On-site Wastewater Management Training Course

Site Assessment: Desktop Study

Land Capability Assessment Site and Soil Evaluation (SSE)

Aim:

- Identify and consider site-specific attributes significant in the selection, design, location and sizing of an on-site sewage management system
- Assess the capacity of the land to sustainably manage sewage within lot boundaries (containment)
- Identify public and environmental health risks of on-site sewage management, especially the effect on groundwater and surface water receptors

SSE Objectives

- To demonstrate the site has sufficient space for:
  - The treatment system
  - The land application system, and
  - Appropriate buffers
- To demonstrate the soil is appropriate and of sufficient depth to:
  - Install the preferred land application system, and
  - Treat the quantity and quality of effluent to be dispersed

Land Capability Classification

- Defines biogeophysical capacity of land to support a given land use
- Groups landform and soils into units according to their suitability
- Often developed by State agencies for agriculture and development, but less-commonly for on-site wastewater management suitability
- Can be developed for individual regions, catchments etc. using GIS

Land Capability Classification

- Land suitability also introduces engineering, social and economic considerations
- Designs should aim to be:
  - Sustainable (long-term benefit)
  - Achievable (practically constructible)
  - Acceptable (minimal impact)
  - Affordable (value for money)

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/s

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** (2023) 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 site coverage)
- Selection of appropriate climate information
- System suitability (dwelling usage, power etc.)
- Sensitive environmental features
- Setback (buffer) distances

Level of Investigation

Guidance documents (DLG 1998, AS/NZS 1547 and WaterNSW 2023) 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 hazard or constraint posed by specific site and soil attributes and applies a risk (limitation) rating
- The risk rating incorporates a range of information (research, empirical and anecdotal) and reflects the consensus understanding of the authors at the time of publication
- Guideline currently under review (expected 2024/5?)

Site Characteristics

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

Other Considerations:

- Built Features
- Buffers
- Adjacent land-use
- Climate impacts

Desktop Study

- Undertaken in consultation with the Site owner
- 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

Information Resources

- Property boundaries, roads, land zoning and planning specifications
- Topographic information (contours, landscape position and surface hydrology)
- Imagery (current and historic)
- Soil mapping
- Climate data (rainfall and evaporation)
- Groundwater resources (domestic and public supply)
- Location of services (water, sewer, gas, electricity etc.)

Information Resources

- Land use mapping (adjacent and regional context e.g. agriculture)
- Environmental Overlays (Flooding, Bushfire, Ecology and Special Water Supply Catchment Area)
- Strategic Plans (development strategies, lot size requirements, backlog sewer areas etc.)
- Known OWMS limitations (poor soils, shallow rock or GW in locality
- Owner resourcing / capacity and understanding

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
- Waterbodies and drainage lines
- Cadastral boundaries
- Grid references
- 1:25,000 maps have 10m contours

Topographic Maps

Topographic map SIX Maps

Maps and Spatial Information

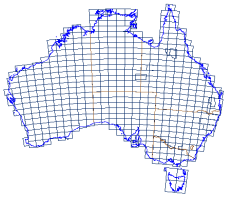
- NSW *www.maps.six.nsw.gov.au*
- NSW *www.nratlas.nsw.gov.au*
- TAS *www.mrt.tas.gov.au*
- VIC *www.dpi.vic.gov.au*
- VIC *www.land.vic.gov.au*
- WA *www2.landgate.wa.gov.au*

Interactive Maps - Australia

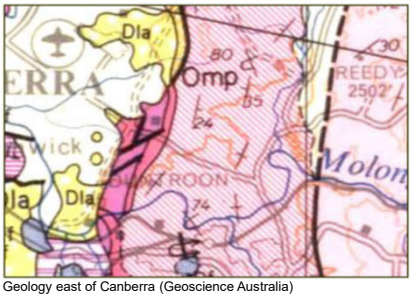
- Geoscience Australia *www.ga.gov.au*
  - GA Portal – Geological, boreholes, minerals, ASRIS (soils), digital elevation
- Elvis – Elevation and Depth – Foundation Spatial Data *elevation.fsdf.org.au*
  - Digital Elevation Model, Point Cloud and Bathymetry – used to generate contours
  - LIDAR data available to 0.5-1.0m resolution

