

LANDSCAPING AN OFFICE PARK IN AMMAN, JORDAN: INCORPORATING SUSTAINABLE SITE DESIGN PRINCIPLES

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Abstract

This project investigates the concepts of sustainable site design and applies those concepts to the landscape design of an office park in Amman, Jordan. The paper defines the role of preliminary analysis and landscape design process with emphasis on site grading, planting design, and stormwater management, with a hope that future designs should be ecological and sustainable, assessing and using resources efficiently. The nature of the collaborative design approach among designers and the design process of the office park are also discussed within this paper. The result of this investigation is a new approach to site design that combines various design alternatives, aesthetic quality and environmental sustainability. The goal and intent of the presentation is to assist in providing designers an overview of issues that they should consider during site analysis and design.

Keywords:

Ecological design; landscape; sustainability; office park; Amman

Introduction

With increased concern for ecology and the environment, emphasizing sustainability and natural preservation becomes an urgent problem. Despite the recent intensification of environmental concerns regarding human practices, current designs do not usually include sustainable design guidelines. The main objective of design should be to develop and confer ideas of creating ecological sensitivity and energy efficiency, which are developed by effectively assessing and managing natural resources. The design ideas proposed in this paper should provide for effective management of nature surrounding buildings, along with a process of integration with nature. It is important to keep in mind that the goal and intent of these designs should be to assist with providing an overview of issues and considerations that need to be included to limit the impact of land development on the existing natural conditions. Designers must develop a respect for the landscape and expend more effort to understand the interrelationships of natural systems and habitats, as well as the impacts of human uses on them. In this context,

the development of a sustainable site design should be achieved through seeking harmony between human interventions and nature.

Guiding Principles of Sustainable Site Design

Site design is a process of intervention involving the location of roads, walkways, structures and utilities, and making natural and cultural values available to users (Landphair and Motloch, 1985; Jacobs, 1986; Brinkhorst, 1991; Grant et al., 1996). Sustainable site design involves simple design and management practices that take advantage of natural site features and minimize impacts on the natural environment (Rees, 1990; Anselm, 2006; Rubenstein, 1987). Site design does not only include the process of designing new environments, but also involves renovating drainageways, revitalizing stream corridors, reintroducing appropriate vegetation to filter runoff (Jadhav and Buchberger, 1995; Mitsch, 1992) and sustaining the ecological diversity throughout the designed site (Forman and Godron, 1986; Derya, 2002; Randolph, 2003). In this context, we should consider preserving natural resources with sustainable approaches (Ellis, 2005; LaGro, 2001; Landphair and Motloch, 1985; Strom and Nathan, 1998). The result is less manipulation of the natural environment with human interventions and sustainability of the natural appearance of the environment; designs should be specific to a particular site.

