

**LIBYA-DARNAH TOWN INFRASTRUCTURE PROJECT  
LANDSCAPE DEVELOPMENT PLAN  
LANDSCAPE SURVEY & ANALYSIS  
LANDSCAPE CONCEPT PLAN  
LANDSCAPE PRELIMINARY PLAN**

DRN-LA-REP-PREP-0003-0001-0A

**ÖZALTIN**  
CONSTRUCTION TRADE & INDUSTRY CO., INC.



**ANKARA ZİRAAT  
TARIM VE TEKNOLOJİ  
YATIRIMLARI A.Ş.**

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Rev.	Date	Revision Description	By	Checked	Approved

LIBYA DARNAH TOWN INFRASTRUCTURE PROJECT  
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PRELIMINARY PLAN**



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## 1.0 PURPOSE

Darnah Town Landscape Development Plan is a project requirement of Libya-Darnah Town Infrastructure project. AZTATEK (Ankara Agriculture and Technology Investigations, Ankara University, Faculty of Agriculture Inc) made a Contract with Temelsu to undertake landscape development work of Libya Darnah Town Infrastructure Project. This Contract was developed in accordance with the document entitled “Guidance Document Design Criteria for Infrastructure Projects” prepared by AECOM for The Great Socialist People’s Libyan Arab Jamahiriya Housing and Infrastructure Board Program Management Department (Revision No. 02, June 2009).

In compliance with the “Guidance Document Design Criteria for Infrastructure Projects” (AECOM, 2009) requirements, the purpose of this document that was prepared by AZTATEK, is to explain Landscape Development Plan procedures, and first two stage of it, as. Landscape Development Plan has six systematically constructed project components:

1. Landscape survey and Analysis and Concept Plan (Scale: 1/5000)
2. Landscape Preliminary
3. Structural Implementation Plans (Scale: 1/500)
4. Planting Implementation Plans (Scale: 1/500)
5. Construction Detail Plans (Scale: 1/200-1/20)
6. Landscape Quantify Surveying



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## 2.0 SCOPE

This report presents the Landscape Preliminary Plan integrated with “Landscape Inventory and Analysis” and “Landscape Concept Plan” works, which were prepared in the scope of “Guidance Document Design Criteria for Infrastructure Projects” (AECOM, 2009) requirements. Landscape Preliminary Plan constructs the second step of Landscape Development Plan Procedures. Table 1 shows the scope of this report and the drawings that were presented as attachments.

Table 1: The scope

DRAWING NAME	DRAWING CODE:
<p><b>Landscape Inventory and Analysis</b>  <b>Content:</b> Slope, aspect, geology, soil, landscape field survey, photographic survey, existing green infrastructure and waterscape  <b>Scale:</b> 1/5000</p>	<ul style="list-style-type: none"> <li>Landscape Inventory and Analysis DRN-LA-DRW-LAIA-0001-0001</li> </ul>
<p><b>Concept Plan</b>  <b>Content:</b> Conceptual landscape and streetscape development  <b>Scale:</b> 1/5000</p>	<ul style="list-style-type: none"> <li>Town Landscape Concept Plan DRN-LA-DRW-CONP-0002-0001</li> <li>Streetscape Concept Plan DRN-LA-DRW-CONP-0002-0002</li> </ul>
<p><b>Preliminary Plan</b>  <b>Content:</b> Landscape development and streetscape  <b>Scale:</b> (1/5000, 1/2000)</p>	<ul style="list-style-type: none"> <li>Landscape Preliminary Plan DRN-LA-DRW-GNRL-0003-0001, -4 (4 adet) DRN-LA-DRW-PREP-0003-0001, -24 (24 adet)</li> </ul>
<p><b>Sample Structural Landscape Implementation Plans (Attachment 2)</b></p>	<ul style="list-style-type: none"> <li>Seaside Park (City Ceremony Area) DRN-LA-DRW-PREP-0003-00025</li> <li>West Seaside Park DRN-LA-DRW-PREP-0003-00026</li> <li>Seaside Park Coastal Terraces DRN-LA-DRW-PREP-0003-00027</li> <li>Urban park &amp; Sport center DRN-LA-DRW-PREP-0003-00028</li> <li>Neighborhood Park DRN-LA-DRW-PREP-0003-00029</li> </ul>

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## 4.0 DEFINITIONS

*“A connected system of parks and parkways is manifestly far more complete and useful than a series of isolated parks”- John Olmsted and Frederick Law Olmsted Jr. 1903*




**Green Infrastructure:** It is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, street trees and open countryside. It comprises all environmental resources, and thus a green infrastructure approach also contributes towards sustainable resource management. (Davis et al., 2006).

**Green interconnection links:** It is an interconnecting system linking parks and other green spaces for the benefit of people

**Greenbelts:** Protected natural lands or working lands that serve as a framework for (city) development while also preserving native ecosystems and/or farms or ranchland (Benedict and McMahon, 2001)

**Scenic corridor:** A route which traverses a visual corridor which offers an unhindered view of attractive urban and/or natural resources within the urban boundaries emphasising natural setting of the landscape.

**Buffered road:** A road which is buffered via landscaping at both sides.

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## 5.0 RESPONSIBILITIES

The infrastructure works of Darnah Town has been decided to be realised in the scope of Libya Housing and Infrastructure Program by The Great Socialist People's Libyan Arab Jamahiriya, Housing and Infrastructure Board (HIB) (Temelsu, 2010).

HIB selected the company AECOM as Libya Housing and Infrastructure Program manager, and the program management work is begun to be performed by both HIB and AECOM recently (Temelsu, 2010).

