Model Local Planning Policy

Horticultural development in Local Governments of the Peel-Harvey Coastal Plain Catchment

Appendices

Version 3.0

10 February 2016

Contents

Tables

Acronyms

DAFWA	Department of Agriculture and Food Western Australia
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
N	Nitrogen
NIMP	Nutrient and Irrigation Management Plan
P	Phosphorus
PDC	Peel Development Commission
SPP	State Planning Policy
WAPC	Western Australian Planning Commission
WQIP	Water Quality Improvement Plan (as for Peel-Harvey)

Appendix A: Catchment Water Quality Improvement Standards and guidance

A1. Phosphorus - For proposals within the Peel-Harvey Coastal Plain Catchment Area (Figure 1)

Phosphorus application rates

To meet targets for phosphorus reduction established in the Peel-Harvey EPP (EPA, 1992) and supported in SPP2.1, proposals for new horticulture should not apply phosphorus at rates exceeding 6.5 kg P/ha/yr (Kelsey *et al,* 2011).

Phosphorus export rates

The following export rates of phosphorus from the Coastal Catchment Area have been determined by State Government (Kelsey *et al*, 2011) to ensure that catchment targets for phosphorus reduction are met:

- 0.29 kg P/ha/yr for sites in the Serpentine River Subcatchments
- 0.28 kg P/ha/yr for sites in the Murray River Subcatchments
- 0.47 kg P/ha/yr for sites in the Harvey Basin.[1]

These export rates of phosphorus from the Coastal Catchment Area are end of sub-catchment targets (measured at the end of the sub-catchment).Phosphorus export rates measured at each Site would be higher due to dilution and in-stream losses. However, the actual loss rate that is acceptable will vary depending upon the location of the site taking into account distance to the receiving water body, shape of sub-catchment, slope of the land amongst other factors.

A.2 Phosphorus – For all proposals in the (insert local government name)

All other proposals in the (insert local government name) should demonstrate, through a Site Management Plan including a Nutrient Export Risk Assessment, how the proposal will minimise the application and export of phosphorus from the production area and site.

A3 - Nitrogen – For proposals within the Peel-Harvey Coastal Plain Catchment Area (Figure 1))

To meet targets for nitrogen reduction, proposals for new horticulture should not apply nitrogen (in all forms) at rates exceeding 45 kg N/ha/yr or on average not discharge nitrogen at rates above 1.2 mg/L (Total Nitrogen) (Kelsey *et al*, 2011).

A4 - Nitrogen – for all proposals in the (insert local government name)

All other proposals in the (insert local government name) should demonstrate, through a Site Management Plan including a Nutrient Export Risk Assessment, how the proposal will minimise the application and export of nitrogen from the production area and site.

[1] Based on the river basin phosphorus targets from the Peel-Harvey EPP, and quoted in Kelsey *et al* 2011, page 80.

Appendix B: Suitability of soil-landscape mapping units in the (Insert local government name) for annual horticulture, perennial horticulture and viticulture

Table 2 provides summary advice from the Department of Agriculture and Food WA on the potential suitability of mapped soil-landscape units in the (Insert local government name) for in-ground horticulture (Column 5). Mapping of soil-landscape units is available from (insert appropriate source for mapping).

The advice is based on two major assessments:

- The risk of phosphorus export from the soil-landscape unit (Column 3); and
- The land capability class rating of the soil-landscape unit for annual horticulture (A), perennial horticulture (P) and vines (V) (Column 4). Land capability refers to the ability of land unit to support a type of land use without causing damage (Austin and Cocks, 1978).

Land capability class ratings (Column 4) are denoted in Table 2 using the following symbols: A1 A2, B1, B2, C1 OR C2. These symbols represent the following:

A1 More than 70% of the unit has high capability land (class 1 and 2)

A2 50-69% of the unit has high capability land (class 1 and 2).

B1 More than 70% of the unit has moderate or high capability land (Class 1, 2 or 3)

B2 50-69% of the unit has moderate or high capability land (Class 1, 2 or 3)

C1 50-69% of the unit has low capability land (class 4 and 5)

C2 More than 70% of the unit has low capability land (class 4 and 5).

Further information on land capability assessment and land capacity classes is provided in the Technical Notes which accompany this policy.

Note: Land capability ratings are designed for broad-scale map units in which proximity to waterways has not been considered. Any on-site assessment should consider this.

