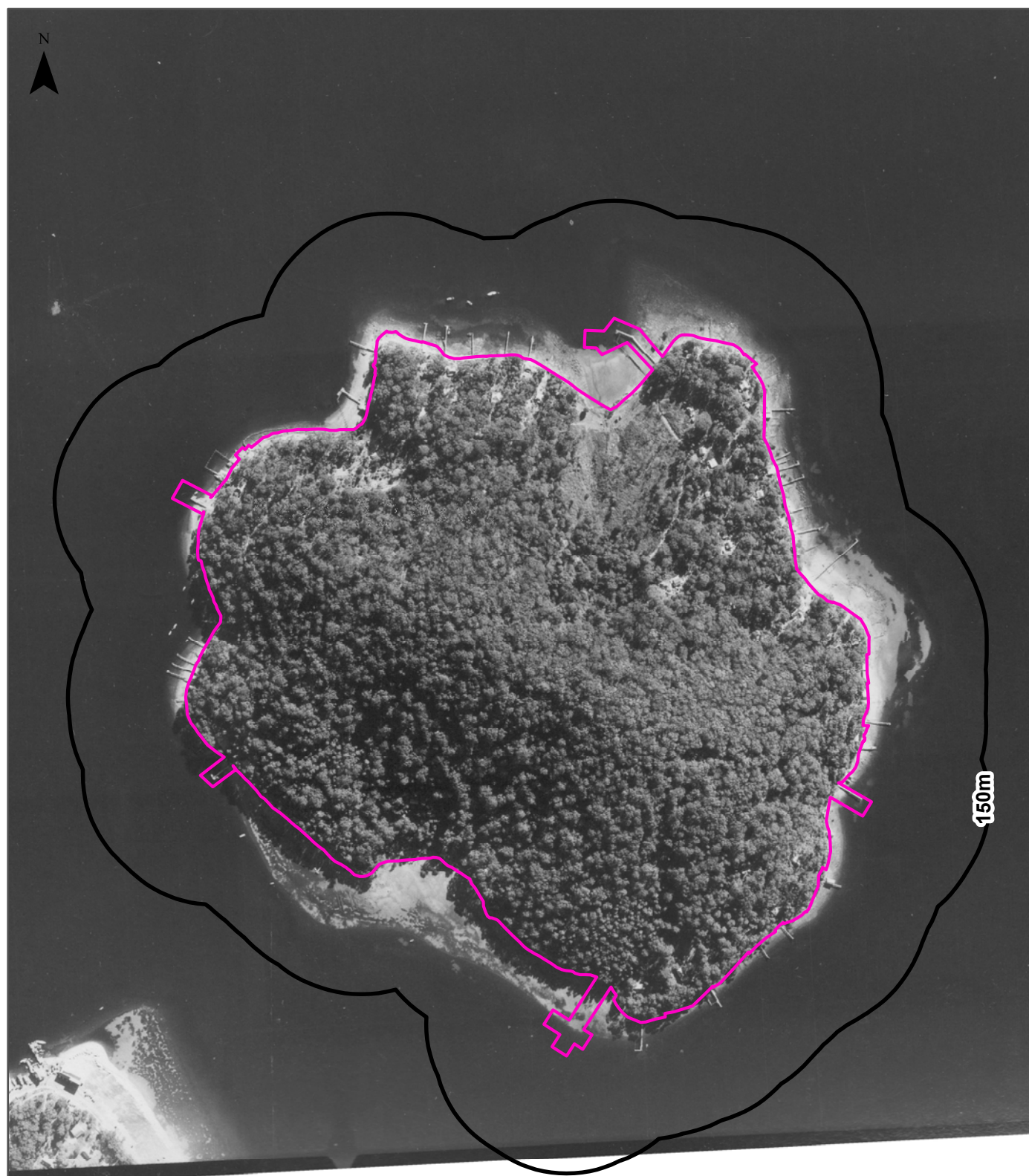


Aerial Imagery 1961

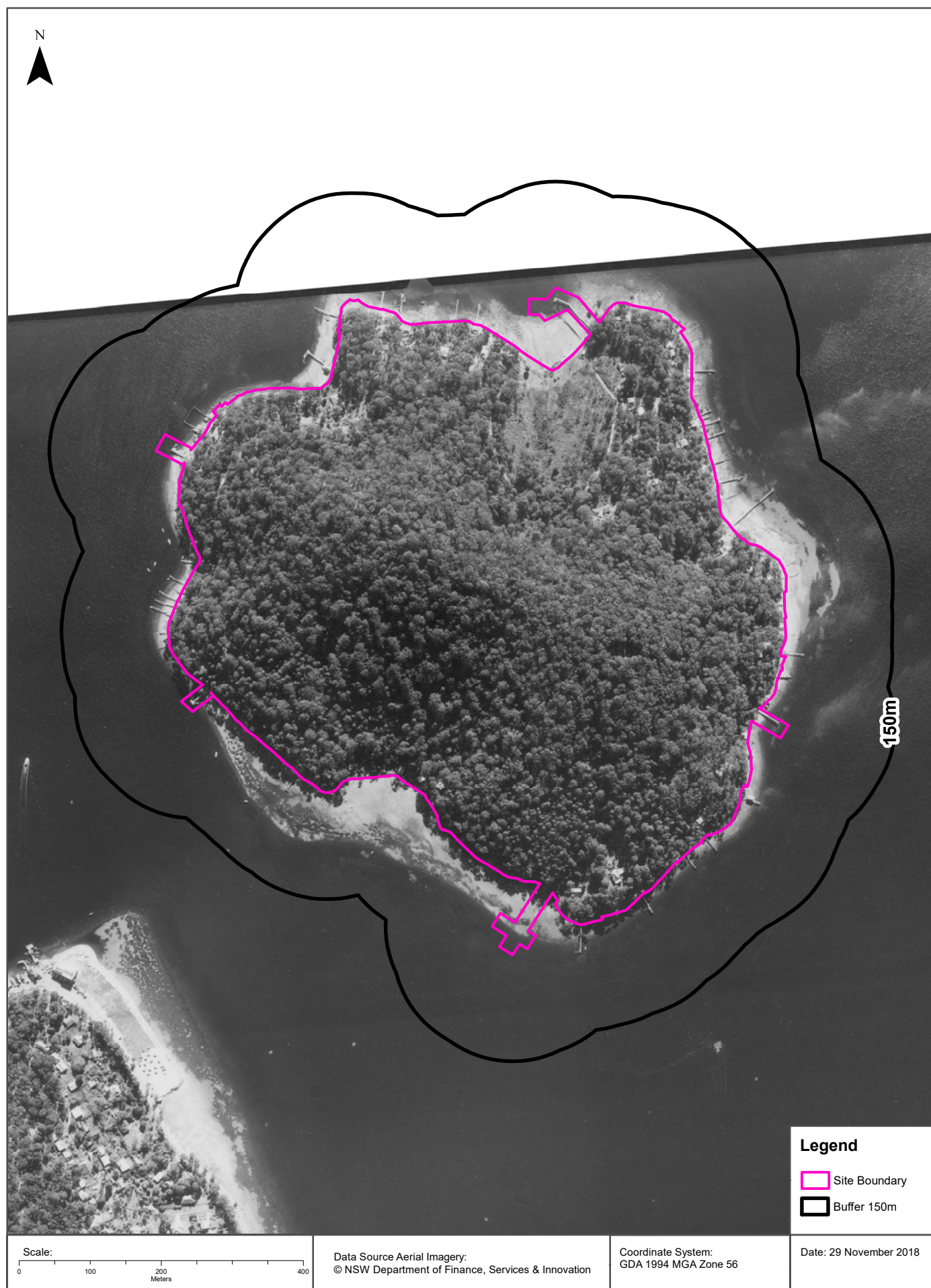
Scotland Island, Pittwater, NSW 2105



<p>Scale:</p> <p>0 100 200 400</p> <p>Meters</p>	<p>Data Source Aerial Imagery:</p> <p>© NSW Department of Finance, Services & Innovation</p>	<p>Coordinate System:</p> <p>GDA 1994 MGA Zone 56</p>	<p>Legend</p> <p>Site Boundary</p> <p>Buffer 150m</p> <p>Date: 29 November 2018</p>
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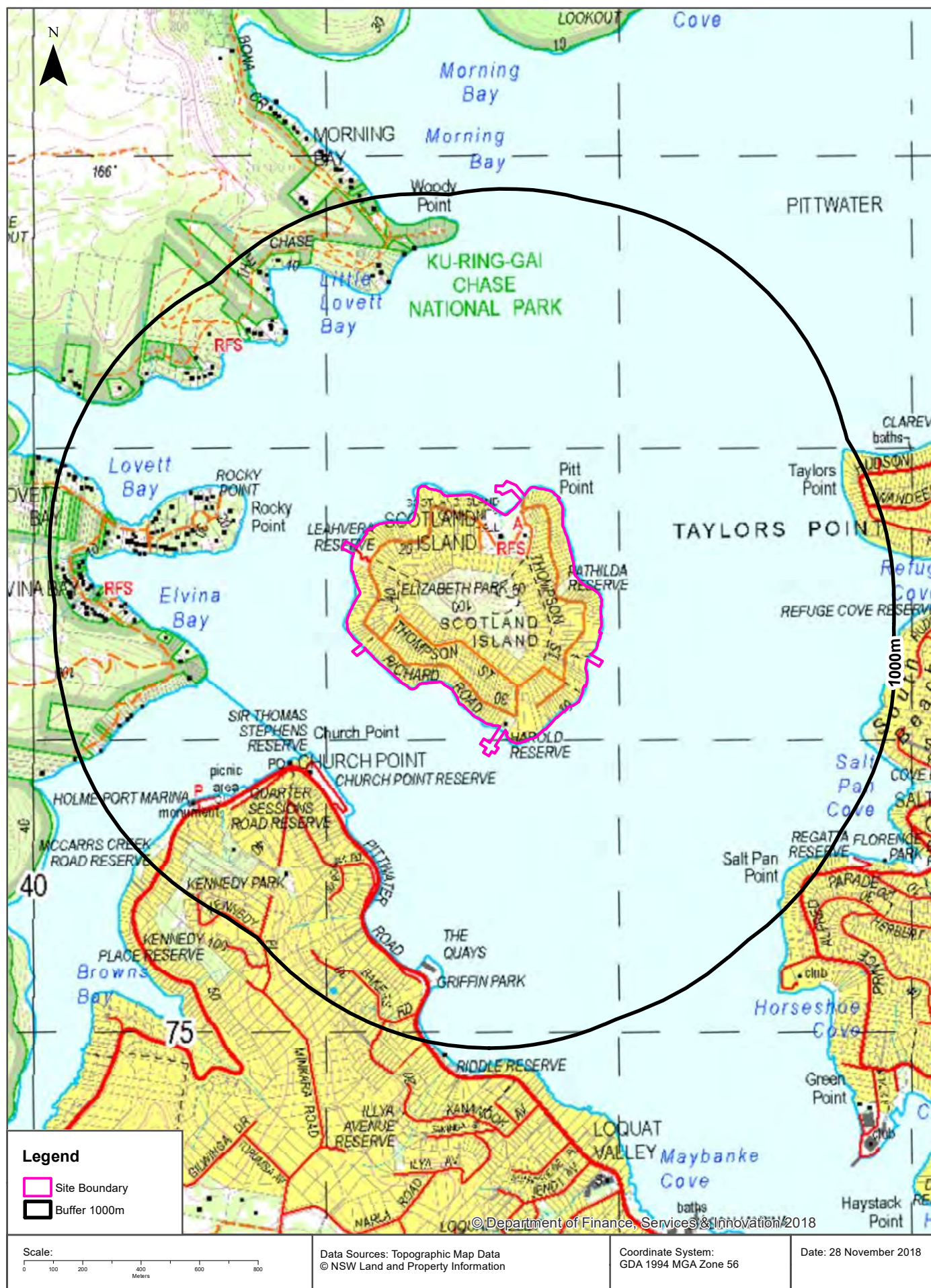
Aerial Imagery 1961

