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## 5. SUMMARY

### **I- Physiographic units:**

#### **(a)-The highland of parent rock structures:**

Parent rock structures are considered the origin of the soil parent materials. They are composed of sedimentary limestone rocks surrounding the lowlands from north, west and south directions. They have no potentiality for agriculture but they are considered the catchments area for water harvesting which is the main water resource necessary for the development of the area.

#### **(b)-The lowland of peneplanation and sedimentation:**

This covers about 88900 ha. (211753 fed.) of the total area and is considered the main promising area for agricultural development. It borders the outskirts of the highland of the rocky structures and includes the following types;

#### **1- Piedmonts:**

These are sediments transported and deposited by gravity and water forces (Colluvial alluvial foot slopes) and are situated along the mountainous escarpments. They cover about 19581 ha. (46623 fed.), which represent 22.1% of the lowland area.

#### **2- Alluvial Terraces:**

The parent material of the terraces is alluvium, derived from the original calcareous rocks of the highland and stony and gravelly surface, gently undulating sloping as a result of gully erosion. They are widely distributed in the study area, flanking wadi Hagol, along wadies Bedaa and Ghwaiba, and between

wadies Hagol and Al-Naqah. The total area of this unit is about 21000 ha. (50016 fed.), represents 23.6% of the lowland area.

### **3- Alluvial fans:**

These are sediments which are transported and deposited by water flush flooding, intersecting the mountain fronts, and crossing the piedmont, forming a cone shape. They cover about 8190 ha (19500 fed.), which represent 9.2% of the lowland area south and mainly near the faulted escarpment of the sedimentary rock structure. They have stony and gravelly surface, sloping to the west and south west and are mostly dissected by narrow channels and gullies.

### **4- Bajadas:**

Cover about 9622 ha. (22910 fed.), which represent 10.8% of the lowland area. The parent material is alluvium, derived from calcareous rocks, has a pattern of coalescing fans extending as a belt along the piedmont zone. The surface is nearly level, gently sloping and detritus.

### **5- Wadies:**

Wadies extend from the highland eastwards to the Gulf of Suez. They are filled with alluvial material developed through weathering the parent rock and transported by flood water to the lowlands. The wadies end with interacting coalescing fans which compose a delta-like unit adjacent to the Gulf of Suez. Its surface is almost flat to nearly level, covers about 23559 ha. (56095 fed.), which represent 26.5% of the lowland area. It is represented by soil profiles No. 3, 5, 8 and 10.

The study area involves four main wadies bordered from the eastern direction by the Gulf of Suez listed from south to north as follows:

**(a) Wadi Ghwaiba:**

The largest wadi, has an area about 13012 ha. (30982 fed.). It is bordered from north by Wadi Bedaa and jabal Akhaydir, from west by jabal qattamiyyah and from south by jabal Minaydrah, jabal al-jalalah al-Bahariyyah and jabal Umm Risays. It includes al-sokhna harbor and the newly developed industrial area.

**(b) Wadi Bedaa:**

It has an area of 5051.7 ha. (12028 fed.), located north of wadi Ghwaiba and jabal Ar-Ramliyyah, bordered from west by jabal qattamiyyah, from north by wadi Hagol and jabal al-kihayliyyah. It includes the Suez cement factories and other industrial activities.

**(c) Wadi Hagol:**

Wadi Hagol, has an area of 2940.3 ha. (7001 fed.). It is bordered from southwest by both wadi Bedaa and jabal al-kihayliyyah and northeast by Al-Naqah and jabal Ataqah.

**(d) Wadi Al-Naqah:**

Wadi Al-Naqah, has an area of 1749.3 ha. (4165 fed.), extends like wadi Hagol northwest – southeast, and bordered from; southwest by wadi Hagol and from northeast by jabal Ataqah.

## **6- Coastal braided deltas:**

The deltas are formed of fine alluvial parent material which is deposited near the sea due to the drop of velocity of the water stream. The surface is subject to gully and sheet erosion and is partly channeled by seasonally active streams. It covers about 5152.5 ha. (12268 fed.) which represent 5.8% of the lowland area and is characterized by almost flat surface partly covered with gravels.

## **7- Marine sediments**

The marine sediments cover about 1823 ha. (4341 fed.), which represent 2% of the lowland area. These sediments are mainly deposited by seawater actions, due to currents, and waves winds. They occupy a narrow strip of a complex pattern along the shoreline of Suez Gulf. The surface is locally covered with overblown sand and scattered natural vegetation of halophytic communities and it is almost flat or nearly level.