Table 1: Nutrient export risk and suitability for in-ground horticulture in different land units of the Peel-Harvey Coastal Catchment

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
The **Forrestfield System (213Fo**) consists of undulating foot slopes of the Darling Scarp on colluvium over granitic and sedimentary rocks in the eastern margin of the Swan Coastal Plain. Soils include duplex sandy gravels, pale deep sands and grey deep sandy duplexes. Native vegetation is jarrah-marri forest and woodland.						
F1a	1-15% lower slopes with well drained shallow to moderately deep, very gravelly acidic yellow duplex soils and common laterite.	No	B2	B2	B2	Yes APV
F1b	1-15% lower slopes with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	No	B1	B1	B1	Yes APV
F1c	1-15% lower slopes with well drained deep uniform yellowish brown sands which are generally free of laterite or gravel.	No	B1	A2	A2	Yes APV
F2a	Low slopes and foot slopes up to 5-10% with well drained shallow to moderately deep, very gravelly acidic yellow duplex soils and	No	B1	B2	B2	Yes APV

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?	Capability Class Rating for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V = vine
Map unit symbol	Map unit description		Annual (A)	Perennial (P)	Vine V)	
	common laterite.					
F2b	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	No	A2	A2	A2	Yes APV
F2c	Low slopes and foot slopes up to 5-10% slopes with well drained deep uniform yellowish brown sands which are generally free of laterite or gravel.	No	B1	A1	A1	Yes APV
F3	1-3% foot slopes with deep, imperfectly drained yellow and, less commonly, acidic gley duplex soils.	No	B1	B2	B1	Yes APV
F4	Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Yes	C1	C1	C2	No
F5	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	Yes	C2	C2	C2	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
Ff1	Foot and low slopes < 10% with deep rapidly drained siliceous yellow brown sands, and pale or bleached sands with yellow-brown subsoil. Shrubland of unidentified species.	No	B1	A2	A1	Yes APV
Ff10	Alluvial fans on lower slopes <5-10% with variable poorly drained soils.	Yes	C1	C1	C1	No
Ff2	Foot and low slopes < 10%.Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of *E.marginata, E. calophylla* and some *B.grandis*.	No	B1	A2	A2	Yes APV
Ff3	Foot and low slopes <10%. Well drained gravelly yellow or red duplex soils with sandy loam to loam topsoil. Woodland of *E. wandoo* and *E. marginata*.	No	B1	A2	A2	Yes APV
Ff7	Alluvial fans on slopes <5-10%.Variable, imperfectly drained soils comprising layers of sand, sandy loam, clay, grit and weathered granitic detritus. Low woodland of *E. calophylla*, *Banksia attenuata*	Yes	C1	C2	C1	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
	and *B. grandis* and some Casuarina spp.					
Ff9	Seepage areas and non-incised drainage channels on foot slopes <3% with poorly drained bleached grey sands over an iron-organic hardpan.	Yes	B2	C2	B2	No
The **Pinjarra System (213Pj)** is a poorly-drained coastal plain on alluvium over sedimentary rocks. Soils include semi-wet soils, grey deep sandy duplexes, brown loamy earths, pale sands and clays. Native vegetation is mainly jarrah-marri-wandoo-paperbark forest and woodland.						
B1	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes	B1	B1	B1	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
B2	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes	B1	B1	B1	No
B2a	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	No	B1	A1	A1	Yes APV
B3	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Yes	C2	C2	C2	No
B4	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes	C2	C2	C2	No
B6	Sandplain and broad extremely low rises with imperfectly drained	Yes	C2	C2	C2	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?	Capability Class Rating for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V = vine
Map unit symbol	Map unit description		Annual (A)	Perennial (P)	Vine V)	
	deep or very deep grey siliceous sands.					
P1a	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	No	B2	C2	C1	Yes A
P1b	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	No	B2	C2	B2	Yes for AV
P1c	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils. Deep pale brown to yellowish sand to sandy loam over clay; imperfectly drained and moderately susceptible to salinity in limited are	No	B1	C2	B1	Yes for AV

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Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
P1d	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity.	No	C2	C2	C2	No
P1e	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	No	B1	B2	B1	Yes for APV
P2	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay.	No	C2	C2	C2	No
P2a	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam with a silcrete hardpan at 50-100 cm depth generally on top of an olive-grey clay.	No	C2	C2	C2	No

