Sustainable Urban Public Landscapes:

A Study of Water as a Sensitive Landscape Element in Design Of Cairo Public Landscapes

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Abstract

Urban public landscapes are an area of land or body of water to which the public has physical and/or visual access. Its importance has been known for centuries, lately, more comprehensive knowledge has become available on the wide range of benefits they provide. Good quality public landscapes contribute to individual wellbeing, and through their social, economic and environmental values. It has been settled in Egyptian minds for several years that Egypt is not facing a water problem since we are blessed with the Nile that is providing us with our needs and even more. Based upon these settled ideas, the careless usage of water is not a case that was thoroughly studied. In the past few years, few studies and research tackled the idea that we are facing the problem of scarcity of water. According to governmental meetings and conferences, the problem of waters scarcity is getting bigger and constructive interventions and initiatives are crucially needed. Apart from the normal uses of water, irrigation is considered a large aspect that is consuming very large amount of water without much of notice. Very limited attention is given to the reuse, recycle of water. There are even deeper concepts that are barely discussed which are: water consumption of plants, definition of hydro-zones, the aesthetics of limited water usage landscapes and control systems applied to the irrigation methods providing the efficient consumption of water. The aim of this research is to, examining the efficiency of water as a sensitive element in the landscape design process in general and come up with some guidelines for sustaining the future public landscapes in Cairo.

Key words: Landscape Design, Sustainability, Irrigation, water management.

تصميم وتنسيق الفراغات والحدائق العامة المستدامة:
دراسة المياه كعنصر أساسي في تصميم وتنسيق الفراغات والحدائق العامة للقاهرة

ملخص البحث

ان الفراغات العامة بالمدن المقصود بها هي أي استعمال أو جسم مائي داخل المدن يمكن للمواطن رؤيته والوصول والدخول اليه واستخدامه. تلعب هذه الفراغات دور مهما في حياة المدن لما لها من اثار بيئية واقتصادية واجتماعية مميزة. ان الموروث العام في مصر يؤكد على انه لا توجد مشكلة في وفرة المياه نتيجة لوجود نهر النيل مما ترتب عليه عدم دراسة الاستدامة لعنصر المياه في اعمال تصميم وتنسيق الفراغات العامة. الا انه في الآونة الأخيرة ظهر بشدة الاحتياج الى دراسة سبل التعامل مع إمكانية حدوث ندرة في توفر هذه المياه على المستوى العالمي وظهر الاحتياج الشديد لهذه الدراسة على المستوى المحلي.

يهدف هذا البحث الى تقييم كفاءة استخدام المياه كعنصر مستدام في الفراغات العامة داخل القاهرة عن طريق عرض دراسة تحليلية لحالة خمس حدائق عامة بالإضافة لشارع متميز من اجل الوصول الى مجموعة من الارشادات العامة التي تساعد على كفاءة واستدامة استخدام المياه في تصميم وتنسيق الحدائق والفراغات العامة في القاهرة.

1 Introduction

Public landscapes most commonly refers to all land and spaces that are accessible to the public, indoors or outdoors. Landscape architecture is the art and science of creating and conserving outdoor environments with respect to cultural values and ecological sustainability (Loures et al, 2007). Its major components are nonliving and living materials for design and planning, that's why the result is always dynamic and changing. Until recently, urban design was associated mainly with architecture and urban planning, and the role of landscape architecture was neglected. Landscape architects have been criticized for their urban design practices with low density, little formal sensibility, and too much open space, which at the end look like suburban environments (Tilley, 2002). Today, on the contrary, urban landscape is considered crucial to creating sustainable urban environments. Urban parks and green spaces provide numerous direct and indirect contributions to people's prosperity, wellbeing, social relations, and daily life experience. Urban landscapes are of a strategic importance for the quality of life of our increasingly urbanized society and provide significant ecosystem services, as environmentally, aesthetically, recreationally, psychologically and economically (Wong, 2012). In addition, a landscape is shaped by both natural and cultural dynamics, which also influence human life styles. Therefore an urban landscape is not only about green spaces within an urban environment. Streets and squares, playgrounds, railway and canal corridors, cemeteries, bicycle and pedestrian paths, and waterfronts are the major components of the public spaces, which provide the city with its urban landscape character (Loures et al, 2007). From a human perspective, many of the earth's landscapes are being used more intensely than ever before in the history of earth, and landscapes are increasingly being used simultaneously for several purposes (Antrop, 2005). During the post-war period, intensified land use has been furthered primarily by spatial segregation of functions. Growing land pressure and environmental problems have made this strategy problematic and a paradigm of complete multifunctional is emerging. Thus, there will be high demands on the landscapes of the future, which will have to serve simultaneously the following functions: ecological ,as an area for living, economic, as an area for production, socio-cultural, as an area for recreation and identification, historical, as an area for settlement and identity, and aesthetic, as an area for experiences (Bendict and Mcmmahon, 2002). Depending on people's different ways of using the landscape, it has a different meaning for them. In this regard, landscape is a very complex phenomenon. Single disciplines can only discover and describe small parts of the landscape as a whole. To understand landscape fully and address its challenges, discrete disciplines have to work together (Malpas, 2011). Urban landscapes are landscapes of urban areas, which are the focus of various local economic and socio-cultural activities. They consist of landscapes of settlement areas, which include housing, commercial, institutional, and industrial areas. The problems with maintaining these land uses with traditional methods are numerous. Maintenance can be very labor and resource intensive, thus costly. As it was mentioned in, landscape textbooks that it is so much more expensive to create and operate 'designed' landscapes constructed parks and landscapes that are mowed or regularly cleaned up than natural landscapes, those which are left alone, except for the occasional trail (Tilley, 2002).

2 Sustainable urban landscapes, definitions, Importance and principles

2.1 *What do we mean by sustainable urban landscapes?*

According to the Chambers Dictionary (1993), to sustain means "to hold up, to bear, to support, to keep going, to support the life of and to prolong " while sustainability means" that which is capable of being sustained"(Benson & Roe, 2000: 32). It was suggested by many researches, that something is sustainable if it is possible to support it, to keep it going or in existence, over a significant period of time. (Chiesura, 2004) claimed that sustainability refers to "the continuing ability of the planet to meet the needs of its living inhabitants". The word 'sustainability' can be similarly ambiguous and flexible. It is simple and sensible to work with the most well known and accepted definition from the Brundtland Commission, a United Nations convened initiative that addressed a growing concern about a perceived deterioration of the human and natural environment (Gairola and Noresah, 2010). In 1987 this Commission defined sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development) (Cadenasso and Pickett, 2008). Landscape may be characterized by, being the embedded heterogeneity of interacted ecological systems; is the special structure of topography, vegetation, land use and human habitation pattern; is an organization of extended upward ecosystem; is the overall system integrated with human activities and regional land; is a beauty scene. Its aesthetic value determined by the culture (Benson and Roe, 2000). Landscape has become a major issue in spatial policy both as a sector in its own right, important to outdoor amenity and the leisure economy, and, increasingly, as a basis for framing and managing wider socio-environmental systems (Antrop, 2005). This trend reflects two broad "schools" in sustainable landscape development, one focused on the design and protection of scenic assets and the other emphasizing dynamic multifunctional links between ecosystem services and human well-being (Waldheim, 2006). Given sustainability's centrality to public policy and corporate social responsibility, it is not surprising that analysts are asking critical questions about the nature of "sustainable landscape" (Chiesura, 2004). In relation to landscape architecture and planning, there is a professional subculture that interprets sustainability in terms of low-impact, but physically and socially pertinent, design and a scenic planning subculture that designates and safeguards rural areas on the basis of "natural" aesthetic value (Gairola. and Noresah, 2010). The discourses of these traditions are often quite distinct and lead to varied interpretations of sustainability.

