

4

LANDSCAPE ARCHITECTURE

MODULE 4

**VIth Semester B.Arch
Teaching Notes**

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¹
IES College of Architecture

- I. Effects & construction of: Podium landscape, green walls, xeriscaping, green retaining walls, green fire tender road
- II. Landscape water elements: Fountain, cascade, mirror pool, swimming pool, mechanism of plant room
- III. Landscape grading, landform design & drainage design
- IV. Preparation of landscape master plan for a third year level design project with hardscape and levels along with site sections

I.

Effects & construction of: Podium
landscape, green walls, xeriscaping,
green retaining walls, green fire tender
road

Podium landscape

Podium gardening basically involves gardening at elevated structure of your building such as-Terrace & Balcony.

Podium landscape

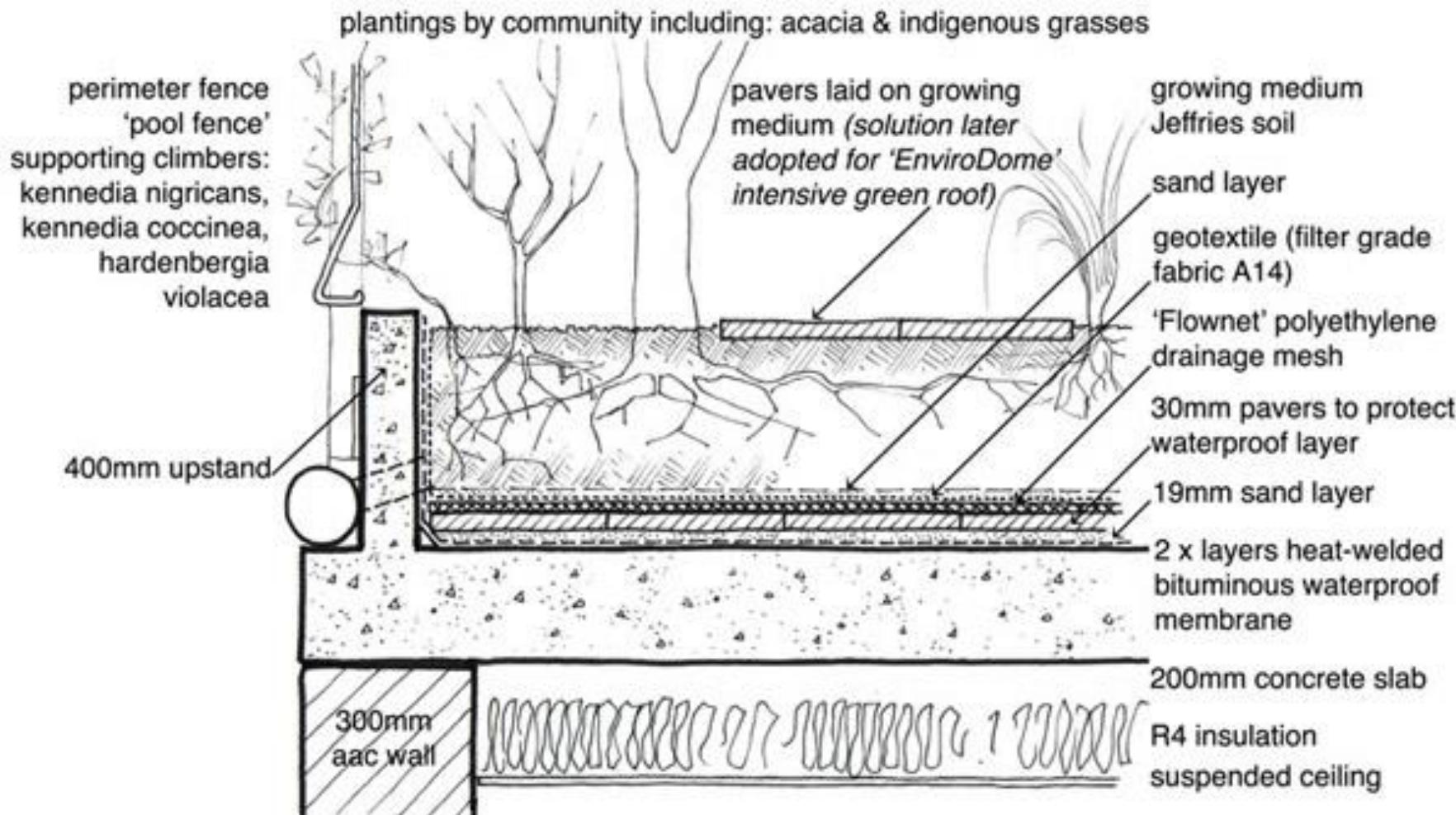


- A Roof Garden or Green Roof, as the name implies, refers to the roof of a building that is designed to be covered with vegetation or greenery, all planted over a waterproofing membrane in order to prevent seepages and erosion.
- There are two types of Green Roofs, intensive and extensive, depending on the maintenance required and the depth of planting medium.
- Some Green Roofs also include additional layers that are helpful to the growth of the vegetation such as a root barrier, and drainage and irrigation systems, depending on the size of the Green Roof.
- Roof Gardens are frequently designed to satisfy specific engineering and performance goals, and Intensive Green Roofs are roofs which have the capability to become quite deep and merge into large on-structure plaza landscapes with features such as promenades, lawns, large perennial plants, bushes and trees.

Podium landscape

- The obvious economic benefits of Green Roofs are:Green Roofs serve as insulation to reduce heat flux through the roof.
- Heating/cooling costs can be reduced by up to 25%.
- It also has property benefits as a Green Roof increases property Value by lessening the stress due to thermal expansion and contraction on the membrane, doubling the service life.
- It reduces noise levels by 50 dB.
- Cultivation of vegetables and food on Green Roofs can contribute to the food supplies of a company and enhances the company's image.
- Green Roofs have social benefits since it fosters community interaction and has therapeutic effects to improve the health of its users

Podium landscape



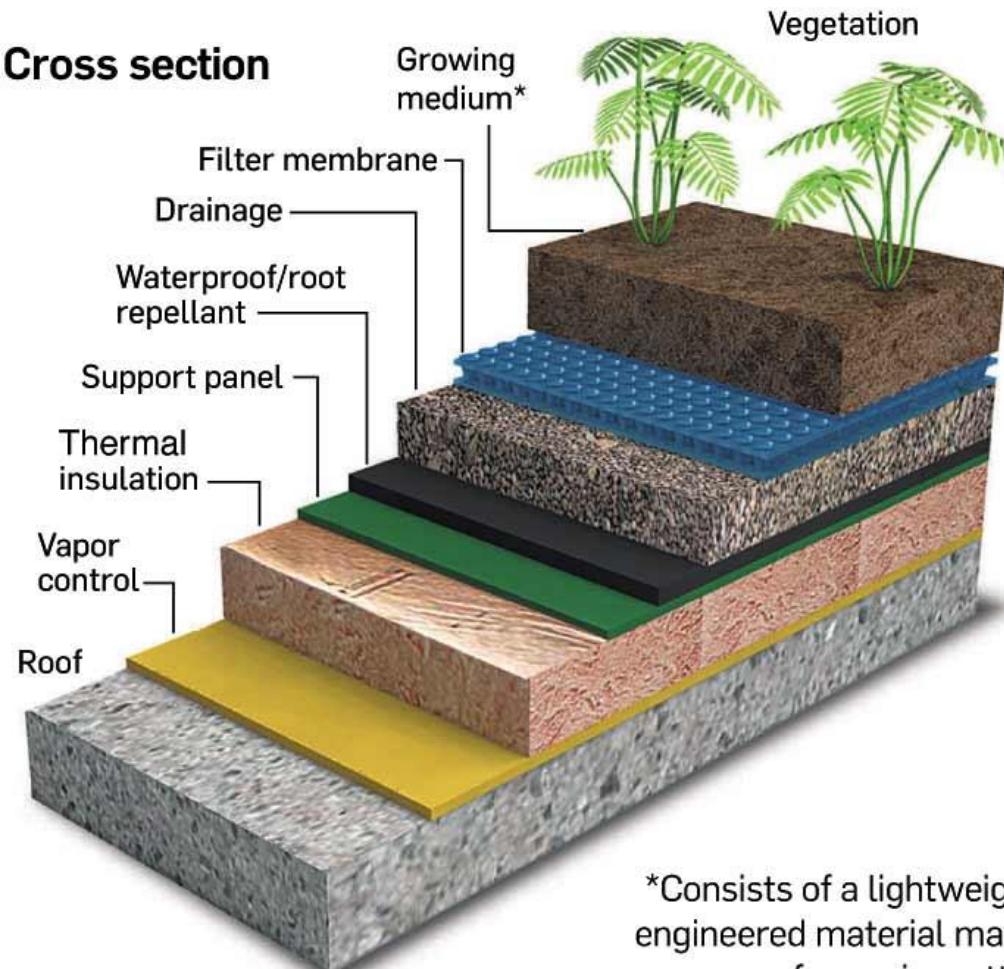
SECTION THROUGH INTENSIVE ROOF GARDEN

Podium landscape

Roofs that really hold water

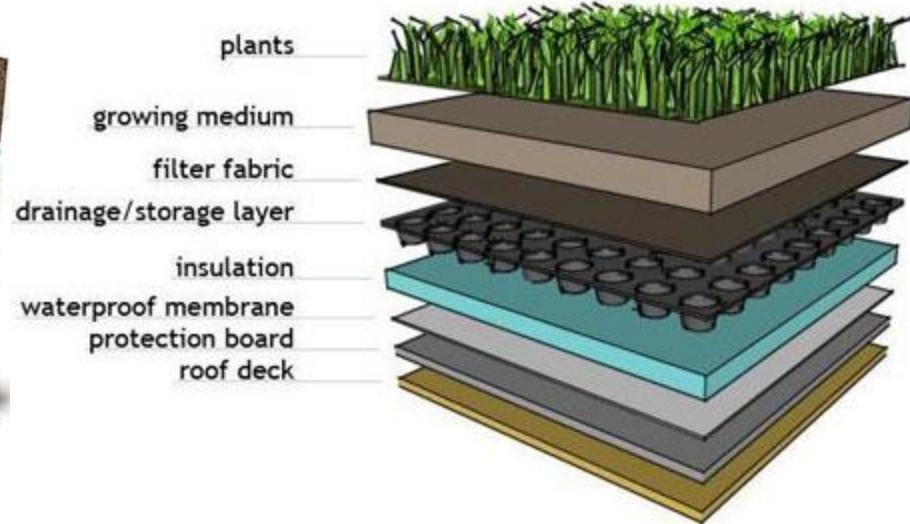
Green roofs vary in plant types used, size and shape, but may consist of some or all of the following:

Cross section

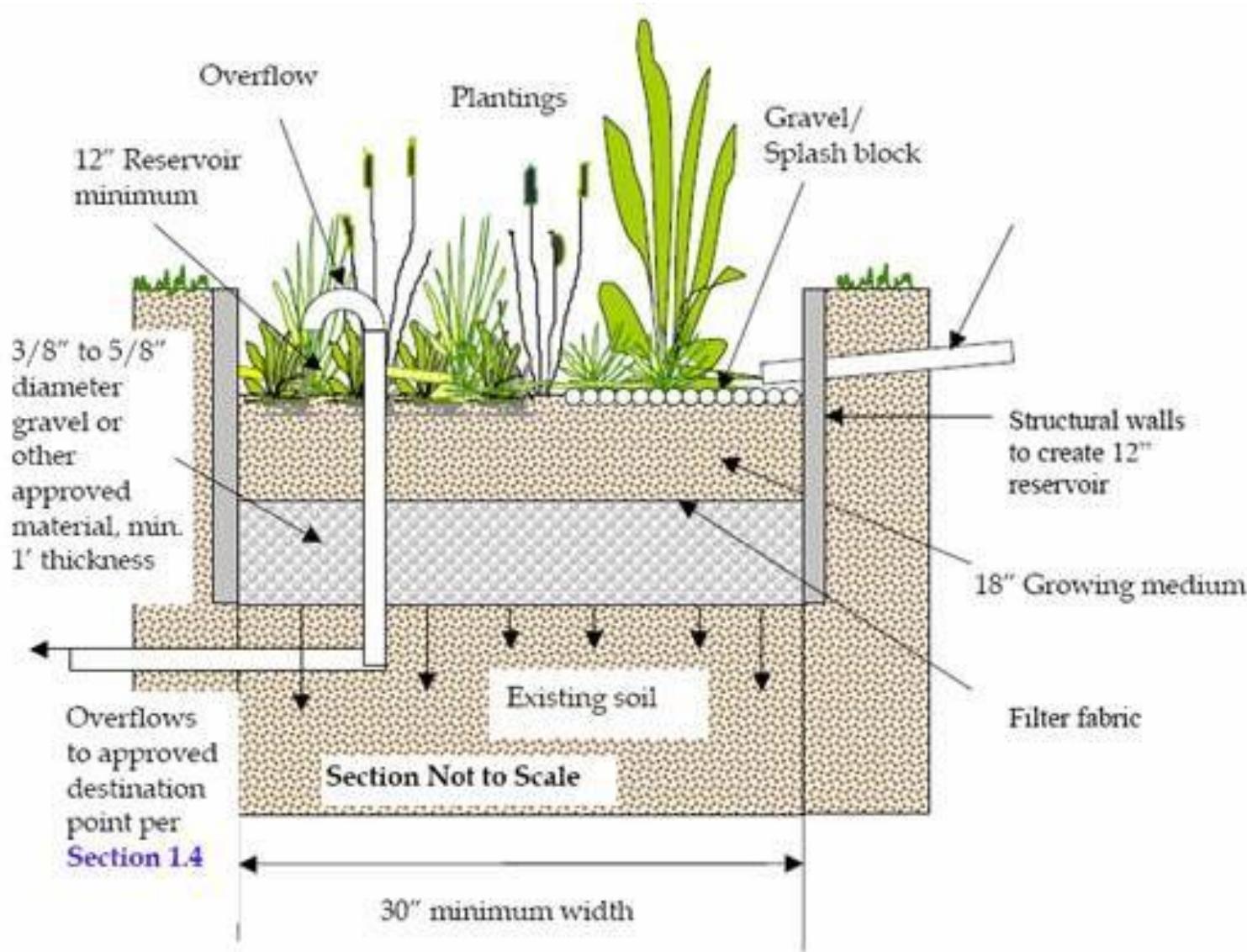


*Consists of a lightweight
engineered material made
of organic matter

WHAT GOES INTO A 'GREEN ROOF'



Podium landscape



Podium landscape



Green walls

- A vertical garden is a technique used to grow plants on a vertically suspended panel by using hydroponics.
- These unique structures can either be freestanding or attached to a wall.
- Vertical gardens have been used since ancient civilizations; many modern vertical gardens can last for decades and give a pop of nature into the modern day business.
- A vertical garden is a technique used to grow plants on a vertically suspended panel by using hydroponics.
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Green walls



Green walls- Irrigation

- Many different green wall technologies exist and new ones are being developed every year.
- Regardless of what type of green wall system, most green walls have one of two types of irrigation systems: recirculating and direct irrigation.



Green walls- Irrigation

- Recirculating irrigation systems do just as the name implies: recirculates water.
- In a recirculating system, the source of water is an irrigation tank which is either remote-controlled or directly underneath the green wall.
- The irrigation tank is filled manually on a regular basis to provide an adequate supply of irrigation water. Water is pumped from the tank to the green wall.
- Water is distributed to the plants in the wall. Gravity pulls excess water downward.
- Excess drainage water collects at the bottom of the wall and is fed back to the tank.
- This water is then used over and over (recirculates).

Green walls- Irrigation

- A direct irrigation system does not have a water tank or pump. Instead, irrigation water comes directly from an external water source (i.e. city water).
- This water is sometimes injected with fertilizer through an injector. A pump is not needed for direct irrigation because of the existing water pressure of the water lines.
- Water is channelled to the green wall and distributed to the plants of the wall.
- As water is pulled downward by gravity, any excess irrigation water is collected and sent to a sewer drain (not recirculated).

Green walls

Direct Irrigation

Medium ICB is used for most wall-mounted installations of approx. 50 sq.ft. (50 Biotiles) or less.



Irrigation Lines To Green Wall

Green Wall Zone Valves

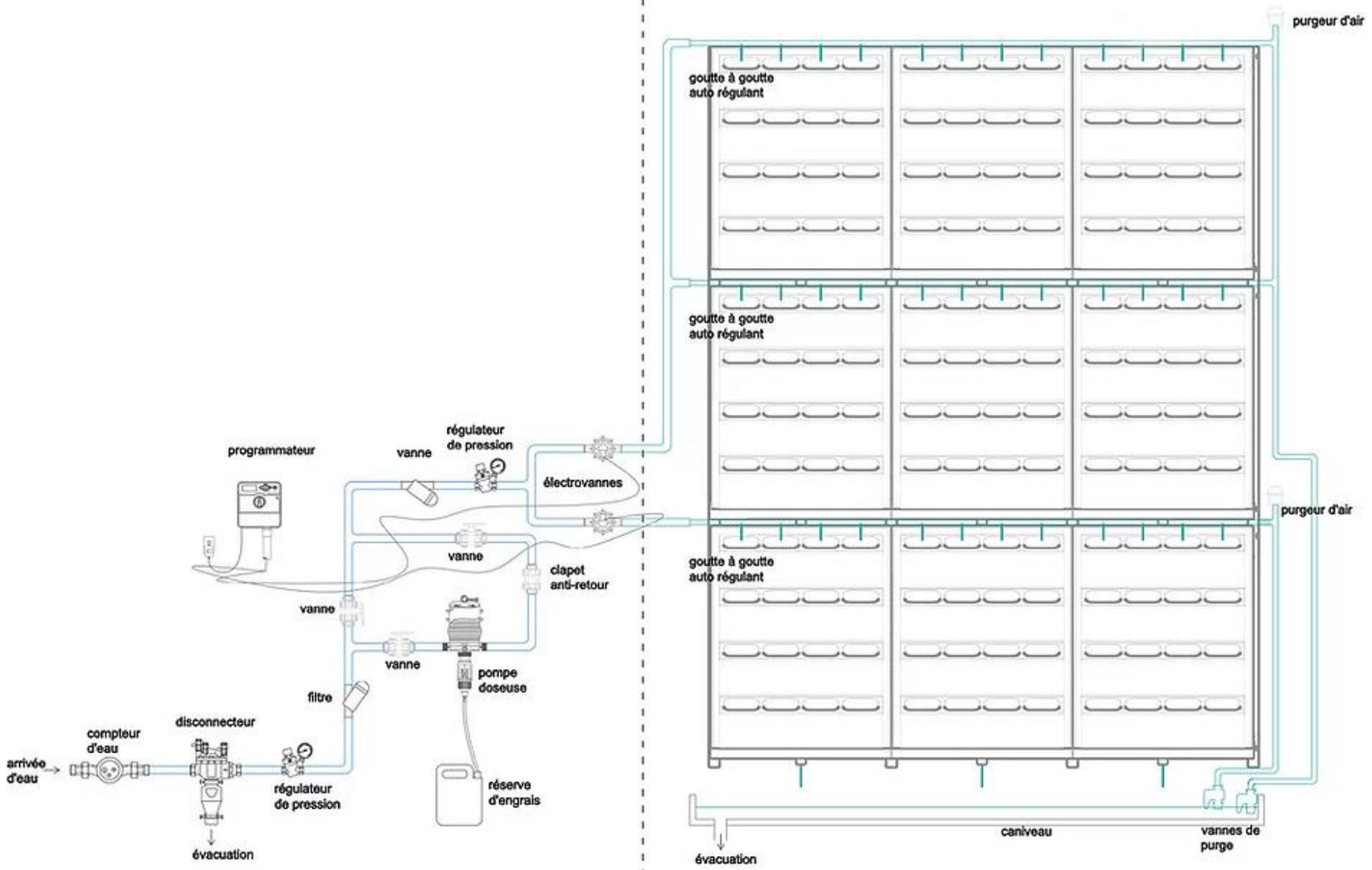
Every green wall has an Irrigation System which is uniquely customized to meet the specifics of the site and the customer while putting plant health requirements and horticultural needs first and foremost in the equation.

Organic Liquid Fertilizer Supply Tank



Irrigation Control Unit (ICU)

Green walls



Xeriscaping

- Xeriscaping is the process of landscaping or gardening that reduces or eliminates the need for supplemental water from irrigation.

