. 1990. *State Planning Goals and Guidelines.* Salem, OR: Department of Land Conservation and Development.

Lapping, Mark B. 1979. Agricultural Land Retention Strategies: Some Underpinnings. *Journal of Soil and Water Conservation* 34: 124–6.

_____. 1980. Agricultural Land Retention: Responses Foreign and American. In *The Farm and the City: Rivals or Allies?,* edited by A. M. Woodruff. Englewood Cliffs, NJ: Prentice-Hall.

Lapping, Mark B., and J. F. FitzSimmons. 1982. Beyond the Land Issue: Farm Viability Strategies. *GeoJournal* 6: 519– 24.

Lapping, Mark B., and Nels R. Leutwiler. 1987. Agriculture in Conflict: Right-to-Farm Laws and the Pari-Urban Milieu for Farming. In *Sustaining Agriculture in Cities,* edited by William Lockeretz. Ankeny, IA: Soil and Water Conservation Society of America.

Lee, Douglass B. 1979. Market Failure. *The Land Use Policy Debate in the United States.* New York: Praeger.

Leutwiler, Nels R. 1986. Farmland Preservation Laws: What Do They Do? Can They Be Justified? Master's thesis, Department of Urban Planning, University of Colorado at Denver.

Lynch, Kevin. 1983. *Theory of Good Urban Form.* Cambridge, MA: MIT Press.

Meier, Bruce W. 1988. An Urban Induced Ring of Disinvestment by Farm Operators. Paper presented to the Association of American Geographers, Miami University, Miami, Ohio.

Mills, Edwin S., and Bruce W. Hamilton. 1988. *Urban Economics.* 4th ed. Homewood, IL: Scott Foresman.

National Agricultural Lands Study (NALS). 1981. Washington, DC: U.S. Department of Agriculture.

Nelson, Arthur C. 1983a. Comment on the Oregon Land Use Act. *Journal of the American Planning Association* 49, 1: 85–7.

_____. 1983b. Comment. *Natural Resources Journal* 23, 1: 1–5.

_____. 1984. *Evaluating Urban Containment Programs.* Portland, OR: Center for Urban Studies, Portland State University.

_____. 1985. A Unifying View of Greenbelt Influences on Regional Land Values and Implications for Regional Policy. *Growth and Change* 16, 2: 43–8.

_____. 1986a. Using Land Markets to Evaluate Urban Containment Programs. *Journal of the American Planning Association* 52, 2: 156–71.

_____. 1986b. Toward a Theory of the American Rural Residential Land Market. *Journal of Rural Studies* 2, 4: 309–19.

_____. 1987. The Effect of a Regional Sewer Service on Land Values, Growth Patterns, and Regional Fiscal Structure Within a Metropolitan Area. *Urban Resources* 4, 2: 15– 8, 58–9.

_____. 1988. An Empirical Note on How Regional Urban Containment Policy Influences an Interaction Between Greenbelt and Exurban Land Markets. *Journal of the American Planning Association* 54, 2: 178–84.

_____. 1990a. Economic Critique of Prime Farmland Preservation Policies in the United States. *Journal of Rural Studies* 6: 114–42.

_____. 1990b. Blazing New Planning Trails in Oregon. *Urban Land.* Washington, DC: Urban Land Institute.

_____. 1990c. The Analytic Basis for Farmland Preservation. *Journal of Rural Studies* 6: 337–46.

_____. 1991. Toward a Definition of Exurbia. *Journal of Planning Literature* 6, 4: 350–68.

_____. 1992. Lessons of Urban Growth Boundary Design and Management in Oregon. *Real Estate Finance* 58, 4: 11–22.

Nelson, Arthur C., and Kenneth J. Dueker. 1989. Exurban Living Through Advanced Technology. *Journal of Urban Planning and Development* 115, 3: 101–13.

_____. 1990. The Exurbanization of America with Notable Planning Policy Implications. *Journal of Planning Education and Research* 59, 2: 91–100.

Nelson, Arthur C., and J. Richard Recht. 1988. Inducing the Residential Land Market to Grow Timber in an Antiquated Rural Subdivision. *Journal of the American Planning Association* 54, 4: 529–36.

Newman, Peter, and Jeffrey Kenworthy. 1989. *Cities and Automobile Dependence.* Sydney, Australia: Gower.

Pacific Meridian Resources. 1991. *Analysis of the Relationship of Resource Dwelling and Partition Approvals Between 1985–87 and Resource Management in 1990.* Salem: Oregon Land Conservation and Development Commission.

Platt, Rutherford H. 1985. The Farmland Conversion Debate. *Professional Geographer* 37, 4: 433–42.

Plaut, Thomas. 1976. *The Effects of Urbanization on the Loss of Farmland at the Rural-Urban Fringe: A National and Regional Perspective.* Regional Science Research Institute Discussion Paper Series No. 94. University of Massachusetts, Amherst.

Pope, C. Arden. 1985. Agricultural Productive and Consumptive Use Components of Rural Land Values in Texas. *American Journal of Agricultural Economics* 66, 1: 81–6.

Prestbo, John, ed. 1975. *This Abundant Land.* Princeton, NJ: Dow Jones Books.

Real Estate Research Corporation. 1974. *The Costs of Sprawl.* Chicago, IL: Real Estate Research Corporation.

Rose, Jerome B. 1984. Farmland Preservation Policy and Programs. *Natural Resources Journal* 24, 3: 591–640.

Rosser, J. Barkley, 1978. The Theory and Policy Implications of Spatial Discontinuities in Land Values. *Land Economics* 54, 4: 430–41.

Sinclair, Robert. 1967. Von Thuenen and Urban Sprawl. *Annals of the Association of American Geographers* 57: 72–87.

Solomon, Barry. 1984. Farmland Protection: A Case of Quality Not Quantity. *Land Use Policy*: 357–66.

United States Department of Agriculture. 1985. *1982 Census of Agriculture.* Washington, DC: U.S. Government Printing Office.

———. 1990. *1987 Census of Agriculture.* Washington, DC: U.S. Government Printing Office.

Vining, Daniel R., Kenneth Bieri, and Ann Strauss. 1977. *Urbanization of Prime Agricultural Land in the United States: A Statistical Analysis.* Regional Science Research Institute Discussion Paper Series No. 99. University of Massachusetts, Amherst.

Vining, Daniel R., Thomas Plaut, and Kenneth Bieri. 1977. Urban Encroachment on Prime Agricultural Land in the United States. *International Regional Science Review* 2, 2.

Volkman, Nancy J. 1987. Vanishing Lands in the USA. *Land Use Policy* 4, 1: 14–30.

Zeimetz, Kathryn A., Elizabeth Dillon, Ernest E. Hardy, and Robert C. Otte. 1976. *Dynamics of Land Use in Fast Growth Areas.* Agricultural Economics Report No. 325. Economic Research Services, United States Department of Agriculture, Washington, DC.

- Routledge
- Publication History
- Sample copy
- Alert me
  - TOC email alert
  - TOC RSS feed

Journal of the American Planning Association

Visit the American Planning Association (APA)
ISSN
0194-4363 (Print), 1939-0130 (Online)
Publication Frequency
4 issues per year

Instructions for authors

SCHOLARONE MANUSCRIPTS™

This journal uses ScholarOne Manuscripts (previously Manuscript Central) to peer review manuscript submissions. Please read the guide for ScholarOne authors before making a submission. Complete guidelines for preparing and submitting your manuscript to this journal are provided below.

The ***Journal of the American Planning Association*** (***JAPA***) publishes research and analysis useful to planners, policymakers, scholars, students, and citizens of urban, suburban, and rural areas. It aspires to bring insight to planning the future, to air a variety of perspectives, to publish only the highest quality research, and to engage readers. ***JAPA*** prefers vivid and direct writing in the active voice. We particularly seek timely papers that offer significant research news.

JAPA is interested in manuscripts that examine historical or contemporary planning experience, broadly defined, in domestic or global contexts, and that do at least one of the following:

· contribute to the theoretical and conceptual foundation of planning;

· improve the link between planning and successful policy implementation;

· advance the methods used in planning practice and planning research;

· explain empirical relationships important to planning;

· interpret noteworthy physical, economic, and social phenomena that have spatial dimensions; or

· analyze significant consequences of planning approaches, processes, and contexts.

Manuscript Submission and Review

JAPA publishes only original material. Manuscripts submitted for review must differ substantially from other published work by the same author or authors. Authors must disclose all related work, whether already published or in preparation, at the time of submission. Simultaneous submission of a manuscript to other publications is unacceptable. Submission to ***JAPA*** implies the author's commitment to publish in that outlet. Please note that ***JAPA*** uses CrossCheck™ software to screen papers for unoriginal material. By submitting a manuscript to ***JAPA*** , the author(s) agree to any necessary originality checks during the peer review and
production processes.

JAPA uses ScholarOne Manuscripts (previously Manuscript Central) to track and manage manuscript submissions for peer review. Please read the guide for ScholarOne authors (http://journalauthors.tandf.co.uk/submission/ScholarOne.asp) for general instructions on beginning/continuing a manuscript submission and
uploading documents before making a submission. All submissions should be made online via the Author Center at the ***JAPA*** ScholarOne Manuscripts site: http://mc.manuscriptcentral.com/rjpa . New users should first create an account. Online user guides and access to a helpdesk are available on this website.

Manuscript Preparation and Requirements

Ordinarily, manuscripts should not exceed 5,000 words of main text, excluding abstract, tables, figures, notes, and references. Only papers with clear potential for publication in ***JAPA*** will be peer reviewed. The editor asks reviewers to judge papers based on contributions to ***JAPA*** 's mission as described above; we ask reviewers to evaluate the accuracy, quality of logic, writing, and research methods as well as appeal to potential readers. The editor has final authority in all editorial decisions.

Reviewer suggestions: Authors are invited to suggest names of preferred reviewers (not from their own institution). The editor does not guarantee that suggested reviewers will be contacted to review the manuscript.

Manuscript: Authors should prepare and upload **two** versions of their manuscript. One should be a complete text with author and funding information, abstract, and figures/tables; the second document should have all identifying information (including in-text and bibliographic references by authors and funding information) redacted to allow for blinded peer review. All figures and tables should be placed at the end of the document (rather than embedded within the body of the manuscript). When uploading files to ScholarOne, authors should designate the complete manuscript as "file not for review," and the redacted manuscript as "main document."

Abstract: The first page of each document must include, using no more than 300 words, a summary of the manuscript with two subheaders: Problem, Research Strategy, and Findings; and Takeaway for Practice (how these findings are relevant to and important for planning practice). Authors should also identify no more than five Keywords. Search engine optimization (SEO) is a means of making your article more visible to anyone who might be looking for it. Please consult http://journalauthors.tandf.co.uk/preparation/writing.asp for further guidance.

Tables and figures: In the text, indicate the appropriate location of each table and figure on a separate line, after the paragraph where it first appears. Use the form: [Figure 1 about here]. Place tables in numerical order at the end of the paper, followed by figures, with each table and figure on a separate page, each with complete title and notes. Do not embed tables in the text. Supply only tables that can be edited in MSWord or Excel. Aim to keep the overall size of the manuscript
file under 2 MB.

It is the author's responsibility to secure permission for reproducing any figure, table, or extract from the text of another source. This applies to direct reproduction as well as "derivative reproduction" (where you have created a new figure or table which derives substantially from a copyrighted source). Use only EPS, TIFF, or JPG formats for image files. Be sure to include only images that will reproduce well in black and white. Authors will receive specific guidelines for
submitting print-quality images if the manuscript is accepted for publication.

Author bio: Authors must also create a separate document providing information on all author(s), including full name, employer/affiliation (including department), email address, AICP status, and a one-sentence summary on each in a separate file from the manuscript files. When uploading this file, designate it as the "Author Bio" file.

Digital files: Upload only MS Word for PC files formatted to eliminate any special coding such as that created by reference citation software or mathematical equations. PDF file submissions will not be accepted.

Type and spacing: Use 12-point Times New Roman type. Double-space all copy except for tables and figures. Left justify the main text and indent first lines of paragraphs rather than spacing between them.

Notes: Use notes sparingly and keep them brief. Provide notes as a numbered list at the end of the text, not as footnotes on each page.

Citations and references: Format all citations and corresponding entries in the list of references according to the Publication Manual of the American Psychological Association, Sixth Edition (American Psychological Association, 2009), **AND** include both volume and issue number for all periodicals.

The Editorial Office reserves the right to reject a manuscript if it fails to follow any or all of the procedural and format requirements described here; the manuscript will not enter the review process until all deficiencies are addressed. Authors will then have to formally resubmit their revised manuscripts as a new submission; the Editorial Office will not keep the deficient submission in the system.

Copyright: If ***JAPA*** publishes a manuscript, the author(s) will be asked to sign a form transferring copyright to the American Planning Association (APA). Signing that form will give the author and APA specific rights of use and reproduction. For more information, please see http://journalauthors.tandf.co.uk/preparation/copyright.asp.

Please contact the ***JAPA*** Editorial Office for questions about submission, peer review, manuscript preparation, or copyright.

Dr. Sandra Rosenbloom, Editor
Journal of the American Planning Association
japaeditor@utexas.edu

Michelle Treviño, Managing Editor
Journal of the American Planning Association
japame@utexas.edu

Reviews of Books, Films/Videos, or CDs

Prospective reviewers should contact the review editor. Publishers who would like a product reviewed should send copies directly to:

Timothy S. Chapin, Review Editor
Department of Urban & Regional Planning
Florida State University
113 Collegiate Loop
330 Bellamy Building
Tallahassee, FL 32306-2280
tchapin@fsu.edu

Subscriptions: For APA members, send subscription orders and address changes to: American Planning Association, 205 North Michigan Avenue, Suite 1200, Chicago, IL 60601-5927; subscriptions@apa.org . For all other subscribers, send subscription orders and address changes to Taylor & Francis Group LLC, 325 Chestnut Street, Philadelphia, PA 19106 (USA/North America), or Taylor & Francis Customer Service, Sheepen Place, Colchester, Essex, C03 3LP, UK(UK/Europe); subscriptions@tandf.co.uk.

Advertising: For space or rate information, contact Leah Stanley at leah.stanley@tandf.co.uk.

Book, Film/Video, or CD Reviews: Publishers who would like a product reviewed should send copies directly to the review editor at the address shown above.

Reprint Permissions: Please visit http://journalauthors.tandf.co.uk/preparation/permission.asp .
Authors from whom we receive a valid email address will be given an opportunity to purchase reprints of individual articles, or copies of the complete print issue. These authors will also be given complimentary access to their final article on *Taylor & Francis Online* .

Visit our Author Services website for further resources and guides to the complete publication process and beyond.

Planning Guidelines

Separating Agricultural and Residential Land Uses

Department of Natural Resources, Queensland
Department of Local Government and Planning, Queensland
DNRQ 97088

These planning guidelines are to be read in association with State Planning Policy 1/92: Development and the Conservation of Agricultural Land

Design and production by Scientific Publishing, Resource Sciences Centre, DNR

ISBN 0 7242 7405 7

DNRQ 97088

Department of Natural Resources
GPO Box 2454
Brisbane 4001

This book is available from:
Department of Natural Resources
Resource Sciences Centre
Land Resources Publications
Block C, 80 Meiers Rd
Indooroopilly Q 4068

Telephone (07) 3896 9426

(07) 3896 9502

Facsimile (07) 3896 9782

Preface

State Planning Policy 1/92: Development and the Conservation of Agricultural Land was approved by the Queensland Government in December 1992, under the *Local Government (Planning and Environment) Act 1990-1992*. State Planning Policy 1/92 addresses key principles for the protection of agricultural land. The policy is supported by planning guidelines which provide detailed advice on implementing the policy.

Planning Guidelines: The Identification of Good Quality Agricultural Land was released in 1993 and addressed the definition and identification of good quality agricultural land and appropriate planning approaches to achieve the protection of such land.

Planning Guidelines: Separating Agricultural and Residential Land Uses provides technical advice and guidance to local government, developers, consultants and landholders on minimising conflicts between farming activities and residential uses (Policy Principle No. 8 of State Planning Policy 1/92). The planning guidelines are a product of extensive public consultation: two drafts were published (1993 and 1995), and the document has been substantially amended in response to comments received. In particular, the document advocates a flexible approach that is responsive to specific circumstances.