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Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
P3	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.	No	C2	C2	C2	No
P4	Poorly drained flats, sometimes with gilgai microrelief and with moderately deep to deep black, olive grey and some yellowish brown cracking clays and less commonly non-cracking friable clays with generally acidic subsoils.	No	C2	C2	C2	No
P4a	Poorly drained flats. Cracking clays similar to P4 with a thin veneer of grey sand.	No	C2	C2	C2	No
P5	Poorly drained flats, commonly with gilgai microrelief and with deep black-grey to olive-brown cracking clays with subsoils becoming alkaline.	No	C2	C2	C2	No
P5a	Poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand.	No	C2	C2	C2	No

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Map unit symbol	Map unit description		Annual (A)	Perennial (P)	Vine V)	
P7	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley sandy duplex and effective duplex soils.	Yes	C2	C2	C2	No
P7a	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley duplex soils becoming alkaline with depth.	Yes	C2	C2	C2	No
P7b	Seasonally inundated swamps and depressions or seepage areas near the base of the foothills with very poorly drained deep bleached siliceous sands.	Yes	C2	C2	C2	No
P8	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline grey and yellow duplex soils to uniform bleached or pale brown sands over clay.	No	C2	C2	C2	No
P9	Shallowly incised stream channels of minor creeks and rivers with	Yes	C2	C2	C2	No

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Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
	deep acidic mottled yellow duplex soils.					
P9a	Generally shallow incised stream channels of minor creeks and rivers with poorly drained deep mottled yellow duplex soils, becoming alkaline with depth.	Yes	C2	C2	C2	No
SW2	Low level, occasionally flooded, alluvial terraces with imperfectly drained variable alluvial soils with loamy surfaces.	Yes	C2	C2	C2	No
P11	Shallow brown loamy soils or less commonly, very shallow sands over ironstone pavement which is a clear barrier to drainage.	No	C2	C2	C2	No
P11a	Shallow sand to sandy loam over lateritic material; imperfect to moderately well-drained.	No	C1	C2	C1	No
SWP10	Gently undulating to flat terraces adjacent to major rivers, but below the general level of the plain, with deep well drained uniform brownish sands or loams subject to periodic flooding.	No	B2	B1	A2	Yes APV

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Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
jSWP10a	Flat terraces adjacent to major rivers with deep black cracking clays with alkaline subsoils; soils similar to P5.	Yes	C2	C2	C2	No
SWP6a	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with major current river systems and larger streams. Acidic red and yellow duplex soils, less commo	No	A1	B1	A1	Yes APV
jSWP6b	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with prior stream deposits. Soils are uniform brownish sands.	No	B1	B1	A1	Yes APV
2SWP6c	Very gently undulating, alluvial terraces and fans. Moderate to moderately well-drained uniform friable brown loams, or well-structured gradational brown earths.	No	A1	B1	A2	Yes APV

The **Bassendean System (212Bs)** is sand dunes and sand plains with flats and swamps on sandy alluvium over sedimentary rocks. Soils include pale

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Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	A=Annual P = Perennial V = vine
deep sand, semi-wet soil and wet soil. These soils have low fertility and are susceptible to leaching. In the Peel, these soils may become waterlogged because of high groundwater levels and may become flooded in some areas. Native vegetation is mainly banksia-paperbark woodlands and mixed heaths.						
B1	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes	B1	B1	B1	No
B1a	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.	No	B1	B1	A1	Yes APV
B2	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes	B1	B1	B1	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
B2a	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	No	B1	A1	A1	Yes APV
B3	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Yes	C2	C2	C2	No
B4	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes	C2	C2	C2	No
B5	Shallowly incised stream channels of minor creeks and rivers with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes	C2	C2	C2	No