Xeriscape is based on seven water-wise landscape principles:

- Planning and Design.
- Soil Improvement.
- Practical Turf Area.
- Efficient Irrigation.
- Mulch.
- Low Water-Use Plants.
- Appropriate Maintenance.

Xeriscaping

- **Xeriscape landscaping** or, simply, "**xeriscaping**," by definition is **landscaping** designed specifically for areas that are susceptible to drought, or for properties where water conservation is practiced. Derived from the Greek xeros meaning "dry," the term means literally "**dry landscape**."
- The **goal** of a **xeriscape** is to create a visually attractive landscape that uses plants selected for their water efficiency. Properly maintained, a **xeriscape** can easily use less than one-half the water of a traditional landscape.
- Converting to a **water-wise** landscape **can** reduce outdoor **water** use by as much as 50 percent. ... Essentially, **Xeriscaping** is a sustainable form of landscaping that conserves **water**, protects the environment and results in less overall maintenance on the landscape

Green retaining walls

- Green retaining walls are efficient techniques for containment or **geotechnical stabilization of slopes**: nowadays they represent a sustainable alternatives to block and concrete walls.
- They provide higher aesthetic appeal and a natural look. These systems are ideal for difficult landscape situations and dangerous ground.
- The respect for the environment and the protection of natural heritage are the most important goals.



Green fire tender road



Green fire tender road

ENERGY POSITIVE APPROACH



Preservation of existing foliage increasing the front set back.

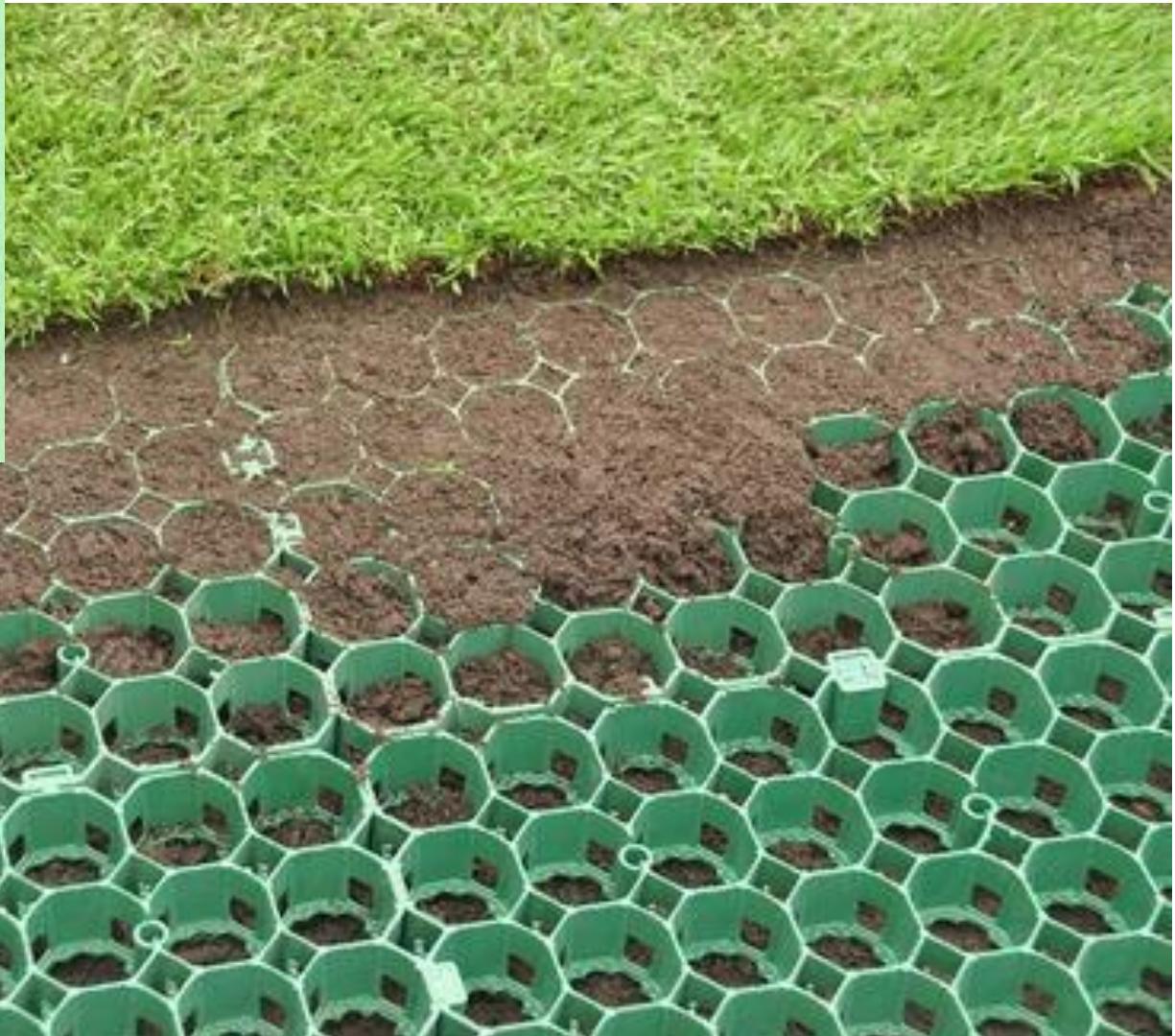
- ▶ More than 50% area outside the building is soft with plantation and grassing.
- ▶ Circulation roads and pathways soft with grass paver blocks to enable ground water recharge



Polymer plastics grids turn the visual asphalt fire tender road into a soft paved space



Green fire tender road



II.

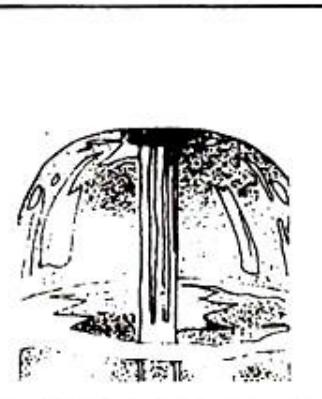
Landscape water elements: Fountain,
cascade, mirror pool, swimming pool,
mechanism of plant room

Fountain

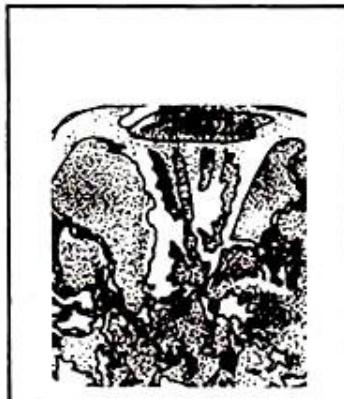
- Fountains are the main attractions in the garden.
- It creates coolness in summer by throwing the tiny droplets of water in the air ultimately through evaporative cooling system it lowers down the temperature of surroundings.
- The fountains of various designs are available to create enchanting effects in the garden.
- Now with the invention of pumps of various horse powers, water force can be regulated as per requirement.
- Hence, now various kinds of fountains are available.
- Different effects are created depending upon the nozzle type used and their arrangement. Very popular types are Geyser, Bell, Finger Jet, Bubble and Floating type fountains.

Fountain

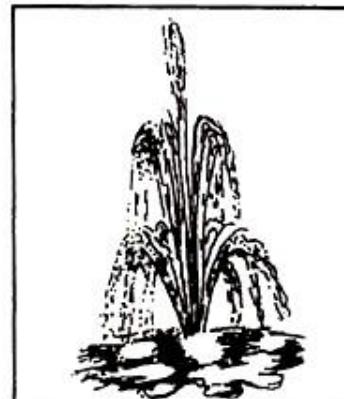
DIFFERENT KINDS OF FOUNTAINS



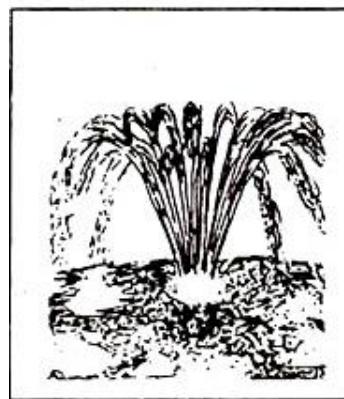
Bell Fountain



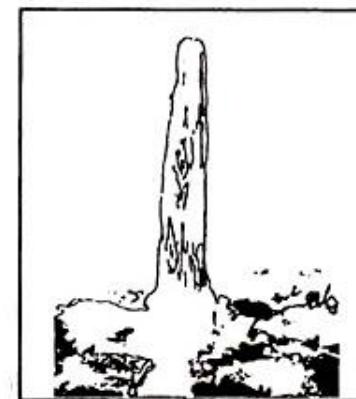
Lilly Fountain



3 Stage Jet Fountain



Flower Jet Fountain



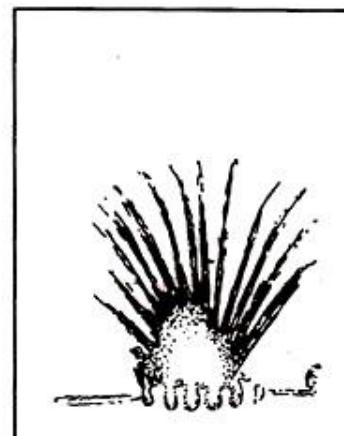
Foam Jet Fountain



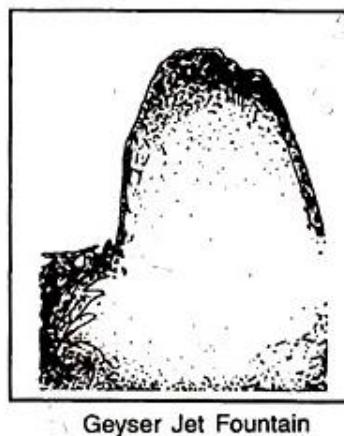
2 Stage Jet Fountain



Vertical Jet Fountain

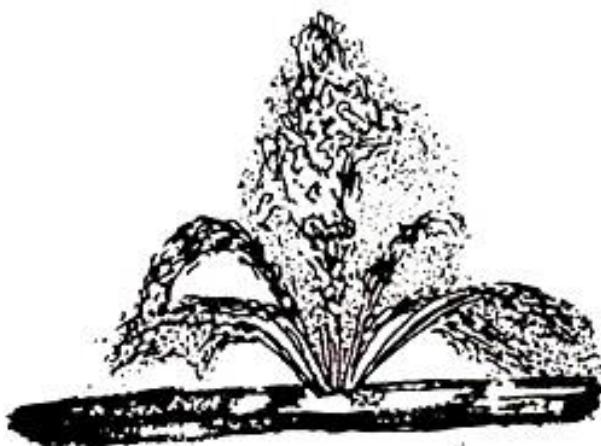


Finger Jet Fountain

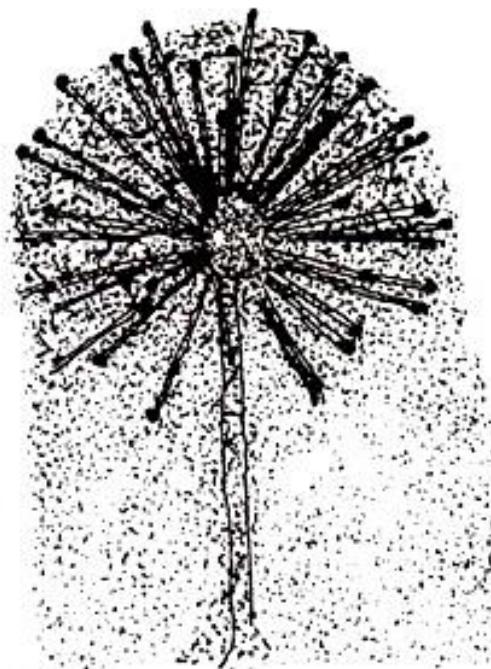


Geyser Jet Fountain

Fountain



Ball with Crown Fountain



Ball Fountain



Bubble Fountain



Double Crown Fountain

Fountain

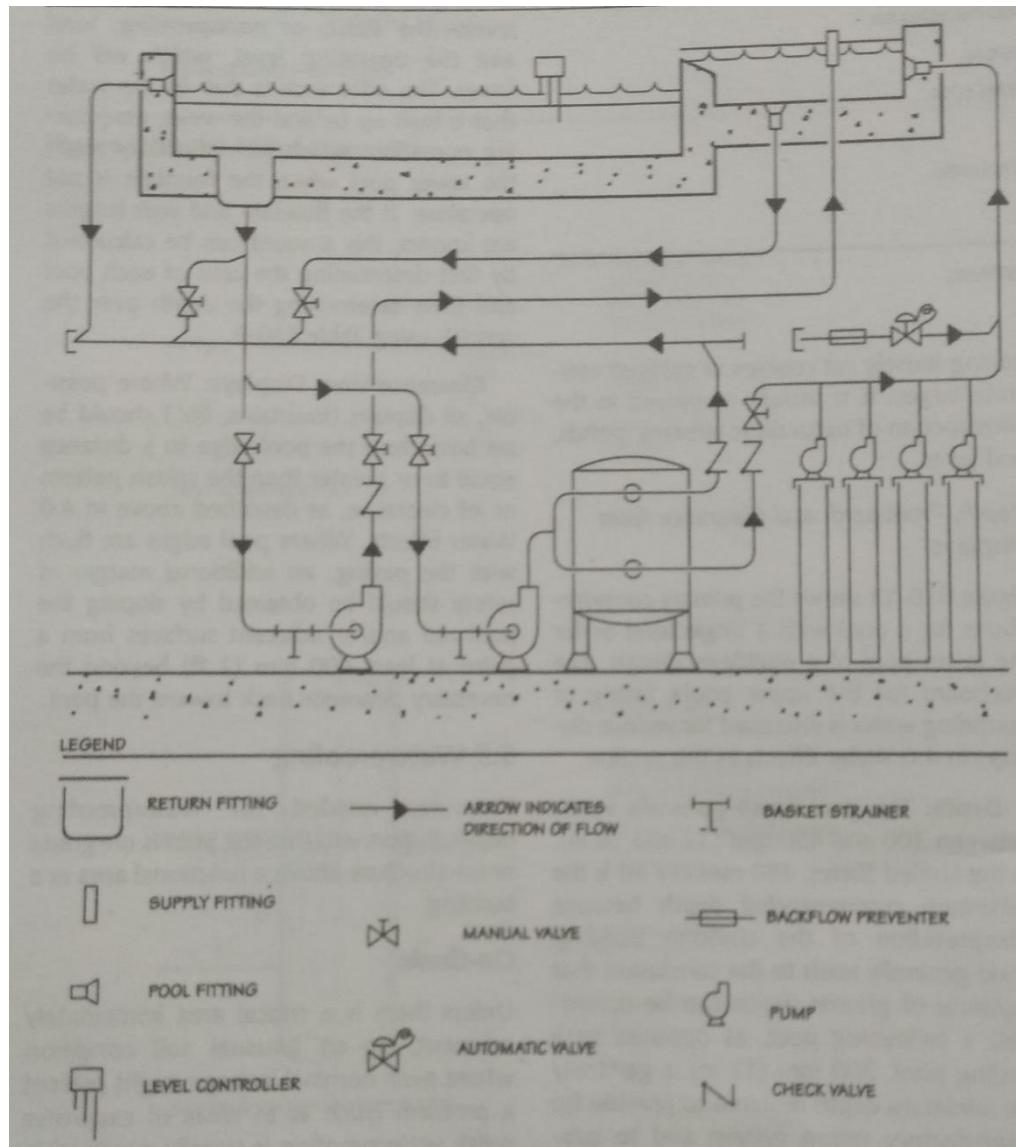


Figure 530-17. Schematic fountain diagram.

Factors affecting the design of water features include its purpose, the environment, construction budget, appropriate materials and governing codes.

1. Hot climates suggest cooling displays, while cold and temperate climates dictate a 4 to 6 month winter shutdown, which may suggest non-pool design or alternative cold weather uses.
2. On-structure pool and fountain design may be limited by concerns for weight and waterproofing. On-grade design may require under drains if soils are expansive, to avoid differential settlement.
3. Native soil or clay materials may be used in pool design to achieve a natural appearance. More formal installations may incorporate concrete, stone, brick, wood, metal or fiberglass.
4. A depth of 300 mm is generally required to provide a satisfactory return system, display jets, and submersible pool lights.
5. Freeboard requirements vary as a function of the edge condition. Cantilevered or stepped edges require only about 25mm whereas soft-planted edges with troughs should allow at least 150mm.
6. Where pool edges are flush with the paving, an additional margin of safety should be obtained by sloping the pool rim and/or adjacent surfaces from a point atleast 600mm beyond the necessary clearance back toward the pool.

Cascade

- Cascading water is a combination of flowing and falling water.
- A cascading waterfall differs from a smooth or aerated waterfall in the sense that water moves over a texture comprised of projecting forms of sufficient dimension to divert the flow laterally or to cause it to spring free of the vertical surface, thereby resulting in a pattern of free falling water, flowing water, and dry areas.

Cascade

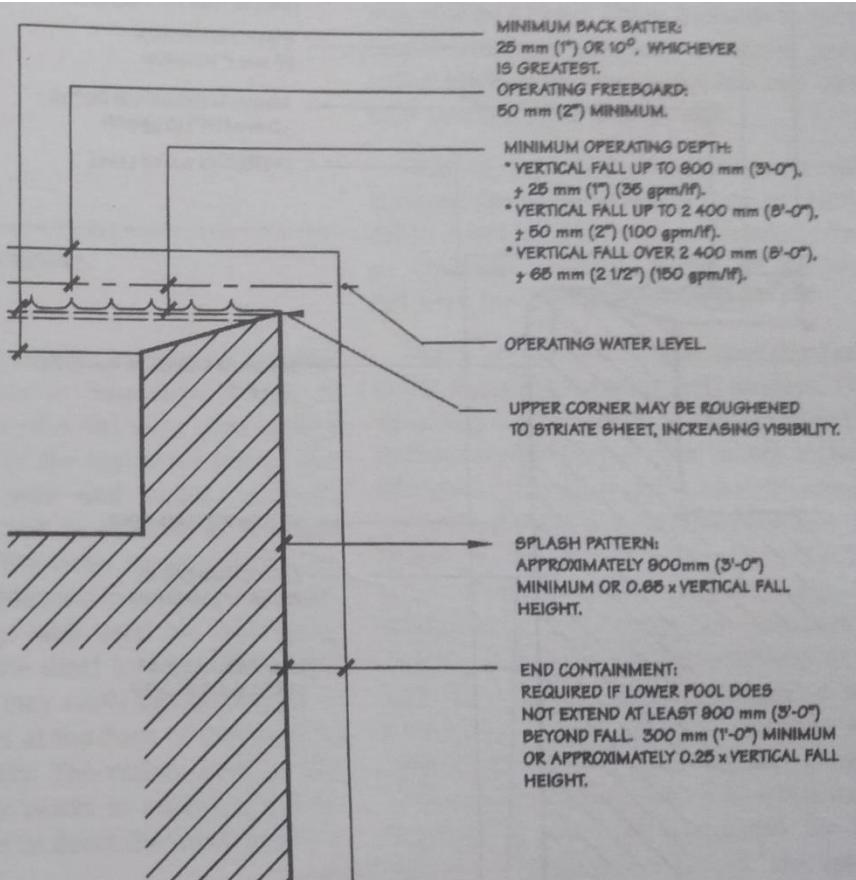


Figure 530-7. Free-falling or cascading sheet design.