2.2 The importance of sustainable urban landscapes

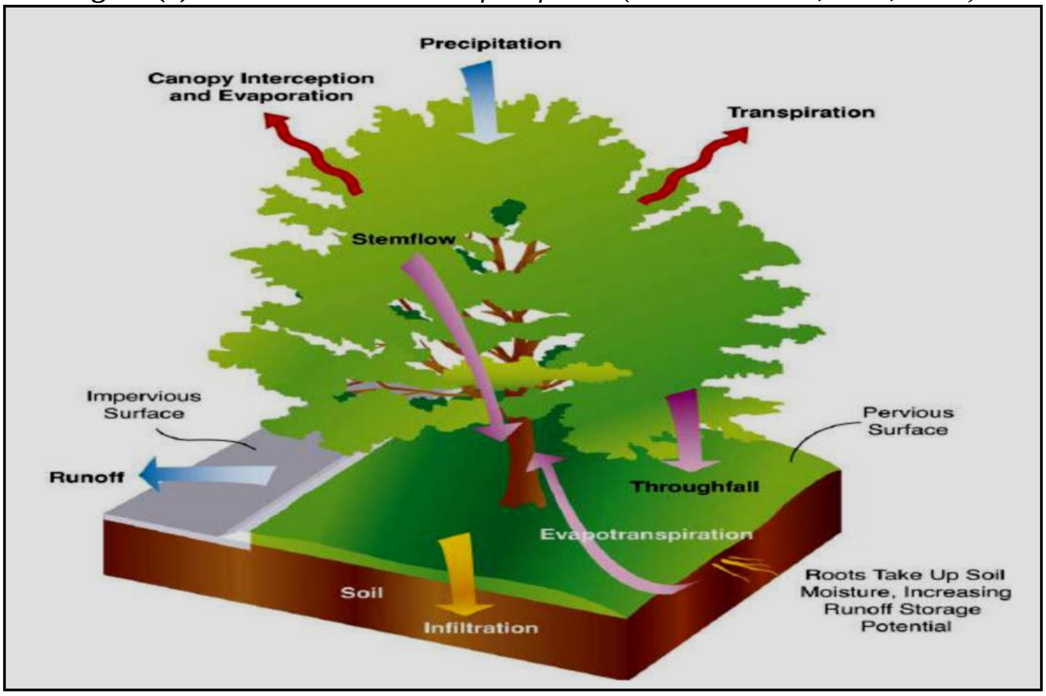
A sustainable landscape is one where the natural resources are protected, where wildlife habitat is improved and where human uses and maintenance practices do not harm the environment. Native vegetation is used whenever possible, and the use of turf grass is minimized. Maintenance practices are chosen to reduce their impact on the environment, while at the same time save money (Adams and Sierra, 2009). Landscapes that are managed to enhance natural resources and that use sustainable practices have been shown to have numerous benefits, such as (Berman, 2008):

a) Economic Benefits:
Although the economic valuation of urban landscape is difficult, open and green spaces have economic benefits in several ways (CABE, 2004):
1. Their aesthetic contribution to cityscape influences property values. In general, urban landscape elements increase the nearby property value and enhance marketability of real estate (Anonymous, 2010). Accessibility, quality and visibility are basic factors that determine economic value of urban landscapes in this context.
2. Urban landscapes provide employment opportunities during their design, construction and maintenance. The construction and maintenance of urban landscapes also supports other sectors such as playground manufacturers and nurseries.
3. The health benefits of urban landscapes which were summarized above can reduce the costs of national health expenses.
4. Public urban landscapes provide environments for walking, sports and other recreational activities for no cost at all, especially for lower income groups.
5. Green spaces can help energy saving. Right selection and planting of plants can provide cooler environments in summer and warmer environments in winter thus reduce air conditioning expenses.
6. Urban landscapes can enhance tourism in cities by attracting people. Park Güell in Barcelona, Spain and Al-Azhar Park in Egypt is a perfect example of how a park can become a global tourism destination.

b) Environmental Benefits:
It was assumed by contemporary urban ecology that urban areas are ecosystems since they have interacting biological and physical complexes (Wong, 2012). However, ecology has been neglected in urban planning systems of most developing countries, which mostly focus on the relationship between physical and socioeconomic aspects of an urban development. Urban green spaces are fundamental in sustaining the urban ecology (Tilley, 2002). Some of the environmental and ecological benefits of the urban landscape are listed below (Sue, 2012):
1. Urban green spaces provide flora and fauna with a habitat to live and therefore support biodiversity conservation.
2. They also act as ecological corridors between urban and rural areas. They support movement of living organisms between these areas.
3. Vegetation cover in urban landscape helps to improve microclimate of urban areas where climate is warmer than their surroundings due to dense built environment and human activities.

4. Vegetation cover raises humidity levels, reduces the stress of the heat island and mitigates the less desirable effects of urban climate. Daytime temperature in large parks was found to be 2-3°C lower than the surrounding streets (Georgi and Zafiriadis, 2006).
5. Vegetation helps to decrease carbon emission levels in cities. Through photosynthesis process in plants CO2 in the air is converted to O2. Therefore, urban vegetation cover helps to reduce excess CO2 in the urban atmosphere. Although the degree of trees' drawing carbon emissions from the air is affected by their size, canopy cover, age and health, large trees can lower carbon emission in the atmosphere by 2-3% (Mikami, and Kubo, 2001).
6. Vegetation covers also filters out other particles and dust in the air. Trees have the capacity to remove pollutants like sulfur dioxide and nitrogen from the air, thus reducing the incidences of asthma and other respiratory diseases.
7. Green spaces absorb and reduce the noise generated by human activities, especially trees act like noise barriers.
8. Vegetation cover and soil in urban landscape controls water regime and reduces runoff, hence helps to prevent water floods by absorbing excess water.
9. Trees can also act like windbreaker.
10. Trees scattered through public landscapes can reduce heating consumption, not only through the cooling processes of evapotranspiration and direct shading, but also by reducing wind spends through surface roughness. Decreasing wind speed reduces the amount of cold air that can flow into a building, which is a major catalyst in the loss of heat during winter (Akbari, et al, 2001). Urban trees are considered a major factor in providing cooling, via shade and evapo-transpiration, and are estimated to offer over 950 MJ (almost 270 kWh) cooling per day, per tree, due to evapo-transpiration effects alone (Mikami and Kubo 2001). Despite the potential for urban vegetation to provide cooling, effectiveness relates to soil water availability.
11. According to the University of Washington's Center for Urban Horticulture (Akbari,et al, 2001), a mature tree canopy can reduce air temperature by five to ten degrees, while the addition of blacktop and other hard, non-porous surfaces contribute to higher temperatures. The evaporation from one large tree can produce the same cooling effect of 10 room-size air conditioners operating 24 hours a day (Figure 1), explains the environmental benefits of trees.

Figure (1) *The environmental benefits of tree. (Source: Akbari, et al, 2001)*



c) Social and Health Benefits:

Trees and green space in urban and community areas can create a positive image and provide an aesthetically pleasing experience for residents. As evidence grows of the vital role that parks play in supporting our health, experts are urging stronger partnerships between the health sector and park and recreation services (Berman, 2008). Although the importance of physical activity for human health is well understood, the vital role that parks play in providing an outlet for this physical activity has only recently been acknowledged (Dunnett, et al 2002). Parks, playgrounds, greenways, trails, and community open spaces help keep residents and their communities fit and healthy. Parks have a role to play in low-income areas, which often have less access to parks than those in more affluent suburbs. One of their key messages is that parks increase 'social capital'. That is, when people work together in a community garden or help create a park from vacant land, they get to know one another, trust one another, and look out for one another (Benson and Roe, 2000). In the last century urban landscapes were referred as being “lungs of the city”, which emphasizes their physical health benefits for urban citizens. As mentioned previously, urban vegetation cover provides a cleaner environment (Bell et al 2005). The old vision of street trees, parks, and public green spaces are regarded as ways to beautify the communities and make life a little more pleasant, these days, their function has been changed from a visual scenatic function to an additional environmental aspect. In summary, sustainable landscapes not only have tremendous value for the environment and wildlife habitat, but also for human health, safety and the state of the economy. When creating new, or enhancing old parks, housing developments and other landscapes, focusing more attention towards natural resource conservation and sustainability is a step that can improve the quality of life for everyone in a community (Figure 2) explains in the roles and functions of the urban landscapes within the sustainability cycle.