IBK is the firm who is responsible from the construction supervision (Temelsu, 2010).

The Özaltın Construction Trade and Industry Inc. awarded the contract for design and construction works of the town Darnah, and Temelsu International Engineering Services Inc. is continuing to realize the design part of the Works.

- The design works consist of:
- Preparation of Maps
- Roads and Related Structures
- Water Distribution System
- Wastewater Collection System
- Storm Water Collection System
- Electricity and Road Illumination Systems
- Telecom System
- Landscaping
- Geological and Geotechnical Investigations

AZTATEK is a sub-contractor of Temelsu for landscape planning and design works. AZTATEK will be responsible for landscaping within the project's site boundaries, including open spaces and for pedestrian (sidewalk) planting areas up to roadside curb with street according to the landscape design criteria described herein (AECOM, 2009).





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## 6.0 PROCEDURE



Landscape Development Plan has six systematically constructed project components:

1. Landscape Survey and Analysis and Concept Plan (Scale: 1/5000)\*
2. Landscape Preliminary Plan(Scale: 1/2000)\*
3. Structural Implementation Plans (Scale: 1/500)\*\*
4. Planting Implementation Plans (Scale: 1/500)
5. Construction Detail Plans (Scale: 1/200-1/20)
6. Landscape Quantify Surveying

Above mentioned landscape planning and design procedures will meet the project requirements which are mentioned in Chapter 11 (Landscape Design Criteria) and Chapter 12 (Streetscape) of Guidance Document: Design Criteria for Infrastructure Projects (AECOM, 2009).

\*: Completed steps

\*\* : Some samples are presented

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## 7.0 PROJECT TEAM\*

Prof. Dr. Şükran ŞAHİN- Project Coordinator (Landscape Architect)

Prof. Dr. Halim PERÇİN- Lead Landscape Designer (Landscape Architect)

Assist. Prof. Dr. Ekrem KURUM- Landscape Designer (Landscape Architect)

Prof. Dr. Oğuz Yılmaz- Landscape Designer (Landscape Architect)

Pelin Ceyda- (Landscape Architect)




Duygu Doğan- (Landscape Architect)

Şirin Özgür- (Landscape Architect)

Res. Assist. Volkan Müftüoğlu- (Landscape Architect)

\* Ankara University, Faculty of Agriculture, Department of Landscape Architecture.

The team conducts the project under the legal institution of AZTATEK (Ankara Agriculture and Technology Investigations Inc, Ankara University, Faculty of Agriculture)

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## 8.0. BASELINE INFORMATION

Darnah town (32°46'N/22°39'E) of north-eastern Libya, situated on the Mediterranean coast, east of Benghazi (Fig.1). It lies on the eastern ridges of the Akhdar Mountains in the delta of the small Wadi (seasonal river) Darnah (Source: Encyclopedia Britannica online).

Darnah is often referred to in Libya as the “Bride of the Sea” for its beautiful location on the Mediterranean, and its luscious gardens, fruit trees, and waterfalls (Azzuz, 1999).

The area of “Souk-El-Dalam” is one of the oldest existing areas in Darnah. It is a complex of traditional specialty stores. The arcaded open market is well known part of the souk (Azzuz, 1999).

The Grand Mosque “Aljamaa Alkabir”, which was constructed in 1689 by Mohammad Bey, is adjacent to the Souk and connected to it with an arcaded corridor. Several Muslim military leaders and disciples of the Prophet Muhammad are buried in one of Darnah’s landmarks, the Cemetery of Al-Sahaba (disciples) with its’ unique architectural style. It is located in the middle of the city (Azzuz, 1999).

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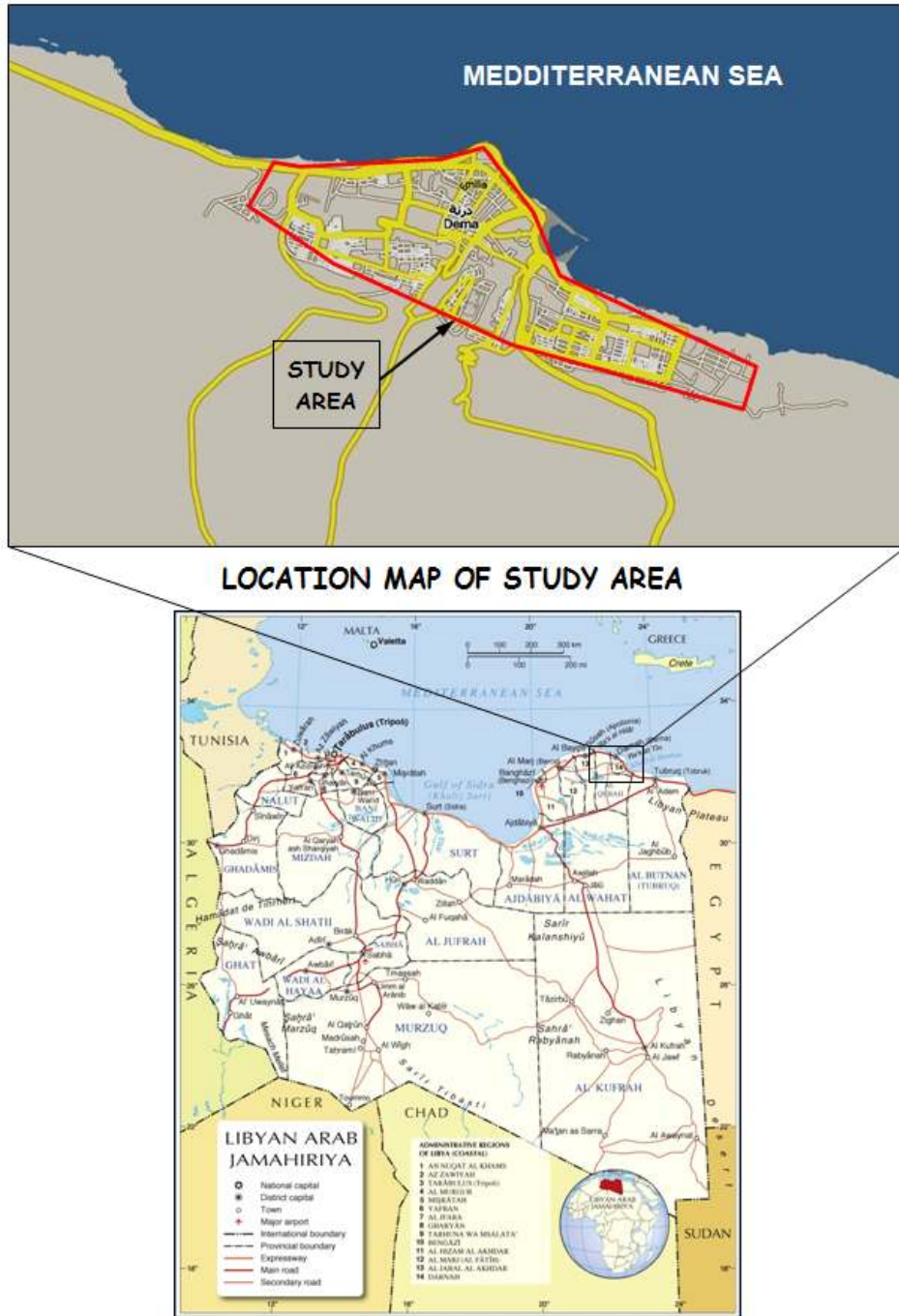