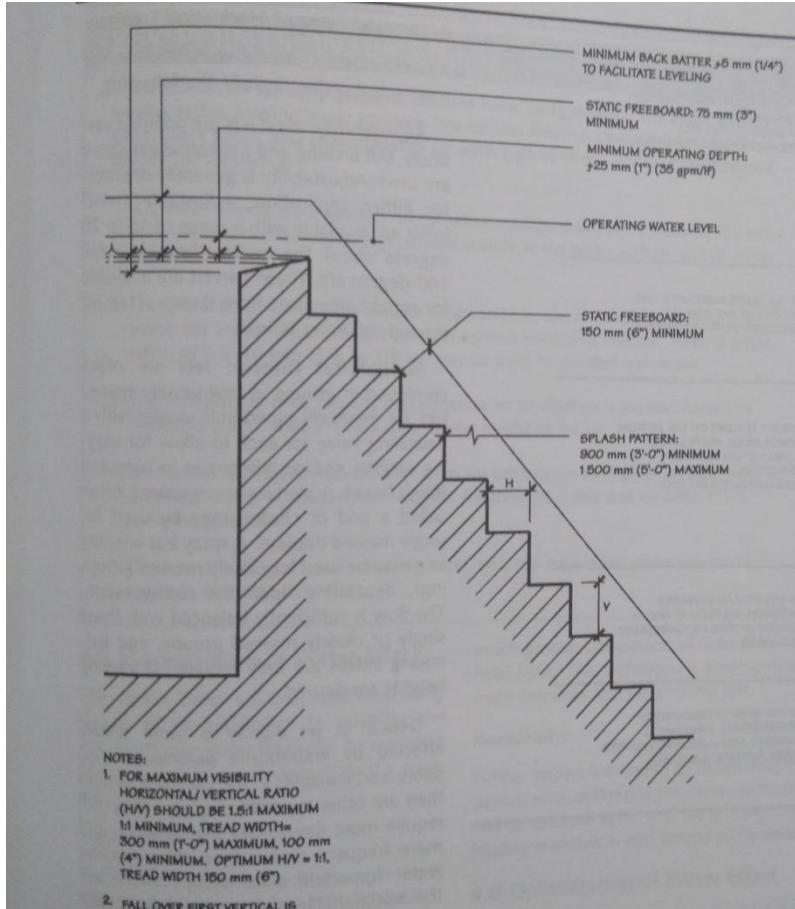


Figure 530-9. Waterstair cascade design (stepped planes).

moderates the sudden increase in velocity down sharply at

Cascade

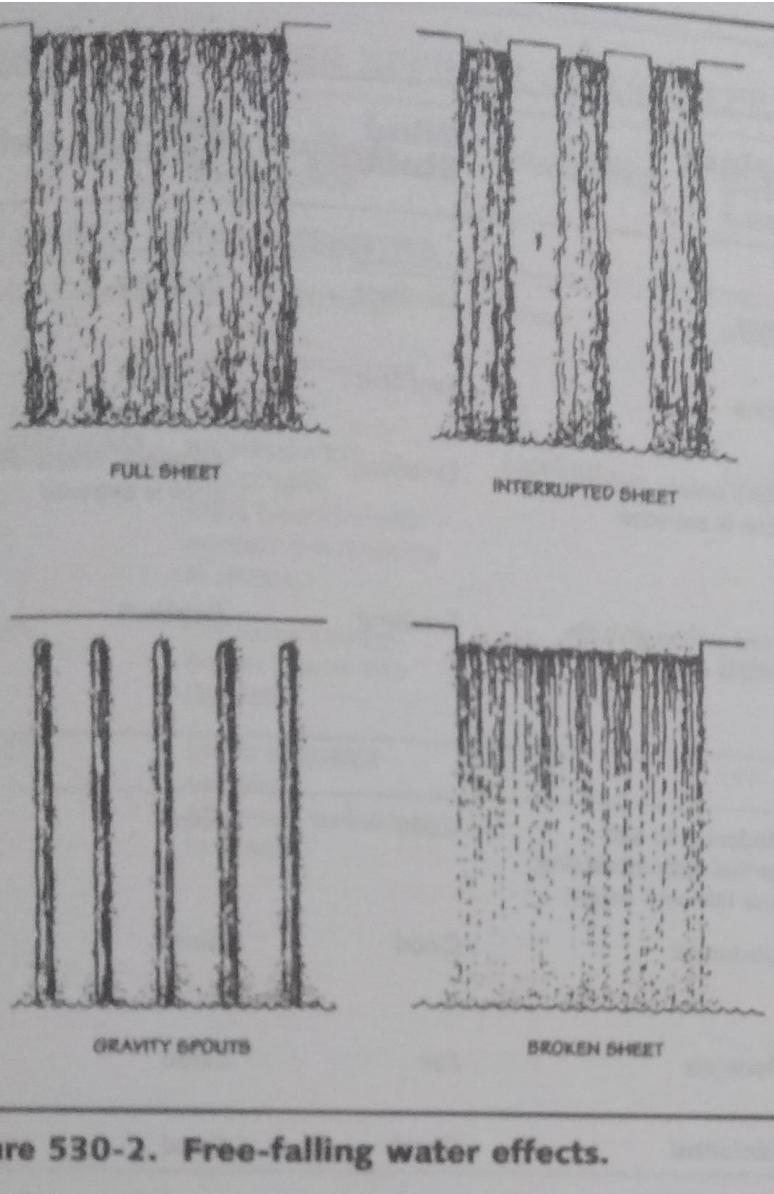


Figure 530-2. Free-falling water effects.

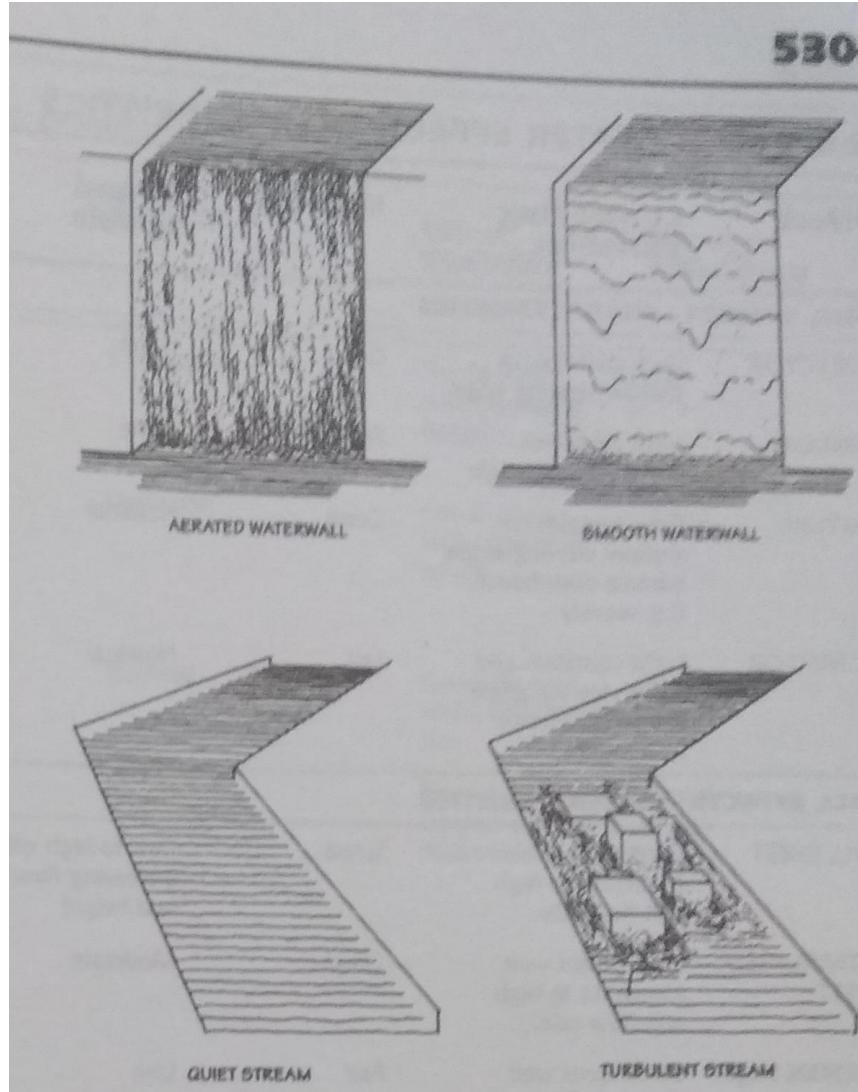
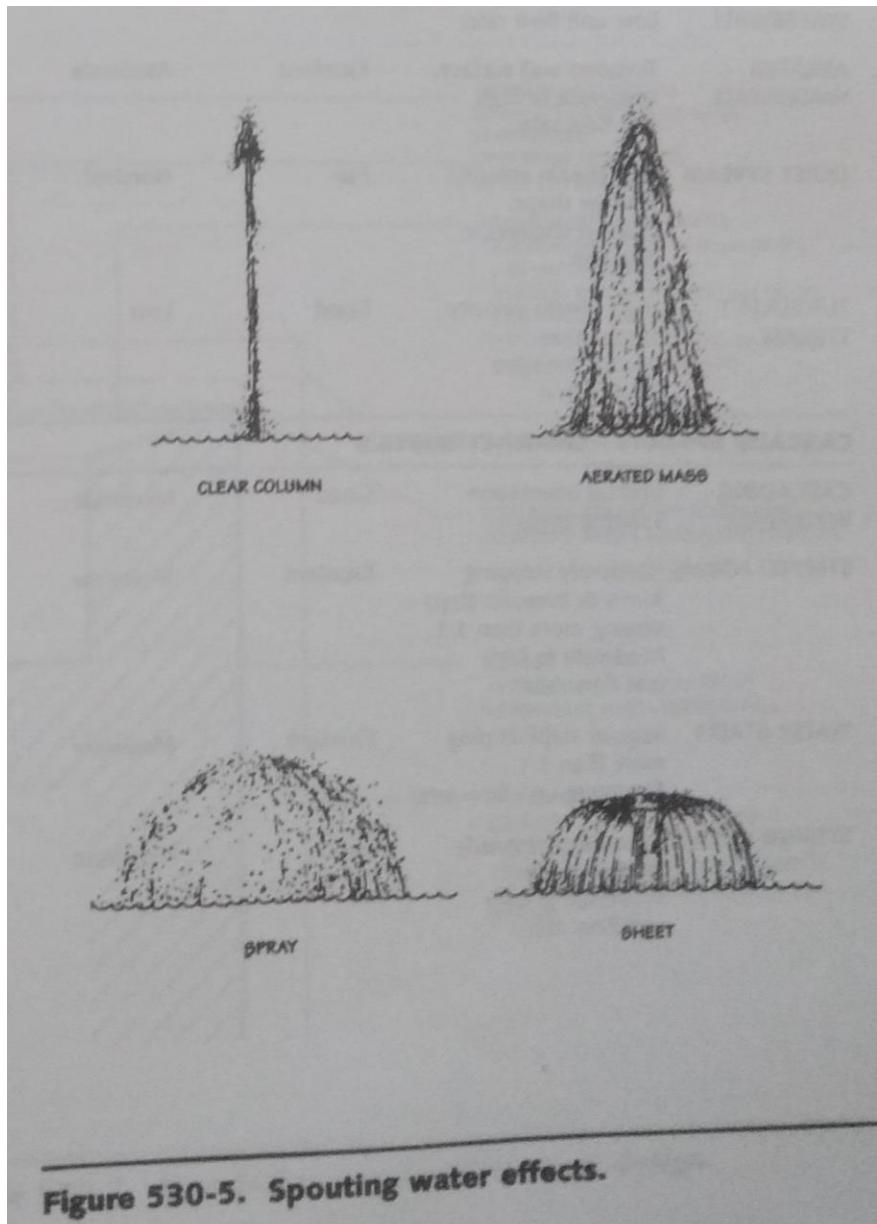
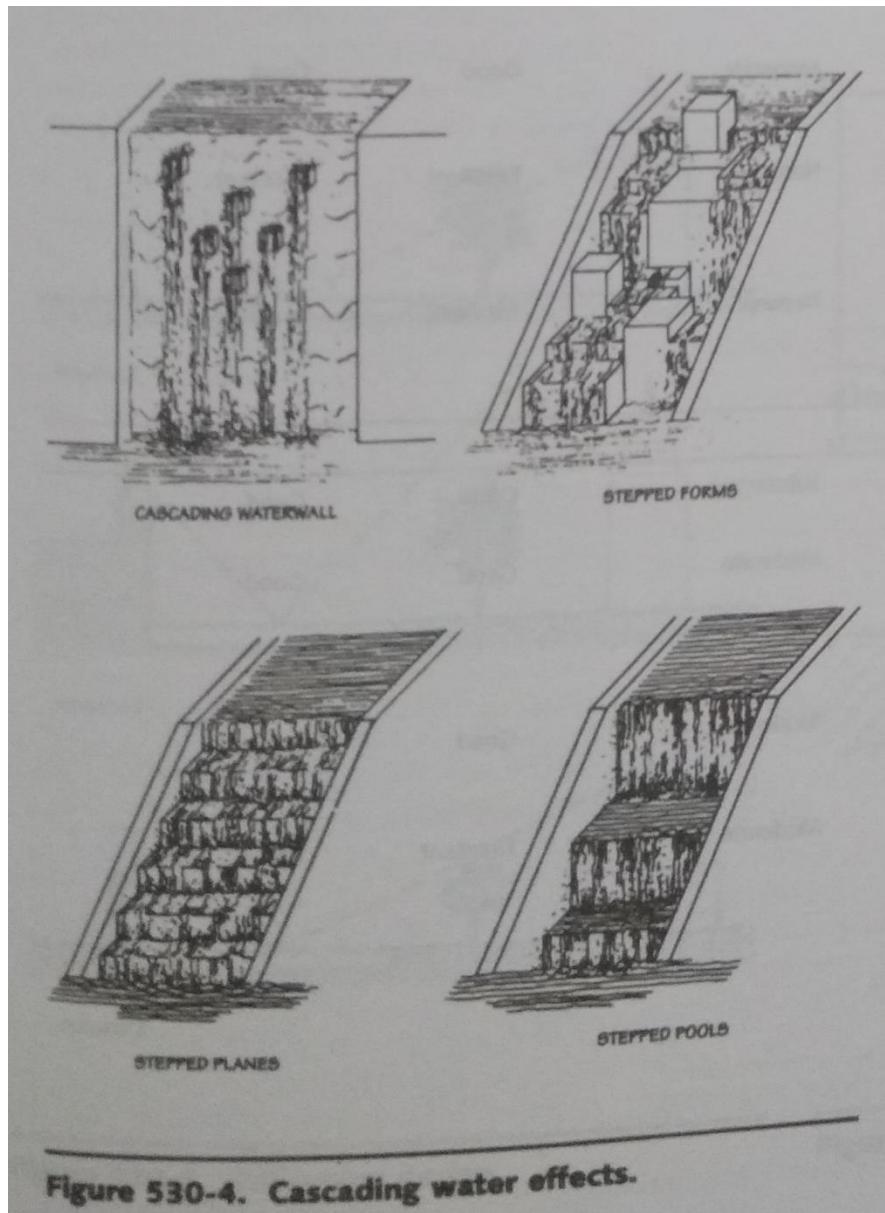


Figure 530-3. Flowing water effects.

530-5

Cascade



Mirror Pool

A **reflecting pool** or **reflection pool** is a water feature found in gardens, parks, and at memorial sites. It usually consists of a shallow pool of water, undisturbed by fountain jets, for a reflective surface.

Reflecting pools are often designed with the outer basin floor at the rim slightly deeper than the central area to suppress wave formation. They can be as small as a bird bath to as large as a major civic element. Their origins are from ancient Persian gardens.

Swimming Pool

Above-Ground Pool



Architectural Pool



An architectural pool is often geometric, sophisticated, and usually designed by an architect. If the house is custom-built, the pool is often built at the same time as the house, taking in size of the lot and the layout and relationship of the house to the pool.

Swimming Pool

Family Pool: Recreational Swimming Pool



Indoor Pool



Awe-inspiring [water features](#), elaborate slides, caves, tunnels, boulders, and a general for-all-ages appeal is what recreational pools are all about. While they are often big enough, don't expect to work in some laps, at least while children are playing and splashing in one of these mini water parks.

An [indoor swimming pool](#) is pretty straightforward—it's inside, under a roof, and insulated by at least three walls. Indoor pools are usually simple, geometric shapes and are built for swimming or training throughout the year, especially in cold climates.

Swimming Pool

Infinity Pool



Kiddie Pool



Infinity pools are also known as infinity edge pools, vanishing edge pools, negative edge, zero edge, or disappearing edge. Infinity pools are always custom-built and should be designed to highlight a view. Done right, an infinity pool gives one an illusion of a sheet of water dropping off over the edge of the property, like a waterfall, although you can't see or hear falling water.

Swimming Pool

Lap Pool



Natural Pool



A [lap pool](#) is a swimming pool built and used for fitness and health purposes. Lap pools are usually long and narrow, often more than 50 feet in length. Typically, lap pools are a rectangular shape and can be built on long, narrow lots.

[Natural swimming pools](#) are self-cleaning pools that combine swimming areas and water gardens.

Swimming Pool

Olympic-Size Pool



Olympic athletic competitions and swimming are the most widely followed Olympic sports in the world and have the largest number of events and participants from different countries.

Plunge Pool



[Plunge pools](#) are small, cold-water pools that have been used for thousands of years in Chinese medicine and were also popular with the Ancient Romans. Many swimmers and athletes like to plunge into a pool of cold water after a heated workout or sauna or spa session, believing it has therapeutic benefits. Plunge pools can be separate or attached to a larger in-ground pool.

Swimming Pool

Saltsater Pool



Spool



saltwater pools are not a design or style of pool. But adding a saltwater chlorinator or generator is something you have built into your pool. The good thing is that the generator can be added during the pool-construction process or after

Blending the words spa and pool, you get a spool. Smaller lots can't accommodate a larger pool. Some like it for relaxation and entertaining, using it more as a lukewarm-to-cool small pool in which to soak and cool off on hot days.

Swimming Pool

A typical swimming pool needs seven major components:

- A basin
- A motorized pump
- A water filter
- A chemical feeder
- Drains
- Returns

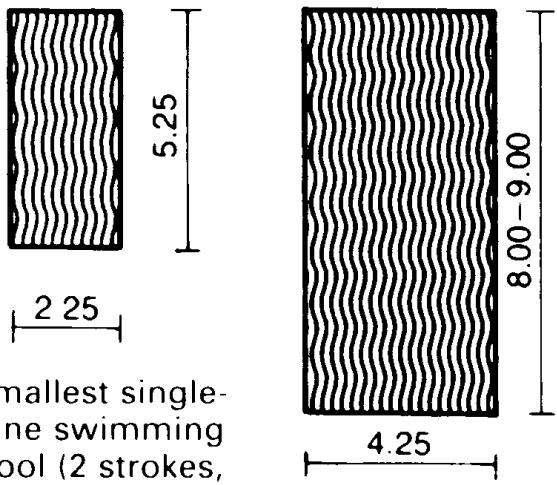
PVC plastic plumbing connecting all of these elements

The basic idea is to pump water in a continual cycle, from the pool through the filtering and chemical treatment systems and back to the pool again.

In this way, the pumping system keeps the water in the pool relatively free of dirt, debris and bacteria.

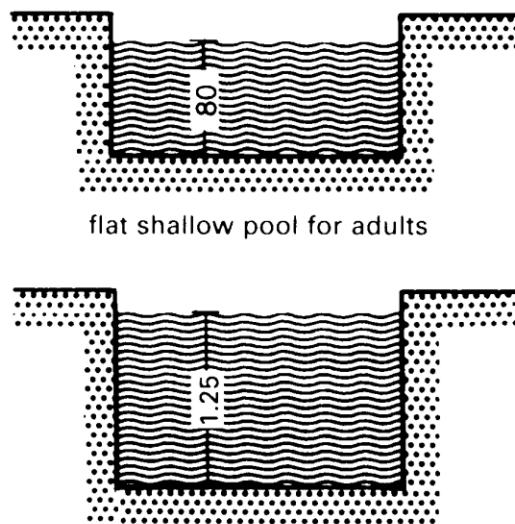
Some pools also include heaters in the mix, in order to keep the water at a certain temperature.