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

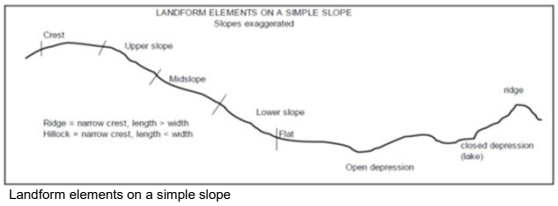


Geological Map



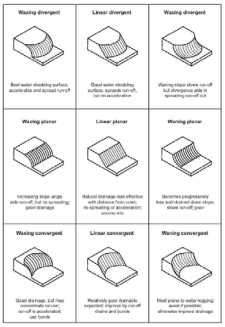
Geology east of Canberra (Geoscience Australia)

Site Landform



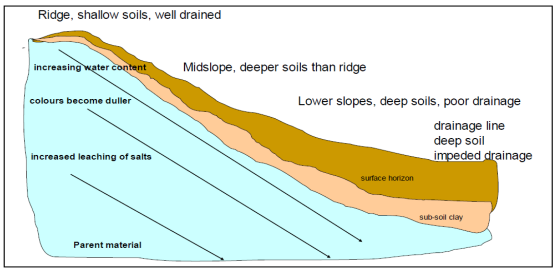
Landform elements on a simple slope

Slope Configuration



- 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

Soil Properties and Topography



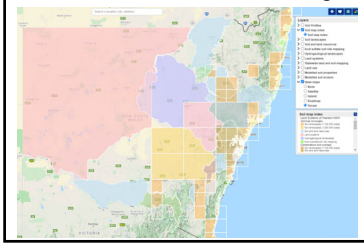
Position in landscape significant in soil profile characteristics

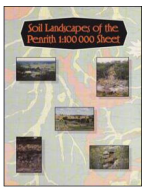
Soil Landscape Resources

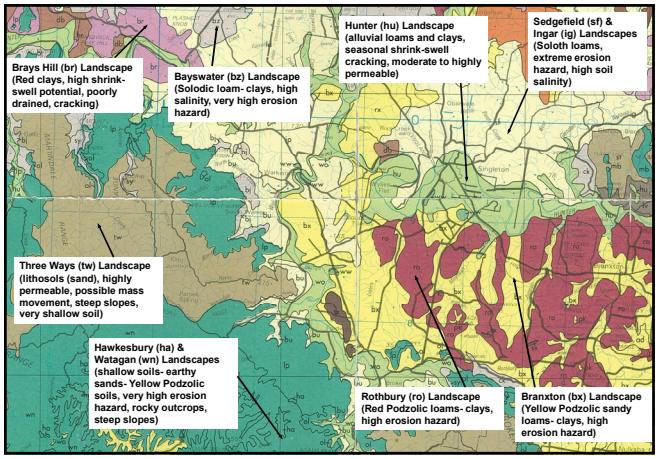
- Atlas of Australian Resources, Volume 1 Soils and Land Use (Division of National Mapping, Canberra, 1980)
- NSW Soil Landscapes (1:100,000) (NSW Department of Land and Water Conservation)

