Construct stone structures and features

AHCLSC305

Overview

By the end of this topic, you should be able to:

- Plan and prepare work
- Set out and prepare the site
- Construct structure or feature
- Install stone paving
- Check quality of work and clean-up site

You will be directed to complete a number of activities during this presentation.
Compile your responses into one submission and email your work to training@cstc.org.au
with the subject 'AHCLSC305 Activities'

Stone landscape features

- There are a range of stone landscape features/structures that may be built, including:

Edgings

Steps and retaining walls

Walls

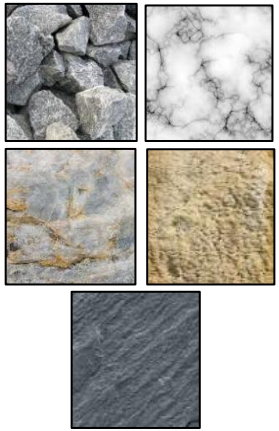
Fences

BBQ and entertaining areas

Water features

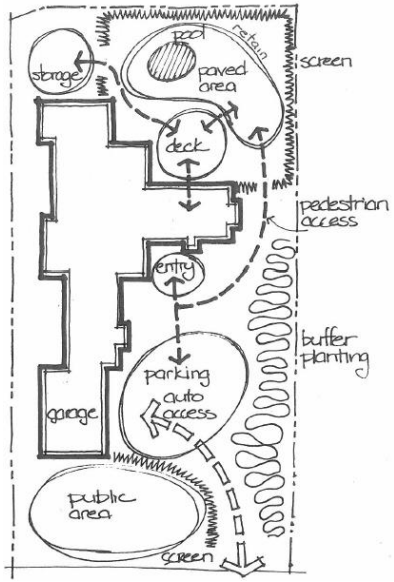
Plan and prepare work

- The materials to be used for stone landscaping projects will differ depending on the work to be completed.
- However, some common materials include:
  - Stone (e.g. granite, marble, quartz-based, limestone, slate)
  - Bedding materials (e.g. crusher dust, decomposed granite, sand)
  - Mortar (i.e. cement and sand)
    - Additives include bonding and colour agents
    - Other admixes may be required in the specifications
  - Drainage system components
  - Damp proofing materials



It is your responsibility to check the quantities and quality of materials matches the specifications

- To prepare for stone landscape projects, you should interpret plans and specifications
  - Landscape concept plans
    - These are a visual record of ideas
    - Usually rough freehand drawings

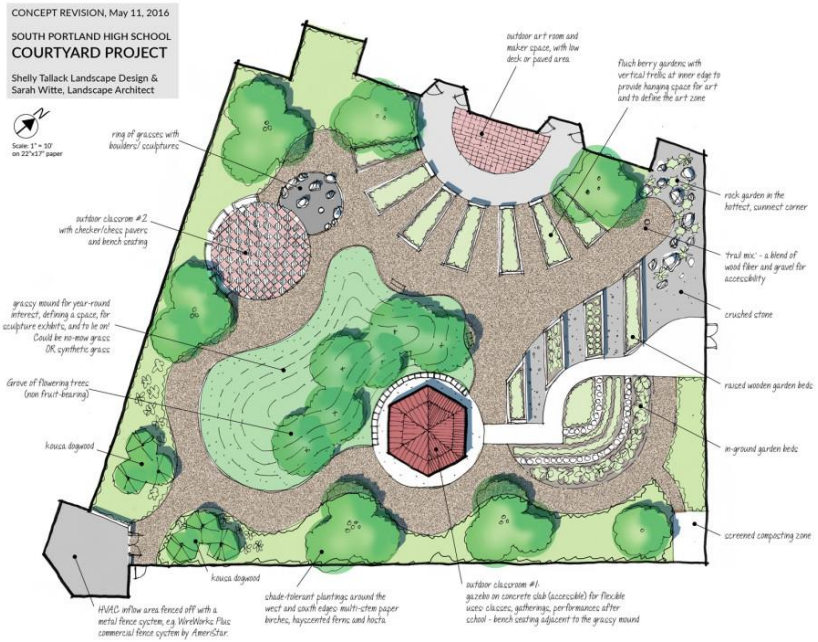


Activity 1: Draw a simple concept plan for a proposed landscape design which includes a stone structure/feature

