Appendices

Appendix 1. Design files, documentation of maps and cross-sections

File name	Level	Description
lward_catrock.dgn	L7	Extent of agriculture
	L17	Outside boundary
	L20	Regolith interpretation
	L21	Transects
	L22	Tags
	L23	Bores
	L24	Hydrozone numbers
	L42	Hydrozone boundary
	L60	Legend
lward_gwater.dgn	L14	Catchment boundary
	L17	Outside boundary
	L18	Groundwater flow directions
	L19	Groundwater divides
	L20	Regolith interpretation
	L21	Cross sections
	L60	Legend
lw_asect.dgn;	L16	Watertable
lw_bsect.dgn;	L17	Geological boundaries and names
lw_csect.dgn	L59	Transect text
	L61	Legend
	L62	Microtags
lw_trans1.dgn;	L16	Watertable
lw_trans2.dgn;	L17	Geological boundaries and names
lw_trans3.dgn	L58	Bores
	L59	Transect text
	L61	Legend
	L62	Microtags

Appendix 2. Land systems and soils groups

Brendan Nicholas, Natural Resource Assessment Group, Agriculture WA, Esperance

Mapping description

The descriptions apply to the whole systems, not just the portion within the Warden Lakes Recovery Catchment. The occurrences of soils within systems are estimates based on surveyor judgement and field inspection. The individual occurrences of systems within the catchment may differ considerably from the described 'norm' in terms of proportions of soils and landforms that occur within them.

Esperance System - 96,649 hectares - 56.5 per cent of catchment

Level to gently undulating plain with poor external drainage (gently undulating plains, level plain) on Tertiary marine sediments in the Esperance Sandplain Zone. **Grey deep sandy duplex (gravelly) soils and pale deep sands**. Shrub heath and mallee heath vegetation.

Soil group	%
Grey deep sandy duplex	65
Pale deep sand	25
Grey shallow sandy duplex	5
Undifferentiated soils	5

Condingup System - -2,167.4 hectares - 1.3 per cent of catchment

Gently undulating plain of sand sheets and linear dunes (gently undulating plains, level plain) on Quaternary aeolian sands in the east of the Esperance Sandplain Zone. **Pale deep sands and grey deep sandy duplex soils**. Shrub heath commonly with banksia.

Soil group	%
Pale deep sand	6
Grey deep sandy duplex	20

Gore System - 8,304 hectares - 4.9 percent of catchment

Level to very gently undulating coastal plain with numerous dunes and lakes (level plain, gently undulating plains) on Quaternary sediments over tertiary sediments in the eastern South Coast between Hopetoun and Esperance. **Alkaline grey sandy duplex soils, pale deep sands and saline wet soils**. Mallee and heath scrub and banksia shrubland.

Soil group	%
Pale deep sand	40
Alkaline grey shallow sandy duplex	35
Saline wet soil	20
Calcareous deep sand	5

Ney System - 2,888 hectares - 1.7 per cent of catchment

Low hills and hills (undulating low hills, rolling low hills) on Archean granite and gneiss with slopes of colluvium, in places aeolian sand may be present on apron slopes in the Esperance Sandplain Zone east of Esperance. **Bare rock and stony soils with slopes of grey shallow and deep sandy duplex soils and pale deep sands**. Mallee and heath vegetation.

Soil group	%
Grey shallow sandy duplex	30
Grey deep sandy duplex	30
Pale deep sand	20
Other soils	10
Bare rock	10

Halbert System - 22,561 hectares - 13.2 per cent of catchment

Gently undulating plain and salt lakes within a palaeovalley (gently undulating plains, level plain) on Tertiary marine sediments (Plantagenet and Werillup formations) in the Salmon Gums-Mallee Zone. **Alkaline grey shallow sandy duplex, pale deep sands, calcareous loamy earths and salt lake soils**. Mallee scrub vegetation.

Soil group	%
Alkaline grey shallow sandy duplex	40
Salt lake soil	25
Pale deep sand	15
Calcareous loamy earth	15
Alkaline grey deep sandy duplex	5

Scaddan System - 33,092 hectares - 19.3 per cent of catchment

Level to gently undulating plain (gently undulating plains, level plain) on Tertiary plain sediments in the Salmon Gums-Mallee Zone . **Alkaline grey shallow sandy duplex soils and calcareous loamy earths**. Mallee scrub.

Soil group	%
Alkaline grey shallow sandy duplex	75
Calcareous loamy earth	15
Pale deep sand	5
Alkaline grey deep sandy duplex	5

Wittenoom System - 1,450 hectares - 0.8 per cent of catchment

Scattered low hills and hills (undulating low hills, rolling hills) on Archean granite and gneiss with slopes of mixed colluvium in the Salmon Gums Mallee Zone. **Bare rock and stony soils with slopes of grey shallow sandy and loamy (occasionally gravelly) duplex soils.** Mallee scrub and heath vegetation.

Soil group	%
Grey/brown shallow loamy duplex	30
Grey shallow sandy duplex	30
Grey deep sandy duplex	15
Pale deep sand	10
Bare rock	10
Other soils	5

Tooregullup System - 4,064 hectares - 2.4 per cent of catchment

Coastal Dunes (undulating hills, undulating rises) on Quaternary sands in the Esperance Sandplain Zone from Bremer Bay to Cape Arid. Calcareous deep sands and calcareous shallow sands. Coastal dune scrub vegetation.

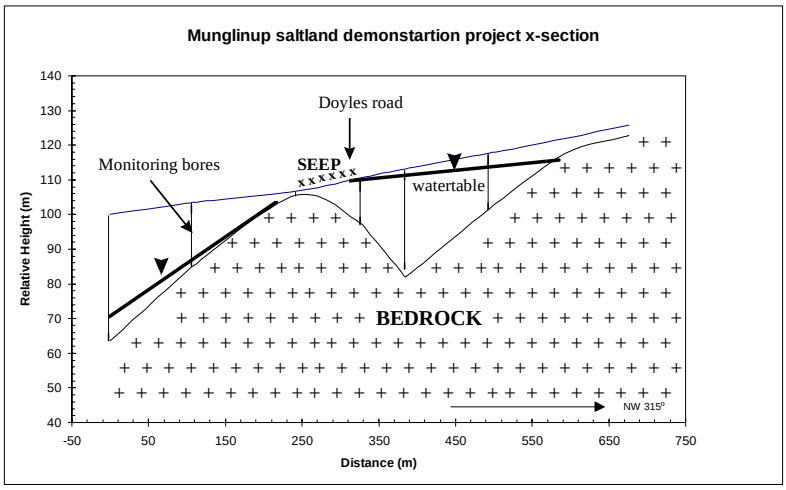
Soil group	%
Non-saline wet soil	5
Calcareous shallow sand	15
Alkaline grey shallow loamy duplex	5
Pale deep sand	10
Calcareous stony soil	20
Calcareous deep sand	45

Appendix 3. Groundwater systems responsible for dryland salinity in Esperance region

R Short, J Simons, B Nicholas & S Gee. Agriculture Western Australia, Esperance

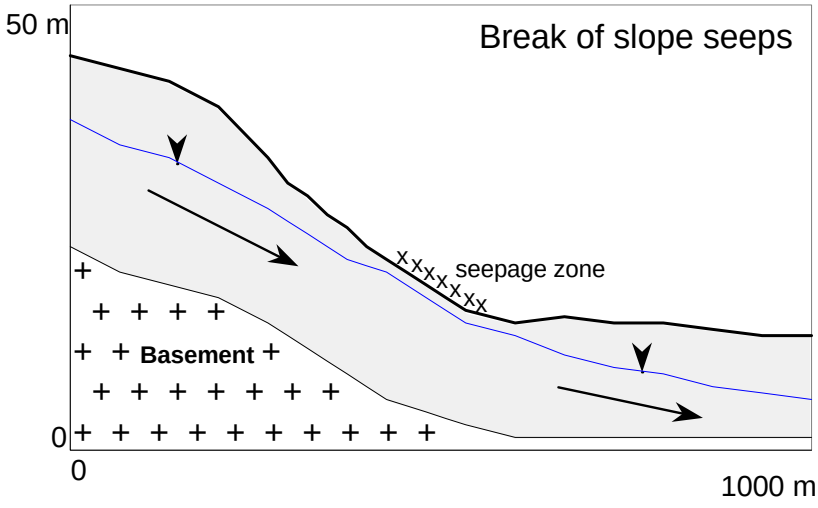
1. Seepage over bedrock highs

'Bedrock high' seeps occur when the bedrock comes close to the surface. The groundwater moving downslope is trapped behind the bedrock high and forced to the surface. The shape of the underlying bedrock is the controlling factor. The groundwater seepage at the 'Munglinup saltland demonstration project' (Doyles Road) is caused by this process (**Hy7**). This occurs in Zones 1, 2, 4, 5, 6, 7, 9.
(Ref 4.1- National Classification of Catchments for land and salinity control)



2. Seepage at break of slope

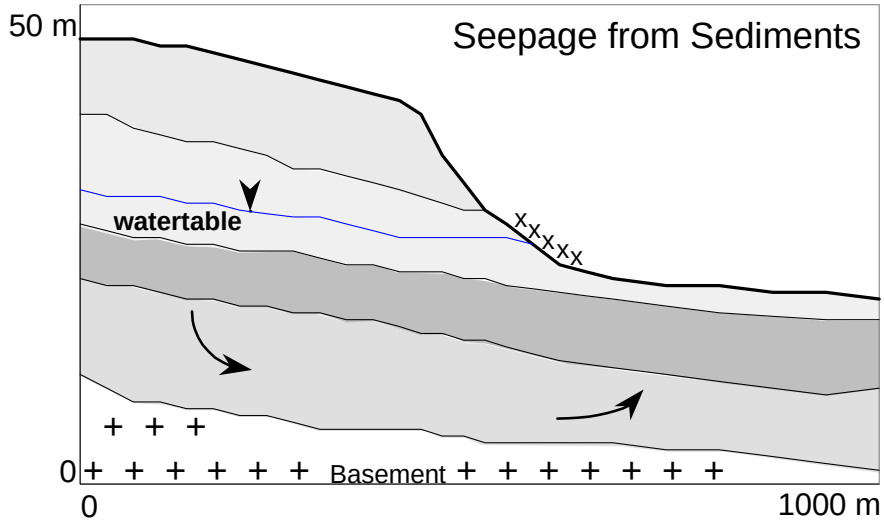
Groundwater seepage (discharge) occurs when there is a sharp decrease in surface slope (gradient), where the available area (cross-sectional) for groundwater to move through is too small to transmit the entire volume of water entering up-slope. With this groundwater process topography has more influence than hydrological factors. Examples can be seen at Munglingup and in the Neridup (**Hy3**) catchments. The process occurs in Zones 1, 2, 4, 5, 6, 7, 9.
(Ref 4.2- National Classification of Catchments for land and salinity control)



3. Seepage from sediments

Groundwater seepage occurs where sediment layers with high hydraulic conductivity are exposed or terminate along slopes (erosional-surfaces). The important factor of this process model is the contrast in hydraulic conductivities between layered sediments. This hydrological process could be responsible for the extensive seepage zones along the lower slopes adjacent to the upper tributaries of the Oldfield River. Common in Zones 4, 8 (**Hy11**).