Swimming Pool

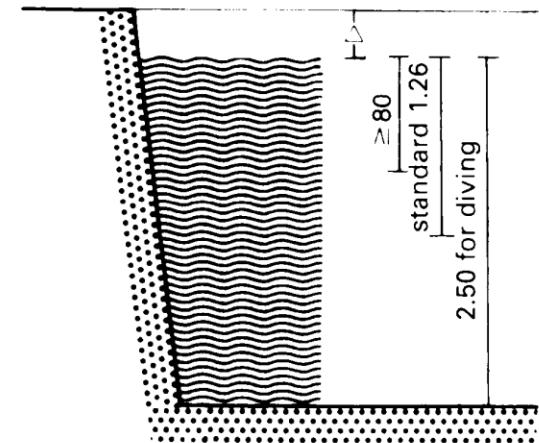


smallest single-lane swimming pool (2 strokes, 1-2 people)

average size two-lane swimming pool (3-4 strokes, 4-5 people); minimum size for racing dive from deep end



flat shallow pool for adults



standard 1.26
2.50 for diving

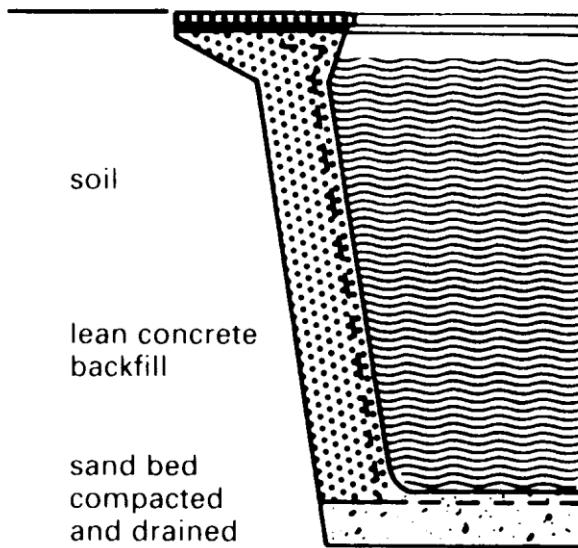
③

Normal depths of garden swimming pools

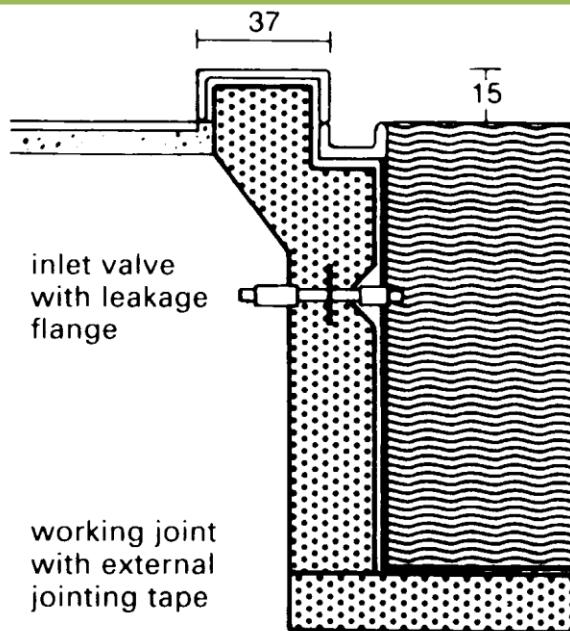
④

Pool depths

Swimming Pool

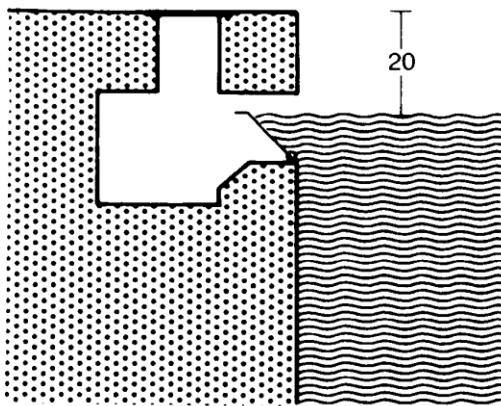


6 Single-shell precast
polyester pool

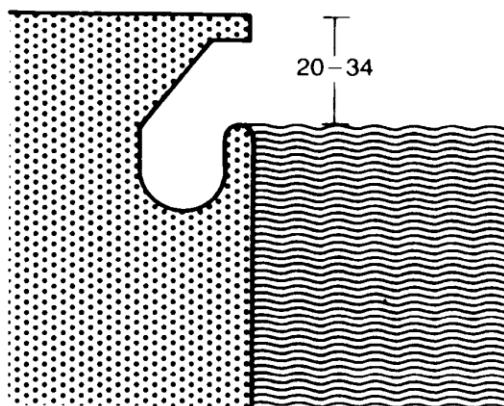


7 Reinforced concrete pool
of simple design

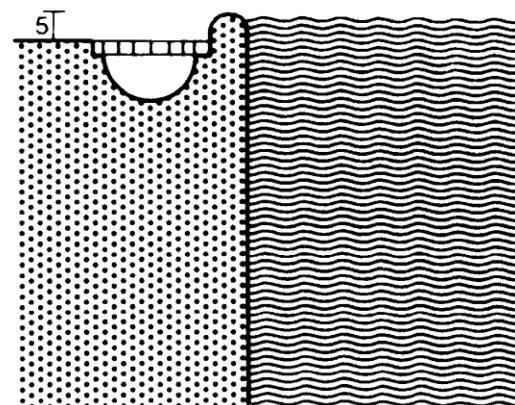
Swimming Pool



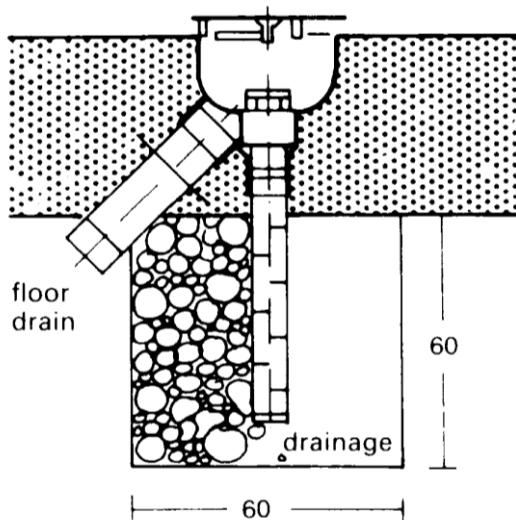
⑨ Skimmer



⑩ Pool with 'Wiesbaden' overflow channel

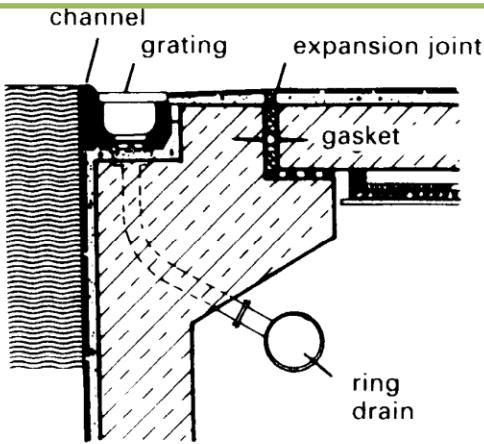


⑪ 'Zürich' channel in surrounding walkway

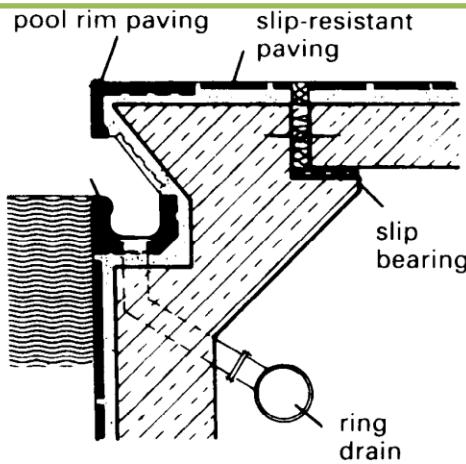


⑭ Floor drain with groundwater pressure balance

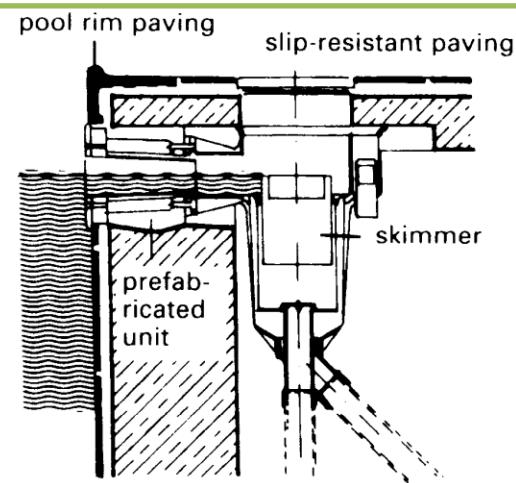
Swimming Pool



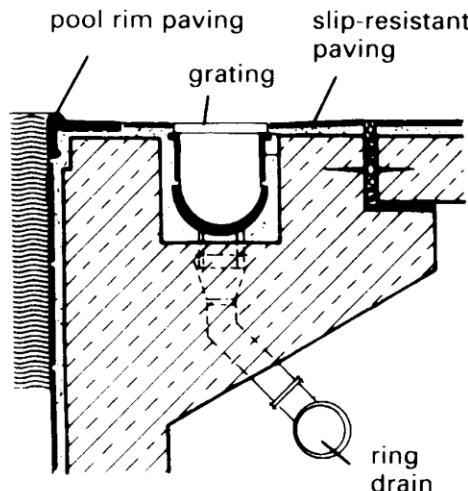
① **'Weisbaden' type pool rim overflow channel**



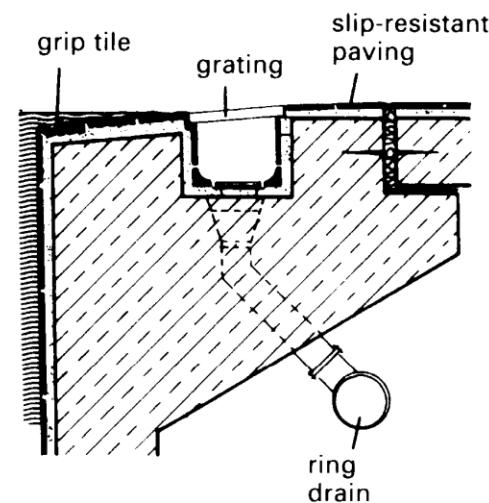
② **'Weisbaden' type poolside overflow channel**



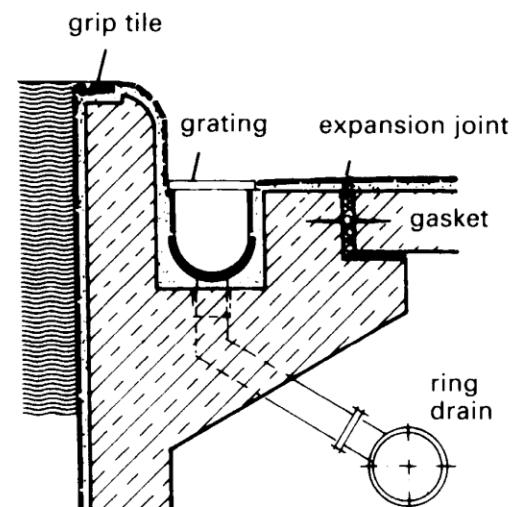
③ **Surface skimmer system**



④ **Overflowing pool with rim paving and channel**

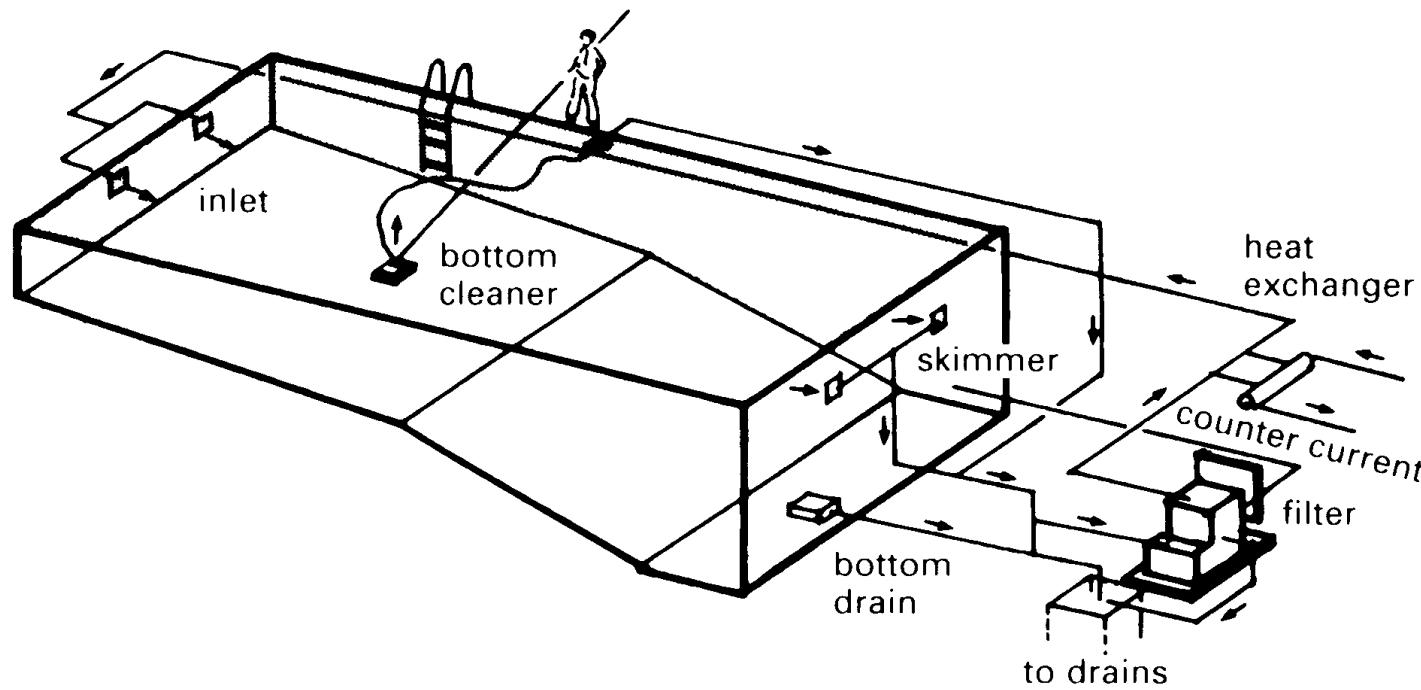


⑤ **Finnish type rim and channel**



⑥ **'St Moritz' type pool rim overflow channel**

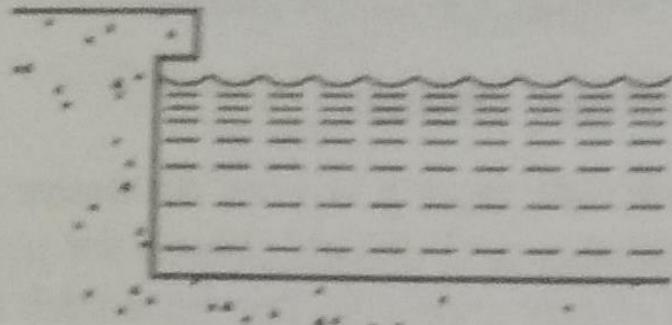
Swimming Pool



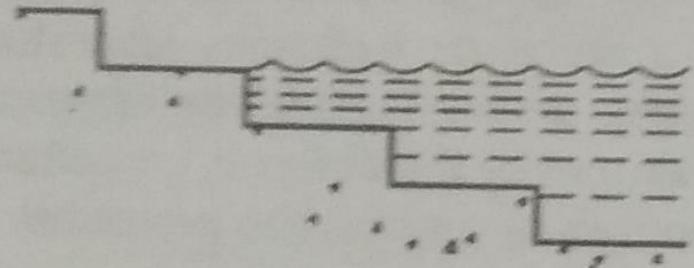
1 **Classic filter system with skimmer and supply**

