[Gibberd, 2000:SBAT]

2.1 LOCAL ECONOMY:

The construction and management of buildings can have a major impact on the economy of an area. The economy of an area can be stimulated and sustained by buildings that make use and develop local skills and resources.

Use local contractors, building materials and supply, components and fittings to ensure efficiency of use, adaptability and flexibility, outsource opportunities and quick repairing and maintenance. It will also help to boost our local economy and training skills of contractors.

Local contractors are cheaper and if necessary can training be carried out to develop a local skill base that can be drawn of for maintenance of the building.

Maximum use of local materials will minimize cost and environmental impact of transport. Specify local technology, materials and components that can be serviced by local contractors. That will develop a local capacity to service technology. By using local people, small businesses will be supported through the design (cleaning, valet services, computer technicians, lift services, fan-services, catering etc.).

2.2 EFFICIENCY OF USE:

Buildings cost money and make use of resources whether they are used or not. Effective and efficient use of buildings supports sustainability by reducing waste and the need for additional buildings.

2.2.1 USEABLE SPACE:

Non useable space such as plant, wcs and circulation does not make up more than 20% of total area.

DEFINITION: This is the area of a floor capable of occupation. On multi-tenants floors it excludes common areas such as toilets and corridors.

Major vertical penetrations of the floor such as lift shafts and stairs are always excluded. It is of prime concern to a tenant in evaluating the size of the area offered by a landlord an in allocating the area required to accommodate personnel and furniture.

On multi-tenant floors it can vary over the life of a building as corridors expand and contract and as floors are modified.

As seen in the plan on the right, most of the area will be useable space. There will not be a lot of corridors and service occupation in the interior. The atrium space will be useable and staircases and ramps will transport the people to the next level. Most of the interior space will be flexible in terms of moveable partitions and temporary screens. The useable spaces will thus differ from time to time according to the layout of the interior atrium spaces (exhibitions).

Fig. 64 – Useable space on ground floor level of DiD Warehouse.

Building and all working/living spaces are occupied for an average equivalent of 30 hours per week.

To meet the requirements of a sustainable building and environment, there must be a high number of people/m2 floor area.

Business hours: Monday – Friday 08h00 – 18h00 (without exceptions – after hour exhibitions/functions/meetings/courses etc.)
Saturday – Sunday 08h00 – 14h00
= (10 x 5) + (2 x 6)
= 50 + 12
= 62 hours per week occupation minimum.

2.2.3 SPACE USE:

Use of space intensified through space management approach and policy such as shared workspaces i.e. 'hot-desking'.

The layouts of the partitions inside the building will be very flexible. Even the shops can subdivide or enlarge their space to suit a specific need. The atriums can be subdivided into a lot of smaller parts or can be use as one big atrium. All of the temporary spaces will have shared possibilities and flexible qualities to adapt change and provide innovation for the future.

A proportion figure of spaces inside the building will look more or less like this:

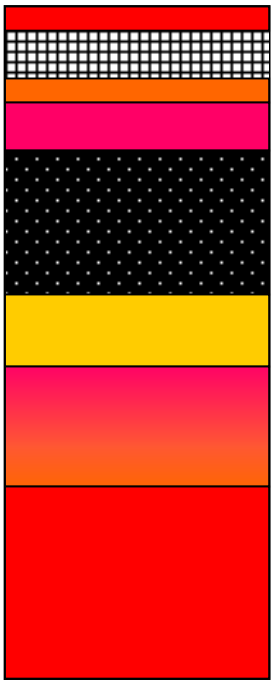


Fig. 65 – A proportion figure of the space occupation in DiD furniture warehouse.

Provide maximum productive space and limit space occupied by services, technology and other equipment. Use more compact technology and ensure that valuables take up large amounts of space.

2.2.4 USE OF TECHNOLOGY:

Communications and information technologies used to reduce space requirements i.e. videoconference, teleworking etc.

The following technology will be used:

- computers - internet, security, ventilation/heating, fire
- video facilities – for meetings, courses etc.
- cameras – security
- e-mail – allow people to shop from home
- computer controlled louver panels