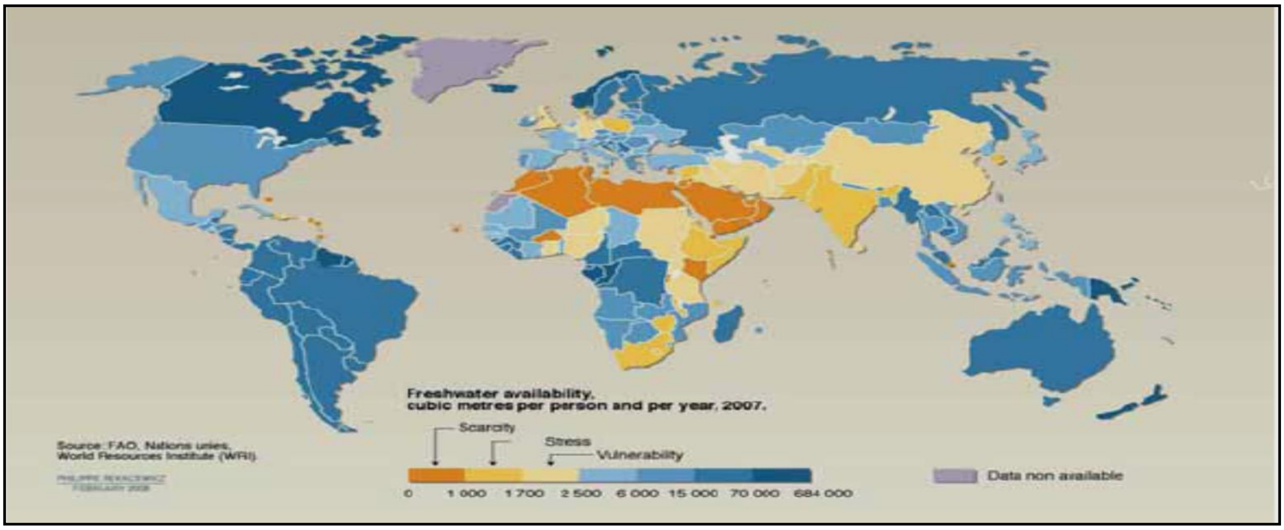
2.3 *Urban landscape sustainability principles*

The principles of sustainable landscape design recognizes the interconnection of natural resources, human resources, site design, building design, energy management, water supply, waste prevention, and facility maintenance and operation (Rahnama and Razzaghian, 2012). According to Benson and Roe (2000) a sustainable design should be well-designed to suit local environmental conditions; contains carefully selected water wise plants; contains plants that will not become environmental weeds; conserves water by using mulch, efficient irrigation, watering only when necessary and grouping plants with similar water needs together; provides habitat for local native fauna such as small birds, butterflies, bats, lizards and frogs; avoids use of pesticide or other chemicals that could harm the natural insect populations and other beneficial organisms; consumes minimal non-renewable energy in construction and maintenance; uses sustainable and locally sourced materials and products, and avoids materials such as rocks, pebbles or wood collected from wild landscapes. The key principles of sustainable landscaping are to design to suit local environmental conditions, water wise or water appropriate plant selection, non-invasive plant selection, and practical water conservation measures. Also, the provision of habitat for local native fauna. The minimal use of pesticides and harmful chemicals and minimal requirement for non-renewable energy consumption is a must. In addition, to using of locally and sustainable sourced materials and products (Malpas, 2011).

3 The Role of Water in the Sustainable Urban Public Landscapes (SUPL)

As water demand continues to grow, and with it the scarcity of renewable natural water resources, we will need to find alternative water sources to complement better water management measures (Domene and Sauri, 2006). Potable water is a finite resource. Water is part of the hydrologic cycle and is the only molecule that can be found in three phases at the same time (vapor, water and ice). Yet, the supply is finite even though it cycles between the three phases in our environment. Pollution also continues to affect the supply of potable water. The earth's water supply is only 2.8% fresh water. (0.l6% is groundwater, 0.01% is lakes and streams, 2.2% is glaciers and icecaps, and 0.01% is water vapor.) The remainder, 97.2%, is salt water. The world is in the midst of a major transition in water management and use (Niemczynowicz, 1999) (Figure 2), shows the water scarcity worldwide.

Figure (2) *The World water map showing the amount and availability of water. (Source: BSRP 2007)*

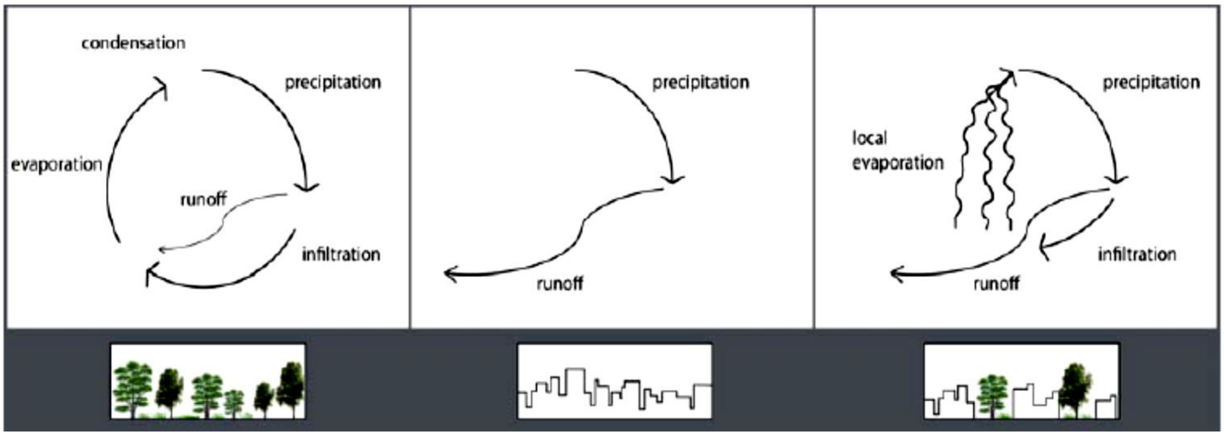


According to Shepherd (2006), over the past century, the construction of massive infrastructure in the form of dams, aqueducts, pipelines, and complex centralized treatment plants, funded with a limited set of financial tools and approaches, dominated the water agenda. This “hard path” approach focused on expanding water supply brought tremendous benefits to billions of people, reduced the incidence of water-related diseases, expanded the generation of hydropower and irrigated agriculture, and moderated the risks of devastating floods and droughts. But the hard path also had substantial, often unanticipated social, economic, and environmental costs.

3.1. Water in the urban landscape planning process

Water is referenced in different ways by many disciplines including design, planning, ecology, geology, anthropology, psychology, sociology, mythology, religion, art, literature and history. But the common thread among all the disciplines is that water is universally perceived as a favorable element. More than anything else, water is a source of life and great symbol for life. It is determined to be critical for human survival. It is considered powerful, and it has been here, in relatively the same quantity understanding the relationship between human needs and the use of water in landscape design and form since the planet's beginning. Urban green spaces can have a positive impact on the hydrological characteristic of urban catchments. The hydrology of urban areas have been highly modified by constructed impervious surfaces such as roads and roofs which increase the velocity and volume of run-off from urban catchments (Shepherd 2006). Water appears in the urban public landscapes in various forms such as, Wastewater and gray water managed by urban sanitation systems; Drinking (Potable) water for daily use (drinking, cooking); Storm water that needs to be drained from hard surfaces (roofs, streets, etc.) to prevent flooding and keep streets and buildings dry and safe; Natural water bodies (e.g. rivers, lakes, brooks); and artificial water bodies and features in open spaces (e.g. fountains, water basins, water streams) contributing to the amenity of cities (improving micro climate, reducing dust and air pollutants, and providing recreation) (Domene, Sauri, 2006). Water plays a significant role in everyday life. Aside from exceptional experiences such as flood and drought disasters, most people are not aware of the function of water. Conventional methods for water management fail to help the city to promote the importance of water resources (GIWE, 2011). Under natural conditions, water operates in a cycle of precipitation, infiltration, surface runoff, and evaporation. However, in urban areas, this cycle is disturbed and cannot run its course. Urban water is polluted, cannot infiltrate the ground due to paved surfaces and is rapidly collected and discharged to the public draining systems leaving no time for evaporation as shown in (Figure 3). Finally, this negatively impacts groundwater recharge, water supplies, the qualitative and quantitative state of receiving rivers, and urban climate. Urban green space impacts significantly on the micro-climate of a region by modifying extremes of climate, improving the hydrological cycle and improving plant health and biodiversity and adding to soil stability (Hoyer, et al, 2011) Most of these advantages are dependent on the vegetation being maintained by irrigation during drought. Water is an essential element in any ecosystem. Yet, it is a very critical feature in arid ecosystems where water is scarce with evaporation exceeds precipitation also the amount of rainfall is frequently low and untimely distributed. Water efficiency in the landscape planning process means: The planned management of potable water to prevent waste, overuse, and exploitation of the resource. In that sense, effective water-efficiency planning seeks to 'do more with less' with no sacrificing performance (Adams, and Sierra, 2009).