Planning Guidelines: Separating Agricultural and Residential Land Uses has been prepared by the Department of Natural Resources and the Department of Local Government and Planning in consultation with a reference group formed from representatives of the following bodies:

Local Government Association of Queensland

Queensland Farmers' Federation

CANEGROWERS

Australian Cotton Foundation

Queensland Pork Producers' Organisation

Queensland Dairy Farmers' Organisation

Queensland Fruit and Vegetable Growers

Queensland Grain Growers' Council

Queensland Conservation Council

Australian Sugar Milling Council

Urban Development Institute of Australia

Royal Australian Planning Institute

Land Resource Consultants

Department of Environment

Department of Primary Industries

Contents

1. Introduction

1.1 *The Queensland Government considers that good quality agricultural land is a finite national and state resource that must be conserved and managed for the longer term.*

State Planning Policy 1/92: Development and the Conservation of Agricultural Land (SPP1/92) was introduced in December 1992 as an instrument to protect good quality agricultural land through local government planning. SPP1/92 Principle No 8 states:

Local Authority planning provisions should aim to minimise instances of incompatible uses locating adjacent to agricultural operations in a manner that inhibits normal farming practice. Where such instances do arise, measures to ameliorate potential conflicts should be devised wherever possible.

Purpose

1.2 The purpose of the planning guidelines is to provide technical advice and guidance on reducing the potential for conflict between farming activities and residential development in accordance with Principle No. 8 of State Planning Policy 1/92. The planning guidelines are intended to assist local governments, developers, landholders and consultants. In particular, the planning guidelines contain provisions which local governments should consider including in their planning schemes or adopting as local planning policies.

1.3 Although intended to support the protection of good quality agricultural land in accordance with State Planning Policy 1/92, the principles in the planning guidelines could be used to assist decision-making on other land where agricultural/residential conflicts could arise. Also, the principles can be applied to situations where conflicts are likely to arise between industrial, tourist, commercial or other urban uses and nearby agricultural uses.

1.4 It should be noted that conflict due to intensive animal industries is not specifically covered in these planning guidelines. Detailed guidance on dealing with the impact from these activities is provided in industry-specific codes of practice and guidelines which are listed in the reference section of this document.

Background

1.5 Conflict between residential development and agricultural land uses is likely to occur where residential land uses directly abut, or are sufficiently close to, farmland such that they are likely to be affected by agricultural activities.

1.6 Such conflict can arise from the use of agricultural chemicals, and noise, dust and odour generating activities. Adverse impacts of residential development on farmland include sediment and stormwater run-off. These planning guidelines outline planning measures to reduce such land use conflict.

The Environmental Protection Act

1.7 The *Environmental Protection Act 1994* (EP Act) was introduced by the Queensland Government primarily to protect the environmental values of air, noise and water. Under the EP Act and associated Environmental Protection Policies (EPPs), everyone has a general environmental duty of care to the environment and their neighbours.

1.8 Advice in the planning guidelines is based on certain assumptions:

(a) All agricultural activities incorporate reasonable and practicable measures to protect the environment in accord with the Environmental Code of Practice for Agriculture (prepared under the provisions of the EP Act) and associated industry specific guidelines.

(b) All agricultural activities are legally conducted as required by other legislation covering workplace health and safety, and the use and handling of agricultural chemicals.

(c) Nevertheless, certain activities practised by even the most careful and responsible farmer may result in a nuisance to adjacent residential areas through, for example, unavoidable odour drift and noise impacts.

1.9 The separation distances recommended in this document are drawn from relevant State and Commonwealth legislation and guidelines, notably the EP Act, relevant research and the sources cited.

The Use of Buffer Areas

1.10 Buffer areas are legitimate planning tools. They are used to separate land uses to ensure long-term protection of both areas impacted upon and areas used for the conflict generating activity. Examples of such activities include sewage treatment works, abattoirs, tanneries, composting plants and rendering works; and intensive animal and plant production facilities (such as feedlots, piggeries and poultry sheds). The principle of separating conflicting uses is also applied to the protection of natural resource areas (such as nature conservation reserves, streams, water supply storage areas and forest reserves).

1.11 By separating agricultural uses from residential and other urban uses, buffer areas can reduce conflict and the resulting complaints. Complaints about agricultural practices are often based as much on perception as reality, particularly in relation to chemical spray drift. Seeing or smelling the source of nuisance may heighten the perception of that nuisance. Buffer areas can contribute to the screening of agricultural activities from the view of residential areas. Thus a suitable visual barrier between the development and agricultural land in the form of a vegetation screen can significantly reduce the level of complaint by minimising both the cause and the perception of a nuisance.

1.12 Nevertheless, buffer areas designed in accordance with these planning guidelines will not totally eliminate all impacts of activities. Also, the planning guidelines do not limit the rights of individuals to take action under the common law or such legislation as the *Health Act 1937, EP Act 1994, Work Place Health and Safety Act 1995* or the *Agricultural Chemicals Distribution Control Act 1966*, if they believe their rights to enjoy a safe environment and the use of their land are restricted. Appendix 1 outlines existing controls and administering agencies for a range of issues.

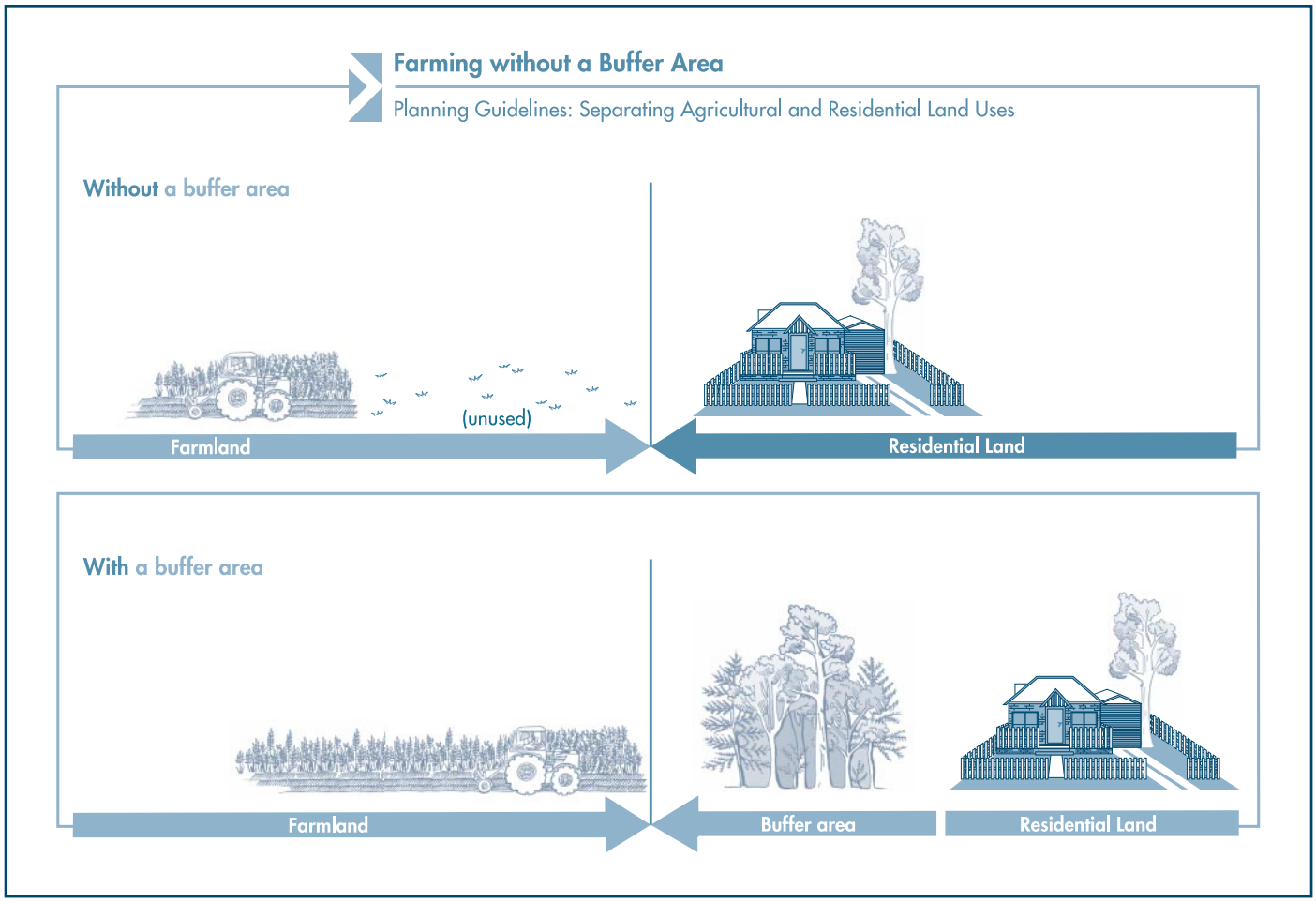


Figure 1. Farming without a buffer area

Principles

1.13 The planning guidelines should be applied with consideration to the following principles:

1. Provided agricultural practices are legally practised according to existing codes of practice, it is unreasonable for new adjacent uses to demand a modification of these practices to an extent which threatens efficient agricultural operations.
2. When preparing planning schemes, local governments should avoid, as far as practicable, locating residential development in close proximity to agricultural land. Where this is not possible, mechanisms such as buffer areas should be used to minimise conflicts.
3. Buffer areas should be determined on the basis of the sustainable agricultural land use with the potential to have the most impact on adjacent land uses and which is reasonably likely to be practised, regardless of current use.
4. Buffer areas should be located within the site being developed for residential purposes, and be provided/funded by the proponent of that development. This principle protects the prior rights of agricultural producers to practice agriculture on rural land.
5. Where conflicts already exist between agricultural and residential land uses, mechanisms including mediation, source controls and public education should be encouraged.

Objectives

1.14 The planning guidelines seek to achieve the following objectives:

1. To protect the use of reasonable and practicable farming measures that are practised in accordance with the Environmental Code of Practice for Agriculture and associated industry-specific guidelines.
2. To minimise scope for conflict by developing, where possible, a well-defined boundary between agricultural and residential areas and not interspersing agricultural and residential areas.
3. To minimise the impacts of residential development on agricultural production activities and land resources.
4. To minimise the potential for complaints about agricultural activities from residential areas.
5. To provide residents with acceptable environmental conditions in residential areas that are located adjacent to agricultural production areas.

Structure of the Planning Guidelines

1.15 The contents of these planning guidelines are as follows:

- **Section 2** provides advice on forward planning to prevent and/or minimise conflicts.
- **Section 3** details how to assess the need for buffer areas as part of development assessment and provides a performance based approach to planning scheme provisions.[1]
- **Section 4** deals with issues of use, ownership and maintenance of buffer areas.
- **Section 5** provides advice on situations where conflict may already exist.
- **Section 6** identifies roles and responsibilities.
- **Appendixes** provide information on existing controls and technical data to assist in the design of effective buffer areas.

Definitions and Abbreviations

1.16 For the purpose of these planning guidelines, the following abbreviations are used:

DLGP	-	Department of Local Government and Planning
DNR	-	Department of Natural Resources
DPI	-	Department of Primary Industries
ESD	-	Ecologically Sustainable Development
EP Act	-	*Environmental Protection Act 1994*
EPP	-	Environmental Protection Policy
$L_{Amax,T}$	-	The average maximum A-weighted sound pressure level in a specified time interval (T) or event
LG(P&E) Act	-	*Local Government (Planning and Environment) Act 1990*
SPP1/92	-	State Planning Policy 1/92: Development and the Conservation of Agricultural Land

1 The performance based approach is explained in paragraph 2.27

1.17 The following definitions have been adopted in the planning guidelines:

Agricultural land use—the use of land for the production of food, fibre and timber; including grazing, cropping, horticulture and forestry[2]. Agricultural land use is subject to constraints imposed by:

- climate
- slope, soil and water limitations
- processing requirements
- economic conditions.

Buffer area—an area of land separating adjacent land uses that is managed for the purpose of mitigating impacts of one use on another. A buffer area consists of a separation distance and one or more buffer elements.

Buffer element—a natural or artificial feature within a buffer area that mitigates an adverse impact. A buffer element may include open ground, a vegetation buffer and/or an acoustic barrier.

Building envelope—A diagram drawn on a subdivision plan, or other plan that forms part of a development application, defining the limits for the siting of buildings (and associated services and facilities e.g swimming pools).

[2] Guidelines for the separation of residential uses from intensive agricultural production establishments including cattle feedlots, piggeries and poultry farms are available in separate publications listed in the references.

Drift—airborne movement of agricultural chemicals onto a non-target area with the potential for risk of injury or damage to humans, plants, animals, environment or property[3].

Residential development—urban subdivision, low density residential subdivision (including rural residential) and rural allotments created primarily for residential purposes (residential excisions, concessional allotments, retirement blocks etc.), and other places used as human accommodation excluding dwellings associated with bonafide agricultural holdings.

Sensitive receptor

- a dwelling, mobile home or caravan park, residential marina or other residential place in a residential development;
- a motel, hotel, or hostel;
- a childcare centre, kindergarten, school, university or other educational institution; or
- a medical centre or hospital.

Separation distance—the total linear distance between a source and a sensitive receptor.

[3] The detection of odour does not necessarily correspond to the presence of an active chemical ingredient.

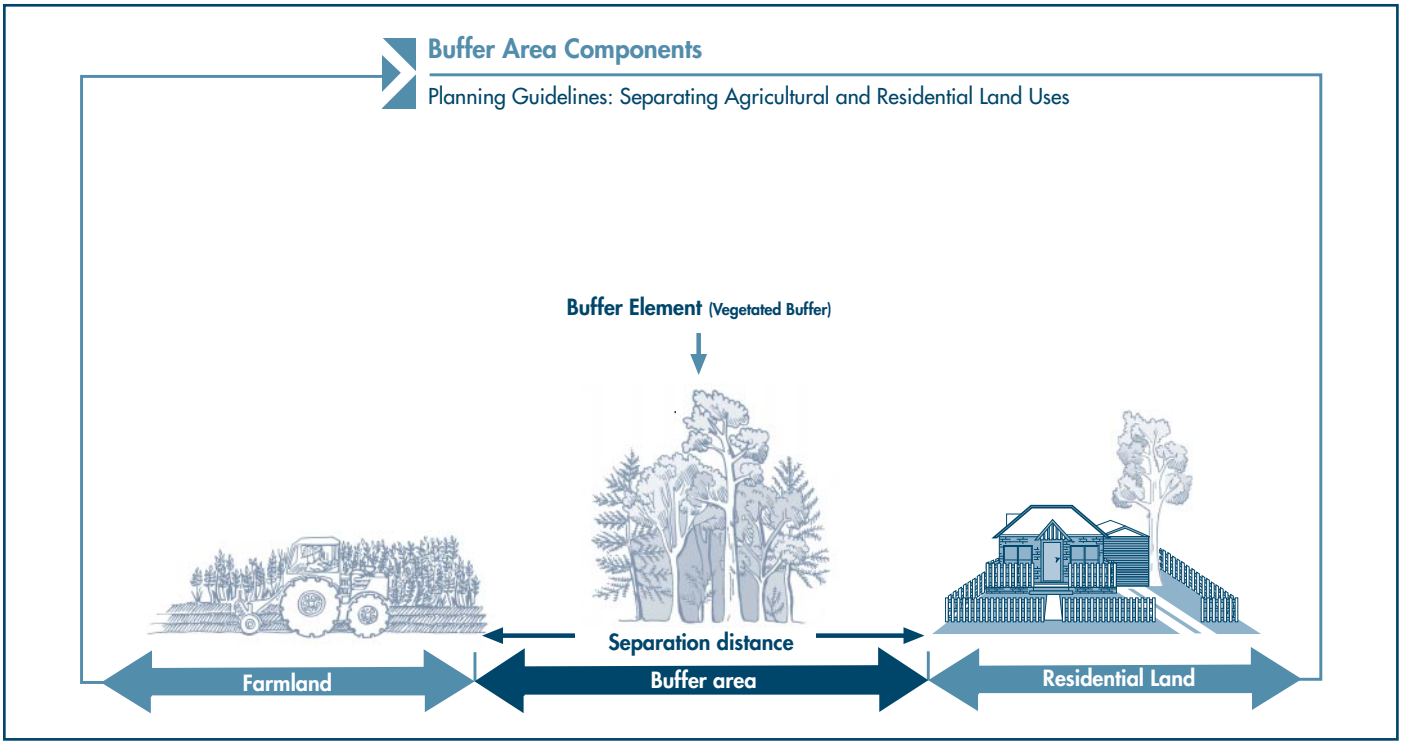


Figure 2. Buffer area components

2. PLANNING SCHEMES

2.1 Planning schemes provide local governments with the opportunity to minimise the potential for conflict between agricultural and residential land uses by separating those uses, thereby providing more certainty for land holders.