Scotland Island, Pittwater, NSW 2105



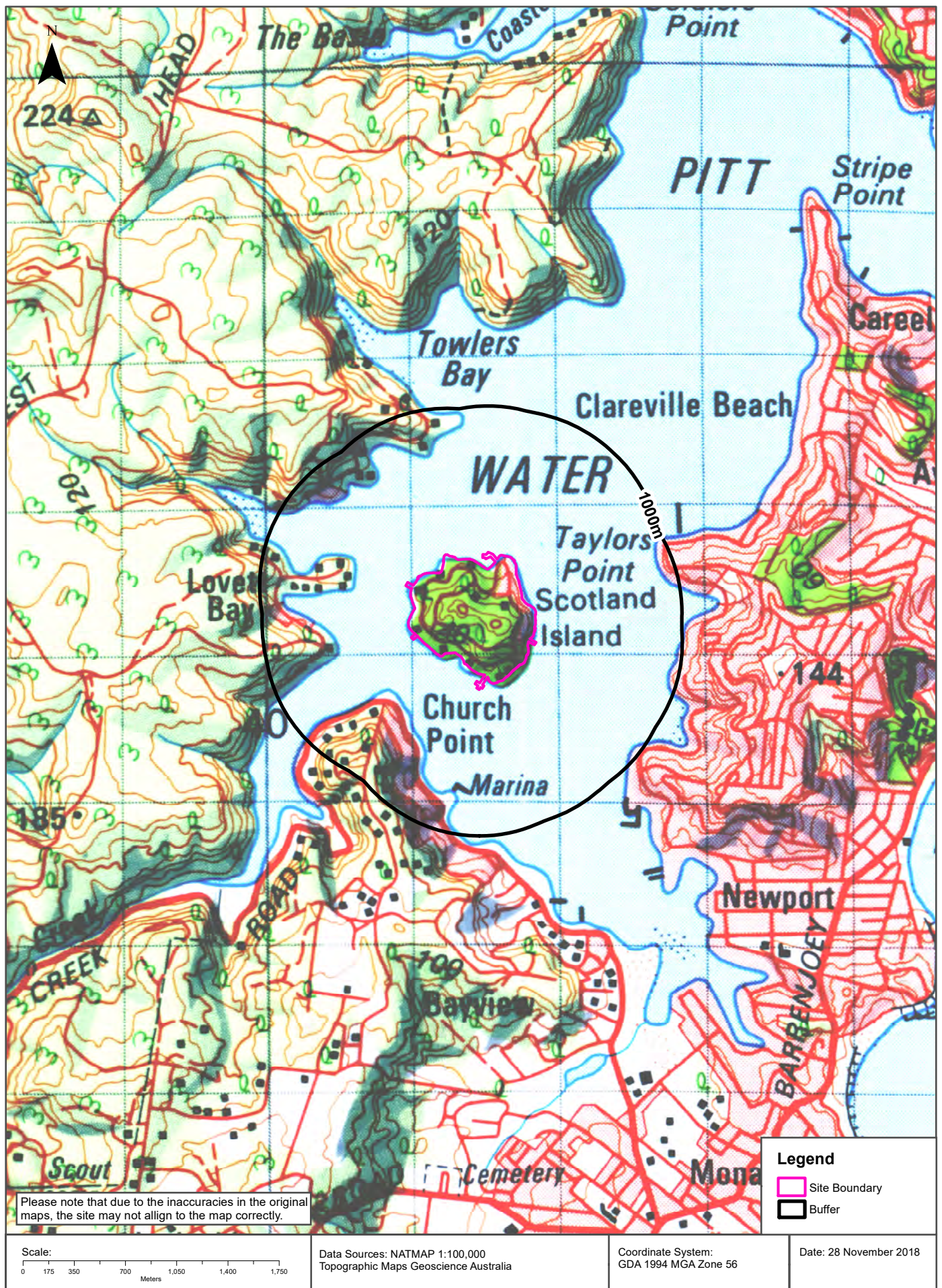
Topographic Map 2015

Scotland Island, Pittwater, NSW 2105



Historical Map 1975

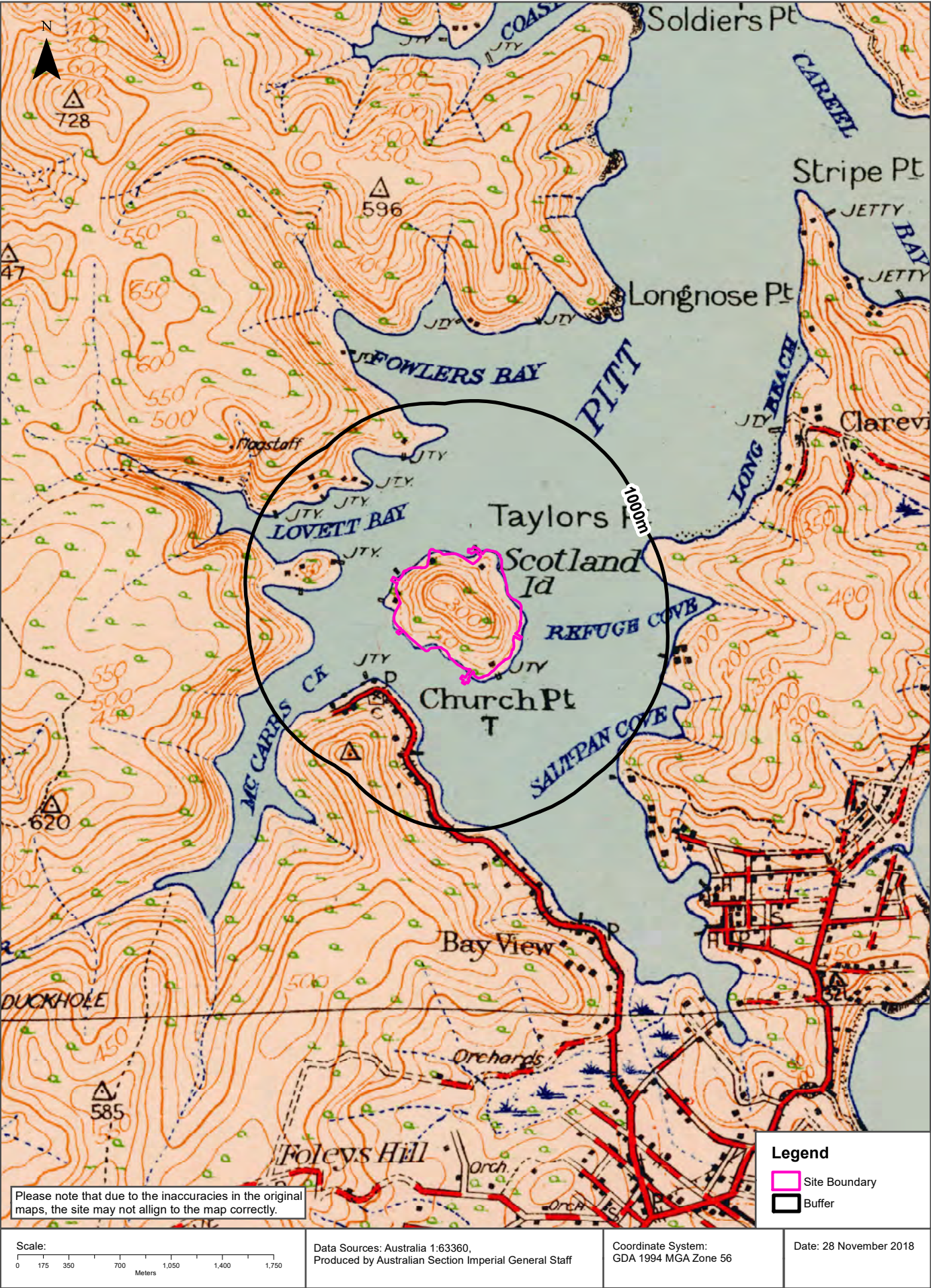
Scotland Island, Pittwater, NSW 2105



Historical Map 1942

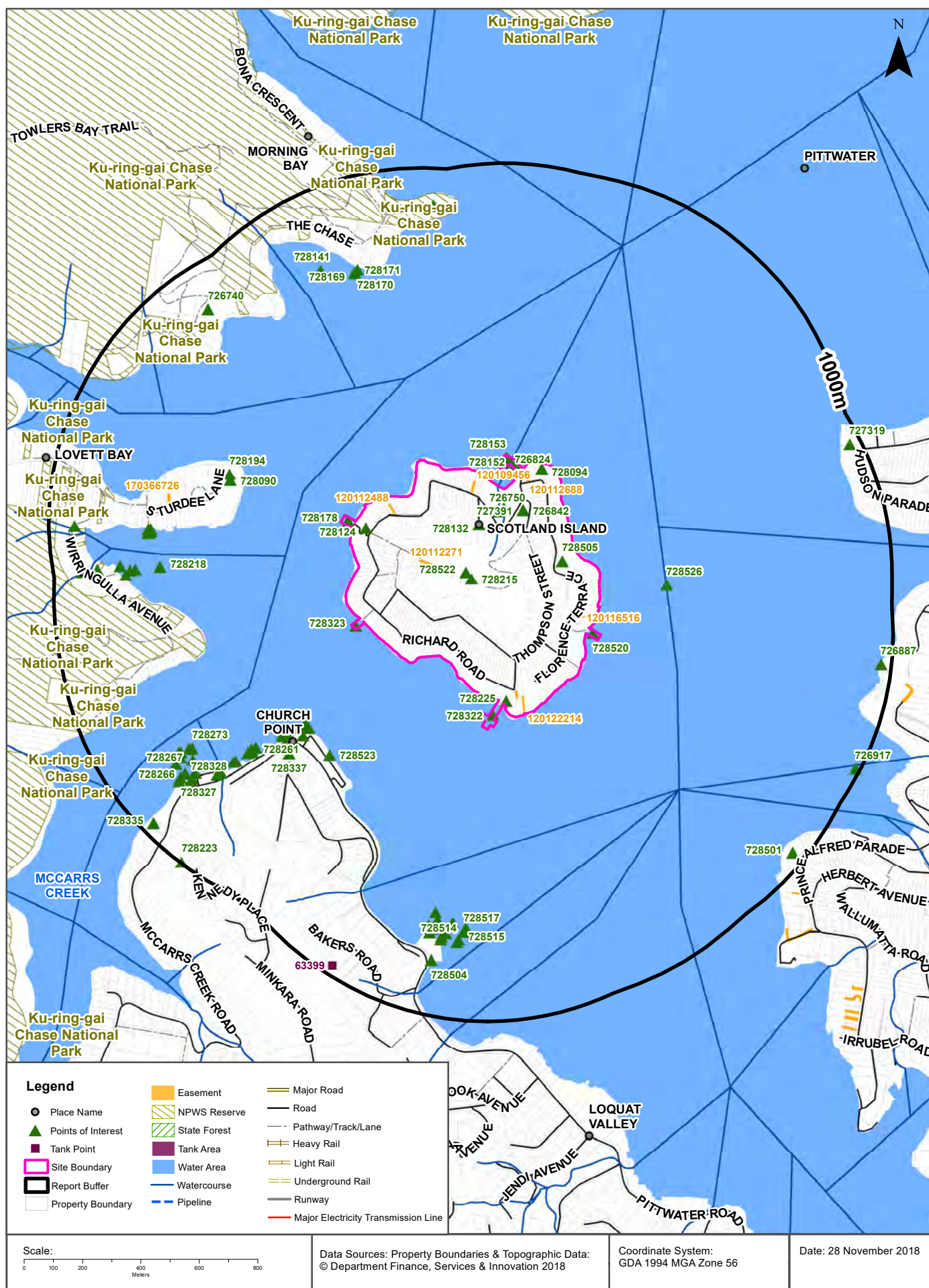
Scotland Island, Pittwater, NSW 2105





Topographic Features

Scotland Island, Pittwater, NSW 2105



Topographic Features

Scotland Island, Pittwater, NSW 2105

Points of Interest

What Points of Interest exist within the dataset buffer?

Map Id	Feature Type	Label	Distance	Direction
726750	Community Facility	SCOTLAND ISLAND COMMUNITY HALL	0m	Onsite
726824	Wharf	TENNIS WHARF	0m	Onsite
726842	Ambulance Station	SCOTLAND ISLAND CFR	0m	Onsite
727391	Firestation - Bush	SCOTLAND ISLAND RFB	0m	Onsite
728094	Headland	PITT POINT	0m	Onsite
728105	Park	CATHERINE PARK	0m	Onsite
728152	Wharf	TENNIS WHARF	0m	Onsite
728153	Wharf	TENNIS WHARF	0m	Onsite
728154	Wharf	TENNIS WHARF	0m	Onsite
728155	Wharf	TENNIS WHARF	0m	Onsite
728124	Park	LEAHVERA RESERVE	0m	Onsite
728132	Suburb	SCOTLAND ISLAND	0m	Onsite
728178	Wharf	CARGO WHARF	0m	Onsite
728215	Island	SCOTLAND ISLAND	0m	Onsite
728225	Park	HAROLD RESERVE	0m	Onsite
728322	Wharf	CAROLS WHARF	0m	Onsite
728323	Wharf	BELL WHARF	0m	Onsite
728505	Park	PATHILDA RESERVE	0m	Onsite
728520	Wharf	EASTERN WHARF	0m	Onsite
728522	Park	ELIZABETH PARK	0m	Onsite
728526	Bay Like	PITTWATER	228m	East
728254	Wharf	Wharf	367m	South West
728253	Wharf	Wharf	370m	South West
728255	Wharf	Wharf	371m	South West
728226	Park	SIR THOMAS STEPHENS RESERVE	374m	South West
728325	Boat Ramp	Boat Ramp	402m	South West
728090	Headland	ROCKY POINT	404m	West
728217	Headland	CHURCH POINT	406m	South West
728194	Park	ROCKY POINT	414m	North West
728315	Wharf	CHURCH POINT FERRY WHARF	415m	South West

Map Id	Feature Type	Label	Distance	Direction
728523	Park	CHURCH POINT RESERVE	415m	South West
728316	Wharf	Wharf	433m	South West
728242	Post Office	CHURCH POINT POST OFFICE	435m	South West
728256	Wharf	Wharf	436m	South West
728259	Wharf	Wharf	438m	South West
728257	Wharf	Wharf	439m	South West
728233	Suburb	CHURCH POINT	441m	South West
728258	Wharf	Wharf	443m	South West
728337	Park	QUARTER SESSIONS ROAD RESERVE	482m	South West
728262	Wharf	COMMUTER WHARF	529m	South West
728263	Wharf	COMMUTER WHARF	545m	South West
728261	Wharf	COMMUTER WHARF	548m	South West
728260	Wharf	COMMUTER WHARF	561m	South West
728331	Wharf	Wharf	610m	South West
728330	Wharf	Wharf	618m	South West
728218	Bay / Inlet / Basin	ELVINA BAY	637m	West
728158	Wharf	ELVINA NORTH WHARF	650m	West
728161	Wharf	ELVINA NORTH WHARF	650m	West
728513	Wharf	Wharf	651m	South
728160	Wharf	ELVINA NORTH WHARF	654m	West
728157	Wharf	ELVINA NORTH WHARF	657m	West
728162	Wharf	ELVINA NORTH WHARF	658m	West
728159	Wharf	ELVINA NORTH WHARF	658m	West
728156	Wharf	ELVINA NORTH WHARF	661m	West
728512	Wharf	Wharf	673m	South
728341	Picnic Area	ROSTREVOR RESERVE	674m	South West
728169	Wharf	HALLS WHARF	676m	North
728511	Wharf	Wharf	677m	South
728171	Wharf	HALLS WHARF	679m	North
728516	Wharf	Wharf	684m	South
728170	Wharf	HALLS WHARF	686m	North
728338	Monument	Monument	687m	South West
728273	Wharf	Wharf	689m	South West
728517	Wharf	Wharf	698m	South
728272	Wharf	Wharf	698m	South West
728251	Wharf	Wharf	700m	South
728518	Slipway	Slipway	707m	South

Map Id	Feature Type	Label	Distance	Direction
728250	Wharf	Wharf	708m	South
728252	Wharf	Wharf	712m	South
728267	Wharf	Wharf	712m	South West
728280	Wharf	ELVINA BAY WHARF	721m	West
728249	Wharf	Wharf	722m	South
728515	Wharf	Wharf	726m	South
728240	Marina	THE QUAYS	727m	South
728271	Wharf	Wharf	728m	South West
728141	Bay / Inlet / Basin	LITTLE LOVETT BAY	732m	North West
728265	Wharf	Wharf	733m	South West
728270	Wharf	Wharf	735m	South West
728514	Wharf	Wharf	736m	South
728248	Wharf	Wharf	738m	South
728269	Wharf	Wharf	740m	South West
728281	Wharf	ELVINA BAY WHARF	740m	West
728279	Wharf	ELVINA BAY WHARF	755m	West
728213	Police Station	BROKEN BAY WATER POLICE	755m	South West
728266	Wharf	Wharf	762m	South West
728328	Marina	HOLME PORT MARINA	763m	South West
728268	Wharf	Wharf	766m	South West
728278	Wharf	Wharf	769m	West
728327	Wharf	Wharf	783m	South West
728264	Slipway	Slipway	795m	South West
728504	Park	GRIFFIN PARK	812m	South
726740	Firestation - Bush	WEST PITTWATER (LOVETT) RFB	846m	North West
727401	Firestation - Bush	WEST PITTWATER (ELVINA) RFB	848m	West
728096	Headland	WOODY POINT	872m	North
728232	Suburb	ELVINA BAY	900m	West
728110	Park	ELVINA PARK	910m	West
728501	Headland	SALT PAN POINT	954m	South East
728335	Park	MCCARRS CREEK ROAD RESERVE	958m	South West
728179	Wharf	MORNING BAY WHARF	959m	North
727319	Headland	TAYLORS POINT	960m	East
726887	Beach	SOUTH BEACH	963m	East
726917	Bay / Inlet / Basin	SALT PAN COVE	984m	South East
728097	Bay / Inlet / Basin	LOVETT BAY	988m	North West
728223	Park	KENNEDY PARK	996m	South West

Topographic Data Source: © Land and Property Information (2015)

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Topographic Features

Scotland Island, Pittwater, NSW 2105

Tanks (Areas)

What are the Tank Areas located within the dataset buffer?

Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
	No records in buffer					

Tanks (Points)

What are the Tank Points located within the dataset buffer?

Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
63399	Water	Operational		06/04/2000	965m	South

Tanks Data Source: © Land and Property Information (2015)

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Major Easements

What Major Easements exist within the dataset buffer?

Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
120112271	Primary	Undefined		0m	Onsite
120112488	Primary	Undefined		0m	North West
120112688	Primary	Undefined		0m	North East
120116516	Primary	Undefined		0m	East
120122214	Primary	Undefined		0m	South
120109456	Primary	Undefined		0m	North
170366726	Primary	Right of way	4m	588m	West

Easements Data Source: © Land and Property Information (2015)

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Topographic Features

Scotland Island, Pittwater, NSW 2105

State Forest

What State Forest exist within the dataset buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

State Forest Data Source: © Land and Property Information (2015)

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National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the dataset buffer?

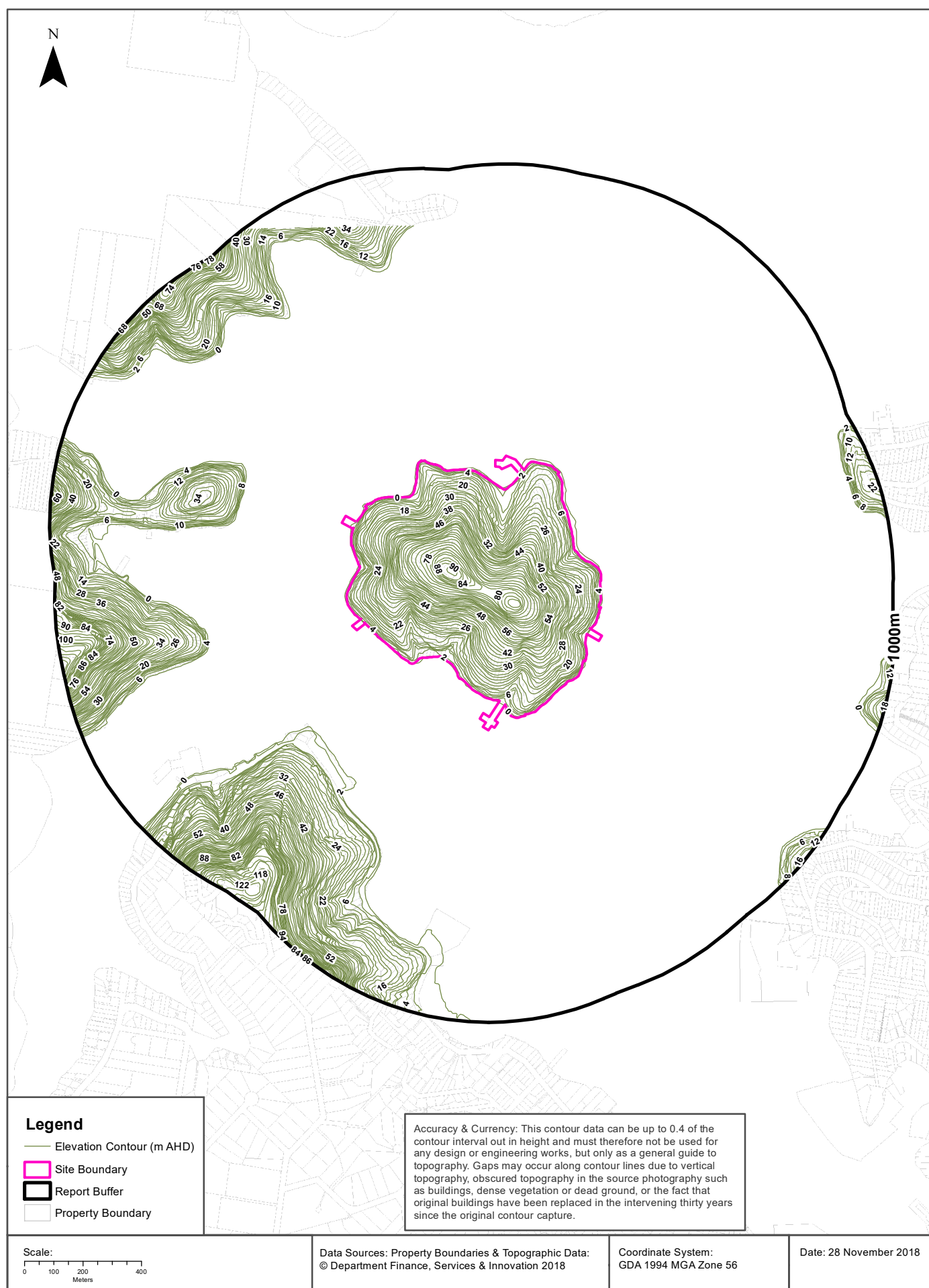
Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N0019	NATIONAL PARK	Ku-ring-gai Chase National Park	01/10/1967	503m	West

NPWS Data Source: © Land and Property Information (2015)

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Elevation Contours (m AHD)

Scotland Island, Pittwater, NSW 2105



Hydrogeology & Groundwater

Scotland Island, Pittwater, NSW 2105

Hydrogeology

Description of aquifers on-site:

Description
No Data

Description of aquifers within the dataset buffer:

Description
Porous, extensive aquifers of low to moderate productivity

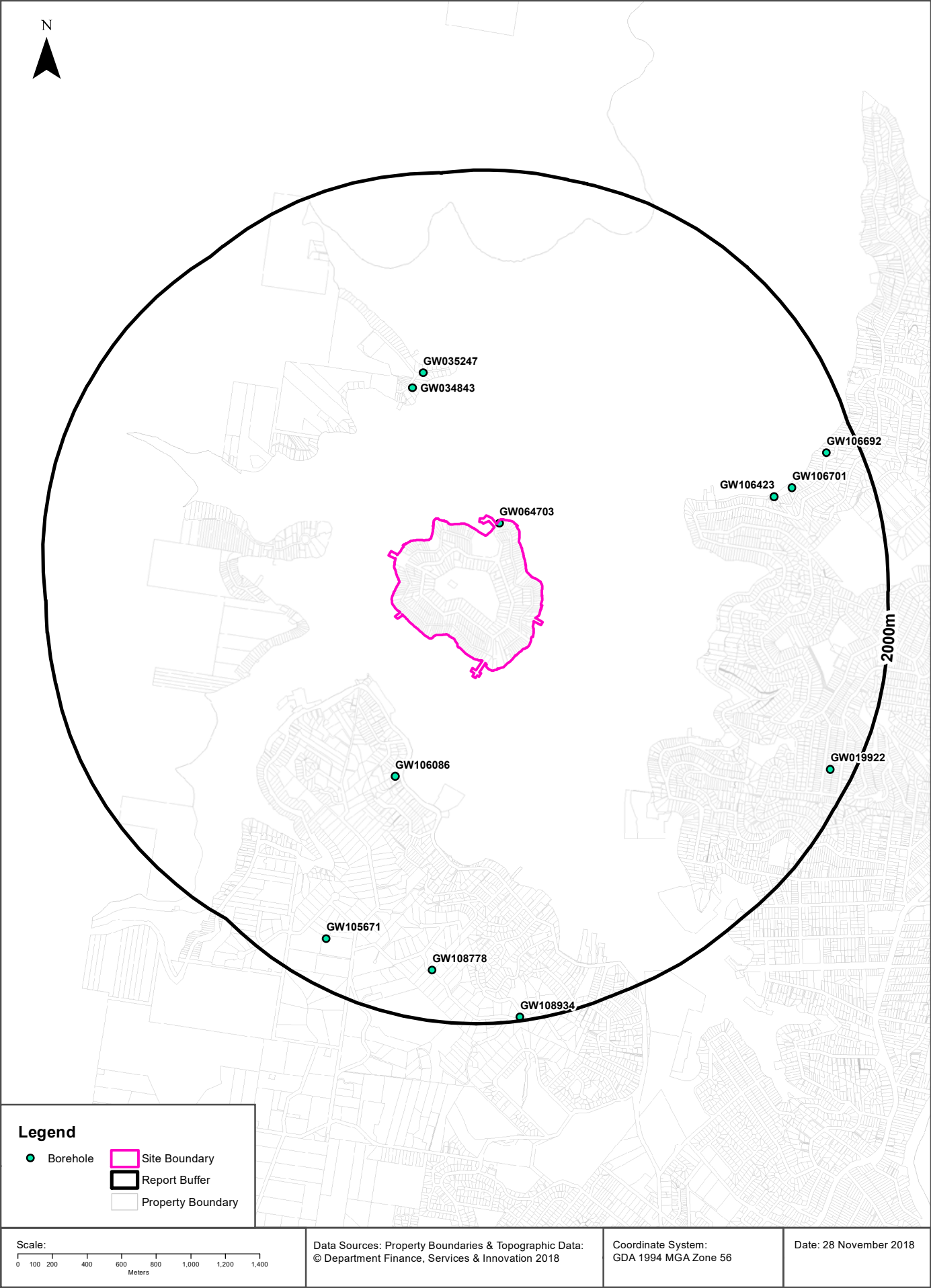
Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)
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Botany Groundwater Management Zones

Groundwater management zones relating to the Botany Sand Beds aquifer within the dataset buffer:

Management Zone No.	Restriction	Distance	Direction
N/A	No records in buffer		

Botany Groundwater Management Zones Data Source : NSW Department of Primary Industries



Hydrogeology & Groundwater

Scotland Island, Pittwater, NSW 2105

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW064 703	10BL137 322	Bore	Private	Domestic	Domestic		01/11/1988	34.00	34.00					0m	Onsite
GW106 086	10BL162 974, 10WA10 8676	Spear	Private	Domestic	Domestic		14/04/2004	3.50	3.50					731m	South
GW034 843	10BL027 080, 10WA10 8159	Bore open thru rock	Private	Domestic, Stock	Domestic, Stock		01/07/1972	24.30	24.40	Salty				766m	North
GW035 247	10BL027 672, 10WA10 8162	Bore open thru rock	Private	Domestic, Stock	Domestic, Stock		01/03/1973	24.30	24.40	Good				845m	North
GW106 423	10BL162 968, 10WA10 8675	Spear	Private	Domestic	Domestic		14/09/2004	2.50	2.50		1.00	0.100		1438m	East
GW106 701	10BL164 165, 10WA10 8838	Spear	Private	Domestic	Domestic		01/01/2003	4.00	4.00		4.00	0.060		1552m	East
GW108 778	10BL601 417, 10WA10 9180	Bore	Private	Domestic	Domestic		19/04/2007	120.00	120.00	480	90.00	0.400		1709m	South
GW105 671	10BL162 365, 10WA10 8602	Bore	Private	Domestic	Domestic		22/10/2003	180.00	180.00	110	105.00	105.000		1740m	South
GW106 692	10BL164 355, 10WA10 8869	Bore	Private	Domestic	Domestic		25/11/2004	120.00	120.00	3600		0.150		1814m	East
GW019 922	10BL011 935	Bore open thru rock	Private	Irrigation	General Use		01/01/1962	10.00	10.05					1871m	South East
GW108 934	10BL601 869, 10WA10 9210	Bore	Private	Domestic	Domestic		19/06/2008	150.00		8000	88.50	0.260		1980m	South