Plan and prepare work

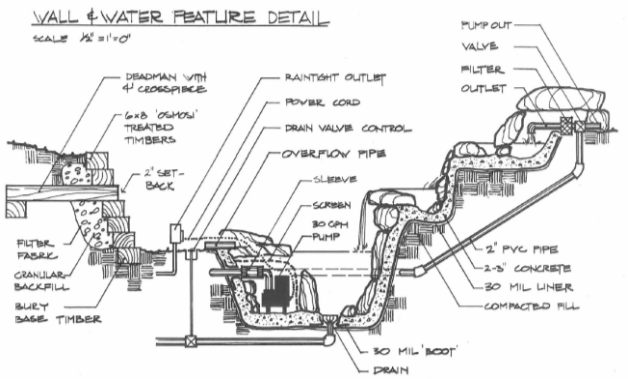
- To prepare for stone landscape projects, you should interpret plans and specifications
  - Landscape plans

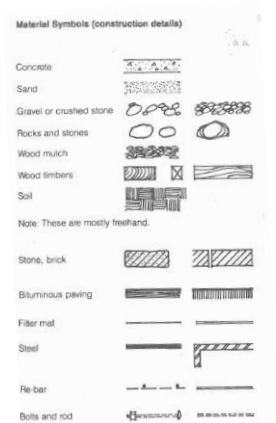
Activity 2: Identify/list the detail on the landscape plan shown



Plan and prepare work

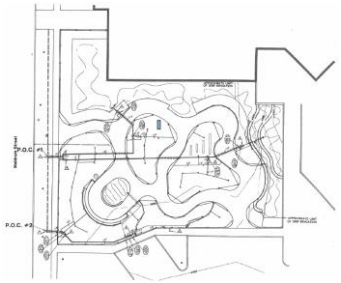
- To prepare for stone landscape projects, you should interpret construction details
  - Details the components of a structure and how they fit together
  - Provides material symbols

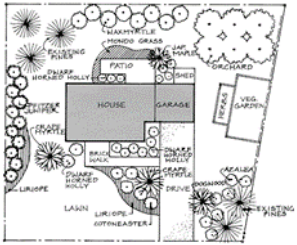




Activity 3: List the materials required to complete the water feature, by using the wall and water feature construction plan shown

- Other plans and specifications include:
  - Irrigation and drainage plans
    - Indicates type, size and location of components
  - Planting plans
    - Details plant species to be planted
  - Underground location plans
    - Contact Dial Before You Dig, which provides a free service for access to underground location plans





Plan and prepare work

- To prepare for stone landscape projects, you should familiarise yourself with the task requirements
  - Refer to plans and specifications for
    - Location of services
    - Required materials, tools and equipment
    - Proposed site of stone structure/feature or paving
    - Measurements (including depths, levels and falls)
    - Drainage requirements
    - Edge restraint requirements
    - Tolerances of work
    - Finished structure – formal or informal

Activity 4: Identify formal and informal stone structures and describe their features

Plan and prepare work

- To prepare for stone landscaping projects, you should familiarise yourself with the work area
  - Identify any WHS hazards and assess risks (e.g. unauthorised persons in work area, underground services)
  - Consider the environmental impacts of the proposed works (e.g. erosion, redirection of water flow, runoff into stormwater drains, disturbance of roots of nearby plants when excavating)

- Report hazards to your supervisor within a timely fashion – especially emergency situations

- Risk is measured in terms of the seriousness of the possible **consequences** of the hazard and the **likelihood** that those consequences will occur, as in the matrix shown below:

Extreme	High	Medium	Low

Consequences
A: Death or Permanent Disability
B: Serious Injury
C: Lost Time Injury
D: Casualty Treatment
E: First Aid