Methods of Achieving Separation

2.2 The main ways of achieving separation through planning decisions and the use of planning controls are as follows:

- As far as possible, isolate good quality agricultural land from uses likely to conflict with nearby farming activities.
- On the edges of urban areas, retain natural features (e.g. watercourses and ridge lines) free from development to act as buffer areas between newly developing areas and farmland.
- Ensure that, as far as practicable, newly develop ing areas are designed so that features such as public open spaces, road reserves or purpose-designed buffer areas provide the required separation.
- Require individual developments to be designed in ways that incorporate buffer areas.

2.3 Some or all of these methods will be appropriate, depending on the local circumstances. The rest of Section 2 describes how these various methods can be used when preparing planning schemes and assessing development applications.

Overview

2.4 Planning schemes comprise a forward-looking land use/development strategy complemented by development assessment provisions. These have been known respectively as the Strategic Plan and the Planning Scheme Provisions in the *Local Government (Planning & Environment) Act 1990.*

2.5 Preventing and/or minimising conflict between agricultural land uses and residential development will involve:

- determining the potential for conflict through investigations conducted as part of the preparation or review of planning schemes;
- reducing the opportunity for land use conflict by adopting appropriate planning strategies in the Planning Scheme;
- adopting provisions that are consistent with these planning guidelines and appropriate to local circumstances.

Strategic Planning

2.6 Strategic planning, supplemented as necessary by local area planning, establishes the broad framework to guide future land use and development. Therefore, when preparing or reviewing strategic plans, areas of good quality agricultural land should be identified and protected through appropriate land use designations[4] .

2.7 These designations should include additional areas considered essential for the protection of good quality agricultural land and its productive potential. Additional areas may need to include buffer areas or areas containing essential agricultural infrastructure (e.g. sugar mill tramways, irrigation pump stations, farm packing sheds and cool rooms).

2.8 Any analysis of future development options and settlement patterns should include an assessment of the potential for conflict between agricultural and other land uses. Areas designated for residential and other urban uses should be clearly delineated thereby providing some certainty about the intended boundaries between urban and rural areas. Designations should be based upon an assessment of future development needs for a reasonable time scale (approximately 15 years). This approach avoids blighting agricultural land long before it may be required for development.

Isolating Good Quality Agricultural Land from Incompatible Uses

2.9 Land use strategies in strategic plans and any supporting local area plans should, as far as practicable, aim to isolate good quality agricultural land from uses likely to conflict with certain farming activities.

2.10 Areas of poorer quality agricultural land, when used for purposes that will not cause land use conflicts, may serve to isolate more intensively farmed land from encroaching incompatible uses. Farm forestry and grazing are examples of rural land uses that are compatible with either adjoining areas of intensive agriculture or adjacent residential uses.

2.11 Where achieving isolation is not possible through forward planning, separation should be achieved in other ways.

[4] Advice on this is contained in *Planning Guidelines: The Identification of Good Quality Agricultural Land.*

Using Retained Natural Features as Buffer Areas

2.12 Boundaries of urban designations should, where practicable, take opportunities to follow natural features that will be retained undeveloped, such as watercourses, ridge lines, steeply sloping ground and areas for nature conservation *(see 4.9)*. All these features can act as natural buffer areas between farmland and urban areas.

Designing Urban Areas to Provide Buffer Areas

2.13 Certain facilities and uses, such as public open spaces, road reserves and golf courses, can also be located and designed to act as buffer areas.

2.14 Public open spaces and recreational uses should only be located at the edge of development and used as buffer areas if:

- the location is appropriate for satisfying the open space needs of the community;
- the use of the buffer area as public open space is compatible with adjoining uses,
- the impacts from the adjoining agricultural use do not preclude recreational use of the open space.

2.15 In many of the smaller towns in Queensland, a strip or a tract of Crown land is set aside as a town reserve or common that can act as a buffer area between agricultural and residential land. As well as a buffer area, such town reserves provide a 'land store' dedicated for various public purposes, including parks.

Designing Developments to Provide Buffer Areas

2.16 Despite designing land use strategies to minimise potential for conflict, there will be areas where residential and other urban uses have to locate adjacent to good quality agricultural land. Policies and measures to reduce the potential for conflict should therefore be set out in strategic plans or elsewhere in planning schemes.

2.17 Broad criteria should be included for determining the need for buffer areas and for the design of features such as vegetated buffers. In areas where potential for conflict is identified, each development application should be required to include an assessment of the need for buffer areas and design measures to ensure their effectiveness. Appropriate design requirements are described in Section 3.

2.18 Strategic plan maps can depict an 'area of investigation' where proposed residential uses adjoin existing agricultural areas *(see Figure 3)*. The size of the area of investigation should be determined by:

- the potential agricultural activities in the area concerned (see paragraph 1.13, Principle 3);
- the minimum separation distances appropriate to the likely sources of conflict *(see Table 2)*.

2.19 Planning schemes should provide scope for required separation to be achieved in different ways. A purpose-designed buffer area is one method. Alternatively, the buffer area could be incorporated into the design of the particular development.

2.20 For example, with residential development, large residential allotments incorporating the required buffer area could be located on the boundary between the residential subdivision and agricultural land. Planning schemes should allow for this approach by specifying minimum lot sizes sufficiently large to incorporate the desired buffer area into the allotment while allowing an adequate balance of the lot to be available for the house and normal residential use. To minimise any loss of development potential, a higher allotment yield could be offered over the balance of the development site to offset the use of the larger lots incorporating the buffer area.

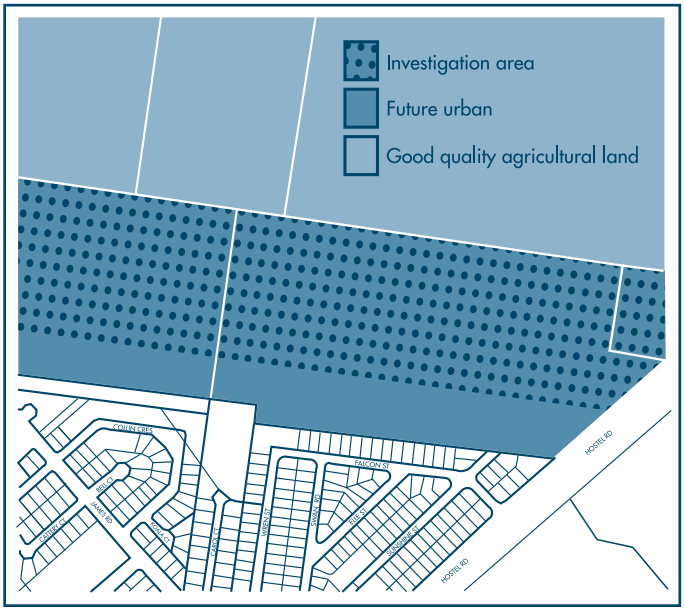


Figure 3. Strategic plan map

2.21 Designing and providing an adequate buffer as part of each residential allotment should enhance the prospect of the buffer areas being effective and well managed.

Temporary Buffers

2.22 In areas experiencing high levels of urban growth, relatively large areas of land might need to be designated for urban development. Situations will arise where good quality agricultural land is necessarily designated for development, but that development may be some years away. In such cases, consideration should be given to the need for temporary buffers at particular development stages to protect continuing farm operations until that farmland is developed.

2.23 Strategic plans or another part of the planning scheme should identify where the need for such buffer areas should be considered. Normally, the temporary buffer area should be incorporated in the future subdivision design, and planning schemes should include such a requirement. However, as the need for a buffer area is only short term, it need not be designed as a permanent feature, unless that feature has a desired role in the urban area (e.g. public open space or large residential allotments as described in 2.20).

2.24 Alternatively, land in the next development stage could still be farmed until required for development, but a buffer area incorporated into the farm management. This approach can only be required when the development approval includes the farmland concerned.

2.25 Depending on the degree of conflict and the lifespan of the buffer area, such temporary buffer areas may be considered unnecessary by council. Temporary buffer areas should be subject to the same design criteria as permanent buffer areas to ensure effectiveness at reducing conflict.

Development Assessment Provisions

2.26 Planning schemes should contain development assessment provisions to support the land use strategy and policies. Such provisions should be designed to achieve the appropriate protection of good quality agricultural land and reduce the potential for conflict between agricultural and residential land uses.

2.27 Development assessment provisions should preferably be performance based[5]. Such provisions focus on achieving specific outcomes, but allow flexibility in the means of achieving these outcomes rather than relying only on prescriptive requirements. Performance-based provisions can therefore ensure that agricultural impacts on adjoining residential and other urban uses are minimised, but allow for differing approaches and responsiveness to local circumstances. Examples of such provisions are provided in Section 3.

2.28 For local governments without a planning scheme, a policy[6] should be prepared to detail the mechanisms required when land use and subdivision approvals are being assessed in close proximity to agricultural land.

Appropriate Development

2.29 Minimising the potential for land use conflict can be achieved by limiting those uses regarded as inappropriate in areas of good quality agricultural land and immediately adjoining areas. The planning scheme should therefore aim to limit development in such areas to agricultural uses and other uses required to support agricultural activities. Such uses may include saleyards, grain drying facilities, animal husbandry services, storage for fresh produce, custom machinery operators.

2.30 In buffer areas between farmland and urban development, the planning scheme should aim to limit development to uses that do not detract from the effective operation of the buffer area. Such uses should therefore be compatible with the adjoining agricultural areas and adjacent residential development.

2.31 Examples of compatible uses (depending on the agricultural uses) include farm forestry, plant nurseries, horse trails, walking/cycling tracks, sport fields or other recreational activities. However, if the buffer area is created primarily to reduce conflict from agricultural chemical spray drift, some of these uses may not be compatible. In certain cases of land use conflict, it may be appropriate that minor loss of amenity is tolerated if the intrusion occurs on an infrequent basis without associated health risks.

2.32 In urban areas, the close proximity of any agricultural land should be a major consideration when deciding upon the type and design of development, including the need for buffer areas.

---

[5] Such an approach involves clearly stated objectives and offers a choice of following prescribed development standards ('acceptable solutions'), or varying those standards in accordance with the objectives and performance criteria:
Objectives: describe the preferred outcomes for development and provide the opportunity for a variety of innovative solutions
Performance Criteria: the means of achieving the objectives—what is to be achieved rather than how this should be done
Acceptable solutions: set out some ways that guarantee the objectives can be met to the desired standards.

[6] Local planning policies under the *Local Government (Planning & Environment) Act 1990* or planning scheme policies under the Integrated Planning Act.

Subdivision of Land

2.33 SPP 1/92 requires local government to give due consideration to the protection of good quality agricultural land when assessing applications for subdivision.

Residential or Rural Residential Areas

2.34 Where residential areas have to abut farmland, adequate separation can be achieved through subdivision design *(see 2.20 and 2.21).*

2.35 If the required buffer area is incorporated in large residential allotments, the buffer portion of the lot should be suitably designed and protected through conditions of development approval. These include requiring the provision and maintenance of planted areas in the buffer area, defining building envelopes for the location of houses outside the buffer area, or applying vegetation protection controls. The larger residential lots could be designed in such a manner as to allow redevelopment should the buffer area become redundant.

2.36 If buffer areas are proposed as one component of the public open space contribution, the issues set out in 2.14 above should be considered.

2.37 The ownership and maintenance of buffer areas are discussed in Section 4.

Single Residential Allotments

2.38 The creation of residential allotments in productive rural areas often fragments farmland and may lead to land use conflict, particularly when the occupants of the new dwelling have no direct connection with the surrounding agricultural activities. Where possible therefore, single residential allotments (such as 'concessional lots' or 'family excisions') should not be located on or adjacent to good quality agricultural land.

2.39 Local governments are encouraged to review and amend any subdivision provisions that permit residential allotments in rural areas to ensure that appropriate buffer areas are required adjacent to good quality agricultural land.

Conditions of Approval

2.40 Conditions should be set by local governments according to the relevant requirements of the planning legislation to ensure that on going maintenance and effectiveness of the buffer areas are binding upon successors in title.

3. Conflict assessment and buffer area design

3.1 Adequate consideration of possible conflict is necessary during development assessment. Development proponents should be required to assess the potential for land use conflict in areas of investigation *(see 2.13)*, or in proximity to good quality agricultural land. This should be done regardless of whether or not the good quality agricultural land is being utilised for agriculture at the time of an application.

3.2 Councils may require reports from suitably qualified consultants to address each element of conflict and accompany an application where:

- the proposed development is within the area of investigation; or
- the planning scheme has not resolved or is silent on the issue of land use conflict; or
- the proposed development is contrary to the planning scheme.

3.3 In investigating the need for appropriate buffer areas, the following steps should be taken:

- Determine the sustainable agricultural land use with the potential of causing most problems for adjacent residential uses and which is reasonably likely to occur on the subject land.
- Identify the elements that may cause conflict and the extent of the conflict. The elements should be quantified, where possible, in terms of frequency and duration of activities to determine the element's impacts.
- Explain how the proponent intends to address each element to achieve acceptable outcomes in terms of residential area design, size of lots, separation widths, tree planting, acoustic barriers etc.
- Propose the means by which the proposed measures will be monitored and maintained. This should include responsibility for implementing and maintaining specific features of the buffer areas to ensure continued effectiveness.

3.4 When assessing development applications, local governments will need to consider the information submitted, and ensure that the mechanisms proposed to ameliorate land use conflict address all elements. The mechanisms must be flexible enough to accommodate possible changes in agricultural practices on the adjacent land and be able to be implemented through the planning approval process. DNR is available to assist local governments in determining likely agricultural land uses.

3.5 The following provisions are provided for guidance in development assessment and for adoption by local government. Solutions other than those described may be acceptable to councils to meet the performance criteria.

Element: Agricultural chemical spray drift

Overview

3.6 The off-target movement of agricultural chemicals can be a cause for concern to residents in proximity to farming areas. These concerns are largely based on fears of exposure to agricultural chemicals but also due to detection of odours associated with the chemical *(see Appendix 5)*. It should be noted that the guidelines treat chemical spray drift and odour as separate elements for the design of buffer areas *(see section 3.15–3.20)*.

3.7 A Federal Government working group has conducted a review of agricultural chemical spray drift (CSIRO 1993). It concluded that 'there is insufficient knowledge to settle on a single distance for a buffer zone and that evidence indicates that buffer zones need to be chemical/formulation specific, based on supporting data.'

Available information

3.8 Studies at Emerald in 1990–91 concluded that the estimated average seasonal exposure for an adult or child of the five aerially applied insecticides detected did not exceed 0.2% of the World Health Organisation Acceptable Daily Intake. These studies did not measure the distance of measurement points from agricultural areas, but generally were in excess of 300 m from areas of chemical applications. However the perception of risk in the community associated with chemical spray drift persists.

3.9 Research and subsequent modelling has indicated negligible chemical drift at a range 300 m downwind from the release point of a chemical spray application (Spillman 1988). This research suggests a 300 m separation distance downwind of agricultural spraying is an acceptable minimum distance for adoption. It should be noted that the perception of 'negligible drift' may be influenced by the toxicity of the chemicals involved and may pose an unacceptable risk to some members of the community.

Other research and field trials have shown vegetated buffers are effective in capturing up to 80% of pesticide spray drift from an application upwind of a single row of trees (Harden 1992). Several Queensland councils now require vegetated buffers as a condition of development approval at the interface between agricultural and residential land use. Specific design criteria for vegetated buffer elements are presented in Appendix 2. Revegetation or thinning of existing stands of vegetation to the specifications in Appendix 2 may also be appropriate.

Buffer Area Width

3.10 From a planning perspective, it is not considered practical to base buffer area dimensions on individual chemicals or formulations. Based on the available research on chemical spray drift, the planning guidelines have adopted a minimum width of 300 m where open ground conditions apply; and a minimum width of 40 m where a vegetated buffer element can be satisfactorily implemented and maintained. These dimensions may vary according to local topographical or climatic conditions or as further knowledge is obtained.