Borehole Data Source : NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corporation for all bores prefixed with GW. All other bores © Commonwealth of Australia (Bureau of Meteorology) 2015. Creative Commons 3.0 © Commonwealth of Australia <http://creativecommons.org/licenses/by/3.0/au/deed.en>

Hydrogeology & Groundwater

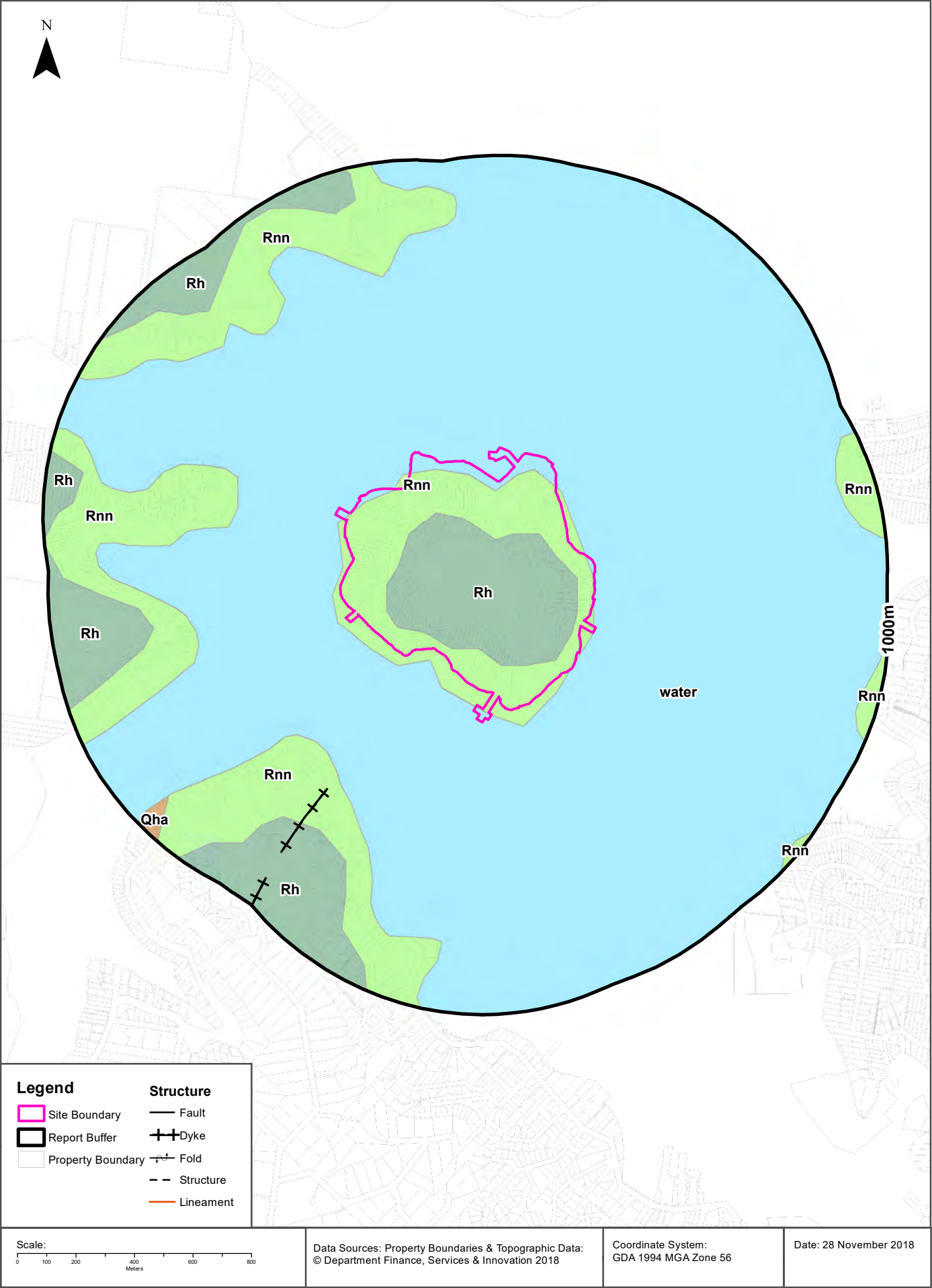
Scotland Island, Pittwater, NSW 2105

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

Groundwater No	Drillers Log	Distance	Direction
GW064703	0.00m-0.50m Soil Sandy 0.50m-1.80m Shale Clay 1.80m-2.40m Sandstone Yellow 2.40m-3.10m Clay Sandy 3.10m-8.70m Sandstone Yellow Silty 8.70m-27.30m Sandstone Grey Silty 8.70m-27.30m Shale Some 27.30m-28.10m Shale 28.10m-28.40m Sandstone Grey Water Bearing Coarse Water Supply 28.40m-34.00m Sandstone Grey Some Shale	0m	Onsite
GW106086	0.00m-1.50m sandy, loam 1.50m-2.00m clay 2.00m-2.60m sand, tight packed 2.60m-3.50m clay	731m	South
GW034843	0.00m-9.14m Clay Rock 9.14m-12.80m Sandstone Soft 12.80m-24.38m Shale Water Supply	766m	North
GW035247	0.00m-1.52m Topsoil 1.52m-3.66m Clay Heavy 3.66m-16.76m Sandstone Water Supply 16.76m-24.38m Shale	845m	North
GW106423	0.00m-0.30m topsoil 0.30m-2.50m brown silty sand grey clay	1438m	East
GW108778	0.00m-1.00m clay, sandy 1.00m-2.40m sandstone, weathered 2.40m-10.00m sandstone, yellow 10.00m-10.50m ironstone 10.50m-14.50m sandstone, grey 14.50m-15.00m ironstone 15.00m-16.00m sandstone, yellow 16.00m-16.50m ironstone 16.50m-28.00m sandstone, grey 28.00m-32.00m sandstone, quartz 32.00m-36.00m sandstone, yellow 36.00m-40.00m sandstone, quartz 40.00m-41.00m shale, clay band 41.00m-44.50m sandstone, grey 44.50m-59.00m shale, clay band 59.00m-72.00m sandstone, grey 72.00m-78.00m shale, clay band 78.00m-81.00m siltstone 81.00m-95.50m sandstone, grey 95.50m-97.00m siltstone 97.00m-99.00m sandstone, quartz 99.00m-112.50m sandstone, grey 112.50m-115.00m siltstone 115.00m-120.00m sandstone, grey	1709m	South
GW105671	0.00m-1.00m soil, dirt 1.00m-3.00m clay 3.00m-66.00m sandstone, soft yellow 66.00m-150.00m sandstone, shale 150.00m-174.00m shale 174.00m-180.00m shale, red	1740m	South
GW106692	0.00m-2.20m clay, brown sand 2.20m-10.40m sandstone, brown 10.40m-10.90m quartz, grey clay 10.90m-14.00m sandstone, grey 14.00m-14.20m clay, brown 14.20m-58.40m sandstone, grey, with bands of red 58.40m-59.30m tuff, medium grained 59.30m-60.90m limestone, grey 60.90m-63.40m sandstone, dark grey 63.40m-65.00m tuff, grey, clay 65.00m-76.70m shale, grey, brown, red, green 76.70m-120.00m sandstone, grey banded with grey siltstone	1814m	East
GW019922	0.00m-0.60m Soil 0.60m-10.05m Sandstone	1871m	South East

Drill Log Data Source: NSW Department of Primary Industries - Office of Water / Water Administration Ministerial Corp
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Geology

Scotland Island, Pittwater, NSW 2105

Geological Units

What are the Geological Units onsite?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Rh	Medium to coarse grained quartz sandstone, very minor shale and laminate lenses				Triassic		Sydney	1:100,000
Rnn	Interbedded laminate, shale and quartz, to lithic quartz sandstone: Minor red claystone north of Hawkesbury River. Clay pellet sandstone (Garie Fm) south of Hawkesbury River	Newport Formation and Garie Formation	Narrabeen Group		Triassic		Sydney	1:100,000
water							Sydney	1:100,000

What are the Geological Units within the dataset buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Qha	Silty to peaty quartz sand, silt, and clay. Ferruginous and humic cementation in places. Common shell layers				Quaternary		Sydney	1:100,000
Rh	Medium to coarse grained quartz sandstone, very minor shale and laminate lenses				Triassic		Sydney	1:100,000
Rnn	Interbedded laminate, shale and quartz, to lithic quartz sandstone: Minor red claystone north of Hawkesbury River. Clay pellet sandstone (Garie Fm) south of Hawkesbury River	Newport Formation and Garie Formation	Narrabeen Group		Triassic		Sydney	1:100,000
water							Sydney	1:100,000

Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Map Sheet	Dataset
No features				1:100,000

What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Map Sheet	Dataset
Dyke			Sydney	1:100,000
Dyke			Sydney	1:100,000

Geological Data Source : NSW Department of Industry, Resources & Energy

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Naturally Occurring Asbestos Potential

Scotland Island, Pittwater, NSW 2105

Naturally Occurring Asbestos Potential

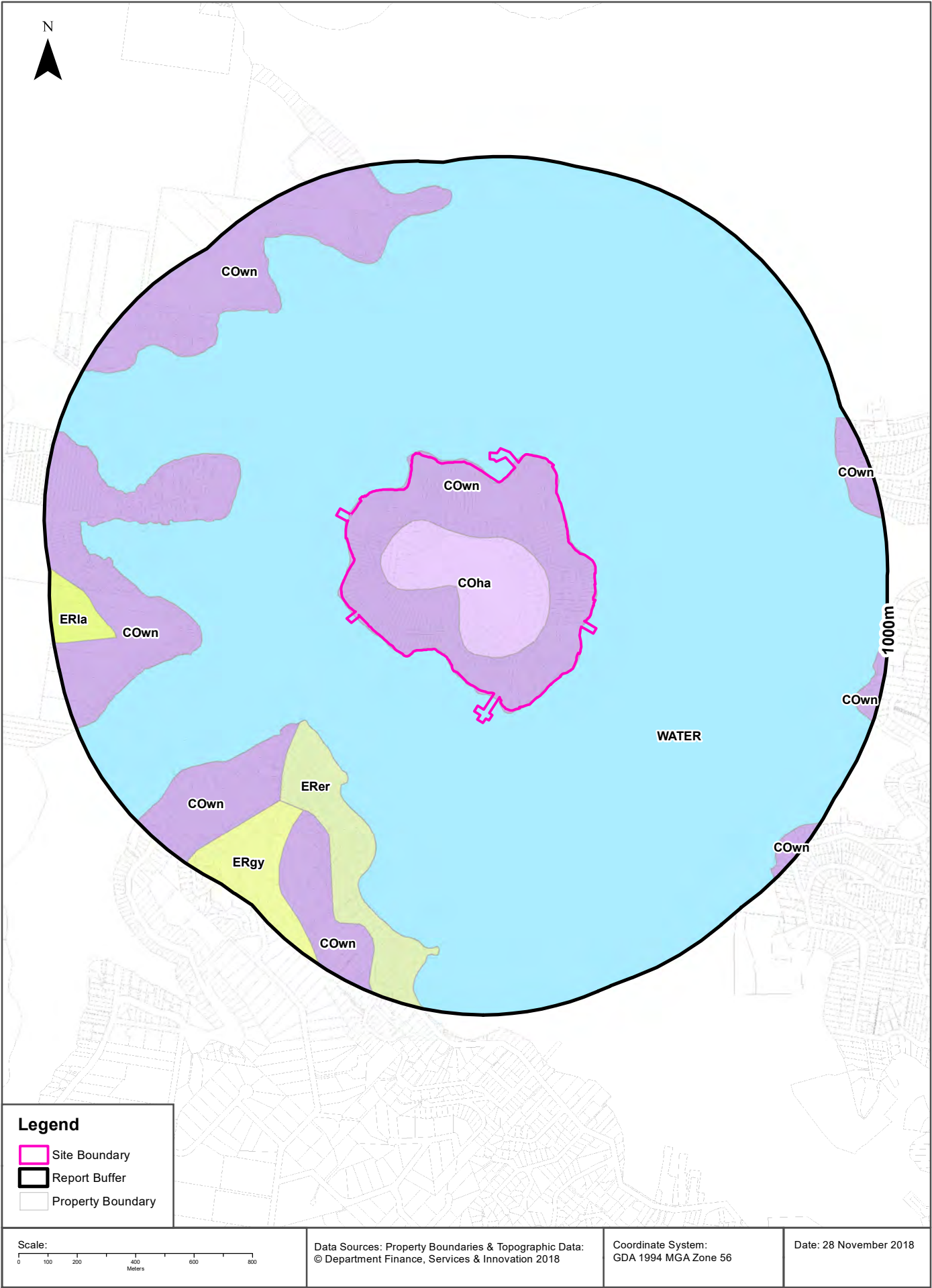
Naturally Occurring Asbestos Potential within the dataset buffer:

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Mining Subsidence District Data Source: © State of New South Wales through NSW Department of Industry, Resources & Energy

Soil Landscapes

Scotland Island, Pittwater, NSW 2105



Soils

Scotland Island, Pittwater, NSW 2105

Soil Landscapes

What are the onsite Soil Landscapes?

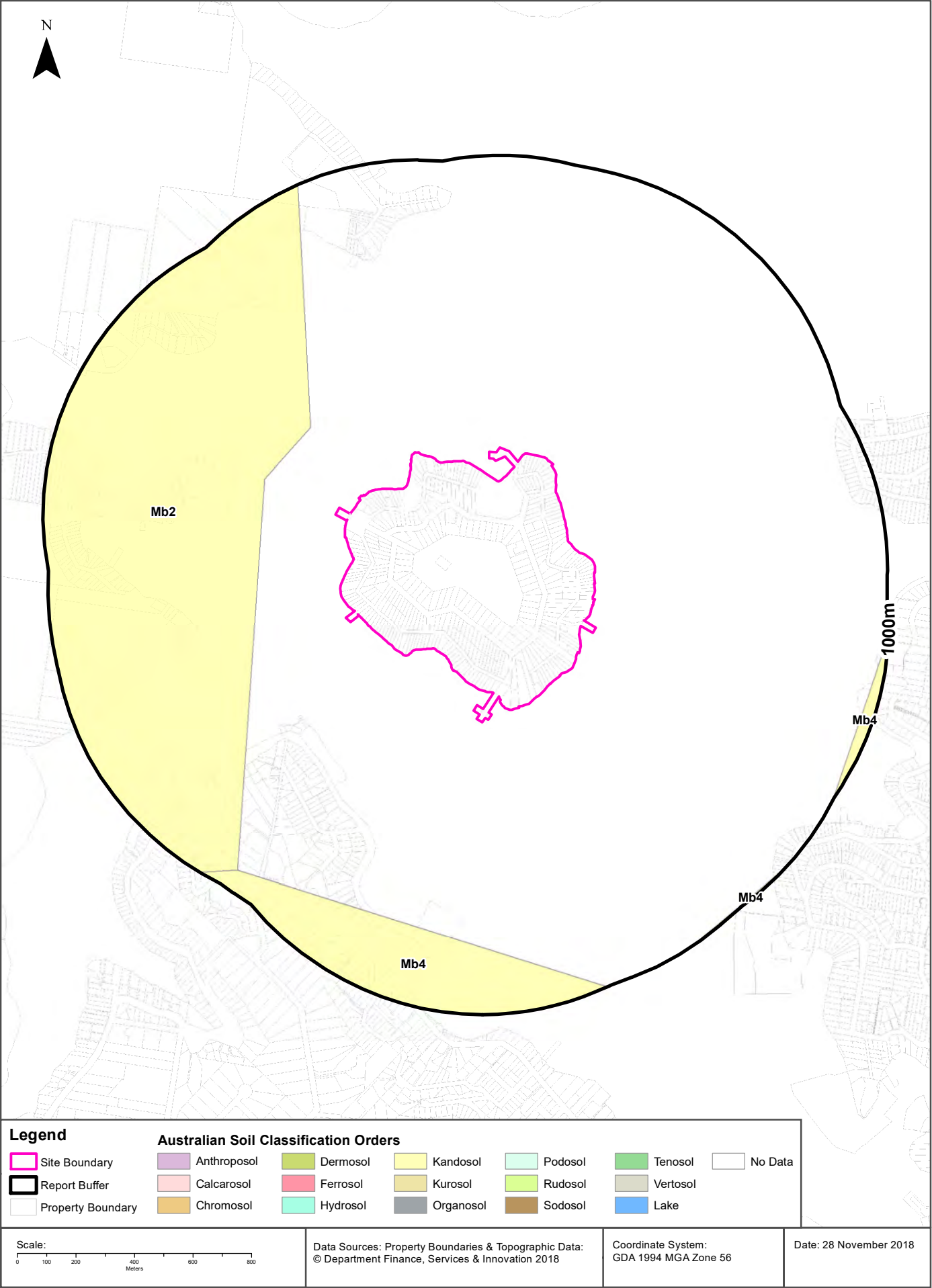
Soil Code	Name	Group	Process	Map Sheet	Scale
COha	HAWKESBURY		COLLUVIAL	Sydney	1:100,000
COwn	WATAGAN		COLLUVIAL	Sydney	1:100,000
WATER	WATER		WATER	Sydney	1:100,000

What are the Soil Landscapes within the dataset buffer?