Fig. 1: Study Area (Temelsu, 2010)

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## 9.0 DARNAH TOWN LANDSCAPE DEVELOPMENT PLAN

### 9.1. Landscape Survey and Analysis

#### Topography: Slope and Aspect:

Plantation at steep slopes is of importance to slow down the runoff and erosion with respect to storm water, soil and vegetation management purposes. The erosive power of runoff increases with slope inclination and distance downhill (Marsh 1978). Specific developments of plantation techniques, drainage pattern and water harvesting will be required at steep slopes. Soil source deficiency will arise at the steep slopes so that external supply, at plantation holes in particularly, is of concern.

The steep slopes are certain risk areas of erosion, although this process is driven by various factors. The aspect of the topography presents different conditions for soil genesis. Also, the aspect affects the temperature. At the northern sphere, the north-facing slopes have higher density vegetation cover and biomass. The humidity level of the soil at those slopes is higher. As for the south-facing slopes, the situation is vice versa because of more dense solar radiation (<http://tr.wikipedia.org>).

At the northern sphere, the north-facing slopes having lower solar radiation are colder and humid. Therefore, at those slopes the vegetation growth rate is slow. The south-facing slopes are warmer and dry, so that the vegetation growth is loose. In the Mediterranean basin region, south-facing slopes receive higher solar radiation thus affecting temperature, soil moisture, nutrients and soil aggregation processes which, in turn, affect the vegetation. In contrast, north-facing slopes generally receive lower solar radiation flux density, resulting in lower evapotranspiration rates and lower daily maximal temperatures during summer water stress periods. These differences are significant in Mediterranean plant communities where water availability is an important limiting factor. In view of favourable growing conditions in north facing slopes in Mediterranean basin ecosystems, it is possible to hypothesize that plant community characteristics such as percentage cover, biomass, volume and density would be greater in this aspect than in opposing slopes (Sternberg and Shoshany 2001).



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Geology and Soil:

Geological structure and soil characteristics of Darnah will be assessed in accordance with permeability during final landscape planning. The permeable areas as infiltration zone of underground water will be dedicated to dense plantation.

Climate

Rainfalls in Libya are intense, short in duration, and infrequent. Along the Mediterranean coast, the wettest months are from September to March (AECOM 2009). Darnah City is warm in summers and rainy in winter (Temelsu, 2010). Climatic conditions with regard to some meteorological data are shown in Table 2.

Table 2: Climatic data of Darnah (Darnah, Libya-Sunrise, sunsets, dawn and dusk times table and graphics, 2010)

Variable	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Temperature, °C	15.96	15.05	15.32	17.00	19.51	22.52	24.76	25.90	24.92	22.75	20.26	17.54
Wind speed, m/s	6.40	6.84	6.48	5.86	5.48	5.46	6.10	5.87	5.61	5.18	5.70	6.31
Precipitation, mm	94	66	45	19	4	1	0	0	10	46	44	82
Wet days, d	12.0	10.2	7.1	3.4	2.2	0.3	0.2	0.1	1.1	3.9	6.3	10.1

Vegetation:

Two major types of vegetation; maquis and steppe can be recognized in the study area. The maquis vegetation begins at the coast and extends across the upper terrace. A large number of the maquis species are found at all elevations, but in certain areas, in response to particular edaphic factors, certain elements of the flora achieve a local dominance. Examples for a number of substantial maquis species are: *Juniperus phoenicea*, *Pistacia lentiscus*, *Quercus coccifera* and *Ceratonia siliqua* (Darier and Mogaspi 2009)

There will be a presumption that all plants should be directly sourced and grown from in-country nurseries. Selection of plants should be based on climatic, geological, and topographical conditions of the site. (AECOM, 2009).

The native plants and the ornamental plants which are suitable for Darnah ecology were searched and given in Table 3. The plants were grouped in accordance with their drought tolerance as a project requirements.

