On-site Wastewater Management Training Course

Site Assessment: Desktop Study

Land Capability Assessment Site and Soil Evaluation (SSE)

Aim:

- Identify landscape and soil characteristics significant in the selection, location and sizing of an on-site sewage management system
- Assess the capacity of the site to sustainably manage sewage within lot boundaries
- Identify public and environmental health risks of onsite sewage management especially the effect on groundwater and surface water on the site

Site and Soil Characteristics

- The site must have sufficient space for:
  - The treatment system
  - The land application system, and
  - Appropriate buffers
- The soil must be appropriate and of sufficient depth to accept and further treat the quantity and quality of effluent to be discharged

Land Capability

- Defines biogeophysical capacity of land to support a given land use
- Land suitability introduces an economic consideration
- Designs should aim to be both:
  - Sustainable
  - Affordable

Land Capability Classification

- Groups soils into units according to their suitability for particular usage
- Often developed by State agencies for agriculture but commonly not available for on-site wastewater management suitability
- Can be developed for individual regions, catchments etc. using GIS

Stages of Data Collection

- Desktop study
- Site and soil check
- Soil description and profile assessment
- Calculations
- Collection of additional data
- Identify site and soil opportunities and constraints
- Selection of appropriate system

Desktop Study

- Collects preliminary data from readily available sources
- Provides an overview of opportunities and constraints
- Determines what information is relevant
- Identifies information gaps exist and what additional information is required

Site and Soil Assessment

Site and Soil Assessment (DLG, 1998) or **Site and Soil Evaluation** (AS/NZS 1547) refers to the procedural investigation of land for the purposes of evaluating its potential for onsite sewage management, including land application of effluent

- Should be undertaken by an appropriately qualified person with specific experience in wastewater applications
- Specific advice regarding field investigation procedures in DLG, 1998 and AS/NZS 1547:2012

Site and Soil Assessment

The **WaterNSW Current Recommended Practice guideline** (2019) also includes information on Site Assessment procedures, with specific focus on requirements within the catchment area. SCA specific matters include:

- Appropriate soil information and investigation rigour (depth, description and frequency)
- Selection of appropriate climate information
- Sensitive environmental features
- Setback (buffer) distances

Levels of Investigation

Guidance documents (DLG 1998, AS/NZS 1547 and WaterNSW 2019) recommend different 'levels of investigation' depending on project intent or scale

- **Subdivision or Rezoning** – investigation will focus on regional or site-wide implications of OSSM (soil characterisation, system suitability, system density, cumulative impacts, planning considerations etc.)
- **Single-lot Development** – at this scale investigation will focus on site-specific attributes (buffers, soil controls, drainage etc.) and optimising OSSM (treatment / application) options

Site and Soil Characteristics

- In NSW, the Environment and Health Protection Guidelines: On-site sewage management for single households (DLG, 1998) provides a simple guide to site (Table 4) and soil (Table 6) characteristics that should be considered in on-site wastewater investigations
- AS/NZS 1547:2012 provides similar information in Appendices B-D
- Other matters may also warrant consideration based on site-specific information

DLG (1998) Assessment Criteria

- The guideline (Silver Book) adopts a prescriptive approach to assessing site and soil conditions
- The 'rating scale' preferred identifies the relative risk or constraint posed by specific site and soil attributes and applies a hazard (limitation) rating
- The hazard rating incorporates a range of information (research, empirical and anecdotal) and reflects the consensus understanding of the authors at the time of publication
- Several attempts have been made to revise or improve the guideline in recent years

Site Characteristics

- Flood potential
- Exposure
- Slope (%)
- Landform
- Run-on and seepage
- Erosion potential
- Drainage (indicative)
- Fill
- (Available) Land Area
- Geology and rock outcrops
- Vegetation

Imagery

Information sources include:

- Satellite imagery *www.google.com/earth/*
- Free to download and activate
- Image quality varies
- Provides information on location (latitude/longitude), elevation and has capacity for measurement and historical imagery
- Images can be rotated for different views (including Street View)