Swimming Pool

EDGE @ POOL

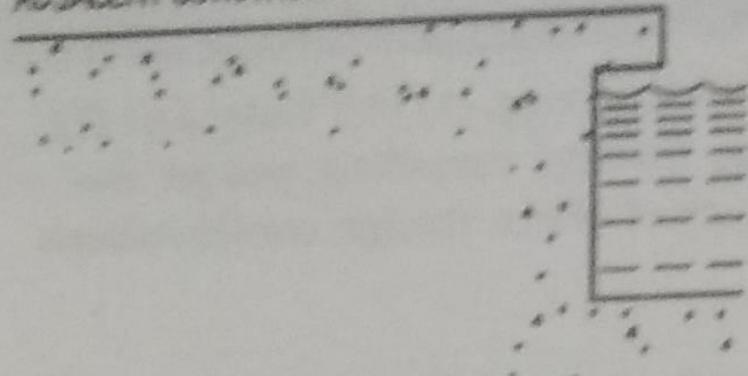


1. CANTILEVERED COPING

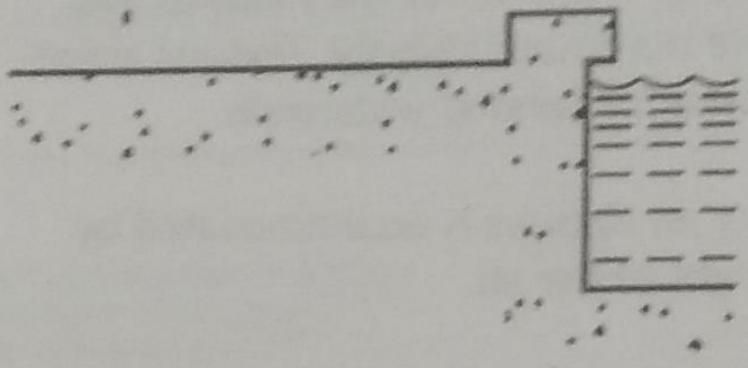


2. STEPPED

ADJACENT CONDITION

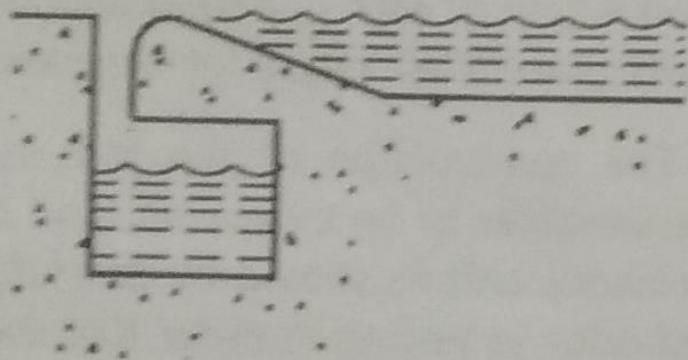


1. FLUSH

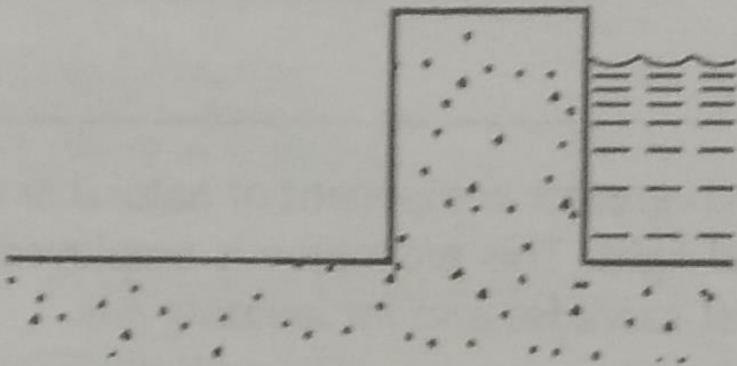


2. CURB

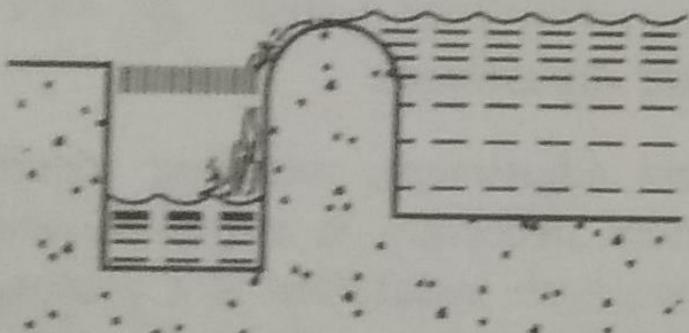
Swimming Pool



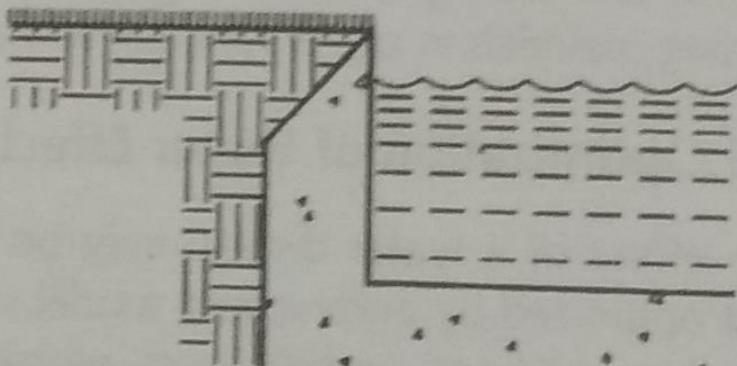
3. SLOT AND CONCEALED TROUGH



3. SEAT WALL



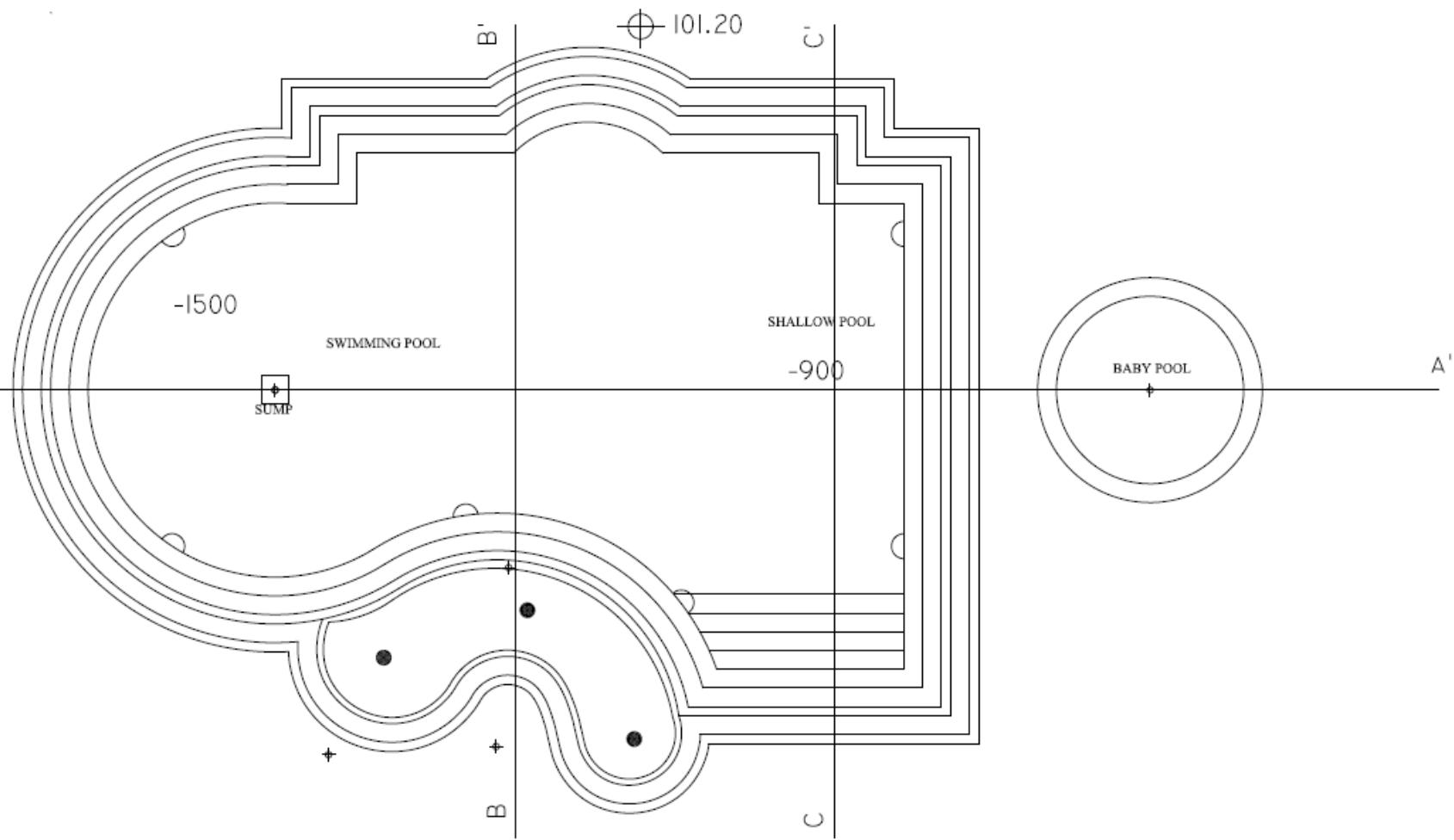
4. ROUNDED EDGE AT OPEN TROUGH



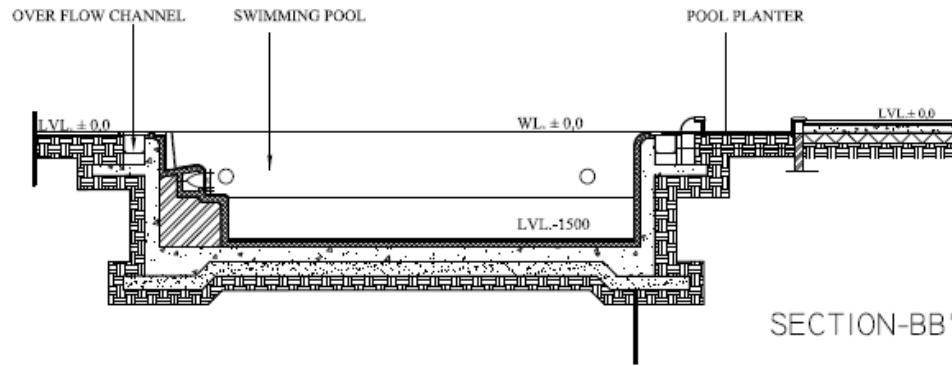
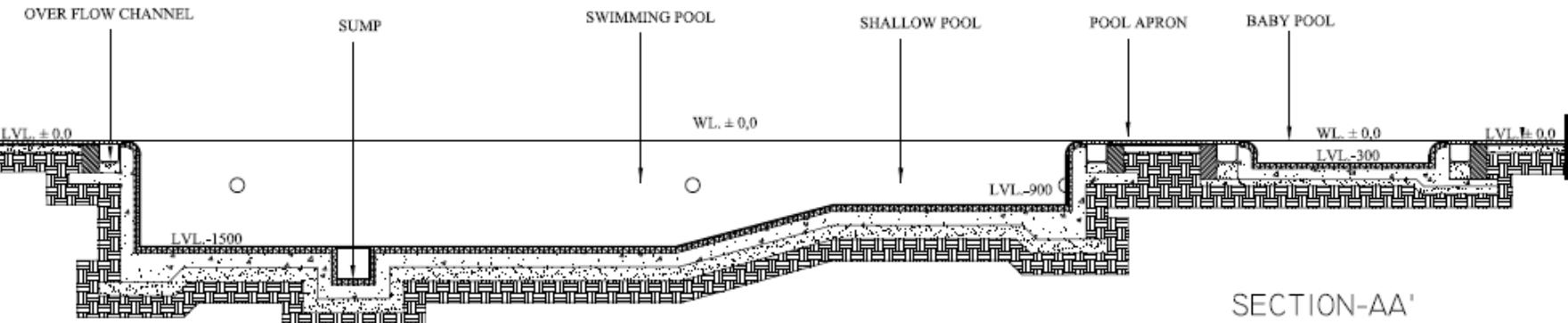
4. PLANTING

Swimming Pool

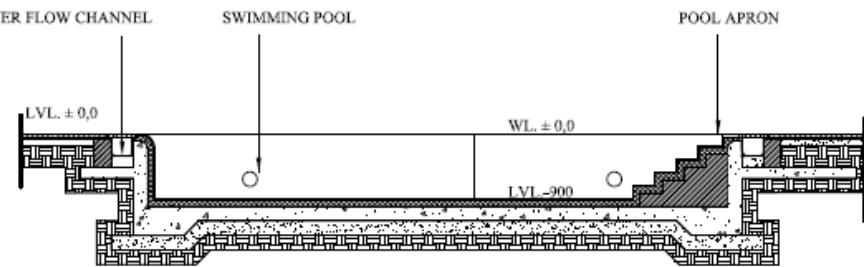
PLAN



Swimming Pool



SECTIONS



Mechanism of Plant room



Plant Room Considerations

The plant room stores all the equipment that controls the pool's operation and ensures it performs efficiently around the clock – this article looks at some of the key design considerations.

Size/Space: Exactly how big the plant room needs to be will depend on the size of the pool, but making it as large as possible given the other constraints will be worth it in the long run. Invariably we find that clients underestimate the space required, so it's important to establish the space requirement early in the discussion. This will avoid costly and time-consuming reconfiguration later down the line. As well as making space for all the necessary equipment and storage of pool chemicals, the bigger it is, the more accessible it will be for future servicing and maintenance.

Access: It is very important that the plant room is easily accessible, as there will be a need for regular maintenance, and you also need to take into account that over time some parts will need to be replaced due to normal wear and tear caused by the necessary use of chemicals to treat the water. Easy access will be needed for such work.

Location: The plant room should be located with its floor at least level with the water line: Ideally, it should be below water level with the pumps always below the pool water level. There are two reasons for this. First, it will mean the water circulation system will operate most effectively, and second, it will need much less suction pipework installation. Of course, there will be various limitations on its location depending on the size of the proposed pool hall or outdoor space, the shape of the pool as well as its depth, but the basic rule of thumb holds: the deeper the better.

Noise suppression: Some equipment in a pool plant room can generate noise, so considering ways to suppress or block out that noise from the pool hall/area is important. Adding a layer of sound insulation around the inside of the plant room will reduce or eliminate background noise – this is especially important if the client stresses that they want their pool to be a tranquil haven where they can unwind and relax.

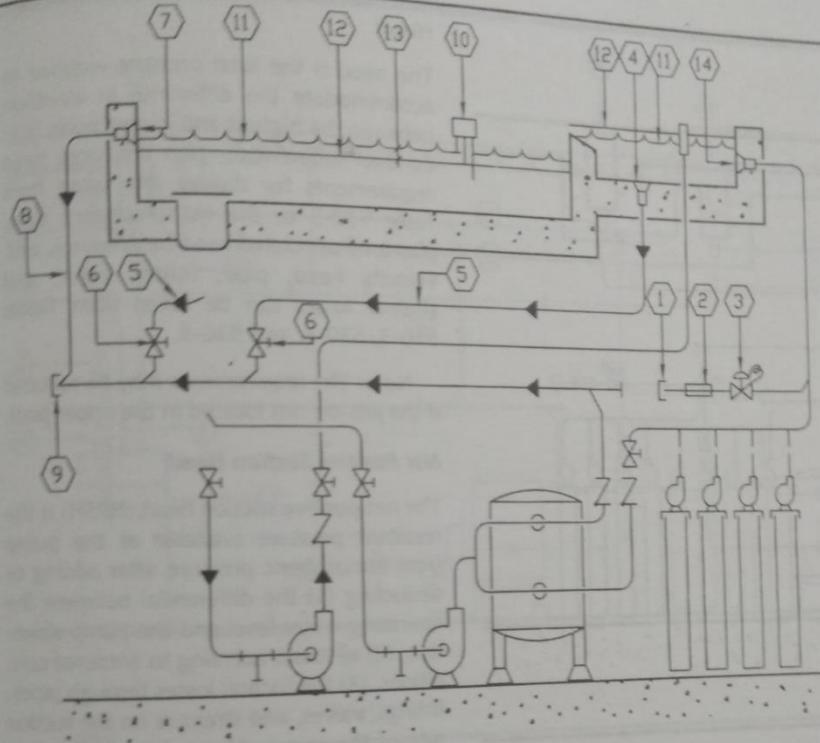
Personal equipment storage: Finally, provision needs to be made for storing items that will be used by swimmers and the pool owner/manager. One thing that often gets overlooked in the planning of a pool plant room is creating storage space for personal and protective equipment, for example, items such as goggles, gloves, aprons and shoe coverings for use when dealing with and handling pool chemicals. Other items that would be worth housing in the plant room include a first aid kit and installing a sink with clean running water can be beneficial - they will all need appropriate space allocation.

OPERATING SYSTEMS

Submersible pumps and larger remote systems are the two mechanical methods for recirculation of water in pools and fountains.

Selection of an appropriate system depends on the size, application, and budget of the proposed display.

1. Submersible pumps are generally limited to installations of 9 sq.m. or less in areas that are drained , cleaned, and filled every few days in lieu of filtering. Maintenance and electrical safety are the primary concerns with these systems.
2. In remote systems, the equipment space should be as close as possible to the pool, and the floor elevation should be atleast 600mm below the lowest water level in the pool in order to provide a flooded suction for the pump.
3. Filter systems are used to remove particulates from the water and return it to the pool.
4. The fill/makeup system establishes the static water level and maintains the operating water level.
5. The overflow/ drain system establishes the static water level and provides for draining of the pools, piping and equipment.



NOTES

(1) WATER SUPPLY PIPING

(2) BACKFLOW PREVENTER

(3) FILL AND MAKE-UP VALVE

(4) DRAIN FITTING*

(5) DRAIN PIPING

(6) DRAIN VALVE

(NOTES WITH * FOR MULT-LEVEL POOLS ONLY)

(8) OVERFLOW PIPING

(9) SEWER PIPING

(10) WATER LEVEL SENSOR

(11) STATIC WATER LEVEL*

(12) OPERATING WATER LEVEL*

(13) OPERATING DRAWDOWN*

(14) OPERATING BUILDUP*

Fill/Makeup and Control Systems:

Fill/makeup and control systems

The fill/makeup and control system maintains static water level in the pools (Item 11) and overflow (Item 8) and controls the water level. It is usually connected to a central pump unit. Item 10 is required by code. Item 12 is derived from the absence of siphoning. Item 13 is a fountain which provides water supply to equipment below the operating water level. Item 14 is a reduced-pressure valve. Item 15 is a solenoid-actuated valve with a float switch to establish operating drawdown levels. Item 16 is a float switch which is dependent on the operating water level.

The operating water level is determined by the static water level, the fill system, the backflow preventer, the pools, the water level sensor, the cleaning equipment, and the fountain. The operating drawdown could free up water for the fountain. Item 4 is a drain fitting located at the bottom of the pump. Item 5 is a drain piping connecting the pump to the sewer. Item 6 is a drain valve on the drain piping. Item 7 is an overflow piping connecting the pump to the top of the pools. Item 8 is an overflow piping at the top of the pools. Item 9 is a sewer piping connecting the pump to the sewer. Item 10 is a water level sensor on the return line. Item 11 is a static water level indicated by a dashed horizontal line. Item 12 is an operating water level indicated by a solid horizontal line. Item 13 is an operating drawdown indicated by a dotted horizontal line. Item 14 is an operating buildup indicated by a dash-dot horizontal line.

III.

Landscape grading, landform design & drainage design

Landscape grading

- Grading or landscape engineering is a fundamental technical aspect of landscape architecture concerned with the development of the site plan into three dimensional reality.
- It involves the remodeling of existing land form to facilitate the functions and circulation of the site plan the knowledge of grading technology is useful in the site planning process .
- Grading is the adjustment and connection of given or required levels. Detailed leveling is needed to make connections between architecture and landscape between indoors sand outdoors.
- The site to structure relationship is a visual as well as functional matter. The floor levels of buildings should be higher than the surrounding ground surfaces adjacent to and outside buildings and should also slope away from the building so that rain water will not easily enter the structures or undermine foundations.

Landscape grading

Grading is done for the following reasons:

- To create level spaces for the construction of buildings
- To create the level spaces required for activities and facilities such as parking lots, driveways, swimming pools & playing fields
- To introduce special effects or improved conditions into the landscape such as better drainage, earth berms, tree wells and ponds
- To improve the rate and pattern of circulation by means of better roads, ramps, tracks, or path
- There are two principle relationships between buildings and land. The land may be graded or adjusted to suite the architectural or engineering requirements or architecture may be adapted to meet variations on ground level so that the original surface is distributed less

Landscape grading

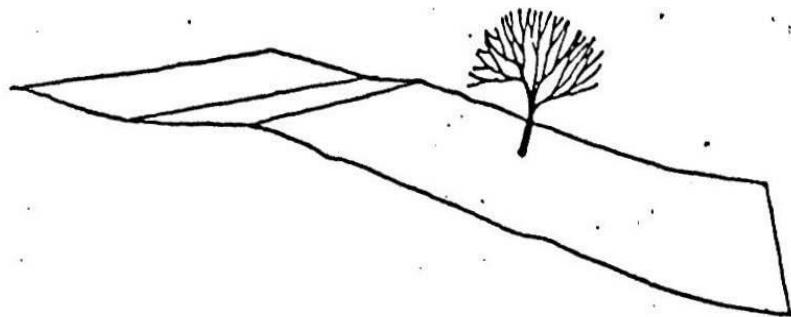


Fig. 12.4a A sloping site.

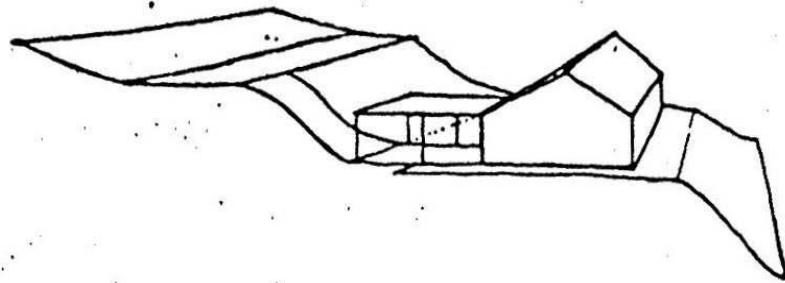


Fig. 12.4c A single storey house set on conventional foundations requires considerable cut and fill resulting in steeper slopes at each side of the lot.

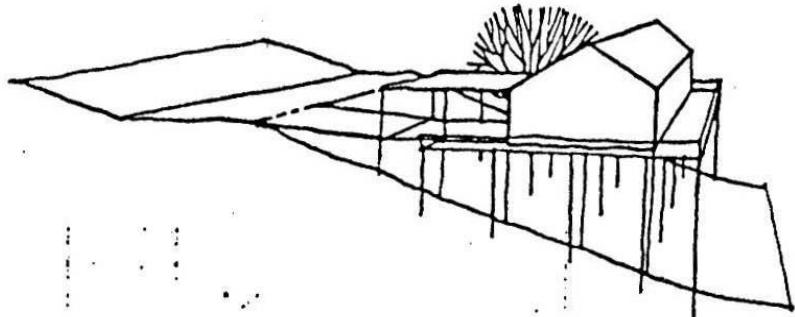


Fig. 12.4b A single storey house set on stilts leaves the ground relatively undisturbed. The tree can be saved.

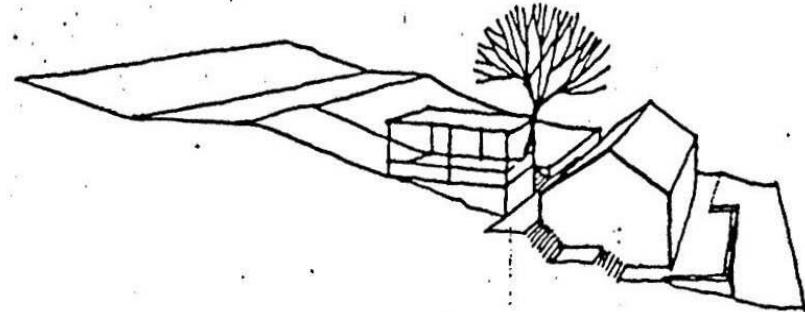


Fig. 12.4d A split-level house with retaining walls maintains shallow slopes at each side of the lot and the tree can be saved. The house is closely related to the form of the landscape.

Landscape grading

The basic principles and goals of grading may be summarized as follows.

1. The ground surface must be suitable for intended purpose or use.
2. The visual result should be pleasing indeed the purpose of grading may be purely aesthetic to screen views or create symbolic landform.
3. The resulting ground surface must have positive drainage.
4. The grading plan should attempt to keep the new levels as close as possible to the original state of the land. In non urban areas esp. existing landscape represents an ecological balance, a natural drainage system, and a developed soil profile.
5. When ground is reshaped, it should be done positively and at the scale of machinery. Grading machinery is by definition gross in nature and subtle details are difficult to achieve except by hand labor.
6. Topsoil should be considered wherever possible. It may be stripped, stockpiled, and reused after heavy grading.
7. In grading, the quantity of cut should approximately equal the amount of fill. This eliminates the need to import soil or to find a place to dump unwanted material.