Likelihood

1: Very Likely
2: Likely
3: Possible
4: Unlikely
5: Very Unlikely

Matrix	A	B	C	D	E
1	E	E	H	H	M
2	E	H	H	M	M
3	H	H	M	M	L
4	H	M	M	L	L
5	M	M	L	L	L

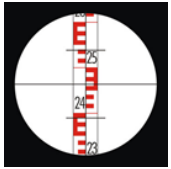
Plan and prepare work

- To prepare for stone work projects, you should organise required PPE, machinery, tools and equipment
  - PPE may include: Gloves, goggles, long pants, sleeved clothing, wide brimmed hat, work boots
  - Machinery may include: Bobcat or excavator, cement mixer
  - Safety equipment may include:
    - Bunting and barricades to reduce risks to personnel on site (e.g. marking exclusion zones)
    - Signage to convey safety messages – placed visibly in the relevant work area, at eye height
  - Tools and equipment may include: Mattock, pick, crowbar, shovel, spade, stringlines, surveying and levelling tools (including line level), trowel, tape measure, grinder, chisel, hammer, wheelbarrow

Ensure they are appropriately selected, prepared and used for the task, following manufacturer recommendations

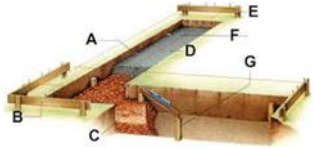
- Follow the steps outlined below when setting up the site:
  - Locate services (e.g. telephone, gas, electricity, water, cable, sewerage)
    - Contact Dial Before You Dig to check the location of such services
  - Mark out the position of the stone landscape structure or feature
    - Locate existing elements/structures to take measurements from
    - Mark out the construction area
      - Use chalk on hard paved surfaces
      - Marking paint
      - Use stringlines and pegs over soil or turf
      - A long garden hose may also be useful for marking out shapes on both hard and soft surfaces

- Follow the steps outlined below when setting out the site:
  - Establish survey benchmarks
    - Benchmarks are based on established datum points
      - A datum is a level surface above or below which all heights are measured – think of it as a ‘starting point’

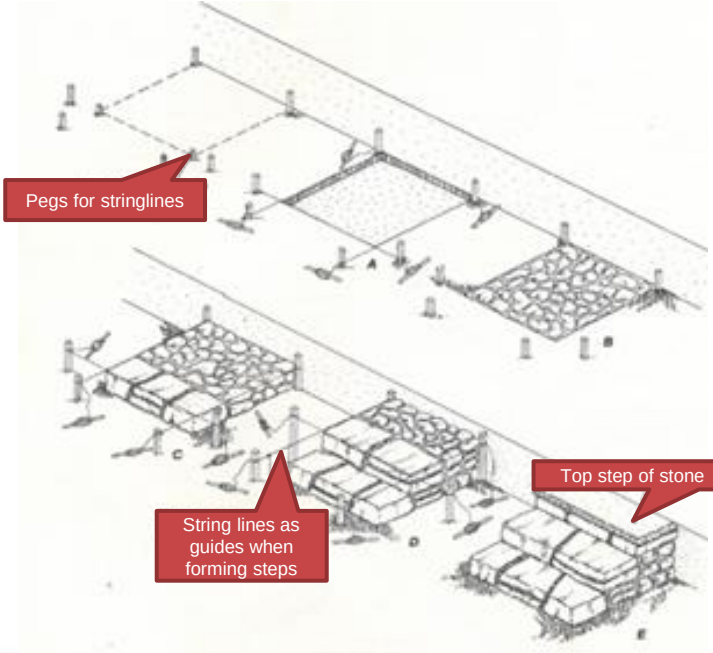


      - The position of the job datum should be clearly marked on site plans
    - Benchmarks are fixed points of known height to which other points can be referred
    - Benchmarks should be established on positions or structures where they cannot be disturbed by construction activity

- Follow the steps outlined below when setting out the site:
  - Determine the location and depth of excavations
    - Peg and stringline the proposed area from the survey benchmark
    - Trim the sub-base to the designated level and falls
    - Remove any roots, soft earth or debris from the subsoil/subgrade
    - Compact the base of the trench to provide a solid foundation for stone work
  - Spread and compact the subbase/bedding material
    - Spread bedding material loosely over the area



Set out and prepare site



Stages in forming free-standing stone steps
A. Steps set out and area excavated
B. Footings for steps formed of stones and mortar
C. First step formed in stone
D. Second step formed
E. Completed steps

