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THIS CITY WORKS FOR YOU

City of Cape Town
Facilities Management

Sustainable Landscapes, Practices and Guidelines

Sustainable Landscapes, Practices and Guidelines is a practical resource guide designed to increase energy and resource efficiency, cut waste, and improve the performance of the external landscapes of the Cape Town City's buildings and facilities. It is intended primarily for facility managers, who administer more resources and have more impact on the environment than any other group in the world. Collectively, they are a powerful force for introducing improvements, and they set an example for the rest of the economy.

This guideline highlights practical actions that facility managers and staff can take to save energy and money, improve the comfort and productivity of employees, and benefit the environment. The guide is one more step in a national effort to promote energy efficiency and sustainable actions in South Africa's buildings and facilities.

Sustainable Landscapes, Practices and Guidelines describes a wide range of effective actions that include selecting nonpolluting materials, recycling, conserving energy and water, improving landscaping, and purchasing the most environmentally enhancing products and equipment.

The guide highlights best practices to:
• Invest in improvements that have quick paybacks and make economic sense;
• Increase the productivity, comfort, and health of employees and building occupants;
• Work within the ongoing operations and procedures of facilities management staff; and most importantly to **REDUCE ENVIRONMENTAL IMPACTS.**

At its heart, sustainability is about leaving a high quality of life for future generations.

Landscape Principles

1. **Enrich** and cultivate the Cape's natural assets through a variety of innovative, productive and sustainable uses of the landscape.
2. **Create** a park-like landscape system for year-round outdoor recreation and relaxation for internal staff and the community.
3. **Design** for outdoor comfort by moderating harsh environmental factors such as high winds and rain.
4. **Utilise** ecosystem services such as water management, improved air quality, carbon sequestration etc.
5. **Improve** the aesthetic experience of our city's landscape.
6. **Manage the** landscape to realise its full potential by the use of resource efficient materials for long term durability, management and sustainability.

Sustainable Landscape Practices

1. Water Management

The goal of effective water management is to reduce water consumption without compromising the performance of equipment and fixtures. Using water more efficiently is a green strategy for several reasons: it reduces pressure on sometimes-limited water resources, reduces the amount of energy and chemicals used for water and wastewater treatment, and, to the extent that the use of *hot* water is reduced, increases energy savings—with associated environmental benefits. In addition to these benefits, water conservation in local community facilities saves taxpayers money. Facility managers should conduct comprehensive audits of water use in all buildings and landscapes under their supervision. The water audit should be accompanied by an examination of available water management techniques and be followed by implementation and monitoring of appropriate measures.

Water Use in the Landscape

Water is key to the survival and prospering of plants in the landscape. Plants use water to absorb and transport nutrients, to respire, to maintain temperature balances, and to remove wastes. Water should be delivered at a rate and on a cycle appropriate to the plant materials in question. The challenge with green facilities is to use water efficiently, to avoid its use when not required, and to maintain—or even improve—water quality.

Efficient water use in the landscape is best planned as part of the initial development and site planning of a facility. There are also many opportunities for improving water use at existing facilities. Irrigation infrastructure typically has to be substantially renewed every twenty to thirty years; this is a good time to thoroughly examine and improve water use and water efficiency.

The availability of innovative new water sources for irrigation, such as gray water and reclaimed water, provides another opportunity for modifying a landscape irrigation system.

The lawn is a horticultural misdemeanor. It represents an attitude toward water use and plant selection that, in many geographic areas, is out of synch with the actual cultural requirements of the plants that we typically use and the microclimate in which we expect them to grow and perform. Water plays a very large part in the support of lawns. In fact, many other equally acceptable, and equally South African planting design approaches, can be implemented to benefit local and regional water conservation and quality.

Responsible water use in the landscape begins and ends with the plant materials selected and designed for the facility. The five components of a landscapes water management model are **supply, quality, delivery (irrigation), planting design, and public awareness programmes**.

Rainwater Harvesting

Rainwater harvesting refers to the collection, storage, and use of rainwater. Most systems use the roof surface as the collection area and a large galvanized steel, fiberglass, polyethylene, or ferro-cement tank as the storage cistern. When the water is to be used just for landscape irrigation, only sediment filtration is typically required. When water is being collected and stored for potable uses, additional measures are required to purify the water and ensure its safety. Rainwater harvesting offers several important environmental benefits, including reduced pressure on limited water supplies and reduced storm water runoff and flooding. It can also be a better-quality source of water than conventional sources and it enhances the growth of plants. After purification, rainwater is usually very safe and of high quality. “Hardness” (mineral content) is low, and in areas with groundwater that is polluted, hazardous (from arsenic or other natural toxins), saline, or hard, properly purified rainwater may be a higher-quality and safer source of drinking water than water pumped out of the ground.
(*See permeable paving – methods of re harvesting of water*)

Water Quality

Water for landscape irrigation can be much lower in quality than potable drinking water. Alternative water sources should be investigated, especially for larger projects.

Retain as much storm water flow on site as possible to minimise downstream degradation, erosion, flooding, and the need for an expensive conveyance infrastructure.

Minimise surface and groundwater pollution by treating (or separating pollutants from) parking lot runoff; pre treat water flowing off-site. In general, bio filtration is the best treatment option; mechanical separation makes sense only where high levels of pollutants are generated (such as fuel storage and very large parking lots).

Organic landscaping techniques and integrated pest management (IPM) programmes can lessen soil and groundwater pollution.

Appropriate fertilisation techniques will reduce nutrient loading in waterways, lakes, and rivers, and enhance local and regional water quality as a result.

Water Delivery and Irrigation

Reduce aerial sprinkling by providing for the use of drip and bubbler irrigation.

Properly zone the irrigation system to the specific needs of plant materials and site microclimate.

Irrigation scheduling: Adjust the time of operation to match the current supplemental needs of the plant material. Use controller timing, system zoning, irrigation durations optimised for drip systems, and adjustment for seasonal variation. Tensio meters, when properly placed, may be used to determine irrigation demand based on soil moisture content. Photovoltaic (PV)-powered irrigation controls can also be used where electric power is not available (such as on road medians).