Soil Code	Name	Group	Process	Map Sheet	Scale
COha	HAWKESBURY		COLLUVIAL	Sydney	1:100,000
COwn	WATAGAN		COLLUVIAL	Sydney	1:100,000
ERer	ERINA		EROSIONAL	Sydney	1:100,000
ERgy	GYMEA		EROSIONAL	Sydney	1:100,000
ERla	LAMBERT		EROSIONAL	Sydney	1:100,000
WATER	WATER		WATER	Sydney	1:100,000

Soils Landscapes Data Source : NSW Office of Environment and Heritage

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Soils

Scotland Island, Pittwater, NSW 2105

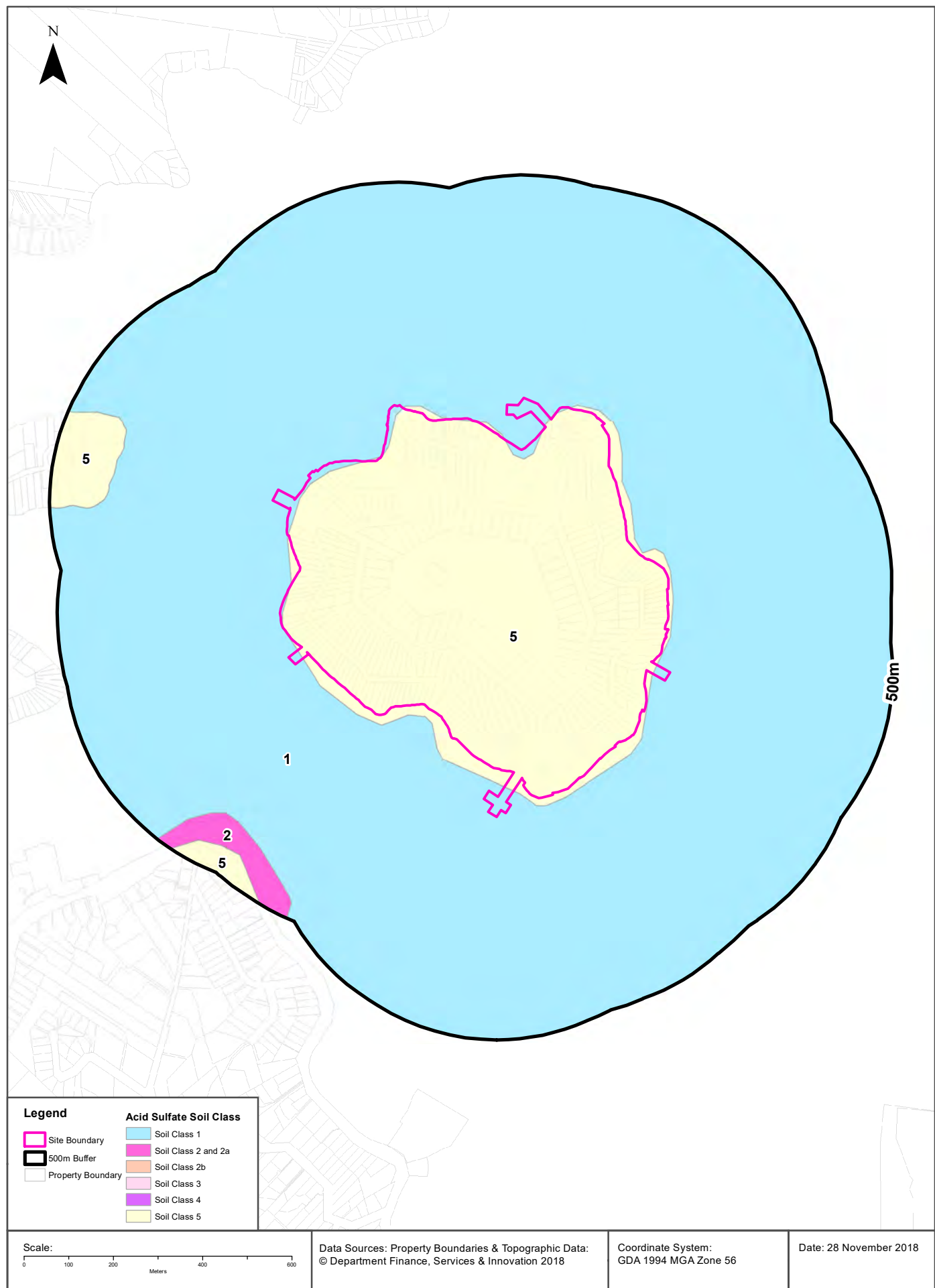
Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Mb2	Kandosol	Dissected sandstone plateau of moderate to strong relief with sandstone pillars, ledges, and slabs-- level to undulating ridges, irregularly benched slopes, steep ridges, cliffs, canyons, narrow sandy valleys: chief soils are (i) on areas of gentle to moderate relief, acid yellow leached earths (Gn2.74) and (Gn2.34) and acid leached yellow earths (Gn2.24)-sometimes these soils contain ironstone gravel; and (ii) on, or adjacent to, areas of strong relief, siliceous sands (Uc1.2), leached sands (Uc2.12) and (Uc2.2), and shallow forms of the above (Gn2) soils. Associated are: (i) on flat to gently undulating remnants of the original plateau surface, leached sands (Uc2.3), siliceous sands (Uc1.2), sandy earths (Uc5.22), and (Gn2) soils as for (i) above (these areas are in part comparable with unit Cb29); (ii) on flat ironstone gravelly remnants of the original plateau surface, (Gn2) soils as for unit Mb5(i); (iii) on gently undulating ridges where interbedded shales are exposed, shallow, often stony (Dy3.41), (Dr2.21), and related soils similar to unit Tb35; (iv) narrow valleys of (Uc2.3) soils flanked by moderate slopes of (Dy3.41) soils; (v) escarpments of steep hills with shallow (Dy) and (Dr) soils between sandstone pillars; and (vi) shallow (Um) soils, such as (Um6.21) on steep hills of basic rocks. As mapped, minor areas of units Mg20, Mm1, and Mw8 are included. Data are limited.	250m
Mb4	Kandosol	Coastal complex: chief soils are acid yellow leached earths (Gn2.74) and (Gn2.34), hard acidic yellow mottled soils (Dy3.41), and hard acidic red soils (Dr2.21). This unit includes headlands and rugged coastal areas of unit Mb2; ridges and slopes of unit Tb35; low-lying coastal areas of unit Cb27; and some swampy areas.	735m

Atlas of Australian Soils Data Source: CSIRO

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Acid Sulfate Soils

Scotland Island, Pittwater, NSW 2105

Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

Soil Class	Description	EPI
1	Any works present an environmental risk	Pittwater Local Environmental Plan 2014

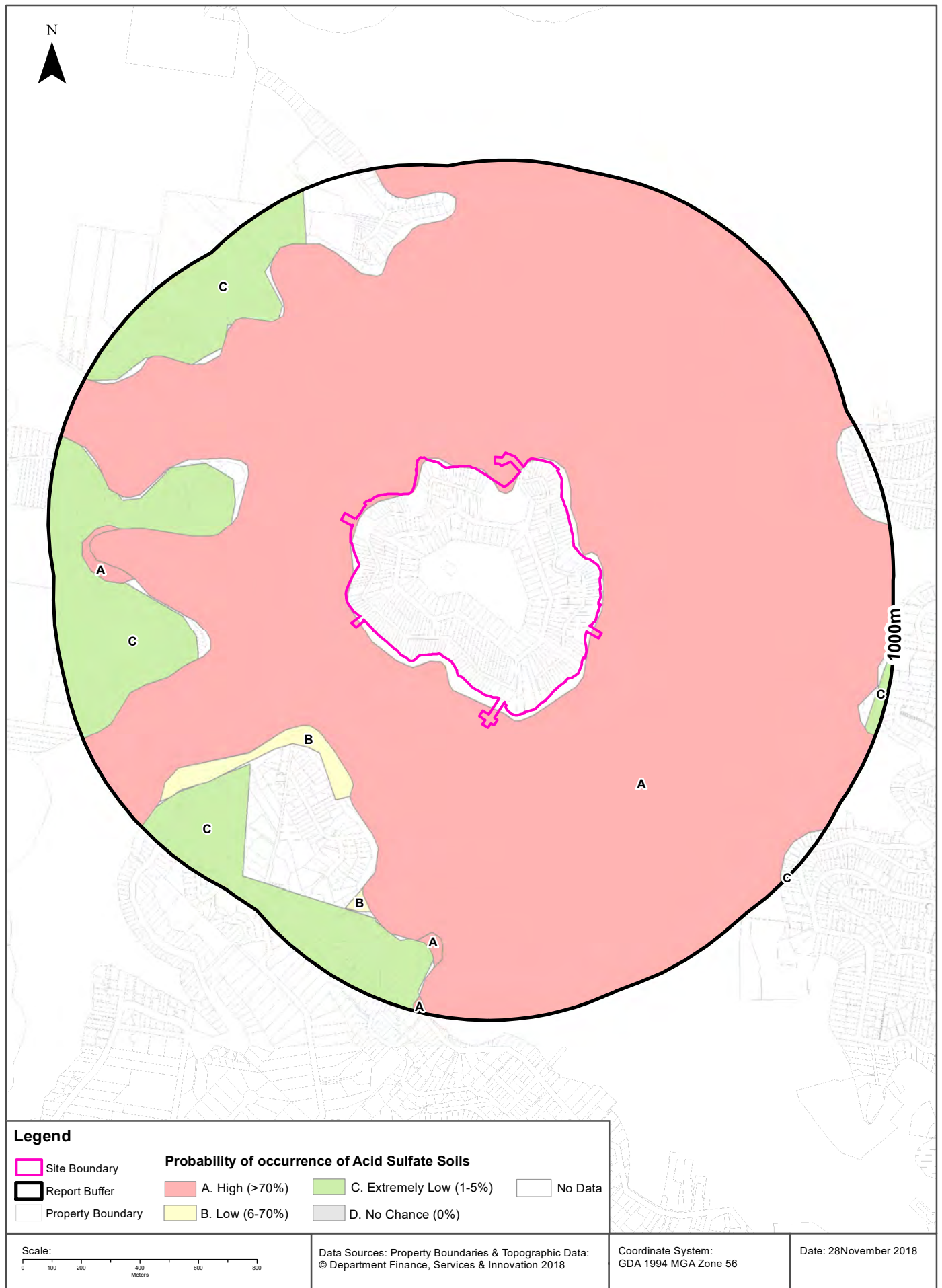
If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	EPI	Distance	Direction
N/A				

Acid Sulfate Data Source Accessed 23/10/2018: NSW Crown Copyright - Planning and Environment
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Atlas of Australian Acid Sulfate Soils

Scotland Island, Pittwater, NSW 2105



Acid Sulfate Soils

Scotland Island, Pittwater, NSW 2105

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
A	High Probability of occurrence. >70% chance of occurrence.	0m
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	367m
B	Low Probability of occurrence. 6-70% chance of occurrence.	370m

Atlas of Australian Acid Sulfate Soils Data Source: CSIRO

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Dryland Salinity

Scotland Island, Pittwater, NSW 2105

Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

No

Is there Dryland Salinity - National Assessment data within the dataset buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A	N/A	N/A

Dryland Salinity Data Source : National Land and Water Resources Audit

The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.

In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Dryland Salinity Potential of Western Sydney

Dryland Salinity Potential of Western Sydney within the dataset buffer?

Feature Id	Classification	Description	Distance	Direction
N/A	Outside Data Coverage			

Dryland Salinity Potential of Western Sydney Data Source : NSW Office of Environment and Heritage

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Mining Subsidence Districts

Scotland Island, Pittwater, NSW 2105

Mining Subsidence Districts

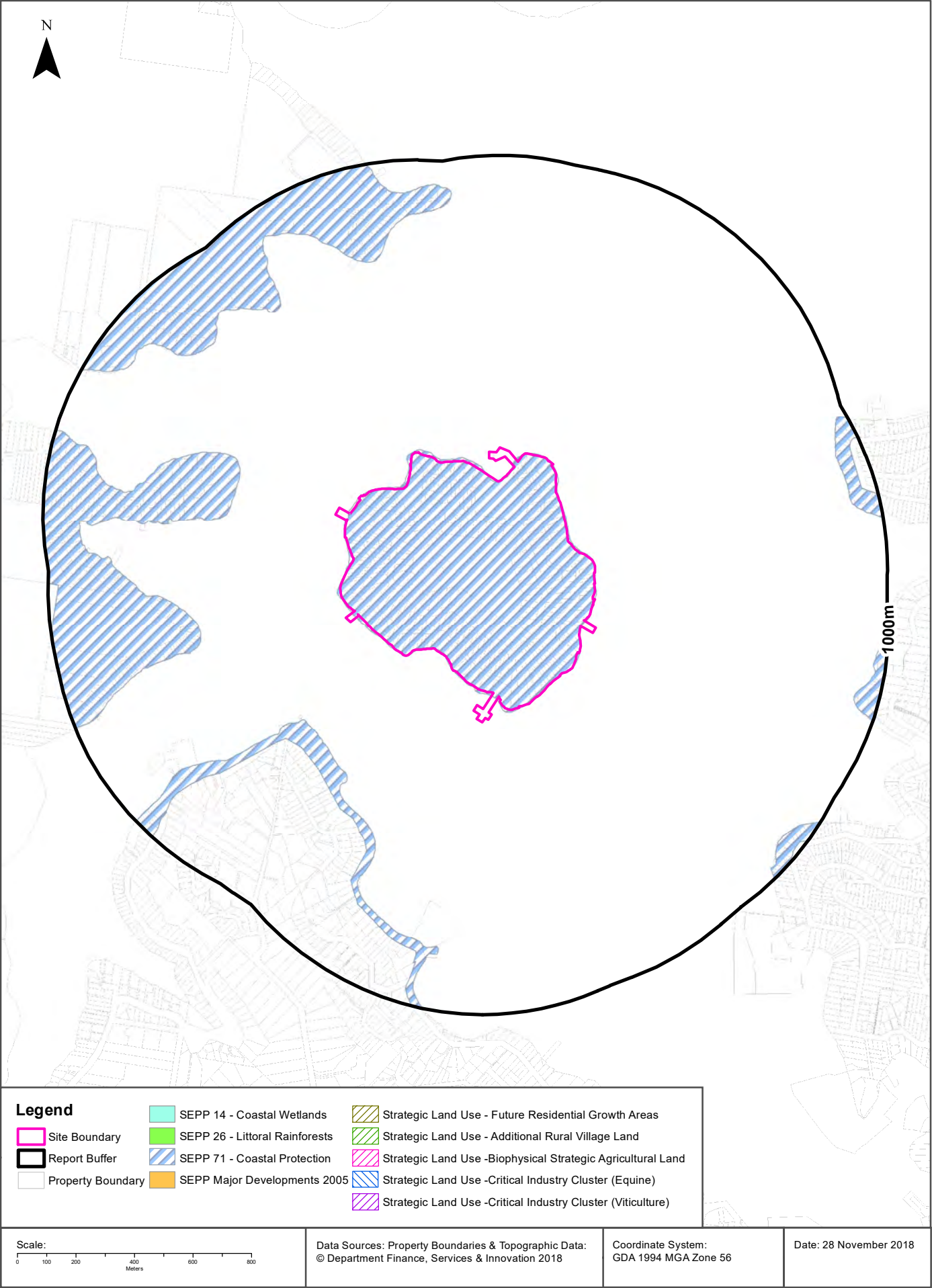
Mining Subsidence Districts within the dataset buffer:

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

Mining Subsidence District Data Source: © Land and Property Information (2016)
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State Environmental Planning Policy

Scotland Island, Pittwater, NSW 2105



Environmental Zoning

Scotland Island, Pittwater, NSW 2105

State Environmental Planning Policy Protected Areas

Are there any State Environmental Planning Policy Protected Areas onsite or within the dataset buffer?

Dataset	Onsite	Within Site Buffer	Distance
SEPP14 - Coastal Wetlands	No	No	N/A
SEPP26 - Littoral Rainforests	No	No	N/A
SEPP71 - Coastal Protection Zone	Yes - SEPP71 covers 98.32% of the site	Yes	0m

SEPP Protected Areas Data Source: NSW Department of Planning & Environment
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State Environmental Planning Policy Major Developments (2005)

State Environmental Planning Policy Major Developments within the dataset buffer:

Map Id	Feature	Effective Date	Distance	Direction
N/A	No records within buffer			

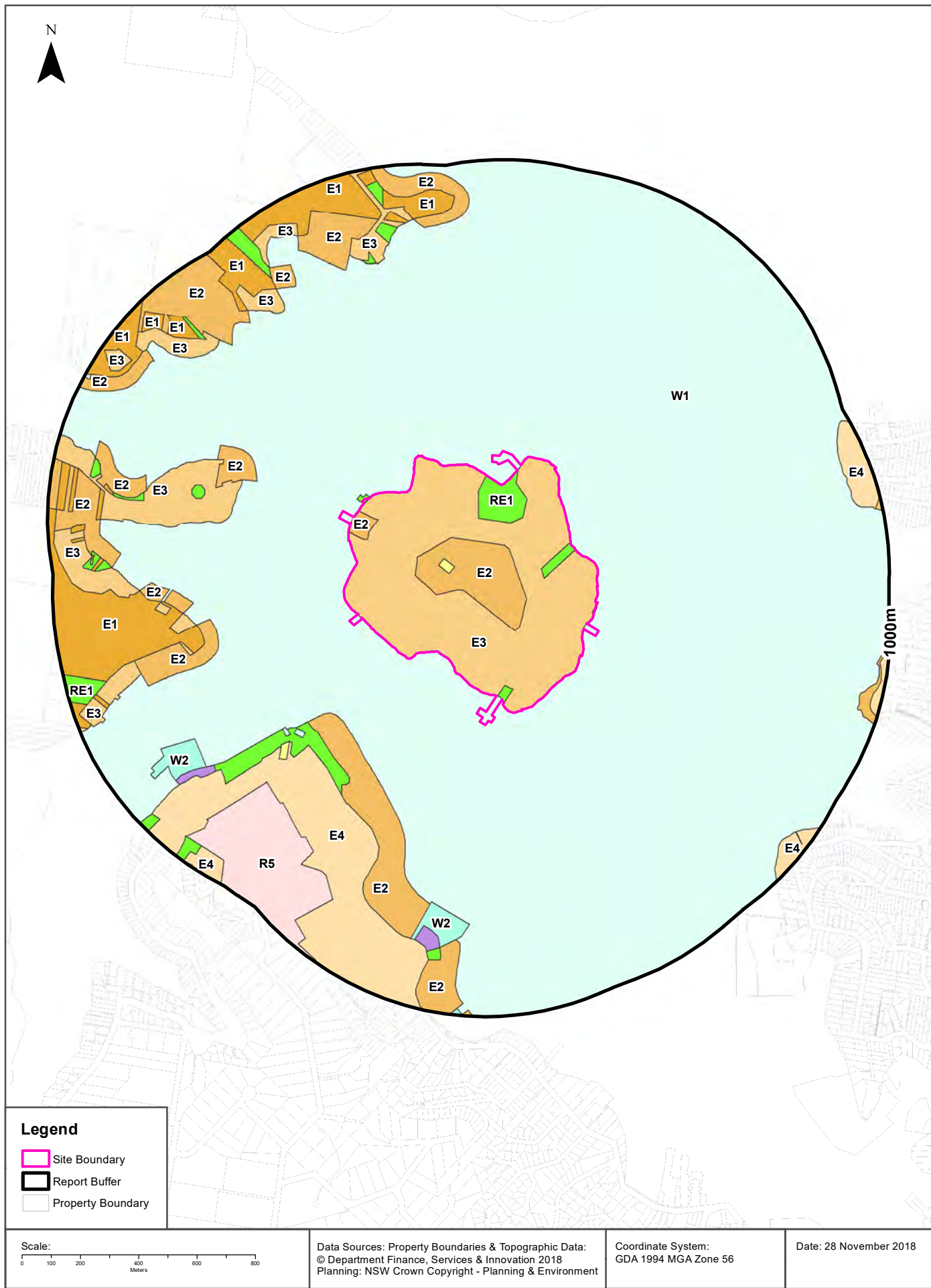
SEPP Major Development Data Source: NSW Department of Planning & Environment
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State Environmental Planning Policy Strategic Land Use Areas

State Environmental Planning Policy Strategic Land Use Areas onsite or within the dataset buffer:

Strategic Land Use	SEPPNo	Effective Date	Amendment	Amendment Year	Distance	Direction
No records within buffer						

SEPP Strategic Land Use Data Source: NSW Department of Planning & Environment
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Environmental Planning Instrument

Scotland Island, Pittwater, NSW 2105

Land Zoning

What Environmental Planning Instrument Land Zones exist within the dataset buffer?

Zone	Description	Purpose	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		0m	Onsite
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		0m	Onsite
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		0m	Onsite
W1	Natural Waterways		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		0m	Onsite
SP2	Infrastructure	Water Supply System	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		0m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		303m	South
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		309m	North West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		354m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		369m	South West
B1	Neighbourhood Centre		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		405m	South West
B1	Neighbourhood Centre		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		423m	South West
E4	Environmental Living		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		440m	South
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		454m	West
SP2	Infrastructure	Cemetery	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		456m	South West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		468m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		503m	North West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		517m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		518m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		545m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		597m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		599m	West
R5	Large Lot Residential		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		616m	South
W2	Recreational Waterways		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		633m	South
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		667m	West
W2	Recreational Waterways		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		668m	South West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		671m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		673m	North
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		677m	North

Zone	Description	Purpose	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		679m	North West
IN4	Working Waterfront		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		680m	South West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		682m	North West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		684m	North West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		701m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		708m	North West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		719m	North West
IN4	Working Waterfront		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		719m	South
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		735m	North
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		738m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		743m	South
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		751m	North West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		759m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		768m	North West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		780m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		780m	South
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		782m	North
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		787m	North West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		798m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		799m	North
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		810m	North
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		820m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		824m	North West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		827m	North West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		830m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		831m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		858m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		862m	North
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		871m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		873m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		875m	West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		877m	North West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		884m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		889m	North West

Zone	Description	Purpose	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
E4	Environmental Living		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		904m	East
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		909m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		921m	East
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		921m	South West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		936m	South East
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		939m	West
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		941m	South West
E1	National Parks and Nature Reserves		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		943m	North
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		967m	West
E3	Environmental Management		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		971m	West
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		974m	East
W2	Recreational Waterways		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		975m	South
E2	Environmental Conservation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		978m	South
RE1	Public Recreation		Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		997m	South

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Environmental Planning Instrument

Scotland Island, Pittwater, NSW 2105

Minimum Lot Size

What are the onsite Environmental Planning Instrument Minimum Lot Sizes?

Symbol	Minimum Lot Size	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
X1	5800 m ²	Pittwater Local Environmental Plan 2014	17/07/2015	17/07/2015	25/09/2015	Amendment No 4	79.49

Maximum Height of Buildings

What are the onsite Environmental Planning Instrument Maximum Height of Buildings?

Symbol	Maximum Height of Building	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
9	8.50 m	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	20/04/2018		98.3

Floor Space Ratio

What are the onsite Environmental Planning Instrument Floor Space Ratios?