Landscape grading

Cut and fill process

- The grading practice of removing earth from a slope is called **cutting**
- The practice of adding earth to a slope is called **filling**
- On a contour map cut is shown as a solid line diverting from and then returning to an existing contour line and moving in the direction of a higher contour
- A fill is shown as a solid line diverting from and then returning to an existing contour line, but moving in the direction of lower contour
- In cut and fill process, the quantity of cut should be calculated to be about 5 % more than would appear to be theoretically necessary for the fill
- When land is graded, not only the top soil is disturbed, but the surface water drainage and vegetation are disturbed as well. Water must drain away from the buildings, not towards them
- Freshly graded slopes must be stabilized to guard against erosion
- The vulnerable area on the ground equals the spread of the tree plus an additional one third of that on each side. The way in which trees grow naturally cut off the ground is an important factor of their aesthetic quality. The surface roots of valuable trees must be protected from the destruction of cutting and the suffocation of filling

Landscape grading

Cut and fill process

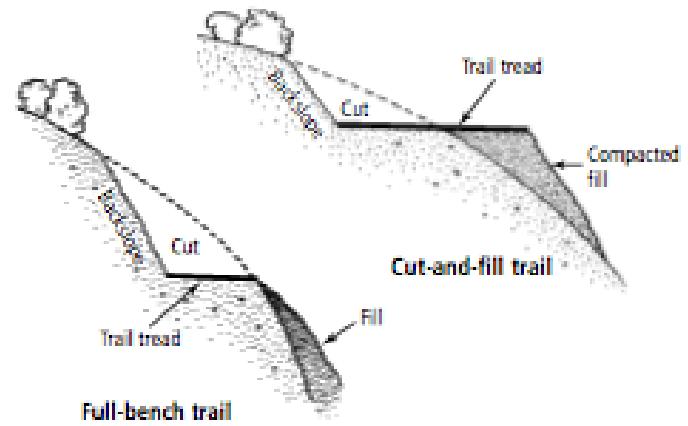
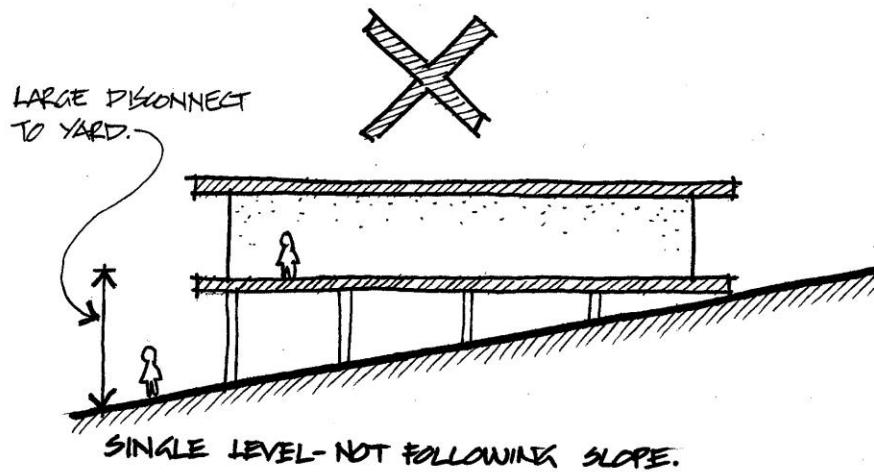


Figure 13-7. Full-bench and cut-and-fill trails provide safe travel across steep slopes.



GRADING & LANDFORM MODIFICATION

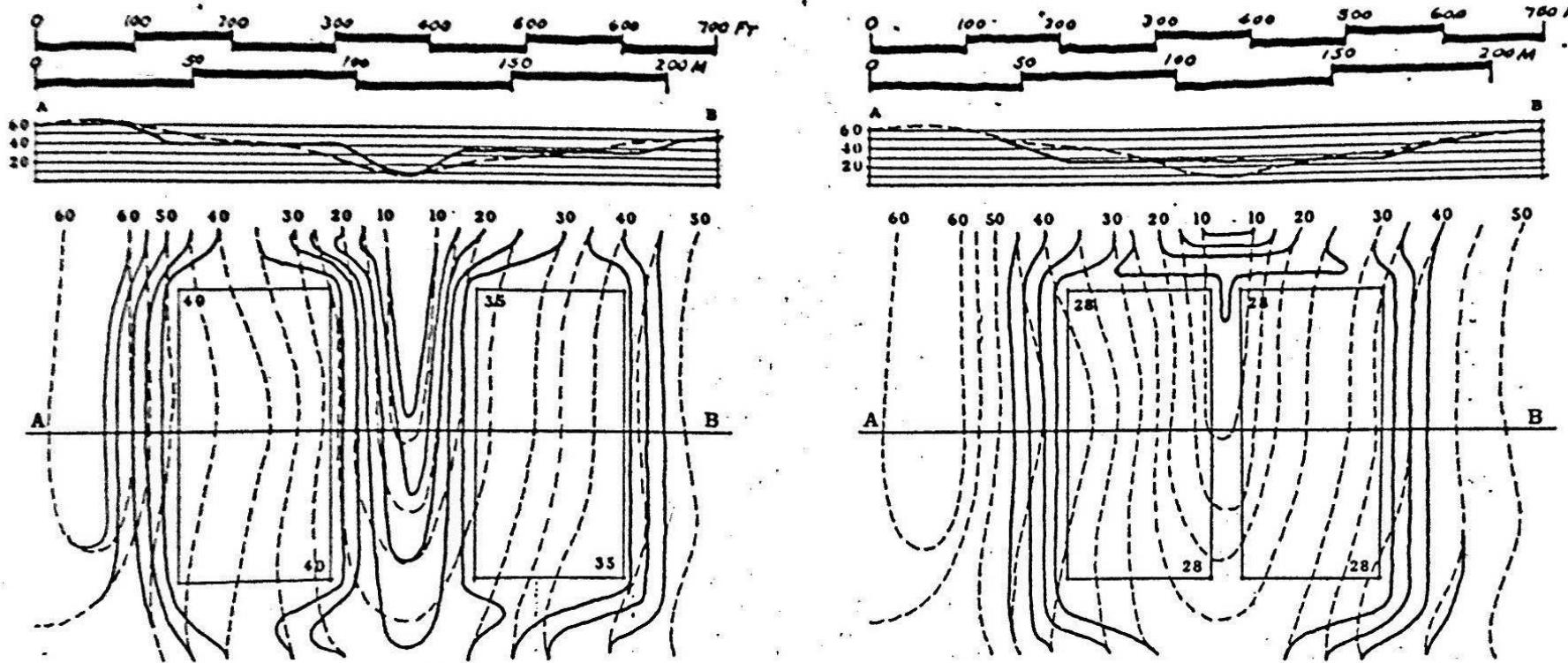
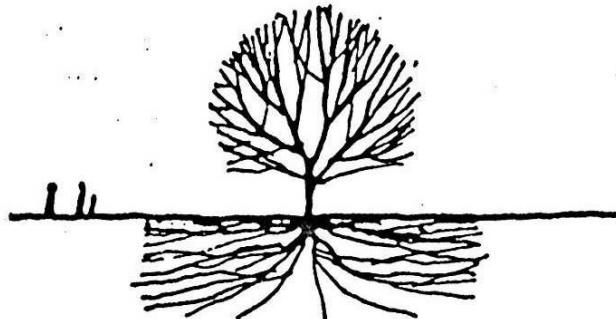


Fig. 12.7 (a) and (b) Two grading solutions fitting playing fields into uneven terrain. In both cases the cut balances the fill. Solution (a) is perhaps the most sensitive of the two, but might have some disadvantages.

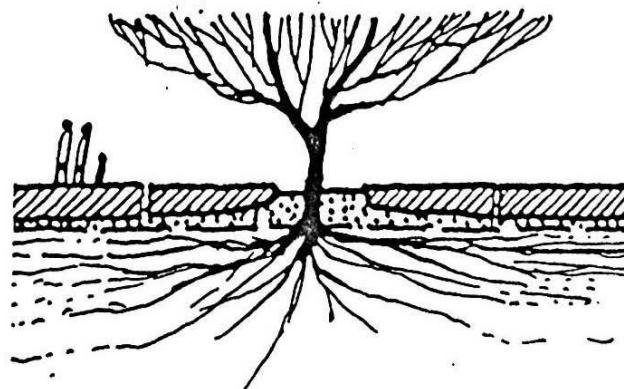
GRADING & LANDFORM MODIFICATION

(a)



(a) The vulnerable area around the tree is equal to its spread plus one-third.

(b)



(b) A system of filling land over the vulnerable area which attempts to maintain the original relationship of air and water to the trees roots.

GRADING & LANDFORM MODIFICATION

Gradients:

- The slope should be as gentle as possible for maintenance
- For shorter distance, ramps with a gradient upto 12% (1:8) can be used ;over 12% steps become the most reasonable way to overcome changes in level, but they should be avoided wherever possible
- Roads and drive ways also have preferred maximum gradients. Although 6% (1:15) is considered desirable, 8% (1:12) -10% (1:10) is permissible for short distances
- Grass cutting machinery is not practical at slopes greater than 30%. (1:3)

GRADING & LANDFORM MODIFICATION

Retaining walls:

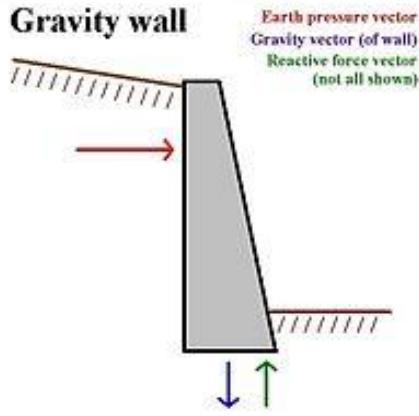
- Retaining walls are devices that can take up differences in elevation abruptly; they are expensive, requiring reinforcement if they are over 3 feet in height.
- Weep holes at the base of the wall are needed to relieve the pressure and weight of rain water behind the wall .
- Retaining wall of any material can be used as an effective design technique to link buildings or structures to the landscape.
- Where land is excessively steep ,flat areas are achieved only through retaining walls or decks.



GRADING & LANDFORM MODIFICATION

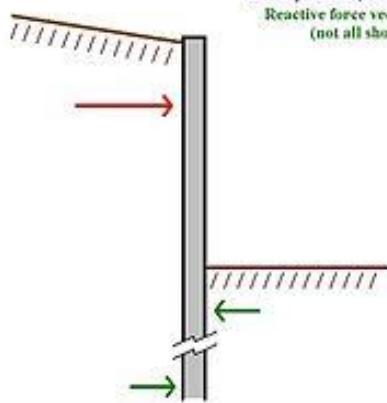
Simplified explanation of typical retaining walls

Gravity wall



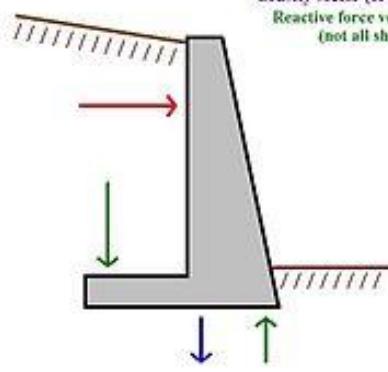
Earth pressure vector
Gravity vector (of wall)
Reactive force vector
(not all shown)

Piling wall



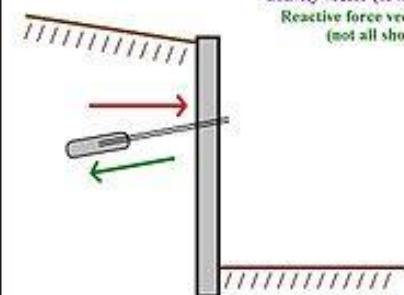
Earth pressure vector
Gravity vector (of wall)
Reactive force vector
(not all shown)

Cantilever wall



Earth pressure vector
Gravity vector (of wall)
Reactive force vector
(not all shown)

Anchored wall



Earth pressure vector
Gravity vector (of wall)
Reactive force vector
(not all shown)

Standard wall type that holds the earth mainly through its own weight. Can pivot and topple relatively easily, as the internal leverage of the earth pressure is very high.

Using long piles, this wall is fixed by soil on both sides of its lower length. If the piles themselves can resist the bending forces, this wall can take high loads.

The cantilever wall (which may also extend in the other direction) uses the same earth pressure trying to topple it to stabilize itself with a second lever arm.

This wall keeps itself from toppling by having cables driven into the soil or rock, fixed by expanding anchors (can be combined with other types of walls).

GRADING & LANDFORM MODIFICATION

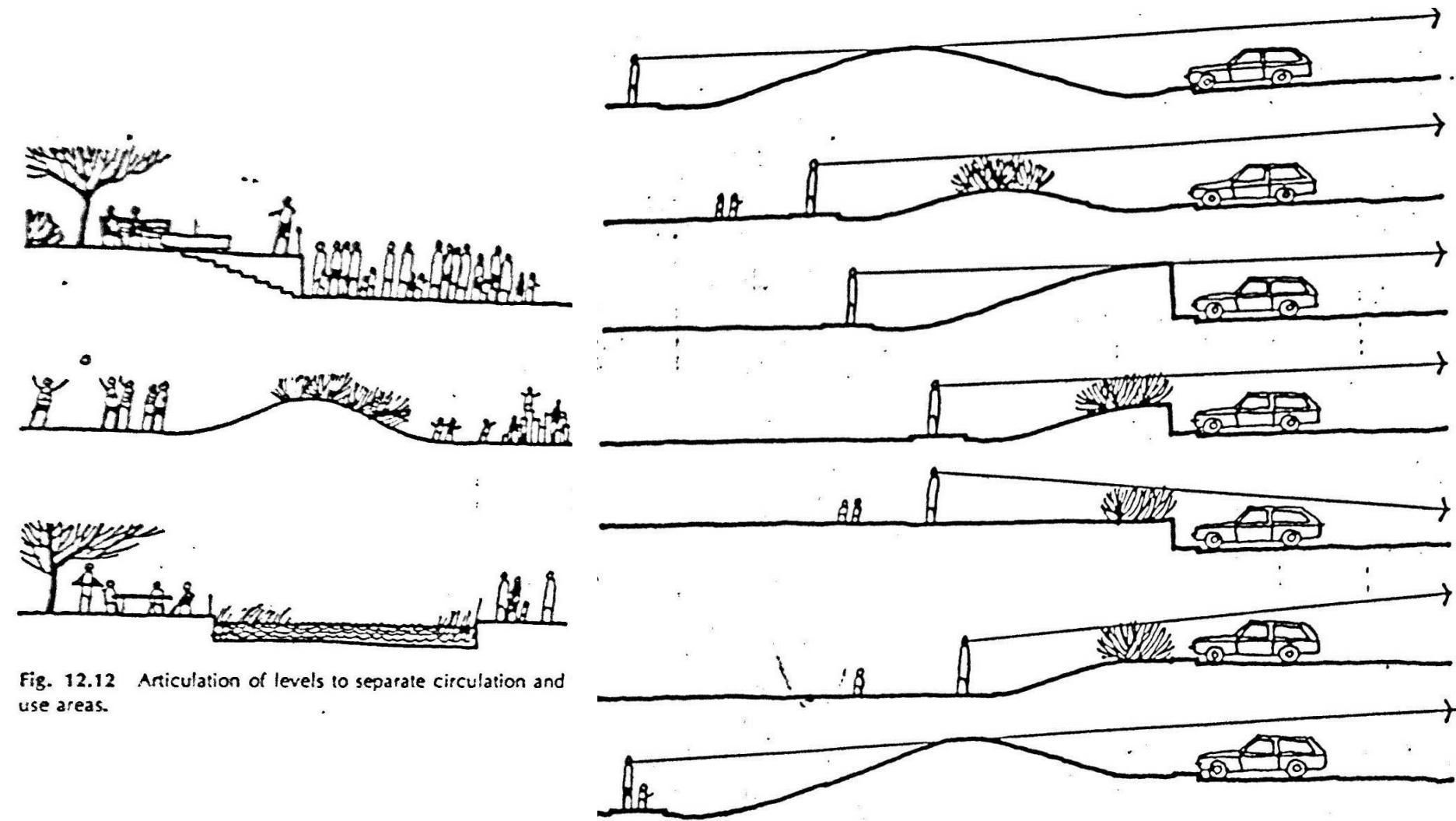


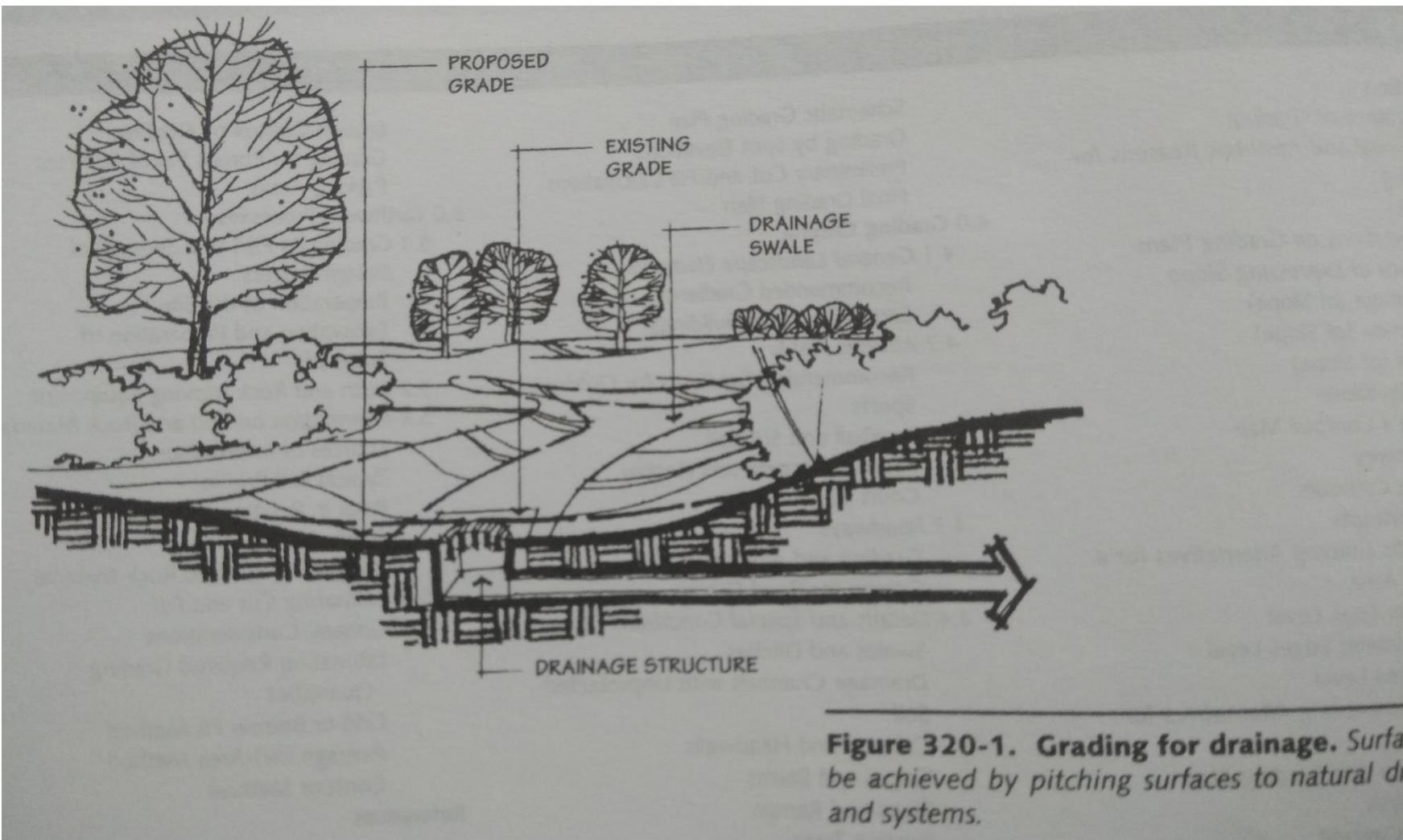
Fig. 12.12 Articulation of levels to separate circulation and use areas.

Fig. 12.11 Land form and form combined with retaining walls and/or planting, and differences in relative levels can be used in design to conceal and separate.