MOST BUILDINGS CAN HAVE A LIFE SPAN OF AT LEAST 50 YEARS. IT IS LIKELY THAT WITHIN THIS TIME THE USE OF THE BUILDING WILL CHANGE, OR THAT THE FEASABILITY OF THIS WILL BE INVESTIGATED. BUILDINGS, WHICH CAN ACCOMMODATE CHANGE EASILY SUPPORT SUSTAINABILITY BY REDUCING THE REQUIREMENT FOR CHANGE (ENERGY, COSTS ETC.) AND THE NEED FOR NEW BUILDINGS. MOST BUILDINGS CAN HAVE A LIFE SPAN OF AT LEAST 50 YEARS. IT IS LIKELY THAT WITHIN THIS TIME THE USE OF THE BUILDING WILL CHANGE, OR THAT THE FEASABILITY OF THIS WILL BE INVESTIGATED. BUILDINGS, WHICH CAN ACCOMMODATE CHANGE EASILY SUPPORT SUSTAINABILITY BY REDUCING THE REQUIREMENT FOR CHANGE (ENERGY, COSTS ETC.) AND THE NEED FOR NEW BUILDINGS. MOST BUILDINGS CAN HAVE A LIFE SPAN OF AT LEAST 50 YEARS. IT IS LIKELY THAT WITHIN THIS TIME THE USE OF THE BUILDING WILL CHANGE, OR THAT THE FEASABILITY OF THIS WILL BE INVESTIGATED. BUILDINGS, WHICH CAN ACCOMMODATE CHANGE EASILY SUPPORT SUSTAINABILITY BY REDUCING THE REQUIREMENT FOR CHANGE (ENERGY, COSTS

[Gibberd, 2000:SBAT]

2.3 ADAPTABILITY AND FLEXIBILTY:

Most buildings can have a life span of at least 50 years. It is likely that within this time the use of the building will change, or that the feasibility of this will be investigated. Buildings, which can accommodate change easily support sustainability by reducing the requirement for change (energy, costs etc.) and the need for new buildings.

2.3.1 VERTICAL DIMENSION:

Structural dimension (floor to underside of roof, or slab of the floor above) minimum of 3m.

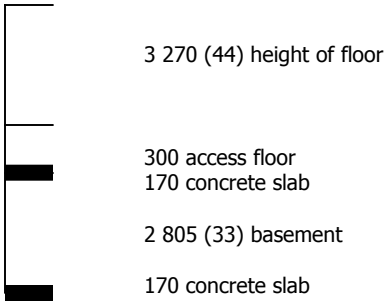


Fig. 66 - The floor to ceiling heights of DiD furniture warehouse – in section.

Floor to ceiling heights are most of the time too low. A higher floor to ceiling height will ensure flexibility in future and will enable the building to accommodate change

- short term (daily)
- long term (life of the building)

Access flooring have a lot of advantages and computer cables, heating/cooling systems etc. will be installed in the raised floor.

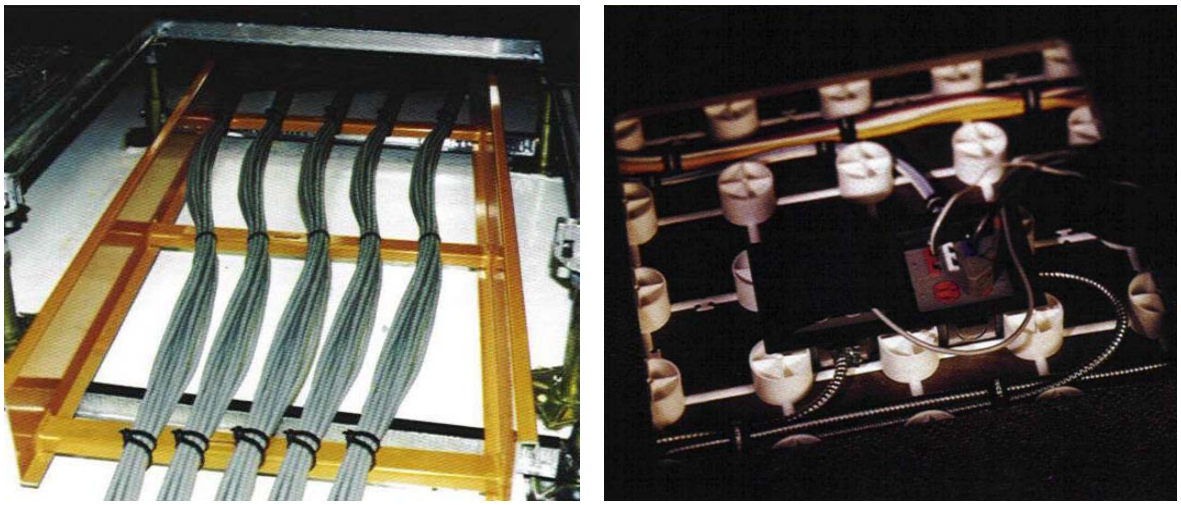


Fig. 67 – Cablefloor has a much lower height requirement (68mm). There are many different cabling systems available in South Africa.

