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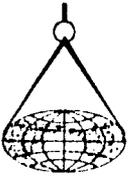
ENVIRONMENTAL  
ASSESSMENT  
Tartous to Lattakia

prepared for the  
SYRIAN ARAB REPUBLIC  
and the  
U.S. AGENCY for  
INTERNATIONAL DEVELOPMENT



**LYON associates, inc.**

in association with  
MORRISON - MAIERLE, INC. and  
JAMES R. SNITZLER ASSOCIATES, INC.



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November 1, 1978

Mr. Douglas A. Campbell, Contracting Officer  
Regional Operations Division-NE  
Office of Contracting Management  
Department of State  
Agency for International Development  
Washington, D.C. 20523

Subject: Highway Feasibility Studies  
Final Environmental Assessment  
Lattakia - Tartous Region-Syrian Arab Republic  
Contract No. AID/NE-C-1459 (Syria)

Dear Mr. Campbell:

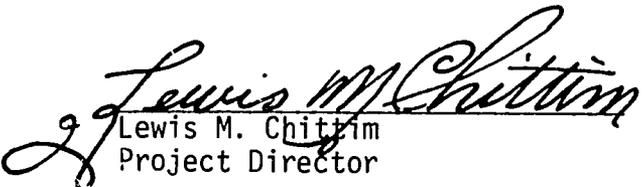
Lyon Associates, Inc., Morrison-Maierle, Inc. and James R. Snitzler Associates, Inc. are pleased to submit six copies of the Final Environmental Assessment for the Lattakia to Tartous feasibility study.

The revisions suggested by those agencies who reviewed the "Draft" report are incorporated in this final version.

We are also submitting ten copies to the Government of Syria, four copies to USAID/Damascus and two copies to the USAID/Reference Center.

Respectfully Submitted,

MORRISON-MAIERLE, INC.

  
Lewis M. Chittim  
Project Director

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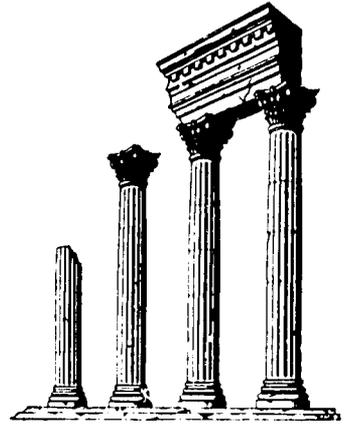


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I

# INTRODUCTION



## INTRODUCTION

The Syrian Arab Republic is emerging as a major economical, cultural and political center of the developing Middle East. The need for modern facilities, equipment, technology, and commerce is vital to the Syrian people as they struggle to meet their goals. And, as we have learned long ago in the United States, a country's growth and development is directly related to its transportation system; and highways are the keystone to any transportation system.

The Syrian government, in cooperation with the U.S. Agency for International Development, wants to build a modern, four-lane highway between its two major sea ports, Lattakia and Tartous, along the Mediterranean Sea coast. This highway is projected to be an asphalt surfaced facility with limited access that would be very similar in design to the U.S. Interstate Highway System. Presently, there is a narrow, twisting two-lane highway, which has minimal design and whose construction is totally incapable of handling even today's vehicle loads and volumes of traffic between these two commercial centers; this does not take into consideration the traffic projected for this stretch of highway in the year 2003.

A four-lane highway is presently under construction south of Tartous. This proposed highway would connect at Tartous to the highway now being built and would continue the 90 kilometers north to Lattakia.

The corridor for this proposed 90 kilometer roadway is sandwiched between the Mediterranean Sea on the west and the Nusayriyah mountain range on the east. Its width varies from 4 to 15 kilometers and it is characterized as a coastal plain region of mild temperatures and abundant



rainfall which is highly developed agriculturally. Fruit orchards, olive groves, vegetable farms and wheat and barley fields literally fill this fertile valley floor.

But, more importantly, this region of Syria is acclaimed by archeologists as one of the richest archeological areas in the world. It is estimated that a mere 5% of the potential "finds" have been made in this region of Syria. Archeologists have found evidence of human activity thousands of years before Christ through archeological finds of stone tools and other materials.

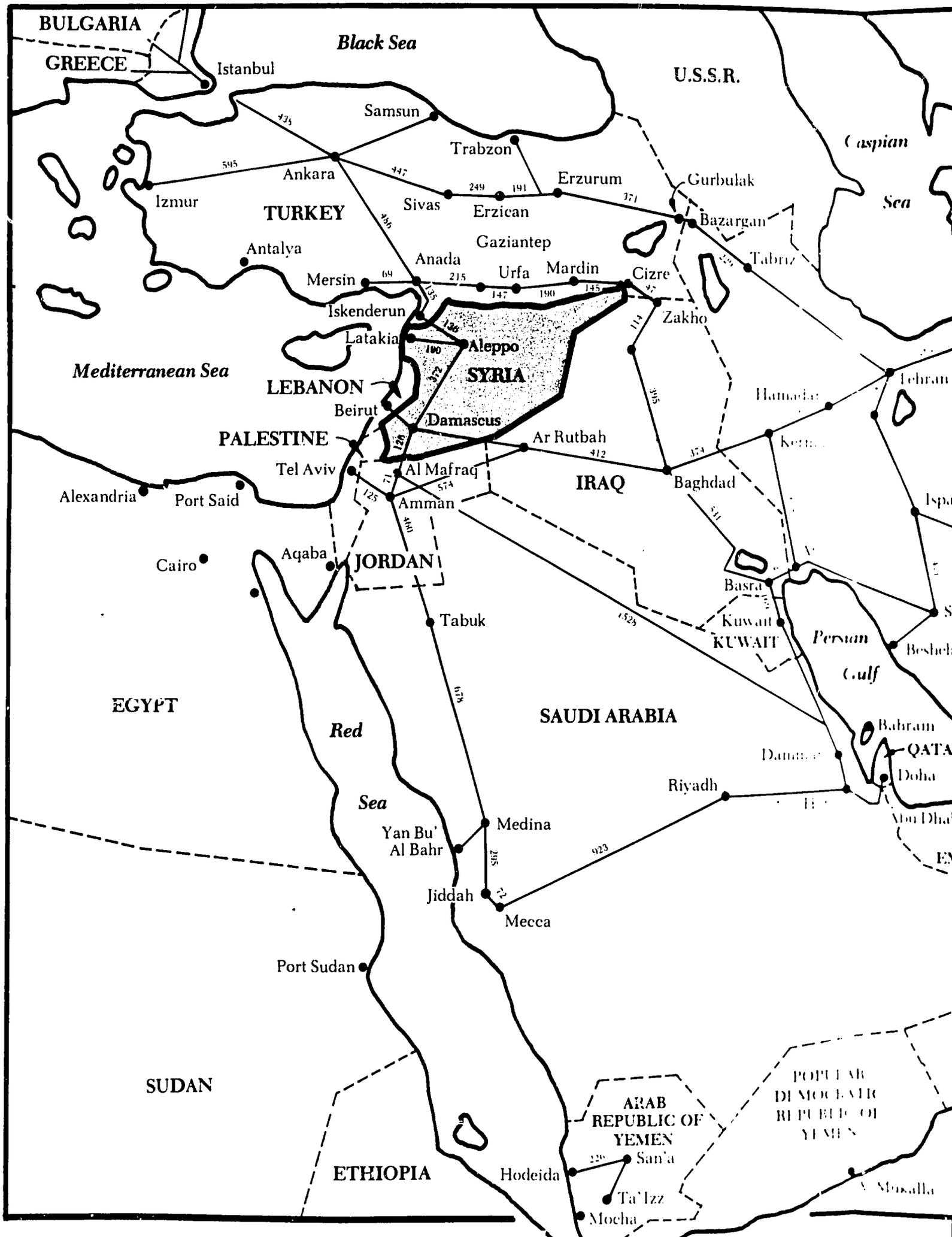
Before this proposed Lattakia to Tartous highway could be built, the Syrian government and the U.S. Agency For International Development required that a feasibility study be made to determine the most favorable alignments and design standards, and to assess the total economic and environmental impact on this coastal region of some 500,000 people. Lyon Associates, in association with Morrison-Maierle, Inc. and James R. Snitzler, Associates, Inc., contracted to produce this study.

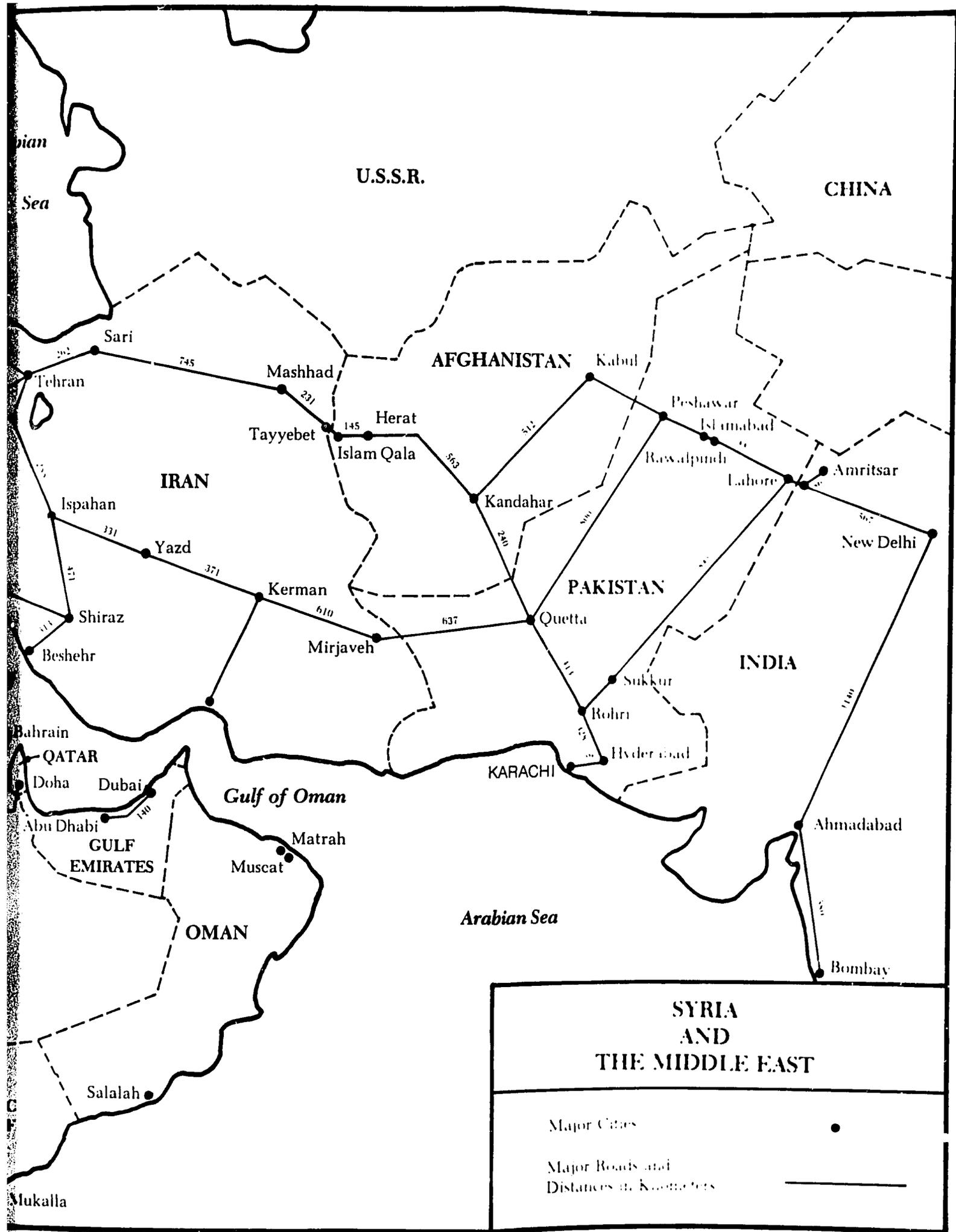
This report is part of that Highway Feasibility Study. Its purpose is to determine the environmental impact on the land and its people. This report was compiled with the help of archeologists, environmental engineers, soils engineers, geologists and economists in the fields of agriculture, transportation, and industry, agronomists, location engineers, transportation engineers and countless individuals both private and from various Syrian Ministries.