Relationship of the gradient with the type of use

Natural Gradients	Characteristics/ Possible Use
Less than 0.80 % (1 in 125)	<p>Do not drain well.</p> <p>Suitable for development only if land is graded to required slopes for satisfactory drainage and stormwater management.</p>
Above 0.80 % to 1 % (1 in 125 to 1 in 100)	<p>Perceived as almost flat.</p> <p>Slopes of this order have positive drainage.</p> <p>Most suitable for building development with only minor grading or earth-moving.</p> <p>Suitable for playfields, and also for extensive grass areas.</p>
Above 1 % to 3 % (1 in 100 to 1 in 33)	<p>Generally suitable for building development with moderate grading and earth-moving.</p> <p>Suitable for vehicular roads and pedestrian paths.</p> <p>With moderate grading and some retaining walls, areas in this range can also be developed for playfields.</p>
Above 3 % to 15 % (1 in 33 to 1 in 6)	<p>Not very suitable, but can be built on in hilly areas with major grading and use of retaining structures.</p> <p>Roads and paths need to be carefully aligned to take advantage of negotiable slopes.</p>
Above 15% to 25 % (1 in 6 to 1 in 4)	<p>These are relatively sharper slopes. Development in areas with these kinds of slopes would almost inevitably have major environmental impacts, especially with regard to soil retention, stormwater runoff and engineering inputs for grading and building during the process of construction.</p> <p>Slopes of this magnitude would usually not be suitable for building development, except where no other alternative exists, in remote hill areas for instance.</p>
25 % and above	<p>Steeper slopes in this range may require measures for erosion-control and soil stabilization.</p> <p>Existing slopes which are already stabilized by tree roots or scrub and wild grass are best left undisturbed, especially in arid situations with sandy soils.</p> <p>As a thumb-rule, a slope of 33 percent (1 in 3) is generally accepted as a stable angle while proposing minimum grades for most soils.</p> <p>Recommended slopes are also based on maintenance needs (cutting grass, irrigation, cleaning, etc.)</p> <p>The angle of repose of loose earth varies, but is usually in the range of 30 degrees (50 percent, or 1 in 2) or a little more or less.</p>

Landscape grading



Landscape grading

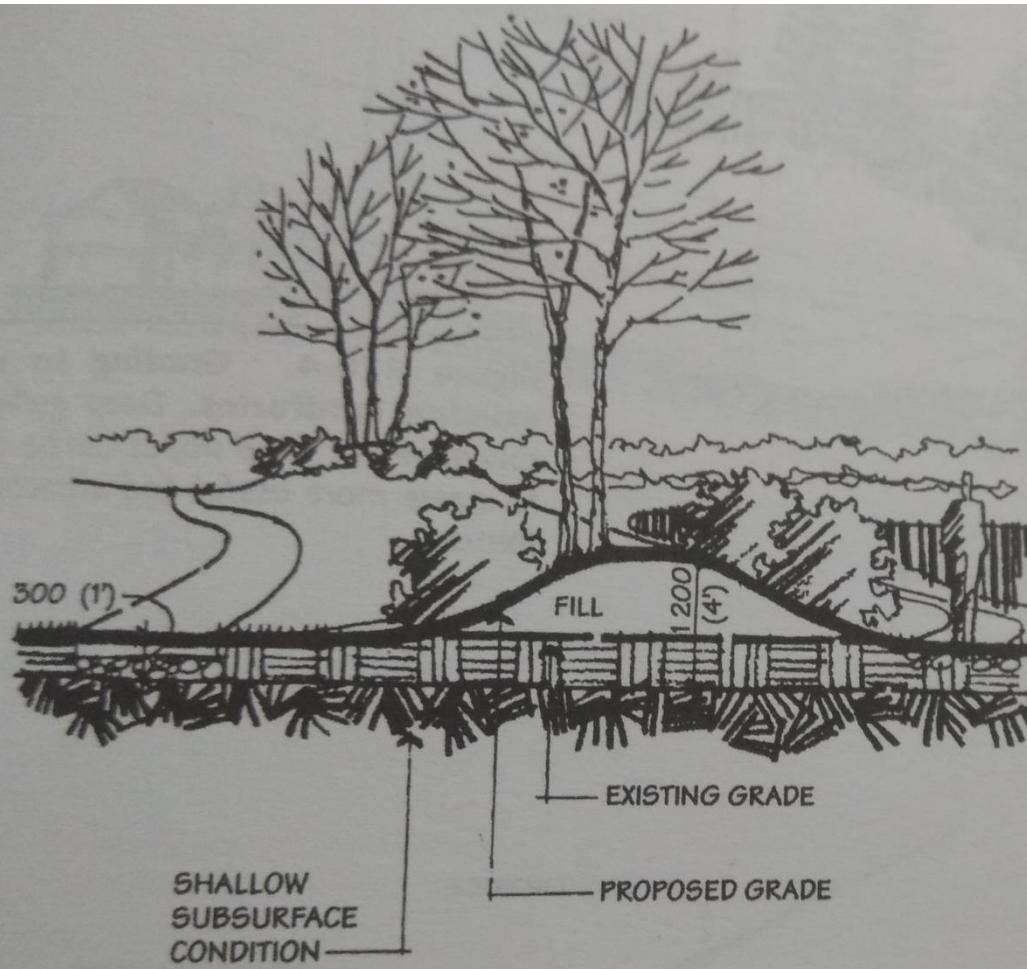
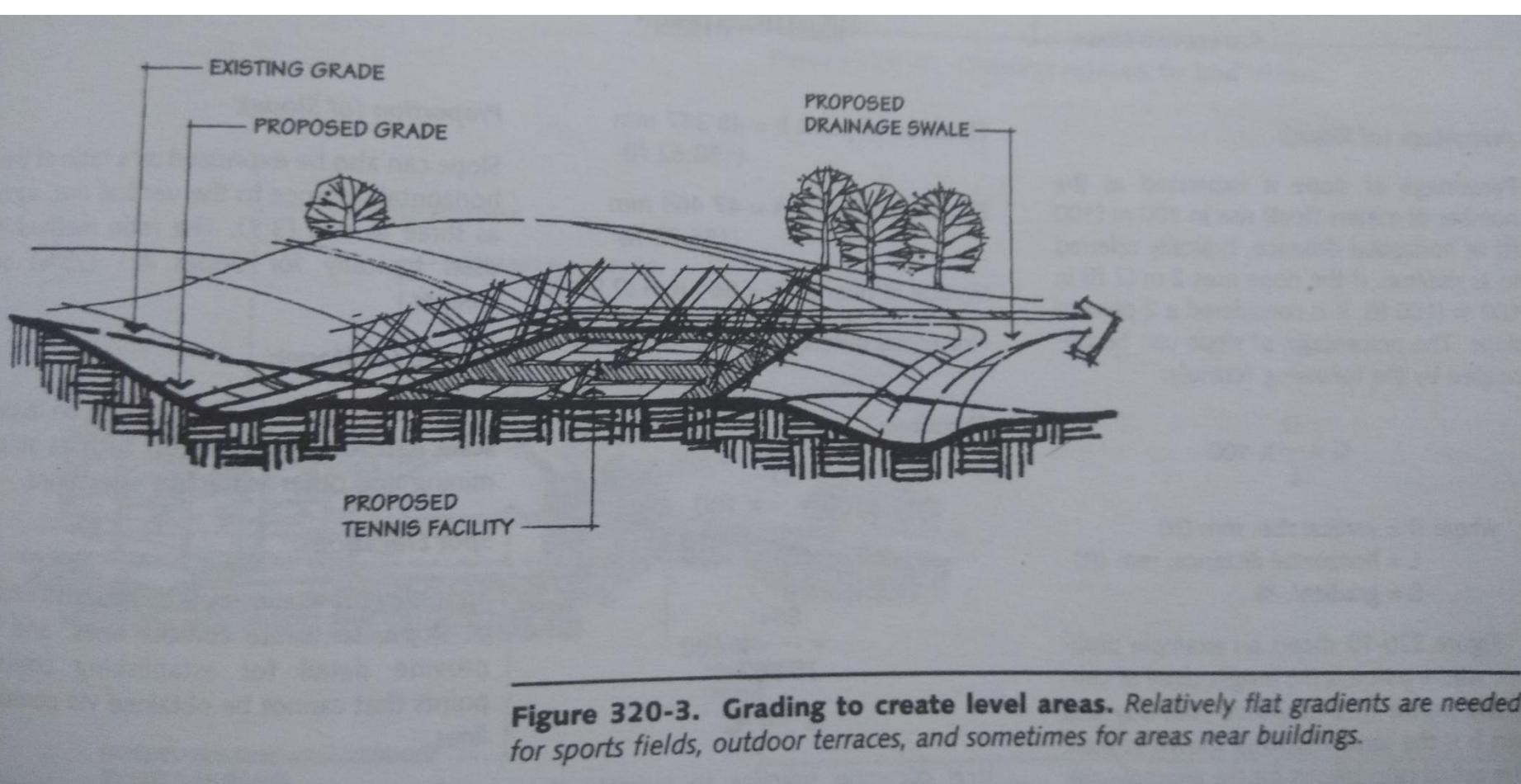


Figure 320-2. Grading to create berms. Berms can be created for noise and wind barriers or for additional soil depth above unfavorable subgrade conditions, such as a high groundwater table.

Landscape grading



Landscape grading

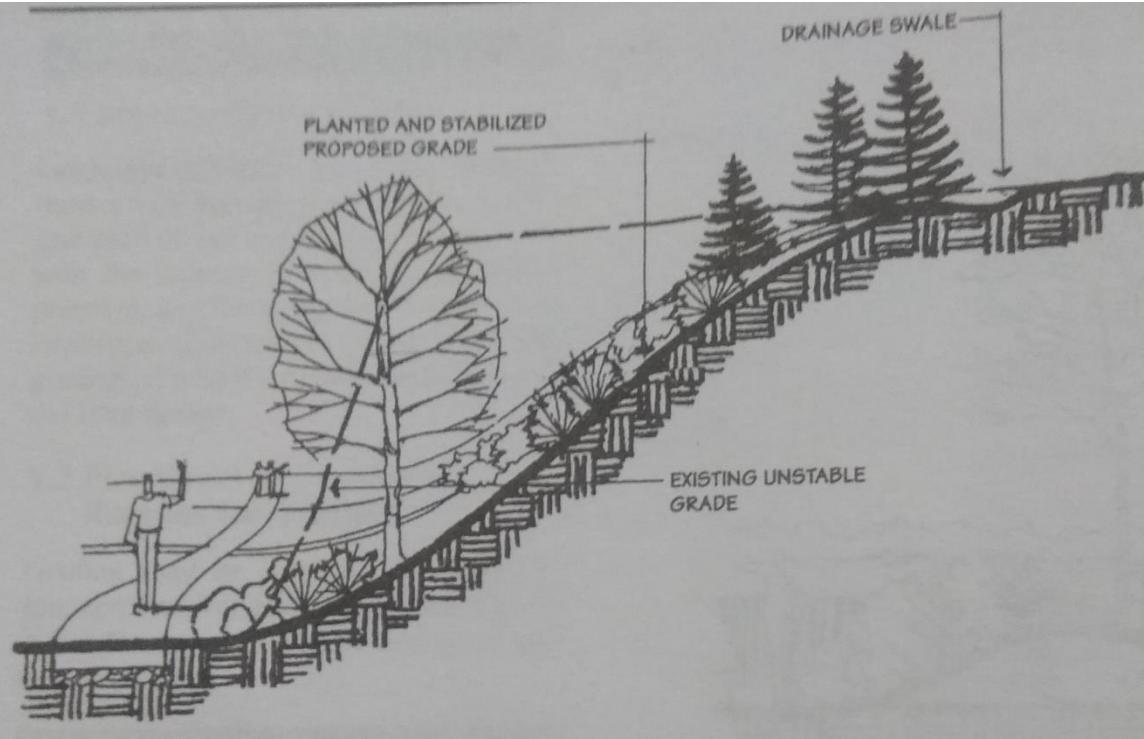


Figure 320-4. Grading to modify existing landforms. Deep gullies, narrow ridges, or steep slopes can be modified to create more useful and attractive landforms.

Landscape grading

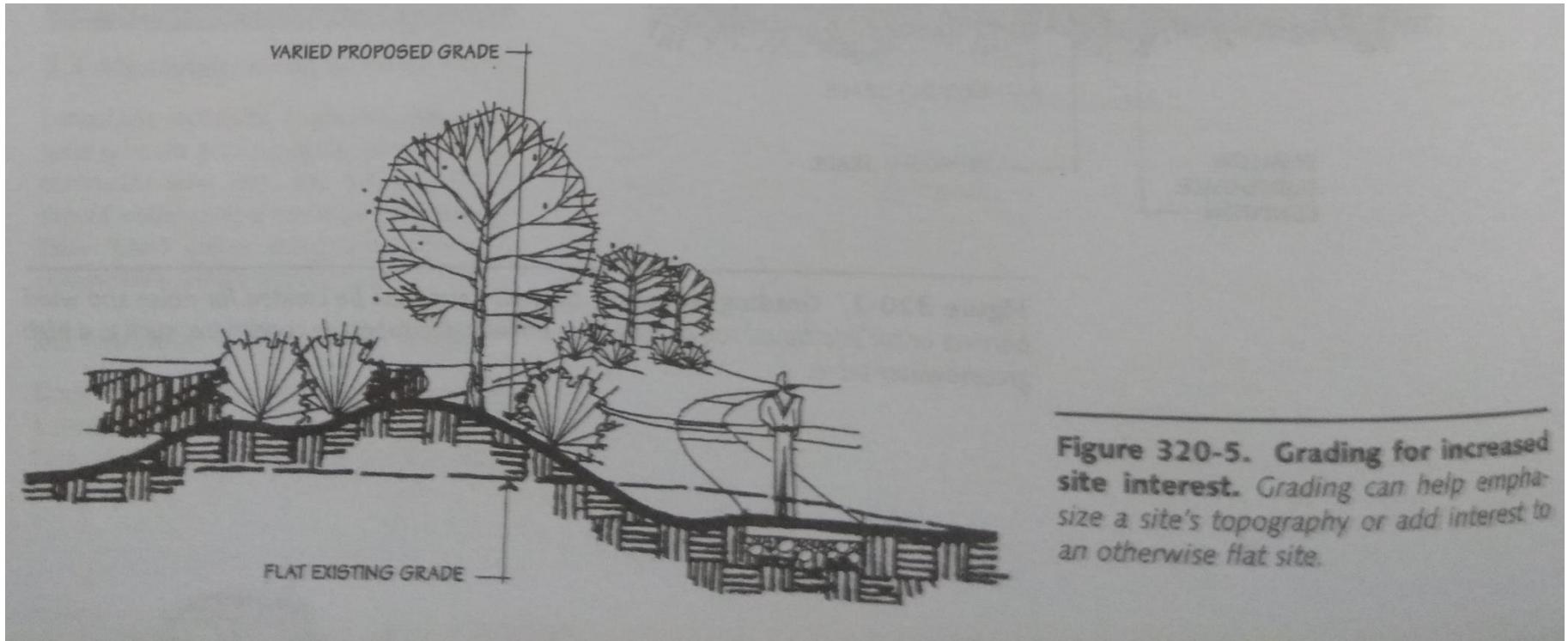
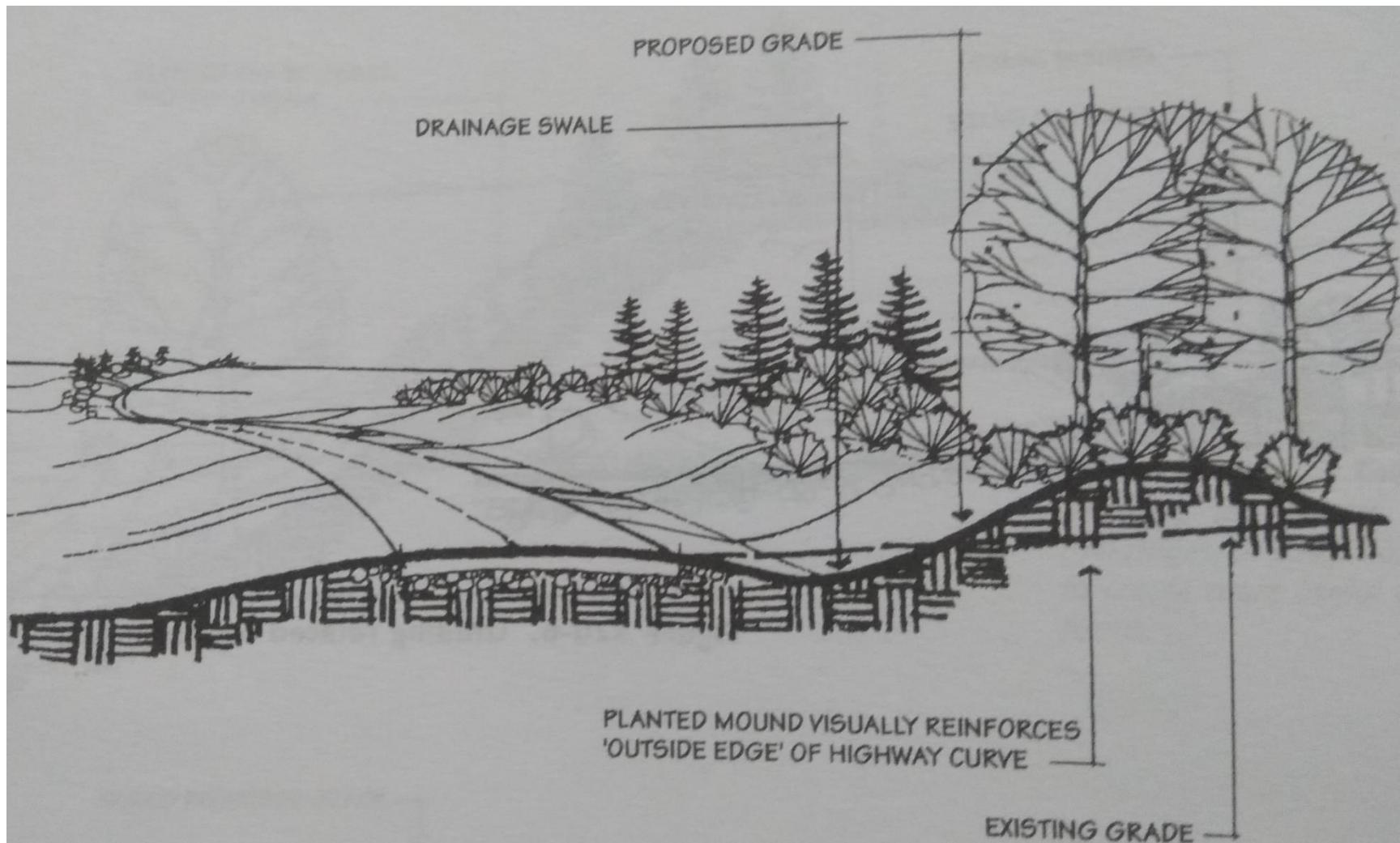


Figure 320-5. Grading for increased site interest. Grading can help emphasize a site's topography or add interest to an otherwise flat site.

Landscape grading



- Grading to emphasize or control circulation.

A surface water drain/storm drain is defined as that portion of the storm drainage system that receives runoff from inlets and conveys the runoff to some point where it is then discharge into a channel, water body or piped system. It consists of one or more pipes connecting one or more inlets.

A storm drain may be a closed conduit, open conduit, or some combination of the two.

Storm Water Inlets

- These are the openings through which the surface runoff and storm sewer is admitted and conveyed to the storm water sewer or combined sewer.
- The inlet is a box of concrete or brick masonry with the clear opening not more than 25mm.
- Maximum spacing depends on road surface, it varies between 30 to 60m.



Storm Water Inlets

nticipated (Fig. 21.1).

- Storm water inlets may be categorised into 3 types:
 - Curb inlets
 - Gutter inlets
 - Composite inlets
- Curb inlet – These are vertical openings in the road curbs through which the storm water flows.
- They are preferred where heavy traffic is anticipated.