Opposite top left: *An area of soil between two large rock outcrops is a suitable position for steps which will blend with their surroundings.*

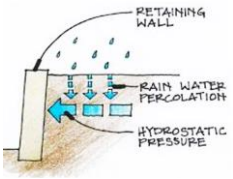
Opposite centre left: *The lower set of steps has been formed with large, split sandstone slabs bedded in the sandy soil between the two rock outcrops.*

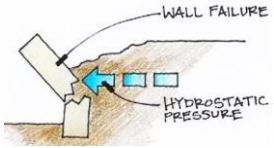
Opposite bottom left: *The completed steps include a sandstone flagged area between the lower and upper flights. Lichens and matching stones at each side make the steps less obtrusive.*

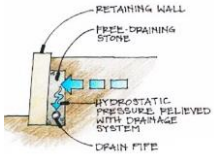
Opposite right: *By placing sandstone slabs at random and using a ground cover of crushed blue metal a simple yet pleasant flight of steps has been created in this Japanese-style garden of exotics.*

Drainage

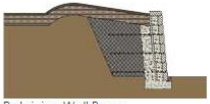
- A retaining wall requires drainage to be installed
  - Drainage types include surface and subsurface

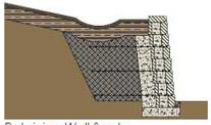






- Installing adequate drainage


Retaining Wall Berm

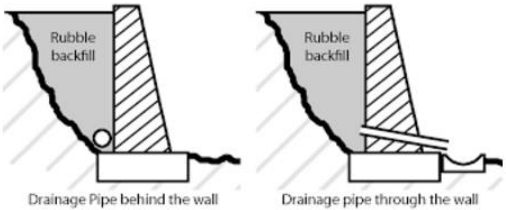

Retaining Wall Swale

Consequences of poor drainage:
- The wall will act as a dam
- Cracks in the wall due to erosion under the base material
- Walls sinking or moving
- Blocks shifting out of alignment
- Wall failure

Activity 5: List the components for four (4) common surface drainage systems used in landscape construction: Spoon, Channel and grate, Pit, Contour

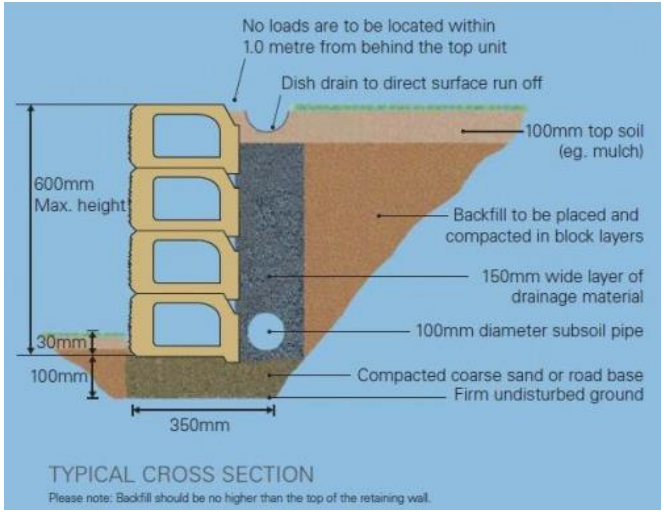
- When do I need drain pipes?
  - All walls taller than 1.2m
  - Sites with poorly draining soils
  - Alongside paved areas
  - Water lines, mains or fire hydrants
  - With slopes above the wall
  - On multi-tiered and terraced walls
  - All commercial and municipal projects

Activity 6: List the advantages and disadvantages of drainage behind and through the stone wall (as shown below)