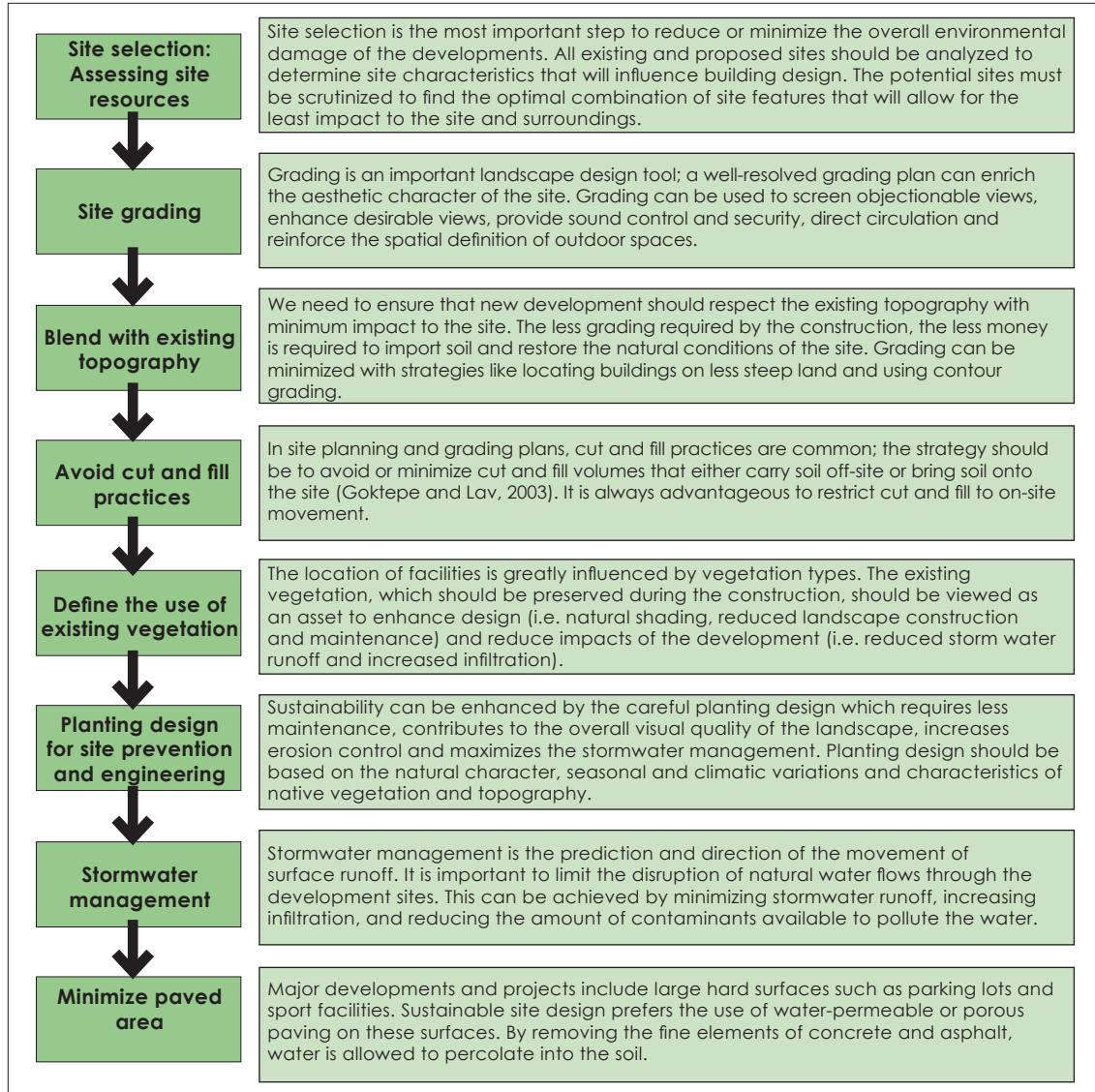
Major issues that need to be considered during sustainable design are site topography, significant natural and geological features, site grading and retaining walls, surface drainage and sediment control (Todd, 1985; Yip, 1994; Marsh, 1983; Fink and Mitsch, 2004; Lee and Heaney, 2003). It is understood that these issues are interrelated during the process of

collaboration between architects, landscape architects and urban planners in major urban development projects (Pickett et al., 1999). An environmentally responsive design process adds the elements of integrated design, design and construction team collaboration, and the development of environmental design guidelines. These elements should be incorporated into development projects from the very beginning and sustained throughout the project phases. Conventional design strategies often fail to consider the interrelationships among building site, design elements, topography and energy (Reffat, 2004; Booth, 1990). Review of these issues in the early planning stages will assist in mitigating conflicts in the later stages of detailed design and physical site development.

Selected principles and approaches of sustainable site design that are applicable to design practices (Özdemir and Başal, 2008; Untermann, 1996; Simmonds, 1997; Booth, 1990; Thompson and Sorviq, 2000; Parker and MacGuire, 1997; Beer, 2000; Harris and Dines, 1998; Andersen, 2006; Bergen et al., 2001; Rubenstein, 1987) are illustrated in matrix (1).

Goals of the Study

This paper examines the sustainable site design approaches employed during the landscape design of Jordan Armed Forces Public Security Directorate Headquarters Complex, Amman (PSD Complex). The guiding principle of sustainable development is an explicit commitment to the environment, defined as the ability to maintain the qualities of the natural environment while protecting and enhancing it for future generations. In this project, we are committed to natural systems protection and



Matrix 1: Guiding Principles of Sustainable Site Design. (Source: Authors).

acknowledge the inherent value of the design site. The Schematic Landscape Design, which is the basis of this paper, states that natural systems and local conditions of the region are important aspects of the overall PSD site. It is, therefore, essential to plan this office development with sustainable fundamentals if the goal is to enact sustainable design practices; that is, the natural systems present on site will be maintained via Schematic Landscape Design. Doing so will produce positive benefits for all aspects of project development—energy use, water conservation, open space, land use and building management. The steps toward sustainability will further enhance the standing of this office park accomplishing its mission while incorporating sustainability into the fabric of social life. While the commitment to sustainability has been made within the preliminary plans, the next step to be taken is to ensure inclusion of these aspects from initial design to finished product. Currently, we are in the decision-making process; plans and projects were presented to the design teams and the project manager for approval, to introduce sustainable concepts, to review the sustainable construction efforts and to develop recommendations for further sustainable efforts of the PSD site.