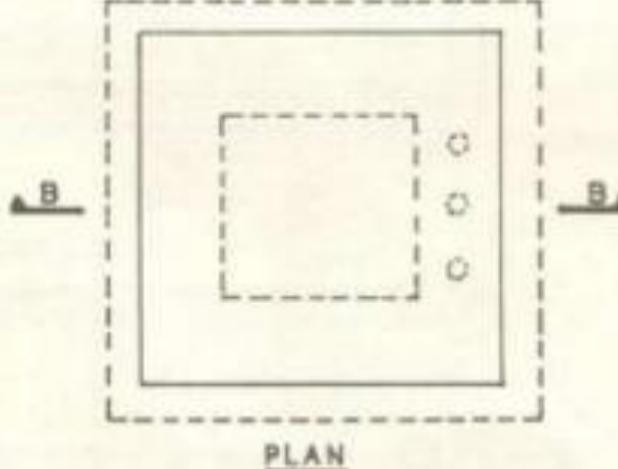
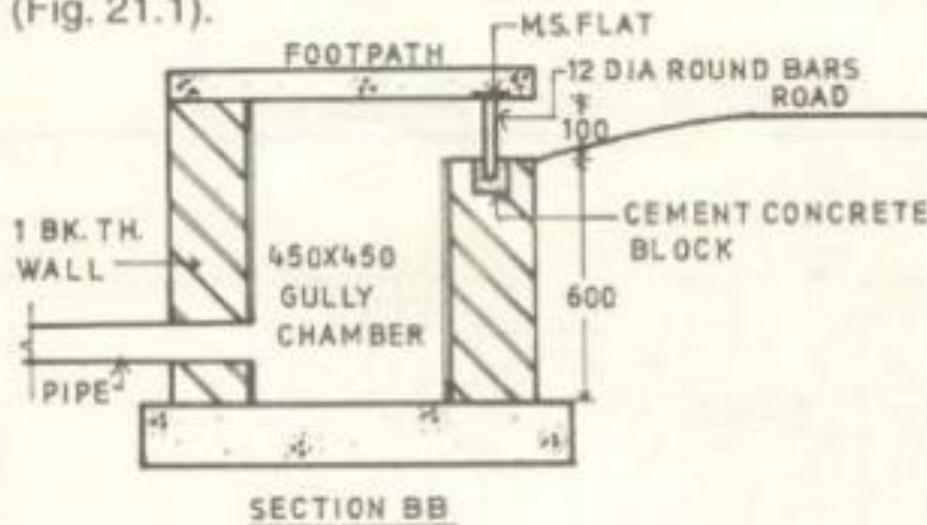
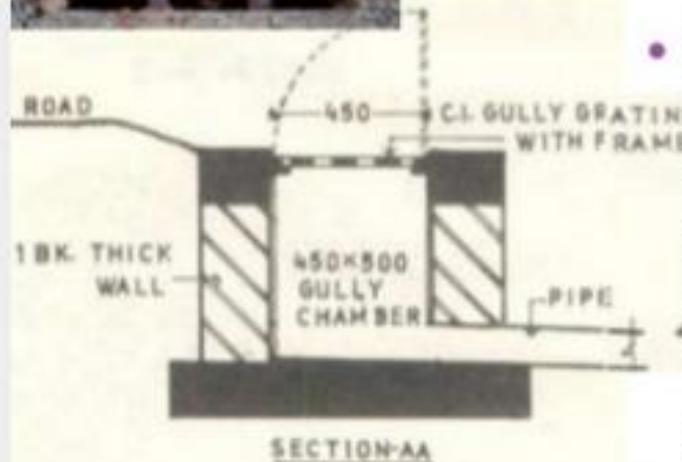


Fig. 21.1 Curb inlets for surface runoff and storm water drainage.



Storm Water Inlets

- Gutter inlet – Horizontal openings in the gutter
- Composite inlet – Combination of both curb & gutter inlet.

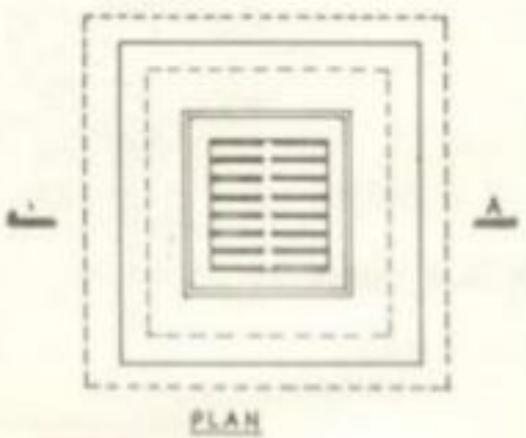
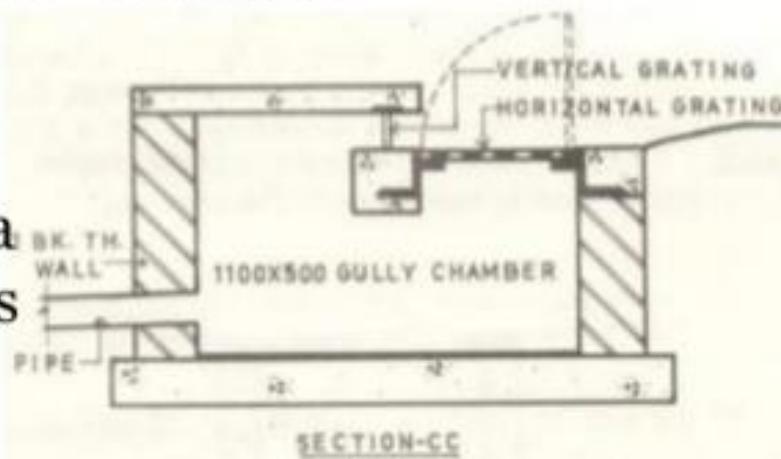


Fig. 21.2 Gutter inlet.

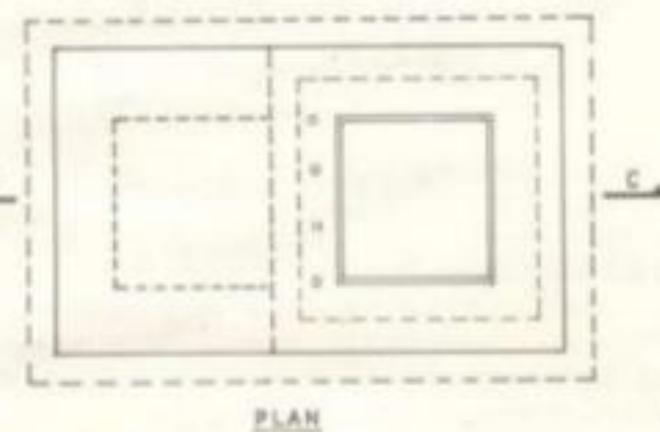
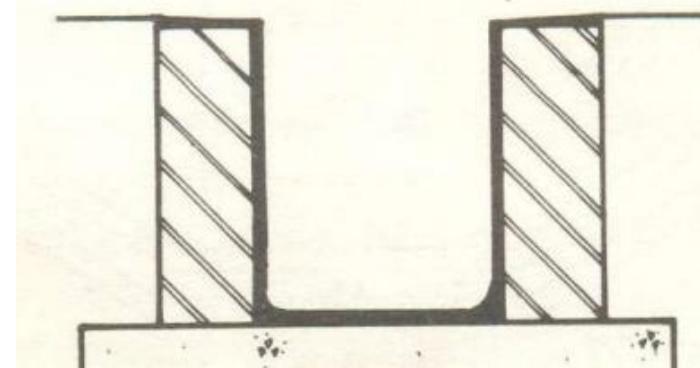
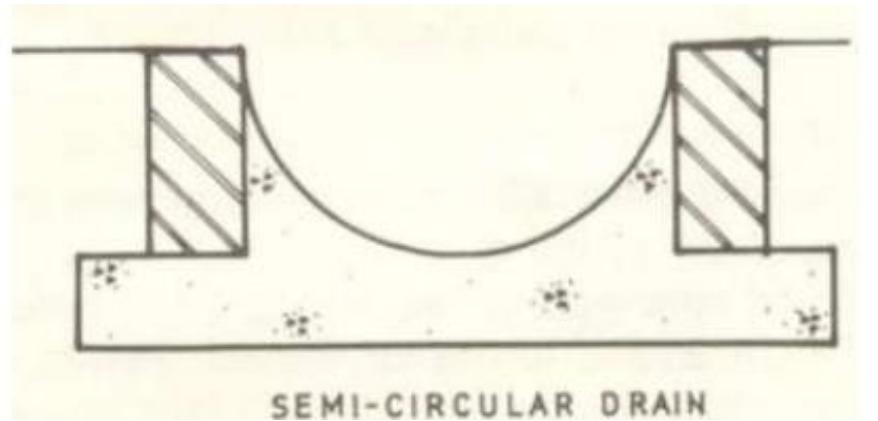
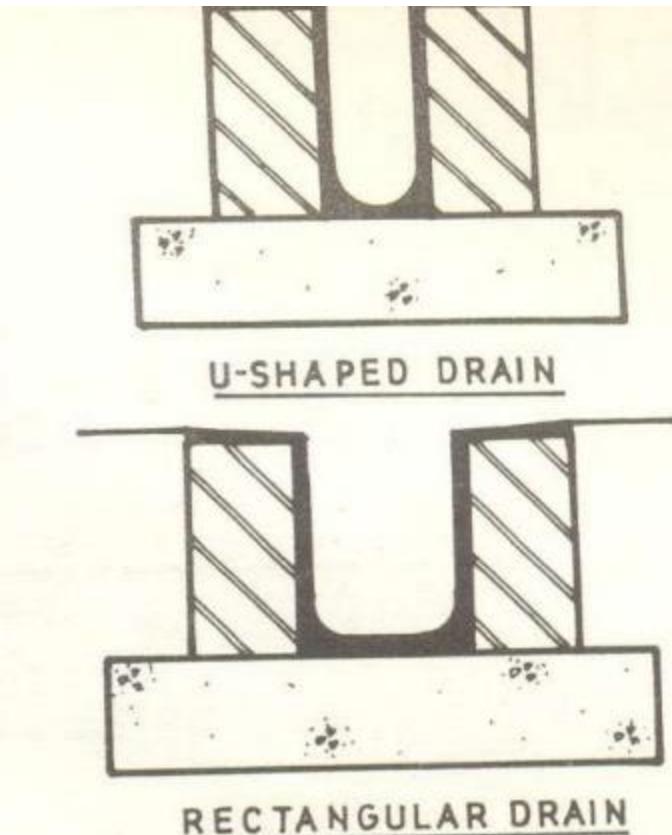
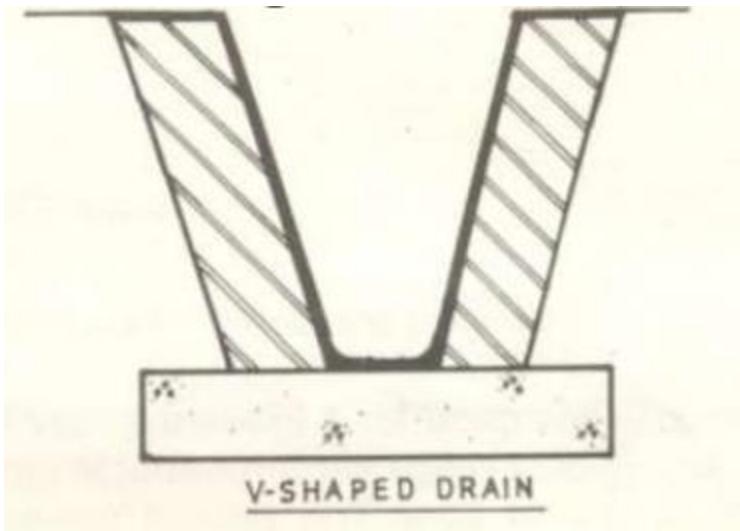


Fig. 21.3 Composite inlet.

Surface Drains

- Cheap arrangement for collecting storm water



Bioswales

Bioswales are landscape elements designed to concentrate or remove debris and pollution out of surface runoff water. They consist of a swaled drainage course with gently sloped sides (less than 6%) and filled with vegetation, compost and/ or riprap.



LANDSCAPE SERVICES

SURFACE WATER DRAINAGE SYSTEMS



Surface water drain and downpipe

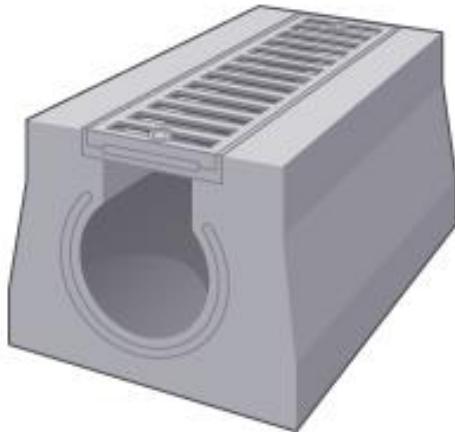


Downpipe to drain grate

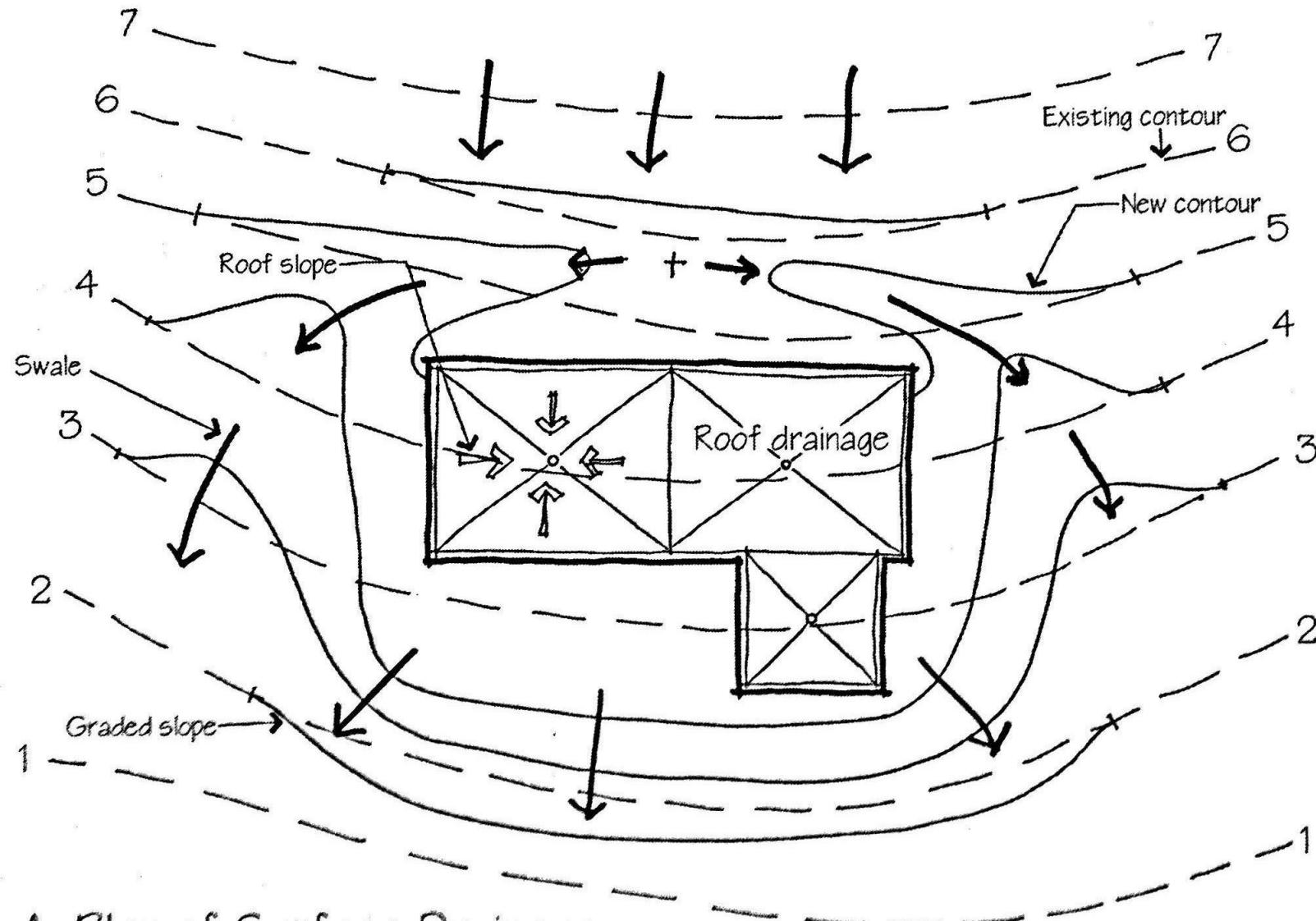


LANDSCAPE SERVICES

SURFACE WATER DRAINAGE SYSTEMS

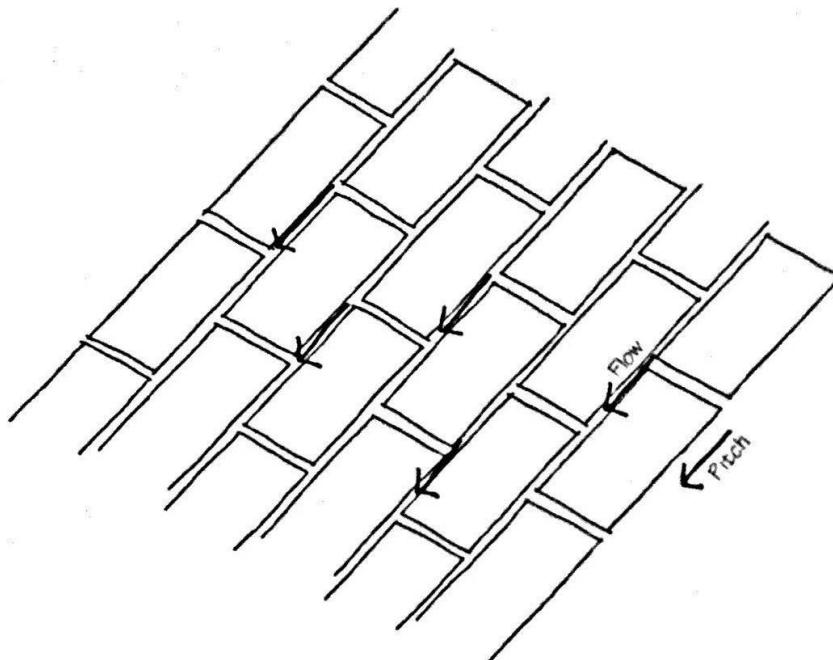


SURFACE DRAINAGE

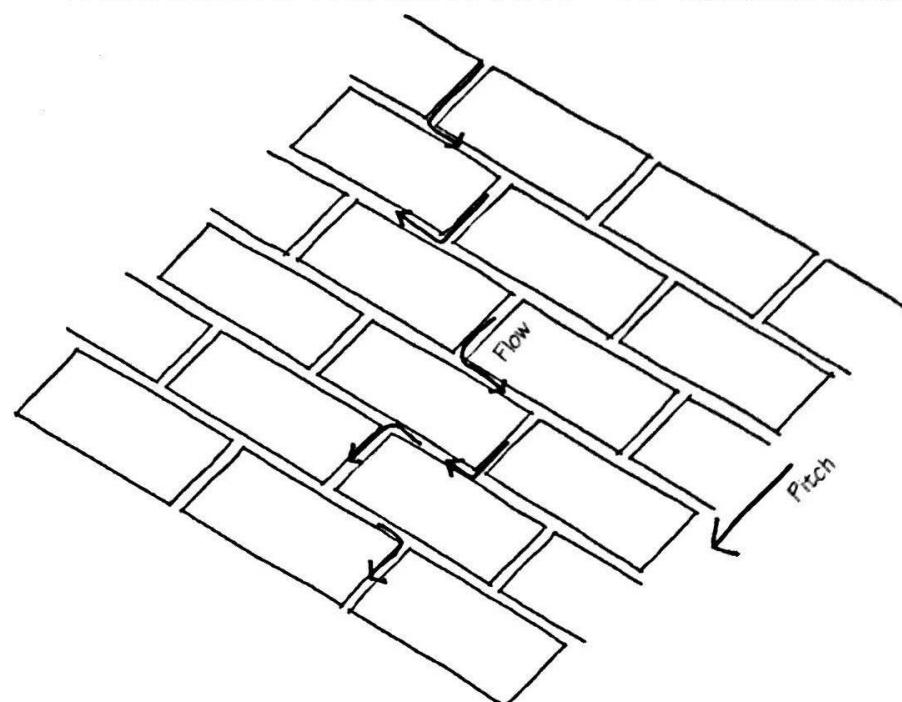


A. Plan of Surface Drainage

SURFACE DRAINAGE



Parallel Joints Facilitate Flatter Slopes



Staggered Joints Require Steeper Slopes

IV.

Preparation of landscape master plan
for a third year level design project with
hardscape and levels along with site
sections