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Land Resource and Water Qualities of North Husseniya Extension for Agricultural Development, Egypt

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THE MAIN objective of this study is to produce a geometrically corrected physiographic- soil map of scale 1:50.000 reduced to the attached map scale 1:250.000 for the studied area as a base to identify land and water resource, recognize the main constrain which are facing the agricultural development and to recommend the most optimum crop can be proposed for the study area. To fulfill this objective 7 soil profiles were chosen from 30 profiles to representing the different soil units. Morphology description were done and soil samples have been collected for physical and chemical analysis. Based on the aerial photo-interpretation and the geographic information system coupled with the field work and laboratory analysis obtained data, the physiographic soil map was produced. Two main landscape can be identified:
I- Coastal plain (The fluvio marine deposits) which contain clay flats, clay swamp, old coast lines, hills and old sandy deposits
II- Young sub-deltaic deposits.

The results indicated that the most effective constrains are: lack of fresh water, soil salinity, soil sodicity, high water table, massive structure due to the heavy texture content and the low effective soil depth.
Therefore, the main crops selected and proposed for the project area: Rice, Clover, Cotton, Maize, Barley and Sudan grass, Amshoutt.

Keywords : Land, Water Husseniya, Development.

Egypt is in a urgent need to increase both of the productivity of the existing land and to expand the cultivated area, therefore, locating new areas having potential for agricultural development is a high priority task of the government to reduce the critical shortage of food production. According to the national land reclamation program special consideration has been focused to the projects of soil reclamation. One of the problems, which are facing the land reclamation policy, is heavy textured salt affected soil. Some of these soils are located at the fringe of the east Nile Delta was chosen for this current study for several consideration, i.e it is the natural expansion of the Nile Delta, its location is neighboring to the main cities, the presence of the new Salam Canal.

Description of the studied area location

The studied area incorporates an area of approximately 65.000 feddans in the south-central part of lake Manzala. It is bounded by longitudes. 32 00 W and 32 15 E and latitudes 31 00 S and 31 15 N (Fig. 1).

Climate

Using the soil toxonomy system bases, soil survey staff (1999). The soil temperature regime of the studied area could be defined as Thermic and soil moisture regime as Torric. Except the soils, which have high water table level its soil moisture regime could be considered as Aquic.

Land use:

Land	Area (Feddans)	%
Open fishing	24030	(37%)
Closed fishing	22100	(34%)
Agriculture	6100	(9.5%)
Settlement	330	(0.5%)
Underutilized lands	12420	(19%)
Total	65000	100

Material and Methods

Aerial photo-interpreation

Panchromatic aerial photographs (1991) (scale 1:40000) average consisting of 26 aerial photographs have been used for the present study.

All photographs were analyzed stereoscopically and further divisions made using "the physiographic analysis" detailed by Bulter (1959); Vink (1963) and Goosen (1967). The main elements used are slop, relief, greytone, in addition to parceling and natural vegetation, so the physiographic map has been obtained.

Field works

Four sample area were chosen to represent all mapping units. The first sample area include (21) augering and mini pits, (19) augering and mini pits in the second, (18) in the third, meanwhile (17) augering and mini pits were done in the fourth one. Finally 11 full soil profile were chosen to represent all mapping units.

Laboratory analysis

Disturbed soil samples and 8 surface and ground water samples were collected for laboratory analyses, which include the following:

mechanical analysis (Piper,1950 and Klut, 1986), $CaCO_3$, O.M, EC (Jackson , 1967). Soil reaction pH (Richard, 1954). Cation exchange (Piper, 1950) as modified by Gohar (1954). Exchangeable sodium according to Tucker modified method (1971) Available N.P.K. (Jackson, 1967). Water analyses (Jackson, 1967 and Page *et al.*, 1982).