It is the intent of this report to point out both the good and the bad effects on the total environment that will be caused by building this highway.



The writers of this report wish to recognize the time, energies and knowledge imparted to them by a very gracious and enthusiastic Syrian people.





Iranian Sea

U.S.S.R.

CHINA

AFGHANISTAN

IRAN

PAKISTAN

INDIA

QATAR

GULF EMIRATES

OMAN

KARACHI

**SYRIA AND THE MIDDLE EAST**

Major Cities

Major Roads and Distances in Kilometers

Sari

Mashhad

Kabul

Tehran

Tayyebet

Herat

Peshawar

Islamabad

Islam Qala

Rawalpindi

Lahore

Amritsar

Ispahan

Kandahar

New Delhi

Yazd

Kerman

Quetta

Mirjaveh

Shiraz

Beshehr

Sukkur

Bahrain

Doha

Dubai

Gulf of Oman

Abu Dhabi

Matrah

Muscat

Arabian Sea

Ahmadabad

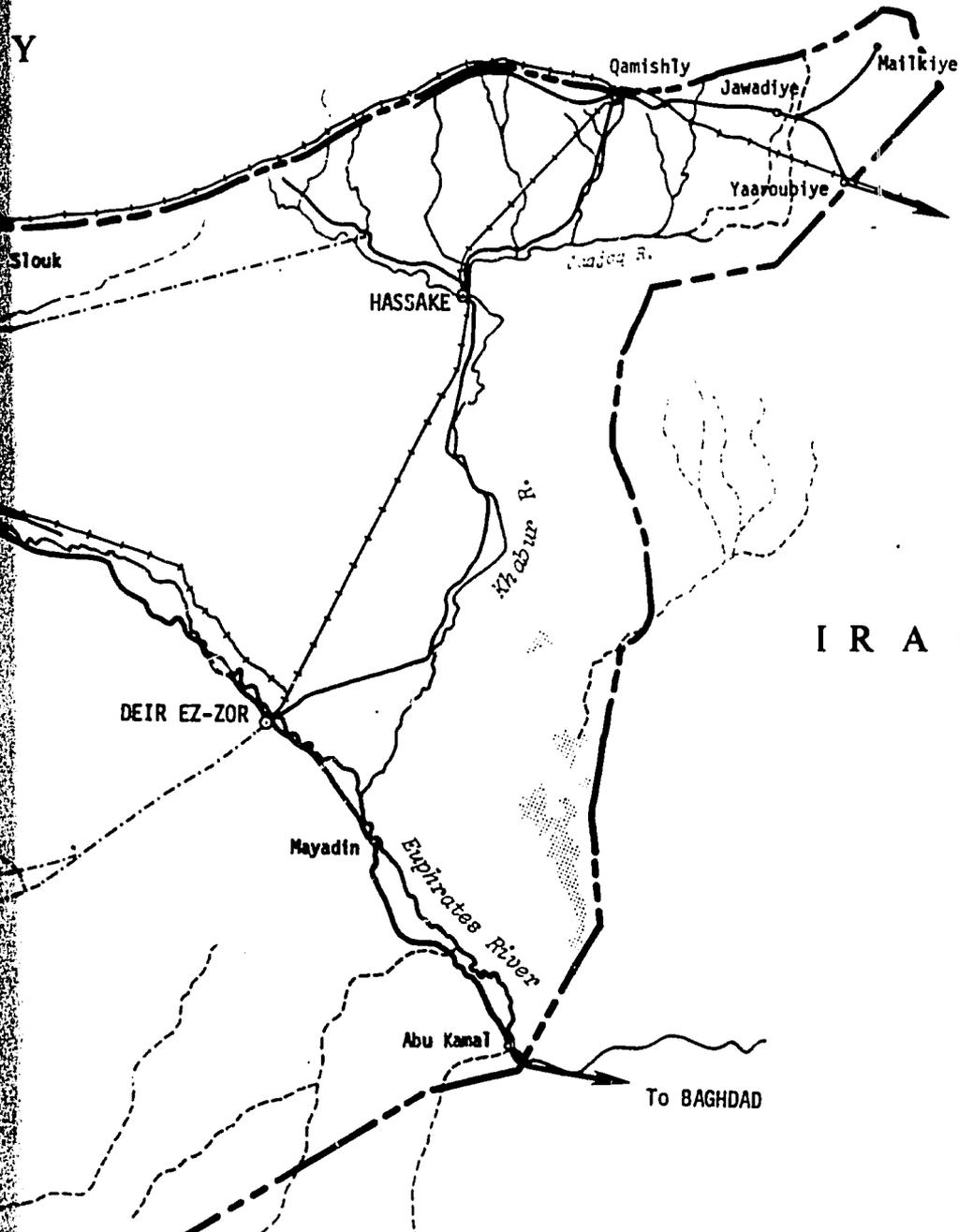
Bombay

Salalah

Mukalla



Y



I R A Q

DEIR EZ-ZOR

HASSAKE

Mayadin

Abu Kanal

To BAGHDAD

# SYRIAN ARAB REPUBLIC

## LEGEND



Highway



Lake



Primary Road



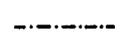
Seasonal Lake



Secondary Road



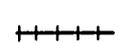
Town



Trail



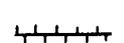
Mohafazat Center



Railroad - Standard Gauge



Capital



Railroad - Metric Gauge



Border



River

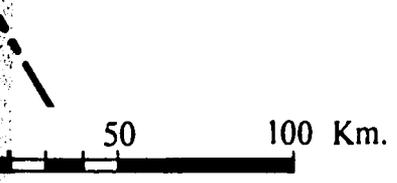


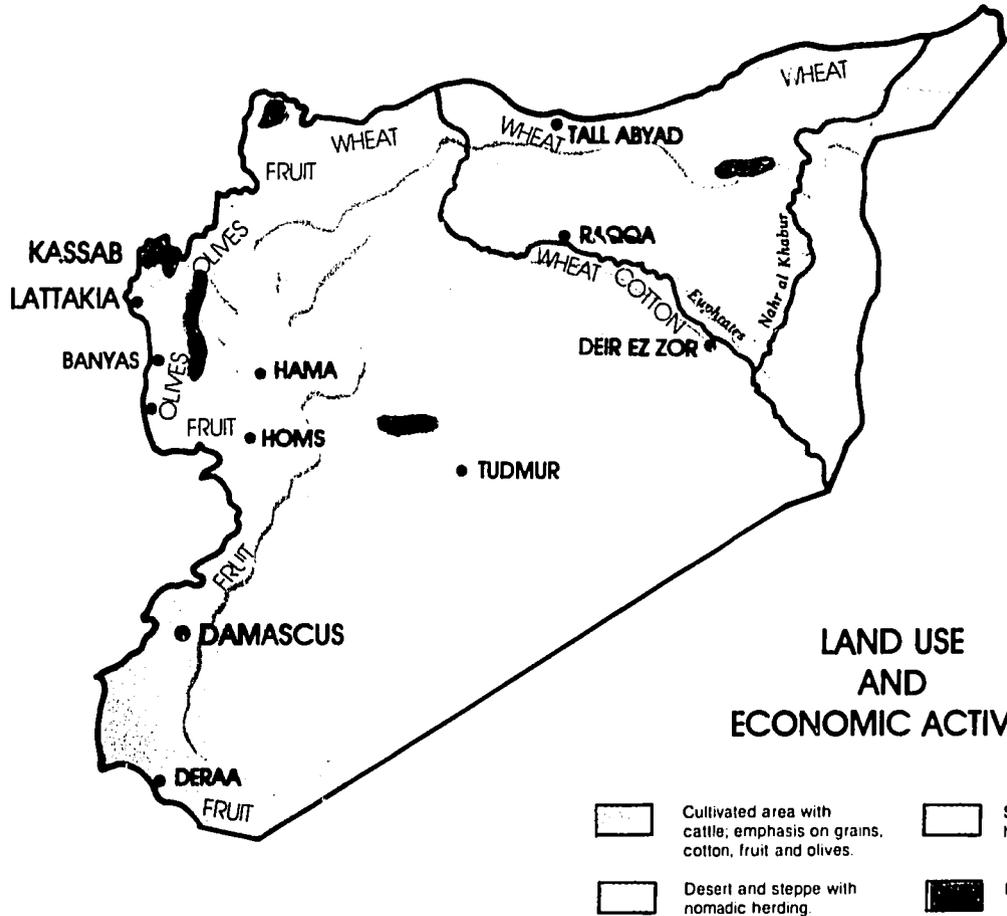
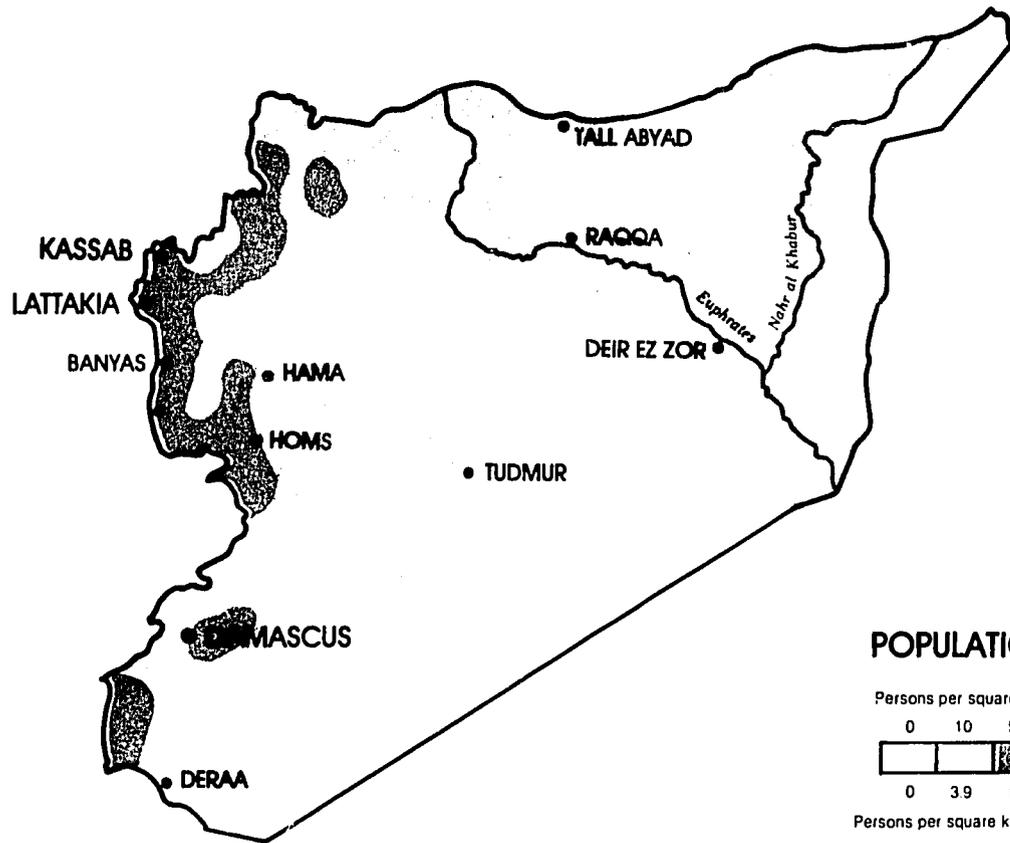
Political Border