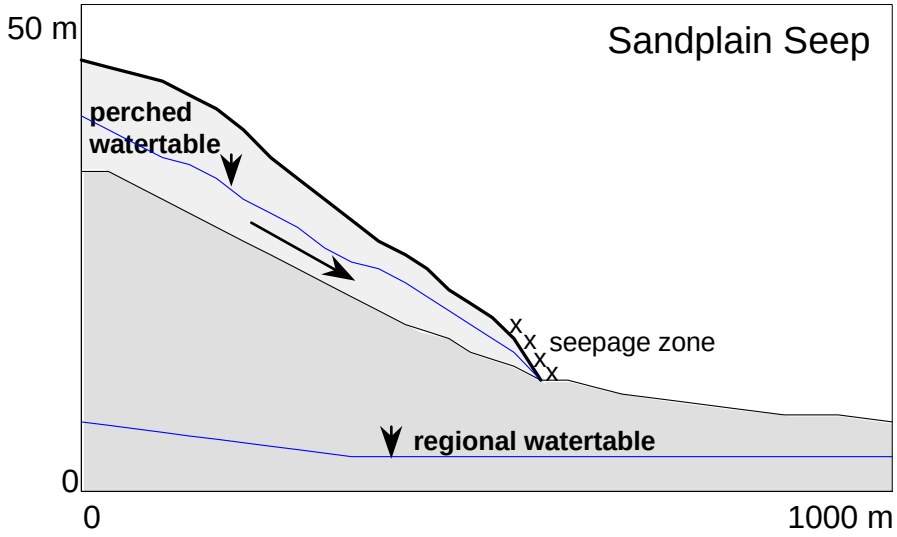
(Ref 4.5 - National Classification of Catchments for land and salinity control)



4. Sandplain seep

Groundwater seepage at the base of sands occurs at the downslope junction of deep sandy soils and finer textured soils (clays and clay loams). Water perches on the clay underneath the deep sands and groundwater seeps out where the sands 'pinch out' or are significantly thinner. This process occurs in Zones 1, 2, 4, 5, 6, 7, 9.

(Ref 4.6 - National Classification of Catchments for land and salinity control)



5. Topographic Low-Seepage/Discharge

Discharge occurs where unconfined and semi-confined aquifers with very low hydraulic gradients rise to meet low points in the topography. Hydraulic gradients are generally < 0.1 per cent. The groundwater systems have been further divided on the basis of geology, geomorphology. Within the region, the rate of rise and depth to the watertable varies, hence the risk of salinity is dependent on time.

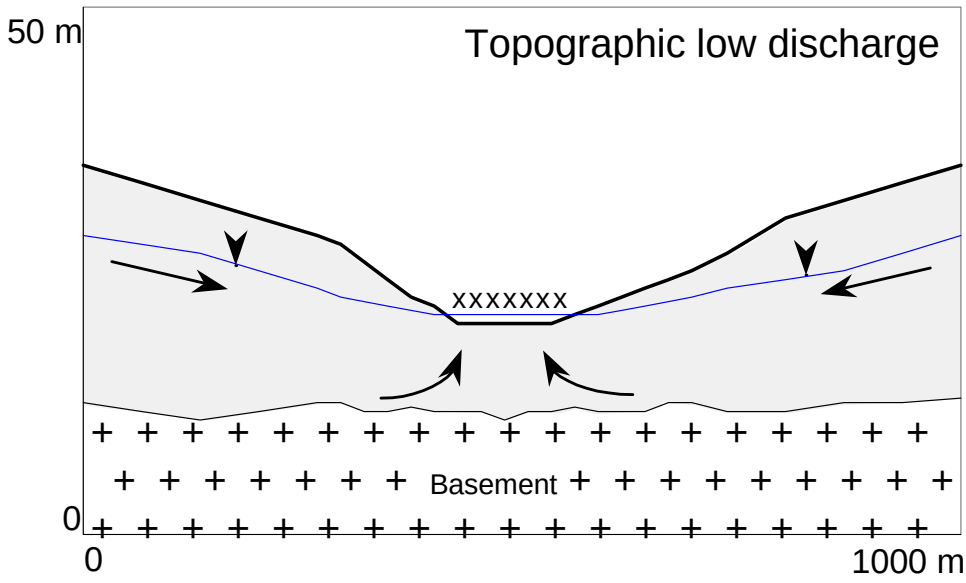
a) This process is occurring in the east-west trending salt lake chains situated in ancient paleodrainage lines trending to the north. The regolith consists of thick Tertiary sediments including the Werillup Formation. Shallow watertables <10 m from the surface intersect topographic lows including the salt lake chains. Groundwater gradients are very low - <0.1 m. Groundwater systems discharge into the salt lakes. Expressions of salinity occur between the lake chains and can be used to map the westerly migratory paths of the lakes. This process is occurring within Hydrogeological Zone 3 and is being investigated at Salmon Gums **(Hy1)** and at the top of the Neridup catchment **(HWU1).**

(Ref 4.8 - National Classification of Catchments for land and salinity control.)

b) This process is occurring on a scale from 1000 to 5000 m. Watertables are usually contained within Tertiary sediments unconformably overlying a quartz rich grit zone a few metres thick on fresh granitic basement. The regolith ranges from 5 to 40 m in thickness depending on the hydrogeological zone. Watertables are between 0 and 15 m from the surface. Rates of rise are generally 0.1 to 0.3 m/yr. This process is occurring within Hydrogeological Zones 1, 2, 4, 5, 7, 8, 9, investigated at EDRS **(Hy1)**, Neridup **(HWU1),** Greens Rd **(Hy3)** and the Munglinup Catchment. (Ref 4.15 - National Classification of Catchments for land and salinity control)

c) This groundwater system is occurring over a horizontal scale >5000 m. A lateritic weathering profile has developed on granitic basement. Large areas of silicified Tertiary sediments can unconformably overlie the weathered and laterised profile. The regolith above basement rocks contains a quartz-rich decomposed basement several metres thick that grade into quartz-rich saprolite then kaolinitic clays. Weathered profiles can be more than 40 m thick. Watertables are generally more than 15 m below the surface and have rates of rise up to 40 cm per year. This is the dominant process in Hydrogeological Zone 6.

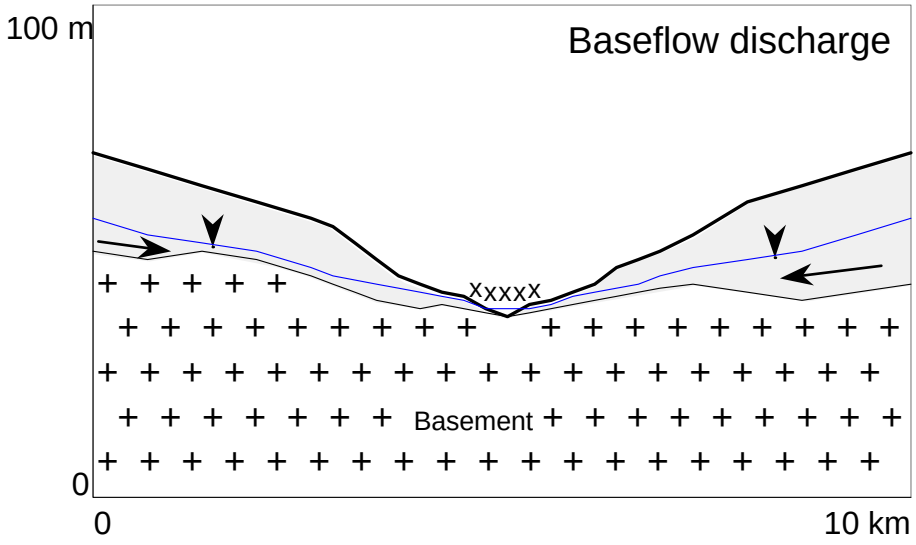
(Ref 4.15 - National Classification of Catchments for land and salinity control.)



6. Baseflow (valley floor discharge)

Baseflow discharge occurs where the base of streams and rivers intercept shallow watertables. This process is very similar to the previous hydrological model however the area contributing recharge to the watertable usually covers a much larger proportion of the catchment. Discharge occurs through a weathered granitic zone (grit) a few metres thick. Hence the groundwater system responsible is considered not only to be a local (1-3 km) but a catchment (intermediate) based system. The majority of salinity in dissected drainage lines in the region are influenced by this hydrological process and include Zones 1, 2, 4, 7b, 8, 12b **(Hy3, 6, 10, 11)**.

(Ref 4.x - National Classification of Catchments for land and salinity control.)