Figure (3) *Water cycle in natural systems (left): in an urban area (middle) and in an urban area with urban public landscapes (Source: The author, after Hoyer, et al, 2011).*



Thus, water management policies in arid landscapes, like in our case in Cairo, should be liable to address two related targets: (a) controlling features of the water resource, especially quantity, quality, and timing; and (b) preservation of landscape elements. Several studies were carried out concluded that urban evapotranspiration is a substantial component of the water balance (GIWEH, 2011). These studies found that the amount of water used in evapotranspiration was almost twice the amount of water that was lost from the studied area through run-off. By adding water to the urban landscape, quantifiable benefits in the form of cooler air temperature and energy consumption savings will result (Hoyer, et al, 2011). In the urban context, there is an aim to better tune the impact of urban development on the natural water cycle. The main task is the establishment of an inner, urban, water cycle loop through the implementation of reuse strategies. To this end, the understanding of the natural pre-development water balance and the post-development water balance is of a great importance (BSRP, 2007). An integrated urban water management system encompasses the three principal water streams: potable and non potable water supply, storm water drainage and wastewater disposal (Domene and Sauri, 2006). It implies integration of water conservation, a seasonal storage system, storm water management, a peak storage system and wastewater disposal, a purification system into one system and their decentralization into drainage and water/wastewater management clusters (Connellan, 2005). Water conservation and reclamation can be located near the point of use and, like this, in-puts out-puts regulations with their long distance transfers can be minimized. Planners and designers are therefore asked to investigate new strategies and tools for integrating water and its infrastructures in urban life and in the image of the city (Adams, and Sierra, 2009). Saving water, reducing paved surfaces, retaining and infiltrating rainwater, preventing water pollution, reusing and recycling water and other integrated and decentralized measures are imperatives to be tested, improved and implemented in the context of modern and livable cities (GIWE, 2011).

3.2 Water as a visual element in landscape design

In the visual landscape, water is a common and abundant element not unlike earth and rock. But what distinguishes water from other landscape elements is its unique ability to be molded, sculpted and re-channeled. It is ever-present in the landscape and its malleable form provides the designer with unlimited opportunity**.** However, water features are generally placed in the landscape simply to fill an empty space or to reroute the water to a more convenient place with no forethought as to the meaning or value people place on water. Surely these uses of water do not enrich the environment; they merely fill a space (Malpas, 2011). The manner in which water is presented is crucial for success of the water feature. Incorporating the reflective quality of water in the design, preferably with vegetation, sky or natural forms confirms the presence of life in the user's surroundings. For example, lighting both daylight and night lighting, is an element, which will add excitement, dimension and usability to a water feature as seen in (Figure 4). While night lighting adds drama to the feature and extends the number of hours that the feature can be used, underwater lighting adds an intriguing dimension to the feature. Pure water is odorless, colorless, and tasteless. Yet in the landscape, water often appears in different colors from opaque dark gray to brilliant blue to clear. The apparent color of water changes with lighting, the diurnal and seasonal positions of the sun, with cloud cover, and with particulates carried in the atmosphere or in the water. (Figure 5) illustrates these visual characteristics, which are more extreme and dramatic in arid landscapes (Shepherd 2006).

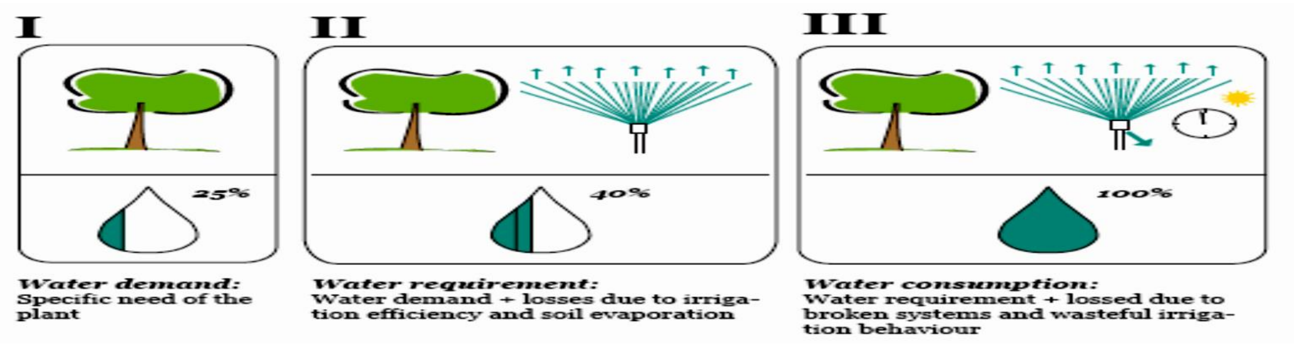
Figure 4: Examples of uses of water lighting both daylight and night lighting. (Source: ASLA 2009).

Figure (5) *Examples of uses of water as a visual element in landscape design. (Source: ASLA 2009).*

3.3 Water as the main source of life in the landscape design process

The most important issue about water function in landscape design apart from its scenatic value, the quantity of water required for irrigating any project. A water budget quantifies all the water flowing into and out of a defined area, such as a watershed or a local park, over a fixed period of time (ASLA, 2009). A water budget looks at precipitation rates, the infiltration of water through the soil, which depends in large part on the amount of non-porous surfaces like roads, evaporation, and the various water users in the area (Georgi, & Zafiriadis, 2006). A water budget can show how much water will be needed for things like restrooms, drinking fountains and irrigation, versus how much water is available. The amount of water being used will depend on factors such as the efficiency rating of faucets and toilets, the time of year (water use is typically higher in the spring and summer) and a whole host of site specific conditions (Connellan, 2005). As illustrated in (Figure 6), the amount of water available will depend on precipitation rates, groundwater levels and stored water. Knowing the amount of water in an area will help to make decisions on how to use and preserve water resources. A sustainable landscape will ensure that human uses of water do not negatively impact the water available for wildlife, plants and the environment. According to (Deister, 2013), there are several systems for calculating the water demand for landscape irrigation, one of the most popular is the University of California Cooperative Extension and California Department of Water Resources 2000, system which is commonly used in order to calculate the water demand for irrigation of any public space.

Figure (6) *Definition of water demand, water requirement and water consumption (Source: Deister, 2013).*



Within this method, the water demand of the planting comprises the demand of the different species, the density of the planting, the microclimate and the reference evaporation rate of the site. To calculate the water requirements, also irrigation efficiency and potential soil evaporation losses are taken into account. These calculations can serve as estimations, but field adjustments as well as upward adjustments due to low water quality, e.g. if reclaimed water is used might still be necessary. Besides, special planting situations, e.g. newly planted or well established planting or trees in turf, can influence the amount of water required for irrigation. Table 1 shows the formula and explains its components.