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Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
B6	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Yes	C2	C2	C2	No
The **Vasse System (211Va)** is poorly drained estuarine flats and swampy depressions of the Swan Coastal Plain. Soils include tidal flat soil, saline wet soil and pale deep sand. Native vegetation includes samphire, sedges and paperbark woodland.						
V1	Saline tidal flats composed of grey, black and brown foetid muds and humic sandy clays with locally common shell and limestone fragments.	Yes	C2	C2	C2	No
V2	Samphire covered sand and mud flats marginally higher than V1 and frequently inundated; with deep alkaline alluvial sands and clayey sands.	Yes	C2	C2	C2	No
V3	Sand flats marginally higher than V2. Frequently inundated; with deep alkaline alluvial sands and clayey sands, commonly supporting	Yes	C2	C2	C2	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
	stands of *Melaleuca* spp.					
V4	Low level storm beach ridges and terraces with shallow to moderately deep uniform alkaline black sandy loams to loams overlying unconsolidated shell beds or clayey marl.	No	C1	C2	C2	No
V5	Upper level sandy terrace and gently undulating beach ridges with shallow to moderately deep grey siliceous sands overlying soft shelly limestone or shell beds.	No	B2	A2	A2	Yes APV
V6	Upper level sandy terrace and gently undulating beach ridges with deep grey or bleached pale brown siliceous sands overlying soft shelly limestone.	Yes	C2	C2	C2	No
V6a	Gently undulating beach ridges similar to V6, but formed from reworked Pleistocene Bassendean sands. Deep bleached grey acidic siliceous sands with iron-organic hardpan.	Yes	C1	C2	C2	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
V7	Very broad shallow depression with deep, poorly drained, fine textured alkaline estuarine alluvium.	Yes	C2	C2	C2	No
V8	Flat poorly drained plains forming the margins of the estuarine deposits which border and partially overlie the Pinjarra Plain with variable, moderately deep to deep saline soils. Commonly, these are mottled yellow duplex soils over calcar	Yes	C2	C2	C2	No
V9	Areas of former swamps which have been artificially drained, with uniform loamy or peaty sands.	Yes	C2	C2	C2	No
The **Spearwood System (211Sp)** is sand dunes and plains on windblown sand and limestone over sedimentary rocks in the western edge of the Swan Coastal Plain. Soils include yellow deep sands, pale deep sands and yellow/brown shallow sands. Native vegetation includes tuart-marri forest and woodland in south changing to heath and open woodland in north.						

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Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
S1a	Dune ridges with shallow to moderately deep siliceous yellow-brown sands, very common limestone outcrop and slopes up to 15%.	Yes	C2	B2	C2	No
S1b	Dune ridges with deep siliceous yellow brown sands or pale sands with yellow-brown subsoil and slopes up to 15%.	No	B1	A2	A1	Yes APV
S1c	Dune ridges with deep bleached grey sands with yellow-brown subsoils, and slopes up to 15%.	No	B1	B1	A2	Yes APV
S1d	Dune ridges with moderately deep to very deep siliceous yellow-brown sands, rare limestone outcrop and slopes 3-20% occurring on the eastern slip face.	Yes	C2	B1	C2	No
S2a	Lower slopes (1-5%) of dune ridge with moderately deep to deep siliceous yellow-brown sands or pale sands with yellow-brown subsoils and minor limestone outcrop.	No	B1	A2	A1	Yes APV
S2b	Lower slopes (1-5%) of dune ridge with shallow to deep siliceous	No	B1	B1	A1	Yes APV

Column 1	Column 2	Column 3	Column 4			Column 5
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Map unit symbol	Map unit description		Annual (A)	Perennial (P)	Vine V)	
	yellow-brown sands and common limestone outcrop.					
S2c	Lower slopes (1-5%) of dune ridge with bleached or pale sands with a yellow-brown or pale brown subsoil (like S1c). Usually occurs on the eastern edge of the Spearwood Dunes.	No	B1	A1	A1	Yes APV
S3	Inter-dunal swales and depressions with gently inclined side slopes and deep rapidly drained siliceous yellow-brown sands.	No	A1	A1	A1	Yes APV
S4a	Flat to gently undulating sandplain with deep, pale and sometimes bleached, sands with yellow-brown subsoils.	No	B1	A2	A1	Yes APV
S4b	Flat to gently undulating sandplain with shallow to moderately deep siliceous yellow-brown and grey-brown sands with minor limestone outcrop.	No	B1	B1	A1	Yes APV
S4c	Flat to gently undulating sandplain with deep, yellow-brown or dark brown siliceous sands that are seasonally inundated.	Yes	C2	C2	C2	No

Column 1	Column 2	Column 3	Column 4			Column 5
Soil –landscape mapping unit		**Greater than 50% of the map unit classed as a High, Very High or Extreme risk of Phosphorus Export?**	**Capability Class Rating for In-ground Horticulture**			**Is the map unit potentially suitable for in-ground horticulture?** A=Annual P = Perennial V = vine
Map unit symbol	**Map unit description**		Annual (A)	Perennial (P)	Vine V)	
S6	Flat stony plain with poorly drained shallow siliceous sands and large areas of bare limestone pavement.	No	C2	C2	C2	No
The **Quindalup System (2111Qu)** is coastal dunes with sand flats on wind-blown sand over sedimentary rocks on the western margin of the Swan Coastal Plain. Soils are mainly calcareous sands with native vegetation of mixed coastal scrub.						
Qf2	Relict fore dunes and gently undulating beach ridge plain with deep uniform calcareous sands.	No	B1	B1	B1	Yes, APV
Qp1	Complex of nested low relief parabolic dunes with moderate to steep slopes and uniform calcareous sands showing variable depths of surface darkening.	No	C1	B2	C1	Yes, P