Appendix 4. Hydrogeological and landform attributes for zones within the Lake Warden catchments

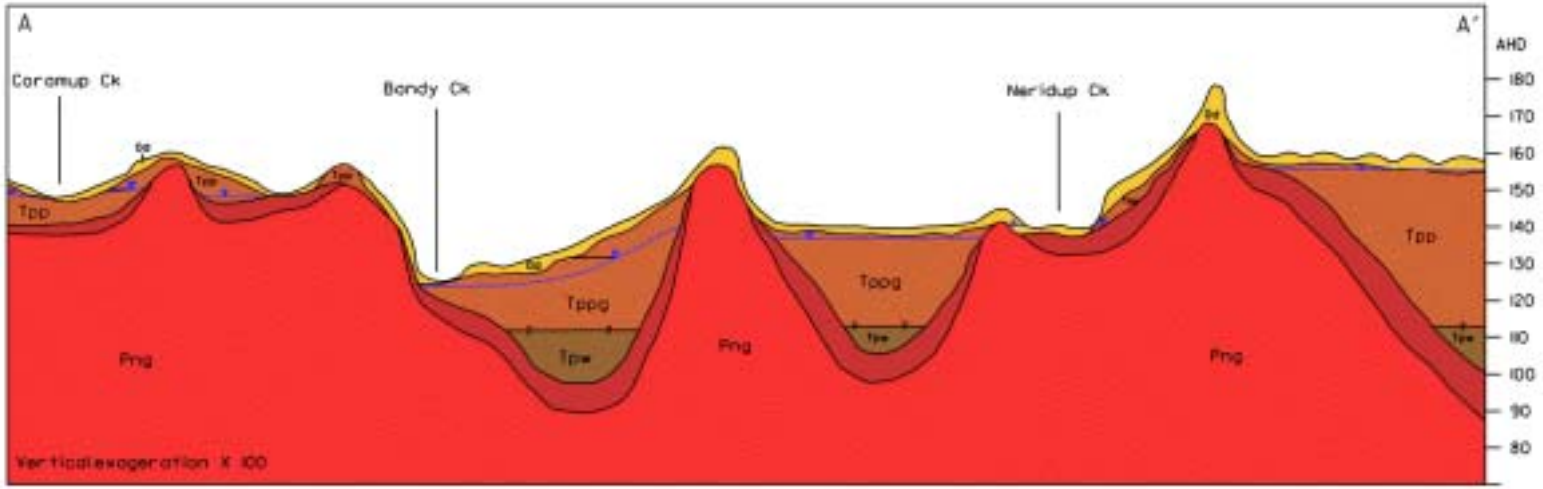
Hydrogeological attributes	Zone 1 (a) Es land system (b) Es, Co land systems	Zone 2 (a) Sc land system (b) Sc, Co land system (c) Sc - faulted basement	Zone 3 Rainfall (a) > 450 mm (b) < 450 mm	Zone 4	Zone 12 (a) Coastal plain (b) Shallow basement
Depth WT m	0 - 22	0 - 17	0 - 13	0-9	< 10 m
Water quality mS/m	45 - 5065	62 - 13300	129-8600	619-7820	Saline with fresh lenses
Rate of rise m/year	Nth. 0.1 - 0.3	0.3 - 0.5	near surface	near surface	
Salt storage t/ha 0 - 6 m	20 - 124	18 - 854	115 - 1285	20 - 898	Unknown
Depth to basement	0 - 40	0 - 40	0 - 40	0 - 40	Shallow
Weathering profile to fresh basement	Deep	Shallow with deep palaeochannels	Shallow with deep palaeochannels	Shallow	Shallow
Drainage	Internal and poorly defined	Internal and poorly defined	Numerous saltlakes and internal	Internal and shallow incised drainage	Coastal lakes and poorly drained
Rainfall mm	> 450	< 525	< 450	> 450	> 550
Landform attributes					
Relief m	< 9	< 9	< 9	< 9	< 9 (mostly < 4)
Model terrain slope	LE - GE	LE - VG	LE	LE - GE	LE
Land system	Es Co	Sc Co	Ha, Sc	Es	Go, To
Landform pattern	GP	GP	LP	GP	LP
Channel development	Incipient and erosional	Incipient	Absent	Incipient	Incipient and alluvial
Mode of geomorphological activities	Eroded or aggraded	Eroded or aggraded	Aggraded	Eroded or aggraded	Eroded or aggraded
Geomorphological agents	WI	WI	WI	WI SH	SH WI
Status of geomorph activities	Frequent	Frequent	Frequent	Frequent	Frequent
Component landform elements	1, 2, 4, 7, 8, 10	1, 2, 4, 7, 8, 10	5, 10	1, 2, 7, 8, 9, 10	1, 4, 6, 8, 9, 0,

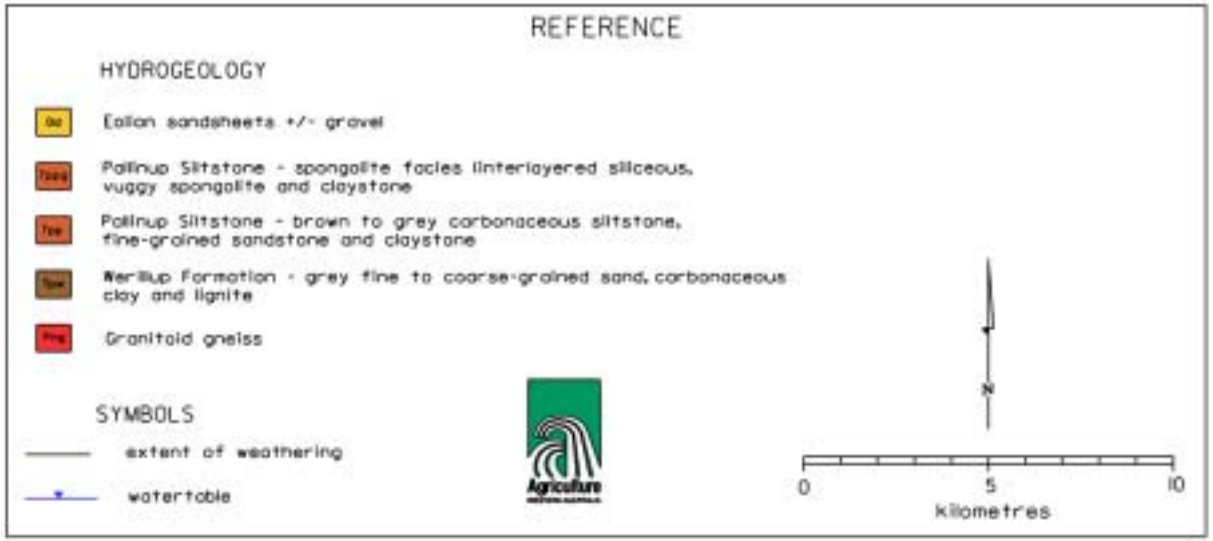
Terrain slope:	LE	=	Level (< 1%);
	VG	=	very gently inclined (1-3%);
	GE	=	gently inclined (3-10%);
	MO	=	moderately inclined (10-32%);
	VS	=	very steep (56-100%).
		=	
Land systems:	ES		Esperance
	Co	=	Condingup
	Sc	=	Scadden
	Ha	=	Halbert
	Yo	=	Young
	Hp	=	Hillup
	Go	=	Gore
	To	=	Tooregullup
	Ky	=	Kyberlup
	Ra	=	Ravensthorpe
	Mu	=	Munglinup
	Sg	=	Salmon Gums
Stream channel development:	Absent:		No traces of channelled flow can be detected
	Incipient:		Traces of channelled flow are very shallow, narrow and discontinuous.
		=	
Geomorphological agents:	WI		Wind;
	SH	=	Sheet flow, sheet wash, surface wash;
	OV	=	Overbank, streamflow, unchannelled.
		=	
Landform pattern:	GP		gently undulating plain;
	LP	=	level plain;
	UR	=	undulating rises;
	UL	=	undulating low hills;
	RH	=	rolling hills.