This project presents a new avenue for the profession of landscape architecture. The planning and design process involves a team of architects, engineers and landscape architects. The role of landscape architects in the design development should be significant due to the need for sustainable design practices such as site inventory and analysis, site planning, the design of proper circulation, topographic modifications, grading and drainage, stormwater management, plant selection, ecological

sensitivity, aesthetic quality of the outdoor environment and the interaction between the built and the natural environment. The main purposes of this paper are to serve as a guide for the future developments through sustainable site design practices, to articulate an enhanced vision and prototype for sustainable urban settlements, to define the process of presenting design proposals through schematic designs and to identify basic principles of site design to guide improvement of design developments. The outcomes of this study, which are presented as the schematic landscape design proposals, attempt to present ingredients for sustainability of future designs and illustrate a useful tool during the collaboration and discussion between design groups.

Project Site

The site with an area approximately 12 hectares located in Amman was selected to establish the PSD Complex. The location of the site, which is on the outskirts of the Amman city center, houses all of the PSD offices, the headquarters, and recreational buildings, along with a proposed open space to form a rigid complex surrounded with a secure perimeter wall. The main idea that has shaped the whole layout is a disciplined unity of numerous buildings with a variety of functions within an image of a military townscape (Figure 1). The site has a terrain with several retaining walls, storage facilities and parking lots. High sloped areas on the north and mid section of the site presented major difficulties for the location of proposed buildings (Figure 2).



Figure 1: General Layout of the PSD Complex (Source: Authors).



Figure 2: Existing Land Use, Topography and Local Vegetation. (Source: Authors).

Phases of Site Assessment and Landscape Design Process

In 2005, we, as a landscape design team, were commissioned by the Yüksel Construction Company, to evaluate the existing site and develop a landscape proposal for the PSD Complex. The site must reflect the elements of Jordanian culture and should be designed in a manner that maintains the symbols of the religion, the originality of culture and the beauty of natural scenery in order to achieve a balance and harmony between the buildings and their surroundings. The design approach, which emphasizes ecological principles, social purpose and the indigenous landscape, allows project and design concepts to take on and strengthen the regional identity and connect the project to its site location. For these purposes, we developed schematic landscape plans aiming to discuss the project goals and schedule the improvement of design guidelines. The process of schematic design began with the gathering of basic data based on the assessments of master plans, architectural drawings, zoning ordinances, topographic and geological maps, vegetation and existing infrastructure. After all available information has been obtained, the data were examined and analyzed. The first objective of these analyses was to establish the site's advantages and limitations.

A detailed site analysis was conducted to help guide the design team and future developments. These include such items as the best areas for building locations, areas to avoid because of steep slopes, areas with drainage problems and areas where the existing vegetation should be kept. Additionally, a set of principles of

landscape and site design was formulated to guide the consultant during the design and application processes.

The schematic plan provides a potential layout identifying parking design and access, roadway and walkway configuration, entryways and landscaping. The presentations were prepared by the use of computer applications (AutoCad, 3D Max and LandDesigner Pro) which enable site designers to depict quickly a land area for pictorial and analytical purposes. We used these techniques for perspective and isometric depictions of topography, slope analysis, cut and fill calculations and simulation studies.

Presentation 1: Assessment of Local Conditions

The development of landscape design began with the creation of a Landscape Analysis Plan that was based on the topography, geography and flora of the local region. Jordan consists mainly of a plateau divided into ridges by valleys and gorges, along with a few mountainous areas. By far the largest part of the East Bank is desert, displaying the land forms and other features associated with great aridity. There are broad expanses of sand and dunes, particularly in the south and southeast, together with salt flats. The Jordan River's principal tributary is the Yarmuk River. The northern area of Jordan, from the Yarmuk River to the Dead Sea, is commonly known as the Jordan Valley.