3.11 Farm management can influence the effectiveness of buffer areas. The advice provided in the planning guidelines in relation to agricultural chemical use assumes farmers and their employees and contractors carry out their activities in accordance with reasonable and practicable measures as set out in the Environmental Code of Practice for Agriculture, and the *Agricultural Chemicals Distribution and Control Act 1966*. The Advisory Standard For the Storage and Use of Chemicals at Rural Workplaces provides additional guidance to persons with obligations under the *Workplace Health and Safety Act 1995*. It should be noted that currently there is no acceptable ambient air standard for agricultural chemical spray drift.

3.12 It should be noted that the recommended vegetated buffer (which includes multiple rows of trees) will not capture 100% of the chemical spray drift, but may reduce spray drift to less than 1% at a sensitive receptor when managed in terms of porosity, litter build up and noxious weed control to ensure effectiveness.

3.13 Factors affecting buffer area requirements for reducing agricultural chemical spray drift include:

- chemical composition/formulation e.g. toxicity, evaporation rates;
- method of application/release height e.g. aerial application, airblast mister etc.;
- spray technology e.g. nozzle type, droplet size;
- frequency of application;
- ability of the vegetation to capture spray droplets;
- target structure;
- weather conditions e.g. wind speed and direction, air turbulence, inversions;
- microclimate;
- geographical conditions and barriers e.g. topography.

3.14 Further information and advice on the use and effects of agricultural chemicals is available from:

Department of Primary Industries Agricultural Standards
Ph: 07 3239 3936

Department of Training and Industrial Relations
Division of Workplace Health and Safety
(Rural Officers) Ph: 1800 177 717

Queensland Farmers Federation (Workplace Health and Safety Officers) Ph: 1800 818 006

Department of Environment district or regional offices

Element: Agricultural Chemical Spray Drift

Objective: To locate new residential areas so that the impact of agricultural chemical spray drift on amenity and health is avoided and complaints from residents regarding the use of agricultural chemicals is unlikely.

Performance Criteria

Residential development to be located or incorporate measures such that chemical spray drift does not adversely affect community public health and safety.

Acceptable Solutions

(i) The separation distance between a sensitive receptor and agricultural land is a minimum of 300 m.

or:

(ii) A vegetated buffer designed by a consultant acceptable to council and incorporating the criteria shown in Appendix 2 is located between the sensitive receptor and adjacent agricultural land. The vegetated buffer should:

- be provided with a suitable watering system;
- include access strips on either side which are kept clear of vegetation and other flammable materials;
- be of a height, density and width (40 m min) acceptable to council prior to the development of residential areas within 300 m of the agricultural land.

or

(iii) Other measures which meet the performance criteria and which are acceptable to council.

Element: Odour

Overview

3.15 Odour in rural areas can arise from use of agricultural chemical sprays, fertilisers (inorganic and organic), effluent disposal and intensive livestock (e.g. feedlots, piggeries and poultry farms) and composting plants. Such detrimental odours can impact on residential amenity and have the potential to affect public health.

3.16 Odour is often a major factor in many complaints about off-site chemical spray drift where there is sometimes no objective evidence of toxic exposure. Some agricultural chemicals contain 'markers' (strong odours) to allow easy identification and these markers or mixing agents are sometimes detected at a distance from the target area and cause concern even though in some circumstances extremely low levels of the active ingredients may be present. Residents' association of the odour with the chemical is sufficient to raise fears of exposure *(see Appendix 5)*.

3.17 Factors affecting complaints from odour are influenced by the frequency, intensity, duration and offensiveness of the odour. An objectionable odour may be tolerated if it occurs infrequently at a high intensity, however a similar odour may not be tolerated at lower levels if it persists for a longer duration.

Available information

3.18 Odour can be emitted from a variety of sources and dispersed by the atmosphere. Ground level concentrations of odour have been reported as being inversely related to wind speed and atmospheric conditions, i.e. the lower the wind speed and the more stable the conditions, the higher the concentration. The subjective nature of conflict resulting from exposure to odour makes the determination of design goals difficult (Holmes et al. 1996).

3.19 Industry-specific guidelines have been developed to determine suitable separation distances to deal with odour for feedlots, piggeries and poultry farms. Factors influencing the separation distance required include the number of livestock, site factors and levels of management. The siting of such industry and other development should be carefully considered in areas with poor dispersion conditions e.g. valleys. The buffer area between a proposed residential development and existing or approved intensive livestock facilities or composting facilities should conform with standards specified in the relevant industry specific guidelines. The separation distance will be determined by consideration of the licence conditions applying to individual facilities set by DPI, DoE and/or local government.

3.20 While detection of odours may be instantaneous, often several hours are needed to confirm the presence and source of such odours. Odours from intermittent sources, such as chemical applications in rural areas, may only reach nuisance levels when exposure at a sensitive receptor exceeds a duration threshold. This is supported by research conducted by Holmes et al. (1996) who nominate 1% of time as an appropriate threshold.

Odour Duration Threshold

3.21 For the purpose of the planning guidelines and the design of effective buffer areas, the following odour duration threshold has been adopted:

- Odour from intermittent agricultural activities (e.g. fertiliser spreading, effluent disposal or chemical spraying) should not exceed nuisance levels outside any affected sensitive receptor for greater than 1% of the time (or 88 hrs/yr).

3.22 The duration threshold allows for some detectable odour levels provided they occur for less than 88 hrs/year. For the purposes of the planning guidelines, the following formula can be used to determine the potential time of odour impact upon a sensitive receptor:

t = n X o

where:

t = potential hours of nuisance level odour per year

n = number of cropped hectares within 500 m of the receptor (40 ha max)

o = hours of operation per hectare per year of odour producing activity (a....z) (see tables in Appendix 4)

If the time 't' is greater than 88 hrs/year then the design goal has been exceeded and a buffer area may be required.

Buffer Area Width

3.23 Information on odours from poultry farms (DoE, 1994) indicate that 500 m would be an acceptable separation distance for odour mitigation should the duration threshold be exceeded.

3.24 Applicants who wish to propose alternative odour reduction measures should consider the following factors that influence odour dispersion:

- atmospheric stability wind speed and direction;
- terrain/topography and drainage flows;
- vegetation density;
- impact location;
- odour source, e.g. composting, chemical formulation, effluent disposal etc.

3.25 Information on odours associated with some agricultural chemicals is provided in Appendix 5. Additional advice should be sought from agricultural chemical suppliers, AVCARE and other sources to determine the nature and odours likely to be encountered in particular instances.

Element: Odour from agricultural activities

Objective: To locate new residential areas so that the impact of odour generated by agricultural activities on residential areas is minimised.

Performance Criteria	***Acceptable Solutions***
Residential development to be located or incorporate measures to minimise the impact of odour in excess of the duration threshold generated by intermittent agricultural activities at dwellings within the development.	(i) The separation distance between a sensitive receptor and agricultural land is a minimum of 500 m. or: (ii) A buffer area design based on a report consistent with the draft EPP (Air) from a qualified consultant acceptable to council detailing relevant factors and verifying that odour design goals in the EPP (Air) will be met at sensitive receptors within the development. or: (iii) Other measures which meet the performance criteria and which are acceptable to council.

Element: Noise

Overview

3.26 There are four types of noise associated with agricultural activity which may lead to land use conflict. These are the noises associated with intensive livestock facilities, aircraft activities, constant or long-term noise, (e.g. pumps or refrigeration plants), and intermittent noise from tractors and other machinery.

3.27 The draft EPP (Noise) and associated guidelines allows agricultural practices to generate noise provided the activity is in accordance with reasonable and practicable industry measures as described in the Environmental Code of Practice for Agriculture and other industry specific guidelines. Under the code, it is not a breach of the general environmental duty of care if noise is generated in circumstances where it can be shown that the activity is not frequent or that there are no practicable alternatives.

3.28 The Code of Practice and other industry specific guidelines, further advises that rural industry practices should seek to avoid causing excessive noise at night-time (10 p.m.–6 a.m.) which may affect residential areas. Modification of farm machinery and management practices may reduce noise levels, but there will be instances when the generation of noise due to agricultural practices is unavoidable and may result in conflicts between land uses. Planning may also reduce conflict arising from noise by requiring appropriate buffer areas.

3.29 Many noisy activities associated with agriculture are intermittent and may only affect a particular adjacent residence for a few hours several times a year. For example, small cropping on a two crop per year basis for potatoes generally requires approximately 25 hours of machinery activity per hectare per year; sugar cane production requires less than 5 hours machinery activity per hectare per year.

Noise Level and Duration Thresholds

3.30 For the purpose of the planning guidelines the following noise levels and cumulative time thresholds have been adopted to determine whether noise is likely to be excessive outside a noise-sensitive receptor. The noise source is classed as intermittent if the specified noise level in the following table is exceeded for a cumulative total of 10 hours per year. If this cumulative time threshold is not exceeded, the noise source is considered not sufficient to require a buffer area. The noise source is classed as long term if the specified noise level in the following table is exceeded for a cumulative total of 50 hours per year. Furthermore, stricter design goals are applied to night time operations between 10 p.m. and 6 a.m.

Table 1. Noise design goals

	Intermittent >10 hrs/yr	Long term >50 hrs/yr
Day-time 6 a.m.–10 p.m.	75 dB(A) ($L_{Amax,T}$)	60 dB(A) ($L_{Amax,T}$)
Night-time 10 p.m.–6 a.m.	55 dB(A) ($L_{Amax,T}$)	45 dB(A) ($L_{Amax,T}$)

3.31 The following formulae outline the steps for calculating cumulative hours of noise which exceed the design goals per year from agricultural activities. The formula for deriving hours per year of excessive noise from intermittent day-time activities is as follows:

$x = \sum\{(c \times f \times h) \times (\pi \times d^2/2)\}$

where:

x = hours/year when noise exceeds 75 dB(A) $(L_{Amax,T})$[7]

c = crops per year

f = frequency of activity (a…z) per crop

h = hours of noise per hectare for activity (a....z)

$d = 10^{\{(N-60.47)/16.6\}}$ where

N = noise measured as $L_{Amax,T}$ at 7.5 m for activity (a....z)

NB: For long-term day-time activity, use

$d = 10^{\{(N-45.47)/16.6\}}$

The formula for deriving hours per year of excessive noise from intermittent night-time activities is as follows:

$y = \sum (c \times f \times n)$

where:

y = hours/yr when noise exceeds 55 dB (A) $(L_{Amax,T})$[7]

c = crops per year

f = frequency of night-time activity (a…z) per crop

n = hours of activity per night (prior to 6am) when noise levels exceed 55dB(A) $(L_{Amax,T})$

[7] $L_{Amax,T}$ is the average maximum A-weighted sound pressure level in a specified time interval or event.

Buffer Area Width

3.32 In cases where the duration thresholds are likely to be exceeded, the planning guidelines use the noise design goals in Table 1 for determining effective separation distances. Minimum separation distances have been determined on the basis of noise attenuation rates of 5 dB(A) for each doubling of distance from the noise source. This attenuation rate assumes open ground conditions. The existence of natural barriers, broken topography or other features would increase attenuation and affect the separation distance required. A standard noise source of 90 dB(A)($L_{Amax,T}$), measured at 7.5 m from the source has been used. For example a day-time noise level attenuates to 75 dB(A) ($L_{Amax,T}$) by a distance of 60 m from the source. A night-time noise level attenuates to 55 dB(A) ($L_{Amax,T}$) by a distance of 1000 m from the source. These distances have been adopted in the planning guidelines as the minimum buffer width for intermittent day and night-time activities that occur more than 10 hrs/yr but less than 50 hrs/yr.

3.33 If a noise source operating at 90 dB(A)($L_{Amax,T}$) were to exceed the noise design goals for >50 hrs/yr, a distance of 500 m to attenuate the noise level to 60 dB(A) ($L_{Amax,T}$) for day-time noise, would be required. Night-time noise at this level may exceed 45 dB(A) ($L_{Amax,T}$) up to 4 km away. Such noise occurrence between 10 p.m.–6 a.m. is likely to be considered intrusive and therefore unreasonable. In circumstances where there are existing long term noise sources close to a proposed residential development, the proponent may consider funding measures such as machinery enclosures, mufflers, noise barriers and /or house design elements such as double glazing to complement subdivision layout and design measures to meet the performance criteria.

3.34 Appendixes 3 and 4 provide technical data on noise issues and worked examples of using these formulae to determine whether noise duration thresholds have been exceeded.

3.35 Applicants who wish to propose alternative noise reduction measures should determine noise levels at specific representative sites and demonstrate that the noise design goals for residential areas as set out in the draft EPP (Noise) and associated guidelines are not exceeded.

3.36 Factors affecting noise from agricultural activities which should be considered in designing buffer areas include:

- type of engine (diesel or petrol; 2- or 4-stroke);
- number of cylinders;
- cooling system (air or liquid);
- load;
- timing, frequency and duration of operations;
- geographical conditions and barriers e.g. topography and inversions;
- weather conditions e.g. wind speed and direction;
- typical industry machinery and practices.

3.37 It should be noted that while noise barriers can reduce noise by 10–16 dB(A) they may prove costly and have long term maintenance implications. Earth mounds to control noise must be carefully engineered to ensure minimum impacts on natural drainage patterns or the effectiveness of vegetated buffers. Noise attenuation devices may reduce the minimum separation distance for 90 dB(A) ($L_{Amax,T}$) intermittent day-time activities from 60 m to 15 m and for intermittent night-time activities from 1000 m to 250 m using a 10 dB(A) reduction as a guide.

Aircraft Noise

3.38 In areas of aerial spraying, the separation distance between the development and agricultural land must be a minimum of 100 m to comply with Air Navigation Order 20.21. This distance is based on operational safety and noise considerations.

Element: Noise from agricultural activities

Objective: To locate new residential areas so that noise from agricultural activities is attenuated to safeguard amenity in noise sensitive places.

Performance Criteria	*Acceptable Solutions*
a) Residential development to be located or incorporate designs to minimise the impact of noise in excess of the duration threshold from **day-time** agricultural activities at dwelling within the development.	a) (i) The separation distance between the sensitive receptor and agricultural land is a minimum of 60 m for intermittent noise and 500 m for long-term noise. or: (ii) A buffer width and design based on a report from a qualified acoustic consultant acceptable to council detailing relevant factors and verifying that noise design goals consistent with the draft EPP (Noise) will be met at sensitive receptors within the development. or: (iii) Other measures which meet the performance criteria and which are acceptable to council.
b) Residential development to be located or incorporate designs to minimise the impact of noise in excess of the duration threshold from **night-time** agricultural activities at dwellings within the development.	b) (i) The separation distance between the sensitive receptor and agricultural land is a minimum of 1000 m. or: (ii) A buffer width and design based on a report from a qualified acoustic consultant acceptable to council detailing relevant factors and verifying that noise design goals consistent with the draft EPP (Noise) will be met at sensitive receptors within the development. or: (iii) Other measures which meet the performance criteria and which are acceptable to council.
c) In areas of **aerial** agricultural activity, development should be located to minimise noise from aircraft.	c) The separation distance between the sensitive receptor and agricultural land to be a minimum of 100 m to comply with Air Navigation Order 20.21 which prohibits air craft flying closer than 100 m to a private dwelling.

Element: Dust, Smoke and Ash

Overview

3.39 Some agricultural activities including cultivation prior to planting, tractor and transport movements, cane fires and harvesting can generate dust, smoke and ash.

3.40 Contemporary farming practices incorporate measures to minimise loss of soil, but at times it is necessary to leave land unplanted for extended periods, which can lead to the movement of dust. Local conditions, including wind strength and direction, rainfall, humidity and ambient temperatures, soil type, vegetative cover and type of on site activity determine the extent of the nuisance.

3.41 The Environmental Audit of the Queensland Cane Growing Industry identifies cane fires as a source of smoke and ash nuisance for residents adjacent to farms but the continuing adoption of green cane harvesting will help to reduce the impacts from cane fires.

Buffer Area Design

3.42 In the absence of quantitative research data, the planning guidelines recommend a separation distance of 150 m where dust, smoke or ash from agricultural activities have been identified as a potential nuisance. In most cases, a vegetated buffer designed to capture chemical spray drift *(see Appendix 2)* will also be effective in reducing conflict resulting from dust, smoke and ash.