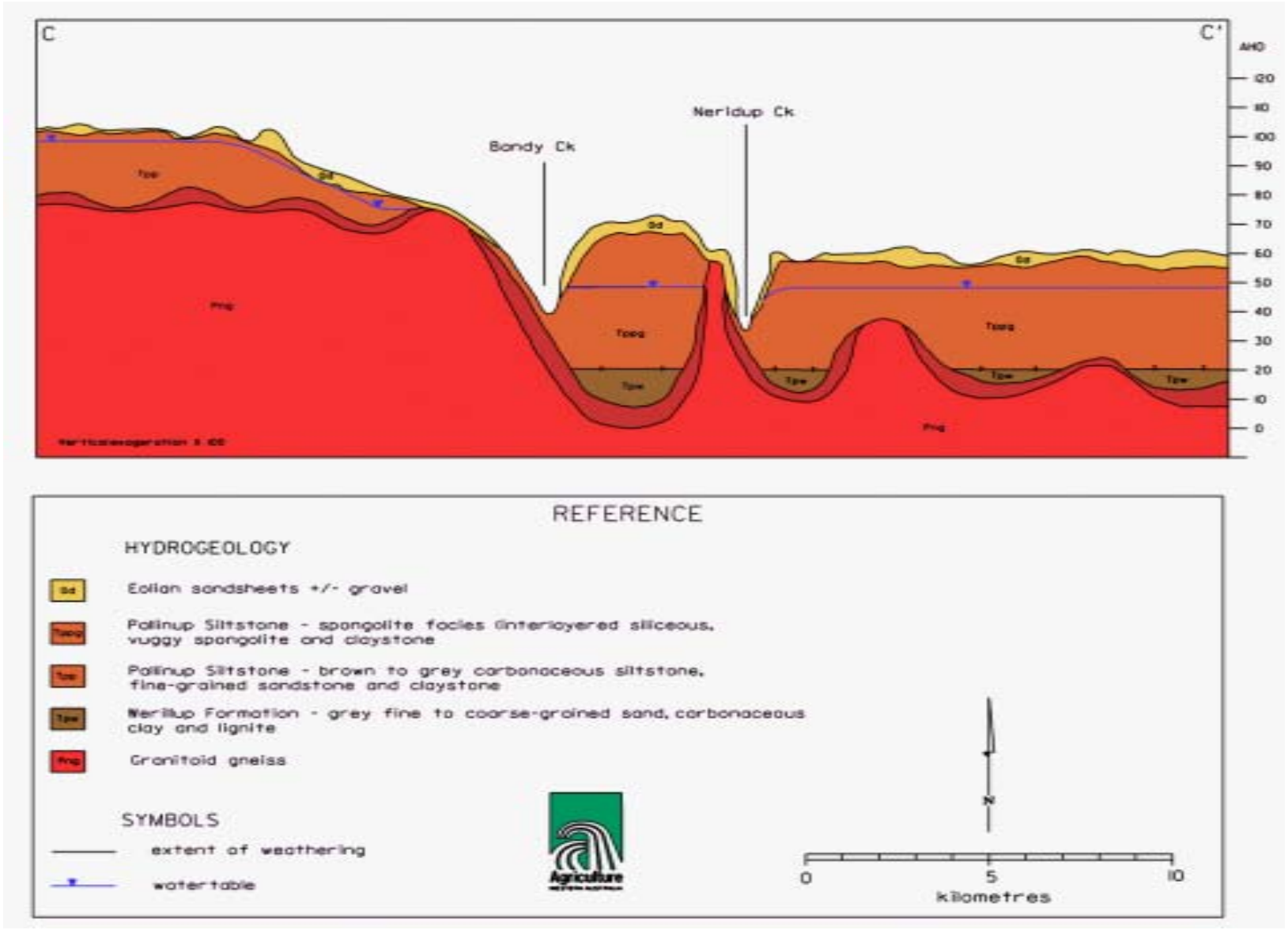
Component landform elements

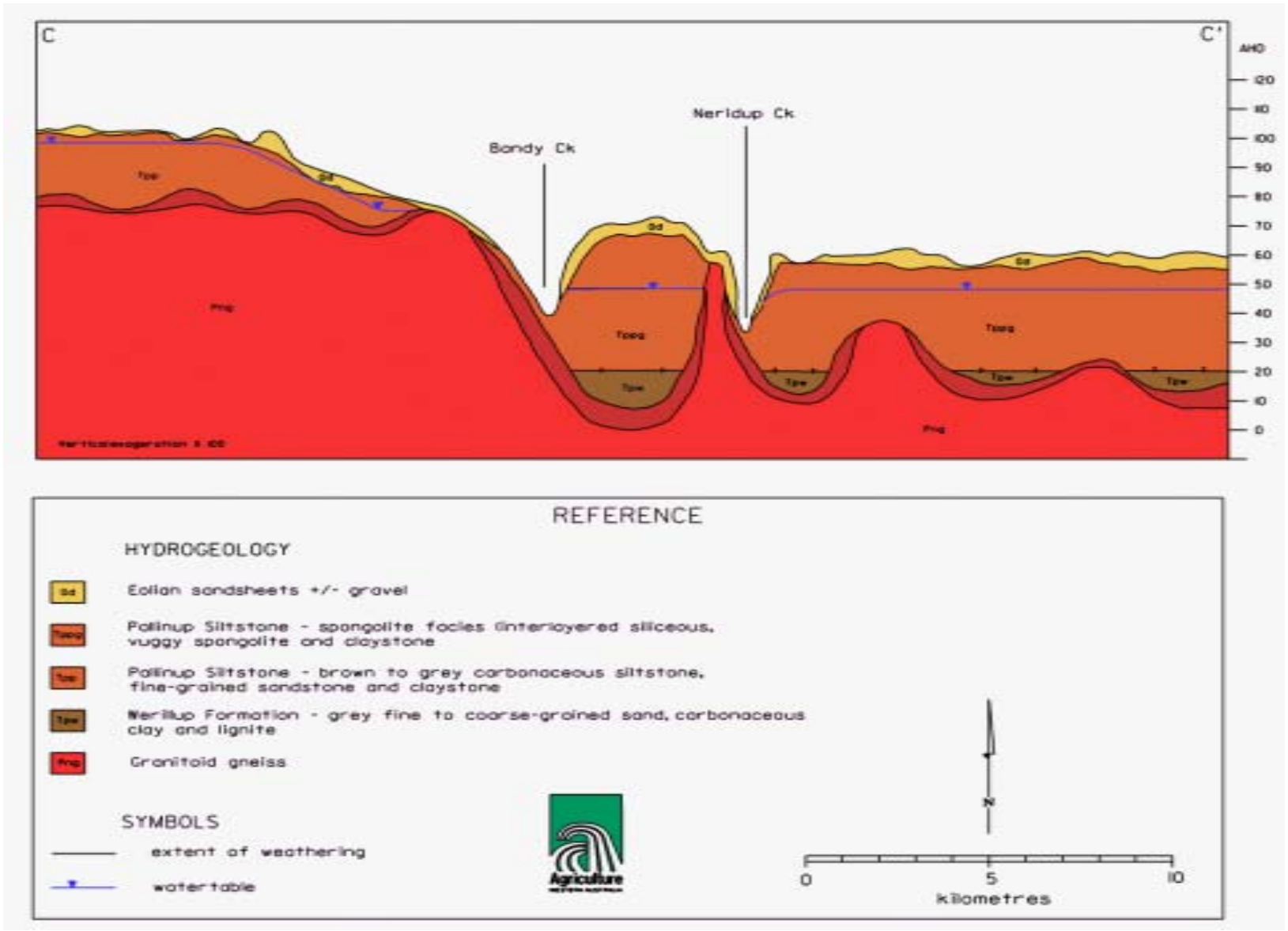
1. Level plains. Large and level, to gently inclined, plains (slope <1%), usually with internal or incipient drainage.
2. Gently undulating to undulating plains (slope 1-10%), usually drained internally.
3. Low hills. Very gently, to moderately inclined, slope (2-15%).
4. Dunes. Longitudinal dunes.
5. Playa plains.
6. Sand sheets. Broad sheet-like sand patches, slope 1-3%.
7. Saline drainage lines - palaeodrainage systems - ephemeral.
8. Rock outcrops.
9. Lakes. Large, water-filled, closed depressions.
10. Swamps. Closed or almost closed depressions with seasonal or permanent watertable. May be fresh or saline reflecting local perched or saline regional water tables. Vegetation: *Melaleuca* spp. and yate (*Eucalyptus occidentalis)*.
11. Alluvial flood plains.
12. Incised drainage lines.
13. Hills.

Appendix 5. Cross-Sections A-A', B-B' AND C-C'






C
C'
AHD
120
110
100
90
80
70
60
50
40
30
20
10
0
Bondy Ck
Neridup Ck
Sd
Tpw
Prg
REFERENCE
HYDROGEOLOGY
Eolian sandsheets +/- gravel
Pallinup Siltstone - spongolite facies (interlayered siliceous, vuggy spongolite and claystone
Pallinup Siltstone - brown to grey carbonaceous siltstone, fine-grained sandstone and claystone
Werillup Formation - grey fine to coarse-grained sand, carbonaceous clay and lignite
Granitoid gneiss
SYMBOLS
extent of weathering
watertable
Agriculture
N
0
5
10
kilometres


C
C'
Bondy Ck
Neridup Ck
AHD
120
110
100
90
80
70
60
50
40
30
20
10
0
Sd
Tpw
Prg
REFERENCE
HYDROGEOLOGY
Eolian sandsheets +/- gravel
Pallinup Siltstone - spongolite facies (interlayered siliceous, vuggy spongolite and claystone
Pallinup Siltstone - brown to grey carbonaceous siltstone, fine-grained sandstone and claystone
Werillup Formation - grey fine to coarse-grained sand, carbonaceous clay and lignite
Granitoid gneiss
SYMBOLS
extent of weathering
watertable
Agriculture
N
0
5
10
kilometres

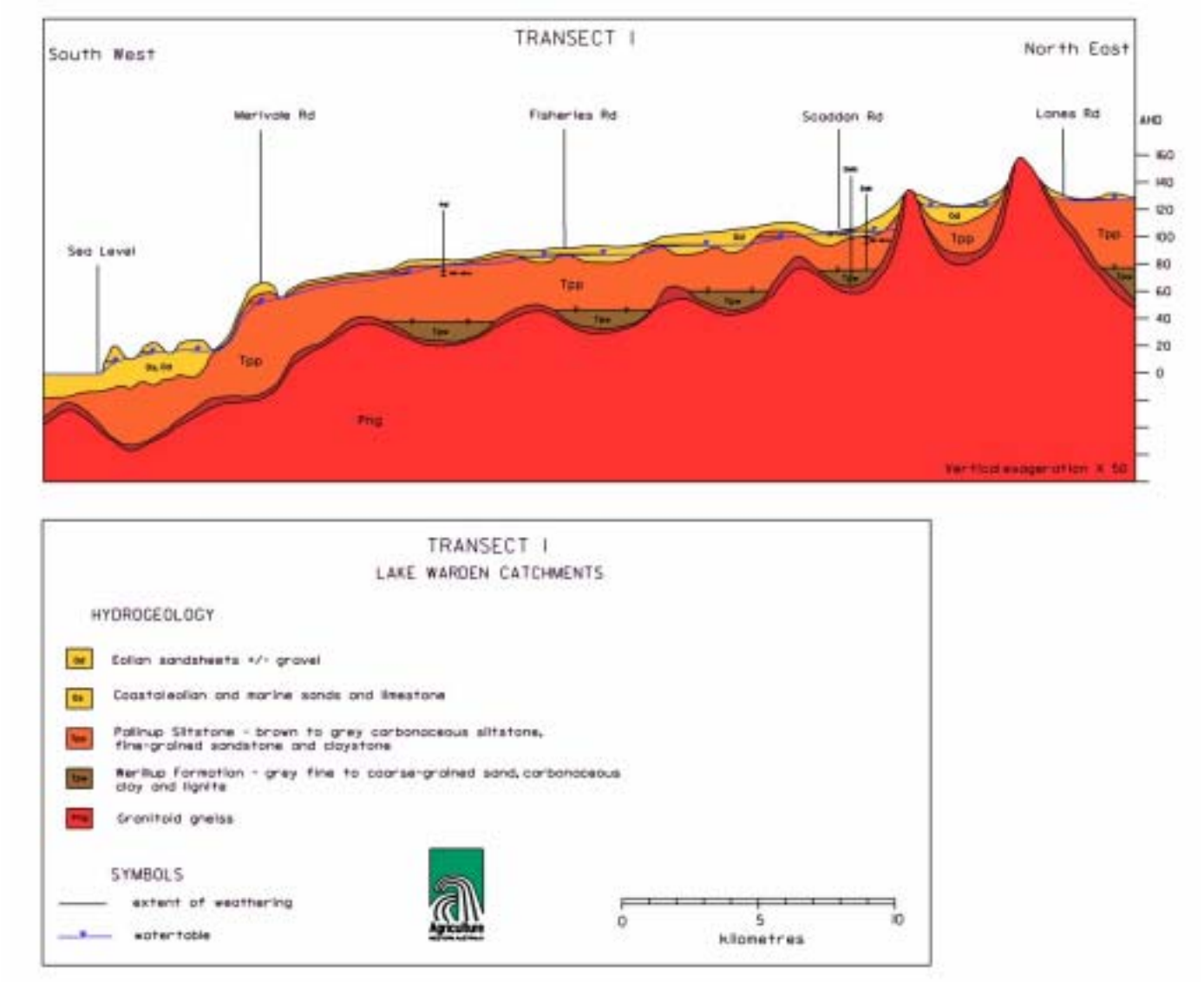
Appendix 6. Location of monitoring bores along Transects 1 to 3