DEFINITION OF AN ACCESS FLOOR:
A raised access floor is a floor consisting of loadbearing, removable floor and that provides panels supported by pedestals and, where installed on a structural subfloor, and underfloor space for the accommodation and distribution of services and provides access to facilitate the relocation. [Hope, 2002:17]

- panel size – 600 x 600mm (18mm thick)
- panel connections – stringerless panels (decrease panel reveberation)
- outlets – flush, concealed or surface-mounted
- accessories – panel lifters, cut-outs and perforated panels
- installation – panels must be precise and dimensionally exact
- fire protection – insure that values for smoke development, heat transfer, and flame spread are sufficient
- electrical performers – static control accomplished by maintaining high relative humidity and using finish materials
- panel finish – carpet, resilient tile, or high pressure plastic laminate

2.3.2 INTERNAL PARTITIONS:

Internal partitions between living/work spaces are non-load bearing (i.e. non-load bearing brick/block or plasterboard partitions) and can be 'knocked-out' relative easily.

As previously mentioned, exhibition spaces and shop spaces will be constructed of temporary internal partitions to accommodate change. A flexible layout is essential to ensure flexibility of spaces. Each exhibition will require different requirements and sizes. The walls will be non-load bearing so that you can the partitions. The internal partitions will be of glass (shopfronts – views towards exhibitions and other spaces) and of thick gypsum board (painted) in the atrium spaces (for exhibition purposes).

A typical gypsum internal drywall construction will look like this:

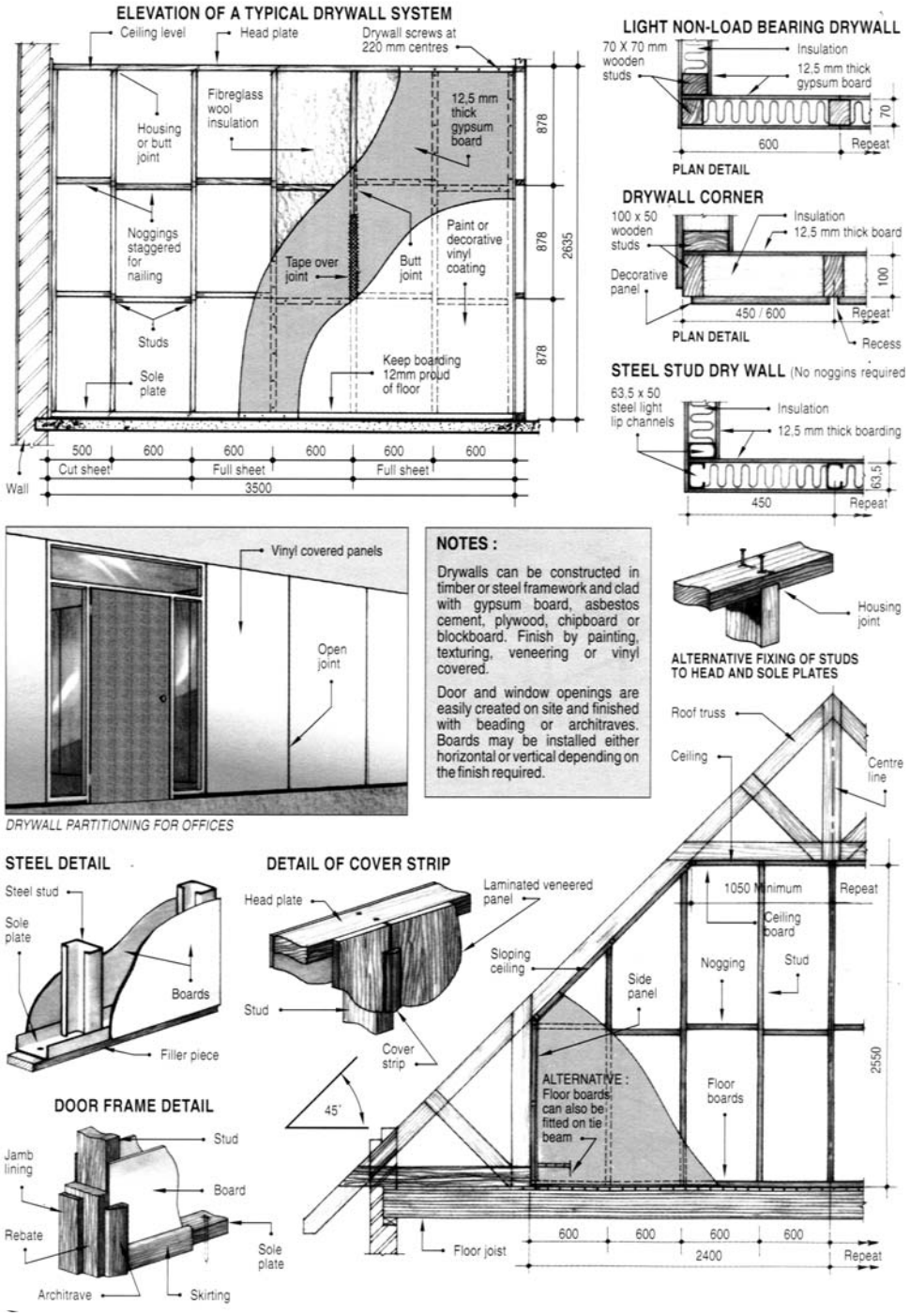
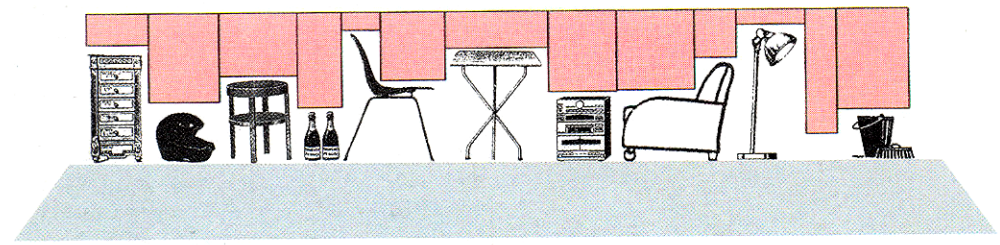
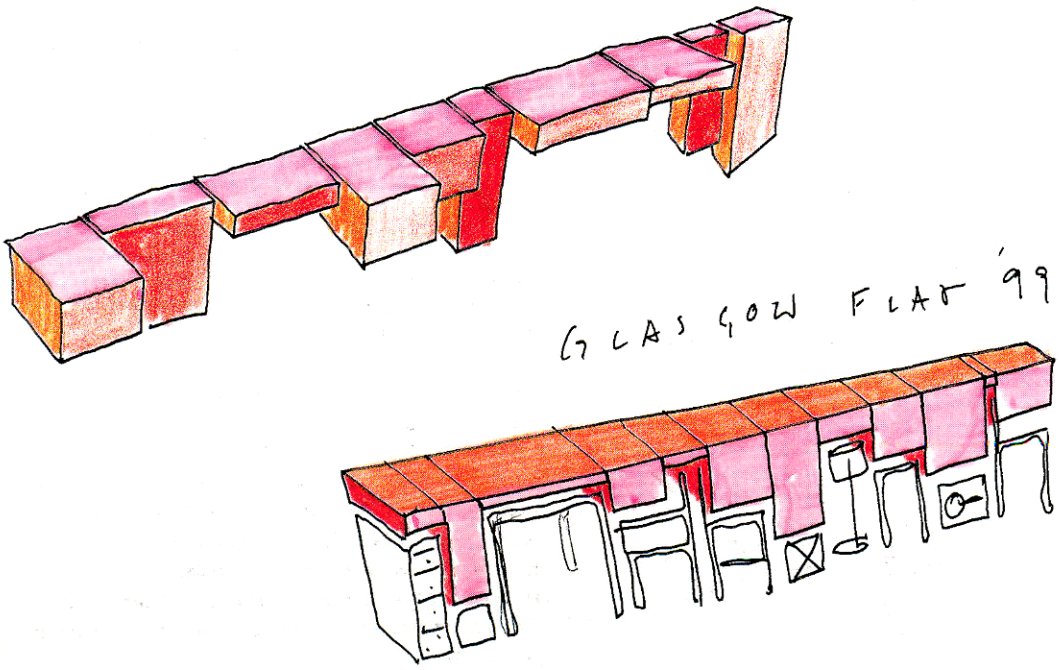


Fig. 68 – A typical drywall construction.





[Domus No 819-820, 1999:44]

Fig. 69 : Not included

Fig. 69 – Movitec Design PTY (Ltd), a local company, will manufacture and install the glass partitions that needs to be provided. The partition range is fully sound proof and fire rated Class 1.

SPECIFICATION AND MATERIAL SPEC. FOR LOW MAINTENANCE AND OR LOW COST MAINTENANCE. ALL PLANT AND FABRIC HAVE A MAINTENANCE CYCLE OF AT LEAST TWO YEARS. LOW OR NO MAINTENANCE COMPONENTS (I.E. WINDOWS, DOORS, PLANT, IRONMONGERY ETC.) TO BE SELECTED. MAINTENANCE CA RIED OUT COST EFFECTIVELY ITEMS SUCH AS LIGHT BU EACHED AND REPLACED EXPENSIVE EQUIPMEN MATERIAL SPECIFICAT NANCE AND OR LOW CO PLANT AND FABRIC HAVE CYCLE OF AT LEAST TWO YEA LOW OR NO MAINTENANCE COMPONENTS (I.E. WINDOWS, DOORS, PLANT, IRONMONGERY ETC.) SELECTED. MAINTENANCE CAN BE CARRIED OUT COST EFFECTIVELY (I.E. REPLACEABLE ITEMS SUCH AS LIGHT BULBS CAN BE EASILY REACHED AND REPLACED WITHOUT USE OF EXPENSIVE EQUIPMENT). SPECIFICATION AND MATERIAL SPECIFICATION FOR LOW MAINTENANCE AND OR LOW COST MAINTENANCE CYCLE OF AT LEAST TWO YEAR

ongoing Costs

[Gibberd, 2000:SBAT]