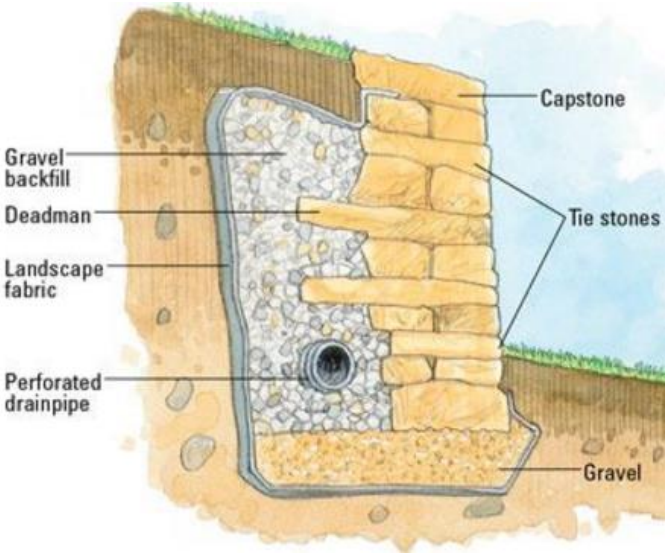


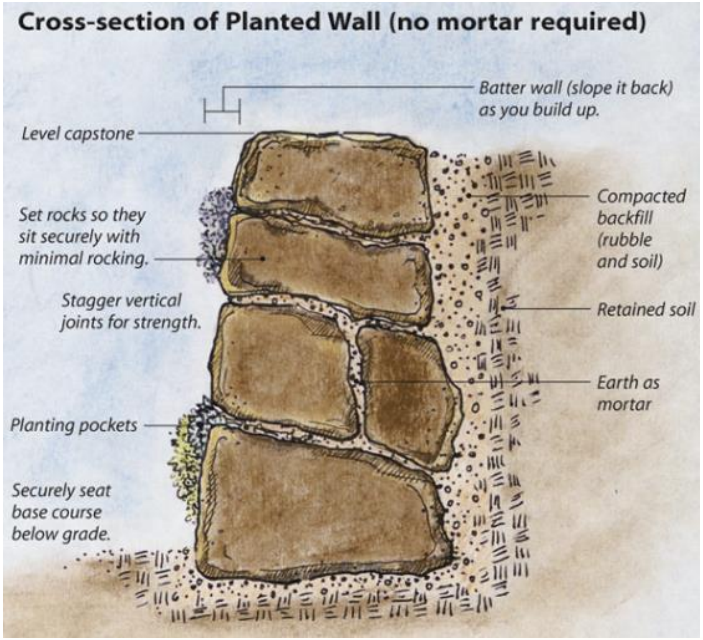
Retaining wall drainage

- Subsurface drainage is installed usually around the first or second courses of stones
- Conduit / ag-flow pipe / weep holes should be placed at various points in the wall to allow sub-surface water to exist
- This may not always be aesthetically pleasing, hence a rubble drain behind the wall is the most general method



Drainage


Capstone
Gravel backfill
Deadman
Tie stones
Landscape fabric
Perforated drainpipe
Gravel


Cross-section of Planted Wall (no mortar required)
Batter wall (slope it back) as you build up.
Level capstone
Set rocks so they sit securely with minimal rocking.
Stagger vertical joints for strength.
Planting pockets
Securely seat base course below grade.
Compacted backfill (rubble and soil)
Retained soil
Earth as mortar

- Note the effects of altering water flow when installing drainage
  - Be mindful of water pooling in new areas, which may affect nearby plants and structures
  - Ensure that slopes are directed away from buildings
  - Consider infiltration water – water entering the bedding sand must not pond
  - Consider subsurface flow – water from beyond the concrete structure and flowing under it
  - Consider surface runoff – that water falls directly onto the concrete structure and flows off the surface

- To establish the required mortar mix, you need to determine the strength requirements for the project

APPLICATION	CEMENT	SAND	AGGREGATE	20kg BAGS OF CEMENT PER m^3
 MORTAR General purpose	1	4	–	15
Improved workability	1	6	+1 Hydrated Lime	8

Source: http://www.cementaustralia.com.au/wps/wcm/connect/website/packaged-products/resources/47607d804a6947e08c21be34cfbbd838/CEM+6611+Mix+table+-+concrete%2C+mortar+and+render+V1.pdf

- All ingredients should be thoroughly mixed together along with required additives, such as:
  - Bonding agents: Increases durability of mortar, improving chemical, corrosion, moisture and salt water resistance of render
  - Colour agents: Customises the colour of the mortar
  - Other admixes: Surfactant, Methyl Cellulose