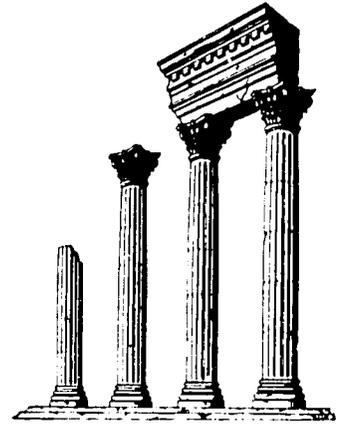


Seasonal River (Wadi)

To BAGHDAD







II

**HISTORY OF SYRIA**



## HISTORY OF SYRIA

Until 1919, Syria (known to the Arabs as Bilad Al-Sham) was scarcely more than a geographical term covering today's Syria, Lebanon, Palestine, Jordan and portions of Iraq. It stretched from what is today Turkey on the north to the Red Sea and the Arabian Desert (Saudi Arabia) on the south and from the Mediterranean Sea on the west to the Syrian Desert (Iraq) on the east.

This was the vital link of land connecting the continents of Europe, Asia and Africa. As such it was an important communications junction and the crossroads of oriental civilization since the earliest of world history.

Thousands of years ago man settled along the valleys of the Orontes and the Euphrates Rivers. Dating from 11,000 years ago, Tell Mreikit on the Euphrates is the earliest settlement known so far. At Abu Huraira, not far from Tell Mreikit, archaeologists unearthed buildings dating from the 9th millenium B.C. Traces of the Uruk civilization from 9,000 B.C. were recently discovered in the upper reaches of the Euphrates Valley.

With the spread of settlements along the banks of the Euphrates, civilization began to flourish. The City of Mari was discovered at the site of Tell Hariri. A number of civilizations were superimposed on each other at this site, the earliest dating from 3,000 B.C. Thirty thousand clay tablets written in Akkadian were unearthed at Mari which have greatly enriched our knowledge of ancient history.

Two other cities contemporary to Mari were mentioned in clay tablets found at Mippur in Iraq, Ebla and Parmoti (Lattakia). The Amorite City of Ebla (actual Tell Mardikh) was situated south of Aleppo on the road to Damascus. A few years ago thousands of clay tablets written in Amoritic classical, Canaanite and Sumerian were discovered in that city neatly



stacked on shelves. This discovery is of great significance to history since it reveals that Ebla was the center of a very important country in the Near East as early as 2300 B.C. that flourished until the first half of the second millenium B.C.

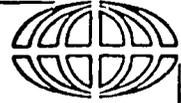
The City of Ugarit at Ras Shamra, nine kilometers north of Lattakia, was discovered in 1929. The site had been inhabited since the Stone Age and flourished during the Canaanite settlements in the middle of the second millenium B.C. It was finally destroyed by the people of the sea at the end of the second millenium B.C. Tablets found at this site produced the oldest known alphabet in history. This 30 character alphabet is the basis of the Semitic Arabic as well as Greco-Roman alphabets.

By the year 1200 B.C. the Hittites and Canaanites were invaded and defeated by the sea people of the Aegean and the Arameans who had migrated there from the Arabian Desert. Thus were born the Phoenician and Arameans civilizations in Syria.

The Phoenicians established themselves on the coast devoting their energies to commerce and the establishment of colonies in the seaboard cities of the eastern Mediterranean district.

Inland Syria was split up mainly into smaller Aramean states such as Hama and Damascus. Aramaic became the language of international trading as well as the diplomatic language of all the Near East. It is spoken today in Christian communities such as Maloula, 50 Km north of Damascus.

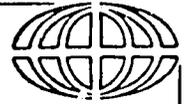
Arameans and Phoenicians managed to survive as Assyrian, New Babylonian and Persian empires emerged one after the other until Alexander of Macedonia won victory over Darius of Persia and started three centuries of Greek domination over Syria. Upon his death in the year 323 B.C. one of



his generals, Seleucus Nictor, took control of the Syrian area and among other cities founded Alexandretta, Antioch and Laodicea (Lattakia), the latter named after his mother. The Seleucids ruled until the year 64 B.C. when the Syrian province was conquered by the Romans. Under the Romans, Syria regained its prosperity. It even became the granary of Rome. Its influence was felt in Rome itself to the extent that the poet Juvenal exclaimed, "The Syrian Orontes has poured its waters into the Tiber." Romans married Syrian ladies. Syria even produced an emperor, Phillip the Arab. Ruins of Roman and Greek influence are numerous in Syria and can be found in such places as Palmyra, Bosra and Apamea and many other locations including Lattakia and Jebleh.

After the Roman Empire crumbled in 395 A.D., the Byzantines from the north controlled the land, followed by a brief Persian intrusion, until the birth of the Islamic religion and the appearance of the Arabs at Syria's southern frontiers. It took them only three years to conquer Syria, from 633 to 636 A.D. The Arabs in time built a civilization that rivaled that of the Romans. Many of the Arab palaces and mosques can still be admired today. The first Arab dynasty, that of the Umayyads, even moved its capital from Arabia to Damascus because of its central location from which to govern the vast Islamic empire. Damascus became the fourth holy city after Mecca, Medina and Jerusalem.

In the eleventh century A.D. the European crusades began. Crusaders were repelled by Saladin and his cohorts, however they stayed long enough to build many castles that remain today. In 1240 A.D. the Mongols invaded and devastated the entire country. Mamelouk armies from Egypt defeated the Mongols in the same year and ruled Syria until the second hoard of Mongols marched across Syria in 1387. Again the country was



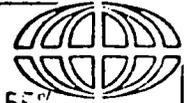
devastated. It was during the rise of the Turkish Ottomans, beginning in 1517, that Syria regained its prosperity. The Ottoman Turks were the conquerors of the European peninsula and the Balkans.

The Turks dominated Syria's history until 1918 when they were expelled by the English and the Arab army of Emir Faysal. The French banished the Arabs in 1920 and detached the states of Jordan (Transjordan) and Iraq. The Treaty of Paris recognized the independence of Syria and Lebanon in 1936. During World War II, Syria was occupied by Allied Forces and it was freed of outside occupiers in 1945. Syria's political position was rather nebulous until 1958 when it joined into the United Arab Republic with Egypt. A military uprising in 1961 ended that union, and in 1963 the Baath Arab Socialist Party came to power and remains so today under the leadership of President Assad.

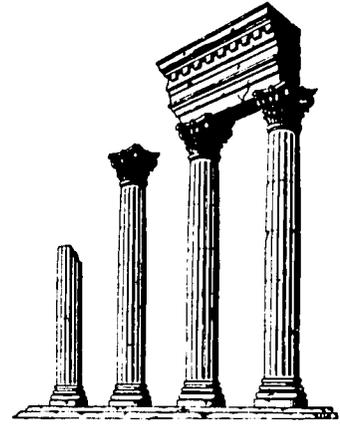
The frontiers of modern Syria, with the exception of the Mediterranean Sea, are not natural boundaries; the country is separated from Turkey, Iraq, Lebanon, Palestine, and Jordan by lines drawn on a map.

Economically, Syria today belongs to the developing nations of the world. The extensive agricultural areas, and its mineral riches which have hardly been tapped, its industrial potential backed by an open and active population eager for progress, all combine to give this country a significant economic future.

Economic and social developments have been implemented in five-year plans most successfully. The present plan, from 1976 to 1980, calls for a major 12% annual growth rate in its Gross Domestic Product, thus establishing Syria as an industrial country in this area of the world.



Agriculture accounted for 22% of the country's GDP in 1976, with 55% of the Syrian population engaged in agriculture. Since independence, Syrian leaders have spared no effort to promote the agricultural sector; vast new areas have come under irrigation and a new fertilizer plant is already pumping 250,000 tons of phosphated fertilizer into the country's agriculture. An increase of 50% to 60% of total agricultural production is predicted by the end of the present five-year plan.