2.4 ONGOING COSTS:

2.4.1 MAINTENANCE:

Specification and material specification for low maintenance and or low cost maintenance. All plant and fabric have a maintenance cycle of at least two years. Low or no maintenance components (i.e. windows, doors, plant, ironmongery etc.) selected. Maintenance can be carried out cost effectively (i.e. replaceable items such as light bulbs can be easily reached and replaced without use of expensive equipment).

Maintenance will be minimized by good detailed design in terms of roof overhangs and exposed material specifications. Weather will play a tremendous role in hard wearing of materials and it is important to design to minimize the direct impact of the weather elements on materials.

The annual maintenance of buildings may cost 1 – 4% of its original erection cost, depending on design. Assuming a conservation average life cycle of 50 years for a building, the maintenance cost spend during the life of the building will be twice the original cost. It is for this reason, very important to choose materials that require low maintenance and have a relative long life span (see materials section).

Solar passive design will minimize maintenance cost since there will be no moving parts and there will be direct financial benefits for energy saving. The building will save energy cost for not using airconditioners and water consumption will benefit from the watertanks and roof catchment system.

[Holm, 1996:84,85]

The basic strategy for choice of sustainable building materials will consist of:

- prevention of unnecessary use and efficient use of materials
- use of renewable and recycled sources
- selection of materials with the least environmental impact

The environmental impact of materials is caused during the complete lifetime. Typical environmental issues are:

[Anink, Boonstra, Mak, 1995:10]

- raw materials, embodied energy, emissions, hindrance, waste, recycling, repair and lifetime. It is important to select those building products which have the lowest environmental impact and long lifespan.

Stainless steel balustrades and fittings are durable and will not need much maintenance. Make use of natural materials, for example brick and stone (without paint) – it will ensure much longer lifespans.

An energy audit can be executed with various levels of accuracy:

- a visual inspection and estimation of approximate maintenance and operation costs
- quantified energy uses and losses by tests and measurements
- complete analysis for each energy function within a building with modeling and pattern predictions

[Holm, 1996:892]

FROM AN ENERGY EFFICIENCY POINT OF VIEW IT PAYS TO INVEST INITIALLY IN ORDER TO SAVE IN THE LONG RUN.

2.4.2 CLEANING:

Measures taken to limit requirement for cleaning. Hard wearing solid flooring (limited or no carpeting) specified. Windows easily accessible for cleaning.

2.4.3 SECURITY/CARE TAKING:

Measures taken to limit requirement and costs of security. This should include mixed-use development (area is always occupied), buildings and spaces overlooked by occupied neighbouring buildings.

2.4.4 INSURANCE/WATER/ENERGY/SEWERAGE:

Costs of insurance, water, energy and sewerage monitored. Consumption and costs regularly reported to management and users. Policy and management to reduce consumption (i.e. switching off lights on leaving building spaces implemented.

2.4.5 DISRUPTION AND 'DOWNTIME':

Electrical and communication services, HVAC and plant located where they can be easily accessed with a minimum of disruption to occupants of building. This should maximizing access to this from circulation areas and lift off panels at regular intervals to vertical and horizontal ducting.

Provide visible meters in the building so that people can monitor their consumption (1 meter per floor).

- the meter must be highly visible (daily/monthly)
- reports for building users each month – encourage them to save
- linking to computer – to build up a long term picture

Lifetime maintenance-plan for the building components:

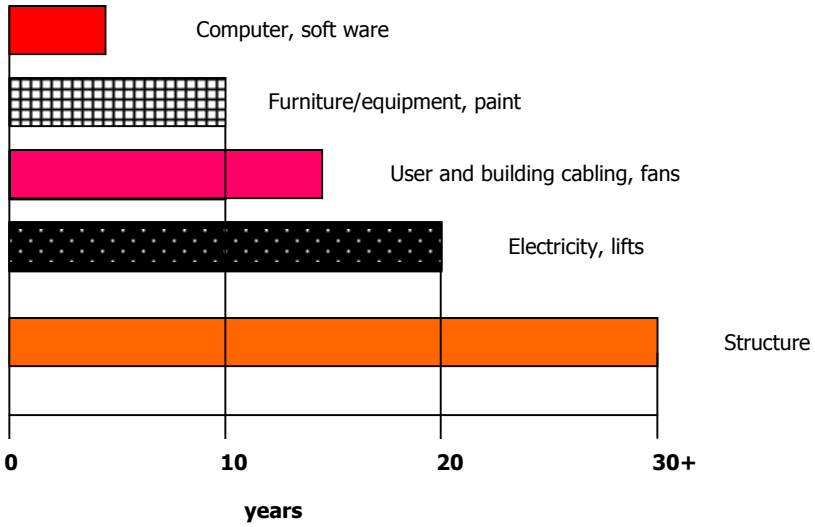


Fig. 70 – Lifetime maintenance-plan for the building components.

2.5 CAPITAL COSTS:

Buildings are generally one of the most valuable assets that people, and often organizations and governments own. Money spent on buildings is not available for other uses such as health and education. Often in addition, the high cost of buildings results in the services (i.e. health and education) and the accommodation (for work and living) is beyond the reach of people with the lowest incomes. Buildings that are cost effective support sustainability by helping provide access to accommodation and services for low-income areas and by enabling money to be spent on other areas that support sustainability.

PROPORTIONS OF COST SPEND:
Capital cost of buildings can be categorized under the following headings:

- services
- HVAC
- electrical
- plumbing

PLATE RATIO:
Ratio of floor space to external wall surface area. Should not exceed 0,4 for an cost efficient building. The ease of construction (shape of building as well) will have an influence on the capital cost. Use prefabricated structures where possible to reduce energy consumption and labour-hours on site. [Gibberd, 2000:SBAT]

WATER IS REQUIRED FOR MANY ACTIVITIES. HOWEVER THE LARGE-SCALE PROVISION OF CONVENTIONAL WATER SUPPLY HAS MANY ENVIRONMENTAL IMPLICATIONS. WATER NEEDS TO BE STORED (SOMETIMES TAKING UP LARGE AREAS OF VALUABLE LAND AND DISTURBING NATURAL DRAINAGE PATTERNS WITH ASSOCIATED PROBLEMS FROM EROSION ETC.); IT ALSO NEEDS TO BE PUMPED (USING ENERGY) THROUGH A NETWORK OF PIPES (THAT NEED TO BE MAINTAINED AND REPAIRED) TO THE USER. THE WATER, A PARALLEL NETWORK IS REQUIRED TO DISPOSE OF THE WATER ONCE USED, I.E. SEWERAGE SYSTEMS. REDUCING WATER CONSUMPTION SUPPORTS SUSTAINABILITY BY REDUCING THE ENVIRONMENTAL IMPACT REQUIRED TO DELIVER WATER, AND DISPOSE OF THIS AFTER USE IN A CONVENTIONAL SYSTEM. WATER IS REQUIRED FOR MANY ACTIVITIES. HOWEVER THE LARGE SCALE PROVISION OF CONVENTIONAL WATER SUPPLY HAS MANY ENVIRONMENTAL IMPLICATIONS. WATER NEEDS TO BE STORED (SOMETIMES TAKING UP LARGE AREAS OF VALUABLE LAND AND DISTURBING NATURAL DRAINAGE PATTER

[Gibberd, 2000:SBAT]

3.1 WATER:

Water is required for many activities. However the large-scale provision of conventional water supply has many environmental implications. Water needs to be stored; it also needs to be pumped through a large network of pipes. Having delivered the water, a parallel efforts is then required to dispose of this after it is used, i.e. sewerage systems. Reducing water consumption supports sustainability by reducing the environmental impact required to delivered water, and disposing of this after use in a conventional system. [Gibberd, 2000:SBAT]

Johannesburg have an average monthly rainfall of 59,50mm.

The highveld-climatic region (Johannesburg) have a rainfall of 650 – 900mm per year.
[Holm, 1996:64]

Building type	Cold water storage (24 hours supply) litre/person	Hot water storage (at 65 degrees Celsius) litre/person
Restaurants	7	3*
Offices: With canteen Without canteen	 45 35	 5 5

* Restaurants vary between 450 litre storage for 50 meals per day, to 1 100 litres for 400 meals per day, and to 3 400 for 1500 meals per day.
Fig. 71 – Water storage in various building types.

Distribution	Minimum or temporary	Normal	With wastage allowance
Standpipe for up to 100 persons	20	40	60
Single tap connection	120	160	180
Multiple tap connection	160	200	240
Multiple tap connection in areas of water shortage	100	150	-

Fig. 72 – Daily domestic water supply standards (litres per capita).