Google Earth

Topographic Maps

Show:

- Landscape
- Contours
- Anthropogenic (human) features
- Cadastral boundaries
- Grid references
- 1:25,000 maps have 10 m contours

Topographic Maps

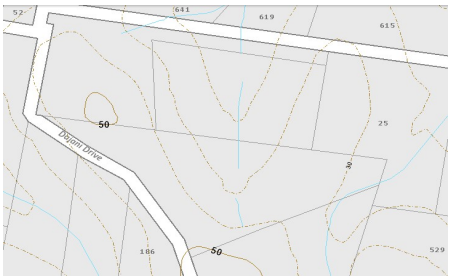
Can determine:

- Shape of land
- Drainage direction
- Water bodies and drainage lines
- Slope
- Relief (difference in elevation)
- Aspect (facing direction)

Topographic Maps

Topographic map SIX Maps

Topographic Maps



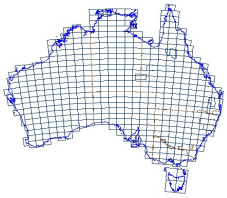
Topographic map maps.gosford.nsw.gov.au

Maps and Spatial Information

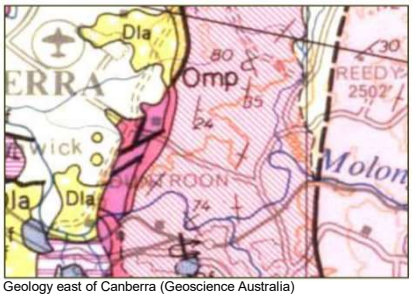
- NSW *www.maps.six.nsw.gov.au*
- NSW *www.nratlas.nsw.gov.au*
- TAS *www.mrt.tas.gov.au*
- VIC *www.dpi.vic.gov.au*
- VIC *www.land.vic.gov.au*
- WA *www2.landgate.wa.gov.au*

Geological Maps

- Scanned 1:250,000 geological maps of much of Australia available from Geoscience Australia *www.geoscience.gov.au*
- Select location
- Choose resolution
- Relate landforms
- Solid geology
- Superficial deposits
  - Alluvium
  - Beach deposits
  - Colluvium



Geological Map



Geology east of Canberra (Geoscience Australia)

Slope Configuration

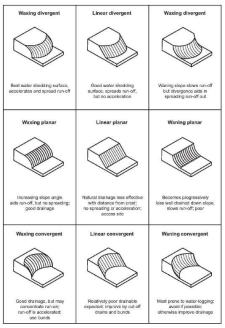
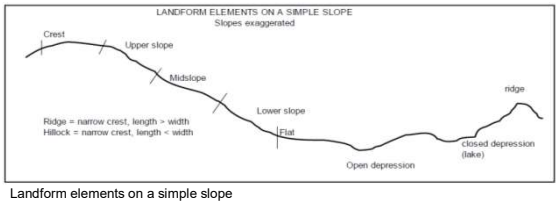


FIGURE C2 SLOPE CONFIGURATION AND SURFACE DRAINAGE

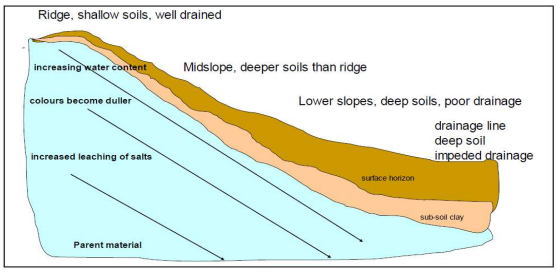
- Slope (gradient and shape)
- Terrain-Soil combinations; important to understand how surface water will flow in or near available EMA
- Waxing / waning / linear
- Converging or diverging

Site Landform



Landform elements on a simple slope

Soil Properties and Topography



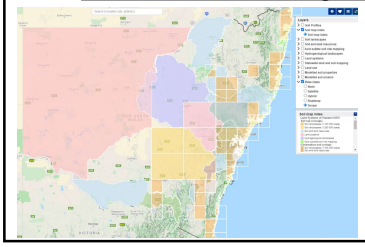
Position in landscape significant in soil profile characteristics