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Table 3: Darnah landscaping plants

PALM	COMMON NAME	HIGHT	WIGHT	DROUGHT TOLERANCE			
				NDT	RDR	DT	VDT
<i>Caryota mitis (B)</i>	Fishtail palm	8 m	4 m		X		
<i>Cocos nucifera</i>	Coconut palm	15-24 m	9-10 m			X	
<i>Cycas revoluta</i>	Japanese Sago Palm	3-3.7 m	2.5-3 m			X	
<i>Draceana australis</i>	Cabbage Tree	6-9 m	1-2 m		X		
<i>Hyphaene thebaica</i>		6-9 m	4.5 m			X	
<i>Phoenix canariensis</i>	Canary Island Date Palm	18 m	10 m			X	
<i>Phoenix dactylifera</i>	Date palm	30 m	0.6-1.2 m			X	
<i>Washingtonia filifera</i>	Desert fan palm	18.3 m	4.6 m			X	
<i>Washingtonia robusta</i>	Washington palm	30.5 m	2-3 m			X	

DECİDUOUS	COMMON NAME	HIGHT	WIGHT	DROUGHT TOLERANCE			
				NDT	RDR	DT	VDT
<i>Acacia albida</i>	Apple-Ring Acacia	6-30 m	2 m				X
<i>Acacia nicolita</i>	Gum Arabic Tree	5-20 m					X
<i>Acacia cyanophylla</i>	Golden Wreath Wattle	2-10 m	3-6 m				X
<i>Albizia julibrissin</i>	Silk tree	10.7 m	0.6 m			X	
<i>Albizia lebbek</i>	Siris tree	30 m				X	
<i>Casuarina equisetifolia</i>	Australian pine	18 m	6 m			X	
<i>Ceratonia siliqua</i>	Carob tree	8 m	12 m			X	
<i>Cercis siliquastrum</i>	Judas Tree	10 m	10 m		X		
<i>Erythrina indica</i>	Indian Coral Tree	6-9 m (28 m)					X
<i>Eucalyptus citriodora</i>	Lemon-Scented Gum	24-40 m		X			

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LARGE LEAF	COMMON NAME	HIGHT	WIGHT	DROUGHT TOLERANCE			
				NDT	RDR	DT	VDT
Ficus benghalensis	Bengal fig	30 m	12.5-25 m			X	
Ficus benjamina	Benjamin's Fig	24 m	15 m			X	
Ficus religiosa	Sacred Fig	9-12 m	8 m			X	
Ficus sycomorus	Sycamore fig	24 m	10 m			X	
Gravillea robusta	Australian Silver-oak	18 m	9 m				X
Jacaranda acutifolia	Jacaranda	8-15 m	6-10 m		X		
Melia azederach	Chinaberry	15.2 m	6.1 m			X	
Ziziphus jujuba	Jujube	12 m					X

SMALL TREE	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
Acacia farnesiana	Needle Bush	4.5 m	4.5 m				X
Acacia fistula	Red acacia	6-10 m					X
Bauhinia variegata	Orchid tree	6-12 m	3-6 m				X
Brachychiton populneum	whiteflower kurrajong	10-12 m				X	
Callistemon lanceolatus (citrinus)	Crimson Bottlebrush	1-3 m				X	
Callistemon viminalis	Weeping Bottlebrush	6 m				X	
Cassia fistula	Golden Shower Tree	10-20 m				X	
Cassia nodosa	Pink Shower Tree	3-6 m				X	
Erythrina cristagalli	Cockspur Coral Tree	18.3-24.4 m	6.1-12.2 m			X	
Ficus retusa (nitida)	Cuban-laurel	15 m				X	
Laurus nobilis	True Laurel	18.3 m				X	
Lawsonia inermis	Henna	2-6 m			X		
Mangifera indica	Mango	35-40 m	20 m		X		
Olea europea	Olive	8-15 m				X	
Parkinsonia aculeata	Mexican Palo Verde	7.6 m	6.1 m			X	
Pistacia lentiscus	Mastic	4 m				X	
Plumeria obtusa		8 m					
Salix babylonica	Peking Willow	15 m				X	
Schinus molle	American pepper	15 m	5-10 m			X	
Tamarix articulata	Farash	15-20 m					X
Tecoma stans	yellow elder	7.6 m				X	
Thevetia neriifolia	yellow oleander	6 m				X	



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EVERGREEN	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
Casuarina equisetifolia	Australian pine	30.5-45.7 m				X	
Cupressus sempervirens	Italian cypress	24 m	2.4 m			X	
Juniperus phoenicea	Phoenicean Juniper	2-12 m				X	
Pinus brutia	Turkish pine	18 m	6 m			X	
Pinus halepensis	Aleppo Pine	18 m	6 m			X	
Pinus maritima	Maritime Pine	20-35 m				X	
Pinus pinea	Stone Pine	24 m	6 m			X	

SHRUB	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
Buddleja davidii	Butterfly-Bush	1.8-3.7 m	1.2-4.6 m		X		
Caesalpinia pulcherrima	Poinciana, Peacock Flower	4.5-6 m				X	
Capparis spinosa	Caper					X	
Cyperus laevigatus	Smooth Flatsedge	60 cm				X	
Dodonea viscosa	Hopseed	1-3 m					X
Duranta repens	Golden Dewdrop	5.5 m					
Hibiscus rosa sinensis	Chinese hibiscus	4.5 m				X	
Lantana camara	Lantana	1.8 m	2.4 m (may)				X
Malvaviscus arborescens		3.5-4.5 m	3 m			X	
Nerium oleander	Oleander	6.1 m	3.1 m			X	
Punica granatum flora plant		8 m	4.5 m	X			
Pistacia lentiscus	Mastic	3.5 m	3.5 m			X	
Plumbago capensis	Blue Plumbago	4.5 m	2 m			X	
Quercus ilex	Holly Oak	20-27 m				X	
Rosa gallica	Gallic Rose	1.2 m	1.2 m			X	
Rosmarinus officinalis	Rosemary	1.8 m	1.2-1.5 m			X	
Ricinus communis	Castor Oil Plant	12 m				X	
Tecoma stans	Yellow Elder	4.5-9 m	3 m				X
Typha capensis				X			