Based on the specified natural characteristics of Jordan, we proposed to simulate the local topography on several sections of the PSD site; a valley system approaching the main entrance walkway has been created. These valleys are named Yarmuk and Jordan, which are the original names of the valleys in Jordan.

The Dead Sea was represented by the elliptical shaped basin covered with lavender (Figure 3).



Figure 3: Entrance of the PSD Site is Designed based on the Local Conditions of Jordan. (Source: Authors).

Western Jordan has essentially a Mediterranean climate with a hot, dry summer, a cool, wet winter and two short transitional seasons. However, about 75% of the country can be described as having a desert climate with less than 200 mm. of rain annually. Jordan can be divided into

three main geographic and climatic areas: the Jordan Valley, the Mountain Heights Plateau, and the eastern desert, or Badia region. The climate of the Jordan region has inspired us to simulate climatic conditions similar to the overall Jordanian climate. The platform around the mosque and the dominant hill on the site has been preserved to present the natural landscape of the region.

The highlands of Jordan host forests of oak and pine, as well as pistachio and cinnabar trees. Olive, eucalyptus and cedar trees thrive throughout the highlands and the Jordan Valley. Jordan's dry climate is especially conducive to shrub trees, which require less water. Several species of acacia trees can be found in the deserts, as well as a variety of sturdy wild flowers and grasses which grow among the rocks in this demanding habitat, rather than bringing exotic plants to the site. The goal was to keep and preserve the local flora as much as possible. We used the characteristics of the natural vegetation of Jordan, and this process was the crucial element during plant selection and local zone formation on the PSD site. (Figure 4).



Figure 4: Use of Local Plants is one Major Goal of the Planting Design (from left to right): loquat (*Eriobotrya japonica*), (b) bougainvillea (*Bougainvillea* sp.), (c) jasmine (*Jasminum* sp.), (d) locust (*Acacia* sp.) (Source: Authors).

Presentation 2: Land Use and Nodes

The site was treated as a compact composition, as an articulation of different functional zones: (1) Entrance Zone, (2) Headquarters Zone, (3) Transition Zone, (4) Main Axis Zone and (5) Future Extension Zone. Density and the area of the green space in these zones were highlighted. The legend included the green spaces, buildings, open plazas and parking lots and aimed to show the balance between open spaces and the buildings. The basic design approach was to analyze the interaction between closed structures (i.e. buildings) and open space to increase the area of vegetation and park space. The intent was to analyze both the current site conditions effectively and create borders for future analyses, along with the balance between the potential landscape zones and buildings/structures. The focus was on the intersections and nodes for future plaza developments while assessing the pedestrian and vehicle flow on major roads and walkways (Figure 5).



Figure 5: Presentation of Nodes and Sections.
(Source: Authors).

Presentation 3: Site Grading and Earthwork Calculations

Due to the sloped character of the site, the analysis required topographic assessments and grading calculations. We used the average-end area method, for cut and fill volume calculations (Harris and Dines, 1998; Strom and Nathan, 1998). The solutions to grading problems were displayed as several vertical sections. The approach was to examine the entrance spot elevations of each building and to assess the buildings with their surroundings. Grading solutions included minimizing the use of retaining walls, use of walls for seating, balancing cut and fill volumes, re-elevating the point elevations, creating smooth slopes around the structures and buildings, and maximizing an aesthetic appeal. This presentation proved problematic once all the design teams calculated just how large the amounts of cut and fill would be, and they decided to reconfigure the corner elevations of all buildings (Figure 6).

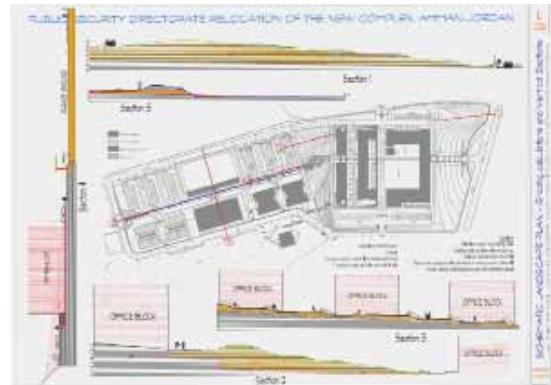


Figure 6: Presentation of Grading Calculations and Solutions with Vertical Sections.
(Source: Authors).