Activity 7: Research other admixes

Construct structure or feature

- Often footings need to be constructed when installing stone structures or features
  - The footing is responsible for securing the structure/feature into the ground

- A foundation is the excavated trench which the footing is placed – it is responsible for supporting the structure/feature
  - It is necessary for the foundation to be excavated to a stable base material
    - An uneven base will effect the levelness and appearance of the finished structure
  - If there are any areas that are soft fill, they should be compacted and filled with a roadbase-type material

- The concrete should be poured into the foundation continuously, rather than in small sections, to avoid cracking in the structure/feature

- When the concrete almost fills the foundation, stone should be placed into the wet concrete and to the face of plane of the stringlines
  - It is important to place the first layer of stone at this point so the first part of the structure/feature is keyed into the footing
  - Ensure the stones are laid tightly side by side

- To reduce moisture and mould from passing from the ground to stone wall structures and features, it is important to install damp proofing close to ground level. For example:
  - Damp-proof course (DPC): A barrier of impervious material built into stone work to prevent moisture from moving upward
  - Integral damp proofing: Adding materials to the concrete mix to make the mortar itself impermeable

Activity 8: Research other methods of damp proofing and the materials used

- Continue building the structure/feature
  - Consider the different types patterns that may be used:




  - To ensure the viability and stability of stone wall structures, apply mortar (usually around 12mm thick) to bind the stones together
    - Joints greater than this width may result in shrinkage cracks within the joint

Activity 9: Research and describe the suitability of various patterns for stone work projects

- Tips for laying stones:
  - Decide if your structure is to be formal or informal
  - Be observant and carefully plan – every stone has a face and it takes a good eye to choose and place the face of a stone
    - When placing a stone, try to find one that looks like a good fit with its neighbour
    - For waterfall construction choose scale of stone to pond ratio
  - Be aware that stones can be laid wet (in mortar) or dry
    - If stones are to be set in mortar even small voids can collect water over time, leading to premature failure of the structure/feature

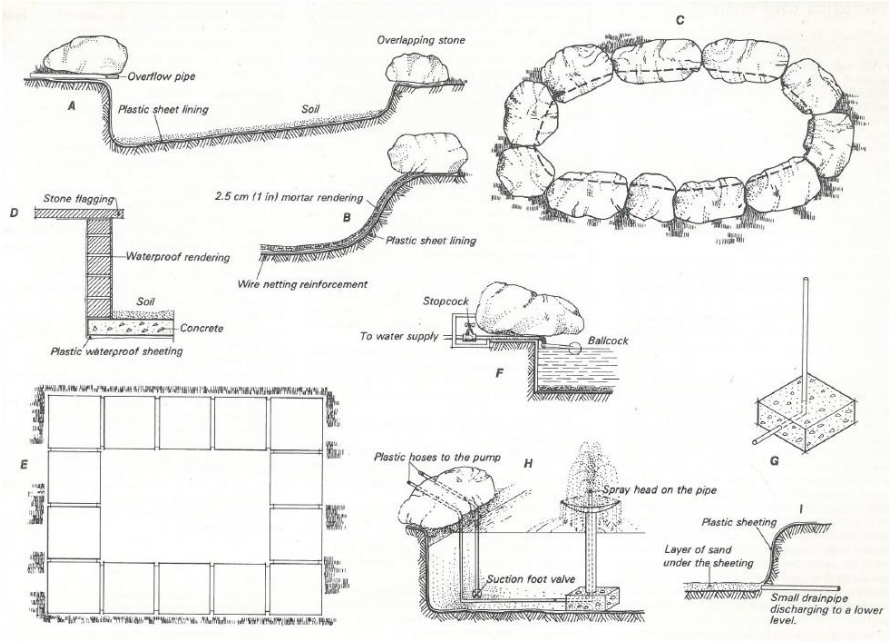
Activity 10: List the advantages and disadvantages of mortared and dry stone features

Source: http://www.mstoneandtile.com/wp-content/uploads/2012/04/MML-Adhered-Veneer-April-2012-rev-1-0.pdf