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	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
<b>CLIMBER</b>							
Bignonia(Bignonia capreolata)	Cross Vine					X	
Bougainvillea varietien	Bougainvillea				X		
Jasminum grandiflorum	Spanish Jasmine	1.5-3.1 m			X		
Wisteria sinensis	Chinese Wisteria	10 m	10 m		X		

	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
<b>GROUND COVER</b>							
Astragalus miguelensis	San Miguel Milkvetch			Endemic			
Gazania sp.						X	
Limonium	Sea Lavender	30 cm	30 cm			X	
Mesembryanthemum edule (Carpobrotus edulis)	Hottentot Fig	0.1-1m				X	
Pelargonium peltatum	Ivy-Leaf Geranium	2.4 m	2.4 m			X	
Pelargonium zonale	Horse-Shoe Pelargonium	1-3 m				X	
Portulaca grandiflora	Moss Rose	15 cm	30.5 cm			X	
Salina oficianalis	Sage	0.6 m	0.6 m	X			
Setcreasea pallida	Purple Heart	0.2-0.3 m	0.4 m		X		
Tradescantia zebrina	Wandering Jew						X
Vinca rosea	Madagascar Periwinkle			X			

	COMMON NAME	HIGH	WIDE	WATER REQUEST			
				NDT	RDR	DT	VDT
<b>SUCCULENTS</b>							
Agave americana	Agave	6-12 m	2-4.5 m				X
Agave sisalana		5-6 m	3-6 m				X
Alue							X
Opuntia dillenii (kaktüs türü)	Erect Prickly Pear	2 m					X
Yucca gloriosa	Spanish Dagger	0.5-2.5 m	1.8-2.4 m				X

<b>NDT</b>	Not Drought Tolerant
<b>RDR</b>	Relatively Drought Resistant
<b>DT</b>	Drought Tolerant
<b>VDT</b>	Very Drought Tolerant



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Landscape field survey

A photographic survey was realized in whole city (between 12nd and 17th December 2009) particularly in open and green areas as well as streets. All photographic survey points were indicated in the map. During that survey the viewpoints which present considerable panoramic sightseeing opportunities towards outstanding elements of the city and/or Mediterranean Sea were indicated on the map, and defined as the areas at higher visual landscape value. On the other hand, the areas that cause or potentially cause visual pollution (existing desalination units, existing water tanks or those to be constructed). In those areas a visual screening will be implemented by plants to avoid or reduce the visual pollution. For the water tanks to be developed a colour scheme will be proposed to reduce their visual dominance in landscape. These kinds of screening plantations will be ascertained during final plan stage.

A landscape survey at the old city centre were also conducted to be able develop strategies and design to enhance local historical and cultural landscape characteristics of the city. This survey was required for form development during final and belonging detailed design stages of Landscape Development Plan.

The introduction of short lengths of one-way road was suggested at community level by transferring of space from pavement to sidewalk or landscape use. These one-way roads are dedicated to create a linkage among neighborhood parks and named as “local green interconnection links (See Streetscape Concept Plan). The detailed design will be presented for those roads during final design stage. In appropriate circumstances shared surfaces can be suggested to provide an area to be used by both pedestrians and motorized traffic on one hand, and as a green linkage on the other hand.

Four city gates were suggested and located on the maps of Streetscape and Town Landscape Concept Plans.

The coastal zone presents higher potential to create landscapes for the activities and facilities such as promenade, sightseeing terraces, restaurants, cafeterias, etc. Those areas were developed on suitable locations and named as “Seaside Parks”.

Night landscape for coastal zone at Darnah will be proposed during final design stage.

The primary areas for landscape implementation were pre-defined over the map and sample structural implementation plans were prepared in accordance with preliminary plan, and presented at separate drawing sheets as Attachment 2 of Landscape Development Plan report.

Some landscapes from City of Darnah (Fig.2- Fig.9).



Fig.2: The landscape at the west



Fig. 3: The landscape at the west



Fig. 4: The landscape at the west



Fig. 5: Traditional agriculture at Wadi Darnah



Fig.6: Garbage at coastal zone at the east (valleys and connecting coastal zones are used as garbage area in Darnah)



Fig.7: The outstanding coastal zone that can be used for recreational activities as well as resting and walking purposes.



Fig.8: Wadi Darnah that requires a particular landscape design



Fig. 9: The solid waste open dumping area at the east of the city, and the natural landscape that will be used for city development.



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## 9.2. Landscape Concept Plan

The components of open-green infrastructure of City Development Plan were classified in accordance with ecological and social requirements of the city. The whole open-green infrastructure were grouped into two main landscape type as follow

### 1. TOWN LANDSCAPE

#### 2. STREETScape

Each landscape, than, classified in accordance with their functional content, (activities) surface area and serving distance.

#### The Components of Town Landscape

The components and the conceptual content of the Town Landscape classes were described below, site related map of them presented in 1:5000 scale conceptual drawings as Town Landscape Concept Plan and Streetscape Concept Plan).