Element: Dust, smoke and ash from agricultural activities

Objective: To locate new residential areas so that the impact of dust, smoke and ash generated by agricultural activities on residential areas is minimised.

Performance Criteria

Residential development to be located or incorporate measures to minimise the impact of dust, smoke and ash generated by agricultural activities.

Acceptable Solutions

(i) The separation distance between the sensitive receptor and agricultural land is a minimum of 150 m.

or:

(ii) A vegetated buffer designed by a consultant acceptable to council is located between the sensitive receptor and adjacent agricultural land. The vegetated buffer should:

- be provided with a suitable watering system;
- include access strips on either side which are kept clear of vegetation and other flammable materials;
- be of a height, density and width (40 metres min) acceptable to council prior to the development of residential areas within 150 m of the agricultural land.

or:

(iii) • Other measures which meet the performance criteria and which are acceptable to council.

Element: Sediment and stormwater run-off

Overview

3.43 Residential development affects land surface characteristics and the hydrological balance, with the impacts often occurring on farmland located lower in the landscape. The increase of impermeable surfaces and changes to drainage patterns can accelerate soil erosion, siltation and sedimentation; and increase the risk of flooding. Techniques to alleviate conflict due to downstream effects of residential development include suitable erosion, sediment and stormwater control during the construction and operational stages of a development.

3.44 Soil erosion can be a major problem due to the highly dispersive and unstable nature of many soils in Queensland. Proper subdivision and infrastructure design to minimise soil movement and silt loads entering drainage lines should be implemented. Temporary sediment control works should be constructed on sloping ground or near drainage lines during construction.

Buffer Area Design

3.45 Options available for council can include provisions for an erosion control plan for the construction and operation phases of the development, and management of stormwater run-off. Buffer areas can also be designed to utilise techniques such as water spreading and water diversion to reduce conflicts from stormwater run-off between residential development and adjacent farmland. Ongoing maintenance and enforcement must be identified and incorporated into conditions of approval.

Element: Sediment and stormwater run-off from residential development

Objective: To design new residential areas so that the impact of run-off and sediment from residential development areas on agricultural land is minimised.

Performance Criteria

Residential development to be located or incorporate measures to minimise the impact of sediment and storm water run-off on agricultural enterprises.

Acceptable Solutions

(i) Residential development proposals to include the following:

- an erosion control plan for the construction and operation phases of the development which meets the standards set out in the Guidelines for Soils Erosion and Sediment Control for Construction Sites (1996);
- stormwater run-off from all hard surfaces (including roads, roofs, driveways etc.) to be carried to stable waterways;
- measures such as water spreading and water diversion implemented within the buffer area.

or:

(ii) Other measures which meet the performance criteria and which are acceptable to council.

Summary of Buffer Area Design Criteria

3.47 The design and adoption of a buffer area for a particular development proposal will reflect an analysis of all the elements likely to cause conflict and the final buffer area and component elements should reflect the most intrusive element. Table 2 gives an overall summary of each element's duration threshold and design criteria for acceptable solutions. See also Appendix 6 for examples of effective buffer areas.

Table 2. Summary of buffer area design criteria

	Duration threshold	Min. default distance (m)	Min. design distance with buffer element(m)
Chemical spray drift	None	300	40
Intermittent odour	>88 hrs/yr	500	500*
Intermittent noise**	>10 hrs/yr<50 hrs/yr	60 (d) 1000 (n)	15 (d) 250 (n)
Long term noise **	>50 hrs/yr	500 (d) 1000# (n)	120 (d) 1000# (n)
Dust, smoke and ash	None	150	40

* Minimum design distance for an odour buffer area may be reduced on consideration of site factors and nature of odour

** Based on source noise level of 90 dB(A) ($L_{Amax,T}$) at 7.5 m

d = Noise occurring in day-time (6 a.m.–10 p.m.)

n = Noise occurring in night-time (10 p.m.–6 a.m.)

= Long-term noise occurring between 10 p.m.–6 a.m. is likely to be considered intrusive and therefore unreasonable. Such noise sources may be ameliorated by a combination of enclosing or muffling the source of the noise, by provision of a buffer area and attention to residential design.

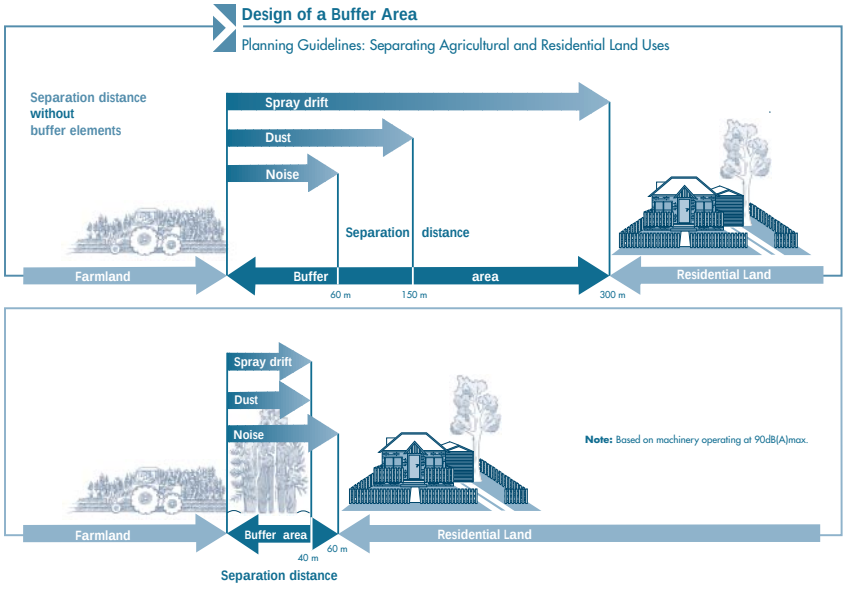


Figure 4. Design of a buffer area

4. Ownership and Maintenance of Buffer Areas

Ownership

4.1 Ownership and tenure may vary depending on the circumstances, and can be mixed over the area. For example, council parks, State land (e.g. roads), leasehold land, freehold land and easements may combine to form a continuous buffer area. An area designated as a 'buffer area' does not need to change tenure. However it should be managed in ways that reduce conflict between land uses.

Private land—single tenure

4.2 Private land refers to freehold and leasehold land. A buffer area on privately-owned land can be created through:

- planning controls such as building envelopes and other reasonable and relevant conditions attached to a development approval;
- Vegetation Protection Orders or other tree clearing controls to protect vegetation where existing vegetation is contributing to an effective buffer area;
- voluntary provision of a buffer area by the rural landholder when initiating an intensification of rural land use.

4.3 The owner will retain the rights to use the land forming the buffer area, subject to the controls and agreements put in place at the time of creation of the buffer area. Vegetation protection orders may need to be revoked if the separation area becomes redundant.

4.4 Where the buffer area is provided voluntarily by the rural land holder on rural land, it should remain in private ownership and may support productive rural uses which will not affect residential amenity, for example grazed pasture or farm forestry. Where the buffer area consists of natural vegetation with conservation values, the landholder may enter a voluntary agreement under the *Nature Conservation Act 1992* to create a nature refuge.

Private land—joint tenure

4.5 Common property areas of land which are often included as part of a community title form of development, may be used as a buffer area where the location is suitable. The land use and management must be consistent with the reduction of land use conflict.

4.6 The common property to be incorporated as the buffer area would be owned by the members of the joint tenure arrangement, usually the body corporate.

Public land

4.7 Buffer areas in public ownership will usually be under the control of local governments but may also include land under the control of State instrumentalities such as the Main Roads Department, Transport Department or Department of Natural Resources. Depending on the circumstances, parks, public open space, road and drainage reserves may be used as buffer areas. The permitted uses of the area may need to be varied if it is to function as a buffer area.

Maintenance

4.8 As a general rule, buffer areas should be properly designed to avoid special maintenance requirements whilst achieving their maximum desired effect of separating conflicting land uses. However, it will be necessary to ensure ongoing maintenance of buffer areas, including replanting, thinning, management for fire protection, herbicide damage, noxious weeds, feral animals, litter build-up etc. so that the buffer areas continue to be effective in reducing conflict. Vegetated buffers may require ongoing attention to maintain a porosity of 0.5 with suitable lower and upper storey vegetation to ensure their effectiveness in capturing spray drift.

4.9 Vegetated buffers may serve as components of wildlife corridors and improve opportunities for conserving wildlife habitat. Expert advice on effective wildlife corridors should be obtained from the Department of Environment. Where natural vegetation is used as a buffer element, management should meet objectives of both nature conservation and buffer performance. Where nature conservation objectives preclude thinning to achieve porosity specifications, an increased buffer width may be necessary.

4.10 To achieve effective management, clear responsibilities for maintenance should be determined before the buffer areas are implemented.

Responsibilities for maintenance will be largely determined by ownership. If in public ownership, local government and other agencies would be responsible for overseeing maintenance in conjunction with their usual town planning/health inspection and parks/gardens operations. In general, maintenance of buffer areas in private ownership will be the responsibility of the proprietor, as controlled by development conditions, local laws, or environmental protection agreements. The recommended mechanism is through planning conditions imposed on a development approval. These conditions attach to the land and are binding on successors in title. The necessary controls to ensure this maintenance is carried out must be in place at the time the buffer area is created.

4.11 Under joint tenure arrangements, the body corporate is responsible for the maintenance of the common area which would include the roads and any dams or buildings which exist on the common area. Control of fire, noxious weeds and feral animals should be the responsibility of the body corporate, as outlined in the body corporate management plan. This would need to be presented to the local government for approval at the time of the development application.

5. Dealing with Existing Conflicts

5.1 It should be noted that while this section does not deal with planning issues, it has been included for the benefit of councils and their local communities.

5.2 Where the opportunity to implement buffer areas is limited due to existing patterns of development, other options to reduce conflict can be explored. Mechanisms should aim to minimise conflict while not restricting existing legitimate farming operations.

Mediation and Negotiation

5.3 Many disputes arise as a result of a lack of information and understanding of why certain practices are carried out, or their effects on nearby residents. Councils should bring the conflicting parties together to discuss their concerns and focus on finding solutions. Often parties in dispute can reach agreement amongst themselves when given the opportunity.

5.4 The Department of Justice provides an alternative dispute resolution mechanism for the resolution of community disputes. It is a free, confidential mediation service that can be accessed from anywhere within the State via a toll free number. The department handles a wide range of disputes and issues. Disputes handled to date have involved neighbours on issues such as trees, boundaries, children and noise, and public issues disputes involving government departments, residents groups, conservation groups, industry representatives etc. The use of this mediation service does not limit an individual's right to use other legal avenues. This service can be reached by telephoning 1800 017 288.

5.5 The National Disputes Centre also offers a mediation service for conflict resolution, and can be reached by telephoning 029 223 1044.

Source Controls and Agricultural Practices

5.6 With the implementation of the EP Act, all persons now have a general duty of care to protect the environment. Rural producers are required to adopt reasonable and practicable measures to avoid environmental harm. These measures are set out in the Environmental Code of Practice for Agriculture. This may mean that some primary producers may need to modify some current practices to comply with the code.

5.7 Local governments will be responsible for administering sections of the EP Act. In some situations, councils may have no alternative other than to impose appropriate source controls on offending activities. An example of this may be that a farmer needs to operate a stationary pump adjacent to residences, for extended periods. In this case a cover, mounding or muffler that reduces the noise emitted by the pump to EPP Noise Design Goals would be required. Farmers can modify their practices or voluntarily forego agricultural production adjacent to residential areas to reduce conflict. Residential land holders may also choose to voluntarily forego the use of land adjacent to agricultural land for a buffer area to reduce conflict.

Education

5.8 Persons intending to live in or adjacent to an agricultural production area need to be fully informed of the likely agricultural practices that may impact on their residential amenity before they settle in such an area.

5.9 Local governments and primary industry bodies can play a role in the education process. Councils can include a 'Notice to Intending Purchasers' *(see Figure 5)* when providing information to persons conducting conveyancing searches. Figure 5 provides an example of such a notice. This could be combined with media releases and other methods of disseminating information to inform people from non-agricultural backgrounds. Government departments can also assist. The Department of Primary Industries produces farmer publications (Farmnotes, Guidelines for producers etc.) that can aid in educating the public; and the Department of Natural Resources provides advice on sustainable land management practices.

(EXAMPLE ONLY)

NOTICE

TO PURCHASERS OF LAND IN RURAL AREAS IN (....) SHIRE

(....) Shire Council supports the right of persons in rural areas to carry out agricultural production using reasonable and practicable measures to avoid environmental harm. An Environmental Code of Practice for Agriculture has been prepared under the *Environmental Protection Act 1995* and provides guidance on reasonable and practicable measures.

Intending purchasers are advised that agricultural production practised in accordance with the Code of Practice may include some of the following activities and some activities may have implications for occupiers of adjacent land :

- Logging and milling of timber
- Dairies
- Intensive livestock production (feedlots, piggeries and poultry farms)
- Vegetation clearing
- Cultivation and harvesting
- Bushfire hazard reduction burning
- Construction of firebreaks
- Construction of dams, drains and contour banks
- Fencing
- Use of agricultural machinery (tractors, chainsaws, motor bikes etc.)
- Pumping and irrigation
- Pesticide spraying
- Aerial spraying
- Animal husbandry practices
- Droving livestock on roads
- Silage production
- Construction of access roads and tracks
- Slashing and mowing vegetation
- Planting of wood lots

Intending purchasers of land in rural areas may have difficulty with some of these activities or the impact of these activities when they are being carried out on land near their proposed purchase. If so, they should seek independent advice and consider their position.

This notice is not intended to affect the rights of individuals to take action under the common law or legislation (including the *Health Act 1937, Environmental Protection Act 1994, Agricultural Chemical Distribution Control Act 1966* or the *Work Place Health and Safety Act 1995).*

This notice is provided for information purposes only.

Figure 5. Sample notice to intending purchasers

6. Roles

Proponents/Consultants

- Submit planning applications to local government.
- Provide accurate information which addresses each element of conflict and submit, a residential design which minimises land use conflict.
- Determine the sustainable agricultural land use with the potential for causing most problems for adjacent residential uses and which is reasonably likely to occur adjacent to the subject land.
- Identify the elements that may cause conflict and the extent of the conflict. The elements should be quantified where possible in terms of frequency and duration of activities to determine the element's impacts.
- Explain how the proponent intends to address each element to achieve acceptable outcomes in terms of residential area design, size of lots, separation distances, tree planting acoustic barriers etc.
- Propose the means by which the proposed measures will be implemented, monitored and maintained to ensure continued effectiveness.

Local Government

- Prepare strategic plans indicating areas of good quality agricultural land, investigation areas (areas of potential conflict), policies for the protection of such areas; and the avoidance of land use conflict.
- Provide applicants with detailed information as set out in *Planning Guidelines: Separating Agricultural and Residential Land Uses.*
- Determine applications, based on independent advice if necessary, and set appropriate conditions.
- Supply site data from planning applications to DNR and/or DoE (if advice from these agencies is required).

Department of Natural Resources

- Provide advice to local government and comment on available broad-scale land resource information for strategic planning.
- Define what constitutes good quality agricultural land within a local government area.
- Assist consultants and local government staff in the interpretation of the elements of land use conflict in rural areas.
- Assist local governments in checking submitted information, if required, and ensure appropriate standards are met.
- Provide advice to DLGP relevant to the implementation of State Planning Policy 1/92.

Department of Local Government and Planning

- Review planning schemes and amendments (rezonings) submitted by local governments.
- Provide policy guidance to local governments.

Department of Environment

- Set standards and provide advice on noise and air quality under the *Environmental Protection Act 1994.*
- Assist local governments in checking submitted information, if required, and ensure appropriate standards are met.
- Provide advice to DLGP and/or DNR relevant to the implementation of State Planning Policy 1/92.

Department of Primary Industries

- Assist local governments in checking submitted information, if required, and ensure appropriate standards are met.
- Provide relevant information on licence conditions for approved intensive animal production facilities to local government.
- Provide advice to DLGP and/or DNR relevant to the implementation of State Planning Policy 1/92.
- Provide advice on the most suitable agricultural land use for an area

Agricultural Producers

- Carry out agricultural practices in accordance with the Environmental Code of Practice for Agriculture and relevant industry guidelines.