Table (1) *The water demand formula and its components. (Source: Auth after, Deister, 2013)*

Water Requirement Calculation Formula	Formula Components
Formula to calculate the water demand of a planning **(ETL)**	**(ETL= KL* ETO)** **ETL**= Landscape evapotranspiration (water demand) **KL**= Plant coefficient **ETO**= Reference evapotranspiration
Calculation of plant coefficient **(KL)**	**KL**= Ks* Kd* Kmc **Ks**= Species factor **Kd**= Density factor **Kmc**= Microclimate factor

Up to now, engineers, ecologists, landscape architects, planners and other professionals have generally adopted divergent approaches and standards to the issue of water. However, nowadays, the perspective is changed. Water-related outcomes have to be interrelated with other sustainability objectives that should be included in the urban development and re-development processes. (Dunnett, et al 2002), Besides, the concept of sustainable development stimulates two levels of integration: firstly, the integration of all waters of the water cycle (storm water, groundwater, surface water but also drinking water and wastewater); secondly, the integration of those disciplines and institutions involved in the organization and maintenance of water cycles and related infrastructures (Poulton, 2000). Such a comprehensive approach opens up to more cross-disciplinary opportunities and less generic standardized and normative “solutions”. One of these solutions a key strategy that reduces demand, gray water reuse is an important strategy in improving the resilience of water systems to the impacts of climate change (ASLA, 2009). In addition, gray water reuse can also be considered a relatively secure or drought resistant source of water supply because presumably, gray water generated from showers and washing machines will continue, if at a reduced rate, in the future. Reuse of graywater can help displace demand for water, thus reducing conflicts over water and reducing the demand for new water supply projects (Sue, 2012).

4 A Suggested Methodology for Evaluating the Sustainability of UPL

In order to have a sustainable urban public landscape, it is suggested that several measures may be used to evaluate its sustainability depending on the water efficiency as the component with the relatively high weight in evaluation. The evaluation procedures may be as follows, as shown in Table 2:

Table (2) *The Evaluation checklist for sustainable urban landscapes SUPL. (Source: Author, after Anon, Crossam Georgi, & Zafiriadis, Cadenasso, & Pickett, Poulton).*

SUPL EVALUATION ELEMNTS	CRITERIA OF EVALUATION
Water Efficiency	1. Water wise or water appropriate plant selection. 2. Limiting or eliminating the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation. 3. Using modern strategies to eliminate the use of potable water in irrigation such as desalination and graywater systems. 4. Using storm water or recycled rainwater in irrigation of public spaces. 5. Enhancing irrigation systems by using soil moisture sensor, water pressure regulators and rotary nozzles which overcomes spray deflection broken heads, tilted and sunken sprinklers, arc misalignment and non-rotating heads. 6. Reduction in distribution informality, as poor uniformity leads to longer run times of irrigation causing water inefficiency.
Softscape-Vegetation	1. Using Vegetation cover to improve microclimate of urban areas where climate is warmer than their surroundings due to dense built environment and human activities. 2. Raising humidity levels, reducing the stress of the heat island and mitigates the less desirable effects of urban climate. 3. Decrease carbon emission levels through photosynthesis process in plants CO_2 in the air is converted to O_2. Therefore, helps to reduce excess CO_2 in the urban atmosphere. Although the degree of trees' drawing carbon emissions from the air is affected by their size, canopy cover, age and health, large trees can lower carbon emission in the atmosphere by 2-3%. It also filters out other particles and dust in the air. 4. Softscape absorb and reduce the noise generated by human activities, especially trees act like noise barriers. 5. Vegetation covers and soil in controls water regime and reduces runoff, hence helps to prevent water floods by absorbing excess water. Trees can also act like windbreaker. 6. Trees scattered through public landscapes can reduce heating consumption, not only through the cooling processes of evapotranspiration and direct shading, but also by reducing wind spends through surface roughness.
Biodiversity (Habitats & Ecosystems Conservation)	1. Providing flora and fauna with a habitat to live and therefore support biodiversity conservation. 2. Acting as ecological corridors between urban and rural areas. They support movement of living organisms between these areas. Also protection and restoration of habitats.
Innovation in Design	1. Design is done to suit local environmental conditions. 2. Application of the general design principles of simplicity, balance, unity and harmony, scale ratio and proportion, as well as visual interest. 3. In addition to fulfilling all functional requirements.
Site & Resources Management	1. Use of locally and sustainable sourced materials and products. 2. Minimal use of pesticides and harmful chemicals. 3. Minimal requirement for non-renewable energy consumption. 4. Using pores surface hardscape helps water penetration to existing soil and form a ground water reservoir.

5 The Egyptian Experience in SUPL

As mentioned earlier, the urban public landscape open spaces can range from playing fields to highly maintained environments to relatively natural landscapes. They are commonly open to public access, however, urban open spaces may be privately owned. Areas outside of city boundaries, such as state and national parks as well as open space in the countryside, are not considered urban open space. Streets, piazzas, plazas and urban squares are not always defined as urban open space in land use planning. The value of urban open space can also be considered with regards to the specific functions it provides. Kafafy (2010) drew up a detailed analysis of the amount, the distribution and also the kind of UPL, which can be found in Cairo. He analyzed different neighborhoods, their urban pattern and the resulting green open space facilities. One very interesting finding is that according to Kafafy's estimations, 67% of the green open spaces in Cairo are privately owned, while only 33% are provided by the government. In addition, just 1/3 of those 33% of public green open spaces are free to enter. (Kafafy 2010: 88). Egypt has reached a state where the quantity of water available is imposing limits on its national economic development. As indication of scarcity in absolute terms, often the threshold value of 1000 m^3/capita/year is used. Egypt has passed that threshold already in nineties. As a threshold of absolute scarcity 500 m^3/capita/year is used, this will be evident with population predictions for 2025 which will bring Egypt down to 500 m^3/ca/yr. The actual resources currently available for use in Egypt are 55.5 Billion Cubic Meter (BCM)/ year (yr), and 1.0 BCM/yr effective rainfall on the northern strip of the Delta, non-renewable groundwater for western desert and Sinai, while water requirements for different sectors are in the order of 75 BCM/yr. The gap between the needs and availability of water is about 20 BCM/yr. This gap is overcome by recycling (Yassin, 2013). In addition in Cairo public landscapes, due to the inefficient irrigation systems used, the excess water, which occur due to the wrong location of sprinklers leading water to travel over hard surfaces like pavement and carry away fertilizers that could promote the growth of algae and invasive plant species. Also, when pesticides are improperly used or disposed of, any excess pesticide could potentially reach drinking water supplies and could harm humans and native plants. In addition to maintenance practices, the design of these areas is not always helpful to conserving and enhancing the natural environment. Roads and parking lots fragment habitats. Plants are chosen for their looks rather than their wildlife benefits, and human uses like recreation and industry can degrade or eliminate habitat for most animal and plant species (Deister, 2013). Furthermore, a site's geology and soils may not naturally support the chosen plants. So as development pressures rise, wildlife have nowhere to go, with all the turf yards, shopping plaza parking lots and freeways taking up all available habitat, creating an unbalanced landscape. These days, in Egypt, the manifold dimensions of sustainable landscapes raise challenging questions over the nature of how to design, plan, and manage them. The matter is further complicated by a variety of traditions and subcultures and by the different scales and concerns of urban and landscape practitioners (Yassin, 2013). However, some common themes emerge around the canons of sustainability. Further, there is a growing acknowledgement of the importance of all landscape, not only that deemed "outstanding" in terms of natural beauty. Also, people may not be comfortable with sustainable landscape; adjusting to it may take time. However implementing just one or a few principles of sustainable design can significantly provide less environmental decline. The benefits may include also; more effective use of water, pesticides and other chemical resources; more valuable wildlife habitat; enhanced landscape beauty; and cost savings from reduced maintenance, labor and resource use (Deister, 2013).

5.2 Applying the Suggested Methodology on Cairo SUPL

This evaluation methodology was carried out among a sample of 10 public parks and 5 streetscapes. In order to demonstrate the purpose of this research, six cases were selected, five parks and a streetscape based on a number of site visits, detailed survey for plant species and typologies inspections and meetings with experts, mangers of these landscapes. Also, the water consumption of each case was calculated based on a simplified version of the water demand formula mentioned earlier. These cases are:

Case Study 1: Al-Asmak Garden, which is considered to be Cairo's aquarium. It is located in the Zamalik Island with a total area of almost 12 feddans. The main purpose of design was to demonstrate all types of sea life. It consists of caves hosting the aquarium as well as a main hilly shaped plateau as a landmark for the whole park. Hardscape is dominant although the material used is non-porous which has negative impacts on the hydrological cycle. When applying the Water Demand Calculation Formula the park water consumption is 300 m3 per day, which is considered moderate in consumption (Figure 7).