#### 1. PUBLIC PARK AND GARDENS

<i>PUBLIC PARK AND GARDENS</i>	<i>SURFACE AREA</i>	<i>SERVING DIAMETER</i>	<i>FACILITIES AND ACTIVITIES</i>
<p><b>1a. URBAN PARK</b> These parks are major recreation or sports parks that offer a wide variety of opportunities to a broad cross section of residents of the planning scheme area. Large in size and well known amongst residents, these parks are major destinations within the planning scheme area.</p>	20-60 ha	1,2 km	<ul style="list-style-type: none"> <li>• Parking lot</li> <li>• Sightseeing lots and terraces</li> <li>• Sport field (Athletic fields, tennis courts, swimming pool, ect.)</li> <li>• Benches</li> <li>• Shelters</li> <li>• Walkways</li> <li>• Spray pool</li> <li>• Drama and concert area</li> <li>• Art center</li> <li>• Playgrounds for children and teenagers (playlots, play equipments, paved game areas)</li> <li>• Picnic area (hiking trails, picnic tables, shelters, off-street car paking, sanitation facilities, open spaces and buffer strips,)</li> <li>• Jogging trails and fitness points</li> </ul>

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<i>PUBLIC PARK AND GARDENS</i>	<i>SURFACE AREA</i>	<i>SERVING DIAMETER</i>	<i>FACILITIES AND ACTIVITIES</i>
			<ul style="list-style-type: none"> <li>• <i>Amphitheatre</i></li> <li>• <i>Flower gardens</i></li> <li>• <i>Horse riding</i></li> <li>• <i>Kioks</i></li> <li>• <i>Food/alimentation points</i></li> <li>• <i>Drinking fountains</i></li> <li>• <i>Zoo</i></li> <li>• <i>Arboretum</i></li> </ul>
<p><b>1b. COMMUNITY PARK</b> These are mid-sized parks providing a range of facilities and activity space for recreation or sport. These parks cater for large groups and are appealing to a range of users or groups. They service several communities or suburbs and are a fairly well known destination for those people living within their catchment.</p>	<i>2-20 ha</i>	<i>400 m</i>	<ul style="list-style-type: none"> <li>• <i>Parking lot</i></li> <li>• <i>Sightseeing lots and terraces</i></li> <li>• <i>Sport field (Athletic fields, tennis courts, swimming pool, ect.)</i></li> <li>• <i>Benches</i></li> <li>• <i>Shelters</i></li> <li>• <i>Walkways</i></li> <li>• <i>Playgrounds for children and teenagers (playlots, play equipments, paved game areas)</i></li> <li>• <i>Jogging trails and fitness points</i></li> <li>• <i>Amphitheatre</i></li> <li>• <i>Flower gardens</i></li> <li>• <i>Kioks</i></li> <li>• <i>Food/alimentation points</i></li> <li>• <i>Drinking fountains</i></li> </ul>
<p><b>1c. NEIGHBORHOOD PARK</b> A system of neighborhood parks is recommended to serve each of the neighborhoods described in the Residential Element. These are smaller parks providing a limited range of recreational opportunities for local residents or employees in the case of workers parks. Neighborhood Park is preliminary a landscape park providing a restful breathing spot.</p>	<i>0,4-2 ha</i>	<i>400 m</i>	<ul style="list-style-type: none"> <li>• <i>Sightseeing lots and terraces</i></li> <li>• <i>Sport field (athletic fields, tennis courts, swimming pool, fitness points ect.)</i></li> <li>• <i>Benches</i></li> <li>• <i>Shelters</i></li> <li>• <i>Walkways</i></li> <li>• <i>Playgrounds for children (playlots, play equipments, paved game areas)</i></li> <li>• <i>Flower gardens</i></li> <li>• <i>Kiosk</i></li> <li>• <i>Food/alimentation points</i></li> <li>• <i>Drinking fountains</i></li> </ul>



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PUBLIC PARK AND GARDENS	SURFACE AREA	SERVING DIAMETER	FACILITIES AND ACTIVITIES
<p><b>1d. POCKET PARKS</b> These are smaller parks providing a limited range of recreational opportunities for city-wide. Also, are the gardens where the land marks for city images located.</p>	<0,4 ha	400 m	<ul style="list-style-type: none"> <li>• Sightseeing lots and terraces</li> <li>• Benches</li> <li>• Shelters</li> <li>• Walkways</li> <li>• Playgrounds for children (playlots, play equipments, paved game areas)</li> <li>• Flower gardens</li> </ul>

## 2. SEASIDE PARKS

- Parking lot
- Sightseeing
- Swimming beach
- Fishing
- Benches
- Walkways
- Spray pool
- Flower gardens
- Kiosk
- Food/alimentation points

## 3. PUBLIC COAST

## 4. GREEN BELT AND BUFFER ZONE

- Tent, trailer, group camping
- Picnicing
- Horse riding trail
- Hiking

## 5. WADI DARNAH STREAM CHANNEL

- River side promenade
- Stream revitalization
- Channel balconies
- Walkways
- Kioks

Wadi Darnah is one of the most important and outstanding components of green infrastructure. So that a particular landscape design is required. Cheonggyecheon in downtown Seoul (South Korea) is a good sample (Fig.10).



Fig.10: Cheonggyecheon (is a nearly 6km long, modern public recreation space in downtown Seoul, South Korea. After restoration project, in 2005 has become popular among city residents and tourists.