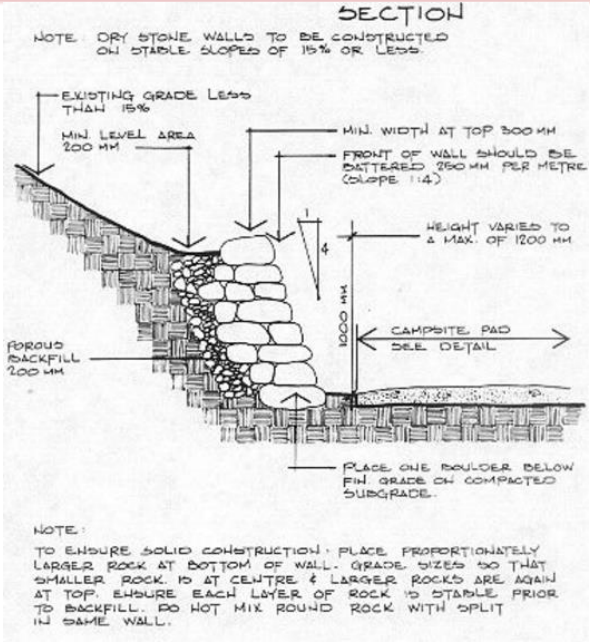
Stone features

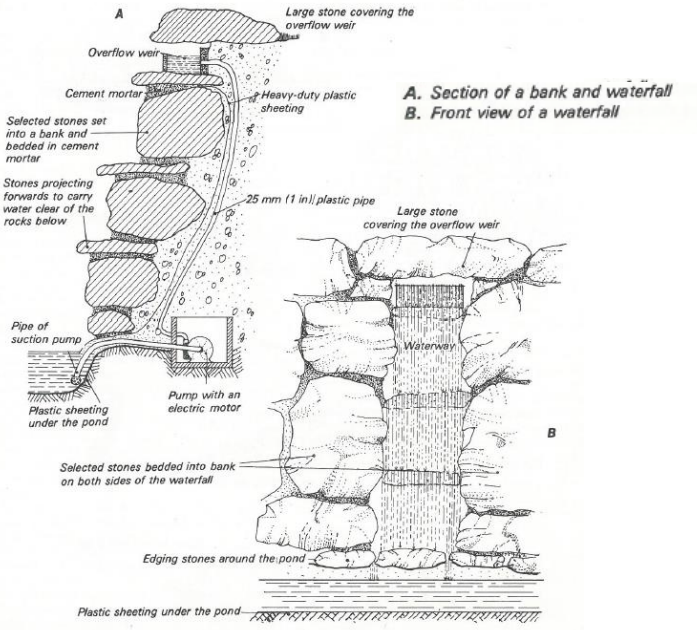
Simple ways of constructing a pool

- **A.** *Section through a pool which has been excavated and lined with plastic sheeting*
- **B.** *Plastic lining of pool made more permanent by rendering it with mortar*
- **C.** *Informal pool with weathered stones around the margins*
- **D.** *Pool with a concrete base and a brick or concrete wall*
- **E.** *Formal pool with sawn or split stones around the margins*
- **F.** *Ballcock to supply water to the pool*
- **G.** *Cast concrete base with a waterpipe as a basis for a fountain in a pool*
- **H.** *A simple fountain incorporating a birdbath*
- **I.** *Layer of sand under the plastic sheeting*