**III**

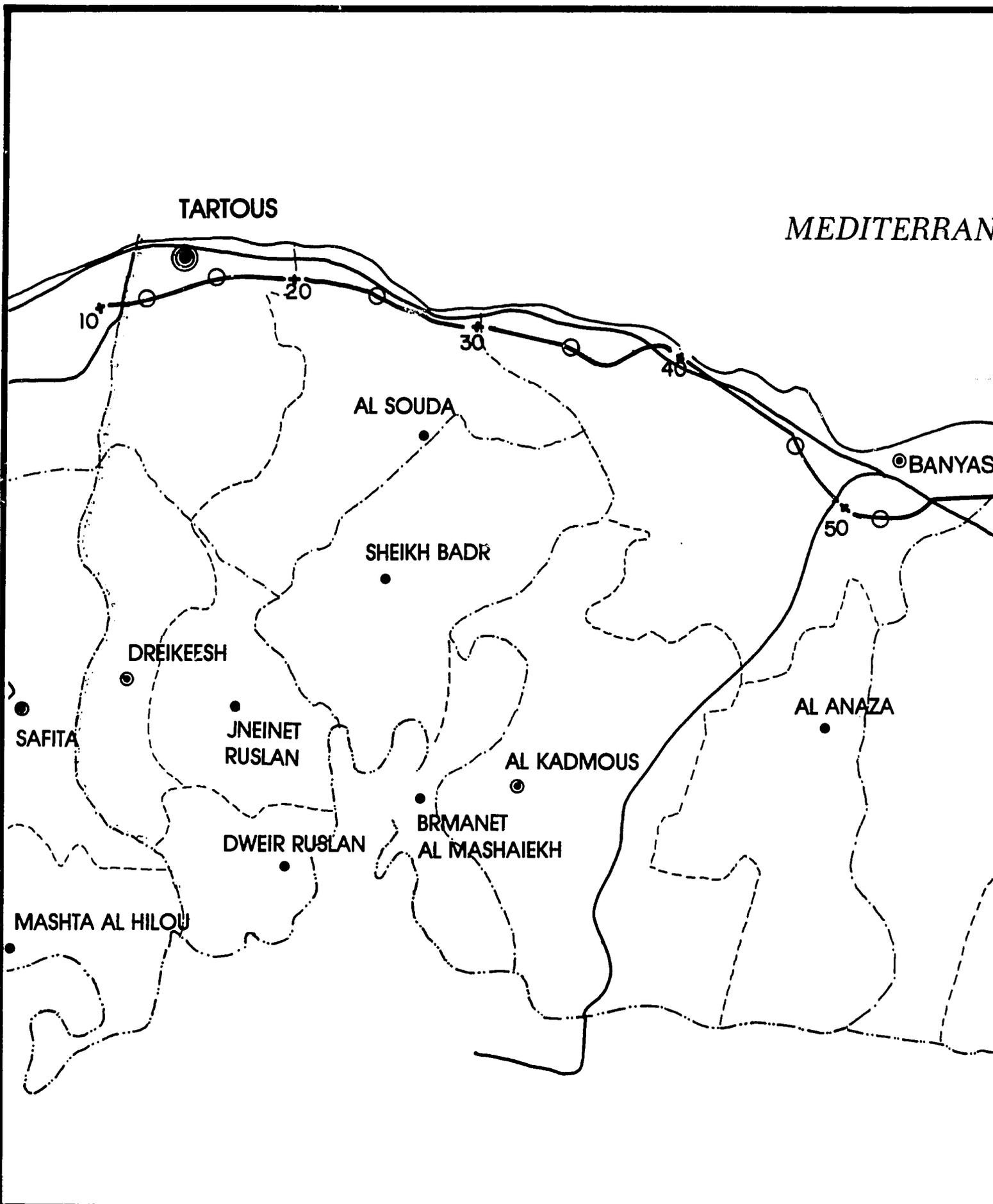
**ZONE OF INFLUENCE**



## ZONE OF INFLUENCE

The economic zone of influence was defined by the economics team and includes the area which would be economically affected by the construction of the proposed highway between Lattakia and Tartous. This environmental report considers this zone of influence, but is more specifically concerned with a narrower corridor which includes the proposed alignment route.

The zone of influence is approximately 2,450 square kilometers in size and the topography consists of flat to rolling coastal plain extending from the sea through the foothills to the mountains. Almost all of the plain and foothill area is agriculturally developed.



MOHAFAZAT CENTER (PROVINCE)



MANTIKA CENTER (DISTRICT)



MOHAFAZAT BOUNDARY



MANTIKA BOUNDARY



MEDITERRANEAN SEA

LATTAKIA

TARTOUS

JEBLEH

AL HISAN

EIN AL SHARKIE

AL KIRDAHA

AL FAKHOURA

MUZEIRAS

SLENFEH

AL HAFEH

60

70

80

90

● NAHIA CENTER (SUB-DISTRICT)

— ZONE OF INFLUENCE BOUNDARY

- - - NAHIA BOUNDARY

— EXISTING PAVED ROADS

TARTOUS - LATTAKIA HIGHWAY

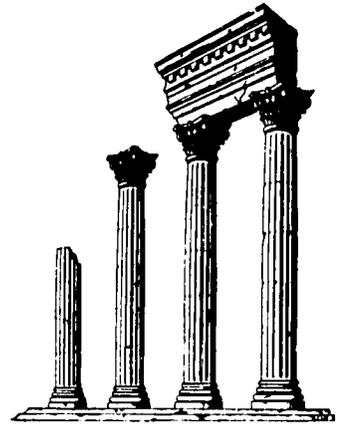
ZONE OF INFLUENCE

Syrian Arab Republic

JAMES R. SNITZLER Assoc., Inc.

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IV

# THE CORRIDOR



## THE CORRIDOR

### The Natural Environment

Virtually all of the study area has been altered by man for agricultural, commercial or residential purposes. There are few areas which could be considered to be in a "natural state." The beaches remain in a semi-natural state, but even here man has done some altering.

This is a beautiful portion of Syria, with the Mediterranean Sea on the west and the mountains to the east. The lower hills are terraced and farmed or planted with fruit trees and natural shrubs and grasses and on the steeper mountains, sheep and goats graze. The lower flatlands are farmed and well tended. The entire study area is dotted with many villages.

The climate is typical of the Mediterranean coastal area, with a winter type rainfall pattern. Yearly rainfall ranges from 90 to 100 centimeters (35 to 40 inches), occurring mostly between October and March. The dry season extends from late March to early October. The rains are gentle, occurring in storms of two to three days and interspersed with rain-free periods. Total rainfall increases with rising altitude to the east.

The temperature is generally mild in winter and mostly frost-free along the coastal area. It is cooler in winter as the altitude climbs to the east. January is the coldest month and July the warmest.

### Cultural Factors

The life-style of the Syrian people in this coastal study area is a mixture of ancient customs and rapidly changing technology. The population is primarily Muslim. While many of the ancient customs are being



retained, they are gradually assuming some of the conditions of western culture.

TABLE 1  
TOTAL POPULATION AND ANNUAL GROWTH RATE BY MANTIKA

Mohafazat and Mantika	Population 1960	Population 1970	Annual Average Growth Rate (%)	Estimated Population 1976 <sup>2/</sup>
Lattakia				
Lattakia	61,403	94,135	4.4	121,886
Jebleh	62,344	92,145	4.0	116,592
Al-Haffeh	23,740	28,127	1.7	31,121
Al-Kirdaha	30,361	34,128	1.2	36,660
Tartous				
Tartous	46,197	61,791	3.0	73,782
Banyas	66,122	77,496	1.6	85,239
Dreikeesh	28,196	34,735	2.1	39,348
Sheikh Badr	21,479	26,100	2.0	29,332
Total or Average	339,842	448,657	3.0	533,960

NOTE: Based on extrapolation of the annual average growth rate 1960 to 1970 - By the economist team.

Transportation, for example, consists of pedestrian, bicycle, donkeys, mules, horses with carts and a varied mixture of automobiles, large trucks and buses.

The population of the Syrian Arab Republic was estimated at 7½ million people in 1976. Within the study area, the population is estimated at slightly more than 530,000 people. The annual growth rate for the country is 3.3 percent, as estimated by the Central Bureau of Statistics, and Syrian government officials anticipate a similar growth pattern in the years ahead. In the study area, the growth rate ranges



from 4.4 percent around Lattakia to 1.2 percent in the Al Kirdaha Nahia (sub-district).

The population density of Syria is 43 persons per square kilometer. In the study area, the density is 218 persons per square kilometer.

The study area is characterized by a young population; 49.3 percent of the total population is 14 years old or younger. This statistic is the same for the total Syrian population.

The trend within the study area has been toward urbanization. From 1960 to 1976, the annual average growth rate for the urban population was 5.7% while the rural population growth rate was 1.7% annually. This compares favorably with the Syrian total growth rate of roughly 5 percent urban and 2 percent rural, for the same period.

#### Labor-Force

The economically active population 10 years of age and over account for 37.8 percent of the study area's total population in 1970; the national average for the same period was 39.9 percent. The ratio of male to female in the economically active population of the study area is 84 to 16, compared with the national ratio of 89 to 11.

Agriculture is by far the major source of employment in the study area, with 60.7 percent of the economically active population engaged in one form or another of agriculture. Other industries employing the working population include wholesale-retail trade, manufacturing, transportation and construction.

#### Education

The average literacy rate for the study area is 51.9 percent. This is near the national average of 54.2 percent. Naturally, the literacy



rate is highest in the major urban areas, with Lattakia and Tartous each having a 55.1 percent rate. Other areas range down to 43 percent. (Figures based on 1970 statistics.)

The literacy rates throughout Syria are expected to rise dramatically in the 70s, as the Syrian government has employed a program of mandatory education of all children through the 12th grade.

#### Health Facilities

In Lattakia there are two hospitals and another planned. Fifteen new health centers are planned to be constructed and they will be dispersed throughout the Lattakia district.

Tartous has one hospital and one health center. Several new health centers, and one new hospital, are planned. It is anticipated that when the Syrian government's health plans are completed, there will be one health center dispensary for each 5000 persons in this study area.

#### Waste Disposal

Raw sewage is currently being dumped into the sea in Lattakia. The new waste disposal collection system is under construction, however, and a new sewage treatment plant is planned; although no construction date has been set. In Tartous, raw sewage is also dumped into the sea. Again, a sewer collection system and treatment plant are planned by city officials, but no construction dates have been set.

Small villages and farms either use septic tanks or dump raw sewage into the local streams. New construction regulations, however, require some type of sewage treatment. The pattern of dumping into streams will most likely continue until government regulations dictate a change.



### Aesthetics and Human Interest

The aesthetic values of the Syrian coastal region lie mainly in the beauty of the Mediterranean Coast, the cultivated coastal plain and the adjacent Jabal An Nusayriyah Mountain Range. The plain and the lower hills are dotted with small farming villages which still maintain many of the ancient cultural patterns. Farming on the small farms is still largely done with oxen, donkeys or mules although the use of tractors is becoming more common.

Evidence of history from ancient times is abundant. Qalat Markab, a castle built during the Crusader times, is one of the more prominent and imposing sites seen from the present roadway, and many religious tombs and archeological "tells" are visible. The continuously unfolding vista of the Jabal An Nusayriyah Mountains on the east and the Mediterranean Sea coast on the west make this tropical corridor one of the most beautiful in Syria.

### Animals and Plants

Birds within the study area are limited to small song birds and a few game birds. Hunting is done on a small scale.

Fishing in streams for sport is practically non-existent. In interviews with forestry officials and with private citizens, they unanimously expressed amazement that any body would consider fishing as a sport. Stream fishing, however, is done with explosives. Charges are detonated in the deep holes and children stand in the shallows downstream to collect the dead fish.

Native animals consist of rodents and a few predators such as fox. The dense human population and the fact that all available cultivable



land is in use, leaves very little natural habitat for any but the smallest wild animals.

Native trees in the study area consist of pine, eucalyptus, cyprus, lebanese cedar, acacia, poplar and a few walnut. There are small areas of natural forest, but these are very limited. No harvesting of pine trees is permitted, except for those which are dead. The poplar trees are harvested in small numbers and are primarily used for scaffolding for light construction work.

Syria has undertaken an active reforestation program in which some 2,500 hectares (6000 acres) per year are planted with about 6 million seedlings of Pine, Cyprus, Eucalyptus, Acacia, Lebanese Cedar and a few other varieties.

During periods when Syria was occupied by foreign powers, nearly all the mountains within the study area were denuded of native trees.

Endangered plant species are limited to the Lebanese Cedar according to the Ministry of Agriculture Forestry Officials. A few years ago these were practically nonexistent but the reforestation program is now restoring the Lebanese Cedar stands.

#### Tourism and Recreation

Within the Lattakia-Tartous study area is much of Syria's principal vacation and recreational area. It includes about 100 of the country's 150 kilometers of coastline and many of its mountain resorts. Syrian and foreign tourists alike vacation in this area, visit the historical sights, use the beaches, and during the summer months take advantage of the coastal and high mountain weather.