## 6. URBAN AGRICULTURE AND RECREATIONAL AREA

- Orchard gardens
- Vegetable gardens
- Nurseries

## 7. VALLEY LANDSCAPES

- River bed restoration
- Landscapes for storm water management

### The Components of Streetscape

- Scening corridor
- Buffered roadway
- City Gates
- Green Interconnections links

Streets dedicated as Green Interconnection Link requires a particular design approach due to the existing limitations for plants location possibilities. The local as well as collector roads presents very much limited (almost not) opportunity for plantation. Three suitable techniques are presented below:

**One-way streets with/without shared surfaces:** The technique can permit the transfer of space from pavement to sidewalk or to landscape use (AECOM, 2009). In the case of one-way street implementation for the narrow streets, efficient road sharing among plants, vehicles and pedestrians can be provided with particular design such as shown in Fig. 11.

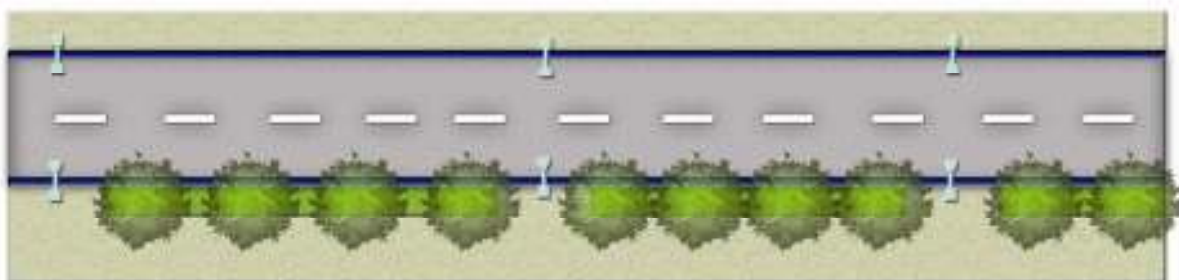


Fig. 11: One-way-street with only one sideway to have wider sideway to be able to have opportunity for plantation.

**Vine-trellised streets:** During Landscape Survey it was noted that vine-trellised streets are traditionally present at Darnah. This vine-trellised streets are good practices for both providing green interconnection links among the city green areas and also shadow for pedestrians (Fig.12).



Fig.12: A sample for vine-trellised street. The main street of Turpan is paved with flag stones and covered with grape vine-draped trellises meant to provide some shelter from the brutal sun. China, Xinjiang Province, Turpan. Source: [www.doncroner.com/labels/Turpan.html](http://www.doncroner.com/labels/Turpan.html), Retrieved: 24 March 2010).

### 9.3 Landscape Preliminary Plan

In accordance with the above mentioned concept plans, Landscape Preliminary Plan was prepared at 1:2000 scale. Land uses, circulations and general plantation pattern of Parks and Gardens (Urban Parks, Community Parks, Neighborhood Parks and Pocket Parks), Seaside Parks and Wadi Darnah as main townscape components were designed.

The existing urban agricultural areas from cultural and historical point of view are suggested to dedicate and improve as urban agriculture integrated with recreational activities. These areas cover publicly owned private land. The uncertainties related to property at Urban Agriculture and Recreational Area should have been resolved before landscape design. So that, this area isn't in the scope of ongoing landscape planning and design task.

Use of Green Belts for recreational purposes as well as river bed restorations for storm water management will be directly resolved at 1:500 scale "plantation implementation plan.

Green Belt and Buffer Zone is suggested for Darnah Town considering their ecological, social and physical functions (e.g. limiting city development, conforming urban ecological environment for the people with cooling air, improving air quality, etc.). This open and green area should be dedicated to public use without disturbance for city development except recreation. Definition of the eastern and western borders of the green belt, and northern border of the buffer zone is not under the responsibility of this project. In this end, these areas aren't in the scope of landscape planning and design task. But the implementation of those areas in future is strongly suggested for the city itself.

The type of the open and green area called as Public Coast is suggested to dedicate to public use without disturbance. Darnah Town has outstanding and characteristic coastal landscape and should be protected as it is, and managed for improvement. In this end, this open and green area is not in the scope of landscape planning and design.

The total landscape implementation areas (open-green infrastructure) were estimated roughly as follow:

- Total area of open and green areas: 2.958.251 m<sup>2</sup> (Table 4 shows surface coverage for each type of open and green area)
- Streetscape components:
  - Scenic Road: 12.674 m
  - Buffered Road: 14.340 m
  - Inner city Green Interconnection Links: 10.734 m
  - Local Green Interconnection Links: 4.469 m



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Table 4: Surface coverage for each type of open and green area