Watering times. Water or irrigate either early in the morning, or in the early evening, to avoid evaporation. Only two out of every one hundred drops of rainwater actually reach the roots of a plant and the rest is wasted either as evaporation or run-off. This is why compost and mulch play such a pivotal role in a garden.

Perform routine maintenance to ensure proper system functioning and reduce the risk of water loss due to leaks.

Investigate the use of separate delivery systems for potable water, reclaimed water, and other sources of irrigation water. Look for opportunities to combine large irrigated areas (parks, golf courses, etc.) on separate delivery systems.

Water and Planting Design

Reduce areas of lawn, particularly in regions where lawn grasses are not native and where water usage is high.

Replace lawn with shrubs, groundcovers, and mulch.

Mulch what you water—water retention is much improved in mulched areas.

Use local and regional indigenous and (non-invasive or infertile) naturalised plant materials appropriate to the microclimate regimes of the facility to reduce water take-up and to balance water use and soil development objectives.

Use associated plant palettes over broader areas to minimise the need for zoning and related controls. Plant in such a way, that plants are grouped according to their watering requirements.

In arid regions and areas prone to drought, install xeriscape (low-water-use) landscapes that are appropriate to the region.

Public Awareness

Proactive public relations by the City's facilities management can be an important part of communicating the benefits of certain actions or changes in water management that might otherwise raise questions in the community.

Develop demonstration areas and signage programmes that make changes in landscape management visible and comprehensible to the public.

Watering of public open spaces grounds during drought periods, which often results in a public outcry but is important to plant viability (and generally less expensive than plant replacement), will generate less concern if there is signage indicating that watering is being done with "Recycled Water Only" .

Landscaping with indigenous or more naturalised plantings can gain public support for our local City **landscaping** expenditures. "Natural Revegetation Area" and similar signage will help to clarify the intent and the responsible motives at work with such landscaping practices.

Initiate public demonstration projects, such as xeriscape demonstration gardens, to help foster public understanding of appropriate plantings and water conservation techniques. Good demonstrations also help to show attractive landscapes and dispel "rock and cactus" stereotypes.

2. Plant Selection for Sustainable Landscapes

"Wherever you go in South Africa, the land needs to speak in its own regional accent"

Plant Materials

Appropriate plant selection means "using the right plant in the right place." Indigenous plants (or others well adapted to local conditions) should be used whenever possible. Plant growth rate, size at maturity, life span, brittleness, and requirements for light, water, and soil pH are important factors in selecting plants—along with color, texture, scent, and seasonal characteristics.

Matching plant requirements with site realities, and correctly placing appropriate plants, helps avoid expensive and time-consuming problems. Thoughtful selection and siting of trees, shrubs, and groundcovers to provide shade and lower ambient air temperature can reduce air conditioning energy use by 5-20%. The use of indigenous and noninvasive naturalised plant materials can reduce maintenance demands

Well-adapted Plants

Selection of plant materials for low water consumption, as well as for disease and pest resistance, can contribute significantly to an environmentally responsible landscape. A key to creating a sustainable landscape is to include plants that are either native to your area or well adapted to similar growing conditions. These plants need less water, fertiliser, and pesticides. There are several environmental factors to consider when selecting plants:

- Your plant hardiness zone
- Seasonal rainfall distribution
- Humidity
- Soil characteristics
- Water availability
- Duration and intensity of light.

Every plant tolerates a range of conditions for each of these factors. The combined effects of all of them determine which plants are adapted to your site.

Interest in indigenous plants for home and commercial landscapes is growing. "Indigenous" plants are plants that grow naturally on undisturbed sites in the local area. Generally, they are better adapted to local growing conditions, less prone to disease and insect problems, and provide better habitat (food and shelter) for the native wildlife than introduced species.

However, it is important to realise that indigenous plants are not a magic answer to creating sustainable landscapes. Some species have difficulty in commercial landscapes because the environment is very different from their natural growing conditions.

It is important to find the right plant for each specific location in your landscape.

Many non indigenous species can also be suitable additions to sustainable landscapes. The key is to look for plants that are not invasive, adapt to a range of growing conditions, and provide habitat for local birdlife. Thoughtful plant selection and proper site preparation can create a sustainable landscape that is a unique blend of well-adapted indigenous and exotic species.

Low Maintenance

Plant survival with minimal maintenance is not the only issue in sustainability. It is important to know a plant's growth rate, expected life span, and whether it spreads rapidly. Placing a plant where it will quickly outgrow its space guarantees the need for frequent pruning. Thus, this plant will not be low-maintenance even if it is drought-tolerant and disease-resistant.

For a low-maintenance landscape, use annuals only in small areas. Trees, shrubs, and perennials reduce yearly planting costs and maintenance.

Reducing the use of invasive plants that might escape, displace native plants, and disrupt natural ecosystems is another factor to consider.

Groundcovers

Groundcovers such as turf, low-spreading shrubs, creeping plants, and prostrate vines are essential landscaping materials. Turf grass lawns can be grown successfully under a wide range of inputs of water, fertiliser, and pesticides. For example, a pure perennial ryegrass lawn requires regular fertilising to look good, while one dominated by bent grass can go several years without fertiliser if the clippings are left on the lawn.

Altering your expectation of perfection is a large part of sustainable landscaping, and turf is one area where you can easily create a more sustainable landscape. In areas where grass does not grow well or is difficult to maintain, such as shady areas and steep slopes, consider replacing it with another type of groundcover.

Mulch

Mulching is one of the most important ways to protect and maintain healthy landscaped plants, shrubs and flowers. Mulches hold soil moisture, reduce weed growth, slow erosion, build soil texture, increase root density by keeping soil cooler in summer and warmer in winter, and feed important soil microorganisms (which, in turn, buffer soil pH). Mulches add color, texture, contrast, and definition.

Mulch in itself is material that is spread out over and around the roots of what you have planted. Two types of mulch are organic and inorganic mulch. Organic mulch includes grass clippings, leaves, bark mulch, newspaper and straw, like pine straw. Inorganic mulch includes various types of rocks, stones and gravel. The advantage of using organic mulch is that over time it breaks down and adds nutrients to the soil, thus making the soil richer. However, because it eventually decomposes, organic mulch will need to be replaced from time to time.