Presentation 4: Surface Drainage and Stormwater Management

Stormwater management was a crucial step in the analysis and design of the PSD site. Topographic conditions with point elevations were used to analyze the surface drainage characteristics. In order to sustain the surface run-off, all paved areas were sloped through the proposed open channels and inlets. An underground storage facility was recommended to collect the stormwater for irrigation and fire emergency. Topography was used as a part of stormwater management; natural reservoirs were developed to collect surface runoff, and excess water was directed to the channels and the landscaped areas. The overall goal of the stormwater management system was to keep the rate and quantity of surface runoff from the site at natural and optimum levels; the basic strategy was to reduce the amount of peak flow, runoff volume and sediments generated on site (Thurston et al., 2003).

Presentation 5: Planting Design

The Landscaping (Planting) plan included xeriscaping principles —the use of water-efficient, low maintenance native plant materials (Walker, 1991; Ingels, 2003; Barış, 2007). The fabric of the landscape reflects the goals of creating a pedestrian friendly atmosphere while strengthening the relationship between built and native environment. The use of native shrubs and ground cover plantings under mature trees along the main axis, at courtyards and in seating areas was encouraged. A carefully conceived and executed planting concept of indigenous plants aims to enhance and maintain the local image of the site. Selected plants project a proper scale relationship between the individual, buildings and open

spaces and create an appropriate relationship to the existing environment. To the degree possible, landscape plans shall include the use of plant species that are indigenous to the Amman area. In cases where non- indigenous plants are used to enhance the landscape, plantings should be limited to those species that are able to resist periods of drought and which require little fertilization and use of pesticides.

The following points were considered when landscaping: (1) preservation of existing trees (Cypress, Eucalyptus, Acacia, etc.), (2) re-establishment of trees along primary roads within parking areas and along site perimeters, (3) improvement of the perimeter wall with emphasis on blocking view from outside with dense plantings, (4) focal or interest plantings around plazas and courtyards with changes in color and texture through seasons, (5) foundation planting for buildings, and (6) reinforcement of pedestrian access ways with focal plantings.

Along the hill areas of the site, a Mediterranean zone was formed; this zone is determined chiefly by its climate, which is characterized by very dry summers and mild, rainy winters; large tracts were covered with maquis (macchie), garigue, or dry semidesert (steppe) vegetation. Maquis consists of dense scrub growths of xerophytic (drought-resistant) and sclerophyllous. Garigue is usually a somewhat open association of dwarf evergreen shrubs and trees mingling with the characteristics of herbaceous plants that thrive during summer under somewhat semi-arid conditions.

Presentation 6: Temporary Landscape Areas

The architectural design concept includes future extension zones where additional office and recreational buildings will be built.

The landscape plan proposed temporary landscape areas with sport and fitness facilities, running paths, flexible materials and removable plants. The purpose was to retain existing walkways for future extension. Materials for this site are generally flexible and foldable for easy construction. In addition, a water detention and retention system was proposed for these areas (Figure 7).



Figure 7: Presentation of Temporary Landscape Areas. (Source: Authors).

Presentation 7: Landscape Approaches

As a conclusion of the schematic design presentations, major landscape approaches, which would contribute to the overall design of the PSD site, were established. Basic approaches of the project were integrating and articulating architectural and site design in conjunction with landscape design, blending new development sites with the character of the local landscapes by retaining islands of natural vegetation and creating new and similar vegetative buffers, which soften building facades and site facilities, seeking to develop new significant landscape features (i.e. topography) in association with

attractive, creatively designed courtyards and pedestrian plazas, continuing the initial style and character of the original plantings with emphasis on transitioning and reflecting the natural formation of plantings, maintaining a selective palette of indigenous and site-adaptive plant species, and creating a sense of arrival at site entrances and at the primary entrance to the complex (Figure 8).

Certain principles have maintained the importance of the landscape aesthetics of the site as it relates to the philosophy of the landscape plan. These principles are:



Figure 8: Site Plan of the PSD Complex. (Source: Authors).