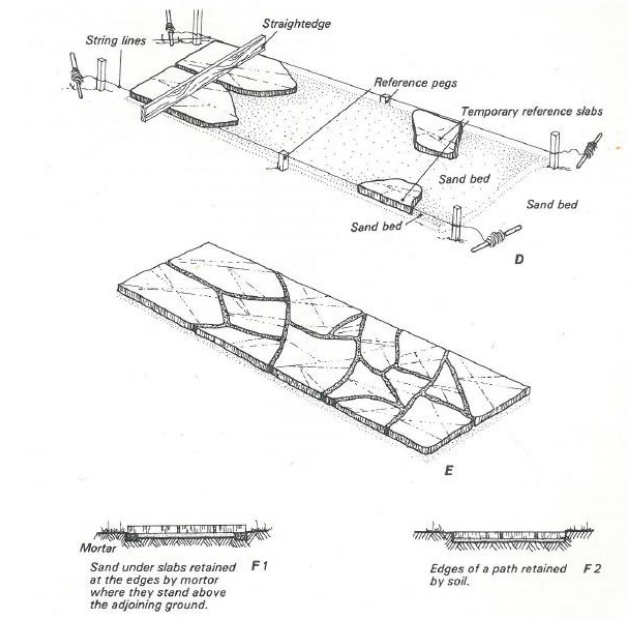


Stone features





Stone features



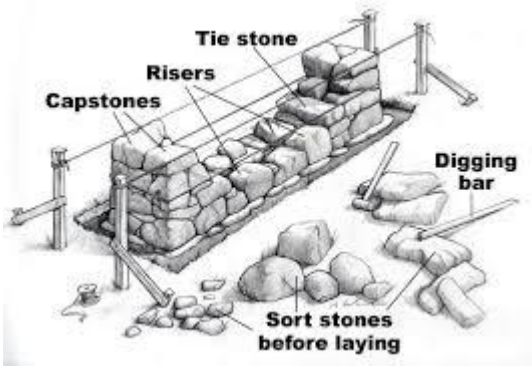
Stages in laying a stone path in a random pattern

D. *Levelling a flagged path*

E. *Section of a flagged path jointed with mortar or loam*

F. *Sections of a flagged path retained by mortar and by soil*

- Apply finishes to the stone work, for example:
  - Capping
  - Raked
  - Full to face
  - Over-grouted
  - Weeping joints
  - Water proofing



Activity 11: Research the different types of stone work finishes

Install stone paving

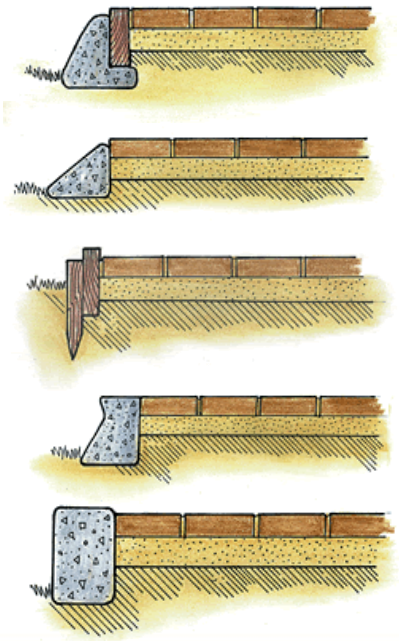
- As with a stone structure/feature, when installing stone paving you are required to set out and prepare the area
  - Excavate the area to the shape, depth and dimensions (to sub-base level)
  - Trim the sub-base to the designated levels and falls
  - Compact base material
  - Spread bedding material over the area
  - Level bedding material to the designated level and falls

Install stone paving

- Place stone and fit to accurately fill gaps in the pattern
  - Observe tolerances nominated within the site plan

- Install edge constraints, as required by the site plan
  - They are required to prevent movement of the edges and restrain the pavers and sand
  - A concrete edge, a paver set on edge or a timber boundary is ideal

Remember the 3mm gap - pavers must not touch



Source: http://www.boral.com.au/packagedproducts/howto/paving_the_way.asp

Quality check and clean up

- After installing the stone structure/feature or paving, you are required to complete the following practices:
  - Compare the quality of the finished works with the drawings and specifications standards
    - Record and/or report your work outcomes to your supervisor
  - Clean up the work area
  - Shut down, maintain, clean and store machinery, tools and equipment
    - Follow manufacturer's specifications and supervisor's instructions
    - Report faults that are discovered in logbook and/or site records

Activity 12: List environmentally safe products for cleaning

Quality check and clean up

- After installing the stone structure/feature or paving, you are required to complete the following practices:
  - Dispose of materials that cannot be reused or recycled
    - Separate soil and waste material (e.g. organic, inorganic and recyclable piles)
    - Ensure that you follow the enterprise guidelines (e.g. JSA and SWMS for handling and disposing of waste)
    - Follow Safety Data Sheets (SDS) and environmental plans to ensure environmentally safe practices

Activity 13: Have team members take photos and videos of your involvement with stone features. Be sure to include all stages of construction.