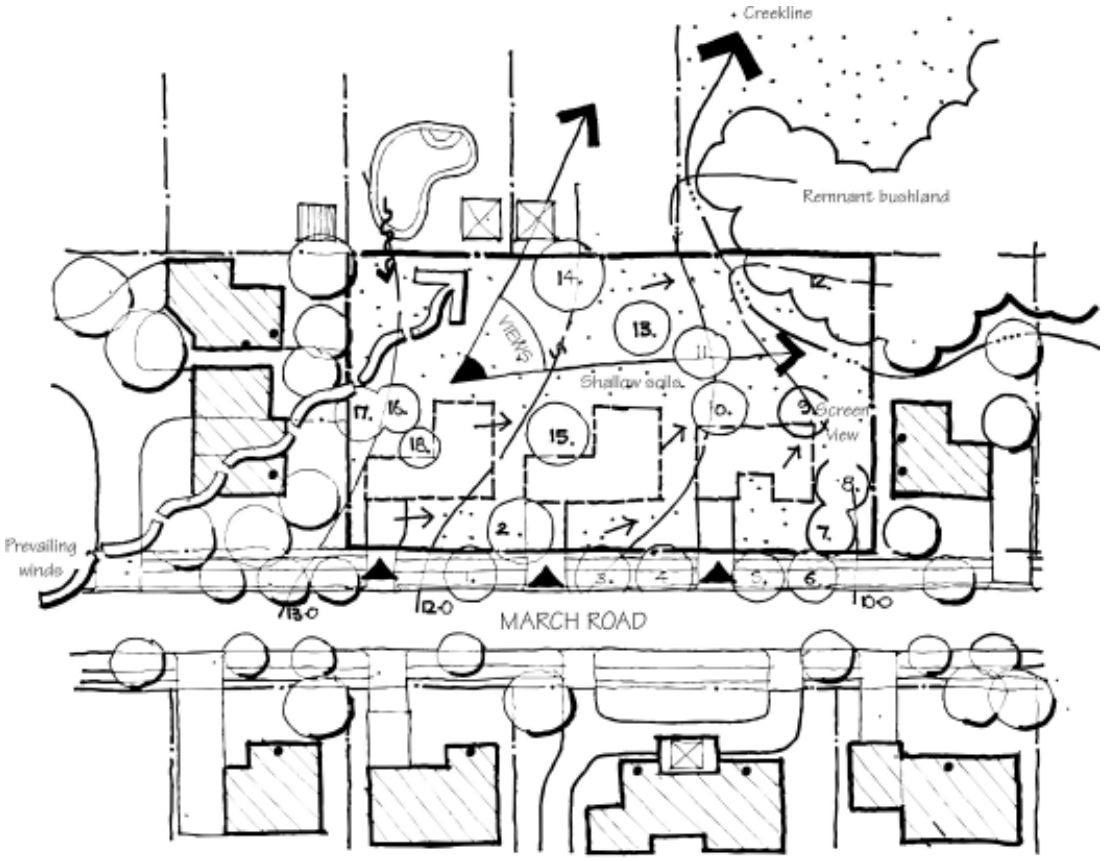
water SMART

PRACTICE NOTE 2

Site planning



WaterSmart development involves simple design and management practices that take advantage of natural site features and minimise impacts on the water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that protect the environment and cost less.

This **WaterSmart Practice Note** explains how to prepare an integrated site plan that responds positively to site constraints and opportunities.

- **Preparing an integrated site plan**
- **Minimising site disturbance**
- **Common mistakes & solutions**

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Site planning

Before you start...

At the earliest stage in deciding where to place buildings, driveways and other structures, always look at the opportunities and constraints of the site and integrate them into a 'whole site' approach. Consider the existing natural features as a resource to be used to advantage, to be retained where possible and to be self-sustaining in the long term. It makes economic sense (cents) and promotes environmental stewardship.

Analyse the site

The first rule is *understand the site*! Collate information on all its natural, constructed and other features. This will help you utilise the site's attributes to best advantage, deal with existing or potential problems and design in tune with the site's soil, vegetation, water and rainfall.

The best way to take a 'whole site' approach is to prepare a Site Analysis. This is usually required to be submitted with development applications, particularly for development on sensitive sites. A Site Analysis is also an essential input to preparing a Soil and Water Management Plan or an Erosion and Sediment Control Plan, which show proposed stormwater, erosion and pollution control measures.