Symbol	Floor Space Ratio	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
No Data							

Land Application

What are the onsite Environmental Planning Instrument Land Applications?

Application Type	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Percentage of Site Area
Included	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	27/06/2014		100

Land Reservation Acquisition

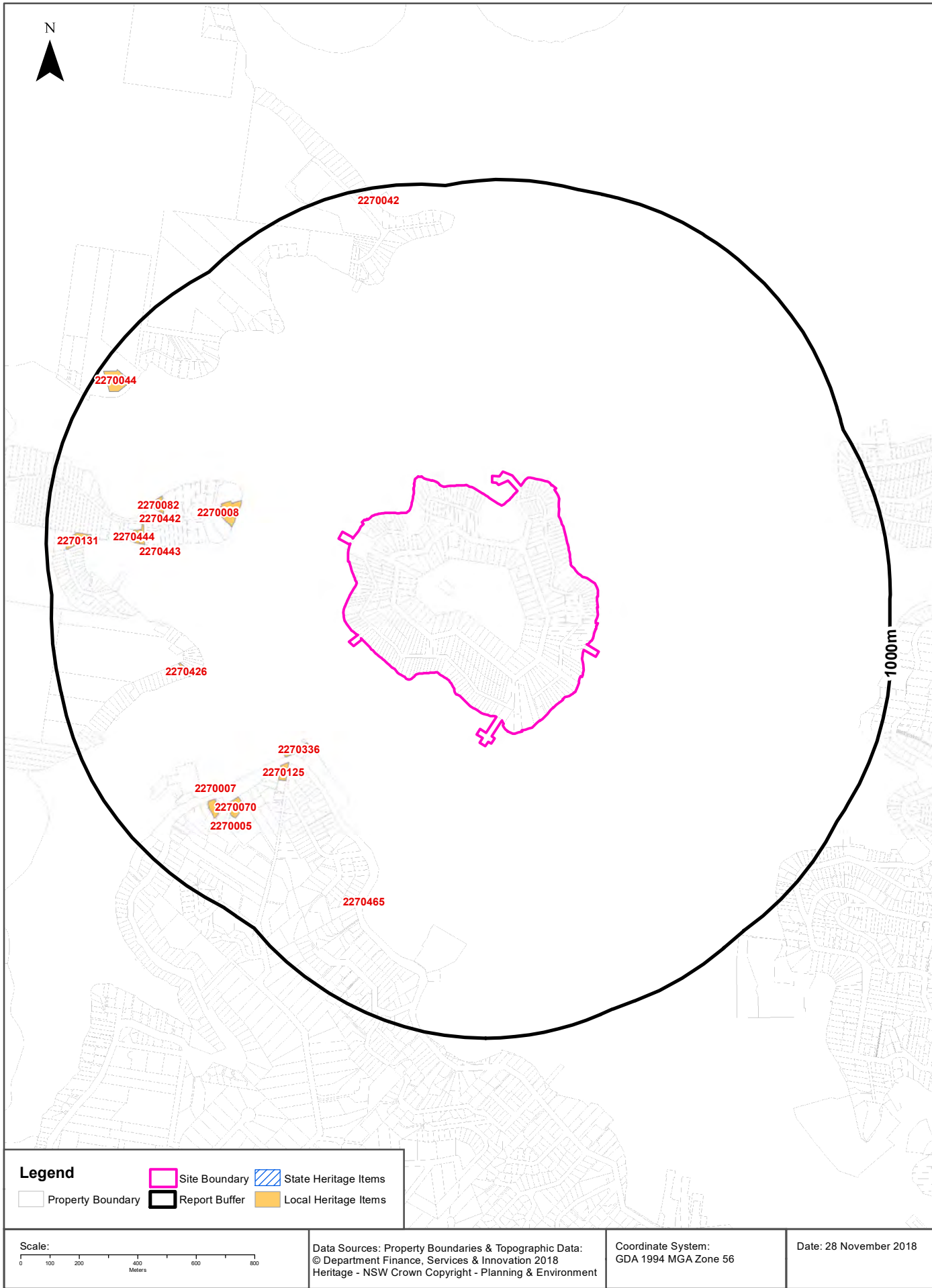
What are the onsite Environmental Planning Instrument Land Reservation Acquisitions?

Reservation	LEP or SEPP	Published Date	Commenced Date	Currency Date	Amendment	Comments	Percentage of Site Area
No Data							

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Heritage Items

Scotland Island, Pittwater, NSW 2105



Heritage

Scotland Island, Pittwater, NSW 2105

State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: NSW Crown Copyright - Office of Environment & Heritage
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Environmental Planning Instrument - Heritage

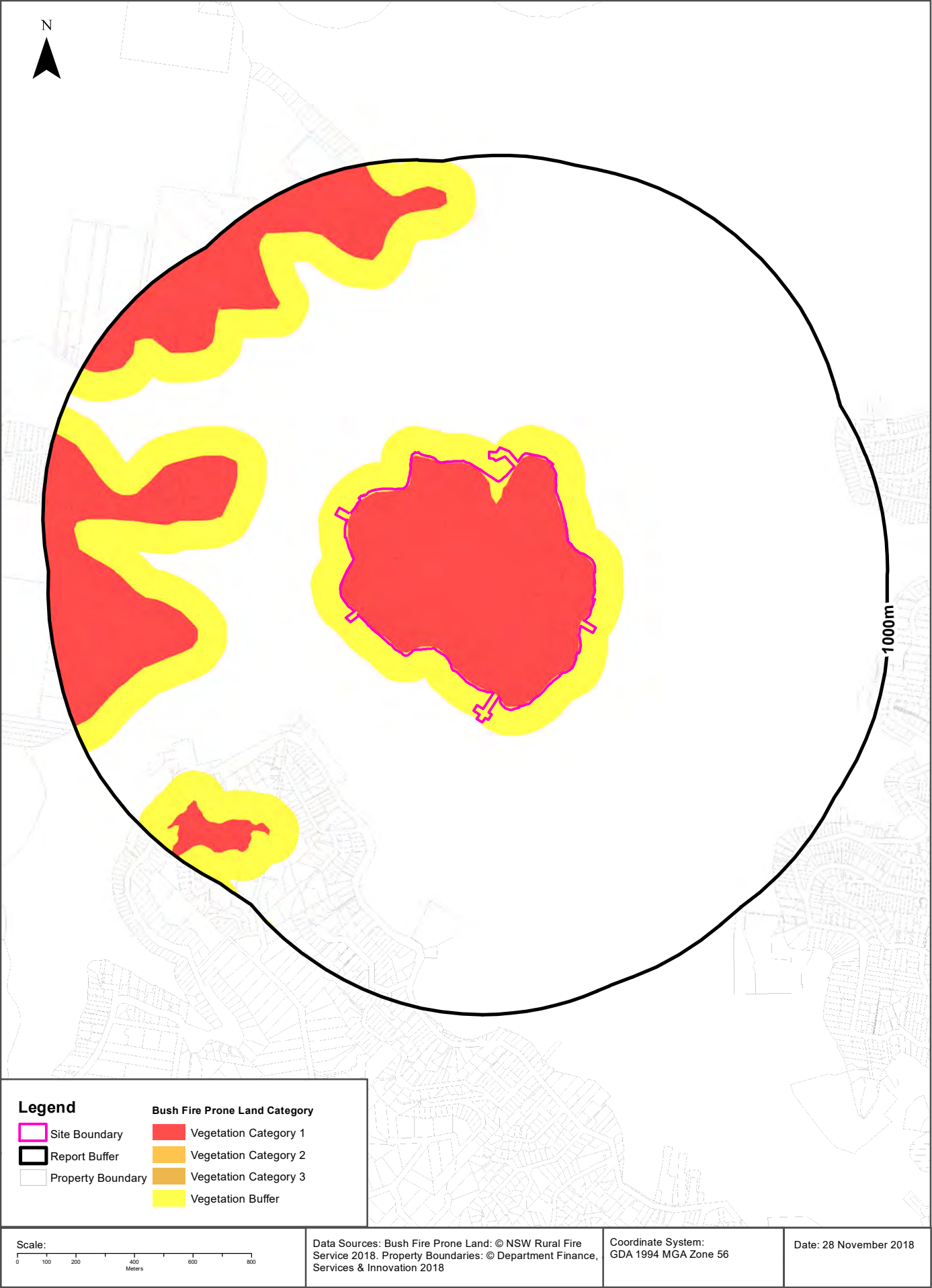
What are the EPI Heritage Items located within the dataset buffer?

Map Id	Name	Classification	Significance	EPI	Published Date	Commenced Date	Currency Date	Distance	Direction
2270008	House - "Trincomalee"	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	354m	West
2270336	Church Point Wharf	Item - Archaeological	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	369m	South West
2270010	Church Point Post Office & Store	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	423m	South West
2270125	Graveyard & site of former Methodist Church	Item - Archaeological	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	456m	South West
2270426	Stone bath remnants	Item - Archaeological	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	545m	West
2270082	House - "Myuna"	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	605m	West
2270070	House "Homesdale"	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	650m	South West
2270442	Cottage - '??Hove Cottage'?	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	663m	West
2270465	Boatshed	Item - Archaeological	Local	Pittwater Local Environmental Plan 2014	22/01/2016	22/01/2016	22/01/2016	667m	South
2270443	Cottage	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	675m	West
2270007	Memorial Obelisk	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	675m	South West
2270444	Cottage	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	692m	West
2270005	House - "Rostrevor"	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	707m	South West
2270131	Frederick Oliver's Grave	Item - Archaeological	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	847m	West

Map Id	Name	Classification	Significance	EPI	Published Date	Commenced Date	Currency Date	Distance	Direction
2270044	House - "Tarrangaua"	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	889m	North West
2270042	Store, jetty & shed	Item - General	Local	Pittwater Local Environmental Plan 2014	30/05/2014	27/06/2014	22/01/2016	950m	North

Heritage Data Source: NSW Crown Copyright - Planning & Environment

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Natural Hazards

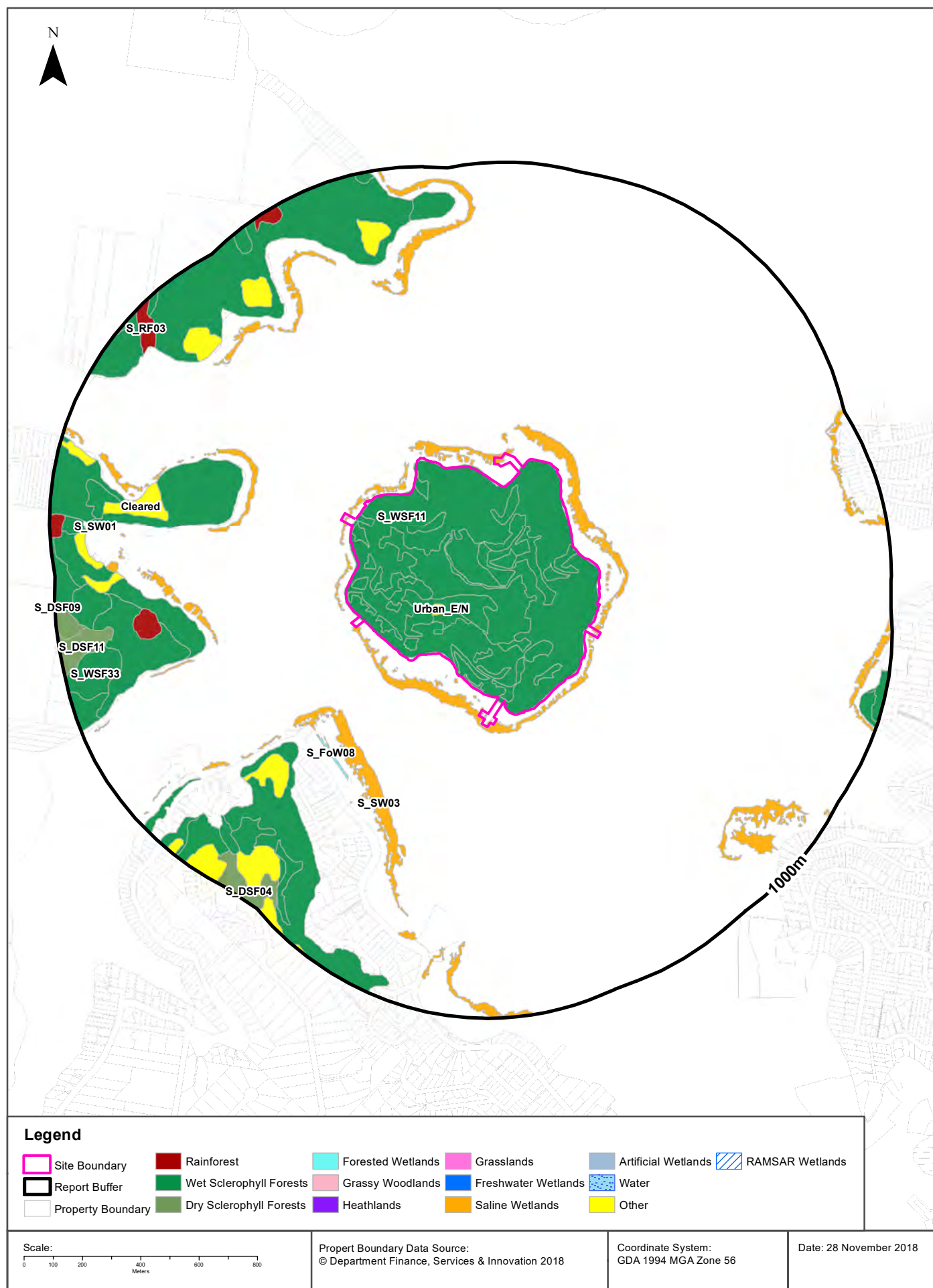
Scotland Island, Pittwater, NSW 2105

Bush Fire Prone Land

What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

Bush Fire Prone Land Category	Distance	Direction
Vegetation Buffer	0m	Onsite
Vegetation Category 1	0m	Onsite

NSW Bush Fire Prone Land - © NSW Rural Fire Service under Creative Commons 4.0 International Licence



Ecological Constraints

Scotland Island, Pittwater, NSW 2105

Native Vegetation

What native vegetation exists within the dataset buffer?

Map ID	Map Unit Name	Threatened Ecological Community NSW	Threatened Ecological Community EPBC Act	Understorey	Disturbance	Disturbance Index	Dominant Species	Dist	Direction
S_SW03	S_SW03: Seagrass Meadows			00: Not assessed	00: Not assessed	0: Not assessed	Seagrass (DPI)	0m	Onsite
S_WSF11	S_WSF11: Pittwater Spotted Gum Forest	Pittwater Spotted Gum Forest		00: Not assessed	00: Not assessed	0: Not assessed	C.maculata/E.paniculata/S.glomulifera/E.umbra	0m	Onsite
S_WSF11	S_WSF11: Pittwater Spotted Gum Forest	Pittwater Spotted Gum Forest		24: Urban and hard surface	24: Urban mixed use	4: Very high	C.maculata/E.paniculata/S.glomulifera/E.umbra	0m	Onsite
Urban_E/N	Urban_E/N: Urban Exotic/Native			00: Not assessed	00: Not assessed	0: Not assessed	Urban Exotic/Native	0m	Onsite
S_FoW08	S_FoW08: Estuarine Swamp Oak Forest	Swamp Oak Floodplain Forest		00: Not assessed	00: Not assessed	0: Not assessed	C.glauca	392m	South West
Cleared	Cleared			00: Not assessed	00: Not assessed	0: Not assessed	Cleared	512m	South West
S_RF03	S_RF03: Coastal Warm Temperate Rainforest			10: Mesic/rainforest	15: Regrowth	2: Moderate	C.apetalum/A.smiithii/L.australis/S.glandulosum	641m	West
S_SW01	S_SW01: Estuarine Mangrove Forest			00: Not assessed	00: Not assessed	0: Not assessed	Mangroves	746m	South
S_WSF33	S_WSF33: Central Coast Escarpment Moist Forest			11: Semi sheltered dry/mesic	24: Urban mixed use	4: Very high	Eucalyptus botryoides/A.costata/E.paniculata/S.glomulifera/E.piperita	788m	West
S_DSF11	S_DSF11: Sydney North Exposed Sandstone Woodland			12: Dry xeric shrubs	99: No visible disturbance	5: No visible disturbance	E.haemastoma/B.serrata	806m	West
S_DSF04	S_DSF04: Coastal Enriched Sandstone Dry Forest			24: Urban and hard surface	24: Urban mixed use	4: Very high	A.costata/E.botryoides/E.piperita	874m	South West
S_DSF09	S_DSF09: Coastal Sandstone Gully Forest			11: Semi sheltered dry/mesic	99: No visible disturbance	5: No visible disturbance	A.costata/E.piperita/C.gummifera/S.glomulifera/E.resinifera	896m	West

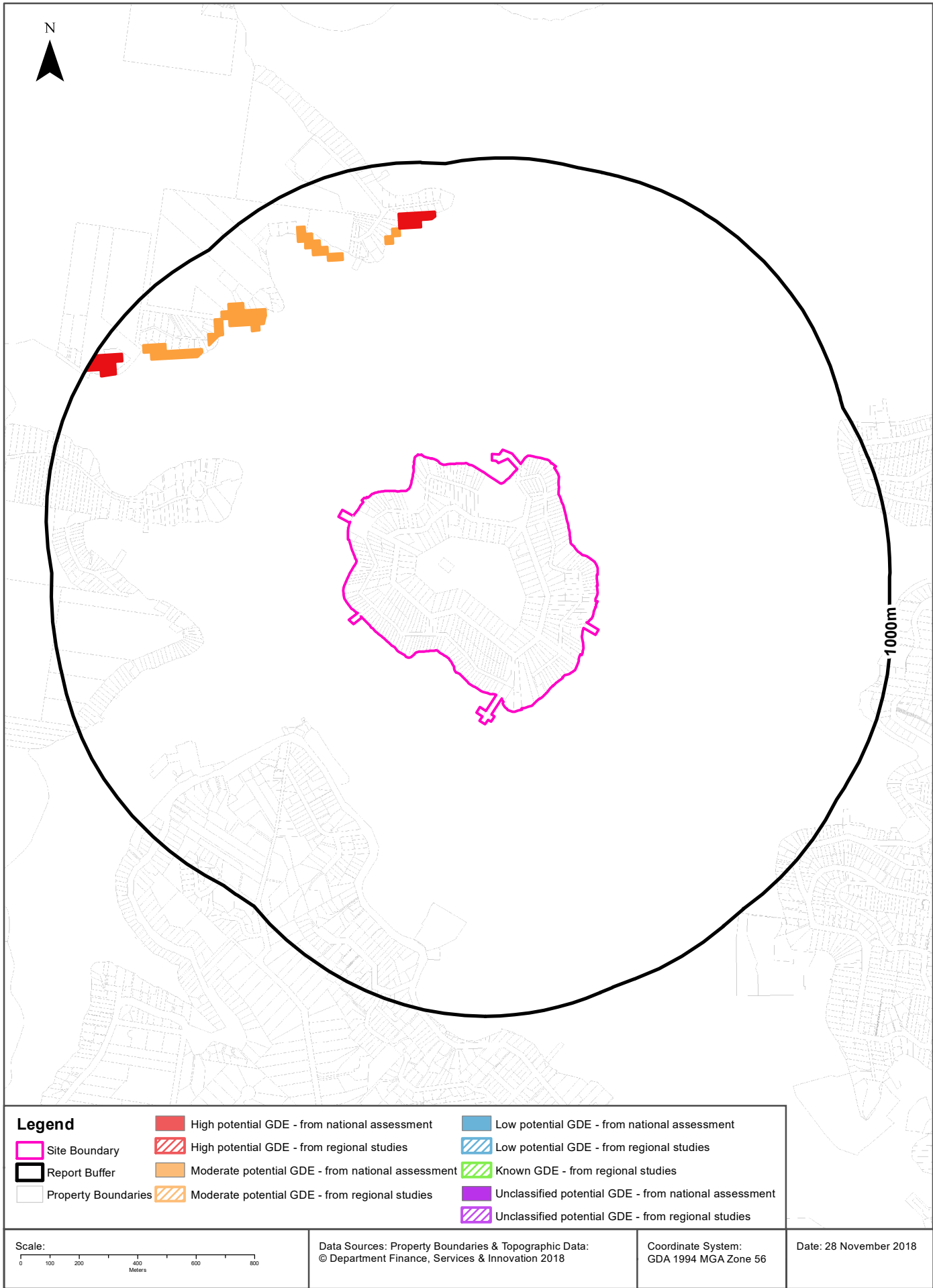
Native Vegetation of the Sydney Metropolitan Area : NSW Office of Environment and Heritage
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RAMSAR Wetlands

What RAMSAR Wetland areas exist within the dataset buffer?