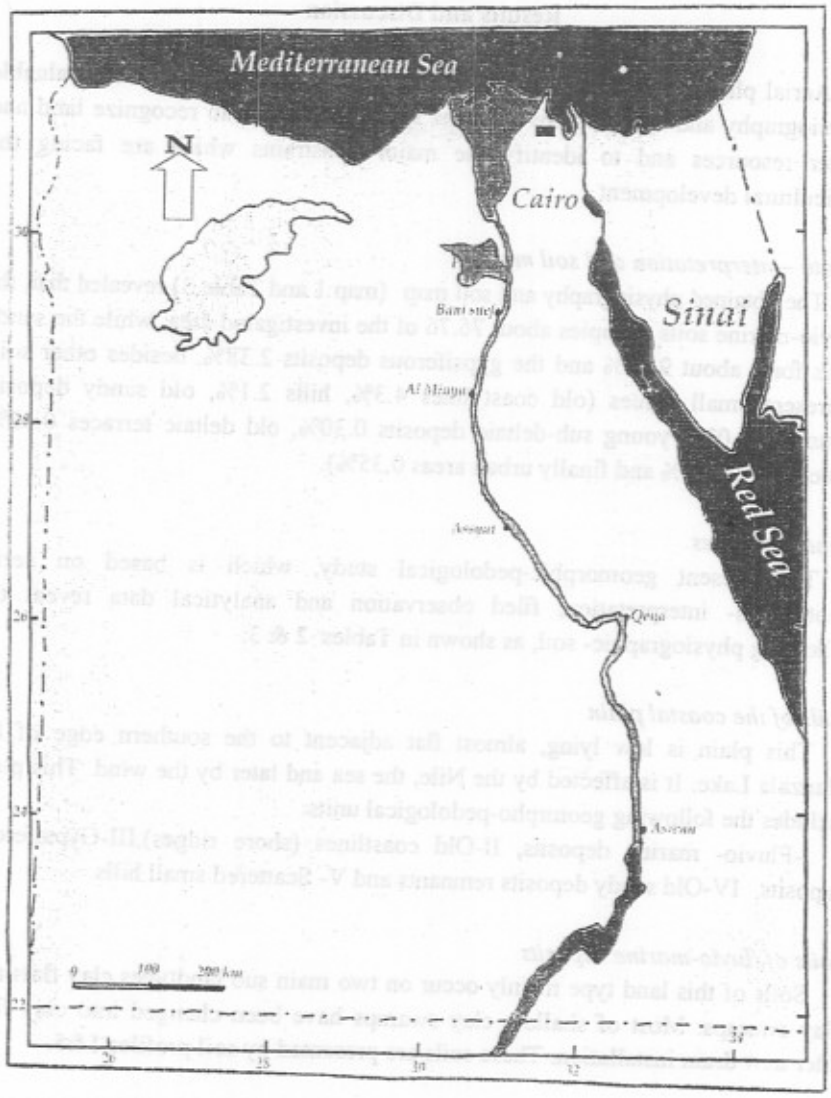


Fig.1. The Location of the studied area.

Soil map compilation

Soil map has been obtained by matching the physiographic units with taxonomic units using G.I.S (ARC-Info Program).

Land suitability

Actual and potential suitability calculated by using the land suitability criteria, by Siderius (1984) & (1989).

Results and Discussion

Aerial photographs- interpretation is very important tool to provide valuable physiography and soil map covering the studied map area to recognize land and water resources and to identify the major constrains which are facing the agricultural development.

Photo –interpretation and soil map

The obtained physiography and soil map (map 1 and Table 3) revealed that, the fluvio-marine soils occupies about 76.76 of the investigated area, while the sandy soils form about 9.17% and the gypsiferous deposits 2.38%, besides other soils represent small values (old coast lines 4.3%, hills 2.1%, old sandy deposits remnants 1.02% young sub-deltaic deposits 0.30%, old deltaic terraces 0.42%, water bodies 3.2% and finally urban areas 0.35%).

Land resources

The present geomorphic-pedological study, which is based on aerial photogrphs- interpretation, filed observation and analytical data reveal the following physiographic- soil, as shown in Tables 2 & 3.