Greening Projects

Trees and other plants not only make places look attractive, they also improve air quality, reduce soil erosion, play an important role in water quality and management systems, and provide food and habitats for birds and other wildlife.

Permaculture

There are ways of gardening, such as permaculture or organic gardening that do not need chemical fertilisers or pesticides. There are also simple techniques that help to reduce the amount of water used for gardens, such as choosing plants that do not need much water, putting a layer of mulch (such as dead leaves or straw) on top of the soil to stop water evaporating, and watering in the evening or early mornings. It is also a good idea to collect rainwater to use on the garden.

3. Trees - Improved Air Quality

Trees are important tools in the fight to stave off global warming, because they absorb and store the key greenhouse gas emitted by our cars and power plants, carbon dioxide (CO_2), before it has a chance to reach the upper atmosphere where it can help trap heat around the Earth's surface.

All Plants Absorb Carbon Dioxide, but Trees are Best

While all living plant matter absorbs CO_2 as part of photosynthesis, trees process significantly more than smaller plants due to their large size and extensive root structures. In essence, trees, as kings of the plant world, have much more "woody biomass" to store CO_2 than smaller plants, and as a result are considered nature's most efficient "carbon sinks." Tree species that grow quickly and live long are ideal carbon sinks. Unfortunately, these two attributes are usually mutually exclusive. Given the choice, foresters interested in maximising the absorption and storage of CO_2 (known as "carbon sequestration") usually favour younger trees that grow more quickly than their older cohorts. However, slower growing trees can store much more carbon over their significantly longer lives.

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmospheric environment. The four main ways that urban trees affect air quality are:

Temperature reduction and other microclimatic effects
Removal of air pollutants
Emission of volatile organic compounds and tree maintenance emissions
Energy effects on buildings.

Temperature Reduction: Tree transpiration and tree canopies affect air temperature, radiation absorption and heat storage, wind speed, relative humidity, turbulence and surface moisture. These changes in local meteorology can alter pollution concentrations in urban areas. Although trees usually contribute to cooler summer air temperatures, their presence can increase air temperatures in some instances. Reduced air temperature due to trees can improve **air quality** because the emissions of many pollutants and/or ozone-forming chemicals are temperature dependent. Decreased air temperature can also reduce ozone formation.

Removal of Air Pollutants: Trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with inner-leaf surfaces. Trees also remove pollution by intercepting airborne particles. Some particles can be absorbed into the tree, though most particles that are intercepted are retained on the plant surface.

Emission of Volatile Organic Compounds (VOCs): Emissions of volatile organic compounds by trees can contribute to the formation of ozone and carbon monoxide. However, in atmospheres with low nitrogen oxide concentrations (e.g., some rural environments), VOCs may actually remove ozone. Because VOC emissions are temperature dependent and trees generally lower air temperatures, increased tree cover can lower overall VOC emissions and, consequently, ozone levels in urban areas.

Trees in parking lots can also affect evaporative emissions from vehicles, particularly through tree shade. Increasing parking lot tree cover from 8% to 50% could reduce light duty vehicle VOC evaporative emission rates by 2% and nitrogen oxide start emissions by less than 1%.

Energy Effects on Buildings: Trees reduce building energy use by lowering temperatures and shading buildings during the summer, and blocking winds in winter. However, they also can increase energy use by shading buildings in winter, and may increase or decrease energy use by blocking summer breezes. Thus, proper tree placement near buildings is critical to achieve maximum building energy conservation benefits.

When building energy use is lowered, pollutant emissions from power plants are also lowered. While lower pollutant emissions generally improve air quality, lower nitrogen oxide emissions, particularly ground-level emissions, may lead to a local increase in ozone concentrations under certain conditions due to nitrogen oxide scavenging of ozone. The cumulative and interactive effects of trees on meteorology, pollution removal, and VOC and power plant emissions determine the overall impact of trees on air pollution.

Plant the Right Tree for the Right Location

Scientists are currently studying the physiological response of plants to global climate change and the carbon sequestration potential of different types of trees in various parts of South Africa , including the aliens such as the Eucalyptus, the Pine and the Blue Gum. These trees, whilst water guzzlers, are low-maintenance and maximise carbon absorption.

Ultimately, trees of any shape, size or genetic origin help absorb CO_2. Most scientists agree that the least expensive and perhaps easiest way for individuals to help offset the CO_2 that they generate in their everyday lives is to plant a tree…any tree, as long as it is appropriate for the given region and climate. However planting evergreen trees will give you a year round removal of particles.

4. "Organic" Pesticides

There is no such thing as an environmentally friendly pesticide; they are designed to kill and that is what they will do in varying degrees of efficacy.

In a rapidly changing world people realise the importance of safer landscaping practices and in particular the more responsible use of pesticides. As facility managers and conservationists we should be concerned with biodiversity and that means all life forms and not just the birds and mammals.

Organic in scientific terms means a molecule that consists mainly of a carbon skeleton with other elements such as hydrogen, oxygen, nitrogen, sulphur, phosphorus and a few others as contributing building blocks.

The majority of modern pesticide molecules are organic and fit in 100% with the scientific classification of organic. The so-called organic pesticides should thus definitely be called natural, as they are also mostly organic (in scientific terms) but are strictly of natural origin. The classic pesticides that are often referred to as chemical pesticides are in fact all chemicals but they are synthetic (such as organophosphates) or semi-synthetic (such as pyrethroids) whereas the natural pesticides are chemicals of a natural origin such as salts of fatty acids and plant oils.

Some of the so-called "organic" pesticides contain active ingredients such as copper octanoate. Copper is extremely damaging to the environment, yet the marketing agencies of these products brand them as environmentally friendly organic pesticides. Copper is inorganic and at best the product may be branded as organo-metallic.

Pesticides and the Law

All pesticides in South Africa are governed by the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947).