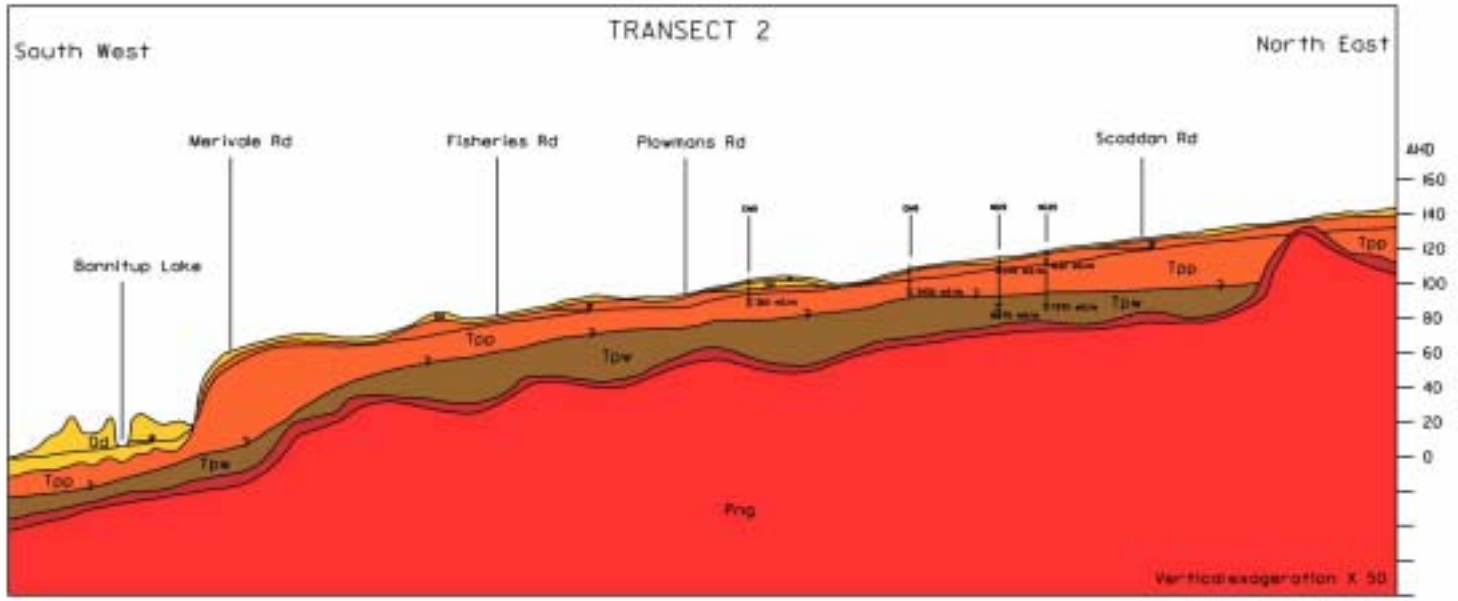
Bore name	North-ing	Easting	Eleva-tion	Hydro zone	Catchment	Map unit
AG1	6266744	416459	83	1B	Bandy Creek	Esperance System (245Es)
AG16	6285185	419731	127.82	2B	Neridup Creek	Esperance System (245Es)
AG16S	6285185	419731	127.89	2B	Neridup Creek	Esperance System (245Es)
CBC1s	6265580	402130	69	1A	Coramup Creek	Esperance System (245Es)
CBC1s	6265580	402130	69	1A	Coramup Creek	Esperance System (245Es)
CBC2	6267000	404200	77	1A	Bandy Creek	Esperance System (245Es)
EM8	6274321	415147	112	1A	Neridup Creek	Esperance System (245Es)
EM9	6278407	417370	107.25	1A	Neridup Creek	Esperance System (245Es)
EM10	6273499	430710	109.54	1B	Kau area	Esperance System (245Es)
EM11	6273636	430836	114.81	2A	Kau area	Esperance System (245Es)
NG1D	6288072	422562	134.39	2a	Neridup Creek	Halbert System (246Ha)
NG2D	6288655	423095	135.17	2a	Neridup Creek	Halbert System (246Ha)
NG2S	6288655	423095	135.17	2A	Neridup Creek	Halbert System (246Ha)
NG3	6288934	422753	136.67	2A	Neridup Creek	Halbert System (246Ha)
NG4	6289978	421401	149.56	2B	Neridup Creek	Halbert System (246Ha)
NG10	6288691	416766	146.89	2B	Bandy Creek	Scadden System (246Sc)
NG11	6288081	418151	150.91	2B	Bandy Creek	Scadden System (246Sc)
NG12D	6283693	418331	122.27	2B	Bandy Creek	Esperance System (245Es)
NG12S	6283693	418331	122.48	2B	Bandy Creek	Esperance System (245Es)
NG19D	6279603	419690	111.52	1A	Neridup Creek	Esperance System (245Es)
NG19S	6279603	419690	111.52	1A	Neridup Creek	Esperance System (245Es)
NG20D	6279862	421015	113.71	1A	Neridup Creek	Esperance System (245Es)
NG20S	6279862	421015	113.71	1A	Neridup Creek	Esperance System (245Es)
TF1	6273810	430874	113.8	1B	Kau area	Condingup and Esperance System (245Es)
TF2	6273810	430874	113.78	1B	Kau area	Condingup and Esperance System (245Es)
TF3	6273941	430755	113.97	1B	Kau area	Condingup and Esperance System (245Es)
TF4	6274016	430657	114.62	1B	Kau area	Condingup and Esperance System (245Es)
TF6	6274129	430549	117.87	1B	Kau area	Condingup and Esperance System (245Es)
TF8	6273528	430358	107.69	1B	Kau area	Condingup and Esperance System (245Es)

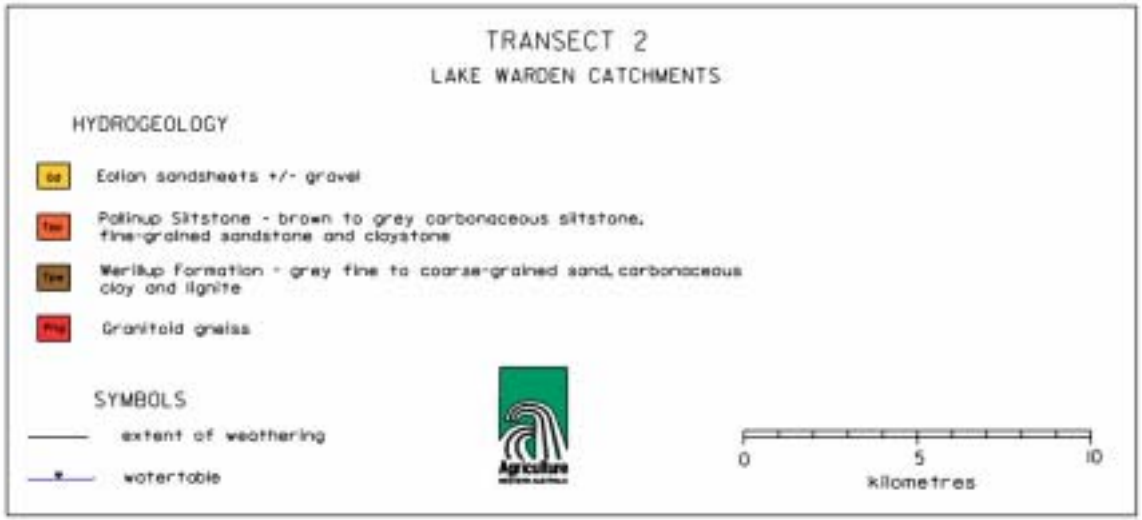
Appendix 7. Attributes of monitoring bores located along Transects 1 To 3