STORMWATER DRAINAGE (For Administrative Region 7): [LIDP, 2002:27]
In the fully developed part of the region the main stormwater conduits appear generally to be of ample capacity to handle presently recurring flows. The topography of the area is such that all stormwater runoff disperses quickly into established watercourses, which have sufficient capacity to handle the run-off water, i.e. the entire region is well drained and offers good drainage for any potential development. Thus bulk stormwater poses no major restraint to development, other than in or in close proximity to such water courses (normally determined by 1:50 year return storm floodplain) such as informal settlements in Alexandra.

WATER (For Administrative Region 7): [LIDP, 2002:27]
The area is fully serviced with water and sanitation. However, certain low-density areas could be redeveloped at higher densities – this could result in the need to upgrade services at the intermediate level (i.e. sub-outfall sewers and/or water reservoirs).

The existing water networks in the Johannesburg and Sandton portions of the former Eastern Metropolitan Local Council are comprehensive and in general in a good condition. Due to the age of certain portions of the networks, it is necessary that upgrading and refurbishing of the networks be carried out on a regular basis.

Supply zone	Reservoir	Capacity Ml	Spare capacity	Equivalent dwellings Low income	Equivalent dwellings Upper income
District 1: Dunkeld	 Dunkeld	 13,6	 62,9	 59 860	 16 760
Parktown 1&2	Parktown 1	22,7	62,9	59 860	16 760
Klipfontein	Linksfield	33	62,9	59 860	16 760
Linbro Park	Linbro Park	12	5,8	5 570	4 920
Marlboro	Marlboro	38,7	0	0	0

Fig. 73 – Reservoir supply zones serving Region 7 and estimated spare capacity.

3.1.1 RAINWATER

Rainwater from 80% of roof surface is harvested, stored and used.

Area of the roof = 2 060m2
(Say 1 900m2 – provide for corners etc.)

Area 1 900m2 x 0,65m rainfall = 1 235m3
(0,9 effect.)
= 1 111,5m3 per year
= 92,6 m3 per month

9 000 litre tanks will be used
= 9 000 x 10
= 90 000 litres

Thus, 10 tanks (9 000 litres) will be necessary.

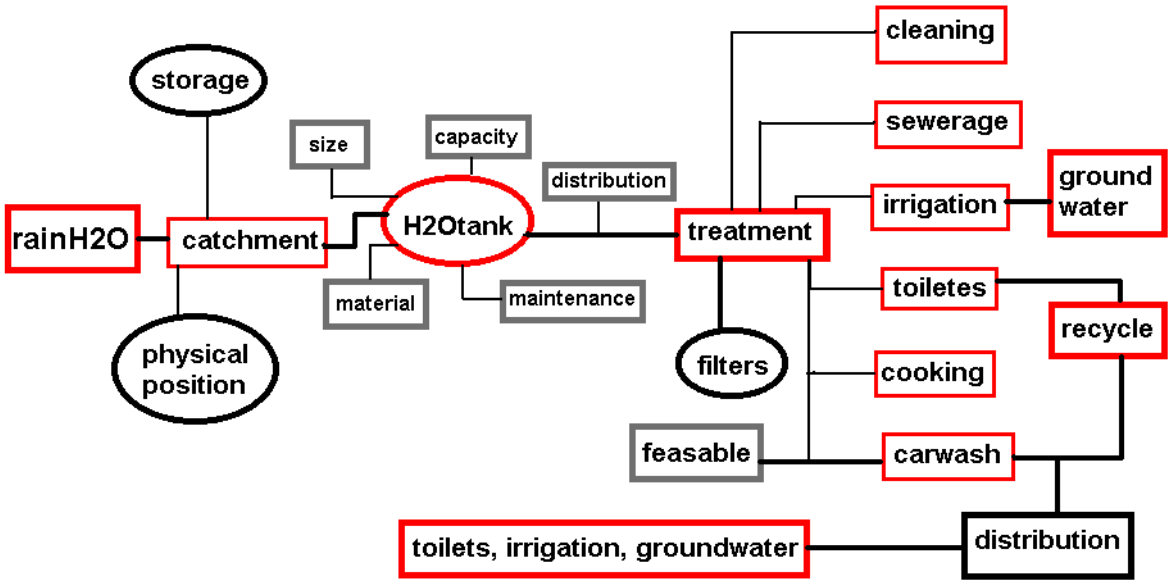


Fig. 74 – Diagrammatic representation of the rainwater catchment and distribution of Did warehouse.

AVERAGE HOT WATER CONSUMPTION:

- handbasin 5 litre
- kitchen sink (per wash-up) 6 litre
- dishwasher 14 litre

(Turning the geyser thermostat down to 65 degrees Celsius will instantly lower energy and costs).