The main historical attractions of the area are the museum of Tartous, Saladin's Castle near Slenfe, Markab Castle near Banyas, the Roman Amphitheater at Jebleh and the famous ancient city of Ugarit at Ras Shamra where archeologists continue to uncover important historical finds. Table 2 shows the increase in tourist visits to these sites between 1970-1976. With improved access to the sites and with improved accommodations in the zone it is expected that visitors to the historical sites will increase substantially.

TABLE 2  
ESTIMATED VISITORS TO HISTORICAL SITES  
LATTAKIA-TARTOUS ZONE OF INFLUENCE

<u>Tourist Site</u>	<u>1970</u>	<u>1976</u>
Museums	3,500	3,400
Castles, amphitheaters, etc.	2,500	22,400
Ancient Cities	<u>5,700</u>	<u>22,000</u>
Zone Total	11,700	47,800

An expansion of all recreational facilities in Syria is being planned and executed to increase the capacity to accommodate the growing tourism industry. Development of tourism facilities in the Lattakia-Tartous zone is of primary importance to the Syrian government, particularly the coastal areas north and south of Lattakia and south of Tartous. The major development of these primary areas is planned during the 1980-1990 period. The high 3.3% growth rate of Syrian population and the growth of neighboring countries, as well as the expected rise in family income,



are expected to produce increasing demands on tourism facilities in the study area. The projected ADT associated with these new tourist facilities is shown in Table 3 below.

TABLE 3  
PROJECTED TOURISM AVERAGE DAILY TRAFFIC  
LATTAKIA-TARTOUS ZONE OF INFLUENCE  
(Four Month Period)

	<u>1983</u> No. for the Period	<u>No. for</u> the Period	<u>1993</u> Accumulative Total	<u>2003</u> No. for the Period	<u>Accumulative</u> Total
Buses	48	152	200	172	372
Cars	<u>264</u>	<u>837</u>	<u>-1,101</u>	<u>1,057</u>	<u>2,158</u>
Total	312	989	1,301	1,229	2,530

#### Land Use

Agriculture in the coastal plains portion of the Lattakia-Tartous study area consists mainly of vegetables, citrus trees and olives. The lower rolling hills and stony lands are planted in vast olive orchards. Citrus crops consist mainly of oranges, apricots, apples, pears, peaches, figs, grapes and nut trees. Virtually all arable land is cultivated, even some of the steeper slopes which are terraced. General land use areas are shown on map plates 3 through 13.

Cultivation is largely done by animal power on the smaller farms. Cattle, mules and horses are used, especially on the terraced hills. However, tractors are coming into use more and more and are used quite extensively on the larger farms. Many tractors are also used on a



cooperative basis, where several farmers will use the same tractors and implements to prepare their land and tend their crops.

Winter crops are predominantly wheat and barley, with some cool season vegetables such as cabbage, cauliflower and broad beans. Summer crops include the majority of warm season vegetables and are consistently more productive where irrigation from streams or wells is available. The coastal plain area has many dependable wells. Irrigated land amounts to about 15% of all arable lands. In irrigated areas crop yields are increased to the point that fresh produce is harvested in all seasons. Former swamps and wet lands have mostly been drained.

Table 4 shows production of marketable surpluses which is the production amount in excess of what is used by the farm families.

Sheep and goats and a few cattle are a part of most farming systems. Many also have donkeys, mules and horses. Few forage crops are raised specifically for livestock. Feeds are largely crop residue and grazing is usually confined to seedling winter wheat and to steep hillsides, ditch banks and roads shoulders. Herding is usually done by women or children and the herds are usually small, often there are less than five animals being herded in one group.

#### Residential, Industrial & Commercial

The main residential areas in the zone are the cities of Lattakia, Jebleh, Banyas and Tartous. The area also contains many small villages and individual farm homes.

Planning departments for the four named cities have or are developing future expansion plans, with designated areas for residential, commercial, industrial and other specific uses. Expressway alignment

TABLE 4

PROJECTED PRODUCTION OF MARKETABLE SURPLUSES  
(In Thousands of Metric Tons)  
LATTAKIA-TARTOUS ZONE OF INFLUENCE

Commodity Group	Marketable Surplus					
	1976	1983	1993		2003	
			Potential (000 MT)	Achievable	Potential	Achievable
Vegetables	241.8	679.3	2,476.7	1,708.4	4,983.5	3,976.9
Fruits	82.7	138.1	344.9	239.0	442.9	354.3
Cereals	44.9	80.0	188.1	130.4	271.5	217.2
Industrial Crops	22.1	24.5	70.4	48.8	94.8	75.8
Livestock & Products	<u>31.1</u>	<u>39.0</u>	<u>55.0</u>	<u>45.1</u>	<u>70.4</u>	<u>63.3</u>
TOTAL	422.6	960.9	3,135.1	2,172.7	5,863.1	4,690.5

IV-10





studies took these plans into account and access to villages was also studied.

#### Mining and Quarrying

Mining and quarrying in the study area is primarily confined to the area near Tartous where a large cement plant is under construction. Limestone in large quantities will be quarried in this area, but it will primarily be done in the mountains to the north and east of the cement plant. The proposed alignment has been planned so that no interference with these operations will occur.

#### Forestry

In the study area, natural forests make up a very small percentage of the land area. As mentioned previously, Syria is currently implementing a vigorous reforestation program but as yet harvesting of the trees for any purpose is very limited. Some poplar and eucalyptus are harvested primarily for construction scaffolding and a limited amount of oak is harvested and is used for farm implements such as the wooden plows which are used to till the land with animal power. Forest areas are shown on map plates 3 through 13.

#### Parks and Reserves

Areas set aside for parks are confined primarily to beach areas. No figures are available on the quantity of land that is involved. The trend is to set aside the desirable areas for public use and to provide the needed facilities.

There are no reserves for game in the Lattakia-Tartous study areas. There are, however, a few small areas of forest reserve set aside as shown on map plates 3 through 13. These are primarily used for picnicking and there are a few designated camping areas. There is a great deal



of picnicking done by the Syrian people. Much of it occurs along the roadside, in the mountain or beach areas wherever there is a desirable spot.

#### Man-made Facilities

The existing transportation network of major paved roads, railroads, and major pipelines is shown on the plan maps plates 3 through 13.

The existing two-lane north-south roadway is the only through route between Lattakia and Tartous. It is narrow with no shoulders or with only narrow gravel shoulders. It carries heavy volumes of truck traffic as well as a diversity of other modes, including pedestrians, animal drawn carts, bicycles, tractors, and an increasing number of conventional automobiles. The surface condition is from fair to poor and passing is hazardous. The facility in general is inadequate for the present traffic volumes because of poor alignment, limited sight distance and heavy cross traffic. Bridges are narrow, often restricted to one-way traffic when used by large trucks.

The two major pipelines in the study corridor carry petroleum products. Both enter the study area near Tartous, one ends at Banyas and the other continues to Lattakia.

Near Tartous at about Km-22 a cement plant is under construction and near Banyas at about Km-54 a large oil refinery, the Syrian Oil Transportation Company, is being built along with a residential complex for refinery workers. Near Km-55 lies the Al Sinn Reservoir which supplies water to the city of Lattakia. The water pipeline generally follows the existing road to the north.



The existing airport near Km-74 is currently undergoing expansion. It lies east of the roadway and about 18 kilometers south of Lattakia.

A railroad feasibility study which was prepared by others for the Syrian Ministry of Transport in 1976 presents a proposed railroad alignment between Lattakia and Tartous. This is shown on the plan maps. Expressway alignment studies took this into account but there are no known plans nor proposed dates for its construction.

Existing railroads within the zone of influence are limited to short sections of the Tartous to Homs and the Lattakia to Aleppo lines.

#### Physical Features

The area being studied for the proposed highway passes through rolling foothills and farm lands. However, the landform seen from the location of the roadway will be the mountain range, low rolling hills with their orchards and terraced farms, the crop farm land and, of course, the Mediterranean Sea with its beaches and sea cliffs.

The Lattakia-Tartous study area includes three major geologic formations. The coastal plain and the adjoining low rolling hills are of marine origin consisting of limestone and unconsolidated sands and marls. These higher elevations consist of igneous rocks that are a part of the mountain range and the alluvial deposits along stream valleys.

There are also three major soil groups, the first of which is the uplifted marine sediments which have become clothed with "red Mediterranean soils" created by weathering in place of the limestone, marls and sandstones. The soils are predominantly red in color, non-acid, and loamy to clay loam in texture. In general the red soils are productive under good management, but crops respond to nitrogen and phosphate



inputs. Except where erosion has occurred under improper management, the soils are prime farm lands.

In the second group, igneous rocks have given rise by weathering to brownish soils rather alkaline, containing clay but with clay loam texture. Many of these are stony but arable and moderately productive when relatively free of surface stone. Sloping terrain and stones make such areas best suited to fruit and nut trees, pastures or forests.

The third group, the alluvial lands of the stream valleys, are generally loamy in texture and quite productive, except where poorly drained or subject to periodic flooding by streams. The soil materials are those washed in from adjoining uplands but these sediments are more fertile than those of the upland.

#### Surface Water and Water Quality

There are seven major Nahers (rivers) between Lattakia and Tartous. They are the Al Kabir-Al Shamaly, Al Snouber, Al Samk, Al Rous, Al Sinn, Markieh and Al Hussayn. Water from many of these is used for irrigation and in some cases for human consumption. However, water quality as yet is not well controlled. Many individual farms and villages empty raw waste into these rivers but regulations now require that new developments employ waste treatment such as septic tanks and drain fields. This will probably eventually extend to include all waste effluent.

#### Ground Water

Ground water is abundant in the coastal plain, especially between Km 58 to 80 in the area of the town of Jebleh but it is also available in many of the other lower elevations. Many of the known wells are shown



on plan sheets 3 through 13 as small round dots. Irrigation water as well as water for human consumption is pumped from these wells.

#### Erosion and Sedimentation

Erosion does occur in some of the untilled clay formations in the steeper foothills but these areas are limited since almost all arable land is cultivated and well tended and erosion in these areas is minimal. Newly opened cut slopes mostly occur in the more stable soils and embankment slopes should be stabilized by planting.

During heavy rains, stream turbidity and high water cause some sedimentation in the river plain but this is not normally excessive.

#### Soil Stability and Seismic Consideration

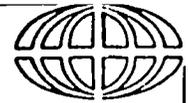
According to the soils engineers and geologists of the study team, evidence of soil instability in the form of slides is not apparent in the zone of influence. No active earthquake fault zones are known to exist in the study corridor although incidents of seismic damage to structures have been recorded in relation to some of the ancient castles.