Soils of the coastal plain

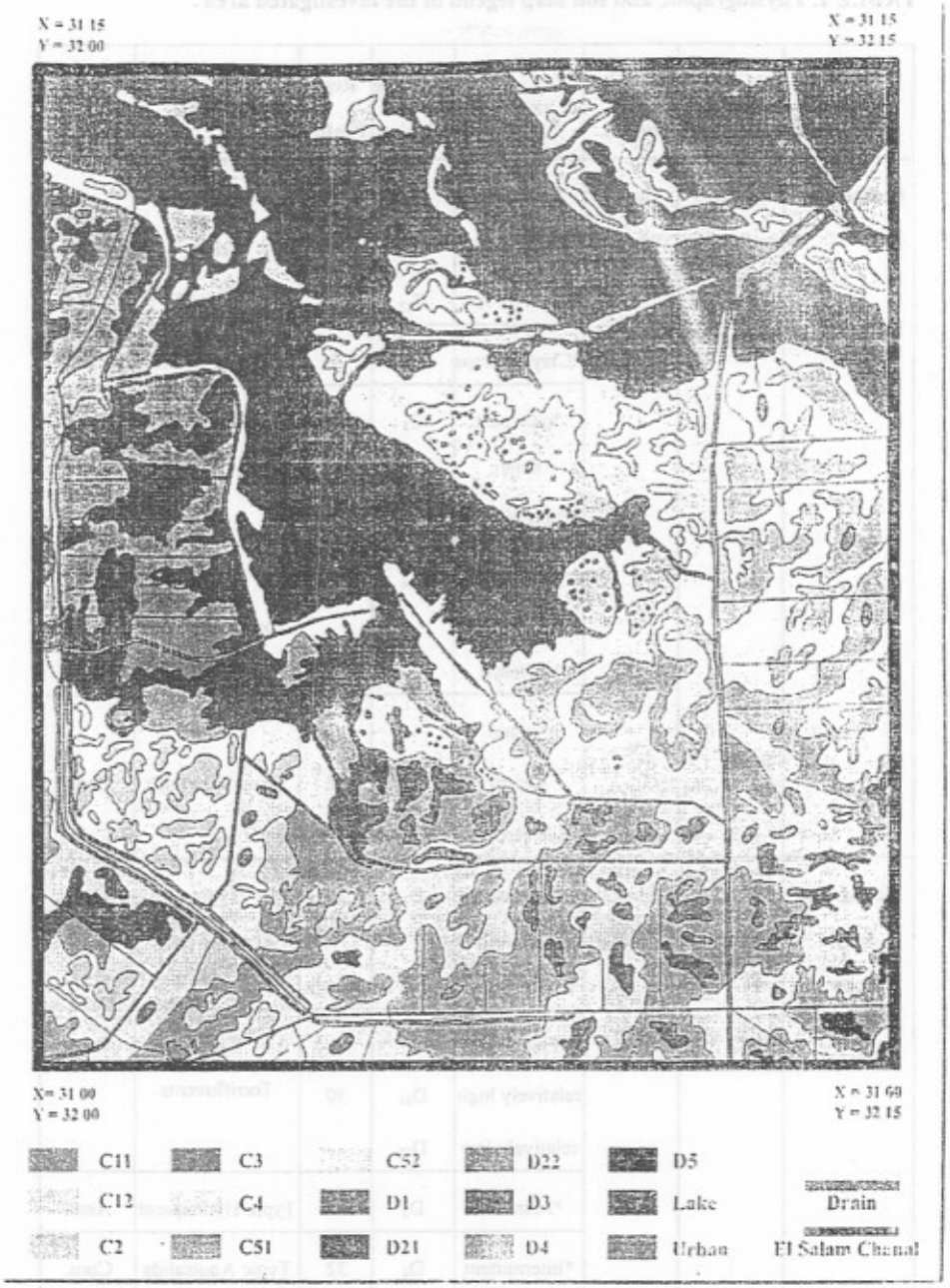
This plain is low lying, almost flat adjacent to the southern edge of El-Manzala Lake. It is affected by the Nile, the sea and later by the wind. This plain includes the following geomrpho-pedological units:

I-Fluvio- marine deposits, II-Old coastlines (shore ridges),III-Gypsiferous deposits, IV-Old sandy deposits remnants and V- Scattered small hills.

Soils of fluvio-marine deposits

Soils of this land type mainly occur on two main sub landtypes,clay flats and clay swamps. Most of shallow clay swamps have been changed into clay flats after new drain installation. These soils are presented by soil profiles 1&5.

The particle size distribution are characterized by alternative pattern of sedimentation as the texture is clayey for the different layers of soil profiles 1 and 5. The Calcium Carbonate ranges between 11.2-14.2%. High precent of $CaCO_3$ is due to shells fragments. Organic matter content ranges between 1.9-2.3%. the high values of O.M% may be due to the common humified and fresh residuals of organic materials (fish ponds) and irrigation water of Bahr El-Bakar drain which is very rich in decomposed organic residuals, the electric conductivity ($EC_{soil\ past}$) is very high at is ranges between 16.7-35.7 dS/m.