Case Study 2: Al-Orman Garden, which is considered Cairo main Botanical Park. It is situated in front of Cairo University and through history; it was connected with the Giza Zoo and was separated due to planning purposes. The park total area is around 35 feddans. It hosts all native and non-native plant species, the concept of design main purpose was to demonstrate the various types of vegetation in a scientific order. When applying the Water Demand Calculation Formula the park water consumption is 1700 m3 per day, which is considered very high in consumption (Figure 8).

Case Study 3: Al-Fostat Garden, which is considered one of Cairo biggest public parks. It is situated in Masr Al-Kadima with a total area of almost 38 feddans. The park landscape design is very simply, with massive lawns areas and large tree patches, with some hardscape plazas. When applying the Water Demand Calculation Formula the park water consumption is 1300 m3 per day, which is considered very high in consumption (Figure 9).

Case Study 5: Al-Orouba Garden (Japanese Cherry Garden), this park is located on Cairo's main road to the airport. The park was considered to a brown field transformation, as the area of the park, which is almost 2.5 feddans, was solid waste and garbage collecting area. The main design consist of a simple walk way trail and lush green lawn hosting some none native plant species which is the Japanese cherry tree, which was donated as gift to the Egyptian Government by the Emperor of Japan. When applying the Water Demand Calculation Formula the park water consumption is 100 m3 per day, which is considered very high in consumption, taking into consideration that main source of water is gray water (Figure 10).

Case Study 4: The Child Park garden, which is located in Nasr City. The planning of Nasr City was done to host several community gardens; the Park is one of them with a total area of almost 22 feddans. The design of the park was done to accommodate several community activities such as a children play area, library and mini funfair. The vegetation cover is considered to be semi-lush a mixture of green lawns and large tree surrounding the park circumference. When applying the Water Demand Calculation Formula the park water consumption is 750 m3 per day, which is considered very high in consumption, taking into consideration that main source of water is potable water (Figure 11).

Case Study 6: Autostrad Road, (10000000 tree sector) this project was targeting greening a vehicular axis as an initiative for saving the environment and creating green environment in the desert environment around the airport. The project acted as a turning point regarding the lands surrounding the project and the large scale of investment that appeared based on this project. One of the basic concepts was to create a middle park (island) that people could use rather than the narrow sidewalks. The area of vegetation is limited to the middle island of the street only. It has many ornamental plants. The types of trees are not changing much along the axes. The most are a grass cover, plants or shrubs on the boundaries or around the trees. The trees are in the middle or two rows on the sides. The social activity is minimal inside these areas as it is only acting as a good view for the street. The total length of this road is 5 km and the length of this specified sector is 1.5 km. When applying the Water Demand Calculation Formula the park water consumption is 500 m3 per day, which is considered very high. But the main network water source is gray water, which is an asset to the water efficiency (Figure 12).
The evaluation was performed on the selected case studies, reported on by Table 3; a simplification of the items in the SUPL Evaluation Criteria table (Table 2) was done to facilitate the understanding of its components. A grading system was made to evaluate the items according to the following criteria:
High Efficiency grade: this grade is given when the item fulfills the sustainability aspects in general, with emphasis on the water efficiency in particular.
Medium Efficiency Grade: this grade is given when the items does not fit well with the sustainability aspects in general, with emphasis on the water efficiency in particular.
Low Efficiency Grade: this grade is given when the items have negative impact on the sustainability aspects in general, with emphasis on the water efficiency in particular.

5.3 Assessment and Findings of the Case Studies

After reviewing the case studies, from Table 3, the following findings were deduced concerning the existing condition. All UPL suffer some major deficits. Nonfunctional “landscape scenery design” with high maintenance requirements and excessive water consumption are a common finding. Water budget is not a factor in design. There are no solutions for limiting water consumptions of different landscape projects. The application of water reuse, recycle and treatment as solutions for limiting high water usage through landscape is minimal. Different irrigation techniques and control systems for limiting the wasted water through landscape consumption does not exist. Integration of the permeability of the flooring material is not considered in the design. Lack of maintenance for public parks and open spaces is a common case. The concept of edible landscape is absent in application. The density of vegetation and its effect on transpiration and accordingly the water consumption are fields that are always neglected in the landscape design Stereotyped types of vegetation used in all open green spaces in Cairo.

Figure (7) *Case study 1, Al-Asmak garden analysis, showing the water efficiency condition of the garden (Source: by the author).*

Figure (8) *Case study 2, Al-Orman garden analysis showing the water efficiency condition of the garden (Source: by the author).*

Figure (9) *Case study 3, Al-Fostat garden analysis showing the water efficiency condition of the garden (Source: by the author).*

Figure (10) *Case study 4, Al-Orouba garden analysis showing the water efficiency condition of the garden (Source: by the author).*

Figure (11) *Case study 5, Child garden analysis showing the water efficiency condition of the garden (Source: by the author).*

Figure (12) *Case study 6, Autostrade (1000000 Tree sector) showing the water efficiency condition of the garden (Source: by the author).*

Table (3) *Assessments and findings of the six case studies (Source: by the author).*

SUPL Evaluation Elements	Criteria of Evaluation	Efficiency					
		CS 1	C S2	CS 3	CS 4	CS 5	CS 6
Water Efficiency	using potable water for irrigation	low	low	low	high	low	high
	using modern strategies for irrigation	low	low	low	medium	low	medium
	poor uniformality of water distribuition	medium	low	low	medium	low	medium
	water consumption calculation	high	low	low	medium	low	medium
Softscape Vegetation	selecting plants with low water consumption	low	medium	medium	low	medium	high
	plant mass affecting co2 decrease	high	high	medium	high	medium	medium
	trees effection heat island	high	high	high	high	high	high
	wind breaking effect	high	high	high	medium	high	high
Biodiversity (Habitats & Ecosystem Conservation)	providing enough flora and fauna	high	high	high	medium	medium	medium
	selecting of native spieces	low	medium	low	medium	high	high
	green ecological corridor	medium	high	high	low	medium	high
Inovation in design	suitability with local environement	medium	high	high	medium	medium	high
	scenatic value	high	high	medium	low	medium	high
	functionality in design/proper use element of water	medium	high	low	medium	high	high
Site & Resources Management	use of local materials	low	medium	medium	medium	medium	medium
	minimum use of perticides	medium	high	low	medium	low	medium
	renewable energy consumption	low	low	low	low	low	low
	recycling solid wastes	low	low	low	medium	medium	medium
	using of porase suface hardscape	low	low	low	low	medium	medium
Total		medium	low	low	medium	low	high

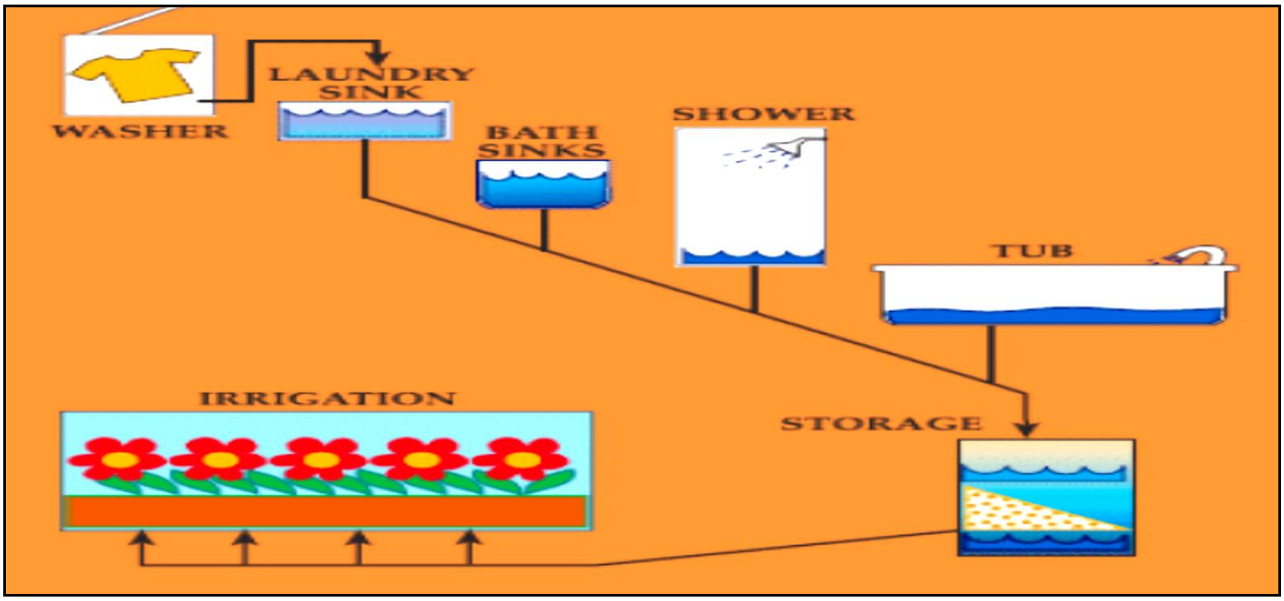
low efficiency medium efficieny high efficieny