The following information below gives a general guide to the wide range of factors that influence the design, layout, construction and on-going use and maintenance of a development site. However, not all of the listed matters may be relevant to each individual site. Some of the information will ordinarily be part of the design-and-construct package for residential development (such as survey information for heights and tree location, location of underground services, etc.). Preparing a Site Analysis brings the information together earlier in the design process for greatest benefit.

Consider these factors

Your site analysis should indicate how each of the following constraints and opportunities (where applicable) affect the site.

Landform

- Topography is critical to the design and layout of buildings, stormwater controls and drainage. Show contours (1 metre intervals), survey benchmarks and areas of steep slope (>20%).
- Existing natural features (cliffs, rock outcrops).
- Orientation of site (northpoint, south-facing slopes).

Water

- Sources of water flowing onto the site and the general quality of that water.
- Drainage patterns, areas of concentrated run-off, ponding, flood prone land.
- Adjoining riparian zone if within 40 metres of a waterway.
- Characteristics of the drainage system immediately downstream of the site (for example, bushland creek or a constructed stormwater drainage channel).

Soils

- Depth of topsoil and subsoil.
- Soil (pH) - affects soil micro-organisms and nutrient availability for plants.
- Soil condition, fertility, whether it has been compacted, cut or filled.
- Erosion problems, contamination, potential acid sulfate soils or salinity.

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Plants

- Undertake a tree and/or bushland survey.
- Existing individual trees, stands of trees and massed shrub planting - show height, spread, condition and species name (common and scientific).
- Trees listed as 'significant' on council register.
- Existing ground levels around the base of trees.
- Weed species present, extent of weed infestation
- Plants that grow well on the site, or that are characteristic of the local area.
- Any threatened species or ecological communities present on the site or nearby land—refer to the local council for information.
- Trees and vegetation proposed to be removed.

Wildlife

- Habitats present on the site or nearby land.
- Potential to provide fauna habitat, such as niches in rockeries, ponds for frogs, habitat plants (nectar-bearing shrubs for small birds).

Climate

- Direction of pleasant and unpleasant summer and winter winds.
- Windbreaks and their likely permanence.
- Frost pockets.
- Areas of full or partial shade in winter and summer at 9am, midday and 3pm.
- Direction and extremity of bushfire threat.

Views

- Good and unsightly views from the site.
- Views into the site and privacy problems.
- Qualities of the site that are important in the view to and from the site (such as major trees).

Existing site features

- Location and uses of any existing buildings and structures on the site showing those to be removed and retained.
- Location and height of walls and fences built to the boundary.
- Heavily shaded areas from existing structures, mature trees or dominant landform, such as rock ledges.
- Archaeological and heritage sites.
- Any easements, rights-of-way and their restrictions.

Services

- Location of existing overhead and underground utility services (electricity, gas, telephone, water, sewer and stormwater drainage lines, inlets and collection points).

Use of adjacent land

- Location and uses of adjacent buildings.
- Rooftop ridge levels and floor levels of adjacent buildings.
- Potential for overlooking into and from window openings in walls adjacent to the development site.
- Potential for shading on adjacent properties.
- The form and character of adjacent and nearby development, including characteristic styles of buildings and landscaping, and bulk and scale of buildings.
- Street frontage features, such as street trees, poles, kerb crossovers, bus stops.
- Potential sources of nuisance dust or noise, such as flight paths, main roads, railway lines, quarries or mines.

Site planning

Planning controls

- Planning objectives, zoning, design criteria, lot size, site coverage and density controls, and other provisions in local environmental plans and development control plans.
- Restrictions on development due to hazards (such as flooding, landslip, land contamination).
- Controls on removing vegetation or trees or on earthworks.
- Building setbacks, building envelopes, height restrictions, view corridors.

Design rules

There are a number of basic rules to consider when preparing an integrated site plan. The emphasis is on minimising the impacts of development, managing construction activities and considering the on-going use and dynamics of the proposed development and the landscape it sits within. Each aspect is interrelated with the others. Adherence to the following principles will make a considerable contribution to reducing impacts on the natural water cycle.