Map Id	RAMSAR Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

RAMSAR Wetlands Data Source: © Commonwealth of Australia - Department of Environment



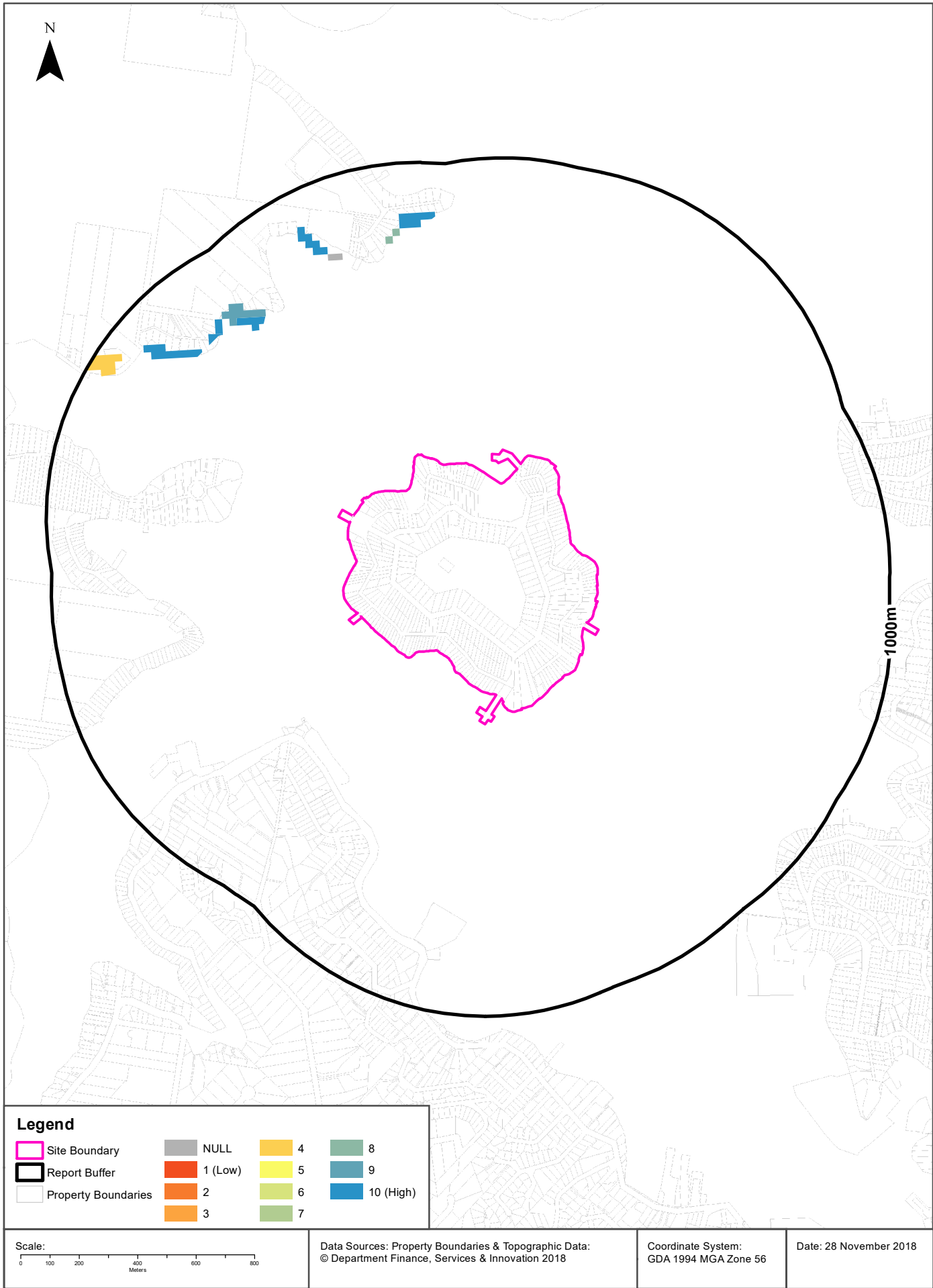
Ecological Constraints

Scotland Island, Pittwater, NSW 2105

Groundwater Dependent Ecosystems Atlas

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	Moderate potential GDE - from national assessment	Deeply dissected sandstone plateaus.	Vegetation		677m
Terrestrial	High potential GDE - from national assessment	Deeply dissected sandstone plateaus.	Vegetation		776m

Groundwater Dependent Ecosystems Atlas Data Source: The Bureau of Meteorology
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Ecological Constraints

Scotland Island, Pittwater, NSW 2105

Inflow Dependent Ecosystems Likelihood

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	10	Deeply dissected sandstone plateaus.	Vegetation		677m
Terrestrial	9	Deeply dissected sandstone plateaus.	Vegetation		702m
Terrestrial	8	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	727m
Terrestrial	4	Deeply dissected sandstone plateaus.	Vegetation	Consolidated sedimentary	903m

Inflow Dependent Ecosystems Likelihood Data Source: The Bureau of Meteorology
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Ecological Constraints

Scotland Island, Pittwater, NSW 2105

NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Amphibia	Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Amphibia	Litoria aurea	Green and Golden Bell Frog	Endangered	Not Sensitive	Vulnerable	
Animalia	Amphibia	Pseudophryne australis	Red-crowned Toadlet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Anous stolidus	Common Noddy	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Not Sensitive	Critically Endangered	
Animalia	Aves	Apus pacificus	Fork-tailed Swift	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Ardea ibis	Cattle Egret	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna carneipes	Flesh-footed Shearwater	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Ardenna grisea	Sooty Shearwater	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna pacificus	Wedge-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ardenna tenuirostris	Short-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Burhinus grallarius	Bush Stone-curlew	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Calidris acuminata	Sharp-tailed Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Calidris ruficollis	Red-necked Stint	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Calyptorhynchus lathamii	Glossy Black-Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Dasyornis brachypterus	Eastern Bristlebird	Endangered	Category 2	Endangered	
Animalia	Aves	Diomedea exulans	Wandering Albatross	Endangered	Not Sensitive	Endangered	JAMBA
Animalia	Aves	Diomedea gibsoni	Gibson's Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Egretta sacra	Eastern Reef Egret	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Fregata ariel	Lesser Frigatebird	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Gallinago hardwickii	Latham's Snipe	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not Sensitive	Not Listed	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Haematopus fuliginosus	Sooty Oystercatcher	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus longirostris	Pied Oystercatcher	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Halobaena caerulea	Blue Petrel	Not Listed	Not Sensitive	Vulnerable	
Animalia	Aves	Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Hydroprogne caspia	Caspian Tern	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ixobrychus flavicollis	Black Bittern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Lathamus discolor	Swift Parrot	Endangered	Category 3	Critically Endangered	
Animalia	Aves	Limosa lapponica	Bar-tailed Godwit	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Lophoictinia isura	Square-tailed Kite	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Macronectes giganteus	Southern Giant Petrel	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Merops ornatus	Rainbow Bee-eater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Neophema pulchella	Turquoise Parrot	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox connivens	Barking Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox strenua	Powerful Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Numenius madagascariensis	Eastern Curlew	Not Listed	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius phaeopus	Whimbrel	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Onychoprion fuscata	Sooty Tern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pandion cristatus	Eastern Osprey	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Petroica boodang	Scarlet Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ptilinopus magnificus	Wompoo Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ptilinopus superbus	Superb Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Rostratula australis	Australian Painted Snipe	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Thalassarche cauta	Shy Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thalassarche chrysostoma	Grey-headed Albatross	Not Listed	Not Sensitive	Endangered	
Animalia	Aves	Thalassarche melanophris	Black-browed Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Tringa brevipes	Grey-tailed Tattler	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tringa nebularia	Common Greenshank	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Tyto novaehollandiae	Masked Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto tenebricosa	Sooty Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Xenus cinereus	Terek Sandpiper	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Mammalia	Arctocephalus forsteri	New Zealand Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Arctocephalus pusillus doriferus	Australian Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Not Sensitive	Endangered	
Animalia	Mammalia	Dugong dugon	Dugong	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Eubalaena australis	Southern Right Whale	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Isodon obesulus obesulus	Southern Brown Bandicoot (eastern)	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Miniopterus australis	Little Bentwing-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Mormopterus norfolkensis	Eastern Freetail-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Myotis macropus	Southern Myotis	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Petauroides volans	Greater Glider	Not Listed	Not Sensitive	Vulnerable	
Animalia	Mammalia	Petaurus norfolcensis	Squirrel Glider	Endangered Population, Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Petaurus norfolcensis	Squirrel Glider	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Endangered Population, Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Physeter macrocephalus	Sperm Whale	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Pseudomys gracilicaudatus	Eastern Chestnut Mouse	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Pseudomys novaehollandiae	New Holland Mouse	Not Listed	Not Sensitive	Vulnerable	
Animalia	Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Saccolaimus flaviventris	Yellow-bellied Sheath-tail-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Vespadelus troughtoni	Eastern Cave Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Cacophis harriettae	White-crowned Snake	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Caretta caretta	Loggerhead Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Chelonia mydas	Green Turtle	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Reptilia	Dermochelys coriacea	Leatherback Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Eretmochelys imbricata	Hawksbill Turtle	Not Listed	Not Sensitive	Vulnerable	
Animalia	Reptilia	Varanus rosenbergi	Rosenberg's Goanna	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Asterolasia elegans		Endangered	Not Sensitive	Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Plantae	Flora	<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Boronia umbellata</i>	Orara Boronia	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Brachyscome muelleroides</i>	Claypan Daisy	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Callistemon linearifolius</i>	Netted Bottle Brush	Vulnerable	Category 3	Not Listed	
Plantae	Flora	<i>Chamaesyce psammogeton</i>	Sand Spurge	Endangered	Not Sensitive	Not Listed	
Plantae	Flora	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	Vulnerable	Category 2	Vulnerable	
Plantae	Flora	<i>Davidsonia jerseyana</i>	Davidson's Plum	Endangered	Category 2	Endangered	
Plantae	Flora	<i>Diuris bracteata</i>		Endangered	Category 2	Extinct	
Plantae	Flora	<i>Epacris purpurascens</i> subsp. <i>purpurascens</i>		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	<i>Epacris purpurascens</i> var. <i>purpurascens</i>		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	Endangered	Category 2	Endangered	
Plantae	Flora	<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	Endangered	Category 3	Not Listed	
Plantae	Flora	<i>Grevillea caleyi</i>	Caley's Grevillea	Critically Endangered	Category 3	Critically Endangered	
Plantae	Flora	<i>Grevillea shiressii</i>		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Haloragodendron lucasii</i>		Endangered	Not Sensitive	Endangered	
Plantae	Flora	<i>Isotoma fluviatilis</i> subsp. <i>fluviatilis</i>		Not Listed	Not Sensitive	Extinct	
Plantae	Flora	<i>Kunzea rupestris</i>		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Lasiopetalum joyceae</i>		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Macadamia integrifolia</i>	Macadamia Nut	Not Listed	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Maundia triglochinoides</i>		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	<i>Melaleuca deanei</i>	Deane's Paperbark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Micromyrtus blakelyi</i>		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Microtis angusii</i>	Angus's Onion Orchid	Endangered	Category 2	Endangered	
Plantae	Flora	<i>Persoonia hirsuta</i>	Hairy Geebung	Endangered	Category 3	Endangered	
Plantae	Flora	<i>Persoonia laxa</i>		Presumed Extinct	Not Sensitive	Extinct	
Plantae	Flora	<i>Persoonia marginata</i>	Clandulla Geebung	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	<i>Persoonia mollis</i> subsp. <i>maxima</i>		Endangered	Not Sensitive	Endangered	
Plantae	Flora	<i>Persoonia pauciflora</i>	North Rothbury Persoonia	Critically Endangered	Category 3	Critically Endangered	
Plantae	Flora	<i>Pimelea curviflora</i> subsp. <i>curviflora</i>		Vulnerable	Not Sensitive	Vulnerable	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Plantae	Flora	Pimelea curviflora var. curviflora		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Prostanthera densa	Villous Mint-bush	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Tetratheca glandulosa		Vulnerable	Not Sensitive	Not Listed	

Data does not include NSW category 1 sensitive species.

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Data obtained 27/11/2018

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Appendix E Ausgrid Contamination Investigation Report



Ausgrid

Scotland Island Energy Reliability Project Contamination Investigation Report

October 2018

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1. Introduction

1.1 General

Ausgrid engaged GHD Pty Ltd (GHD) to undertake a contamination assessment as part of the geotechnical investigation for input into detailed design phases of the Scotland Island Energy Reliability Project.

This report presents the findings of the targeted contamination assessment. The findings of the geotechnical investigation are presented under a separate cover (GHD ref. 21-27425-8323).

1.2 Project background

It is understood that Ausgrid are planning to re-enforce the electricity supply to Scotland Island. This is to be done with Horizontal Directional Drilling (HDD) to allow the installation of a second underground 11kV cable to the island between Church Point parking area and Carols Wharf. The HDD will comprise several High Density Polyethylene (HDPE) pipes with a nominal bore bundle diameter of 400mm and length of 650m.

1.3 Objectives

The objectives of this assessment were:

- Undertake a targeted intrusive site assessment in conjunction with the geotechnical investigation, to characterise subsurface conditions at the site and assess concentrations of contaminants of potential concern (COPC), in relation to human health for intrusive and maintenance workers during the construction.
- Use the findings of the intrusive investigation to inform whether environmental management or remediation is required on the site prior to Ausgrid's proposed development.
- Undertake a preliminary waste classification of the site and assess potential impact of human health during the construction and maintenance phase of the development.

1.4 Scope of work

In order to meet the stated objectives, GHD completed the following scope of works:

- Undertake targeted intrusive site investigations to characterise subsurface conditions and the site and assess concentrations of contaminants of potential concern (COPC).
- Laboratory analysis of selected soil samples; and
- Preparation of this factual report documenting the findings of the assessment and recommendations for the proposed development from a contamination perspective.

1.5 Limitations

GHD's limitations to the assessment are provided in **Section 9**.

2. Details of investigation

2.1 Site Setting

2.1.1 Locality

Located between Ku-ringai National Park and the Northern Beaches peninsula, the site is approximately 30km north of Sydney CBD and within the Pittwater Estuary. The proposed HDD alignment will run from the southern end of the Church Point parking area across approximately 650m of waterway to Carols Wharf on Scotland Island.

2.1.2 Geomorphology of Pittwater

Pittwater is a drowned river estuary, formed by rising sea levels (approximately 10,000 years ago) inundating existing valleys and drainage systems along the coastline. The Geology of the Sydney 1:100,000 Sheet 9130, Quaternary Geology Map show the extents of various sediment deposits. The map suggests that the valleys were sculpted into the bedrock by palaeodrainage systems for the Hawkesbury and Pittwater, most likely during the Tertiary period (1,600,000 – 65,000,000 years ago).

The infillings of the palaeochannels include:

- 'Recent' marine sediments deposited during the Holocene epoch <10,000 years ago, described in the map as marine sands underlain by estuarine basin 'mud' and sandy 'mud'.
- 'Ancient' sediments deposited during the Pleistocene Epoch from 10,000 to 1,600,000 years ago, described in the map as estuarine clay and sandy clays overlying bedrock units of the Sydney Basin.

2.1.3 Geology

The Geology of the Sydney 1:100,000 Sheet 9130 map shows the extents of major rock units. The map indicates the local landscape is dominated by thick bedded quartz Hawkesbury Sandstone. However, the lower boundary of the Hawkesbury Sandstone unit occurs in the lower slopes of the terrain. Hence, the HDD will likely progress through stratigraphic sequences underlying Hawkesbury Sandstone, i.e.:

- Newport & Garie formations
- Bald Hill Claystone
- Bulgo Sandstone

The Newport Formation can be seen outcropping along the shoreline near Carols Wharf on Scotland Island and further around the shoreline towards the east. The Newport Formation refers to an interbedded shale and sandstone sequence, with grey to dark grey shales and white sandstones becoming grey to orange when weathered.

Underlying the Newport formation and Garie Formation is the Bald Hill Claystone, which is a commonly recognised marker unit due to its consistent and distinct red-brown colour. The rock predominately consists of claystone and siltstone with a thickness in the order of 10 - 20m measured in outcrops on Sydney's Northern Beaches.

Bulgo Sandstone underlies the Bald Hill Claystone. It is a relatively thick unit, reaching a maximum thickness of 260m consisting of mainly sandstone with siltstone and claystone beds.

2.2 Preliminary activities

A Project HSE Plan, including a Job Safety and Environmental Analysis (JSEA), Risk Assessment and Environmental Work Method Statements (EWMS), was prepared prior to conducting the investigation. Subcontractor HSE documentation was reviewed prior to fieldwork commencement and all staff involved in the investigation fieldwork were inducted into the Project HSE Plan by the GHD fieldwork supervisor prior to commencing fieldwork. In addition, daily safety pre-work assessments and environmental inspections were carried out to address any additional hazards associated with the specific site conditions on each day of the fieldwork.

A 'Dial Before You Dig' (DBYD) buried services enquiry was submitted by GHD and buried services plans were collated and reviewed for the proposed investigation locations. A qualified underground services locator was engaged to review the service plans and scan the land-based test location to confirm the area was clear of services prior to the intrusive investigation fieldwork.

2.3 Investigation fieldwork

The investigation fieldwork comprised of both water and land based boreholes. The investigation locations were based on the proposed HDD alignment as shown on **Figure 1, Appendix A**. Five boreholes (GHD-BH1 to GHD-BH5) were drilled along the proposed HDD alignment to allow borehole logging, sampling of soil and rock profiles and installation of a groundwater monitoring well (GHD-BH1). The boreholes were drilled on land (GHD-BH1) and over water (GHD-BH2 to GHD-BH5), utilising a variety of drilling and sampling techniques. Locations GHD-BH6 and GHD-BH7 were completed by hand auger in Harold Reserve.

The borehole locations were surveyed using a Trimble R10 GNSS system for spatial coordinates and ground surface levels. A summary of borehole locations including coordinates, reduced levels and investigation depths is presented below in **Table 1**.

Table 1 – Borehole and hand auger investigation locations

Test Location	Easting (MGA, m)	Northing (MGA, m)	Level (m, AHD)	Water Depth (m)	Collar Level (m,AHD)	Investigated Depth (m)
GHD-BH1	341060.40	6275750.03	1.76	-	1.76	21.0
GHD-BH2	341234.09	6275851.62	0.32	9.0	-8.68	37.5
GHD-BH3	341299.77	6275900.88	0.74	13.0	-12.26	37.0
GHD-BH4	341145.26	6275801.80	0.47	2.4	-1.97	34.8
GHD-BH5	341540.80	6275988.93	0.41	1.7	-1.29	15.6
GHD-BH6	341616.5	6276042.4	-	1.8	0.5	-
GHD-BH7	341622.4	6276049.8	-	3.4	2.0	-

2.3.1 Borehole drilling

Borehole drilling was conducted under the full-time supervision of an experienced GHD geotechnical engineer. The boreholes (BH1-BH5) were drilled using a subcontracted, specialist geotechnical drilling rig. Two hand auger boreholes (BH6 and BH7) located in Harold Reserve were advanced and sampled by a geotechnical engineering from GHD.

The boreholes were commenced with rotary mud wash boring and a casing advancement system when necessary. Standard Penetration Tests (SPT) were carried out at regular depth increments within the soil profile to assess the in-situ material strength and to collect representative samples. Representative disturbed and undisturbed samples were collected from the boreholes for further assessment and laboratory testing. The encountered sub-surface profiles were logged in accordance with Australian Standard AS1726-2017 and GHD's standard procedures.

Upon SPT and/or wash bore refusal, boreholes were continued into bedrock with HQ and NMLC coring techniques. Core samples were boxed, logged and photographed on the completion of coring.

One groundwater monitoring well was installed in GHD-BH1, with the remaining boreholes grouted on completion of all investigation activities.

Borehole logs are provided in **Appendix B** and should be read in conjunction with the Standard Sheets (**Appendix B**), which explain the terms, symbols and abbreviations used, as well as the limitations of the logging procedures.