Type of the green infrastructure	Area (m <sup>2</sup> )
	(The given numbers are approx. estimations. Certain coverages can only be calculated when all the landscape project phases were completed.)
1a. URBAN PARK and <ul style="list-style-type: none"> <li>• Urban Park &amp; Sport Center: 471.868 m<sup>2</sup></li> <li>• Wadi Darnah Urban Park: 125.749 m<sup>2</sup></li> <li>• All other unclassified green infrastructures (medians, plazas, small green patches, etc.): 826.638 m<sup>2</sup></li> </ul>	<b>1.424.255</b>
1b. COMMUNITY PARK	<b>1.079.353</b>
1c. NEIGHBORHOOD PARK	12.060
1d. POCKET PARKS	Included in Urban Parks
2. SEASIDE PARKS <ul style="list-style-type: none"> <li>• West Seaside Park: 69.192 m<sup>2</sup></li> <li>• City Ceremony Area: 33.077 m<sup>2</sup></li> <li>• Coastal City Terraces: 45.885 m<sup>2</sup></li> </ul>	<b>148.154</b>
3. PUBLIC COAST: * not estimated <i>The type of the open and green area called as Public Coast is suggested to dedicate to public use without disturbance. Darnah Town has outstanding and characteristic coastal landscape and should be protected as it is, and managed for improvement. In this end, this open and green area is not in the scope of landscape planning and design task.</i>	
4. GREEN BELT AND BUFFER ZONE: *cannot be estimated <i>Green Belt and Buffer Zone is suggested for Darnah Town considering their ecological, social and physical functions (e.g. limiting city development, conforming urban ecological environment for the people with cooling air, improving air quality, etc.). This open and green area should be dedicated for public use without disturbance for city development except recreation. Definition of the eastern and western borders of the green belt, and northern border of the buffer zone is not under the responsibility of this project. In this end, these areas are not in the scope of landscape planning and design task. But the implementations of those areas in future are strongly suggested for the city itself.</i>	
5. WADI DARNAH STREAM CHANNEL	<b>145.000</b>
6. URBAN AGRICULTURE AND RECREATIONAL AREA: *not estimated <i>The existing urban agricultural areas from cultural and historical point of view are suggested to dedicate and improve as urban agriculture integrated with recreational activities. These areas cover publicly owned private lands. The uncertainties related to property at Urban Agriculture and Recreational Area should have been resolved before landscape design. So that, Urban Agriculture and Recreational Area isn't in the scope of ongoing landscape planning and design task.</i>	
7. VALLEY LANDSCAPES	<b>149.429</b>
<b>TOTAL</b>	<b>2.958.251</b>
* Not included in total size of green infrastructure that is covered by landscape planning and desing.	

Whenever the Landscape Preliminary Plan approved by the Authority, it will be started for the preparations of landscape implementation plans.

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In accordance with the landscape implementation plans (structural and planting implementation plans) Landscape Quantify Surveying will be prepared in which water requirement for plants is of concern. Total plants number (item) and total grass cover (m<sup>2</sup>) can only be certainly calculated when all the project phases were completed. On the other hand a rough estimation for water requirement for green areas was executed by the steps given below:

1. At the first step, total open and green areas were divided in two parts as “eco-centric” and “anthropocentric” with respect to the nature-based and human-based context of land use decisions.
2. Then, grass coverage and trees & scrubs coverage were approximately estimated (Table 5).

Table 5: Grass coverage and trees & scrubs coverage .

Open and green areas classes	Surface area that will be irrigated (Approx. m <sup>2</sup> )*		Suggested irrigation system/ Temporal Irrigation requirement	
	Grass coverage	Trees & scrubs coverage	Grass coverage	Trees & scrubs coverage
Class I: Anthropo-centric landscape ( <i>It is presumed that 10% of the total area of that class is grass cover; 90% of that area is trees and scrubs cover</i> ) <ul style="list-style-type: none"> <li>• 1a. URBAN PARK</li> <li>• 1b. COMMUNITY PARK</li> <li>• 1c. NEIGHBORHOOD PARK</li> <li>• 1d. POCKET PARKS</li> <li>• SEASIDE PARKS</li> <li>• WADI DARNAH STREAM CHANNEL</li> <li>• STREETSCAPE**</li> </ul>	285.000	2.565.000**	Spray irrigation/ Permanent	Drip irrigation/ Temporal (first three years will be regularly irrigated, than only in extreme conditions)
Class II: Eco-centric landscape ( <i>no grass cover</i> ) <ul style="list-style-type: none"> <li>• VALLEY LANDSCAPES</li> </ul>	-	150.000		
<b>Sub- Total</b>	<b>285.000</b>	<b>2.715.000</b>		
<b>Total</b>	<b>3.000.000 m<sup>2</sup></b>			
* The coverage areas were taken from Table 4 and generalized. **Although open and green areas have hardscapes, all numbers given here are assumed as soft landscapes because the given numbers do not include streetscape green cover. The streetscapes green cover cannot be estimated at that stage of landscape planning and design process, it is assumed that the hard landscape coverage can be replaced with streetscape green cover.				

Table 6: The approx. water requirements for grass and trees & scrubs cover

<b>MOUNTS</b>	<b>WATER REQUIREMENT FOR IRRIGATION (mm/day)</b>			
	<b>NUDAYBIN (MARDIN) 500 A.S.L 37°02'N/41°14'E</b>		<b>BODRUM (MUĞLA) 27 m A.S.L 37°02'N/27°26'E</b>	
	<b>Trifolium (corresponding grass cover)</b>	<b>Orchard (corresponding trees &amp; scrubs cover)</b>	<b>Trifolium (corresponding grass cover)</b>	<b>Orchard (corresponding trees &amp; scrubs cover)</b>
January				
February				
<b>March</b>	2,5			
<b>April</b>	3,5		2	
<b>May</b>	7,5	3	4,3	1,6
<b>June</b>	9,5	4,8	6,3	3,5
<b>July</b>	11	5,8	7,5	5,2
<b>August</b>	9,5	5,2	6,7	6,2
<b>September</b>	6,7	3,9	3,7	5,3
<b>October</b>	4		0,8	1
November				
December				

The water requirement in open and green areas, then, can be roughly estimated in accordance with the Table 5 and Table 6. On the other hand, the certain calculations should be made just after all landscape planning and design procedures were completed and approved.





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## 10.0 ATTACHMENTS LIST

- |              |                                   |
|--------------|-----------------------------------|
| ATTACHMENT 1 | DARNAH PLANTS                     |
| ATTACHMENT 2 | SAMPLE STRUCTURAL LANDSCAPE PLANS |
- a) Seaside Park (City Ceremony Area)
  - b) West Seaside Park
  - c) Seaside Park (Coastal City Terraces)
  - d) Urban Park & Sport Center
  - e) Neighborhood Park