(1) Site character—the PSD site should maintain its small-scale ambiance, its natural appealing character, and the conjunction of formal and informal landscape setting,

(2) Common language—maintain the overall landscaped environment and a series of memorable, beautiful spaces with structures; use of a consistent vocabulary for all site elements, including planting, lighting, paving, seating, and signage,

(3) Sustainability—improve the overall landscape quality with sustainable design principles on site with the use of local plant material, balance between cut and fill of lands; preserve existing trees; collect and use stormwater for irrigation,

(4) Topography—use of topography in a creative way to reinforce the fundamental hillside character of the site; general principles included the study of grading with slopes, ridges, and elevation changes based on the existing conditions; creation of landforms—ridges, valleys, gorges, wadis, dunes and hills—associated with aridity and local climate.

General Assessment

Landscape design projects integrating sustainable site design approaches have been part of plans that have been strongly orientated toward improving the natural environment. For sustainability purposes and ecological validity, this landscape design case engaged the natural environment and ecological values have been given special emphasis. The proposed landscape plan strikes the best balance between competing opportunities and risks of the site, and attempts to present a sense of place and community by developing

an inviting and open atmosphere. Another goal is to improve the quality of open space by enhancing the landscape with emphasis on the improvement of the connection between people and the natural landscape with the implementation of xeriscaping principles. Site grading is also an important landscape design tool in this project. The landscape plan's objective is to create aesthetic appeal while gracefully contouring the land to blend with existing conditions of the site.

The Mission Statement of the PSD Landscape Design seeks to provide a headquarters complex for innovation and contemplation in a large-scale urban setting. The Schematic Landscape Design and Landscape Report, which presents ingredients for future designs, and envisions the establishment of a dynamic, attractive and living outdoor environment. These presentations and analyses illustrate a useful tool during collaboration with the architects and the consultant. Indeed, they are the best examples to show us the effectiveness of designers in dealing with site design issues and environmental concerns, and how we express our own way of thinking in design.

Emerging Issues and Future Directions

Once major designs are built, they are difficult to change. The best opportunities to influence the environment, therefore, exist in the beginning stages of decision-making when key principles and strategies that guide development are established. Assessment of land uses, infrastructures, site elements and resources and future developments are important for such decisions. Designers should promote sustainable site design approaches;

the principal component of sustainable site design is to harmonize the relationship between human and buildings, between buildings and environment, especially the natural landform. For designers, manipulation of the landform, which adds variety to the setting and reduces the sense of visual clutter common to urban centers and complex interchanges, is a very effective tool for modifying the landscape elements.

Comprehensive understanding of natural systems coupled with the application of design tools such as computer models and careful analysis of the project site can make a major contribution to the mitigation of any developmental impacts. In this respect, there is a need to highlight the role that sustainable site design approaches can play in reducing the risk of human interventions, and to mitigate the consequences. Therefore, this paper illustrates how sustainable site design practices in the early stages of a site development can be a useful tool for policy makers, planners and designers. This paper explored the natural topography as an important element of site design, which improved the identity of site with a concern that attitudes toward design should be ecological and sustainable using resources efficiently. The process and guidelines presented in this paper are intended to guide planning and design processes toward sustainable sites of better visual and functional quality. The content and material of this paper can be used by practicing landscape architects and landscape students for future projects.

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References

- Andersen, A. (2006). Urban Landscapes and Sustainable Cities, *Ecology and Society*, Vol. 11 (1), pp. 34-40.
- Anselm, A. J. (2006). Building with Nature: Ecological Principles in Building Design, *Journal of Applied Sciences*, Vol. 6 (4), pp. 958-963.
- Barış, M. E. (2007). Kurakçıl Peyzaj [Xeriscape Landscaping], *Bilim ve Teknik*, Vol. 478, pp.24-26.
- Beer, A. R. and Higgins, C. (2000). *Environmental Planning for Site Development*, Spon Press, New York, USA.
- Bergen, S. D., Bolton, S. M. and Fridley, J. L. (2001). Design Principles for Ecological Engineering, *Ecological Engineering*, Vol. 18, pp. 201-210.
- Booth, N. (1990). *Basic Elements of Landscape Architectural Design*, Waveland Press, Prospect Heights, Illinois, USA.
- Brinkhorst, L. (1991). Planning for Sustainable Development, *Town and Country Planning*, Vol. 60 (1), pp. 16-18.
- Derya, O. (2002). Design with Climate in Housing Environments: An Analysis in Northern Cyprus, *Building and Environment*, Vol. 37, pp. 1003-1012.
- Ellis, C. (2005). Planning Methods and Good City Form, *Journal of Architectural and Planning Research*, Vol. 22 (2), pp.138-147.
- Fink, D. F. & Mitsch, W. J. (2004). Seasonal and Storm Event Nutrient Removal by a Created Wetland in an Agricultural Watershed, *Ecological Engineering*, Vol. 23, pp.313-325.