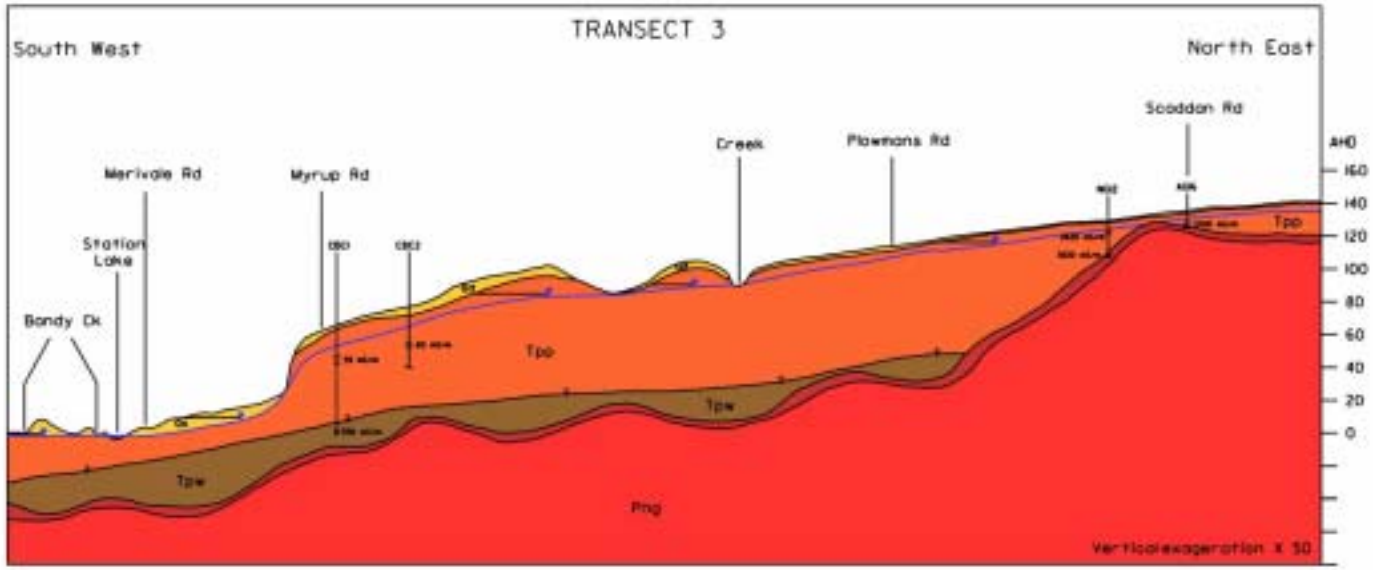
Bore name	Depth drilled	Casing length	Screen from:	Screen to:	Last monitored	SWL last:	mS/m max:	SWL min:	SWL max:
AG1	11	10.38	- 8.38	- 10.38	17-11-98	- 4.99	390	- 5.52	- 4.59
AG16	14.5	11.6	- 9.6	- 11.6	17-11-98	- 0.42	3700	- 2.27	- 0.42
AG16S	5.6	5.59	5.59	3.59	18-11-98	- 0.41	3610	- 2.28	- 0.41
CBC1d	65.5	65	59	65	13-02-95	- 15.5	550		
CBC1s	24.5	24	18	24	13-02-95	- 10	55		
CBC2	35.5	23.5	17.55	23.5	14-02-95	- 8.6	60		
EM8	28.5	13.26	13.26	11.26	17-11-98	- 6.06	380	- 8.41	- 5.74
EM9	33	14	14	12	26-11-98	- 1.14	3430	- 2.9	- 0.66
EM10	44	6.48	6.48	4.48	17-11-98	- 3.4	865	- 5.83	- 3.22
EM11	36	15.52	15.52	13.52	09-02-99	- 7.38	968	- 10.85	- 7.25
NG1D	26	19.57	19.57	17.57	31-03-98	- 1.68	6380	- 2.32	- 0.31
NG2D	32	30.68	30.68	28.68	31-03-98	- 2.14	6710	- 2.59	- 0.59
NG2S	8	7.62	7.62	5.62	31-03-98	- 1.99	5980	- 2.59	- 0.41
NG3	8	7.65	7.65	5.65	31-03-98	- 2.29	5490	- 3.36	- 0.88
NG4	14.3	14.3	14.3	12.3	31-03-98	- 5.4	4240	- 6.43	- 4.3
NG10	32	28.18	28.18	26.18	12-12-96	- 13.56	4090	- 13.71	- 13.56
NG11	35.4	30.5	30.5	28.5	22-07-98	- 9.31	4760	- 9.76	- 9.29
NG12 D	23.12	23.12	23.12	21.12	19-11-98	- 2.21	3830	- 2.21	- 1.58
NG12S	8	7.97	7.97	5.97	19-11-98	- 2.2	2620	- 2.28	- 1.63
NG19 D	40.2	29.11	29.11	27.11	04-06-98	- 3.58	13670	- 4.73	- 2.92
NG19S	8	7.32	7.32	5.32	04-06-98	- 2.98	970	- 4.06	- 2.15
NG20 D	40.2	31.92	31.92	29.92	04-06-98	- 3.63	7270	- 5.21	- 3.63
NG20S	7	6.85	6.85	4.85	04-06-98	- 3.18	1632	- 4.74	- 2.76
TF1	45	30.47	30.47	28.47	29-09-98	- 6.77	760	- 7.14	- 6.27
TF2	7.7	7.3	7.3	5.3	29-09-98	- 6.53	352	- 6.91	- 6.37
TF3	10	8.9	8.9	6.9	29-09-98	- 7.15	157	- 7.35	- 6.8
TF4	10	9.37	9.37	7.37	29-09-98	- 7.12	493	- 7.9	- 6.77
TF6	5.5	5.12	5.12	3.12	29-09-98	- 5.12	dry	dry	dry
TF8	3.5	3.2	3.2	1.2	29-09-98	- 2.41	86	- 2.7	- 1.43

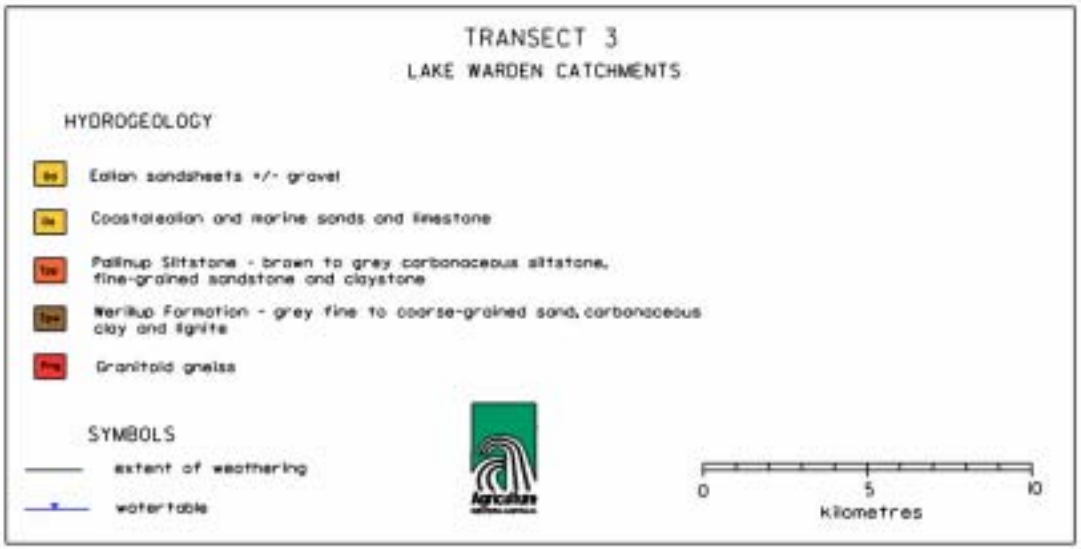
Appendix 8. Transect cross-sections




TRANSECT 2
South West
North East
Merivale Rd
Fisheries Rd
Plowmans Rd
Scaddan Rd
Bannitup Lake
ASD
160
140
120
100
80
60
40
20
0
Qd
Tpp
Tpw
Png
Vertical exageration X 50


TRANSECT 2
LAKE WARDEN CATCHMENTS
HYDROGEOLOGY
Qd
Eolian sandsheets +/- gravel
Tpp
Pallinup Siltstone - brown to grey carbonaceous siltstone, fine-grained sandstone and claystone
Tpw
Werillup Formation - grey fine to coarse-grained sand, carbonaceous clay and lignite
Png
Granitoid gneiss
SYMBOLS
extent of weathering
watertable
Agriculture
0
5
10
kilometres

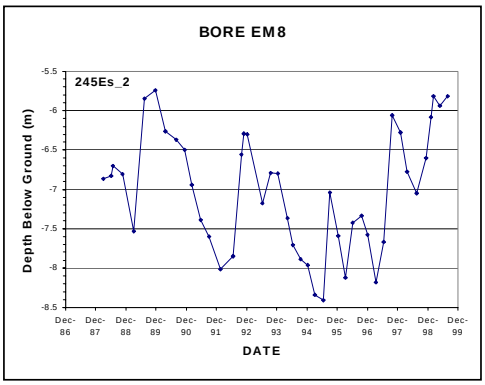

TRANSECT 3
South West
North East
Scaddan Rd
Creek
Plowmans Rd
Merivale Rd
Myrup Rd
Station Lake
Bandy Ck
Tpo
Tpw
Png
Vertical exageration X 50
AHD
160
140
120
100
80
60
40
20
0

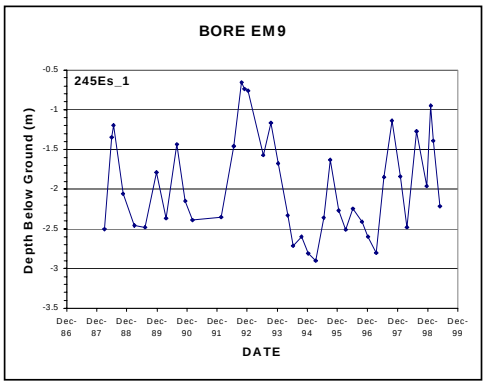

TRANSECT 3
LAKE WARDEN CATCHMENTS
HYDROGEOLOGY
Eolian sandsheets +/- gravel
Coastal eolian and marine sands and limestone
Pallinup Siltstone - brown to grey carbonaceous siltstone, fine-grained sandstone and claystone
Werillup Formation - grey fine to coarse-grained sand, carbonaceous clay and lignite
Granitoid gneiss
SYMBOLS
extent of weathering
watertable
Agriculture
0
5
10
kilometres

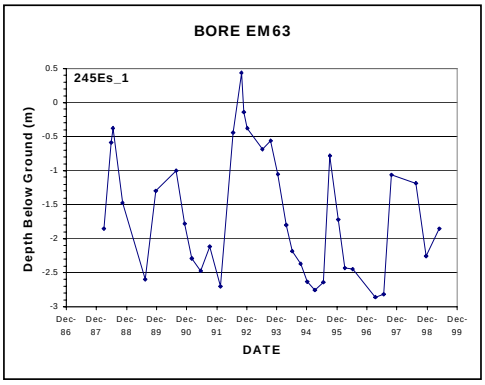
Appendix 9. Lake Warden Catchments – Hydrographs of AGWEST bores in each hydrogeological zone