Residents

- Understand agricultural workplace practices.
- Maintain buffer areas and buffer elements located on private land.

References

Community Exposure to Insecticides in Emerald during the 1990-91 Cotton Growing Season 1991, Queensland Health, Brisbane.

DPI/DHLGP 1993, *Planning Guidelines: The Identification of Good Quality Agricultural Land*, Department of Housing, Local Government and Planning, Brisbane.

Dowling, D. 1991, 'Biological buffer zones offer many advantages', the *Australian Cottongrower* vol. 12, no. 3, pp. 8–10.

Draft Environmental Guidelines: Intensive Poultry Farms 1994, Department of Environment, Brisbane.

Draft Environmental Protection (Air) Policy 1997, Department of Environment, Brisbane.

Draft Environmental Protection (Noise) Policy 1997, Department of Environment, Brisbane.

Environmental Audit of the Queensland Canegrowing Industry 1996, Gutteridge Haskins and Davey Pty Ltd

Environmental Code of Practice for Agriculture 1997, Queensland Farmers Federation, Brisbane.

Guidelines for the Establishment and Operation of Cattle Feedlots 1989, Department of Primary Industries, Brisbane.

Guidelines for Poultry Farming in Queensland 1988, Department of Primary Industries, Brisbane.

Guidelines for Soil Erosion and Sediment Control for Construction Sites 1996, Institution of Engineers, Brisbane.

Harden, J. 1992, 'Innovations in Pesticide Application', paper presented to the International Plant Propagator's Society, Australian Regional Annual Conference, 1992.

Holmes, N. et al. 1996, 'Composting Facilities in the Hawkesbury Region: Review of Air Quality Issues'. *Composting in the Hawkesbury, Final Background Repor*t, Rust PPK, 1992.

Leviticus, L. & Morgan, D. 1993, *Nebraska and OECD Tractor Test Data for 1993,* Department of Biological Systems Engineering, University of Nebraska, Lincoln.

Principles for the safety assessment of food additives and contaminants in food 1987, Environmental Health Criteria 70, International Safety in Cooperation with the Joint FAO/WHO Expert Committee on Food Additives (JECFA), World Health Organisation, Geneva.

Review of Agricultural Chemical Spray Drift: Report for Public Discussion 1993, CSIRO, Melbourne.

Spillman, J. 1988, 'A Rapid Method of Calculating the Downwind Distributions from Aerial Atomisers'. *EPPD Bulletin* 13 (3): 425–431.

State Planning Policy 1/92: Development and Conservation of Agricultural land 1992, Queensland Government, Brisbane.

Trees and Shrubs 1991, Department of Primary Industries, Brisbane.

ACKNOWLEDGMENTS

The following individuals and organisations have provided invaluable assistance in the preparation of this document:

Members of the State Planning Policy 1/92 Reference Group

John Woods, Australian Cotton Foundation Ltd
Shauna Dewhurst, Queensland Fruit and Vegetable Growers
David Hecksher. Royal Australian Planning Institute
Mike Russel, Urban Development Institute of Australia
Robin Charters, Queensland Pork Producers' Organisation
Shane Gittens, Queensland Dairyfarmers' Organisation
Mark Everson, Canegrowers
Ross Dunn, Queensland Grain Growers' Council
Saleena Ham, Queensland Farmers' Federation
Ray Ison and Peter Shields, Consultants
Andrew Zuch and Steve Greenwood, Local Government Association of Queensland
Nicky Hungerford, Queensland Conservation Council

Department of Environment
Bob Thorne, Adrian Just, Richard Birt
Department of Natural Resources
Mick Capelin, Robert Fleming, Sue-Ellen Dear, Phillip Kohn, Howard Briggs, Melissa Whyte, Steve Flynn, Sue Pavasaris
Department of Local Government and Planning
Jeremy Harle, Amanda Raleigh, Tim Comino, Kathy Eyles
Department of Primary Industries
Michael Artlett, John Walthall, Nick Delaney, Garth Grainger, Jim Fletcher

For technical Enquiries concerning this publication contact the Principal Policy Officer (LandUse), Department of Natural Resources

Telephone (07) 3224 8392

APPENDIX 1: Existing controls

Issue	legislation/regulations	Guidelines/	Contact Codes of Practice
Agricultural Chemicals	• *Agricultural Chemicals Distribution and Control Act, 1966* • *Chemical Use (Agricultural and Veterinary) Act, 1988*	*Environmental Code of Practice for Agriculture*	Department of Primary Industries*
Aircraft	Civil Aviation Order 20.21	Civil Aviation Authority	
Air Quality	• *Environmental Protection Act, 1994* • EPP (Air)	*Environmental Code of Practice for Agriculture*	Department of Environment**
Environmental Health	*Health Act*		Department of Health
Feedlots	*Stock Act, 1989*	*Guidelines for the Establishment and Operation of Cattle Feedlots*	Department of Primary Industries*
Fire	*Qld Fire Services Act, 1990*	Qld Fire Service	
Noise	• *Environmental Protection Act, 1994* • EPP (Noise)	*Environmental Code of Practice for Agriculture*	• Department of Environment** • Local governments
Piggeries		*Draft Environmental Code of Practice for Piggeries in Qld*	• QPPO, Department of Primary Industries*
Poultry Farms		*Guidelines for Poultry Farming in Queensland*	Department of Primary Industries*
Water Quality	• *Environmental Protection Act, 1994* • EPP (Water)	*Environmental Code of Practice for Agriculture*	• Department of Environment** • Local governments
Waterways	*Water Resources Act, 1989*	*Water Quality Council of Queensland Guidelines*	• Department of Natural Resources*** • Local governments
Work Practices	*Workplace Health and Safety Act, 1995*	Advisory standards for: • Storage and Use of Chemicals at Rural • Use of Rural Plant at a Rural Workplace	Department of Training and Industrial Relations

* Contact local offices of the Department of Primary Industries listed in local telephone directories.

** Contact district or regional offices of the Department of Environment listed in local telephone directories.

*** Contact district offices of the Department of Natural Resources listed in local telephone directories.

APPENDIX 2: Vegetated buffer element design

While buffer areas of 300 m width are recommended for forward planning between residential and agricultural areas, 'vegetated buffers' can offer an alternative to this separation requirement. Research into the behaviour of pesticide spray drift has shown that vegetation screens can prove effective barriers to spray drift where they meet the following criteria:

- are of a minimum total width of 40 m;
- contain random plantings of a variety of tree and shrub species of differing growth habits, at spacings of 4–5 m for a minimum width of 20 m;
- include species with long, thin and rough foliage which facilitates the more efficient capture of spray droplets;
- provide a permeable barrier which allows air to pass through the buffer. A porosity of 0.5 is acceptable (approximately 50% of the screen should be air space);
- foliage is from the base to the crown;
- include species which are fast growing and hardy;
- have a mature tree height 1.5 times the spray release height or target vegetation height, whichever is higher;
- have mature height and width dimensions which do not detrimentally impact upon adjacent cropped land;
- include an area of at least 10 m clear of vegetation or other flammable material to either side of the vegetated area;

Vegetated buffers have other advantages in that they:

- create habitat and corridors for wildlife;
- increase the biological diversity of an area, thus assisting in pest control;
- favourably influence the microclimate;
- are aesthetically pleasing;
- provide opportunities for recreational uses;
- contribute to the reduction of noise and dust impacts.

Applications for development, where vegetated buffers are proposed, should include a landscape plan indicating the extent of the buffer, the location and spacing of proposed and existing trees and shrubs and a list of tree and shrub species to be planted. The application should also contain details concerning proposed ownership of the vegetated buffer and the means by which the buffer is to be maintained. Information on appropriate vegetation species is available in the publication *Trees and Shrubs* or from DNR forestry extension officers.

Based on research by Centre of Pesticide Application and Safety, University of Queensland, Gatton College.

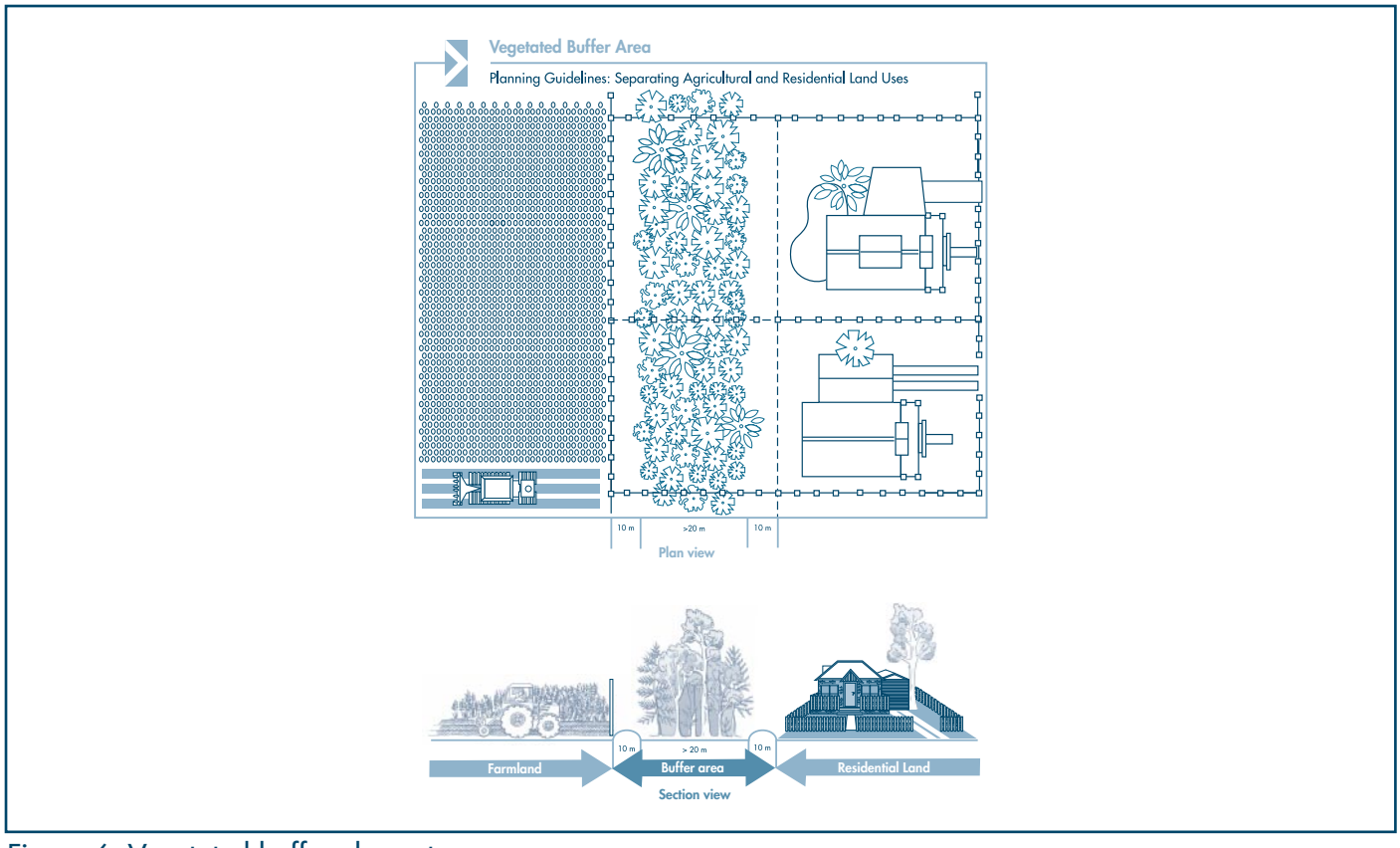
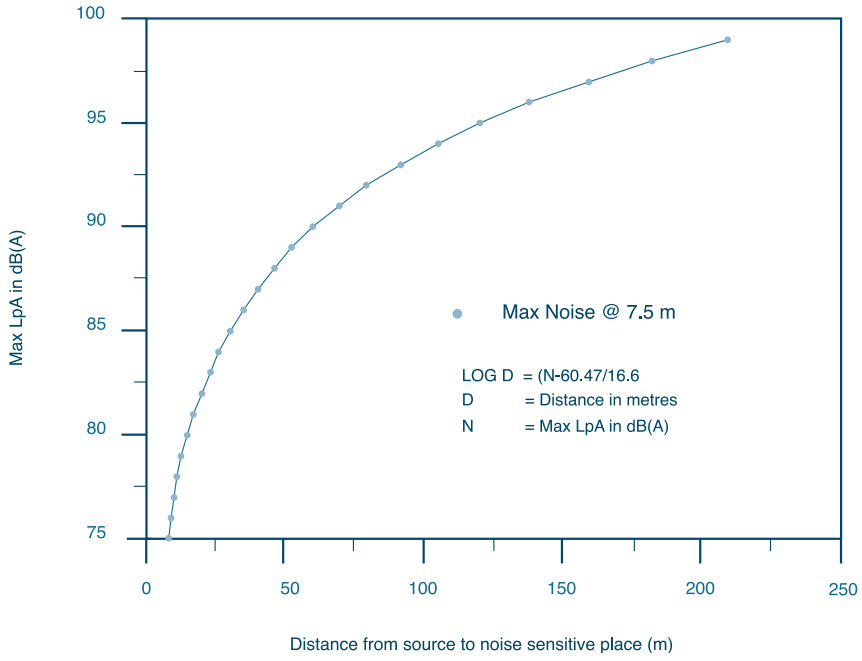


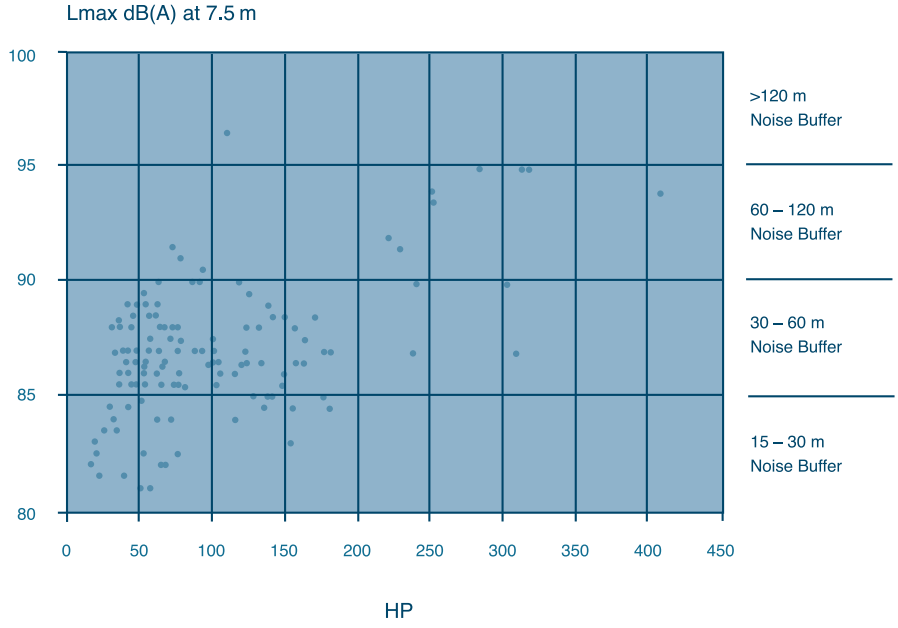
Figure 6. Vegetated buffer element

APPENDIX 3: Noise levels and separation distances

Noise levels and separation distance required to reduce noise levels to 75 dB(A)($L_{Amax,T}$)



Tractor HP and Noise Levels



Source: Leviticus and Morgan (1993)

APPENDIX 4: Examples and formulae for duration thresholds

The following formula and examples demonstrate the duration thresholds of intermittent noise generating activities by crop type. For day-time activities the formula for determining the number of hours of noise from agricultural activities per year is:

$x = \Sigma\{(c \times f \times h) \times (\pi \times d^2/2)\}$

where:

x = hours/year when noise exceeds 75 dB(A) ($L_{Amax,T}$)

c = crops per year

f = frequency of activity (a…z) per crop

h = hours of noise per hectare for activity (a....z)

$d = 10^{[(N-60.47)/16.6]}$

N = noise measured as ($L_{Amax,T}$) at 7.5 m for activity (a....z)

The results indicate that of all crops tested, tomatoes (25 hrs) and beetroot (15 hrs) have more than 10 hours of day-time activity per year when noise will exceed 75 dB(A) ($L_{Amax,T}$). The other crops conform with the duration threshold for noise which allows for up to 10 hours of day time activity per hectare per year. The separation distance required would be 69 m.