- Forman, R. T. T. and Godron, M. (1986). *Landscape Ecology*, John Wiley and Sons, New York, USA.
- Grant, J., Manuel, P. and Joudrey, D. (1996). A Framework for Planning Sustainable Residential Landscapes, *Journal of the American Planning Association*, Vol. 62 (3), pp. 290-331.
- Harris, C. W. & Dines, N. T. (1998). *Time-Saver Standards for Landscape Architecture*, McGraw Hill, New York, USA.
- Ingels, J. E. (2003). *Landscaping: Principles and Practices*. Cengage Delmar Learning, Clifton Park, NY, USA.
- Jadhav, R. S. and Buchberger, S. G. (1995). Effects of Vegetation on Flow through Free Water Surface Wetlands, *Ecological Engineering*, Vol. 5, pp. 481-496.
- Jacobs, P. (1986). *Sustaining Landscapes, Sustaining Societies*, *Landscape and Urban Planning*, Vol. 13, pp. 349-358.
- Lagro, J. (2001). *Site Analysis: Linking Program and Concept in Land Planning and Design*. John Wiley and Sons, New York, USA.
- Landphair, H. C. & Motloch, J. L. (1985). *Site Reconnaissance and Engineering*, Elsevier, New York, USA.
- Lee, J. G. & Heaney, J. P. (2003). Estimation of Urban Imperviousness and Its Impacts on Stormwater Systems, *Journal of Water Resources Planning and Management*, Vol. 129 (5), pp.419-426.
- Marsh, W. (1983). *Landscape Planning: Environmental Applications*, John Wiley and Sons, New York, USA.
- Mitsch, W. J. (1992). Landscape Design and the Role of Created, Restored, and Natural Riparian Wetlands in Controlling Non-Point Source Pollution, *Ecological Engineering*, Vol. 1, pp. 27-47.
- Özdemir, A. and Başal, M. (2008). *Sustainable Site Design Approaches*, Ankara University Press, Ankara (in press).
- Parker, H. and MacGuire, J. W. (1997). *Simplified Site Engineering for Landscape Architects*, Wiley, New York, USA.
- Pickett, S. T. A., Birch, W. L. and Grove, J. M. (1999). *Interdisciplinary Research: Maintaining the Constructive Impulse in a Culture of Criticism, Ecosystems*, Vol. 2, pp. 302-307.
- Randolph, J. (2003). *Environmental Land Use, Planning and Management*, Island Press, New York, USA.
- Rees, W. E. (1990). *Planning for Sustainable Development: A Resource Book*, The University of British Columbia Center for Human Settlements, Vancouver, BC, Canada.
- Reffat, R. M. (2004). *Sustainable Development of Buildings and Environment*, In *Proceedings of 2nd International Conference on Development and Environment*, Assiut University, Egypt.
- Rubenstein, H. M. (1987). *A Guide to Site and Environmental Planning*, John Wiley and Sons, New York, USA.
- Simmonds, J. O. (1997). *Landscape Architecture: A Manual of Site Planning and Design*, McGraw Hill, New York, USA.
- Strom, S. & Nathan, K. (1998). *Site Engineering for Landscape Architects*. John Wiley and Sons, New York, USA.
- Thompson, J. W. and Sorviq, K. (2000). *Sustainable Landscape Construction: A Guide to Green Building Outdoors*, Island Press, New York, USA.
- Thurston, H. W., Goddard, H. C., Szag, D. & Lemberg, B. (2003). Controlling Stormwater Runoff with Tradable Allowances for Impervious Surfaces, *Journal of Water Resources Planning and Management*, Vol. 129 (5), pp.409-418.
- Todd, K. W. (1985). *Site, Space and Structure*, Van Nostrand Reinhold, New York, USA.

Untermann, R. K. (1996). Principles and Practices of Grading, Drainage and Road Allignment: An Ecological Approach, Prentice Hall, New York, USA.

Walker, T.D. (1991). Planting Design, VanNostrand Reinhold, New York, USA.

Yip, S. (1994). Applying Sustainable Development Principles to Residential Community Planning, Plan Canada, March Volume, pp. 31-34.

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