Soil Landscape Maps

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







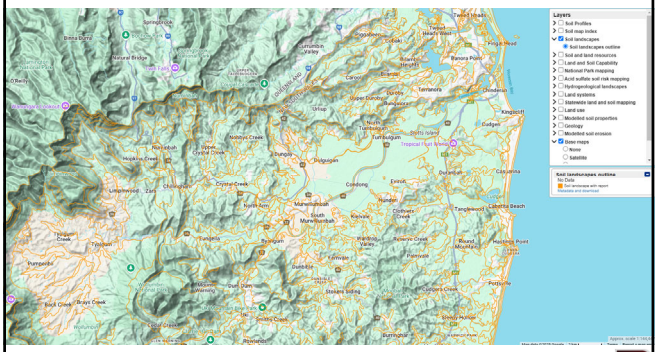
Soils Data Online

- 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/

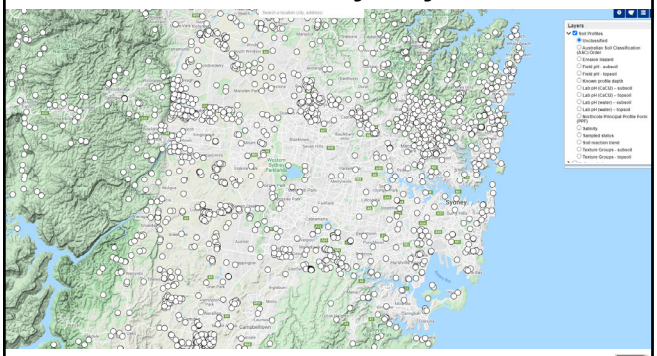
Soils Data Online

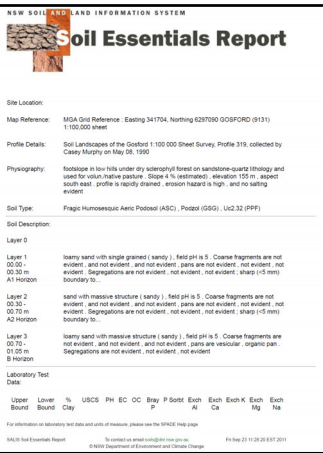
- NSW Soil and Land Information System (SALIS) provides a substantial database of information including soil descriptions
- SALIS can be accessed via: *www.environment.nsw.gov.au/soils/data.htm*
- Or the eSPADE portal: *https://www.environment.nsw.gov.au/eSpade2Webapp*

Soil Landscapes – Tweed Shire



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 us email soils@dnr.nsw.gov.au — Fri Sep 23 11:29:20 EST 2011

©NSW Department of Environment and Climate Change

Three reports:

Soil Essentials

Soil Profile

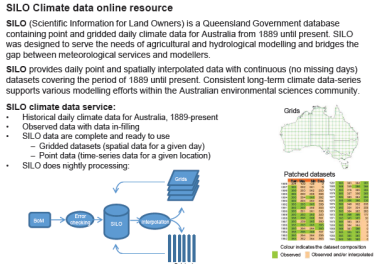
Soil Technical (increasing level of detail)

Climate Data

- Bureau of Meteorology *www.bom.gov.au*
- Rainfall
- Evaporation
- Consider data range (years) and location suitability
- Compile local climate data into zones across the council area based on topography
- SILO data drill is available if no suitable or local station

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:

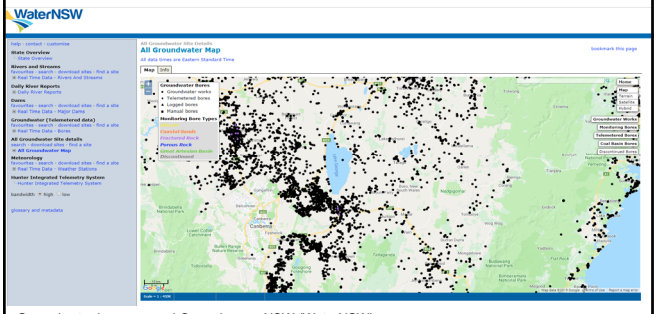
Grids

Patched datasets

Colour indicates the dataset composition

Observed | Observed and/or interpolated

Groundwater



Groundwater bores around Queanbeyan, NSW (WaterNSW)

Other Resources

NSW ePlanning portal
https://www.planningportal.nsw.gov.au/

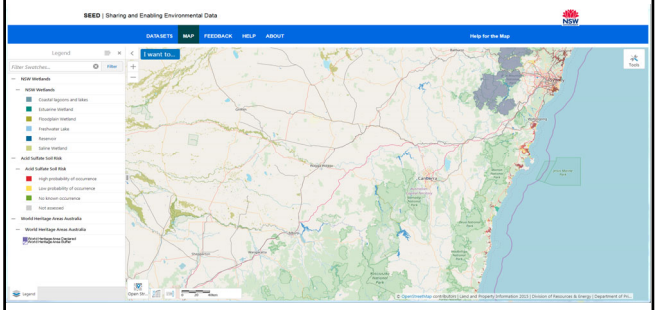
- Zoning Maps
- Hazard Maps (Flood, Bushfire etc.)
- Protection Maps (Vegetation, drinking water catchments etc.)
- Air photographs
- Local studies

Sensitive Receptors

NSW 'Sharing and Enabling Environmental Data' (SEED)
https://geo.seed.nsw.gov.au/

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

Sensitive Receptors



Utility / Services Search

- Before You Dig Australia
  www.byda.com.au
- Asset location referral service
- Interactive map to order asset plans
- Protection of people and assets
- Certified locator database (Telstra)

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.
- Designs should aim to reduce all Site limitations to 'low' or 'minor'

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

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2)

Site feature	Setback distance range (m) (See Note 1)	Site constraint items of specific concern (from Table R2) (see Note 1)
	Horizontal setback distance (m)	
Property boundary	1.5 – 50 (see Note 2)	A, D, J
Buildings/houses	2.0 – > 6 (see Note 3)	A, D, J
Surface water (see Note 4)	15 – 100	A, B, D, E, F, G, J
Bore, well (see Notes 5 and 6)	15 – 50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on) (see Note 7)	3 – 15 (see Notes 8 and 9)	A, E, J
In-ground water tank	4 – 15 (see Note 10)	A, E, J
Retaining wall and Embankments, escarpments, cuttings (see Note 11)	3.0 m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical setback distance (m)	
Groundwater (see Notes 5, 6, and 12)	0.6 – > 1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5 – ≥ 1.5	A, C, J

NOTES:

1 The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constraint scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.