For night-time activities the formula is:

$y = \Sigma(c \times f \times n)$

where:

y = hours/yr when noise exceeds 55 dB(A) ($L_{Amax,T}$)

c = crops per year

f = frequency of night-time activity (a…z) per crop

n = hours of activity per night (prior to 6 a.m.) when noise levels exceed 55dB(A) ($L_{Amax,T}$)

The results indicate that while some crops do not require any night-time activities, beetroot (12 hrs), avocado (28 hrs), potatoes (32 hrs), tomatoes (96 hrs) and lucerne (48 hrs) require nighttime activities which exceed 10 hr/year when noise will exceed 55 dB(A) ($L_{Amax,T}$). The other crops conform with the duration threshold for noise which allow for up to 10 hours of night-time activity per year without the need for a buffer area.

The separation distance required without other amelioration measures would be 500 m for beetroot and lucerne and 1000 m for avocado, potatos and tomato.

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Beetroot	2	plough	D	3	6	1.67	10.00	91.00	69	0.75	7.49	
	2	cultivate	D	3	6	0.50	3.00	87.00	40	0.25	0.74	
	2	plant	D	1	2	1.00	2.00	87.00	40	0.25	0.49	
	2	fertilise	D	2	4	1.00	4.00	87.00	40	0.25	0.99	
	2	spray	N	3	6	0.40	2.40 °	87.00	40/500	0.25	0.59	12.00
	2	harvest	D	1	2	3.33	6.67	91.00	69	0.75	4.99	
Total				**13**	**26**	**7.90**	**28.07**				**15.29**	**12.00**

o = hours of operation per hectare per year of odour producing activity

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Sugar cane	0.25	plough	D	1	0.25	1.00	0.25	95.00	120	2.27	0.57	
	0.25	plant	D	1	0.25	1.00	0.25	91.00	69	0.75	0.19	
	1	cultivate	D	4	4	0.25	1.00	91.00	69	0.75	0.75	
	1	fertilise (N)	D	1	1	0.33	0.33	91.00	69	0.75	0.25	
	1	fertilise (P)	D	1	1	1.00	1.00	91.00	69	0.75	0.75	
	1	spray	D	2	2	0.17	0.33 °	91.00	69	0.75	0.25	
	1	harvest	D	1	1	1.00	1.00	96.00	138	3.00	3.00	
Total		**aerial spray**		**11**	**9.5**	**4.75**	**4.16**				**5.76**	**0.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Avocado	1	slashing	D	10	10	0.33	3.33	90.00	60	0.57	1.89	
	1	weed spraying	D	4	4	0.40	1.60	90.00	60	0.57	0.91	
	1	pesticides	N	14	14	0.40	5.60 °	90.00	60/1000	0.57	3.18	28.00
	1	harvesting	D	3	3	1.00	3.00	85.00	30	0.14	0.43	
Total				**31**	**31**	**2.13**	**13.53**				**6.41**	**28.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB (A) {x}	Hrs/yr> 55 dB(A)
Irrigated	1	chisel plough	D	1	1	1.67	1.67	91.00	69	0.75	1.25	
Cotton	1	rip	D	1	1	1.67	1.67	91.00	69	0.75	1.25	
	1	bed preparation	D	3	3	1.00	3.00	91.00	69	0.75	2.25	
	1	fertiliser	D	1	1	0.42	0.42	87.00	40	0.25	0.10	
	1	plant	D	1	1	1.00	1.00	87.00	40	0.25	0.25	
	1	boom spray	D	7	7	0.40	2.80 °	87.00	40	0.25	0.69	
	1	aerial spray	D	8	8	0.10	0.80 °	100	1.57	1.26		
	1	picking	D	2	2	1.00	2.00	91.00	69	0.75	1.50	
	1	stick pulling	D	1	1	1.00	1.00	91.00	69	0.75	0.75	
Total				**25**	**25**	**8.26**	**14.36**				**9.30**	**0.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Dryland	1	chisel plough	D	1	1	1.67	1.67	91.00	69	0.75	1.25	
Cotton	1	cultivation	D	2	2	1.67	3.33	91.00	69	0.75	2.50	
	1	bed preparation	D	2	2	1.00	2.00	91.00	69	0.75	1.50	
	1	fertiliser	D	1	1	0.42	0.42	87.00	40	0.25	0.10	
	1	plant	D	1	1	1.00	1.00	87.00	40	0.25	0.25	
	1	boom spray	D	3	3	0.40	1.20 °	87.00	40	0.25	0.30	
	1	aerial spray	D	4	4	0.10	0.40 °	100	1.57	0.63		
	1	picking	D	1	1	1.00	1.00	91.00	69	0.75	0.75	
	1	stick pulling	D	1	1	1.00	1.00	91.00	69	0.75	0.75	
Total				**16**	**16**	**8.26**	**12.02**				**8.03**	**0.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Wheat	1	chisel plough	D	1	1	1.67	1.67	91.00	69	0.75	1.25	
Sorghum	1	cultivate	D	2	2	0.33	0.67	87.00	40	0.25	0.16	
Maize	1	plant	D	1	1	1.00	1.00	87.00	40	0.25	0.25	
	1	spray	D	1	1	0.40	0.40 °	87.00	40	0.25	0.10	
	1	harvest	D	1	1	1.00	1.00	91	69	0.75	0.75	
Total				**6**	**6**	**4.4**	**4.74**				**2.51**	**0.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Potatoes	2	plough	D/N	1	2	1.67	3.33	91.00	69/1000	0.75	2.50	4.00
	2	cultivate	D/N	2	4	0.50	2.00	87.00	40/500	0.25	0.49	8.00
	2	plant	D	1	2	2.50	5.00	87.00	40	0.25	1.23	
	2	fertilise	D	2	4	0.50	2.00	87.00	40	0.25	0.49	
	2	spray	D/N	5	10	1.00	10.00 °	87.00	40/500	0.25	2.47	20.00
	2	harvest	D	1	2	1.67	3.33	91.00	69	0.75	1.50	
Total				**12**	**24**	**7.84**	**25.66**				**8.68**	**32.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Tomatoes	2	plough	D/N	1	2	1.67	3.33	91.00	69/1000	0.75	2.50	4.00
	2	disc/tyne	D	3	6	1.67	10.00	91.00	69	0.75	7.49	
	2	bed forming	D	1	2	2.50	5.00	91.00	69	0.75	3.74	
	2	lay plastic	D	1	2	2.50	5.00	91.00	69	0.75	3.74	
	2	plant	D	1	2	2.50	5.00	91.00	69	0.75		
	2	rip	D/N	1	2	1.67	3.33	91.00	69/1000	0.75	2.50	4.00
	2	rotary hoe	D/N	1	2	0.33	0.67	87.00	40/500	0.25	0.16	4.00
	2	fertilise	D	1	2	0.42	0.83	87.00	40	0.25	0.21	
	2	spray	N	21	42	0.40	16.80 °	87.00	40/500	0.25	4.15	84.00
	2	harvest	D	2	4	1.00	4.00	87.00	40	0.25	0.99	
Total				**33**	**66**	**14.66**	**53.96**				**25.48**	**96.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Lucerne	0.6	chisel plough	D	1	0.6	1.67	1.00	91.00	69	0.75	0.75	
	0.6	cultivation	D	3	1.8	0.33	0.60	87.00	40	0.25	0.15	
	0.6	plant	D	1	0.6	1.00	0.60	87.00	40	0.25	0.15	
	0.6	fertilise	D	1	0.6	0.42	0.25	87.00	40	0.25	0.06	
	1	spray	D	10	10	0.40	4.00 °	87.00	40	0.25	0.99	
	1	cut	N	8	8	1.00	8.00	87.00	40/500	0.25	1.97	16.00
	1	raking	D/N	16	16	1.00	16.00	85.00	30/500	0.14	2.27	32.00
	1	bailing	D	8	8	1.00	8.00	85.00	30	0.14	1.13	
Total				**48**	**45.6**	**6.82**	**38.45**				**7.47**	**48.00**

Crop	Crops/yr {c}	Activity	Day /Night	Freq/ crop {f}	Freq/ yr	Hrs/ ha {h}	Hrs/ ha/yr {o}	dB(A) @ 7.5 m {N}	Impact dist.(m) {d}	Impact area (ha) {π*d2/2}	Hrs/yr> 75 dB(A) {x}	Hrs/yr> 55 dB(A)
Peanuts	1	chisel plough	D		2	1.67	3.33	91.00	69	0.75	2.50	
	1	cultivation	D	2	2	0.33	0.67	87.00	40	0.25	0.16	
	1	plant	D	1	1	1.00	1.00	87.00	40	0.25	0.25	
	1	fertilise	D	1	1	0.42	0.42	87.00	40	0.25	0.10	
	1	spray	D	2	2	0.40	0.80 °	87.00	40	0.25	0.20	
	1	IR cultivation	D	2	2	0.33	0.67	87.00	40	0.25	0.16	
	1	digging	D	1	1	1.00	1.00	85.00	0	0.14	0.14	
	1	threshing	D	1	1	1.00	1.00	85.00	30	0.14	0.14	
Total				**12**	**12**	**6.15**	**8.89**				**3.65**	**0.00**

APPENDIX 5: Examples of agricultural pesticides and odours

	Chemical	Trade Names	Odour
Organophosphates	azinphos-methyl dichlorvos chlorpyrifos	Gusathion, Azithion, Benthion, Cotnion Mafu, Vapona, Insectigas-D, Chlorban Dursban,Argenstem, Lorsban, Grubkil Deter, Antkil, Chlorfos, Predator, Pyrinex Suscon Blue	sulphurous or garlic-like odour due to 'mercaptans' impurities
	chlorpyrifos-methyl diazinon	Nucidol, Reldan, diazinon, Gesapon Diacap, Pennside, Diazamin, Knox-out Neocid	
	dimethoate	Rogor, Gomite, Roxion, Saboteur Perfekthion, Danadim	
	fenitrothion	Folithion, Sumithion, Synergen F, Tugon Fenitrogard	
	methamidophos	Nitofol, Monitor	
	methidathion mevinphos	Supracide Phosdrin	
	maldison*	Malathion, Hy-Mal, Ulvomal	* low odour formulations marketed at various times
	monocrotophos	Azodrin, Cronofos, Nuvacron	
	parathion (parathion-ethyl)	Novafos, E-605	
	parathion-methyl	Folidol M, Penncap M	
	profenofos**	Curacron, Sabre	** deodoriser added to prepared spray
	phorate	Thimet, Umet	
	temephos	Abate, Lypor, Assassin, Tempor	
	terbufos	Counter, Hunter	
Phenoxy type ('hormone') herbicides	2,4-D (dimethylamine salt)	Amicide 500, Aminoz, D-500, 500, Shirweed	ammoniacal/phenolic 'fishy'
	dichlorprop	AF-302, Lantana DP-600	
	MCPA,	Agritox, Thistle, MCPA 500, Killem	
	2,4-D (diethanolamine salt)	Amicide Lo-500A , Baton, Zephyr,	'low odour' formulations
Miscellaneous	phosphine	various (e.g.Phostoxin)	rotting fish
	paraquat	Gramoxone, Shirquat	stench agent added to formulation
	endothal	Accelerate, Endothal	ammoniacal odour
	dithianon	Delan	musty
	dithiocarbamates (e.g. mancozeb)	Dithane, Manzate, Dek, Penncozeb	moderately sulfurous/musty
	methomyl	Lannate, Methomex, Marlin, Nudrin	sulfurous
	metribuzin	Lexone, Sencor	sulfurous mercaptan-like odour
	EDB	EDB	chloroform-like odour
	chloropicrin	Larvacide	pungent odour

Source: DPI
Note: This table is not a complete list of available agricultural pesticides

APPENDIX 6: Examples of minimum effective separation distances

This table provides examples of effective minimum separation distance for each of the elements described in Section 3. Design of individual buffer areas must take account of specific conditions and sources of conflict. In these examples it is assumed that a noise buffer will result in a reduction of noise level of 10 dB(A).

	Sources of conflict	Minimum effective distance of open ground (metres)	Minimum effective distance with vegetated and noise buffer elements (metres)
1.	Agricultural chemical spray	300	40
	Night-time tractor use with mister (90 dB(A) $L_{Amax,T}$) (>10 hrs)	1000 *	250
	Odour (>88hrs/yr)	500	500 *#
	Effective width	**1000**	**500**
2.	Agricultural chemical spray	300	40
	Night-time tractor use (80 dB (A) $L_{Amax,T}$) (>10hrs)	250	60
	Odour (>88 hrs/yr)	500 *	500 *#
	Effective width	**500**	**500**
3.	Aerial spray application	100	100 *
	Agricultural chemical spray	300 *	40
	Tractors (95 dB(A) $L_{Amax,T}$) (>10hrs)	120	30
	Dust generation	150	40
	Odour (<88 hrs/yr)	0	0
	Effective width	**300**	**100**
4.	Agricultural chemical spray	300 *	40
	Tractors (85 dB(A) $L_{Amax,T}$) (>10 hrs)	30	10
	Day time irrigation pump (85 dB(A) $L_{Amax,T}$) (>50 hrs)	250	60 *
	Dust generation	150	40
	Odour (<88 hrs/yr)	0	0
	Effective width	**300**	**60**
5.	Agricultural chemical spray	300 *	40 *
	Tractors (90 dB(A) $L_{Amax,T}$) (>10 hrs)	60	50
	Dust generation	150	40 *
	Odour (<88 hrs/yr)	0	0
	Effective width	**300**	**40**
6.	Tractors (90 dB(A) $L_{Amax,T}$) (>10 hrs)	60	15
	Dust generation	150 *	40 *
	Odour (<88 hrs/yr)	0	0
	Effective width	**150**	**40**

Note: * Most limiting factor to determine minimum separation distance

\# Minimum design distance for odour buffer area may be reduced on consideration of site factors and nature of odour.

This table should be read in conjunction with the text of Section 3.

- The separation distances in this table are not definitive distances for individual agricultural activities.
- Long-term noise sources operating >50 hrs/yr particularly between 10 p.m. and 6 a.m., such as pumps and cooling units, may require acoustic muffling to reduce noise to acceptable levels.

APPENDIX 7: Sample report

NEED FOR AND DESIGN OF A BUFFER AREA BETWEEN RESIDENTIAL AND AGRICULTURAL LAND USES AT SMITHVILLE

INTRODUCTION

Property Description:	Lot 111 on RP 23702, Parish of Tropicana Smith Street, Smithville
Site Description:	The site consists of 40 ha, and is an undulating area with gentle northerly slopes ranging from 5–10%. The subject land comprises 24 ha of good quality agricultural land which are not to be developed, and 16 ha of rocky poor quality soils in the southern portion of the lot. The farming areas to the north and east of the site are used for mixed tree cropping enterprises of avocados, lychees and pineapples. There is a grazing property to the west of the site, and the Smithville township to the south.
Local Government:	Black Stump Shire Council
Proposed development:	The proposal involves a part urban expansion on 16 ha of unproductive rural land, with the remaining 24 ha of good quality agricultural land to remain in production.

SUSTAINABLE CROPPING USE OF THE LAND

The subject land has been mapped at a scale of 1:100 000 in the report Black Stump Horticultural Land Suitability Study (by Jones, M.A), published by the Department of Primary Industries in 1987. The report classifies part of the land as being suitable for most tree and vine crops with minor limitations (Class 2), and part as unsuitable for agriculture (Class 5). Class 2 land has been identified by *Planning Guidelines: The Identification of Good Quality Agricultural Land* (DPI/DHLGP 1993) as Class A, Crop land. This classification is not disputed.

The property has been mapped into two land types. Land type 1 consisting of 24 ha has been classified as a red ferrosol (ASC) or krasnozem (GSG). Land type 2 consists of red and yellow kurosols and tenosols (ASC) or gravelly red and yellow podzolics and lithosols (GSG) *(See attached map)*.

The most intrusive cropping use that the subject land is capable of sustaining consists of tree crops. In Black Stump Shire, the most common crops for this land type are avocados and lychees (the current land use). Table 1 outlines a range of farming activities associated with avocado and lychee production in Black Stump Shire.