5.4 Tools and Methods to Enhance Sustainability and Water Efficiency in Cairo SUPL

In order to overcome the deficiencies the overall sustainability in general and the water efficiency in particular in Cairo urban public landscapes, the following blue print me may suggested:

A) Introducing the Use of Gray water as Main Source of Irrigation: According to Cohen, (2009) Gray water is the untreated wastewater, excluding toilet and, in most cases, dishwasher and kitchen sink wastewaters, as illustrated in (Figure 13). Wastewater from the toilet and bidet is "backwater." Exclusion of toilet waste does not necessarily prevent fecal matter and other human waste from entering the gray water system, albeit in small quantities. Examples of routes for such contamination shown in (Figure 14) include shower water, bathwater, and washing machine discharge after cleaning of soiled underwear and/or diapers. California's latest gray water standards define gray water as: "gray water" means untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. "Gray water" includes but is not limited to wastewater from bathtubs, showers, bathroom washbasins, clothes washing machines, and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers" (Bahman, 2010: 1-2).

Figure (13) *Sources of Gray water for landscape irrigation. (Source: Cohen, (2009).*



Gray water use is not something new to our communities. In rural areas throughout the world, reuse of water that has already been used for washing, cleaning, and bathing has always been a common practice. With the advent of piped water systems and wastewater collection networks, this practice diminished in importance, especially as communities grew denser and increasingly urbanized in the 20th century. Population explosion, especially in the arid and semi-arid regions of the world, has exerted a tremendous stress on available water resources. People have responded to water rationing, elevated water costs, and calls for water conservation with ingenious methods beyond those "best management practices" (BMPs) advanced by their water purveyors. Gray water reuse is indeed a rediscovery of a very ancient practice, one that went out of style because it was deemed unsanitary, potentially dangerous to public health, and needless because of the availability of cheap, seemingly limitless tap (potable) water and easy wastewater disposal (Zoubi et al 2012). Each episode of drought in the past 50 years has brought about a surge of new advocates and users of gray water with various levels of sophistication (Travis et al., 2010). Users of the simplest of gray water systems carry the warm-up water from the sink or bath to throw on their landscape plants. Others concoct plumbing systems that capture washing machine effluents.

Users of still more elaborate systems build a second drainage system in their residence to capture nearly all gray water sources and lead the water to storage tanks, treatment systems, and application to the irrigated landscape areas on the property. While, what is called Backwater is collected in a separate sewer and sent to the central treatment plant. Effluent from the onsite treatment system is then utilized as non-potable recycled water in a manner similar to that for recycled water. The rationale for such systems is that (a) gray water sources within the building provide enough water for the non-potable water demand in the building and its vicinity and (b) the lower solid loading, BOD loading, and microbial content of gray water make treatment less costly and less energy-intensive (Cohen 2009). In order to overcome the accusations for gray water being dangerous for public health the following precautions should be considered (Zoubi et al 2012):

1. First and foremost, avoid human contact with gray water or with soil irrigated with gray water.

2. Use gray water for household gardening, composting, and lawn and landscape irrigation, but use it in a way that it does not run off your own property.

3. Do not surface irrigate any plants that produce food, except for citrus and nut trees.

4. Use only flood or drip irrigation to water lawns and landscaping. Spraying gray water is prohibited.

5. Gray water may be used only in locations where groundwater is at least 5 ft. below the surface.

6. Label pipes carrying Gray water under pressure to eliminate confusion between gray water and drinking water pipes.

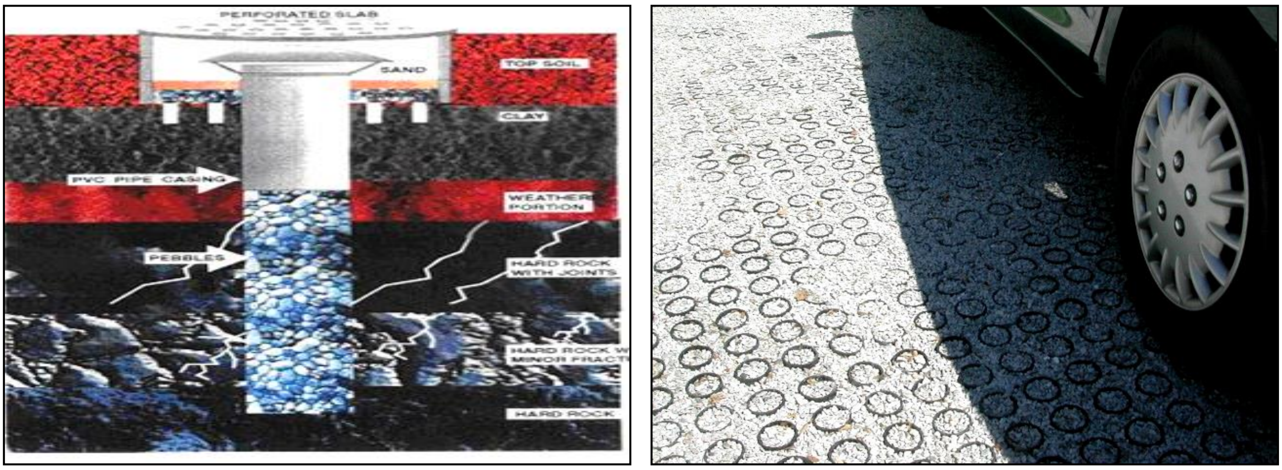
7. Gray water from washing diapers or other infectious garments must be discharged to a residential sewer or other wastewater facility, unless it can be disinfected prior to its use.

8. Surface accumulation of Gray water must be kept to a minimum.

One of the significant incentives for reuse of Gray water in future landscaping of our parks is the point credit system used by green building certification organizations, such as LEED (Leadership in Energy and Environmental Design), developed by the U.S. Green Building Council (USGBC) (Travis et al., 2010). This system provides a suite of standards for environmentally sustainable projects. Since its inception in 1998, LEED has grown to encompass more than 14,000 projects in the United States and 30 countries covering 1.062 billion square ft. (99 km^2) of development area (Cohen 2009). LEED is an internationally recognized green building certification system providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emission reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts. The goal of the Water Efficiency credit category is to encourage smarter use of water inside and out. Water reduction is typically achieved through more-efficient appliances, fixtures, and fittings indoors and through water-wise landscaping outdoors (Zoubi et al 2012).