#### Air Quality

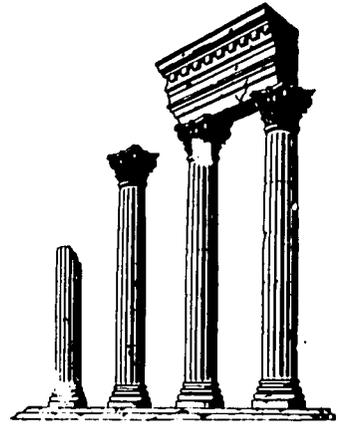
There are no current regulations on air quality which control auto emissions or industrial air pollutants, however, several Syrian planners interviewed expressed concern about these matters since the country is becoming more industrialized and vehicular traffic is increasing. No actual tests were made but from observation the air quality appears to be good. Prevailing off-shore winds tend to disperse present pollutants.

#### Noise Levels

Current noise levels from vehicular traffic were not measured. The noise level estimates are based on methods developed in the United States.

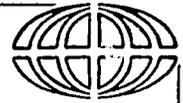


The roadway surface is extremely rough, adding to the noise level on the existing roadway, and the curvature and grades produce passing sight distances which are very low standard. The high percentage of trucks, about 35%, and the constant acceleration and deceleration of all vehicles adds to the sound levels. The constant use of horns for passing and the apparent absence of any regulations of vehicle muffler systems also increases the noise levels which are noticeably objectionable when compared to acceptable U.S. standards. It is roughly estimated that noise levels probably reach daytime levels of 85 to 90 dBA on the existing facility.



V

# THE PROPOSED HIGHWAY



## THE PROPOSED HIGHWAY

The proposed 90 kilometer highway would be 4-lane with interchanges at the locations shown and would include at-grade intersections in certain locations, thereby classifying the facility as a "limited access" highway. Design criteria is shown in Table 5.

A 4-lane facility is now under construction from the south to Tartous. The proposed highway would join the newly constructed one at this point.

One of the current major problems is the large percentage of truck traffic (about 35%), which is largely generated by the two seaports. Many military vehicles are also present but are not included in the truck traffic increase estimates shown in Tables 6 and 7.

Two of the major design controls in selecting an alignment are the An Nusayriyah mountain range and the Mediterranean Sea. Between these two major controls and within the study corridor the three largest cities include the port of Tartous, population 35,000, the city of Banyas, population 15,000 and Syria's largest port city of Lattakia, population 120,000. These cities with their existing development and their future master plans constitute major design considerations.

There are also two oil transport pipelines, a power transmission line, many small villages and farms and seven major river crossings to be considered. Industrial sites include the free-zone area and a cement plant under construction plus an industrial area near Tartous. There is also a refinery under construction near Banyas, tobacco and textile factories and a free-zone and industrial area near the City of Lattakia. The free-zones and industrial areas near Lattakia and Tartous are part



TABLE 5  
RECOMMENDED DESIGN CRITERIA

DESCRIPTION	EXPRESSWAY	EXPRESSWAY RIGHT-OF-WAY RESTRICTED	RAMPS	FRONTAGE ROADS AND CROSSROADS
DESIGN SPEED MINIMUM (KM/H)				
Level Terrain	120	100	60	80
Rolling Terrain	100	80	60	60
Mountainous Terrain	80	80	60	60
STOPPING SIGHT DISTANCE (M)				
120 KM/H	200	200	--	--
100 KM/H	150	150	--	150
80 KM/H	110	110	--	110
60 KM/H	--	--	80	80
PASSING SIGHT DISTANCE (M)				
100 KM/H	--	--	--	700
80 KM/H	--	--	--	550
60 KM/H	--	--	--	425
MINIMUM RADIUS OF CURVATURE (M)				
120 KM/H	675	675	--	--
100 KM/H	420	420	--	420
80 KM/H	230	230	--	230
60 KM/H	--	--	145	145
TRANSITION CURVES	YES	YES	NO	NO
MINIMUM GRADE	0.5%	0.5%	0.5%	0.5%
MAXIMUM GRADE				
LEVEL TERRAIN	3%	3%	7%	8%
ROLLING TERRAIN	4%	5%	7%	5%
MOUNTAINOUS TERRAIN	7%	7%	7%	7%
MAXIMUM GRADE				
120 KM/H	6%	6%	--	--
100 KM/H	6%	6%	--	6%
80 KM/H	8%	8%	--	8%
60 KM/H	--	--	8%	8%



of the city's master plans and the new facility is planned to serve these areas and to avoid disruption of current planning.

TABLE 6  
PRELIMINARY ESTIMATES OF GROWTH RATES

YEAR	1976-1983	1983-1993	1993-2003
Trucks	10.3%	7.1%	5.6%
Automobiles	9.5%	9.3%	7.4%
Buses	9.1%	10.7%	9.6%

TABLE 7  
PROJECTED TRAFFIC (PRELIMINARY ESTIMATE) ADT

YEAR	1976	1983	1993	2003
Trucks <sup>1/</sup>	1,066	1,676	3,117	5,196
Automobiles	1,460	2,654	6,114	11,357
Buses	<u>324</u>	<u>664</u>	<u>2,034</u>	<u>5,593</u>
TOTAL	2,790	4,994	11,265	22,146

<sup>1/</sup> Excludes military trucks.

A railroad feasibility study completed by others for the Syrian Arab Republic shows a proposed railroad between Lattakia and Tartous. However, interviews with the Ministry of Transportation indicate that



there are no positive construction plans or dates set for construction of this facility.

Archeological sites which are abundant on this coastal plain are another important design control.

The purpose of the action, if implemented, would be to provide the Syrian Arab Republic with a fast, safe, efficient link in their planned national transportation system. It would serve the increasing truck traffic generated by the expanding seaports of Lattakia and Tartous as well as the rapidly increasing auto traffic volumes generated by tourism and by the growing travel needs for business.

The new expressway would also provide greater and faster mobility for the nation's coastal military defense system and would provide greater economic opportunity for the commercial industries as well as farm produce transportation.

The following plan maps plates 1 through 13 show the proposed typical section of the new road as well as the alignment of the road and land use and archeologic sites. Several alternate alignments also appear on these plates.

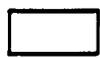
# RECOMMENDED HIGHWAY ALIGNMENT Tartous to Lattakia

## LEGEND

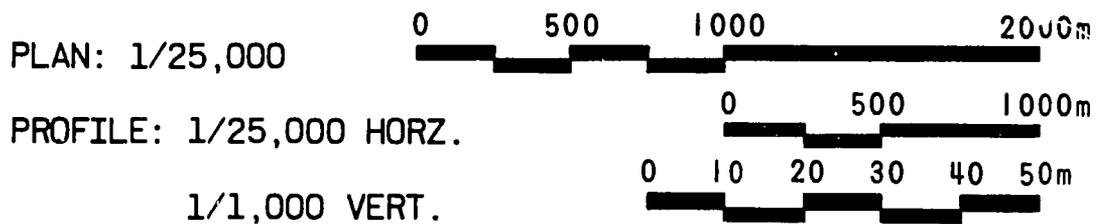
### Archeologic Sites

-  RELIGIOUS TOMB
-  TELL (ARCHEOLOGIC HILL)
-  ANCIENT RUINS

### Land use

-  POPULATED AREA
-  COMMERCIAL
-  FARM
-  FRUIT
-  OLIVE
-  FOREST
-  OPEN

### Scale



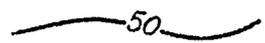
EXISTING GROUND ELEVATIONS ARE IN METERS

TYPICAL SECTIONS: AS SHOWN

# ALIGNMENT

LEGEND

Existing



CONTOUR (10m interval)