All products that claim to control, kill or repel any vertebrate or invertebrate pest have to be registered with the Registrar of Act No. 36 of 1947 whether such products are natural or synthetic of origin. The Act is highly prescriptive in terms of the registration requirements, claims that are made on the labels of such products and a

host of other things. This is to ensure that products are effective, that they do not pose a significant risk to human beings and the environment, and do what they are supposed to do.

Pesticide manufacturers are bound by law to print warnings and precautions on their labels but we can expect that in many cases the public do not read and follow the advice presented on the labels. The synthetic pesticides sold in the household and nurseries are generally much less toxic than those products supplied to agricultural industry, yet homeowners poison themselves, their pets and their garden wildlife by not adhering to instructions.

Try to choose a product that you believe will do the job and be less harmful to the environment, but base your selection of pesticide on the holistic facts of wildlife and human life and not on fictitious marketing claims. Don't believe that synthetic pesticides are all bad news. These products have all been tested rigorously and approved by the Department of Agriculture and if used according to the label instructions pose little risk to life.

Sustainable Pest Management

The principles of integrated pest management (IPM) are a part of sustainable landscapes. This pest management strategy centres on preventing and managing pests with minimal impact on human health, the environment, and non target organisms. The first steps are to choose plants that will have few pest problems and to care for them properly to keep them healthy. Choose plants that are labeled resistant or tolerant and are healthy to start with, put them in the right growing environment, and follow good sanitation practices in the garden.

Regularly check your plants for signs and symptoms of pest damage. If you see a problem, be sure to identify the cause correctly. Finally, if the damage is severe enough, select a control measure.

IPM control measures include physical, biological, and chemical methods. Physical methods include removing pests from plants by hand, pruning out infected areas, and protecting plants with sticky traps and plant cages. Maintaining a well-balanced ecosystem is the key to biological control methods. Beneficial insects and animals feed on many pests and keep populations under control. Chemicals are used as a last resort. Start with the least toxic products first and move to more toxic ones only if necessary.

Types of Control

Cultural

Good horticultural practices constitute the first line of defense against pest problems. Select proper sites for growing plants. Plants are healthier and better able to tolerate pests when they are protected from sun scalding and given good growing conditions. The use of slow-release fertilisers at optimum rates and proper watering practices can make plants less attractive to pests. Weed control in and around production areas eliminates alternate host plants for pests.

Physical

Pest infestations can be physically manipulated with light, humidity and temperature. In interior plantings, light quantity and quality affect plant health and influence pest populations and their damage. Unlike conventional lights, yellow "bug" lights used at night around plants will not attract insects such as moths, crickets and June beetles. Temperature and humidity are important, although not always controllable. In greenhouses and interior scapes, these factors can sometimes be manipulated to reduce pest survival or improve the success of natural enemy releases. Devices, which use sound for pest suppression, have not been shown to be effective.

Biological

The term "biological control" refers to the use of natural enemies to suppress pests. Biological control tactics include the conservation, augmentation and importation of natural enemies. Biological control is an environmentally safe method and is the basis for some integrated pest management programmes.

Conservation.
Pesticides kill beneficial predators, parasites and pathogens as well as pests. They can cause outbreaks of secondary pests, or rapid resurgence of pests, that were initially suppressed. Using nonchemical control methods or pesticides that kill only the target pest protects natural enemies. Some easily seen predators are spiders, lacewings, lady beetles, ground beetles, rove beetles, syrphid flies, flower flies, hover flies, true bugs (including minute pirate bugs, big-eyed bugs and damsel bugs), predatory mites and even fire ants. However, many important natural enemies are rarely seen, such as parasitic wasps and flies (more than 8,500 species), nematodes, and pathogenic bacteria and fungi.

5. Organic Fertilisers

When used in reference to fertilisers, the word organic generally means that the nutrients contained in the product are derived solely from the remains or a by-product of an organism. Cottonseed meal, blood meal, fish emulsion, manures and sewage sludge are examples of organic fertilisers. Urea is a synthetic organic fertiliser, an organic substance manufactured from inorganic materials.

When packaged as fertilisers, organic products have the fertiliser ratio stated on the package label. Some organic materials, particularly composted manures and sludges, are sold as soil conditioners and do not have a nutrient guarantee stated on the package, although small amounts of nutrients are present.

Some organic fertilisers are high in one of the three major nutrients (nitrogen, phosphorus, or potash,) but low or zero in the other two. Some are low in all three macronutrients. A few organic products can be purchased "fortified" for a higher nutrient analysis. The ingredients used to fortify organic fertilisers are organic materials; for example, rock phosphate to increase phosphorus, or greensand to increase potash.

Organic fertilisers depend on soil organisms to break them down to release nutrients; therefore, most are effective only when soil is moist and warm enough for the microorganisms to be active. Nutrient release by microbial activity, in general, occurs over a fairly long time period. One potential drawback is that the organic fertiliser may not release enough of their principal nutrient when the plant needs it for growth.

Cottonseed meal is a by-product of cotton manufacturing. As a fertiliser, it produces a somewhat acidic reaction; consequently, it is frequently used for fertilising acid-loving plants such as azaleas, camellias, and rhododendrons. Formulas vary slightly, but generally, cottonseed meal contains 7 percent nitrogen, 3 percent phosphorus, and 2 percent potash. Nutrients are most readily available to plants in warm soils, but there is little danger of burn.

Blood meal is dried, powdered blood collected from cattle slaughterhouses. It is a rich source of nitrogen, so rich, in fact, that it may burn plants if used in excess. Gardeners must be careful not to exceed the recommended amount suggested on the label. In addition to nitrogen, blood meal supplies some essential trace elements, including iron.

Fish emulsion, a balanced, organic fertiliser, is a partially decomposed blend of finely pulverized fish. A strong odor is associated with most brands of fish emulsion fertiliser, but the smell dissipates within a day or two. Recently, deodorised brands have been developed.

Fish emulsion is high in nitrogen and is a source of several trace elements. Contrary to popular belief, too strong a solution can burn plants, particularly those growing in containers. In the late spring, when garden plants have sprouted, an application of fish emulsion followed by a deep watering will boost the plants' early growth spurt.