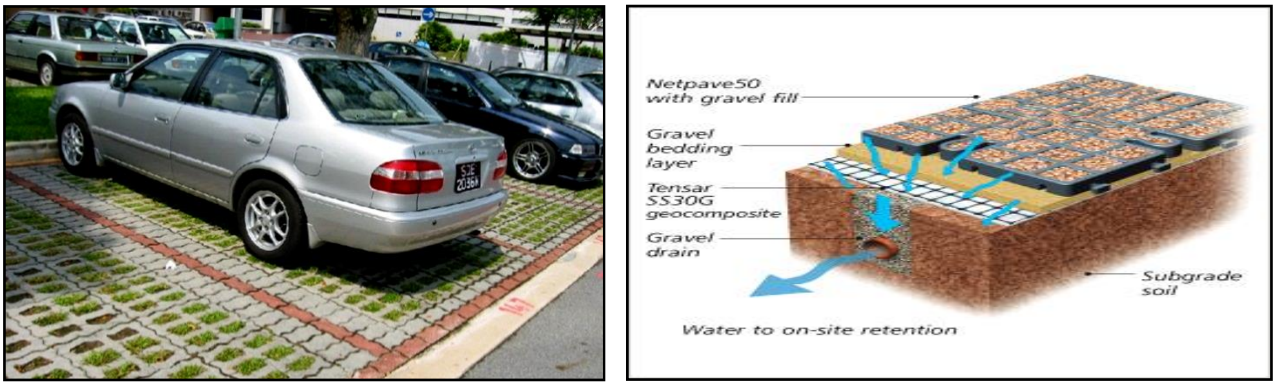
B) Landscape Design Concepts Modifications: All design concepts should take into consideration the water budget calculation as a main constrain while formulating the design concept in order to create water efficient landscapes. Select plant material that can tolerate drought and reflected heat from play surfaces. Plant larger shade trees to provide shade and cooling over play areas. Use products that promote a site's hydrological, soil, vegetative, habitat or climatic health and improve overall ecological functioning. Use products and assemblies that reduce the urban heat island effect. Use products and assemblies that reduce energy and water consumption during site operations. Use porous pavement such as stabilized gravel, porous concrete, porous aggregate unit pavers, stone or concrete unit pavers, and decks in hardscape areas that are suitable for infiltration. Consider clogging of cells in porous pavements as explained in (Figure 14). Possible adverse changes to the soil pH caused by leaching from pavers and crushed stone. Spray features can reduce water use through low flow and misting sprays, and reduce water waste by directing runoff to planted areas (Anon, 2009).

Figure (14) *Use porous pavement and apply water filter hardscape techniques (Source: Anon, 2009).*



Streetscapes should be looked at, as more than transportation corridors, they are also public spaces. By transforming street medians, traffic triangles, and other road configurations into gardens with vegetative and canopy cover, streetscapes can reduce airborne particulates, carbon dioxide, the urban heat island effect, and ground level ozone by reducing ambient temperatures. Trees and other vegetation can provide shading, evaporative cooling, habitat, and storm water capture. Trees, shrubs, perennials, and groundcovers in paved, vacant traffic islands and medians can serve as small ecologically functional areas with a positive cumulative impact to the city’s appearance and environmental quality. Planting in the public right of way requires careful site assessment and design. Sub grade compaction, poor soil, poor infiltration rates, and underground utilities are common. For street pavement, consider using porous asphalt to enhance the hydrological cycle. Porous asphalt pavement has been successfully used in low traffic areas for more than two decades these systems allow the penetration of water to the sub-soils and continue the hydraulic cycle as seen in (Figure 15).

Figure (15) *The Porous asphalt pavement for streets and parking lots (Source: Anon, 2009).*



C) Irrigation System Water Efficiency Techniques: Conserve through proper design of irrigation systems and by using high irrigation efficiency application methods and proper pressure regulation, (i.e. high efficiency verses spray irrigation). Conserve 20% - 40% of irrigation water annually by using a “smart” irrigation controller (automatically adjusts run times based on actual weather or soil moisture conditions. Conserve through proper hydro zoning. (Separation of irrigation zones/ stations/ run times according to areas of the landscape with similar water needs based on plant species water requirements, slope/aspect, soil conditions, exposure (sun/ shade), wind, or other microclimate factors.) Preserve by using areas of non-irrigated inert groundcovers/ mulches. A proper maintenance of irrigation systems is required. Also, irrigating during hours with the least evaporation (evening or early morning) (Domene, Sauri, 2006). Use new irrigation strategies such as Gray water, which is the water that can be collected from sinks, tubs, dishwashers, clothing washers, etc. and reused within the landscape. The reusable water is collected by connecting the drain lines to pipes that flow to a sealed filtering tank instead of the sewage system. This tank has an overflow connection to the sewer system with a backflow prevention device, which protects the reusable water. In case the reusable water is not produced in a sufficient quantity, potable water is added to the system to maintain the required water needs of the landscape. Using a properly designed and installed gray water and rainwater capture/harvesting system can utilize up to half of the water used from a home. Upgrading irrigations controllers to weather based or soil moisture sensing “Smart Clocks” will distribute the appropriate amount of irrigation water based on plant requirements, soil type, and actual weather/ soil moisture conditions, thus conserving an estimated 20% - 40% of irrigation water annually compared to standard clocks. Inefficient spray nozzles should be retrofitted with high efficiency irrigation systems. Retrofitting non-functional (purely decorative) turf areas with native species, lower water use plantings, newer hybrids of more water efficient turf grasses, or inert materials such as decomposed granite and decorative gravel will provide additional water conservation (GIWEH, 2011) as shown in (Figure 16)***.***

Figure (16) *Modern techniques in irrigation that helps to improve water efficiency (Source: GIWEH 2011).*

D) Vegetation / Softscape Selection: Conserve by using low water use plant species Native plants typically survive with minimal amounts of supplemental irrigation, are adapted to the climate, and provide habitat for birds and other wildlife species. The planting of native plants where possible and appropriate will contribute to reduction of water use, minimize maintenance, reduce introduced weed species, and provide a regionally appropriate aesthetic compatible with the natural environment. (Figure 17) explains how a self-sustaining native landscape will survive drought and establish itself in perpetuity, intercepting rain in the leaf canopy, increasing water infiltration into soil, slowing surface run-off, reducing flooding, and erosion. A self-sustaining native landscape can self-seed, regenerate and continue to establish which will continually lower maintenance requirements. Native landscapes require little or no supplemental irrigation and require little or no trimming or manicuring.

Figure (17) *Some planting concepts and techniques to enhance the water efficiency and site sustainability (Source: ASLA, 2009).*

6 Conclusion and Issues to be raised

In the 19th century with massive urbanization in Cairo, the continued explosive growth of urban areas and the decline of nature throughout the 20th century, the alienation between people and the nature was increased. Urban public landscapes and related human health issues are a critical component of any state, regional, and local infrastructure plan for livable, just communities. Urban public landscapes in Cairo are the core values at stake in building public infrastructure: providing children the simple joys of playing in the park; improving health and recreation; equal access to public resources; democratic participation in deciding the future of the community; economic vitality for all with increased property values, local jobs, small business contracts, and affordable housing; spiritual values in protecting people and the earth; the environmental benefits of clean air, water, and ground; and sustainable regional planning. Urban public landscapes should be vital places for us to learn, play, grow, and connect with both nature and our neighbors and communities in modern and urbanized society. They refill our air and water; they protect or provide safe havens for Cairo. They may define what a civil society is; they define what a livable city is. The need to achieve a sustainable future is the driving force changing the way we live and work in the 21st century Cairo. Climate change, loss of biological diversity, declining air and soil quality, the spread of pest plants and animals and shortages of drinking quality fresh water all point towards a critical need for this behavior change. Cairo environmental problem is the non-sustainable way we live. The challenge to our generation is to bring about change in a way that is respectful and creative. Our landscapes in Egypt in general and Cairo in particular, are therefore a resource, which is to be used prudently and sustainable; they are the matrix through which, with our design skills and ingenuity, we can accommodate development. The great opportunity for urban communities and urban landscapes is in their potential contribution to a healthy future for urban environments. This means much more than building 'green' parks and gardens that function as air-cleansing lungs or places for family fun and fitness. It involves enhancing and promoting modern techniques for getting the best environmental sustainability benefits. As water shortages, droughts, and awareness of water scarcity become increasingly popular topics in the media and public discourse, any measure to reduce demand for water is viewed favorably and given credit for achieving sustainability goals. Gray water is no exception. In fact, Gray water appears to be more favorably viewed by the public at large than are the much more sophisticated water reuse projects proposed in some parts of the world, It is recommended to increase the attention to the use of this concept as a source of water irrigation in landscaping our parks. The need to achieve a sustainable future in Cairo should be the driving force changing landscaping practices. Thus, a well-designed sustainable landscape that reflects a high level of self-sufficiency should be established.

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