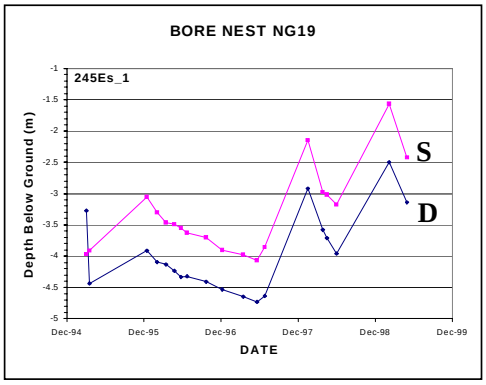
Compiled by John Simons, Agriculture Western Australia, Catchment Hydrology Group, Esperance

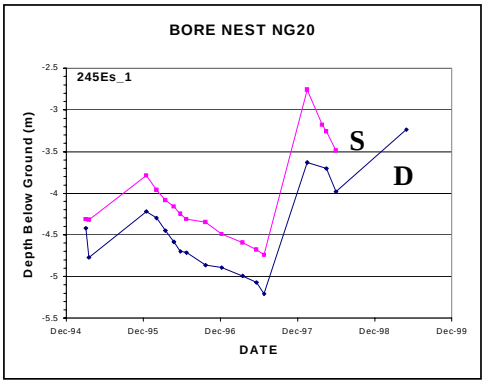
HYDRO - ZONE

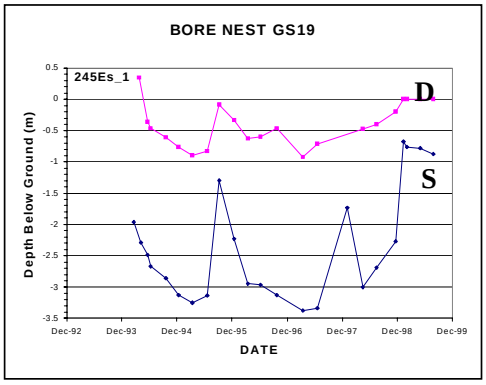


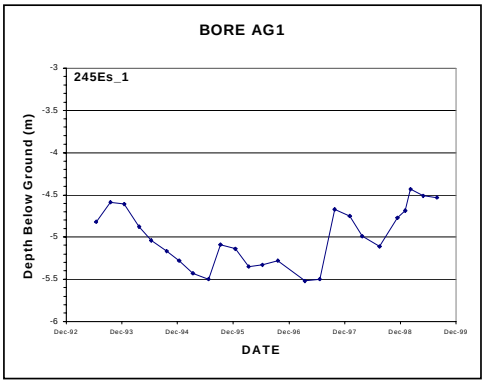




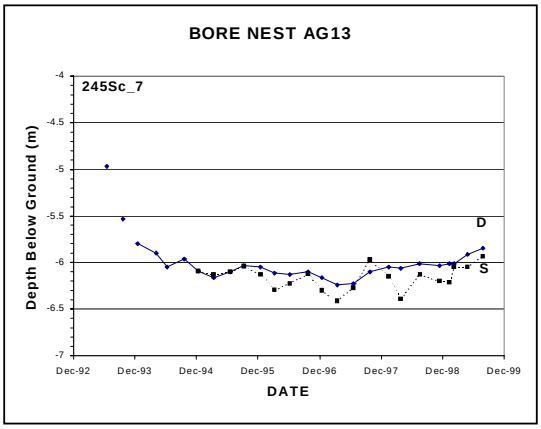


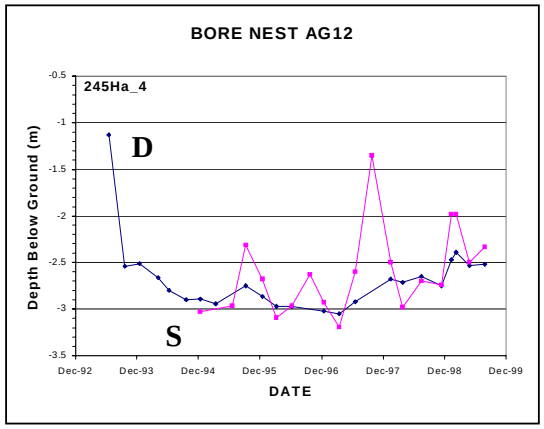


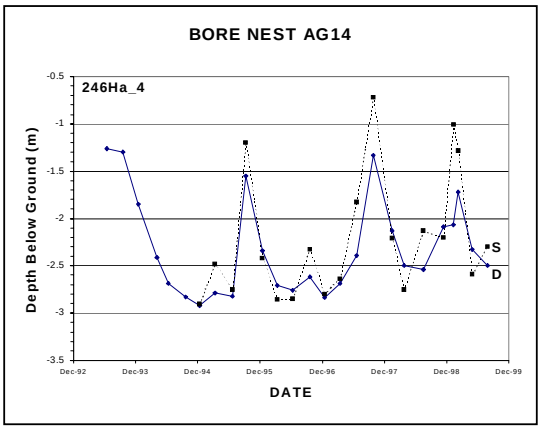


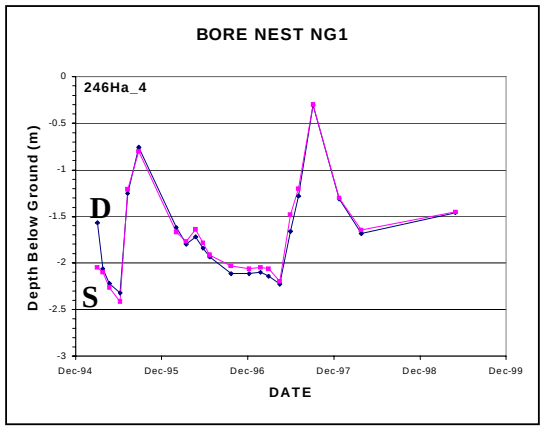


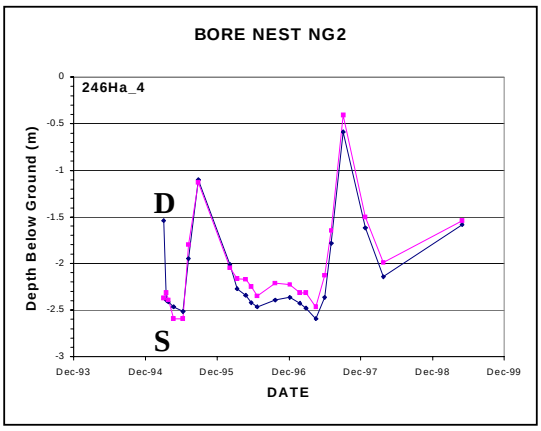
HYDRO - ZONE 2a

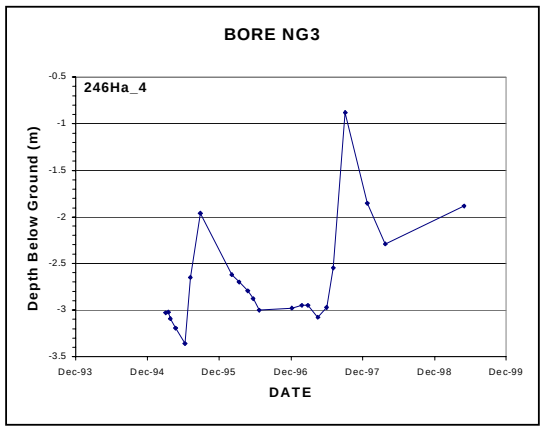


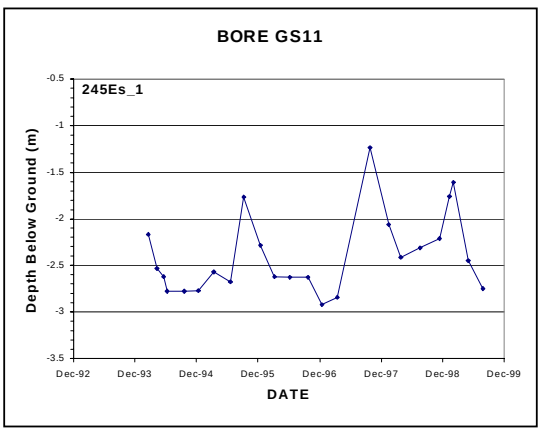


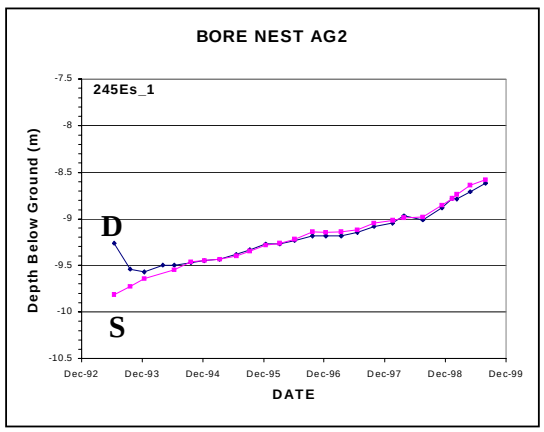




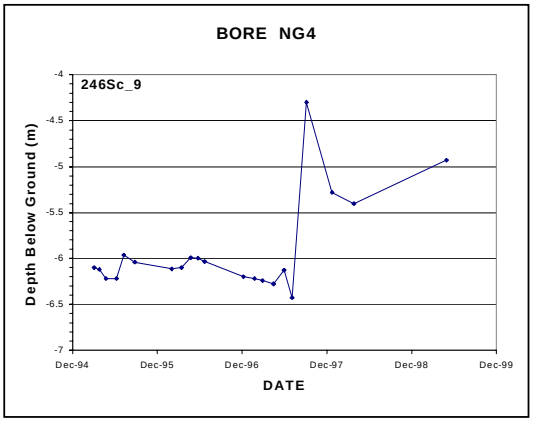