## **II- Soil Taxonomy:**

According to Soil Taxonomy System, soils are classified into two orders; Aridisols and Entisols, five suborders; salids, Gypsid, Calcids, Fluvents and Orthents, five great group; Aquisalids, Calcigypsid, Haplocalcids, Torrifluvents and Torriorthents, seven subgroups; Sodic Aquisalids, Typic Calcigypsid, Typic Haplocalcids, Sodic Haplocalcids, Typic Torrifluvents, Typic Torriorthents and Lithic Torriorthents and eleven soil families as follows:

### **1- *Sodic Aquisalids, coarse loamy, mixed, hyperthermic.***

Identified in the Marine Sediments, profiles 11 and 12.



**2- *Typic Haplocalcids, sandy skeletal, mixed, hyperthermic.***

In the alluvial terraces; soil profile 2 and Bajadas profile 9.

**3- *Sodic Haplocalcids, loamy skeletal, mixed, hyperthermic.***

In the alluvial terraces soil profile 6 and piedmonts profile 7 .

**4- *Sodic Haplocalcids, sandy skeletal, mixed, hyperthermic.***

Identified in the bajadas profile 14.

**5- *Typic Clacigypsids, sandy, carbonitic. hyperthermic.***

In alluvial fans, represented by profile 15.

**6- *Typic Clacigypsids, coarse loamy, carbonitic. hyperthermic.***

In alluvial fans, profile 16.

Five Entisol families as follows:

**1- *Typic Torrifluents, loamy skeletal, mixed, hyperthermic.***

Identified in the wadies represented by profile 5.

**2- *Typic Torrifluents, sandy skeletal, mixed, hyperthermic.***

Identified in the wadies represented by profiles 3 and 8.

**3- *Typic Torrifluents, coarse loamy, mixed, hyperthermic.***

Also in the wadies profile 10.

**4- *Typic Torriorthents, coarse loamy, mixed, hyperthermic.***

In the coastal braided deltas, profiles 4 and 13.

**5- *Lithic Torriorthents, loamy skeletal, mixed, hyperthermic.***

In the piedmont area, profile 1.

### **III- Hydrology:**

The digital elevation model (DEM) by which the area landforms are portrayed is produced from satellite data (Raster data). Six topographic maps 1:50.000 were used for drawing the

contour lines After wards, the triangular irregular network (TIN) is produced using DEM data. TIN is built from a series of irregularly spaced points which are used to construct a network of linked triangles.

The produced TIN helps in figuring the altitudes for road, and water courses constructions, cut and fill calculations and the characterization of suitable areas for water harvesting.

Moreover, TIN structure is used for the slope and aspect maps which determine the horizontal component of gravity Aspect identifies the steepest downslope direction at a location on a surface.

#### **IV- Land evaluation:**

##### **Current land suitability:**

The current suitability of the studied area is estimated by the present land characteristics.

Currently includes two orders {suitable (S) and not suitable (N)}, two classes {marginally suitable (S3) and currently not suitable (N1)}, four subclasses (S3sn, N1tsn, N1sn and N1wsn) and seven units (sub classes and sub-subclasses) as follows:

1- **S3sn-1:** Marginally suitable with a severe intensity of salinity and alkalinity, moderate intensity of texture and calcium carbonate, and slight intensity of topography and gypsum limitations. This unit represents soils of the coastal braided deltas physiographic unit and occupies an area of about 12268 feddans.

2- **S3sn-2:** marginally suitable with a moderate intensity of texture and salinity and alkalinity, and slight intensity of

topography, calcium carbonate and gypsum limitations. This unit represents soils of the wadies physiographic unit and occupies an area of about 56095 feddans.

**3- N1tsn-1:** not suitable with a sever intensity of texture and salinity and alkalinity, moderate intensity of topography, calcium carbonate and slight intensity of gypsum limitations. This unit represents soils of the alluvial fans physiographic unit and occupies an area of about 19500 feddans.

**4- N1tsn-2:** not suitable with a sever intensity of texture, moderate intensity of topography, depth, calcium carbonate and salinity and alkalinity, and slight intensity of gypsum limitations. This unit represents soils of the bajadas physiographic unit and occupies an area of about 22910 feddans.