MAP 1. Physiographic – Soil map of the studied area .

TABLE 1. Physiographic and soil map legend of the investigated area .

Landscape	Relief	Lithology/ origin	Land form	Mapping Unit	Rep. Profile	Soil Sets.	Type of soil Sets.
Coastal plain	gently undulating	Fluvio-marine deposits	* clay flats relatively high	C_{11}	1	Vertic Torrifluvents	Cons.
			relatively low	C_{12}	2		Cons.
			*Clay Swamps	C_2	5	Typic Aquisalids	Cons.
			*old coast liens. (shore ridges)	C_3	11	Typic Hapolsalids	Cons.
			*Old sandy deposits remnants	C_4	18	Typic Torripsamments	Cons.
			*Island Recent	C_{51}	22	Typic Salorthids	Cons.
			Sub-Recent	C_{52}			Cons.
Young sub-deltaic deposits	Flat to almost flat	Alluvial deposits	*Scattered small hills (Hummocks)	D_1	25	Typic Torrifluvents	Cons
			*Flat Plains relatively high	D_{21}	30	Typic Torrifluvents	Cons.
			relatively low	D_{22}			
			*Marches.	D_3	31	Typic Hydraquent	Asso.
			*Intermittent wet land.	D_4	32	Typic Aquisalids	Cons.
			*Gypsiferous deposits	D_5	33	Typic Petrogypsids	Cons.

TABLE 2. Summary of soils morphological features at the studied area.

Map-ing Unit	Rep. Profile No.	Depth in CM	Slope	Colour		Text-ure class	Structure	Consistency	Stickiness	Plasticity	Carbonates	Boundary	cementation	Other
				Dry	Moist									
C_1	1	0-45	A	10 YR5/3	10 YR 2/2	C	MG	EFI	VST	VPL	MO	C	MO	Shells
		45-100		5YR5/3	5 YR 3/2	C	MG	EFI	VST	VPL	MO	C	MO	Shells
		+100	Water table level											
C_2	5	0-35	A	10 YR5/3	10 YR 2/2	C	MM	VFI	ST	PL	MO	C	O	Shells
		+35	Water table levels											
C_3	11	0-30	G	5YR 3/2	10 YR 2.1/1	C	MM	VFI	ST	PL	MO	C	O	Shells
		+30	Water table levels											
C_4	18	0-15	A	5YR 2.5/2	5YR 3/2	Scl	SG	VFR	SST	SPL	SL	G	O	Shells
		15-65		10 YR 5/3	10 YR 3/2	S	SG	LO	NST	NPL	SL	C	O	Shells
		+65	Water table level											
C_5	22	0-45	A	5YR 3/2	5 YR 3/1	L	MW	FR	SST	SPL	MO	C	O	Shells
		+45	Water table levels											
D_1	25	0-15	A	10 YR 5/3	10 YR 2/2	C	MW	VFI	ST	PL	SL	G	O	Shells
		15-90		5 YR 3/2	5 YR 2.1/2	C	MW	VFI	ST	PL	SL	C	O	Shells
		+90	Water table level											
D_2	30	0-25	A	5YR 3/2	5 YR 2.1/1	C	MW	VFI	ST	PL	SL	G	O	Shells
		25-110		10 YR 5/2	10 YR 2/2	C	MW	VFI	ST	PL	SL	C	O	Shells
		+110	Water table level											

* All abbreviation according to FAO (1990) & ISRIC (1991).

TABLE 3. The main physical & chemical characteristics of the representative soil profiles .