Manure is a complete fertiliser, but low in the amount of nutrients it supplies. Manures vary in nutrient content according to the animal source and what the animal has been eating. A fertiliser ratio of 1-1-1 is typical. Commonly available manures include horse, cow, pig, chicken and sheep.

The highest nutritional concentration is found in manure when it is fresh. As it is aged, exposed to weather, or composted, nutrient content is reduced. However, most gardeners prefer to use composted forms of manure to ensure lesser amounts of salts, thereby reducing the chance of burning plant roots. Because of its low concentration of plant nutrients, manure is best used as a soil conditioner instead of a fertiliser. Typical rates of manure applications vary from a moderate 22kg per 1000 square feet to as much as one ton per 1000 square feet.

Sewer sludge is a recycled product of municipal sewage treatment plants. Two forms are commonly available: activated and composted. Activated sludge has higher concentrations of nutrients (approximately 6-3-0) than composted sludge. It is usually sold in a dry, granular form for use as a general purpose, long lasting, non burning fertiliser. Composted sludge is used primarily as a soil amendment and has a lower nutrient content (approximately 1-2-0).

There is some question about the long-term effects of using sewage sludge products in the garden, particularly around edible crops. Heavy metals such as cadmium, sometimes present in the sludge, may build up in the soil. Possible negative effects vary with the origin of the sludge and with the characteristics of the soil where it is used.

Compared to synthetic fertiliser formulations, organic fertilisers contain relatively low concentrations of actual nutrients, but they perform important functions, which the synthetic formulations do not. They increase the organic content and consequently the water-holding capacity of the soil. They improve the physical structure of the soil, which allows more air to get to plant roots. Where organic sources are used for fertiliser, bacterial and fungal activity increases in the soil. Mycorrhizal fungi, which make other nutrients more available to plants, thrive in soil where the organic matter content is high. Organically derived plant nutrients are slow to leach from the soil making them less likely to contribute to water pollution than synthetic fertilisers.

6. Sustainable Soil

Soil is formed slowly by the weathering and erosion of rocks over many thousands of years. Almost everything which humans need can be traced back to the soil: food, clothing, medicines, oxygen, etc. As one of the three primary resources of the biosphere, humankind's well-being is inextricably linked to the soil.

South Africa has very limited fertile soil. Less than 7% of South Africa's land area is regarded as high grade, good agricultural production land. It has been said that soil is one of South Africa's greatest exports, as each year over 460 million tonnes of topsoil are stripped from poorly managed land, by rain and wind, thus wasting the limited resource base and reducing the productivity of the land. The loss of protective vegetation through deforestation, over-grazing, ploughing and fire increases the vulnerability of soil to being swept away.

The conservation of soil, in particular the precious fertile topsoil, is therefore one of South Africa's most pressing environmental concerns. Soil erosion can be prevented by not exposing bare earth to rain and wind, through the observance of good farming practices (including the use of crop rotations, which include fallow periods under grass or pasture, to allow the soil to recover) and by farming within the carrying capacity of the land. The planting of trees also helps to reduce soil erosion. The conservation of soil requires a firm commitment from all South Africa's citizens – government departments and policy developers, industry, developers, farmers and individual home-owners – who all need to ensure that land-use practices and developments do not further deplete this essential resource base.

The criteria below indicate a soil that functions effectively today and will continue to nourish plants and trees long into the future. These characteristics can be created through management practices that optimise the processes found in native soils.

Features of Good Soil

. Feels soft and crumbles easily
. Drains well and warms up quickly in the spring
. Does not crust after planting
. Soaks up heavy rains with little runoff
. Stores moisture for drought periods
. Has a few clods and no hardpan
. Resists erosion and nutrient loss
. Supports high populations of soil organisms
. Has a rich, earthy smell
. Does not require increasing inputs for high yields
. Produces healthy, high-quality plants and trees

The soil, the environment, and your facility's plant life will benefit when the soil's natural productivity is managed in a sustainable way. Good soil management produces plants and trees that are healthier, less susceptible to disease, and more productive.

7. Recycling

Recycling Saves Resources

Using recycled materials in manufacturing reduces the need to destroy habitat and ecosystems in the extraction of raw materials. Fewer clear cuts, strip mines and oil drilling operations mean more of earth's ecosystems remain intact. In South Africa, Gauteng generates the most PET post-consumer product at 55% of the national total, followed by the Western Cape with 13%. KwaZulu Natal accounts for 10% and the Eastern Cape and Mpumalanga account for 5% each.

Commercial buildings, including our City facilities, generate millions of tons of municipal solid waste per year in Cape Town. Municipal facilities have the potential to conserve natural resources—from energy to water to the trees that are made into office paper—by the way in which buildings are operated, provisioned, and serviced. The three-R hierarchy of resource conservation— Reduce, Reuse, Recycle—can reduce overall waste and save money as well. Recycling helps keep financial resources within a community—producing jobs and generating other economic benefits. Strong, proactive recycling programmes at government and local municipal facilities also serve as an important model for the communities where they are located and can project a positive public image.

The Landscape - Compost

Organic matter generated from food services and landscaping operations should be composted if possible. As much as 38% of landfill is kitchen waste and garden refuse – all of which can be recycled to be used as compost and mulch. This not only reduces land filling but also provides a high-grade soil amendment for landscaping.