The subject land utilises a piped irrigation system, allowing fertiliser application with the irrigation water. Therefore, foliar spraying of fertilisers is unlikely.

The majority of the activities on the subject farm are carried out during the period from October to April. The main activities throughout this period are inter row weed control and grass slashing, and insecticide and fungicide spraying. Machinery will be used in the orchard for approximately 31 events per year.

Stationary pumps on the property will operate for more than 50 hr/year (day and night).

Table 1. Typical farming activities for tree crops

Activity	Expected frequency	Machinery
Inter-row weed and grass slashing	2–10 times per annum depending on canopy size	60 hp tractor and slasher
Weed spraying around tree bases	up to 4 times per annum	60 hp tractor and spray pack
Insect and disease control	up to 14 times per annum depending on the season	60 hp tractor and air blast mister
Picking	1–3 times per annum	utility and/or cherry picker

POTENTIAL FOR CONFLICT

Land use conflict can occur in situations where agricultural activities impact on residential amenity. There is potential for conflict along the interface of the proposed northern and eastern residential boundaries, as the proposed residential land will abut agricultural land where the farming activities listed in Table 1 can be expected.

ELEMENTS LIKELY TO CAUSE CONFLICT

Agricultural chemical spray drift

- Avocado and lychee production entails regular spraying of pesticides (herbicides, insecticides and fungicides) which are recognised to release a moderate to strong odour. This is particularly an issue during summer when the majority of the activities on the subject farm are carried out.
- The off target movement of chemical sprays is unlikely to remain airborne greater than 300 m from the release area. However associated odour may be detectable at greater distances from the source.

Noise

- Noise from airblast misters and tractors utilised in pesticide spraying and general weed and grass control is anticipated to be in the vicinity of 85 dB(A) ($L_{Amax,T}$) when measured 7.5 m from the noise source.
- Day-time activity ie between 6 a.m. and 10 p.m. the same day is likely to occur up to 31 occasions per year. Using the formula as per *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DNR/DLGP 1997), results in less than 7 hours of day-time activity per year for which noise will exceed 75 dB(A). This conforms with the design goals for noise which allows for up to 10 hours of day-time activity per year.
- Night-time activity i.e. between 10 p.m. and 6 a.m. the next day (as defined by the EP Act) is likely to occur on this farm up to 14 occasions per year for up to 2 hours at a time (given that spraying is likely to commence at 4 a.m., and that noise from such an activity is likely to exceed 55 dB(A) up to 500 m from the source). This will result in up to 28 hours of night-time activity per farm per year which will exceed 55 dB(A). This fails to conform with the Design Goals for Noise which allow up to 10 hours of night time activity per farm per year.

Dust

- It is considered that due to tree crop production, and the limited amount of bare earth exposed, dust generation will occur only on rare occasions, and should not be considered as a factor contributing to conflict in this situation.

Odour

- It is considered that due to the nature of tree crop production and the regular spraying of agricultural chemicals, that the generation of odour will occur up to 5.6hr/ha/yr. Using the formula as per *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DNR/DLGP), the time of potential odour impact is 134 hrs/yr. This level exceeds the duration threshold for odour and therefore odour is likely to impact upon the proposed residential area.
- Prevailing wind direction will carry odour away from the residential area for approximately 50% of time. This will reduce the time of odour impact to 67 hrs/yr and below the duration threshold.

Sediment and stormwater run-off

- The proposed residential area is of higher elevation than the agricultural land.
- There is also potential for the residential area to impact on the agricultural land through increased runoff and sedimentation, particularly during the construction phase of the development.

RECOMMENDED MEASURES TO ADDRESS EACH ELEMENT

Chemical spray drift

- The south easterly prevailing winds on the subject land will assist in directing residual chemical spray away from the residential areas.
- The minimum vegetated buffer (40m width) designed to the criteria set out in Appendix 2 of *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DNR/DLGP 1997) to reduce conflict in this situation is recommended *(See attached plan)*.
- DNR Forestry Extension Officers have recommended the following species as being suitable to capture spray droplets for this particular site:

  Casuarina cunninghamiana, river she-oak (outer rows)

  Syzygium luehmannii, small-leaved lillipilly (inner rows)

  Acmena smithii, lillipilly satinash (inner rows)

  Melaleuca bracteata, river tea-tree (inner /outer rows)

  Melaleuca leucadendra, white paperbark (inner/outer rows)

  Melaleuca quinquenervia, broad-leaved tea-tree (inner/outer rows)

  Waterhousia floribunda, weeping satinash (inner rows)

  Grevillea baileyana, Findlay's silky oak (inner/outer rows)

  Callitris columellaris, coastal cyprus pine (outer rows)

  Araucaria cunninghamii, hoop pine (inner/outer rows)

Noise

- The south easterly prevailing winds on the subject land will not be a factor affecting noise levels.
- A maximum distance of 500 m of open ground will reduce the night time noise level from tractors and farm machinery to 55 dB(A) which is recognised in *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DNRI/DLGP 1997) as an acceptable design goal for intermittent night-time agricultural activities. An appropriately designed noise mound put in place at 50 m from the resource boundary will reduce the overall separation distance required to meet the noise design goals to 120 m.
- . It is recommended that the developer provide a pump enclosure to eliminate night-time noise from stationary pumps.

Odour

While odour impacts are within the duration threshold, the following will further assist in the reduction of odour impacts:

- The south-easterly prevailing winds on the subject land will assist in directing odour from chemical spray awayfrom the residential areas.
- Not all the chemicals used or likely to be used on activities possible on this farm contain an strong odour.
- The presence of a vegetated buffer element may also assist in reducing the impacts from odour associated with chemical spray.

Sediment and Stormwater run-off

- Erosion control measures will be necessary during the construction phase of the residential development, and, should meet the standards set out in *Guidelines for Soil Erosion and Sediment Control for Construction Sites* (IEA/AIAS, 1996).
- Stormwater runoff from all hard surfaces should be designed to ensure that all runoff is drained or piped to Black Stump Township's existing storm water drainage system.
- Water spreading devices should be utilised within the buffer area to minimise impacts on the adjacent farmland.

IMPLEMENTATION

W. Anonymous Consultants recommend the establishment of a 120 m wide buffer area incorporating the buffer elements of a 40 m vegetated buffer and noise mound along the northern and eastern boundaries of the subdivision. In this situation, the buffer area will be provided on private land of single tenure, utilising a series of larger lots along the agricultural land boundary. See attached map.

The proponent has agreed to provide an acoustic enclosure for stationary pumps on the adjacent agricultural property to reduce noise from these sources to acceptable levels. Additionally, it is recommended that council set the following conditions if the proposed development is approved, to take account of the agricultural conflict issues. These conditions must be continuous with all subsequent owners of the affected lots until such time as the buffer area is no longer required.

Conditions on development

1. Building envelopes to be specified on the affected lots to ensure that residences do not encroach into the required buffer area.
2. The buffer area will consist of a 120 m area along the northern and eastern boundaries of the development.
3. A vegetative buffer element of 40 m width within the buffer area, designed according to Appendix 2 of the *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DPI/DHLGP, 1997) is to be established by the applicant to the satisfaction of council prior to any building approval within 300 m of the good quality agricultural land, i.e. land type 1.
4. The land owner is to be responsible for on-going maintenance of the vegetative buffer element to ensure that the buffer area complies with the criteria of Appendix 2 of *Planning Guidelines: Separating Agricultural and Residential Land Uses* (DNR/DLGP, 1997). This includes:
   - replacement of dead or dying vegetation;
   - management for fire protection, including reduction in litter build-up;
   - ensuring access to the 10m maintenance strips either side of vegetation;
   - ensuring that the buffer element does not shade adjacent cropping land for a significant period in the afternoon;
   - control of noxious weeds.

5. The vegetated buffer is to be protected by the tree clearing controls applicable to a 'Vegetation Protection Area' which are identified in the Planning Scheme of Black Stump Shire Council.

6. Prior to the sealing of the plan, a noise barrier acceptable to the engineering department of Black Stump Shire Council to be constructed by the applicant within 120 m of the good quality agricultural land ie Land Type 1. The noise mound must be of a height which is at least equal to the direct line of site of the noise source.

7. The land owner is to be responsible for on going maintenance of the noise barrier.

8. An erosion control plan which meets the standards of the Guidelines for Erosion and Sediment Control for Construction Sites is to be submitted by the applicant and complied with throughout the construction phase of the development.

9. Stormwater run-off from all hard surfaces is to be designed to ensure that all runoff is drained or piped to Black Stump township's existing stormwater drainage system.

10. Water spreading devices to be installed within the buffer areas by the applicant. Maintenance of these devices will be the land owner's responsibility.

W. Smith

ANONYMOUS CONSULTANTS LIMITED

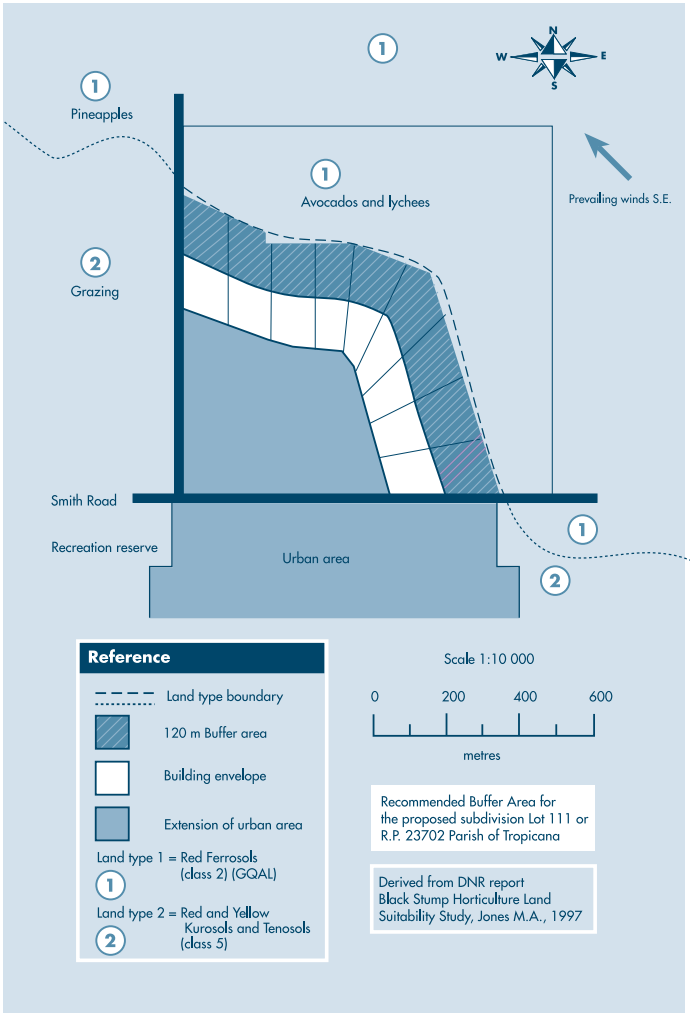


Figure1. Site Plan

Google Earth

File Edit View Tools Add Help

Search

Vancouver, WA

Search

ex: 94043

Get Directions History

Vancouver, WA

Places

- The Titanic
  Located in the North Atlantic Ocean
- The Forbidden City
  Located in China
- Mount Fuji
  Located near Tokyo, Japan
- Google Headquarters
  Located in Mountain View, California
- Potential PDR Site 1
- Project Site 1
- Project Site 2
- Temporary Places

Layers Earth Gallery »

- Primary Database
  - Voyager
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Ocean
  - Weather
  - Gallery
  - Global Awareness
  - More

Sign in

NE 149th St
NE 101st Pl
NE 114th Ct
NE 137th Ave
NE 144th St
NE 137th Cir
NE 90th Ct
NE 97th Ave
NE 93rd Ave
NE Laurin Rd
NE 110th Ave
NE 126th Cir
Porthaney Rd
NE 127th St
NE 132nd Ave
NE 123rd St
NE 117th Ave
NE 121st St
NE 96th Ave
NE 99th Ave
NE 103rd Ave
NE 111th Ave
503
NE 119th St
2737 ft
© 2016 Google
Google earth
Tour Guide 1990
Imagery Date: 4/17/2015 45°43'05.79" N 122°33'14.19" W elev 284 ft eye alt 12412 ft

Google Earth

File Edit View Tools Add Help

Sign in

▼ Search

Vancouver, WA

Search

ex: 94043

Get Directions History

Vancouver, WA

▼ Places

- The Titanic
  Located in the North Atlantic Ocean
- The Forbidden City
  Located in China
- Mount Fuji
  Located near Tokyo, Japan
- Google Headquarters
  Located in Mountain View, California
- Potential PDR Site 1
- Project Site 1
- Project Site 2
- Temporary Places

▼ Layers

Earth Gallery »

- Primary Database
  - Voyager
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Ocean
  - Weather
  - Gallery
  - Global Awareness
  - More

NE 149th St
NE 101st Pl
NE 114th Ct
NE 137th Ave
NE 144th St
NE 137th Cir
NE 97th Ave
NE 90th Ct
NE 93rd Ave
NE Laurin Rd
NE 110th Ave
NE 127th St
NE 126th Cir
Porthaney Rd
NE 96th Ave
NE 103rd Ave
NE 111th Ave
NE 117th Ave
NE 132nd Ave
NE 123rd St
NE 121st St
503
NE 119th St
2737 ft
© 2016 Google
Google earth
Tour Guide
1990
Imagery Date: 4/17/2015 45°43'05.79" N 122°33'14.19" W elev 284 ft eye alt 12412 ft

Google Earth

File Edit View Tools Add Help

Sign in

▼ Search

Vancouver, WA

Search

ex: 94043

Get Directions History

Vancouver, WA

▼ Places

- My Places
  - Sightseeing Tour
    - Make sure 3D Buildings layer is checked
    - Start tour here
    - The Eiffel Tower
      - Located in Paris, France
    - Christ the Redeemer
      - Located in Rio, Brazil
    - The Grand Canyon
      - Located in Arizona, USA
    - Sydney
      - New South Wales, Australia

▼ Layers

Earth Gallery »

- Primary Database
  - Voyager
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Ocean
  - Weather
  - Gallery
  - Global Awareness
  - More

Salmon Creek Pond

NE 154th Cir

NE 154th St

Brush Prairie

Old State Hwy 503

NE 151st St

NE 31st Ave

NE 144th St

503

NE 105th Ave

NE 139th St

NE 82nd Ave

NE 97th Ave

NE 134th St

NE 131st St

NE 87th Ave

NE 93rd Ave

NE Laurin Rd

NE 117th Ave

NE 132nd Ave

NE 123rd St

NE 121st St

NE 96th Ave

NE 99th Ave

NE 103rd Ave

NE 107th Ave

NE 111th Ave

NE 119th St

2812 ft

© 2016 Google

Google earth

Tour Guide

1990

Imagery Date: 4/17/2015 45°43'11.06" N 122°33'22.80" W elev 285 ft eye alt 12412 ft

Google Earth

File Edit View Tools Add Help

Sign in

▼ Search

Vancouver, WA

Search

ex: 94043

Get Directions History

Vancouver, WA

▼ Places

- The Titanic
  Located in the North Atlantic Ocean
- The Forbidden City
  Located in China
- Mount Fuji
  Located near Tokyo, Japan
- Google Headquarters
  Located in Mountain View, California
- Potential PDR Site 1
- Project Site 1
- Project Site 2
- Temporary Places

▼ Layers

Earth Gallery »

- Primary Database
  - Voyager
  - Borders and Labels
  - Places
  - Photos
  - Roads
  - 3D Buildings
  - Ocean
  - Weather
  - Gallery
  - Global Awareness
  - More

Salmon Creek Pond

NE 154th Cir

NE 154th St

Brush Prairie

Old State Hwy 503

NE 151st St

NE 31st Ave

NE 144th St

503

NE 139th St

NE 82nd Ave

NE 134th St

NE 131st St

NE 87th Ave

NE 93rd Ave

NE Laurin Rd

NE 117th Ave

NE 96th Ave

NE 99th Ave

NE 103rd Ave

NE 107th Ave

NE 111th Ave

NE 132nd Ave

NE 123rd St

NE 121st St

NE 119th St

2812 ft

© 2016 Google

Google earth

Tour Guide 1990

Imagery Date: 4/17/2015 45°43'11.06" N 122°33'22.80" W elev 285 ft eye alt 12412 ft