WATER CONSUMPTION:
INDOOR:

- restaurant – drinking (4 persons = 1 litre per day)
  350 = 88 litre per day
  - cooking 1000 litre per day
  - dishes 800 litre per day

- toilets – wcs
  (1 toilet flush = 10 litre)
  60 times per hour
  60 x 8 = 480 times per day
  480 x 10 = 4 800 litre per day
  - whbs, urinals = 1 600 litre per day

- spray pipes

TOTAL:
= 88 litre + 1 000 litre + 800 litre + 4 800 litre + 1 600 litre
= 8 288 litre per day
= more or less 248 640 litre per month.

OUTDOOR:

- landscaping – irrigation (30 litre x 60 = 1 800 litre/hour) – once a day
- other (flower boxes etc.)
- hose pipe = 30 litre per minute
- a dripping tap = 6-12 kl per month

TOTAL:
= 1 800 litre per day

Thus, more or less, one third of the required amount of water will be used from the tanks per month.

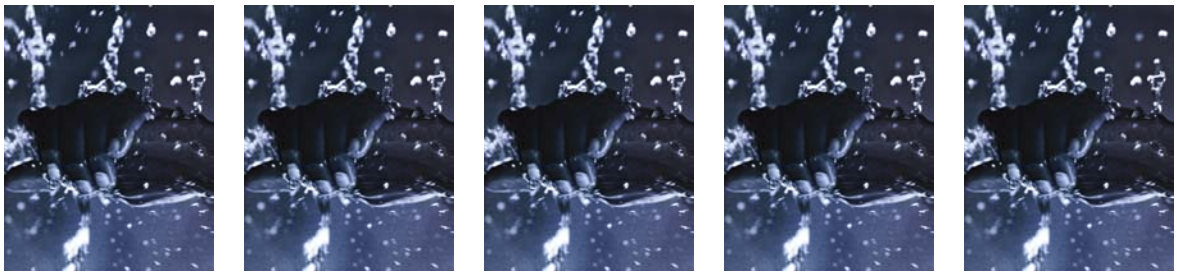
Fig. 75 : Not included

Fig. 75 – Diagrammatic layouts – boreholes, tanks and stands.

3.1.2 WATER USE:

All water devices specified minimize water consumption and encourage efficient use.

Use efficient:
- toilets – below 6 litre
- taps – below 0,03 – 0,17 litre per second (specify low flow taps)



3.1.3 PLANTING:

All planting specified has a low water requirement (indigenous species).

HARD PAVING:
- recycled concrete slabs
- concrete slabs, turf
- clay tiles, concrete blocks

Restricting the extent of paving, and aiming for water-permeable hardening is preferable because it enlarges the water collecting area, which favours the micro-climate. It reduces the burden on the water treatment plant, which helps to prevent annual overflows. Pilot studies already carried out, which have taken this into account, have proven that a reduction of the hardening, including roof surfaces, from about 50% down to 40% is feasible.

Recycled concrete slabs are preferable for paving as they consist, in part, of secondary raw materials. Slabs are generally preferable to clay tiles due to their lower energy content. Grass turf has a limited use because of its structure, but it has the advantage of a smaller amount of material and greater water permeability.
[Anink, Boonstra, Mak, 1995:36]

Run-off will be reduced when using soft landscaping. Trees and lawn (soft landscape) will filter/absorb water. Soft clay bricks will absorb water as well.

Sand surfaces for parking will be better than tar surface roads. A steep site will cause erosion – (water gets up to a certain speed). Large areas of exotic plants must also be avoided because they will consume more water. For that reason, indigenous planting will be used.

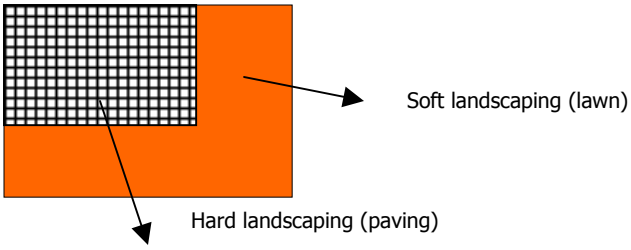


Fig. 76 – A strategy called 'Hydrozone Planting' – to prevent water run-off.

Soft landscaping will absorb the water coming from the hard surface to prevent run-off on site. Use grass-concrete blocks instead of paving. The grass inside the concrete block will absorb the water. Locate species with different requirements (soft edges). Continuous trees must be provided on north-west and north-east edges as well as evergreen trees on the south side (windbreak trees).

Indigenous planting: (deciduous trees) – plant on northern side of the building for sun (winter) and shade (summer).
- EKEBERGIA CAPENSIS
- CELTIS AFRICANA

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