Recycling saves energy, reduces pollution

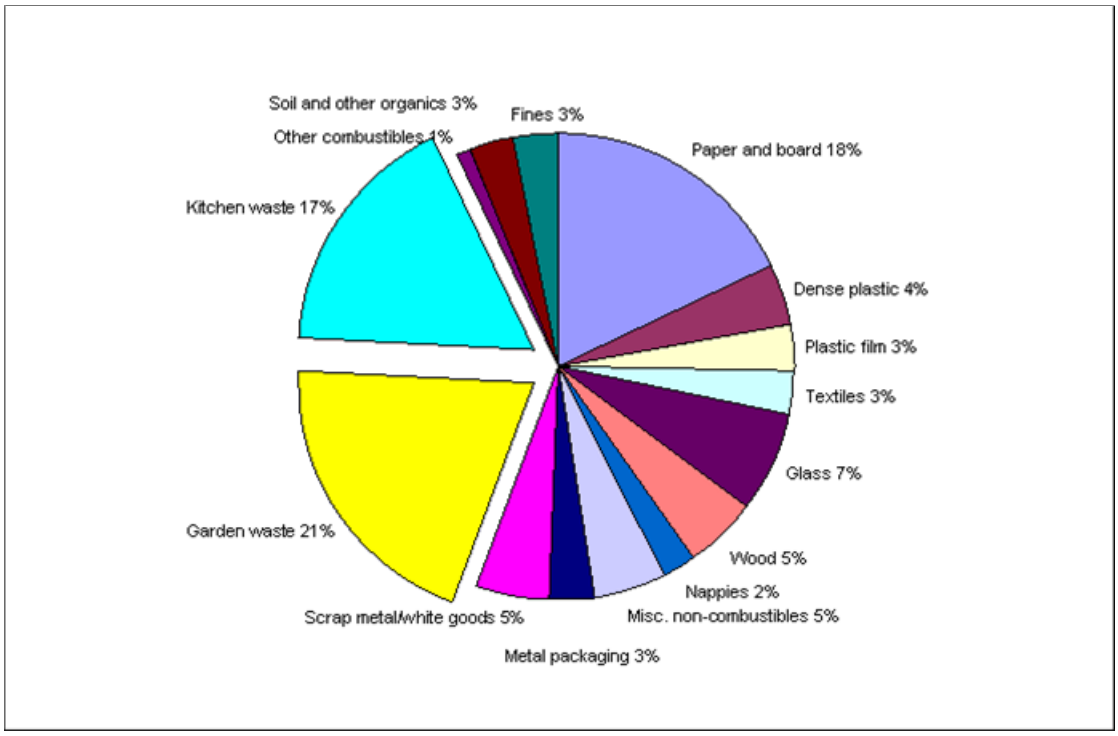
Traditionally, gardeners have created their own compost using leaves, grass, shrub clippings and other useful organic materials found in the garden. Applying compost to soils provides an excellent conditioner and mulch,

which fertilises and provides soil structure, retains moisture and can restrict weed growth. Man-made compost is an alternative to the peat-based compost extracted from important natural wildlife sites.

The success of facilities composting is dependent upon the separation of organic waste from other waste. It has been estimated that there is around 105 kg of botanical waste per head of population per year in South Africa

Facility Composting Schemes

Facility composting schemes involve the collection and centralised processing of various organic wastes including: kitchen and garden waste separated at source by a “recycling team” Many local authorities have carried out experiments to make a range of compost and mulch products from either one or a combination of these sources.



Collections of prunings and trimmings from landscaping projects can be converted into wood chippings, which decompose to form mulches and composts. In the majority of situations, weeds, seeds and potentially harmful organisms do not have to be separated out as they will be killed by the heat produced during the "breaking down" process.

The highest quality compost, which is contaminant free, is ideal for horticulture. Compost which is slightly contaminated with glass and plastics may be suitable for landscaping, tree planting and for use in our city’s parks and gardens. The grossly contaminated compost derived from a combination of municipal solid wastes and sewage sludges can be utilised for land reclamation and restoration of landfill sites.

Large-scale, centralised schemes involve management, outlay and maintenance costs and are dependent upon staff participation to sort their own rubbish at source for recycling. However, the sale of this compost and mulch products to the public may offset production costs and the costs of alternative waste disposal methods.

8. Hardscape Materials and Structures

Paved surfaces

To pave surfaces in landscaped areas**,** use loose set masonry units, flagstones, gravel, grass blocks planted with grass or groundcovers; porous and permeable paving with specially formulated design criteria is appropriate for most applications.

With alternatives to pavement, consider other issues, such as the fact that crushed stone and pebble surfaces do not contribute organic matter to soils, that crushed shell surfaces may raise soil pH, and that some light-colored surfaces might reflect sunlight onto nearby plants and thus injure them. As the Cape Province is a rich fruit growing area, use peach, apricot and plum pips as an alternative.

Permeable Paving

Permeable paving, also called pervious paving or porous pavement, is a term used to describe paving methods for roads, parking lots and walkways that allow the movement of water and air through the paving material. Although some permeable paving materials appear nearly indistinguishable from nonporous materials, their environmental effects are qualitatively different. Whether porous concrete, paving stones or bricks, all these pervious materials allow precipitation to percolate through areas that would traditionally be impervious and instead infiltrates the storm water through to the soil below. The infiltration capacity of the native soil is a key design consideration for determining the depth of base rock for storm water storage or for whether an under drain system is needed.

In new suburban growth, permeable pavements protect pristine watersheds. In areas already built out, old town centres, redevelopment and reconstruction are opportunities for environmental rehabilitation. Permeable paving is an important component in the low impact development concept, which is a process for land development that attempts to minimise impacts on water quality.

Prevention of Soil Erosion

Permeable paving surfaces are highly desirable because of the problems associated with water runoff from paved surfaces. Part of the problem is creating an unnatural volume of runoff from precipitation, which causes serious erosion and siltation in streams and other bodies of waters. Part of the problem is also the washing off of vehicular pollutants into water bodies.

Permeable paving surfaces keep the **pollutants** in place in the soil or other material underlying the roadway, and allow water seepage to recharge groundwater while preventing the stream erosion problems. They capture the heavy metals that fall on them, preventing them from washing downstream and accumulating inadvertently in the environment. In the void spaces, naturally occurring micro-organisms digest car oils, leaving little but carbon dioxide and water; the oil ceases to exist as a pollutant. Rainwater infiltration through the permeable pavement into the underlying soil reduces storm water volume and restores natural subsurface flow paths. The cost of permeable pavements, with its built-in storm water management, is usually less than that of an impervious pavement with a separate storm water management facility somewhere downstream.

Porous and permeable pavements give urban trees the rooting space they need to grow to full size. A “structural-soil” pavement base combines structural aggregate with soil; a porous surface admits vital air and water to the rooting zone. This integrates healthy ecology and thriving cities, with the living tree canopy above, the city’s traffic on the ground, and living tree roots below.