1. Minimise disruption to landforms & drainage patterns

By minimising disruption to landforms and drainage patterns, you can avoid related impacts on vegetation, weed growth and loss of habitat, both on and off the site. Soil surface disturbance creates an immediate potential for:

- loss of topsoil by wind and water erosion
- sediment to be carried away and deposited downstream
- changes to nutrient and moisture conditions in deposition zones – this may make existing plants unsuitable for the conditions, causing native plants to die or not regenerate and allowing weeds to establish and dominate
- long term effects on the pattern of runoff and infiltration for established areas of vegetation, damp spots, creeks and watercourses, thereby causing irreversible changes to natural systems.

2. Minimise disruption to existing vegetation

Maintaining existing vegetation avoids many soil and weed management problems, and helps conserve biodiversity.

- Minimise removal of plants and root systems as this makes the site prone to erosion.
- Avoid increased light levels on bare soil as this encourages weed growth.
- Maintain the area's full ecological spectrum of plants as this helps to conserve habitats for all sizes of fauna. For example, an incremental loss of breeding and feeding areas for insects, lizards, frogs and insectivorous birds. Their disappearance from gardens and their natural ability to help control pests can lead to the reliance on chemical control and detrimental impacts on other natural elements such as soil ecology.

3. Minimise impacts on neighbouring areas

This includes adjoining allotments as well as nearby natural areas, such as bushland areas, creeklines, swamps, lakes, beaches and foreshore areas.

- Consider your site as one part of the whole landscape. For example, large evergreen trees create useful summer shade, but may be unpleasant for neighbours in winter. Large root systems may invade and block leaking drainage pipes or damage driveways and kerbs. Well-placed plantings can protect areas from direct exposure to extremes of sun and wind.
- Avoid impacts on adjoining sensitive environments due to construction works, gradual accumulation of sediment, or exotic plants that become weeds and displace other plants.

- Manage construction works so as to minimise environmental impacts on soil, water, vegetation and air. Limit nuisances such as noise and waste. Make detailed plans to protect the site and adjoining properties prior to commencement of work. This will provide long-term benefits for on-going site use and management.
- Prevent sedimentation in creeks and drainage lines, as this can reduce flow capacity, increase localised flooding and cause property damage.

4. Prevent or repair ongoing problems

Some sites are already disturbed or experience problems caused by external activities. These may include soil loss, sediment deposits, potential acid sulfate soils, soil salinity, weed invasion, or risk from bushfire or other hazards. These must be factored into layout and management of the site.

- Carry out measures to reverse existing damage and control/ prevent further damage (for example, soil conditions or weed invasion).
- Choose building materials and planting species to suit site conditions (such as bushfire hazard).
- Place pavement areas so as to redirect or reduce impact of large stormwater flows.
- Reduce reliance on supplementary garden watering by species selection and placement, grouping species with similar water needs, creating and utilising micro-climates to advantage, changing maintenance and watering regimes, or other horticultural practices.

For further details, see *Practice Note 2: Landscape Practices* and *Practice Note 3: Landscape Measures*.

5. Consider siting requirements

Buildings, utilities and stormwater measures have particular siting requirements.

- Position and orient buildings to take best advantage of solar access, views, microclimate and natural site features.
- Position driveways so as to minimise gradient. This reduces the velocity of runoff.
- If possible, site water tanks so that water can be fed by gravity.
- Infiltration devices need to observe minimum separations from buildings. These vary according to soil conditions.
- Place porous paving in locations that will not receive significant amounts of sediment, debris or other material likely to hinder performance.
- Place landscaped areas in positions that will receive runoff from upstream areas. This will promote infiltration and filtering of runoff.

Special environmental conditions

The following environmental conditions require specific site planning and management responses. Contact your local council for detailed guidance, special requirements, or advice on other matters specific to your site or area.

Steep slopes

The greater the ground slope, the greater the speed of unimpeded stormwater runoff. Use contour banks, landscape mounds, grassed swales or other slope modifications to break the velocity and intensity of stormwater flow.

Soil surface disturbance and loss of topsoil is characterised by slow regeneration and continuing erosion on steeper land. Avoid or minimise ground disturbance, and regenerate ground cover as quickly as possible. For example, reusable organic matting can be used to contain topsoil.

Depending on geological conditions, steep slopes may also be associated with geotechnical instability. This may require soil stabilisation measures.

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Flooding

Flooding occurs on the floodplains of minor streams and major waterways. Urban drainage systems are also subject to localised flooding.