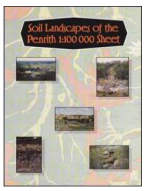
Soil Landscape Resources

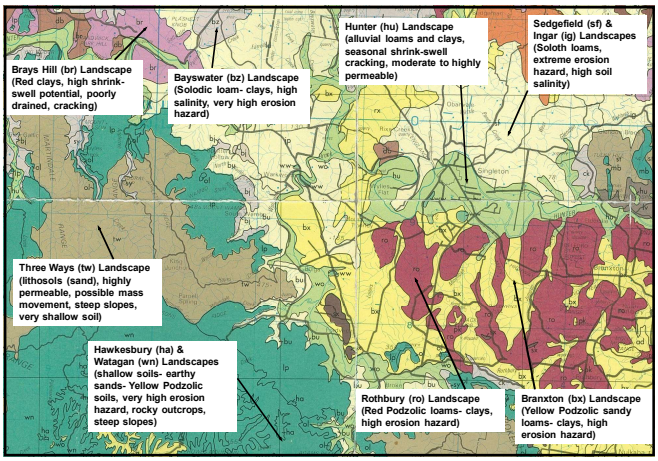
- Atlas of Australian Resources, Volume 1 Soils and Land Use (Division of National Mapping, Canberra, 1980)
- NSW Soil Landscapes (1:100,000) (NSW Department of Land and Water Conservation)

Soil Landscape Maps

- Soil landscape maps of NSW available from NSW Environment & Heritage
  www.environment.nsw.gov.au/soils/soilmaps.htm



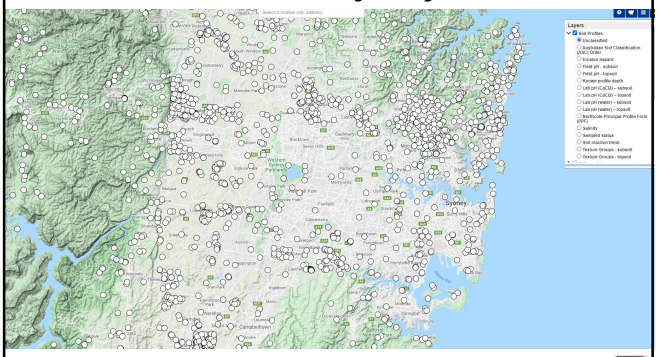


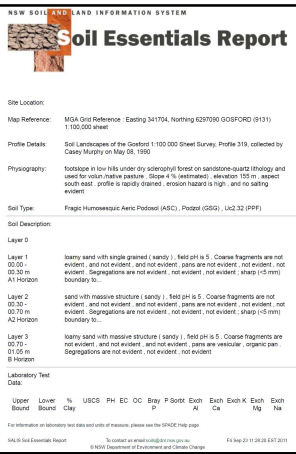


Soils Data Online

- NSW Soil and Land Information System (SALIS) provides a substantial database of information including soil descriptions
- SALIS can be accessed via:
  www.environment.nsw.gov.au/soils/data.htm
- Or the eSPADE portal:
  https://www.environment.nsw.gov.au/eSpade2Webapp

Soil Profiles – Sydney Basin




NSW SOIL AND LAND INFORMATION SYSTEM

Soil Essentials Report

Site Location:

Map Reference: MGA Grid Reference : Easting 341704, Northing 6297090 GOSFORD (9131) 1:100,000 sheet

Profile Details: Soil Landscapes of the Gosford 1:100 000 Sheet Survey, Profile 319, collected by Casey Murphy on May 08, 1990

Physiography: footslope in low hills under dry sclerophyll forest on sandstone-quartz lithology and used for volun..native pasture.. Slope 4 % (estimated) , elevation 155 m , aspect south east.. profile is rapidly drained , erosion hazard is high , and no salting evident

Soil Type: Fragic Humosesquic Aeric Podosol (ASC) , Podzol (GSG) , Uc2.32 (PPF)

Soil Description:

Layer 0

Layer 1 00.00 - 00.30 m A1 Horizon: loamy sand with single grained (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are not evident , not evident , not evident . Segregations are not evident , not evident , not evident , sharp (<5 mm) boundary to...