Over and above all the benefits of permeable paving, this method also allows for the re-harvesting of water. A retention tank is fitted within the layering system and all excess water can either be filtered through a geo textile or directly to the tank for reuse.

Roof Gardens

Green roofs have beneficial environmental effects. Green roofs offer new habitats for fauna and flora to remain within urban areas and reduce the immediate water run-off by rainwater retention on site. Moreover, green roofs improve the microclimate and reduce dust and smog levels. Green roofs reduce sound reflection and improve sound insulation. Green roofs also improve the thermal insulation, which reduces the cost for heating and cooling. They protect the waterproofing from UV exposure, heat, cold, and hail, which considerably increases the life expectancy of the roof.

For extensive green roofs, plant communities that are proven to be specially adapted, have to be used because of the severe conditions of the roof surface – sun, wind, drought, dust etc.

Green Roofs - A Substitute for Lost Areas of Landscape

Centuries old, the roof garden concept has been most recently embraced in South Africa. The City of Cape Town's Civic Centre itself boasts seven of the most successful indigenous roof gardens in Cape Town. Both functional and aesthetically-appealing, this technology improves the structure's energy efficiency while adding plant life in populated areas.

Currently, the focus on improving the quality of life in urban environments has made these issues more pertinent than ever. Roof gardens meet the objectives of many of the mandates to improve the air quality of cities by mitigating the effects of heat islands caused by ever increasing development. The benefits of the modern roof garden have been demonstrated by the Green Star certification programme.

Advantages of the Roof Garden

- Reduces urban heat island effects
- Storm water run-off management
- Adds valuable/useable space providing economic benefits
- Energy efficiency year-round
- Air and water purification

Using Garden Roof Systems to Achieve Sustainable Building Envelopes

There is increasing interest in the garden roof system as a sustainable building design option in South Africa today. This reports the results of a field study to evaluate the thermal performance of this technology, as well as its potential to retain storm water runoff.

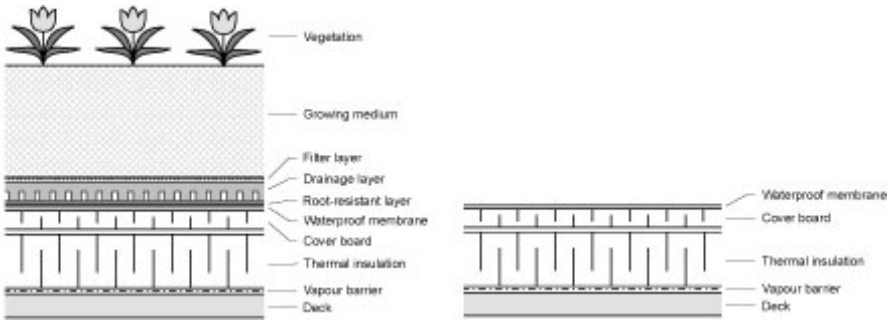


Figure 1. Conventional roofing system (a) with and (b) without a garden roof system.

Heat Flow and Energy Efficiency

In general, the energy savings realised with garden roof technology would depend on the climate, the type of heating/cooling mechanisms used in the building, and their particular efficiencies, and the energy sources, which are site specific. However, any reduction in energy demand means a reduction in the green house gas emissions associated with the production of that energy, resulting in positive effects on climate change and the environment.

Retention of Storm Water Runoff

During a rain storm, water rushes off impermeable surfaces such as rooftops and pavements into the storm sewers, causing a sudden surge in the storm water infrastructure. When the amount of runoff exceeds the capacity of the storm sewers, flash floods can occur, causing environmental and health problems. The garden roof delayed storm water runoff, and reduced the peak runoff rate and volume.

9. Energy Management - External Lighting

Exterior lighting improves security, enhances safety, and directs pedestrians and vehicles. It is also used in night time work areas, sports facilities, landscapes, and cityscapes. A wide selection of new lamps, ballasts, fixtures, and controls are available to lighting designers to replace inefficient exterior lighting systems. The use of white light sources increases night time visibility and maximises peripheral vision. With any exterior lighting design it should be a high priority to avoid light pollution (the upward transmission of light) and light trespass (glare obnoxious to neighbours)—careful luminaire and lamp selection can minimise these problems.

Natural Daylight

One of the most beneficial, free sources of energy is daylight. Daylight makes a useful contribution to interior luminance when properly utilised, and can be more comfortable than electric lighting by providing a better quality of light. All occupants of a building should have the opportunity for the refreshment and relaxation afforded by a change of scene and focus. Unless an activity requires the exclusion of daylight, a view out-of-doors should be provided irrespective of its quality. Studies have demonstrated benefits in worker productivity and health related to daylight in buildings. Another reason to use daylight in conjunction with appropriate lighting controls is the reduction in building energy use.

Exterior Lighting Principles

Facilities managers should consider exterior lighting principles when implementing any exterior lighting retrofit or new design. These principles must assist in achieving energy conservation, provide superior lighting quality to users, and help preserve the night sky.

Manual switches, time clocks, photocells, motion sensors, or sophisticated energy management systems may provide control of exterior lighting. By automating controls, users need not manually switch lights on and off each night. Where time clocks are used, however, they should be periodically checked to ensure that the time is set correctly and adjusted for changes in time of sunrise and sunset. Where photocells are used, they should be very sensitive to low light levels and placed in open areas, such as on roofs.

10. Biodiversity

South Africa's plant conservation efforts should be improved – it has the second highest number of extinct plants in the world. The main recognised threats to the biodiversity of the country are:

- Rates of land transformation: urban development, cultivation, plantation, mining, roads and dams;
- alien invasion;
- environmental pollution;
- climate change;
- and land degradation.

What is being done

Threatened species research is being done by various departments within SANBI (South African National Biodiversity Institute), in collaboration with other national and provincial organisations. This includes developing guidelines and protocols for:

- Monitoring the national status of biodiversity (National Monitoring Framework)
  - for listed species (Threatened Species Programme)
  - for listed ecosystems (Threatened Ecosystems)
  - for biodiversity management plans (Ecosystem & Bioregional Programmes)
  - and restoration ecology (Kirstenbosch Gardens Threatened Species Programme)

For the immediate future, there are plans to focus additionally on animals and population and demographic issues pertaining to threatened species. There is a need for partnerships, communication and vision which combine synergistically to find a solution.