2 Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5 m.

TABLE R2
SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES
(used as a guide in determining appropriate setback distances from ranges given in Table R1)

Item	Site/system feature	Constraint scale (see Note 1) LOWER ← → HIGHER Examples of constraint factors (see Note 2)		Sensitive features
A	Microbial quality of effluent (see Note 3)	Effluent quality consistently producing ≤ 10 cfu/100 mL *E. coli* (secondary treated effluent with disinfection)	Effluent quality consistently producing ≥ 10^5 cfu/100 mL *E. coli* (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water (see Note 4)	Category 1 to 3 soils (see Note 5) no surface water down gradient within > 100 m, low rainfall area	Category 4 to 6 soils, permanent surface water <50 m down gradient, high rainfall area, high resource/environmental value (see Note 6)	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 and 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0 – 6% (surface effluent application) 0 – 10% (subsurface effluent application)	> 10% (surface effluent application), > 30% subsurface effluent application	Off-site export of effluent, erosion
E	Position of land application area in landscape (see Note 6)	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, highly porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes, and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

NOTES:

1 Scale shows the level of constraint to siting an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.

2 Examples of typical siting constraint factors that may be identified either by *SSE* evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.

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

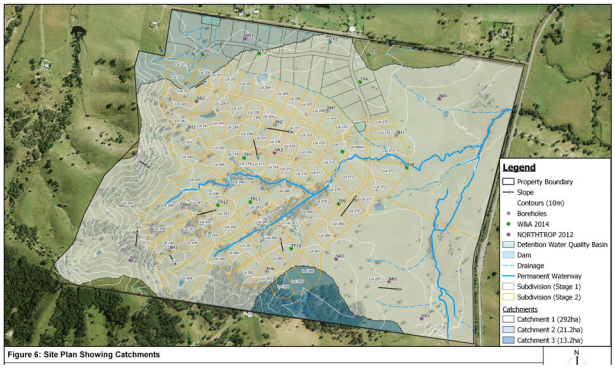


Figure 6: Site Plan Showing Catchments

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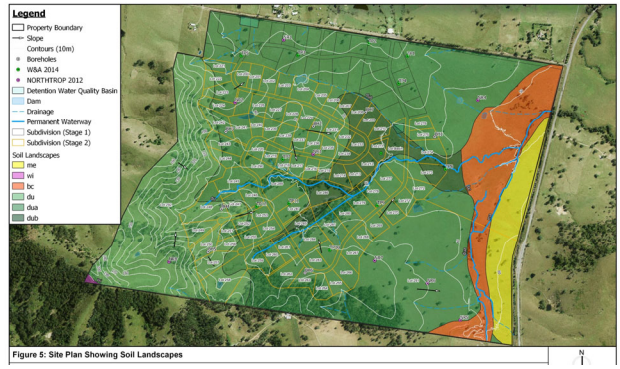

Figure 5: Site Plan Showing Soil Landscapes

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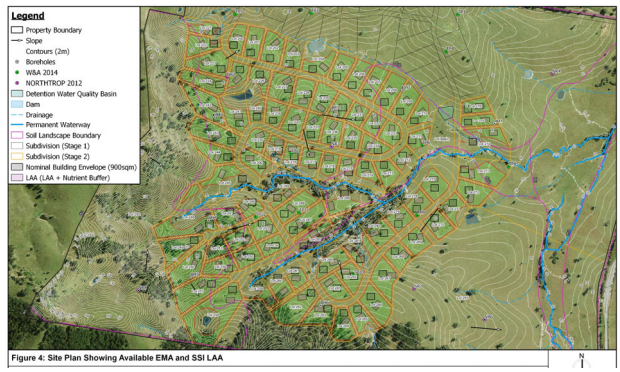

Figure 4: Site Plan Showing Available EMA and SSI LAA

Centre for Environmental Training

Figure 3: Site Plan Showing Proposed OSSM

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