Layer 2 00.30 - 00.70 m A2 Horizon: sand with massive structure (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are not evident , not evident , not evident . Segregations are not evident , not evident , not evident , sharp (<5 mm) boundary to...

Layer 3 00.70 - 01.05 m B Horizon: loamy sand with massive structure (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are vesicular , organic pan . Segregations are not evident , not evident , not evident

Laboratory Test Data:

Upper Bound	Lower Bound	% Clay	USCS	PH	EC	OC	Bray P	P Sorbt	Exch Al	Exch Ca	Exch K	Exch Mg	Exch Na

For information on laboratory test data and units of measure, please see the SPADE Help page

SALIS Soil Essentials Report — To contact an email soils@dnr.nsw.gov.au — Fri Sep 23 11:28:26 EST 2011

© NSW Department of Environment and Climate Change

Three reports:

Soil Essentials

Soil Profile

Soil Technical (increasing level of detail)

Soil Data online

- Australian Soil Resource Information System (ASRIS)
  http://www.asris.csiro.au/mapping/viewer.htm
- TERN ecosystem data collection (90m resolution) Australian Soil Classification
  https://www.tern.org.au/news-australian-soil-classification-map/

Climate Data

- Bureau of Meteorology *www.bom.gov.au*
- Rainfall
- Evaporation
- SILO or Data Drill data available if no suitable or local station

Rainfall and Evaporation Data

- Use to prepare a water balance

Site name: BADGERYS CREEK MCMASTERS F.STN **Site number:** 067068 **Commenced:** 1936
Latitude: 33.87° S **Longitude:** 150.73° E **Elevation:** 65 m **Operational status:** Closed 31 Dec 1996 Map

Statistics Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	Plot	Map
Mean rainfall (mm)	93.5	93.4	88.9	64.9	60.0	66.3	33.5	47.5	37.7	55.6	73.9	74.1	790.1	59	1936 1996	
Highest rainfall (mm)	311.2	435.9	328.5	382.0	238.1	416.7	191.0	247.0	158.6	196.6	366.5	277.2	1695.2	59	1936 1996	
Date	1972	1956	1955	1988	1943	1950	1952	1986	1995	1976	1961	1962	1950			
Lowest rainfall (mm)	4.4	0.0	2.3	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	329.7	59	1936 1996	
Date	1965	1939	1945	1980	1957	1962	1946	1995	1957	1988	1956	1939	1944			
Decile 1 rainfall (mm)	13.9	19.2	19.0	12.8	5.4	6.2	1.6	3.0	1.6	6.4	8.6	6.4	427.2	59	1936 1996	
Decile 5 (median) rainfall (mm)	75.4	62.8	71.4	38.4	31.2	30.0	19.8	27.4	33.8	43.8	61.6	50.8	770.7	59	1936 1996	
Decile 9 rainfall (mm)	183.5	224.7	184.3	160.2	155.4	157.1	64.1	122.2	80.4	135.3	150.9	175.4	1142.6	59	1936 1996	
Mean daily evaporation (mm)	5.9	5.4	4.4	3.3	2.1	1.7	1.9	2.9	4.0	4.6	5.6	6.5	4.0	13	1967 1994	

SILO Data Drill

- QLD DNR *www.longpaddock.qld.gov.au/silo/*

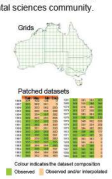
SILO Climate data online resource

SILO (Scientific Information for Land Owners) is a Queensland Government database containing point and gridded daily climate data for Australia from 1889 until present. SILO was designed to serve the needs of agricultural and hydrological modelling and bridges the gap between meteorological services and modellers.