Contact your local council for detailed information about likely incidence of flooding, and suitable flood protection measures, including siting, floor heights, building materials and flood proofing.

Acid sulfate soils

Acid sulfate soils are widespread in estuarine areas such as mangroves, tidal flats, salt marshes or tea-tree swamps. If potential acid sulfate soils are identified, leave the ground undisturbed so that the acid conditions are not released. A pH of 4 or less allows oxidation to occur. The actual presence of acid sulfate soils can only be identified by detailed soil sampling and chemical analysis.

Bushfire risk

Development adjacent to and within bushland areas is at some risk of bushfire. Site layout, fuel reduced areas, planting 'ember catching screens', strategic placement of plants low in volatile oils, water storage and other techniques can be utilised. These landscape tools can be integrated with building location, design and use of materials so as to reduce the risk of damage.

Design for lifestyle

It is also important to create a pleasant living environment for the occupants. Some issues are common to all residential development irrespective of density. Where possible, consider opportunities for providing:

- outdoor entertainment or barbecue areas
- utility areas for clothes drying or storing waste, compost and recyclables
- access paths
- driveways, visitor car parking (may be available on street) and vehicle turning areas
- car washing bays to trap nutrients and grease, and direct soapy water to lawns or garden areas.

Some issues that should be considered in the site plan and layout are specific to particular lifestyle, age and interests groups. Examples include:

- children's play areas (require flat grassed areas)
- pet dogs (may require fencing to separate from garden beds)
- disabled access (requires graded and sealed paths around the site, and benched seating to give respite).

Over time, different areas may need to be adapted to changed conditions. For example, filling in a sand pit to create a new garden bed, converting a cubby house into a pergola, providing privacy screening from an extension to an adjoining dwelling.

Common mistakes & solutions

Siting structures

- Place structures on sites that are already cleared. This will minimise ground disturbance.
- Set structures below the topmost point of a hill to reduce the intensity of wind exposure. Take advantage of established windbreaks or other natural features to create a pleasant microclimate.
- Reduce driveway, paths and other pavement areas to a minimum by re-dimensioning, choosing alternative materials or rationalising the layout so that some become multi-purpose (and more economic to construct).

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Minimising cut & fill

- Use natural ground levels where possible for siting houses and other structures.
- Use house construction techniques to accommodate slope (such as pole construction or split level design).
- Use pier-and-beam foundations rather than slab-on-ground construction to minimise ground and tree root disturbance.
- Design driveways to contour around slopes. Use grassed swales to direct flow towards vegetated areas at regular intervals (every 3 metres) as this reduces water volume and requires a smaller depression in the driveway profile.

Managing stormwater

- Slow down flow rates where possible to prevent erosion, promote infiltration and reduce reliance on supplementary watering and irrigation.
- Use permeable paving, pebble paths, infiltration trenches, swales, soakwells, terraced garden walls, mulched garden beds or other landscaping elements to slow down and infiltrate runoff.

Tree loss

- Assess the health, vigour and longevity of existing mature trees at the site planning stage. Existing trees may not tolerate construction activity in the root zone, resulting in decline in tree health, accelerated limb loss, pest and disease attack or complete demise. This can lead to injury or property damage.
- If removing trees, consider planting replacement trees that are deep-rooted species: This will help:
  - lower the water table and assist with problems of dryland salinity and poor moisture infiltration
  - bind the soil and reduce soil erosion
  - decrease run-off velocities
  - filter nutrients and capture sediment.

References

Archer, J., Le Hunt, R., & Hodges, J., (1993). *The Water Efficient Garden: a practical and innovative guide, from planning through to established gardens*. Random House, Milsons Point NSW.

Environment Australia (2001). *Your Home: Technical Manual and Consumer Guide*: http://www.greenhouse.gov.au/yourhome

Environment Protection Authority and Department of Land & Water Conservation (2001a). *Model Landscape Development Control Plan*. (Draft, unpublished).

For further references, see Practice Note 7.

Other practice notes

Other WaterSmart Practice Notes are available in this series:

No. 1	The WaterSmart Home
No. 2	Site Planning
No. 3	Drainage Design
No. 4	Rainwater Tanks
No. 5	Infiltration Devices
No. 6	Paving
No. 7	Landscape Measures
No. 8	Landscape Practices
No. 9	Wastewater Reuse
No.10	Groundwater
No.11	Site discharge index

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