2.3.2 Surface soil sampling

Six surface soil samples were collected within Harolds Reserve on Scotland Island. The samples (SI01-SI06) were collected using a hand auger by a geotechnical engineer from GHD. Surface soil samples were analysed for asbestos only.

2.3.3 Groundwater monitoring well

One groundwater monitoring well instrumented with a vibrating wire piezometer was installed in GHD-BH1 for groundwater sampling and temperature monitoring purposes, from a geotechnical perspective. Contamination sampling was conducted on the 27 September 2018 at this location, utilising disposal bailers. Sampling was conducted in conjunction with sampling for geotechnical parameters.

The construction details of the groundwater well are presented on the GHD-BH1 borehole log in **Appendix B**.

3. Data quality objectives

3.1 Overview

A process for establishing data quality objectives for an investigation site has been defined in the NSW EPA *Contaminated Land Management Draft Guidelines for the NSW Site Auditor Scheme* (3rd edition, 2006). The Data Quality Objectives (DQO) process was applied to the investigation and data assessment, as described below, to ensure that data collection activities were appropriate and achieved the project objectives. The DQO process involved seven steps defined as follows:

3.1.1 Step 1: State the problem

GHD understands the site is proposed to be developed for the installation of a second underground 11kV cable to the island between Church Point parking area and Carols Wharf.

The problems as it stands is that the site needs to be further investigated to characterise the potential for contamination at the site and assess the impact on human health during the development.

3.1.2 Step 2: Identify the decisions

The key decisions to be made in the assessment include:

- Is soil and groundwater contamination present on-site at concentrations exceeding adopted site investigation levels?
- Are the sources of potential contamination (primary or secondary) from on and / or off-site sources?
- Is there an unacceptable risk posed by contamination (if present) to human health (construction and maintenance workers)?
- If soil contamination is identified on-site at concentrations exceeding the adopted site investigation levels, is there a need for further assessment, remediation and/or management of the contamination?

3.1.3 Step 3: Identify inputs to the decision

The sampling program was designed to provide sufficient information to allow a sound scientific evaluation of the questions set out in **Section 3.1.2**. This was achieved by:

- Visual inspection of site areas, along with soils at the investigation locations.
- Collection of soil and groundwater samples to provide data upon which to base subsequent decisions.
- Comparing the soil and groundwater analytical data to applicable guidelines (as defined in **Section 6**) to evaluate the potential for contamination to adversely impact upon human health.

3.1.4 Step 4: Define the study boundaries

With respect to physical boundaries, the lateral boundaries of the investigation area are defined on **Figure 1, Appendix A**, and discussed in **Section 1**.

The vertical investigation boundary is defined as up to 37.54 metres below ground level (m bgl) which is the maximum depth of the intrusive investigation.

3.1.5 Step 5: Develop a decision rule

The degree of impact by contaminants and the decisions associated with accepting data was assessed with reference to the chosen site investigation levels, which were established within the framework of guidelines made or approved by NSW EPA. The decision rule is:

- If the data has been collected in an appropriate manner to establish completeness, comparability, representativeness, precision and accuracy, it will be considered suitable for the purposes of this assessment; and
- If soil or groundwater contamination is identified on-site at concentrations exceeding the adopted site investigation levels (**Section 4**), then further assessment and/or management of the contamination may be required.

3.1.6 Step 6: Specify limits on decision errors

Two primary decision error-types may occur due to uncertainties or limitations in the project data set:

- A sample/area may be deemed to pass the nominated criteria, when in fact it does not. This may occur if contamination is 'missed' due to limitations in the sampling plan, or if the project analytical data set is unreliable.
- A sample/area may be deemed to fail the nominated criteria, when in fact it does not. This may occur if the project analytical data set is unreliable, due to inappropriate sampling, sample handling, or analytical procedures.

An assessment will be made as to the likelihood of a decision error being made based on the results of a QA/QC assessment and the closeness of the data to the assessment criteria. The QA/QC assessment will include reference these data quality indicators.

3.1.7 Step 7: Optimise the design for obtaining data

This was achieved through the development of an appropriate sampling and analytical strategy which was reviewed and refined as necessary during the assessment evaluating field observations and analytical results. This included collection and analysis of soil and groundwater samples, and visual, observation for surface asbestos containing materials.

3.2 Data quality indicators

Data quality indicators (DQIs) have been established for completeness, comparability, representativeness, precision and accuracy.

The DQIs for sampling techniques and laboratory analysis of collected samples identifies the acceptable level of error for this investigation. The data quality objectives were assessed by reference to data quality indicators as follows:

Data Representativeness - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the site, and by using an adequate number of sample locations to characterise the site. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.

Completeness - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.

Comparability - is a qualitative parameter expressing the confidence with which one data set can be compared with the other set. This is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.

Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_o = Analyte concentration of the original sample

C_d = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics. However, it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

Accuracy - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analytical techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards.

Accuracy of field works is assessed by examining the level of contamination detected in trip blanks. Blanks should return concentrations of all organic analytes as being less than the practical quantitation limit of the testing laboratory.

4. Basis for assessment

4.1 Relevant guidelines

The framework for the contamination assessment made herein, was developed in accordance with guidelines “made or approved”, by the NSW EPA under Section 105 of the *Contaminated Land Management Act, 1997*. These guidelines include, but are not limited to the following:

- ASSMAC (1998), *NSW Acid Sulphate Soils Manual*.
- NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*
- NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*
- NEPM (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure (No.1)*, National Environment Protection Council (NEPC)
- NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*.
- NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW EPA (2016) *Contaminated Land Management: Draft Guidelines for NSW Site Auditor Scheme* (3rd edition)

4.2 Assessment criteria

4.2.1 Soil assessment criteria

Site investigation levels have been adopted from assessment criteria presented in NEPM (2013) as discussed below: Given the proposed development of the site is an electrical cable excavation, health screening levels (HSL) and health investigation levels (HIL) for a commercial and industrial land use have been selected as the investigation screening criteria. The investigation levels used to evaluate measured chemical concentrations in soil samples are presented in the results tables in **Appendix D** and are discussed below:

It is noted that some samples collected are considered as sediments (from below water locations at GHD-BH2 to GHD-BH5). In the absence of investigation levels for the protection of human health (i.e. maintenance workers) for sediments, or sediment criteria specifically for waste classification, the data collected from sediment sampling locations BH2 to BH5 have been reviewed with reference to the guidelines outlined below.

Health Screening Levels (HSL) for Petroleum Hydrocarbons

The NEPM (2013) presents Health Screening Levels (HSLs) for fuel derived petroleum hydrocarbons, which are generic criteria based on a series of reasonably conservative assumptions in order to be protective of human health for a variety of land use types. As such they are considered to be appropriate to determine whether further contamination investigation, remediation, management or more detailed risk assessment is required. For the purposes of selecting health based investigation levels for the site, a commercial/industrial exposure setting (HSL-D) is considered to be appropriate for the commercial / industrial exposure for the proposed works.

Note that the NEPM (2013) presents HSLs for vapour intrusion only. For the direct contact and vapour intrusive pathway for intrusive maintenance workers, reference has been made to Friebe and Nadebaum (2011) Health Screening Levels for Petroleum Hydrocarbons in Soil and

Groundwater CRC Technical Report No 10. The NEPM HSLs are based on the work by Friebe and Nadebaum, however the direct contact pathway was not included into the NEPM (2013).

Health Investigation Levels (HIL)

For non-petroleum hydrocarbons, the NEPM 2013 Health Investigation Levels have been adopted for a commercial / industrial setting HIL-D. The HILs take into account direct contact pathways, including incidental ingestion and dermal contact.

4.2.2 Groundwater assessment criteria

Human health screening levels

The HSLs for petroleum hydrocarbons for commercial / industrial land use have also been adopted for the assessment of groundwater to characterise the risk posed to receptors by potential hydrocarbon vapour intrusion. Commercial users of the metro/commuters are unlikely to come into contact with the groundwater.

Ecological criteria

Based on the proximity of the site, it has been assumed for this assessment that groundwater in the area has potential to discharge to the nearby aquatic systems of Pittwater and Hawkesbury River. Therefore, the assessment criteria nominated for this assessment are the Marine Waters Groundwater Investigation Levels (GILs) from the NEPM (2013).

4.2.3 Waste classification guidelines

For waste classification, the acid sulphate soils (ASS) potential of the soil must be assessed, as outlined in the *NSW EPA (2014) Waste Classification Guidelines, Part 4: Acid Sulphate Soils*. Where potential ASS can not be classified as VENM or a suitable underwear disposal site at a landfill is not available, the soil must be treated in accordance with the neutralising techniques outlined in the *NSW Acid Sulphate Soils Manual (ASSMAC, 1998)*. After treatment the soil should be chemically assessed as per below.

The concentrations of the chemicals in the samples analysed will be compared to the criteria outlined in Table 2 of the *NSW EPA (2014) Waste Classification Guidelines, Part 1: Classifying Waste*. The guidelines provide criteria for assessing the appropriate waste classification for material requiring offsite disposal and subsequently assessing the required disposal location for solid and liquid wastes. The classification process for non-liquid wastes focuses on the potential for the waste to release chemical contaminants into the environment through contact with liquids (leachates).

The first test used to chemically assess waste is the Specific Contaminant Concentration (SCC) test, which determines the total concentration of each contaminant in the waste sample. The guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as either general solid waste or restricted solid waste.

The toxicity characteristics leaching procedure (TCLP) test estimates the potential for waste to release chemical contaminants into a leaching liquid. The guidelines set different maximum levels of the leachable concentration of each contaminant in order for waste to be classified as general solid waste, restricted solid waste or hazardous waste.

5. Sampling, analysis and quality assurance/quality control program

5.1 Soil sampling methodology

A total of seven intrusive sampling locations were completed across the site to assess potential for contamination of soils and sediments at the nominated sampling locations including:

- Five borehole locations (GHD-BH1 to GHD-BH5) were drilled using a track mounted rig operated by a licensed driller.
- Two hand auger borehole locations (GHD-BH6 to GHD-BH7) were advanced and sampled by hand operated hand auger by a geotechnical engineer.

During intrusive investigations, soil samples were collected from the profile where changes in the geology or indications of contamination were observed. Samples were recovered either by SPT or recovered from solid flight stem drilling and were placed into laboratory prepared sample jars which were then placed in an ice pack filled cooler and transported to the nominated laboratory under chain of custody documentation. Soils were described on borehole logs in general accordance with the Unified Soil Classification System (USCS), with features such as seepage, discolouration, staining, odours and other indications of contamination being noted. Copies of the borehole logs are included in **Appendix B**.

All soil samples were screened in the field using a hand held photo-ionisation detector (PID). The PID was used to screen concentrations of volatile organic hydrocarbons to inform which samples should be selected for BTEX and light end TPH laboratory analysis. The results of the PID screening are noted on the logs presented in **Appendix B**. The PID calibration sheet is included in **Appendix C**.

All waste soil generated during drilling of the soil bores was used to backfill the boreholes following sampling.

Selected soil samples were submitted to the nominated laboratory for analysis for the contaminants of potential concern (COPC), these contaminants include:

- Heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc).
- Total Recoverable Hydrocarbons (TRH).
- Polycyclic aromatic hydrocarbons (PAH).
- Benzene, toluene, ethyl benzene and xylenes (BTEX).
- Organochloride pesticides (OCP).
- Polychlorinated biphenyls (PCB).
- Asbestos identification (absence / presence)

5.2 Groundwater sampling methodology

Groundwater sampling was carried out at least one week following the installation of the new groundwater well. The sampling was conducted by a GHD geotechnical engineer in conjunction with the sampling for geotechnical parameters.

The groundwater well was purged using disposable Teflon-free plastic bailers, with at least three well volumes removed and well allowed to recharge.

The groundwater sample was retrieved using a clean disposable bailer and transferred immediately into laboratory prepared bottles suitable for the requested analyses. Where required, sample bottles were filled to minimise headspace.

The containers were labelled with the job number, sample identification and date. These were transferred to chilled coolers for preservation for transportation to the project laboratory. Samples were accompanied with chain of custody documentation to the project laboratory and were submitted within holding times appropriate to the analysis required.

The groundwater sample was submitted to the nominated laboratory for analysis for the contaminants of potential concern (COPC), these contaminants include:

- Heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc).
- Total Recoverable Hydrocarbons (TRH).
- Polycyclic aromatic hydrocarbons (PAH).
- Benzene, toluene, ethyl benzene and xylenes (BTEX).
- Organochloride pesticides (OCP).
- Polychlorinated biphenyls (PCB).

No duplicate samples were collected as part of the groundwater sampling.

6. Site investigation results

6.1 Encountered sub-surface profile

Summarised descriptions of the encountered sub-surface profile units are provided below. Reference to the borehole logs should be made for a detailed description of the subsurface conditions encountered at each borehole location. Detailed bore hole logs from the investigation locations are provided in **Appendix B**. Detailed geotechnical information is provided in GHD's geotechnical report presented under a separate cover (GHD ref. 21-27425-8323).

6.1.1 Fill

Fill was only encountered in one borehole during the investigation, GHD-BH1 to a depth of 0.2 m bgl, the fill was described as a dark brown gravelly sand with trace clay. No visual or olfactory evidence of contamination was observed during sampling.

6.1.2 Sediments

The origins of Pittwater estuary (drowned river valley) has generally led to a complex deposition of sediments, with generally granular over land sediments deposited under fluvial (stream) conditions and marine or estuarine sediments deposited in low energy conditions. Further interpretation of layering is discussed in Section 4.

Fluvial deposits

Deposited over-land, under higher energy fluvial conditions, generally these sediments are likely to be sand with little to no fines (cohesive soils). Fluvial deposits encountered are described below:

- Sand was generally found at the surface of the seabed. The sands were brown to grey with little to silt or clay and traces of shell fragments. This sediment layer was typically from 1m to 2m thick.
- Grey and/or brown sand and clayey sand was encountered in GHD-BH2, GHD-BH3 and GHD-BH4, with a thickness of 4.5m to 7.5m thick and described as moderately dense to dense.
- Grey to brown sands had varying proportions of clay throughout were encountered towards the bottom of the soil profile in boreholes GHD-BH2 and GHD-BH3. Fine to coarse sub-rounded quartz gravels were throughout the sediments, suggesting a high-energy overland deposition particularly within the upper extent of these layers

Estuarine/marine deposits

Estuarine and marine sediments are deposited under low energy and submerged conditions, are generally cohesive, dark in colour and normally consolidated. Estuarine/marine deposits encountered are described below:

- Layered deposits of medium to high plasticity, black clay with thicknesses of 2m to 4m and soft to stiff consistency. These materials were encountered in boreholes GHD-BH2, GHD-BH3 and GHD-BH4 below 12.5m depth.
- Low to high plasticity, very stiff to hard grey clay and sandy clay was encountered in boreholes GHD-BH2, GHD-BH3 and GHD-BH4. These materials occurred in 1.5m to 5m thick layers.

6.1.3 Bedrock

Four different Sydney Basin geological formations were encountered. Table 2 below summarises the extents of each formation encountered in the boreholes. The following descriptions are generalised. Reference to the cored borehole logs should be made for detailed descriptions of the bedrock material and defects encountered in each borehole location. Detailed descriptions of bedrock formations are discussed in the GHD geotechnical report (GHD ref. 21-27425-8323).

Table 2 – Bedrock formation summary (boreholes in order of west to east)

Formation	Depth below ground/seabed surface (m)				
	GHD-BH1	GHD-BH4	GHD-BH2	GHD-BH3	GHD-BH5
Newport & Garie Formation	5.5 – 21+	24.5 – 29.3	-	-	9.2 – 15.6+
Bald Hill Claystone	-	29.3 – 34+	-	27.3 – 32	-
Bulgo Sandstone	-	-	28.5 – 37.5+	32 – 37+	-

6.2 Soil laboratory analytical results

The soil investigation laboratory results are presented in **Table D1, Appendix D** and laboratory reports are provided in **Appendix E**. Laboratory analytical results are summarised below.

6.2.1 Heavy metals

The majority of soil samples submitted for analysis reported heavy metal concentrations below the applicable human health guidelines.

6.2.2 TRH / BTEX

The majority of soil samples submitted for analysis reported concentrations of TRH and BTEX below the laboratory limit of reporting and below the nominated soil screening criteria for the applicable human health guidelines.

6.2.3 PAH / OCP / PCB

The majority of soil samples submitted for analysis reported concentrations of PAH, OCP and PCBs below the laboratory limit of reporting and below the nominated screening criteria for human health

6.2.4 Asbestos

A total of 14 soil samples were submitted for analysis for asbestos in soils. No asbestos was detected in any of the samples.

Six surface soil samples (GHD-SI01 to GHD-SI06) were submitted for analysis of asbestos. No asbestos was detected in these samples.

6.3 Groundwater laboratory analytical results

The groundwater investigation laboratory results are presented in **Table D3, Appendix D** and laboratory reports are provided in **Appendix E**. Laboratory analytical results are summarised below.

6.3.1 Heavy metals

The groundwater sample, GHD-BH1, submitted for analysis reported heavy metal concentrations below the applicable human health guidelines. Minor exceedances for copper, nickel and zinc above the ecological guideline NEPM 2013 Marine Water guidelines. It is considered that these exceedances are indicative of naturally occurring background concentrations in the groundwater of this area.

6.3.2 TRH / BTEX

The groundwater sample, GHD-BH1, submitted for analysis reported concentrations of TRH and BTEX below the laboratory limit of reporting and below the nominated groundwater screening criteria for the applicable human health guidelines.

6.3.3 PAH / OCP / PCB

The groundwater sample, GHD-BH1, submitted for analysis reported concentrations of PAH, OCP and PCBs below the laboratory limit of reporting and below the nominated groundwater screening criteria for the applicable human health guidelines.

6.4 Waste classification

As outlined in Section 5.3 of the geotechnical report, ASS and PASS are present at the site. If disposal of the material is required offsite, the soil must be treated in accordance with the ASSMAC guidelines as described in GHD's geotechnical report, prior to disposal at a facility licenced to accept General Solid Waste.

7. QA/QC data quality assessment

7.1.1 Field QA/QC

Soil RPDs

As part of the GHD QA/QC program, three blind duplicate samples were collected and analysed during the investigation. These duplicate samples were analysed for metals, TRH/BTEX, PAH, OCP and PCB. For analytes with detected concentrations reported, RPDs were within the acceptable range with the exception of exceedances shown in **Table D4, Appendix D**.

Equipment rinsate

As part of the GHD QA/QC program, one rinsate was taken from the soil sampling equipment during the investigation. This sample was analysed for PAHs. The sample resulted in all analytes below the laboratory detection limit. Results are presented in **Table D5, Appendix D**.

7.1.2 Laboratory quality control

Holding times

All analytes were extracted within the laboratory's technical holding times.

Laboratory program

The NATA certified laboratories utilised for this assessment (Eurofins MGT Sydney) undertook their own quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached as **Appendix E**.

Method blank results were less than the PQL, and surrogate spike and laboratory control sample recoveries were within laboratory acceptance criteria.

7.1.3 Discussion

The results of the QA/QC programme are considered to provide an acceptable degree of confidence in the analytical program completed. Overall, the analytical data set is considered to be valid and acceptable to base conclusions on the contamination status of the site.

8. Conclusions and Recommendations

In accordance with the objectives detailed in **Section 1.3**, based on the information contained within this assessment, the following conclusions are made (subject to the limitations outlined in **Section 9**).

- A targeted intrusive contamination assessment was conducted in conjunction with the geotechnical investigation.
- The subsurface conditions across the proposed development route comprise of a thin layer of fill and natural materials in the land based investigation location, and marine sediments in the overwater locations, followed by natural bedrock.
- Fill was encountered in one, land based, investigation location, GHD-BH1 to a depth of 0.2 m bgl. No visual or olfactory evidence of contamination was observed during sampling.
- Concentrations of the COPC including metals, BTEX, TRH, PAH, OCP and PCB in analysed soil samples were below the adopted human health screening levels.
- Asbestos was not identified in any of the sample submitted for analysis.
- Concentrations of COPC including BTEX, TRH, PAH, OCP and PCB, were reported below the laboratory limit of reporting in the groundwater sample collected for analysis. Some heavy metals, including copper, nickel and zinc, were reported at levels which exceed the ecological screening criteria for marine waters. The presence of these heavy metals in groundwater is likely indicative of background concentrations in the local aquifer and not representative of a wider contamination issue which may impact on, or require management, as part of the proposed works.
- Acid sulphate soils were detected in the sediment samples submitted for analysis
- Soils and sediments must be treated as per the ASSMAC guidelines and geotechnical investigation report, prior to disposal offsite (if required). The preliminary waste classification of the material indicates General Solid Waste. However, it is noted that this classification does not take into consideration any drilling fluids or chemicals used as part of the construction works.
- The findings of the investigation do not indicate the presence of contamination impacting the proposed works. However, an unexpected finds protocol should be in place during the construction works, in the event that visual or olfactory signs of potential contamination are encountered.
- The surface samples (GHD-SI01 to GHD-SI06) within Harolds Reserve were analysed for asbestos in soil only. No asbestos was reported in these samples. If any excavation is required in this area as part of the proposed works soils should be stockpiled separately for waste classification prior to off-site disposal if required.