ROAD CLASS I



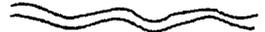
ROAD CLASS II



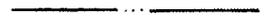
ROAD CLASS III



RAILROAD



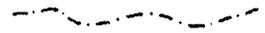
RIVER



CHANNEL MORE THAN 5m WIDE



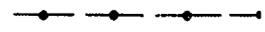
CHANNEL LESS THAN 5m WIDE



CREEK



SUBSURFACE CHANNEL



POWER LINE

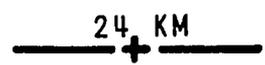


OIL PIPE LINE



EXISTING GROUND PROFILE

Proposed



EXPRESSWAY AND STATION



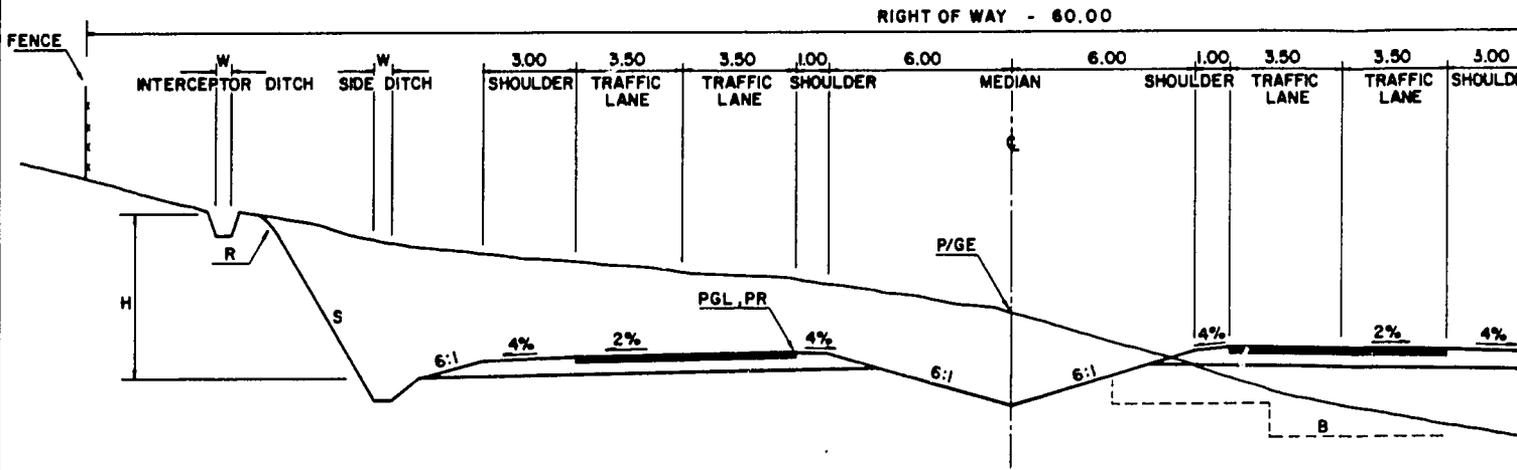
INTERCHANGE



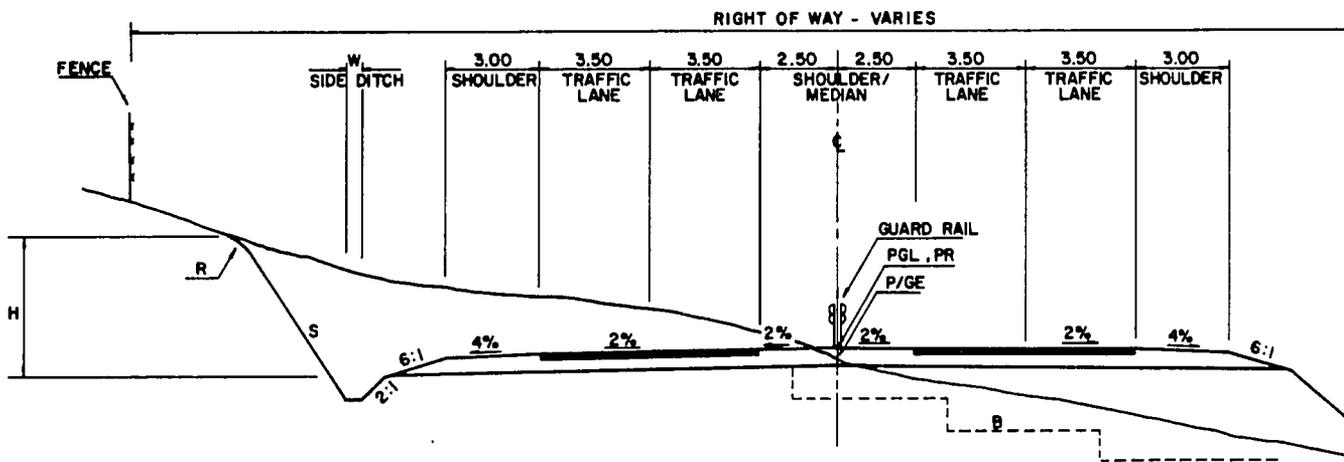
RAILROAD

PLATE 1 TITLE SHEET      LATTAKIA HIGHWAYS STUDY

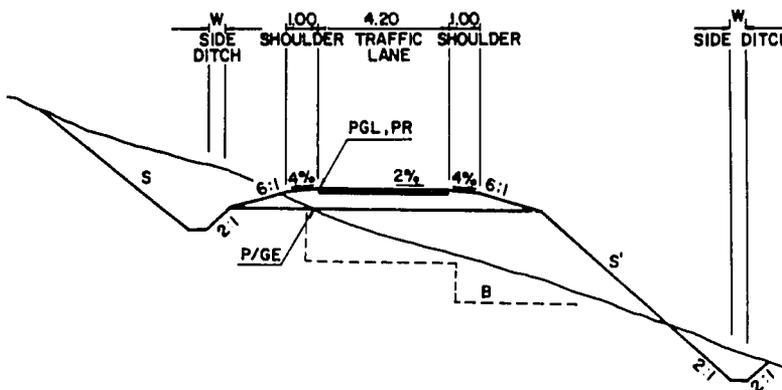
LYON Associates, Inc.      MORRISON - MAIERLE, Inc.      JAMES R. SNITZLER Assoc., Inc.      Syrian Arab Republic



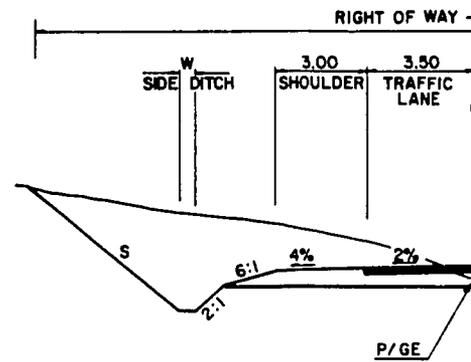
TYPICAL EXPRESSWAY SECTION



TYPICAL EXPRESSWAY SECTION - RIGHT OF WAY RESTRICTED



TYPICAL RAMP SECTION



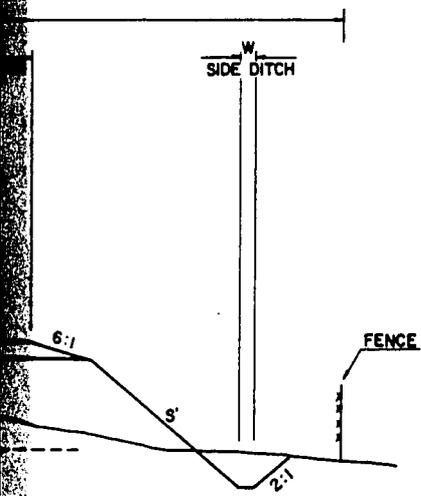
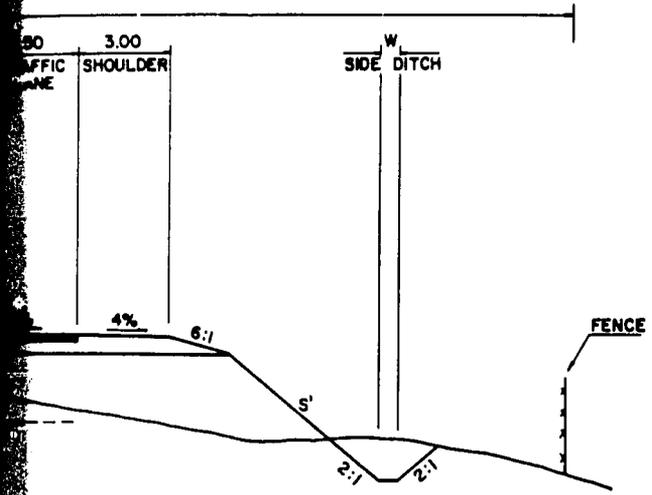
TYPICAL CROSSROAD SECTION

LEGEND

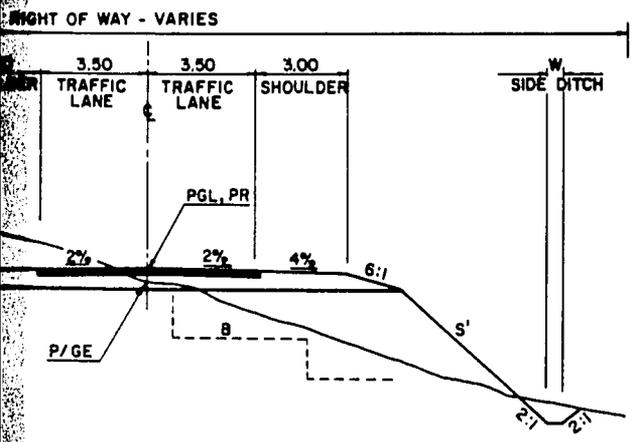
- P/GE PROFILE GROUND ELEVATION
- PGL PROFILE GRADE LINE
- PR POINT OF ROTATION
- W DITCH WIDTH VARIES
- H HEIGHT OF SLOPE
- S CUT SLOPE VARIES - BENCH REQUIRED FOR  $H \geq 4.00$
- S' FILL SLOPE VARIES  
 $H \leq 3.00, S' = 4:1$   
 $H > 3.00, S' = 2:1$  (GUARD RAIL REQUIRED)
- B BENCHING AS REQUIRED FOR FILLS
- R SLOPE ROUNDING

NOTES

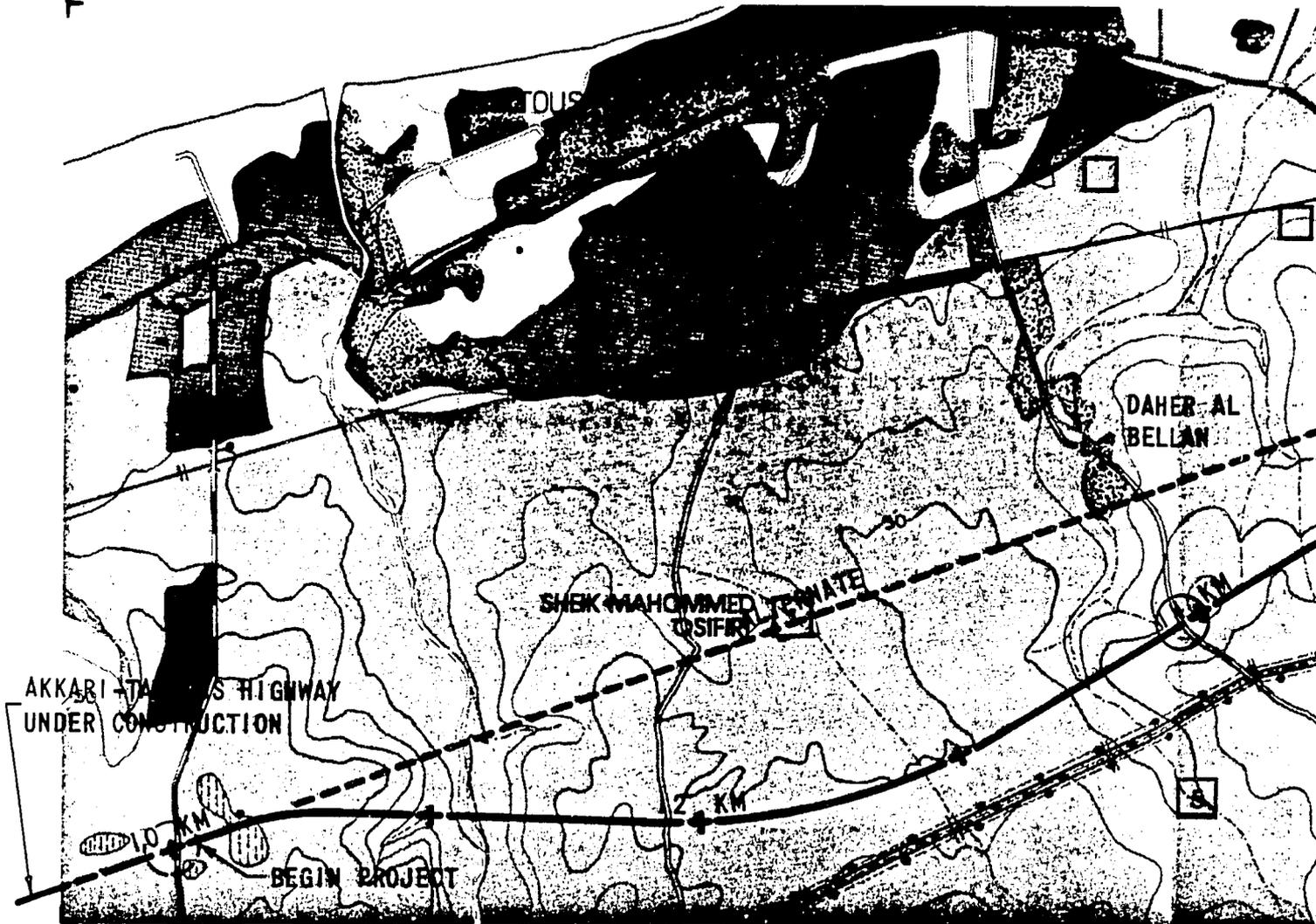
1. DIVIDED HIGHWAYS WILL BE BIFURCATED WHERE ECONOMICALLY AND TECHNICALLY FEASIBLE TO DO SO.
2. SUBGRADE DRAINAGE WILL BE PROVIDED AS REQUIRED BY GROUND WATER CONDITIONS.
3. ALL DIMENSIONS ARE IN METERS.