Mapping Unit	Rep. Profile No.	Depth in cm	Particle size distribution						pH	O.M %	$CaCO_3$%	EC dS/m	CEC meq./100 gm Soil.	ESP %	Available Macro Nutrients (ppm)		
			Gravel %	C.Sand %	F. sand %	Silt %	Clay %	Texture class							N	P	K
C_1	1	0-45	0.0	0.31	2.61	16.58	80.50	Clay	8.6	2.3	13.6	16.2	71.1	17.7	210	40.2	270.1
		45-100	0.0	0.62	3.14	20.33	75.91	Clay	8.6	1.9	14.2	26.7	61.3	18.0	-	-	-
		+100	Water table level														
C_2	5	0-35	0.0	0.11	0.30	33.40	66.81	Clay	8.0	2.1	11.2	35.7	50.2	20.3	213	36.2	251.3
		+35	Water table level														
C_3	11	0-30	0.0	0.22	0.6	33.31	65.87	Clay	8.1	2.2	12.3	51.2	53.4	25.2	200	31.2	231.6
		+30	Water table level														
C_4	18	0-15	0.0	3.03	60.0	14.55	22.41	Sandy clay loam	8.5	1.3	5.3	36.2	19.4	15.2	30.3	20.2	110.3
		15-65	0.0	10.6	80.8	2.4	7.15	Sandy	8.0	0.7	7.2	11.1	6.1	13.1	21.8	19.6	90.8
		+65	Water table level														
C_5	22	0-45	0.0	7.31	40.32	39.18	13.18	Loam	8.6	2.3	11.0	37.6	12.7	17.3	68.2	24.2	130.7
		+45	Water table level														
D_1	25	0-15	0.0	0.21	0.92	25.38	73.49	Clay	7.9	0.9	4.8	15.6	66.1	11.8	190	31.2	261.0
		15-90	0.0	0.18	1.05	25.18	73.59	Clay	8.0	0.3	3.4	11.3	60.3	13.7	178	27.1	250.3
		+90	Water table level														
D_2	30	0-25	0.0	0.13	3.51	33.26	36.11	Clay	8.6	1.3	5.1	16.3	60.1	18.7	210	41.2	251.9
		25-110	0.0	0.23	1.17	35.15	63.44	Clay	8.6	0.8	6.8	10.11	59.3	19.1	180.1	40.1	241.3
		+90	Water table level														

Soils of the coast lines or former shore ridges

These soils are formed as a result of sea pretreatment leaving former shore ridges beyond it. Soils of this sub-land type is represented by soil profile no.11. Soil texture is clayley in the upper layers while it is sandy in the deepest layers. $CaCO_3$ varies between 11.0- 21.3. ($EC_{soil\ past}$) ranges between 30.1- 51.2 dS/m. CEC ranges between 41.0 and 53.4 due to texture and organic matter content. ESP varies between 15.3 - 25.2, *i.e.*, strongly alkali-saline soils.

Soils of sandy deposit remnants

These soils are formed as a result of wind action. It is represented by soil profile 18. Soil texture is sandy clay loam, in the upper layer, while it is sandy in the subsurface. $CaCO_3$ content varies between 5.3 and 7.2%. organic matter ranges between 0.7 - 1.3%. ESP ranges between 13.1 and 15.2%, and ($EC_{soil\ past}$) ranges between (11.1-36.2).

Soils of young sub-deltaic deposits

These soils represent the young sub-deltaic plain, which is of recent age. Throughout the long ages, when the river terraces has been formed, immense quantities of gravel and sand have been carried by the Nile into the sea, where they spread out around the river's mouth in the form of Delta. As the relative level of the sea fell, the less compacted sandy and gravelly deposits were disintegrated by water action and the materials were again redistributed, where the more resistant portions remained in position and formed islands. These soils are called "Turtle backs". This unit is represented by soil profile 25. Texture is clayley and there is a few small to medium gravel in all layers as it ranges between 3.4 and 4.8 Organic matter content is very low and ranges between 0.3 and 0.9%. ($EC_{soil\ past}$) tends to increase with depth and it ranges between 11.3 and 15.6 dS/m. ESP ranges between 11.8 and 13.7.

Water qualities

Water plays an important role in soil forming processes, especially ground water table (its depth and salinity) which is considered the decisive factor of salinization, as it affect the salt balance of the soil and this reflects directly on the exchangeable sites in soil complex. The analytical data of surface and ground water tables in the different mapping units are given in Table 4.

The main constrains and how to get rid of them

The main constraints and the ability to overcome these limiting factors in North Husseniya extension could be summarized in the following Table:

The main constrains	Solutions
- Lack of fresh water	Installation of Salam Canal
- Soil salinity	Leaching requirements
- Soil sodicity	Gypsum & leaching requirements
- High water table	Installation of high capacity drains
- Fertility improvement	Adding O.M & chemical fertilizers
- Lack of infra structure	Schools, hospitals, factories installation, etc ...

TABLE 4. salinity and chemical composition of surface and ground water table in the studied area .