Appendix C: Guidance on site specific soil testing and land capability assessment for horticulture on the Peel-Harvey coastal plain catchment (draft)

The following guidelines have been developed by the Department of Agriculture and Food specifically for on-site assessment of annual or perennial horticulture on the Peel-Harvey Coastal Plain. If you have queries regarding this guidance please contact Department of Agriculture and Food.

Soil sampling, survey and land capability assessment undertaken as a requirement of this policy need to adhere to the following published guidelines:

Soil survey and characterisation

McKenzie NJ, Grundy, MJ, Webster, R and Ringrose-Voase AJ 2008 *Guidelines for Surveying Soil and Land Resources* Second Edition Australian Soil and Land Survey Handbooks Series 2 CSIRO Publishing

National Committee on Soil and Terrain 2009 *Australian Soil and Land Survey Field Handbook* Third edition Australian Soil and Land Survey Handbooks Series 1 CSIRO Publishing; specifically Soil profile (RC McDonald and RF Isbell)

Soil analysis

Rayment, GE and Lyons DJ 2010 *Soil Chemical Methods - Australasia* Australian Soil and Land Survey Handbooks Series CSIRO Publishing

Allen, DG and Jeffery, RC 1990 *Methods for analysis of phosphorus in Western Australian soils*. Report of investigation No:37. Chemistry Centre of Western Australia.

Soil type description and land capability

Isbell, R 2002 *The Australian Soil Classification* Revised Edition Australian Soil and Land Survey Handbooks Series 4

Schoknecht N and Pathan S 2013 *Soil Groups of Western Australia A simple guide to the main soils of Western Australia* Fourth edition Resource Management Technical Report 380 Department of Agriculture and Food. Western Australia

Van Gool, D, Tille P and G Moore 2005 *Land evaluation standards for land resource mapping* Third edition Resource Management Technical Report 298 Department of Agriculture and Food

Minimum requirements

- Grid survey, free or transverse survey at scale of 1:10 000

- Observations in the range of 1 per ha to a minimum of 0.25 per ha.
- On deep sands profiles, observations to extend to at least 100 cm (or to impeding layers if less than 100cm)
- Detailed profile descriptions and sampling of each main soil type at a minimum one site per 10 ha
- GPS coordinates of soil profiles and soil sampling sites or sites located on aerial photo base image
- Detailed soil profiles described to at least 100 cm (or to impeding layers if less than 100cm)
- Description of impeding layer if present
- Horizons depths recorded and for each horizon:
    - Soil colour (Munsell colour chart) main colours and mottles
    - Soil texture
    - Soil structure (if described from soil pit)
- Information on soil samples collected for analysis: sampling depths and type of analysis
- Main soil types identified and classified to WA soil group (plus Australian Soil Classification is preferred)
- The above should be included in a report (e.g. Site Management Plan) and descriptions included in Appendix
- Map of main soil types, preferably marked on aerial photo background, scale and north needs to accompany report; map should also identify area that is to be developed for horticulture. This map should show location of nearest surface drains creeks and waterways
- The depth to groundwater in winter needs to be assessed. This is difficult if studies are undertaken in summer and may require subsequent information to be provided by proponent if not available. The levels and dates of measurement need to be included in the Site Management Report.

Soil testing

Analysis for soil pH 1:5 Calcium chloride, salinity (EC 1:5), total phosphorus and soil PRI should be undertaken by an accredited laboratory.

The most important aspect for soil phosphorus (P) retention is the Phosphorus Retention Index (PRI) as described by Allen and Jeffery (1990)

Allen, DG and Jeffery, RC 1990 *Methods for analysis of phosphorus in Western Australian soils*. Report of investigation No:37. Chemistry Centre of Western Australia.

It is also important to interpretation of results of soil PRI against relevant experimental data for horticultural crops on the Swan coastal plain.