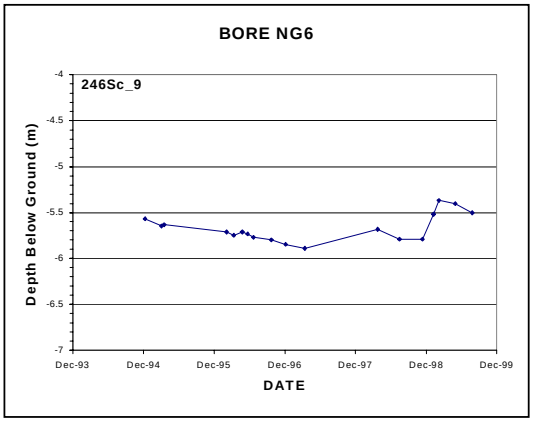


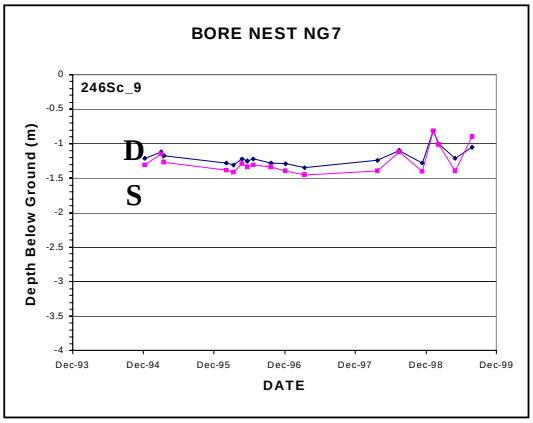


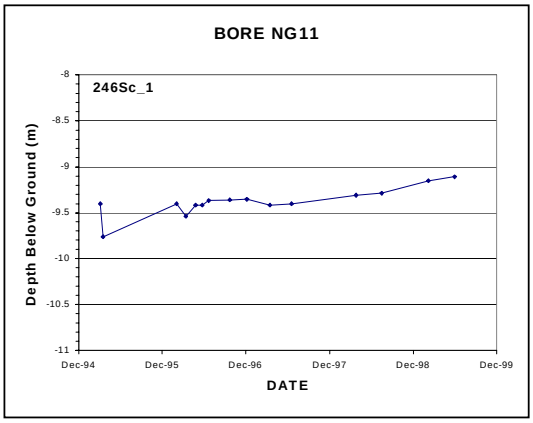


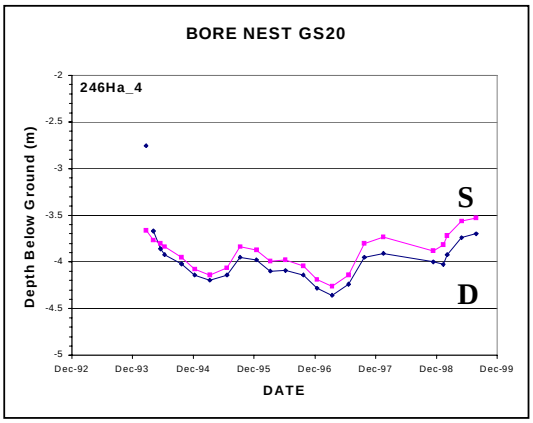
HYDRO - ZONE 2b

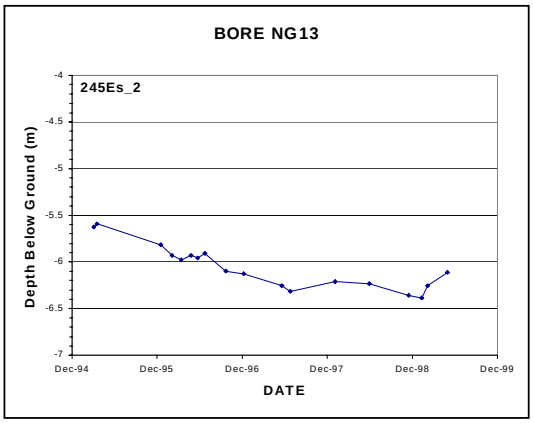


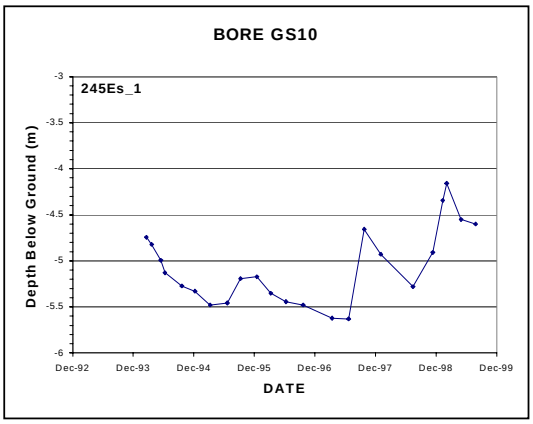


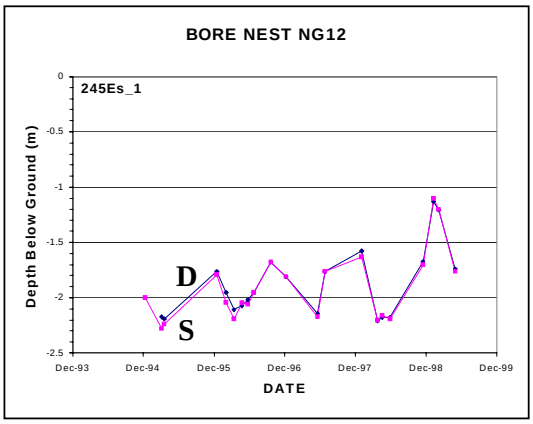












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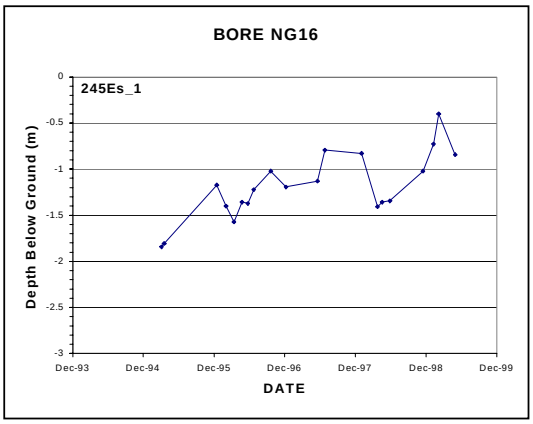

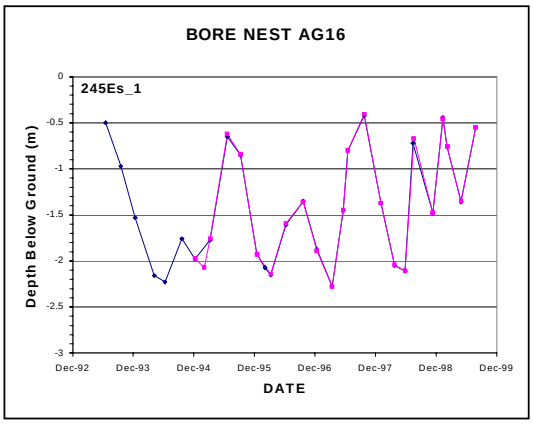

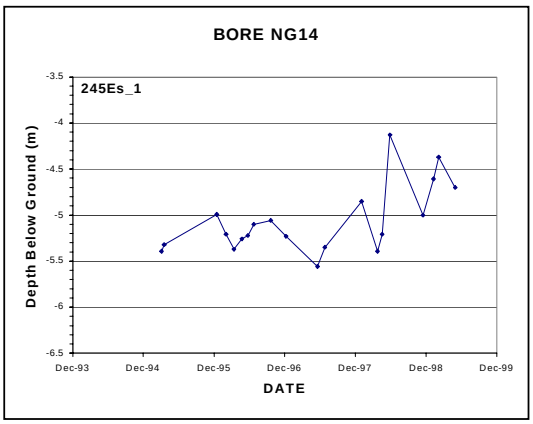

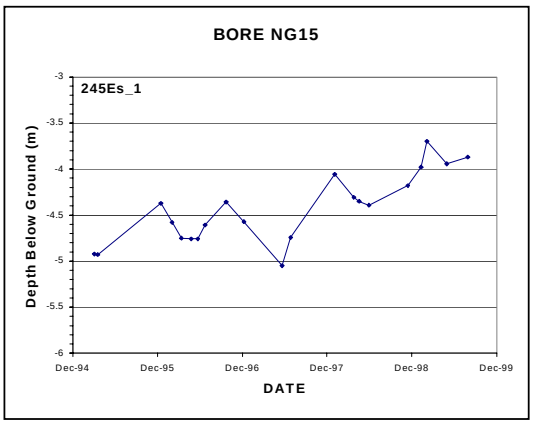

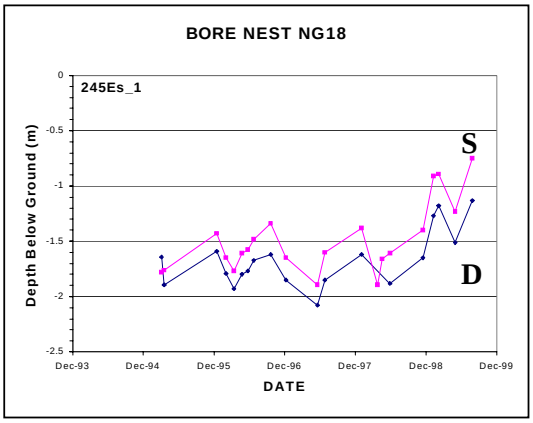

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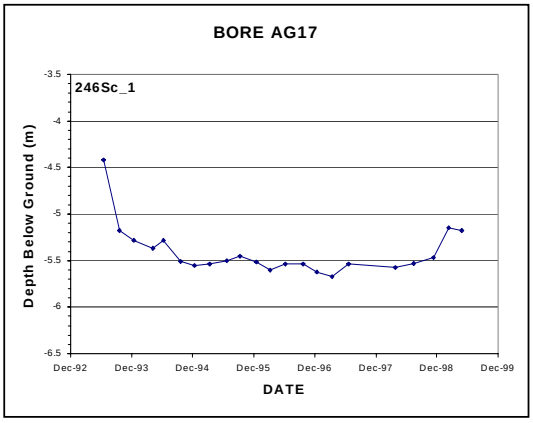

HYDRO - ZONE 4