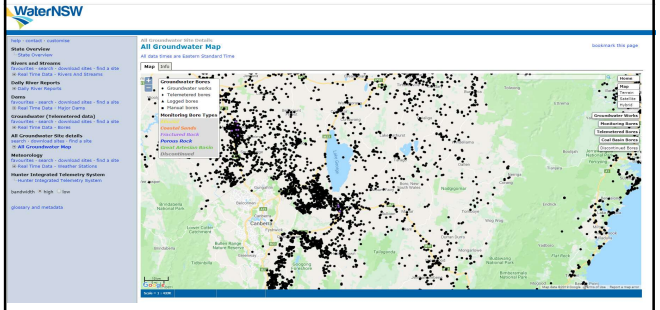
SILO provides daily point and spatially interpolated data with continuous (no missing days) datasets covering the period of 1889 until present. Consistent long-term climate data-series supports various modelling efforts within the Australian environmental sciences community.

SILO climate data service:

- Historical daily climate data for Australia, 1889-present
- Observed data with data in-filling
- SILO data are complete and ready to use
  - Gridded datasets (spatial data for a given day)
  - Point data (time-series data for a given location)
- SILO does nightly processing:



Groundwater



Groundwater bores around Queanbeyan, NSW (WaterNSW)

Other Resources

NSW ePlanning portal
https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address

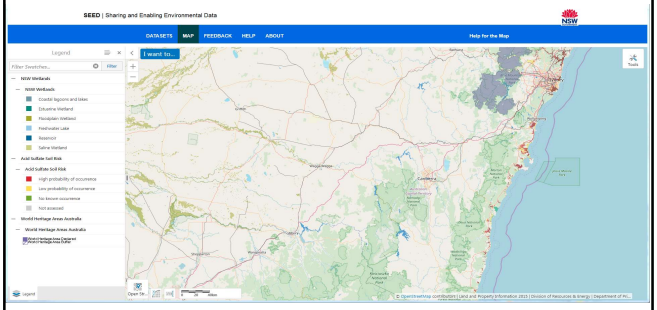
- Zoning Maps
- Hazard Maps (Flood, Bushfire etc.)
- Protection Maps (Vegetation, drinking water catchments etc.)
- Air photographs
- Local studies

Sensitive Receptors

NSW 'Sharing and Enabling Environmental Data' (SEED)
https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU

- Acid Sulfate Soils
- Wetlands and Marine Reserves
- World Heritage Areas
- Priority Aquaculture Areas
- Endangered Ecological Communities (EEC)
- Threatened Species

Sensitive Receptors



Desktop Summary

- Tabulate data
- Assessment or rating – Level of 'constraint' or 'limitation' for OSSM

- Design on most limiting feature/s,
- Engineer out limiting features, or
- Provide mitigation to address limitation.

NSW Site Assessment: Rating

Site Feature	Relevant System(s)	Minor Limitation	Moderate Limitation	Major Limitation	Restrictive Feature
Flood potential	All land application systems	Rare, above 1 in 20 year flood contour		Frequent, below 1 in 20 year flood contour	Transport of wastewater off-site
	All treatment systems	Vents, openings, and electrical components above 1 in 100 year flood contour		Vents, openings, and electrical components below 1 in 100 year flood contour	Transport of wastewater off-site. System failure and electrocution hazard
Exposure	All land application systems	High sun and wind exposure		Low sun and wind exposure	Poor evapotranspiration
Slope%	Surface irrigation	0-6	6-12	>12	Run-off, erosion
	Sub-surface irrigation	0-10	10-20	>20	Run-off, erosion
	Absorption system	0-10	10-20	>20	Run-off, erosion
Landform	All systems	Hill crests, convex side slopes and plains	Concave side slopes and footslopes	Drainage plains and incised channels	Groundwater pollution hazard Resurfacing hazard
Run-on and upslope seepage	All land application systems	None - low	Moderate	High - diversion not practical	Transport of wastewater off-site.