Creating a landscape that is both environmentally sound and aesthetically pleasing is not difficult, but it does require careful attention to detail. As human populations grow, there is more pressure on our natural resources. Incorporating the principles of sustainability into new or existing landscapes will enhance the environment for humans, plants, and wildlife. Sustainable landscapes **MUST** be part of the solution to some of our environmental concerns and global warming.

11. Facilities Management - Landscape Maintenance

Measuring and Monitoring Benefits

When an organisation makes a commitment giving higher priority to reducing energy costs and protecting the environment, it is important to measure the results of these efforts. Senior managers need this information to justify budgets for capital improvements to produce long-term benefits and to determine the benefits received from these investments. These measurements can provide feedback on whether investments are producing the anticipated benefits. If they are not, monitoring may identify reasons for the shortfalls and help facility managers improve performance with other projects.

Some of these measurements are relatively easy to quantify. For example, energy and water quantities and associated costs are provided monthly to the facility manager, and the cost-benefit of some energy and water reduction measures can be readily determined from those bills. Levels of specific indoor air pollutants can be measured, but the cost-benefit determination is less straightforward. Many issues are not so readily quantified—for example: durability, maintenance, drought-tolerant landscaping, and indoor environmental quality.

The City's procurement department may think of introducing a compulsory "Green" Savings Performance Contract (not unlike BEE scorecard) that ensures that the awarded contractor keeps to the City's Greening Guidelines. Instrumentation and measurements play a role throughout the process, from measuring baseline energy use, to commissioning new systems, to optimising long-term performance and serving as the basis of performance metrics for contractors. Monitoring and verification protocols will ensure consistency for companies doing business with both the public and the private sectors.

Maintenance Programmes

Water fixtures and irrigation systems: Routine inspections and maintenance programmes for water fixtures and irrigation systems are crucial. Population growth and development have reduced the availability of high-quality, potable water in many regions of the country. Along with increased water prices, reduced supply often leads to usage restrictions. A Facilities Management maintenance programme will reduce operating costs when it verifies that fixtures and systems are functioning effectively and ensures that leaks or components are quickly repaired.

Waste systems: Recycling and waste-reduction programmes and their supporting hardware need frequent attention and maintenance in order to function at peak performance.

Landscape maintenance: Use of indigenous plantings can reduce Facilities Management maintenance landscape requirements and costs significantly. Although natural vegetation may take several years to become established, once it is established there is usually less need for water. Integrated pest management can also reduce overall O&M costs by reducing the need for hazardous chemicals and pesticides.

12. Setting Standards and Training

To reduce the negative environmental impacts of the City of Cape Town's facilities, we must change the various standards, operational procedures, and other documents that define how these facilities are designed and managed. To ensure that these modified standards are followed, a comprehensive training programme to disseminate and explain them must be implemented. The contents of this guide can be used as material for this training and can be supplemented with a wide range of government, private-sector, and academic information resources concerning environmental issues as they relate to the design and maintenance of the built environment.

Setting Standards

Leadership by example is imperative to inspire the deep changes required to shift to low consumption and efficient utilisation of resources, low waste, and the creation of healthy exterior and interior environments. The organisational culture must be transformed to one that has fully internalised the benefits of this shift. A change of this magnitude demands firm commitment and leadership from senior management; consequently, it is imperative that management is educated and informed, permitting a top-down change in culture.

Facility managers and others are required to follow a wide array of standards and mandatory regulations from various authorities. There are also a number of suggested green standards and rating systems. It is often difficult to grasp the wide range of requirements and potential solutions available. Even more critical and difficult are the financial issues associated with change. Only an integrated design team—facility managers, planners, architects, engineers, and others—can collectively create an overall blueprint and critical path for an effective, resource-efficient organisation. Appropriate standards must be set that not only meet and integrate the requirements of existing standards but also "raise the bar" still higher whenever possible. In addition, "champions" must be identified within the team that will be responsible for specific goals and objectives.

In order to meet and maintain the standards set, a continual and consistent feedback loop of priorities, evaluation, and course corrections is needed from this integrated design team.

The City of Cape Towns Green Building Guidelines are such–guidelines. However, in the near future many of these will become by-laws or legislated national initiatives. It is imperative that the City leads the way in the reduction of environmental impacts and embraces these principles and sets an example to ensure the private sectors follow suit. Facility managers should also be aware that the Green Star building practices is imminent and that many new developments are using these to gain the highest Green Star Rating. (*See www. gbcsa.co.za for more information*) These should be of prime importance when writing standards for facilities and at best begin to introduce the assessment tools and green building rating systems to develop the City's future plans as a target for environmental performance of new and renovated facilities.

Through the Green Star Rating Programme, commercial buildings receive points for various energy and environmental features—ranging from energy performance and water efficiency to the control of light pollution and protection of local ecosystems.

Current design and development processes of facilities should be reviewed in an attempt to locate opportunities and obstacles related to sustainable design. Ways to implement an integrated team approach should also be sought. Establishing a clear process outline during training, noting "points of opportunity and obstacles", will allow participants to create realistic plans of action for sustainable design.

Training

High-quality training programmes are key to changing the behaviour of a wide range of people involved in the design and management of the City's facilities. It should be action- oriented and hands-on whenever possible. If the training is successful, participants will take the information and put it into action—incorporating sustainable design concepts into everyday choices.

As is the case with many other issues, the quality and quantity of the training provided often depends on funds. In any organisation's budgeting process, setting aside resources for education and training is essential, because the success of the City's facilities management depends on its employees having the most up-to-date information regarding their particular work, trade, or discipline.

For training to be effective it must have the backing of top management and it must be delivered periodically to continually reinforce high-priority ideas.

Greening – Good for the Environment – Good for Business

Should you have any queries or require additional information regarding the City of Cape Town's Sustainable Landscape Guidelines, contact Beth McKellar-Basset

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