**5- N1tsn-3:** not suitable with a very sever intensity of salinity and alkalinity, sever intensity of depth, moderate intensity of topography and texture and slight intensity of calcium carbonate and gypsum limitations. This unit represents soils of the piedmont physiographic unit and occupies an area of about 46623 feddans.

**6- N1sn:** not suitable with a severe intensity of texture, moderate intensity of salinity and alkalinity, and slight intensity of topography, calcium carbonate and gypsum limitations. This subclass represents soils of the alluvial terraces physiographic unit and occupies an area of about 50016 feddans.

**7- N1wsn:** not suitable with a very severe intensity of wetness, severe intensity of texture, depth and salinity and

alkalinity, and slight intensity of topography, calcium carbonate and gypsum limitations. This subclass represents soils of the marine sediments physiographic unit and occupies an area of about 4341 feddans.

### **Potential land suitability:**

Potential suitability term refers to the suitability of units, for a defined use, after specified major improvements have been completed where necessary. Land improvements cause beneficial changes in the qualities of the land itself.

The future land improvements required to correct or reduce the severity of limitations existing in the area under consideration. Such as a) leveling, good drainage systems in the soils of marine sediments, leaching of salinity and reclamation of alkalinity where needed soil conditioners and application of modern irrigation systems, to save irrigation water.

Potential suitability indicate the existence of two orders (S and N), three classes (S2, S3 and N1), three subclasses (S2s, S3s and N1ws) and three units (S3s-1, S3s-2 and S3s-3) as follows:

- **S2s:** Represents soils of the wadies. Occupies an area of about 56095 feddans. Moderately suitable, moderate intensity of texture and slight intensity of calcium carbonate and gypsum limitations.
- **S3s-1:** Represents soils of the coastal braided deltas. Occupies an area of about 12268 feddans. It is marginally suitable, moderate intensity of texture and calcium carbonate, and slight intensity of gypsum limitations.

- **S3s-2:** Represents soils of the alluvial terraces, alluvial fans and Bajadas. Occupy an area of about 92426 feddans. Marginally suitable, severe intensity of texture, moderate intensity of calcium carbonate, and slight intensity of gypsum limitations.
- **S3s-3:** Represents soils of the piedmonts Occupies an area of about 46623 feddans. Marginally suitable, severe intensity of depth, moderate intensity of texture and slight intensity of calcium carbonate gypsum limitations.
- **N1ws:** Represents soils of the marine sediments. Occupies an area of about 4341 feddans. It is not suitable with a severe intensity of wetness, moderate intensity of texture and depth and slight intensity of calcium carbonate and gypsum limitations.

#### **4.5.3. Land suitability for specific crops:**

Eleven crops were selected to test their suitability for cultivation in the study area. These crops are grouped as follows:

Field crops: Wheat, Cotton, Barley and Sesame.

Fodder crops: Alfalfa and Sorghum.

Fruit crops: Olives, Grape and Guava.

Vegetable crops: Watermelon and Cabbage.

##### **4.5.3.1. Current land suitability for specific crops:**

Not suitable (N1) for Wheat, Cotton, Barley, Sesame, Alfalfa, Sorghum, Olives, Grape, Guava, Watermelon and Cabbage, which are compared and matched with the different

physiographic units except Olives are marginally suitable (S3). The wadies and braided delta units are highly suitable for Olives.

#### 4.5.3.2. Potential land suitability for specific crops:

Potential suitability of the study soils for selected crops could be evaluated after executing necessary land improvements. Classes of the study soils for specific crops are given as follow:

Units Crops	Piedmont	Alluvial fans	Bajadas	Alluvial terraces	Wadies	Coastal braided delta	Marine sediments
Wheat	S3	N1	N1	N1	S3	N1	S3
Cotton	N1	N1	S3	S3	S3	S3	N1
Barley	S3	N1	N1	N1	S3	N1	S3
Sesame	S3	S3	S3	S3	S2	S3	S3
Alfalfa	S3	N1	S3	S3	S2	N1	S3
Sorghum	S2	S3	S3	S2	S2	S3	S3
Olives	S3	S1	S3	S2	S1	S1	N1
Grape	S3	S3	S3	S3	S2	S3	N1
Guava	S3	S3	N1	N1	S2	N1	S3
Watermelon	S3	S2	S2	S2	S2	S2	N1
Cabbage	S3	N1	S3	S3	S3	N1	N1