> Dellar GA, Eales M, McPharlin IR, Delroy ND, and Jeffery RC (1990) *Phosphorus retention of sandy horticultural soils on the Swan Coastal Plain* Journal of Agriculture Western Australia 4 ser. V31(1) 28-

Dellar et al (1990) has evaluated existing horticultural sites on sandy soils and assessed the P leaching with respect to the PRI. All of the P was retained in the top metre of soil from 25 years of horticultural operations in a soil with a **PRI of 7.** Based on this a **target PRI of 10 for a metre of soil would retain P for at least this period of time**.

This could be achieved by a shallower depth of higher PRI but the minimum depth of the high PRI soil should be greater than the usual operational tillage depth or 30cm. Note that this pertains to predominantly sandy soils and relies on their permeability to make contact with the subsoil and the water table must be greater than 1 metre.

Qualifications of consultant

The report should outline the experience and background of the consultant in soil survey and land capability assessment. A Certified Professional Soil Scientist or Fertcare Accredited Advisor is preferred.

Appendix D: Other considerations

Planning matter	Consideration
Protection of groundwater and surface waters	• Potential impacts of dam or drain construction (note: Approvals are generally required for dams and drain construction) • Storage of hydrocarbons, pesticides and other chemical • Levels of total suspended solids and organics in discharge waters (e.g. hydroponics) or drains/watercourses on the site • Levels of salinity and acidity of discharge waters (e.g. hydroponics).
Stormwater management	• Management of runoff from hard surfaces • Management of runoff from production area and site
Wetlands	Proposals should comply with State Government policy in regard to: • protection and management of Conservation Category Wetlands • protection and management of Resource Enhancement Wetlands, and \ • management of Multiple Use Wetlands (Water and Rivers Commission, 2001) (EPA, 2008b)
Wetland Buffers	• Wetland buffers should be determined in accordance with the Draft Guideline for the Determination of Wetland Buffer Requirements (WAPC, 2005
Watercourse protection	• Identification of suitable buffers to watercourses • Physical delineation and protection of the buffer area • Restoration of vegetated buffers

Native vegetation and bushland protection	• Protection of:
	  ○ Peel Regionally Significant Natural Areas,
	  ○ Bush Forever Sites
	  ○ Known location of Declared Rare and listed species of flora and fauna
	  ○ Threatened Ecological Communities
	  ○ Priority Ecological Communities
	  ○ Other significant vegetation and flora
	  ○ Other habitat for wildlife
	• Protection of buffers to native vegetation and bushland protection

Weeds, pests and diseases	• Compliance with control and management of species listed under the Biosecurity and Agricultural Management Act and Regulations • Other weed management • Other feral animal management
Odours	• Storage and use of manures
Visual amenity	• Existing vegetation • Proposed revegetation and landscaping
Noise	• Operating hours • Types and standards of machinery or motors
Management of effluent	• Workers ablution facilities • Effluent treatment systems
Transport impact assessment	• To consider road access standard and property access standards to local roads.
Other matters	• Dam construction approval • Drain construction approval • Groundwater abstraction licence • Building approvals • Buffers to sensitive premises • Setbacks

Appendix E: Checklist for Site Management Plans

The following provides a checklist of the types of information that should be included within a Site Management Plan. Not all information may be required for all proposals. The checklist is not intended to be used as the format/structure of the Site Management Plan. It is intended to list the types of information that are used by government to assess development applications.

Information should be provided in map form where appropriate

Site conditions	• Soil types and mapping of soil types
	  ○ Nutrient retaining capacity of soils
	  ○ Other soil capability issues
	• Site-specific land capability assessment
	• Location of vegetation, watercourses and wetlands
	• Depth to groundwater
	• Existing structures and fences

Crop and cultivation details	• Location and size of production area • Future stages of development • Types of crops • Cultivation system • Physical barriers to soil (plastics)
Nutrient inputs and management	• Fertiliser regimes – rate and frequency • Total nutrient input calculation • Nutrient content of fertiliser • Application method • Nutrient monitoring – soil and water • Crop nutrient monitoring
Irrigation management	• Type of irrigation • Water source • Irrigation control and monitoring
Nutrient Export Risk Assessment	• As per Section 9.2 of the local planning policy
Nutrient reduction strategies	• Production area design and establishment • Soil amendment • Soil ameliorants • Type of fertiliser – controlled release fertilisers • Crop monitoring and testing • Soil condition monitoring • Fertiliser application methods • Type of irrigation methods • Cultivation methods • Physical barriers • Vegetative barriers
Details of any other nutrient reduction strategies	e.g. Where not addressed above: • Offset plantings
Information to address other considerations listed in Appendix D relevant to the site and proposal	• See Appendix D