9. Limitations

This report: has been prepared by GHD for Ausgrid and may only be used and relied on by Ausgrid for the purpose agreed between GHD and the Ausgrid as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Ausgrid arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Ausgrid and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Appendix A – Figures



Appendix B – Borehole Logs

GEO BOREHOLE 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

SHEET 1 OF 6

Note: * indicates signatures on original issue of log or last revision of log

PIEZOMETER

See standard sheets for details of abbreviations & basis of descriptions




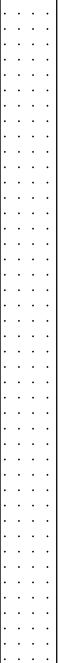
Job No. **21-27425**

BOREHOLE LOG SHEET WITH STANDPIPE PIEZOMETER

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH1**SHEET 2 OF 6**

Position : 341060.4 E 6275750.0 N MGA94/ 56 **Surface RL:** 1.76m AHD **Angle from Horiz. :** 90° **Processed :** MAG
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 8/8/2018 **Date Completed :** 9/8/2018 **Logged by :** CT **Date:** 31/08/2018

DRILLING					MATERIAL				Comments/ Observations		Piezometer Log	Components
SCALE (m)	Drilling Method	Hole Support Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index		
5.50	SFA	Nil		SPT 10/16/20 N=36			SC - CL	Sandy CLAY / Clayey SAND, as previous.	w>PL	VSt	BAG, DUP04 PID<1ppm	
6								SANDSTONE, pale grey, fine to coarse grained, completely to extremely weathered, extremely low strength, iron stained.	-	-		Bentonite
7		HWT Casing						From 7.00m, becoming red orange.				Grout
7.70				SPT 13/29/ 11 for 80mm N=ref				Start of coring at 7.7 metres. For cored interval, see Core Log Sheet.				
8												
9												
10												

See standard sheets for
 details of abbreviations
 & basis of descriptions

**GHD GEOTECHNICS**

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**21-27425**

GEO COREHOLE VISUAL 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

HOLE No. GHD-BH1

Position :	341060.4 E 6275750.0 N MGA94/ 56	Surface RL:	1.76m AHD	Angle from Horiz. :	90°	Processed :	MAG
Rig Type :	HydraP Trekker	Mounting:	Track	Contractor :	Stratacore	Driller :	TR
Casing Dia. :	HQ	Barrel (m) :	1.5m	Bit :	Surface set	Bit Condition :	New
Date Started :	8/8/2018	Date Completed :	9/8/2018	Logged by :	CT	Date Logged :	9/8/2018
							Note: * indicates signatures on original issue of log or last revision of log

Note: * indicates signatures on original issue of log or last revision of log

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Job No. **21-27425**

GEO COREHOLE VISUAL 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

HOLE No. GHD-BH1

Position :	341060.4 E 6275750.0 N MGA94/ 56	Surface RL:	1.76m AHD	Angle from Horiz. :	90°	Processed :	MAG
Rig Type :	HydraP Trekker	Mounting:	Track	Contractor :	Stratacore	Driller :	TR
Casing Dia. :	HQ	Barrel (m) :	1.5m	Bit :	Surface set	Bit Condition :	New
Date Started :	8/8/2018	Date Completed :	9/8/2018	Logged by :	CT	Date Logged :	9/8/2018
							Note: * indicates signatures on original issue of log or last revision of log

Note: * indicates signatures on original issue of log or last revision of log

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Job No.

21-27425

CORE LOG SHEET WITH STANDPIPE PIEZOMETER

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH1**SHEET 6 OF 6**

Position : 341060.4 E 6275750.0 N MGA94/ 56 **Surface RL:** 1.76m AHD **Angle from Horiz. :** 90° **Processed :** MAG
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Casing Dia. : HQ **Barrel (m) :** 1.5m **Bit :** Surface set **Bit Condition :** New **Date:** 31/08/2018
Date Started : 8/8/2018 **Date Completed :** 9/8/2018 **Logged by :** CT **Date Logged :** 9/8/2018

Note: * indicates signatures on original issue of log or last revision of log

DRILLING				MATERIAL				NATURAL FRACTURES											
Progress		Drilling & Casing	Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength Is ₍₅₀₎ MPa		Spacing (mm)		Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.	Piezometer Log	COMPONENTS	
SCALE (m)											EL 0.03	VL 0.1	L 0.3	M 1					H 3
21	HMLC coring+HWT Casing			21.00	(0) (100)		21.00		SILTSTONE, as previous.	SW- Fr									Grout
									End of Borehole at 21 metres. Target Depth										
22																			
23																			
24																			
25																			

SILTSTONE, as previous.

SW-Fr

Grout

End of Borehole at 21 metres.
Target Depth

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details of abbreviations
& basis of descriptions

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**21-27425**

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 1 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL					Notes	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1 											

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Job No.**21-27425**


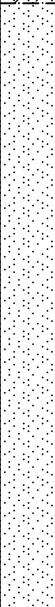
BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 2 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL							Note: * indicates signatures on original issue of log or last revision of log	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations		
6	RW (m)	HWT casing		SPT 5/13/20 N=33			SC/ CL	Clayey SAND/Sandy CLAY, as previous.	W	H	5.00-5.45m, JAR, BAG PID=16.7ppm		
7													
8				SPT 1/2/9 N=11	8.00		SP	SAND, grey, fine to coarse grained, poorly graded, with clay (alluvium).	W	MD	8.00m, SPT top 300mm possible cave in 8.00-8.45m, JAR, BAG PID=10.4ppm		
9													
10													

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**21-27425**

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 3 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL						Note: * indicates signatures on original issue of log or last revision of log
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
11	RW (m)	HWT casing		SPT 26/ 12 for 80mm N=45*			SP	SAND, as previous.	W	MD	11.00-11.23m, JAR, BAG PID=31ppm 11.00m, BAG of black organic layer, slight sulphur odour
12								11.00m, 50mm black peat layer.		D	
13					12.50		CH	CLAY, black, high plasticity (alluvium).	w>PL	S	
14				SPT 0/1/1 N=2							14.00-14.45m, JAR, BAG PID=8.0ppm
15					15.00						

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Job No.**21-27425**

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 4 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Note: * indicates signatures on original issue of log or last revision of log					
SCALE (m)	Drilling Method		Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations			
16			HWT casing		U75			CH	CLAY, as previous.	w>PL	F	16.00m, first 300mm SPT values from cave in 16.00-16.45, BAG			
									SPT 0/2/8 N=10			CL	16.00m, becoming / grading to, dark grey, low plasticity, with fine to coarse grained sand.	St	
17															
						17.50		SC	Clayey SAND, dark grey-brown, fine to medium grained, trace clay (alluvium).	W	D	17.50-17.77m, BAG			
18					SPT 15/ 25 for 120mm N=45*										
19									From 19.00m, trace medium to coarse, sub-angular to rounded quartz gravel.			19.00-19.45m, BAG			
					SPT 18/15/17 N=32										
20															

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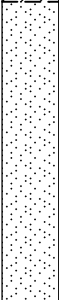
BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 5 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL						Note: * indicates signatures on original issue of log or last revision of log	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations	
	RW (m)	HWT casing		SPT 5/6/6 N=12	21.00		SC	Clayey SAND, as previous.	W	D	22.00-22.45m, BAG, JAR	
21						CI	CLAY, black, medium plasticity (alluvium).	w>PL	St			
22												
23												
24					24.00		SW	SAND, grey, fine to coarse grained, well graded, with fine to coarse, sub-rounded to rounded quartz gravels, trace clay (alluvium).	W	VD		
25												

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BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 6 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL						
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
26	RW (m) HWT casing			SPT 24/ 22 for 80mm N>50*			SW	SAND, as previous.	W	VD	
27				27.00	-	CLAYSTONE, pale grey, extremely weathered, extremely low strength (bedrock).	-	-			
28				SPT 17/25/ 4 for 10mm N=ref	28.50		Start of coring at 28.5 metres. For cored interval, see Core Log Sheet.				
29											
30											

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Job No.**21-27425**

CORE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH2**SHEET 9 OF 9**

Position : 341234.1 E 6275851.6 N MGA94/ 56 **Surface RL:** -8.68m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Casing Dia. : HWT **Barrel (m) :** 1.5m **Bit :** Surface set **Bit Condition :** New **Date:** 31/08/2018
Date Started : 23/7/2018 **Date Completed :** 27/7/2018 **Logged by :** CT **Date Logged :** 27/7/2018

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DRILLING					MATERIAL					NATURAL FRACTURES				
Progress		Drilling & Casing Water	Drill Depth (m)	(Core Loss / Run %)	RQD (%)	Depth / (RL) metres	Graphic Log	Description ROCK TYPE, colour, grain size, structure (texture, mineral composition, hardness, alteration, cementation, etc. as applicable) and SOIL TYPE, moisture, colour, consistency, structure, minor components (origin)	Weathering	Estimated Strength Is ₍₅₀₎ MPa ● - Axial ○ - Diametral	Spacing (mm)	Visual	Additional Data (joints, partings, seams, zones and veins) Fracture type, orientation, infilling or coating, shape, roughness, other.	
SCALE (m)														
36	HQ Coring + HWT casing		36.25	(0)	(100)		Interbedded SILTSTONE / SANDSTONE, as previous.	SW						
37			37.25	(0)	(100)		36.40m, becoming predominantly dark grey to black.	Fr						
			37.54	(0)	(100)	37.54	End of Borehole at 37.54 metres. Target Depth							
38														
39														
40														

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**21-27425**

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH3**SHEET 1 OF 9**

Position : 341299.8 E 6275900.9 N MGA94/ 56 **Surface RL:** -12.26m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 13/7/2018 **Date Completed :** 13/7/2018 **Logged by :** CT **Date:** 31/08/2018

Note: * indicates signatures on original issue of log or last revision of log

DRILLING					MATERIAL						Note: * indicates signatures on original issue of log or last revision of log	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations	
	RW (m) Casing Advancer	HWT					SC	Clayey SAND, grey/brown, fine to medium grained (alluvium).	w>PL	S	Note: 'TR' = undisturbed sample for Thermal Resistivity testing *Denotes SPT terminated early due to difficulties extracting sampler on floating barge. Inferred N value.	
1												
2						SPT 3/7/12 N=19			1.85m, possible increase in stiffness and clay content.	w~PL	VSt	1.50-1.85m, BAG, JAR PID=4ppm
3						U75			From 2.90m, increase in clay content, becoming grey, Sandy CLAY/ Clayey SAND matrix.		H	2.50-2.90m, U75 (TR) 2.90-3.35m, BAG, JAR PID<1ppm
4						SPT 7/15/16 N=31						
5								From 4.50m, becoming orange brown, with iron indurated zones.		VSt	4.50-4.95m, JAR+BAG PID<1ppm	
					5.00							

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Job No.**21-27425**

GEO BOREHOLE 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH3**SHEET 2 OF 9**

Position : 341299.8 E 6275900.9 N MGA94/ 56 **Surface RL:** -12.26m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 13/7/2018 **Date Completed :** 13/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
6	RW (m) Casing Advancer	HWT		SPT 5/8/10 N=18	6.00		SC	Clayey SAND, as previous.	w-PL VSt	
7							CH	CLAY, grey, high plasticity, trace fine grained sand (alluvium).	w-PL VSt	6.00-6.45m, JAR+BAG PID<1ppm
8				SPT 2/6/10 N=16	7.50		SC	Clayey SAND, grey, streaked brown, fine to coarse grained (alluvium).	W MD	7.50-7.95m, BAG
9				SPT 8/7/11 N=18					VD	9.00-9.45m, BAG
10										

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GEO BOREHOLE 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

SHEET 3 OF 9

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DRILLING					MATERIAL					Note: * indicates signatures on original issue of log or last revision of log	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
							SC	Clayey SAND, as previous.	W	MD	
								10.50-10.60m, dark grey to black clay band, high plasticity.			10.50-10.66m, BAG 10.66-10.75m, BAG



Job No. **21-27425**

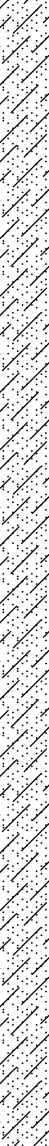
BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH3**SHEET 4 OF 9**

Position : 341299.8 E 6275900.9 N MGA94/ 56 **Surface RL:** -12.26m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 13/7/2018 **Date Completed :** 13/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support \\ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
16	RW (m) Casing Advancer	HWT		SPT 13/15/8 N=23			SC	Clayey SAND, as previous.	W MD	Possible cave in for SPT (sand) 15.00-15.45m, BAG
17										
18				SPT 30/ 11 for 50mm N>50*				From 18.00m, becoming grey-dark grey, trace of silt.	D- VD	18.00-18.20m, BAG
19					18.90		SP	SAND, grey, medium to coarse grained, with fine to coarse, sub-rounded to rounded quartz gravel (alluvium).	W VD	18.90m, increased drilling resistance. 19.50m, increase and decrease in resistance through gravel layers.
20										

See standard sheets for
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BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH3**SHEET 5 OF 9**

Position : 341299.8 E 6275900.9 N MGA94/ 56 **Surface RL:** -12.26m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 13/7/2018 **Date Completed :** 13/7/2018 **Logged by :** CT **Date:** 31/08/2018

Note: * indicates signatures on original
 issue of log or last revision of log

DRILLING					MATERIAL				Note: * indicates signatures on original issue of log or last revision of log			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations	
21	RW (m) Casing Advancer	HWT					SP	SAND, as previous.	W	VD	20.00m, water discharging of the top of drilling casing. Possible hole collapse.	
22												
23												From 21.00m, unable to do SPT due to sand cave in.
24												
25												

From 21.00m,
unable to do SPT
due to sand cave in.

See standard sheets for
 details of abbreviations
 & basis of descriptions

**GHD GEOTECHNICS**

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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**21-27425**

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH3**SHEET 6 OF 9**

Position : 341299.8 E 6275900.9 N MGA94/ 56 **Surface RL:** -12.26m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 13/7/2018 **Date Completed :** 13/7/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Note: * indicates signatures on original issue of log or last revision of log	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
26	RW (m) Casing Advancer ↓	HWT			26.40		SP	SAND, as previous.	W	VD	From 25.50m, variable / increased drilling resistance (possible sediment layering)
27					27.30			SILTSTONE, grey, extremely weathered.	-	-	26.40m, consistent increase in drilling resistance
28								Start of coring at 27.3 metres. For cored interval, see Core Log Sheet.			27.00m, increased drilling resistance
29											
30											

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GEO COREHOLE VISUAL 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

SHEET 7 OF 9

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Job No. **21-27425**

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

SHEET 8 OF 9

Position :	341299.8 E 6275900.9 N MGA94/ 56	Surface RL:	-12.26m AHD	Angle from Horiz. :	90°	Processed :	RCO
Rig Type :	HydraP Trekker	Mounting:	Track	Contractor :	Stratacore	Driller :	TR
Casing Dia. :	HWT	Barrel (m) :	1.5m	Bit :	Surface set	Bit Condition :	New
Date Started :	13/7/2018	Date Completed :	13/7/2018	Logged by :	CT	Date Logged :	13/7/2018
							Note: * indicates signatures on original copy of log sheet submitted to the relevant authority

Note: * indicates signatures on original issue of log or last revision of log

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& basis of descriptions**



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CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.

21-27425

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH4**SHEET 1 OF 8**

Position : 341145.3 E 6275801.8 N MGA94/ 56 **Surface RL:** -1.97m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 30/7/2018 **Date Completed :** 2/8/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Notes	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition	Consistency / Density Index	Comments/ Observations
1 <											

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Job No.**21-27425**

GEO BOREHOLE 2127425 SCOTLAND ISLAND ERP.GPJ GHD GEO TEMPLATE.GDT 7/9/18

BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH4**SHEET 2 OF 8**

Position : 341145.3 E 6275801.8 N MGA94/ 56 **Surface RL:** -1.97m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 30/7/2018 **Date Completed :** 2/8/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support \\ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
6				SPT 5/13/14 N=27	6.00		SC	Clayey SAND, as previous.	W	MD
7				U75			CL	CLAY, pale grey, low plasticity, with fine to coarse grained sand, iron stained (alluvium).	w-PL	VSt
8				SPT 7/8/14 N=22				From 7.50m, becoming pale grey/brown with iron staining, slight iron induration.		
9				SPT 10/12/15 N=27				From 9.00m, becoming brown/red from iron staining.		
10					10.00					

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BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH4**SHEET 3 OF 8**

Position : 341145.3 E 6275801.8 N MGA94/ 56 **Surface RL:** -1.97m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 30/7/2018 **Date Completed :** 2/8/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support \\ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
11	RW (m)	HWT casing		U75 SPT 12/13/14 N=27			SW	SAND, pale grey, fine to coarse grained, well graded, trace of clay (alluvium).	W MD	10.30m, disturbed sand retained in U75 10.50-10.95, JAR, BAG PID=2.8ppm
12				SPT 5/15/16 N=31				From 12.00m, with clay, localised bands of clayey SAND.	D	12.00-12.45m, JAR, BAG PID=11.8ppm
13	Nil			SPT 6/31/ 4 for 10mm HB N=ref	13.50		CL	Sandy CLAY, grey-brown, low plasticity fine to coarse grained sand (alluvium).	w-PL H	13.50-13.81m, JAR, BAG PID=4.6ppm
14					15.00					
15										

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BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH4**SHEET 4 OF 8**

Position : 341145.3 E 6275801.8 N MGA94/ 56 **Surface RL:** -1.97m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 30/7/2018 **Date Completed :** 2/8/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
16				SPT 8/10/11 N=21			CH	CLAY, black, medium to high plasticity, with fine to coarse grained sand (alluvium).	w-PL VSt	15.00-15.45, JAR, BAG PID=43ppm
17				SPT 17/24/ * N~45*	16.50		SW	SAND, brown-grey, fine to coarse grained, well graded, with clay (alluvium).	W D	16.50-16.80m, JAR, BAG PID=8.3ppm
18				SPT 6/14/25 N=39			SW- SC	From 18.00m, increase in clay, becoming Clayey SAND.		81.00-18.45m JAR, BAG PID=6.2ppm
19										
20					20.00					

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BOREHOLE LOG SHEET

Client : Ausgrid
Project : Scotland Island Energy Reliability Project
Location : Pittwater, Church Point, NSW

HOLE No. GHD-BH4**SHEET 5 OF 8**

Position : 341145.3 E 6275801.8 N MGA94/ 56 **Surface RL:** -1.97m AHD **Angle from Horiz. :** 90° **Processed :** RCO
Rig Type : HydraP Trekker **Mounting:** Track **Contractor :** Stratacore **Driller :** TR **Checked :** JK
Date Started : 30/7/2018 **Date Completed :** 2/8/2018 **Logged by :** CT **Date:** 31/08/2018

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DRILLING					MATERIAL					Comments/ Observations
SCALE (m)	Drilling Method	Hole Support \\ Casing	Water	Samples & Tests	Depth / (RL) metres	Graphic Log	USC Symbol	Description SOIL TYPE, colour, structure, minor components (origin), and ROCK TYPE, colour, grain size, structure, weathering, strength	Moisture Condition Consistency / Density Index	
21	RW (m)	Nil		SPT 8/7/11 N=18			CH	CLAY, dark grey, high plasticity, trace of silt (alluvium).	w-PL St	20.40-20.85m, JAR, BAG PID=9.5ppm
22				SPT 12/15/11 N=26	22.00		CL	Sandy CLAY, brown-grey, low plasticity, fine to coarse grained sand.	w>PL VSt	22.00-22.45, JAR, BAG PID=5.7ppm
23										
24										
25					24.50			Start of coring at 24.5 metres. For cored interval, see Core Log Sheet.		

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