Preliminary Constraints Mapping

- Undertaken in advance of, and to prepare for, field study
- Guides field study
- Identifies data gaps to be filled by field study
- Most importantly, saves time and money

Buffers or Setbacks

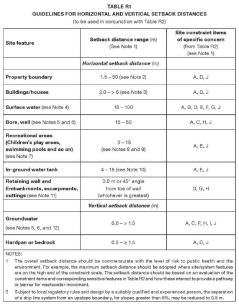
- Provide mitigation against unidentified or unintended hazards
- Reduce potential pathways for human and environmental exposure
- Valuable and cost-effective risk management strategy for OSSM
- Appropriate buffer selection based on procedures in DLG, 1998 and AS/NZS 1547:2012

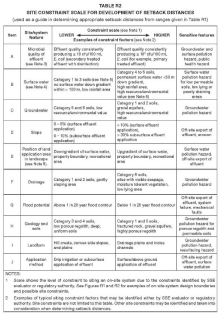
DLG (1998) Buffers

Table 5: Recommended Buffer Distances for On-site Systems

System	Recommended Buffer Distances
All land application systems	100 metres to permanent surface waters (eg river, streams, lakes etc) 250 metres to domestic groundwater well 40 metres to other waters (eg farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation	6 metres if area up-gradient and 3 metres if area down-gradient of driveways and property boundaries 15 metres to dwellings 3 metres to paths and walkways 6 metres to swimming pools
Surface drip and trickle irrigation	6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, property boundaries, driveways and buildings
Subsurface irrigation	6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, property boundaries, driveways and buildings
Absorption system	12 metres if area up-gradient and 6 metres if area down-gradient of property boundary 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, driveways and buildings

AS/NZS 1547:2012 Buffers





Into the Field We Go…….

Desktop Study – the study will have identified potentially suitable effluent management areas (EMAs) from available information sources. A preliminary constraints map will also identify:

- Appropriate setback areas from natural or built features (existing and proposed)
- Identified physical constraints (e.g. bedrock, fill)
- Data gaps (areas for investigation)
- Regional soil landscapes (including boundaries)
- Recommended soil (test pit) locations
- Indicative groundwater depth

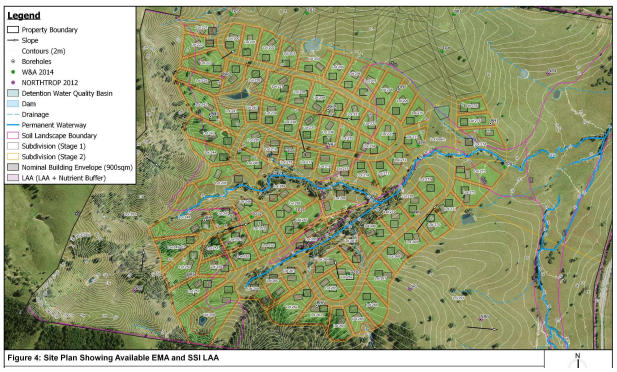
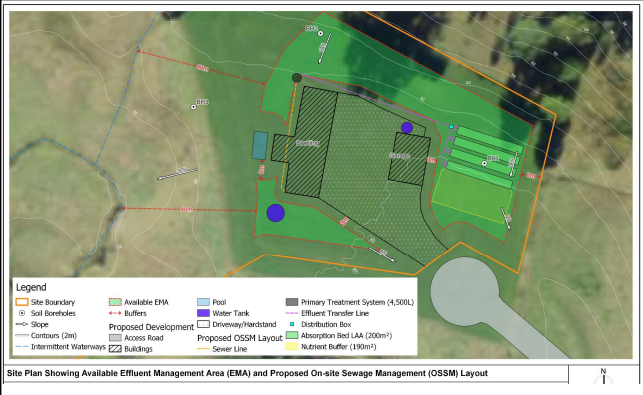


Figure 4: Site Plan Showing Available EMA and SSI LAA



Site Plan Showing Available Effluent Management Area (EMA) and Proposed On-site Sewage Management (OSSM) Layout