Water type	pH	O.M	EC	Soluble cations (meq./L)				Soluble anions (meq./L)				SAR
		mg/L	dS/m	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$	
(I) Surface Water												
*Manzala Lake (W_1)	7.3	80.1	112.2	40.0	630.6	1100.1	40.4	1.2	9.6	1560.3	241.0	51.3
*Water body (W_2)	7.6	40.1	90.3	30.0	178.0	1200.2	53.2	2.0	7.3	860.3	541.9	110.3
*Water of fish pond (W_3)	8.3	79.3	41.2	20.0	99.0	600.1	25.5	2.2	7.0	359.2	376.2	71.1
*Water of gypsiferous swamp (W_4)	8.1	11.3	20.1	37.0	110.0	138.2	17.1	1.8	8.4	139.6	152.6	12.3
*Water of wind blown deposits (W_5)	8.4	15.1	21.2	20.0	44.0	189.3	12.8	2.6	5.4	67.1	191.0	30.1
*Bahr El- Bakr drain (W_6)	8.6	91.3	5.3	6.0	8.0	41.3	9.4	1.0	1.3	40.8	21.1	13.6
(II) Ground Water												
*Profile (1)	8.5	10.2	61.6	18.7	190.4	881.2	49.7	1.8	4.3	786.1	347.7	80.1
*Profile (22)	8.5	29.3	41.0	32.0	32.0	163.2	26.6	3.0	7.6	181.4	189.7	12.4

Agricultural development patterns

A number of factors were considered in selecting cropping patterns suitable for post reclamation cultivation of crops in the study area.

These included:

- Physical/ technical: *e.g.* water, soils, climate, topography, etc...
- Financial/social: financial returns, risks and labour requirements.
- Socio-Economic: economic returns, food production, employment and water requirements.
- Traditional: Past experience and practice.

Based on these factors, fairly traditional crops and rotations are proposed for the study area. The main crops selected are Cotton, Rice, Clover, Sudan grass, Maize and Barley, Amshoutt.

Recommendation

Three other conclusions that emerge from the analysis are:

- Risk considerations tend to support the proceeding conclusion, excepting the question of unforeseen adverse future changes within the study area. By damaging the fishery these would favour reclamation.
- Partial reclamation of the study area should prove technically feasible and economically and might from a valuable starting point or spearhead study for long term full scale reclamation.
- Meanwhile, in the short to medium term, other alternative areas within and around Lake Manzala appear as or more suitable for agricultural reclamation of the study area.

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الموارد الأرضية ونوعية المياه بمنطقة امتداد شمال الحسنية للتنمية الزراعية

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الهدف الرئيسي من هذه الدراسة هو إنتاج خريطة فيزوجرافية أرضية مصححة مقياس ١ : ٥٠,٠٠٠ صغرت إلى الخريطة الملحقة لمقياس ١: ٢٥٠,٠٠٠ لمنطقة الدراسة كأساس التعرف على الموارد الأرضية والمائية ومعرفة المعوقات التي تواجه التنمية الزراعية لاقتراح أكثر دورة زراعية مناسبة يمكن أن تطبق بمنطقة الدراسة وللوصول لهذا الهدف تم عمل ٧ قطاع تم اختيارها من ٣٠ قطاع تمثل مختلف الوحدات الأرضية تم وصفها مورفولوجيا.

كما تم جمع عينات تربة للتحليل الطبيعي والكيماوى وبالاعتماد على تفسير الصور الجوية ونظم المعلومات الجغرافية بجانب نتائج الحقل والمعمل تم إنتاج الخريطة الفيزوجرافية الأرضية. وأمكن تحديد وحدتان رئيسيتان:

١- السهل الساحلي (ترسيبات بحيرية فيضية) والتي تشتمل على السهول الطينية والمستنقعات الطينية وحواف الشواطئ القديمة والتلال والترسيبات الرملية القديمة المتبقية.

٢- الترسيبات التحت دلتاوية الحديثة والنتائج أظهرت أنه من أكثر المعوقات الموجودة بمنطقة الدراسة هي ندرة المياه العذبة وملوحة التربة وقلوية التربة وارتفاع مستوى الماء الأرضى والبناء المتكتل كنتيجة لثقل القوام وكذلك قلة العمق الفعال للتربة.

وعلى هذا فإن أهم المحاصيل التى يمكن اقتراحها لتتناسب وظروف منطقة الدراسة : الأرز، البرسيم، القطن، الذرة، الشعير، وحشيشة السودان والأمشوط.