RESTRICTED



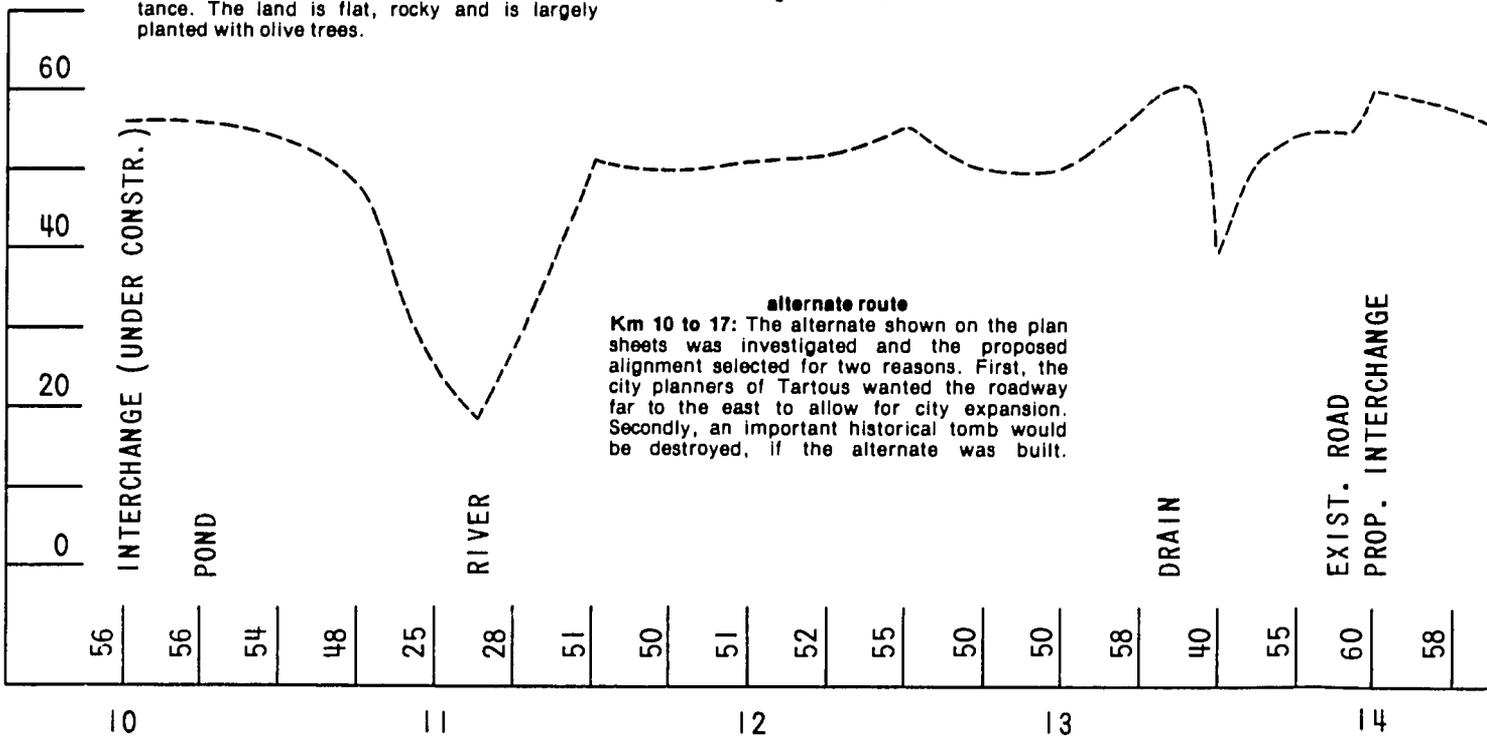
CROSSROAD OR FRONTAGE ROAD



**Km 10**  
 The alignment crosses a small lake. Inspection in the fields nearby brought only a profusion of modern pottery of little archaeological importance. The land is flat, rocky and is largely planted with olive trees.

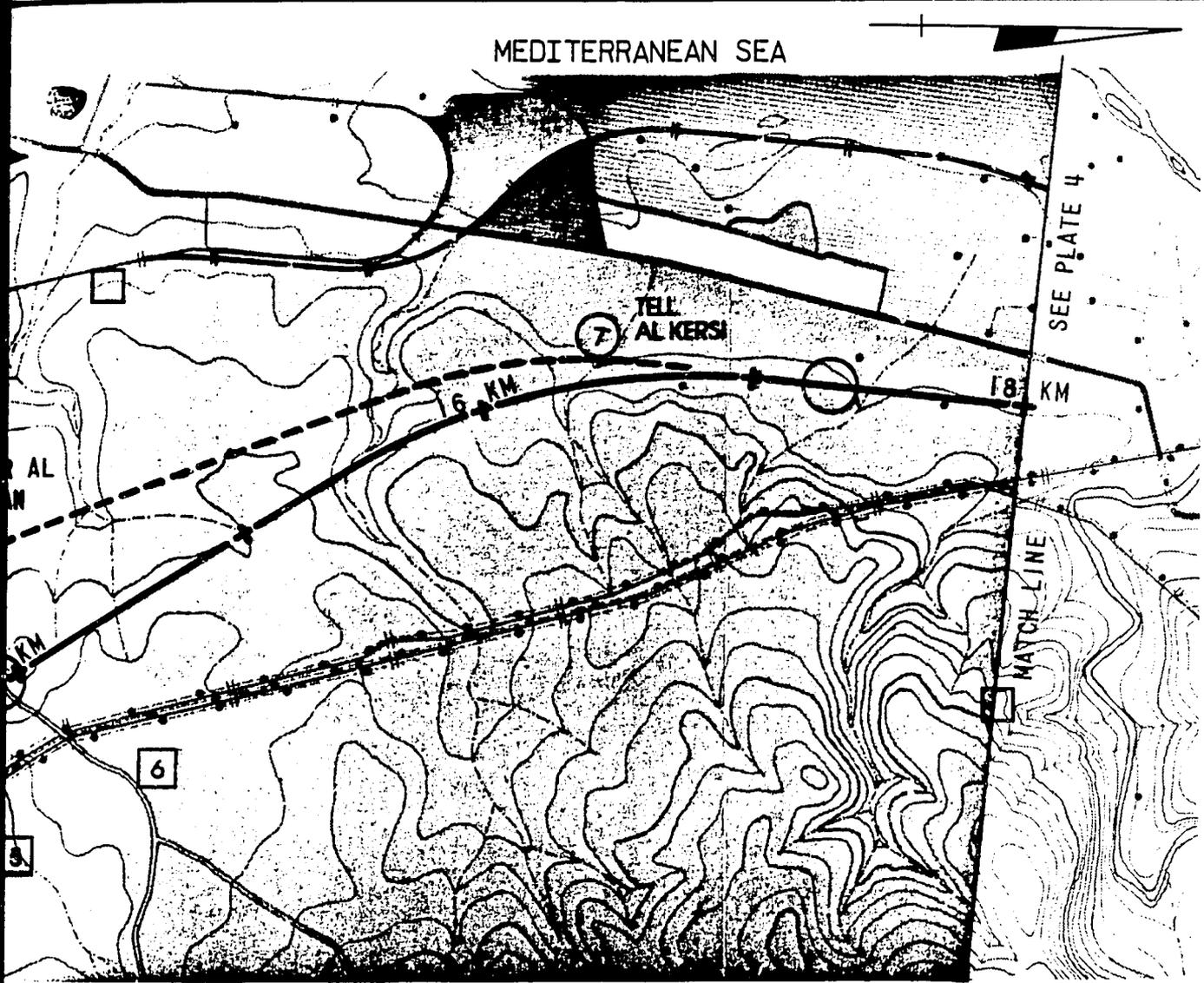
**Km 12**  
 1 Tomb of Sheik Mohammed Qosifiri. The tomb should be saved, but nothing in the area was of archaeological interest.

**Km 14**  
 5 This area produced no  
 6 Tombs 5 and 6



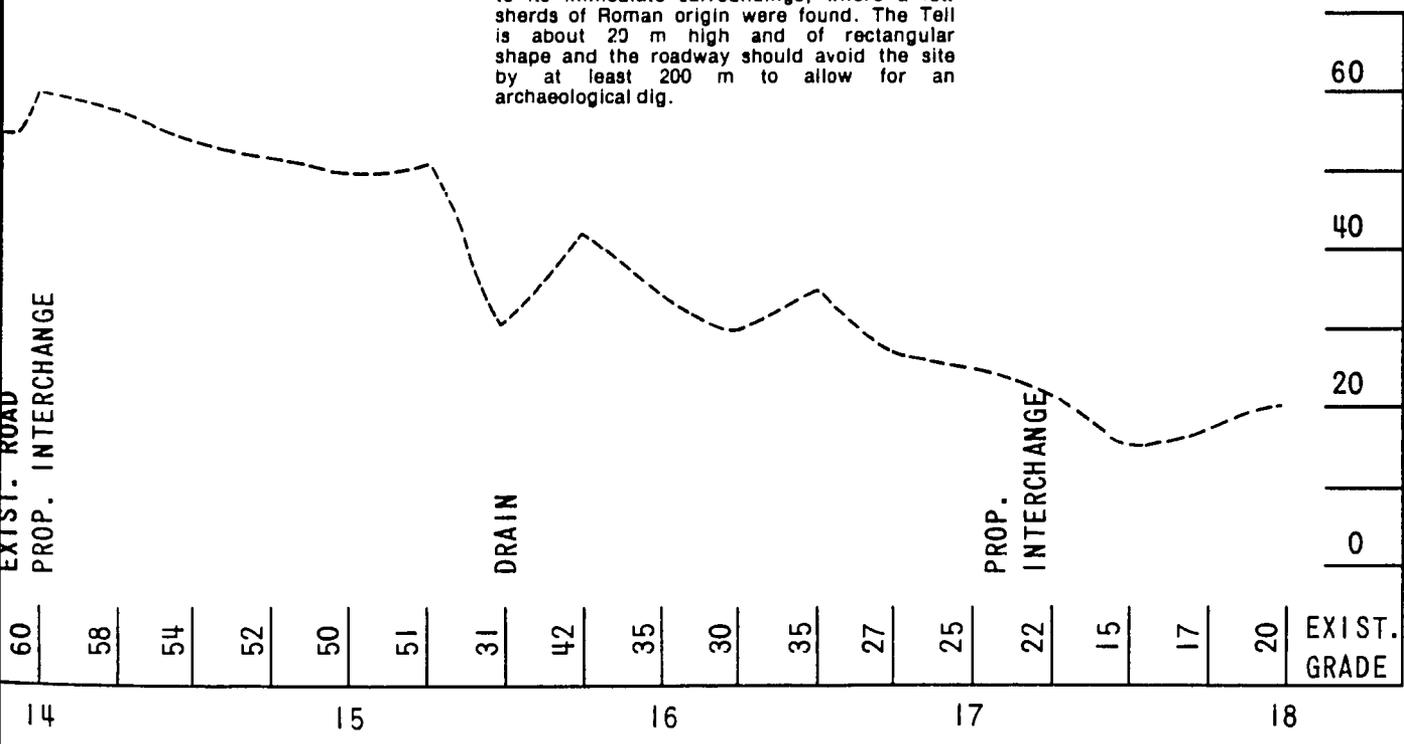
**alternate route**  
 Km 10 to 17: The alternate shown on the plan sheets was investigated and the proposed alignment selected for two reasons. First, the city planners of Tartous wanted the roadway far to the east to allow for city expansion. Secondly, an important historical tomb would be destroyed, if the alternate was built.

MEDITERRANEAN SEA



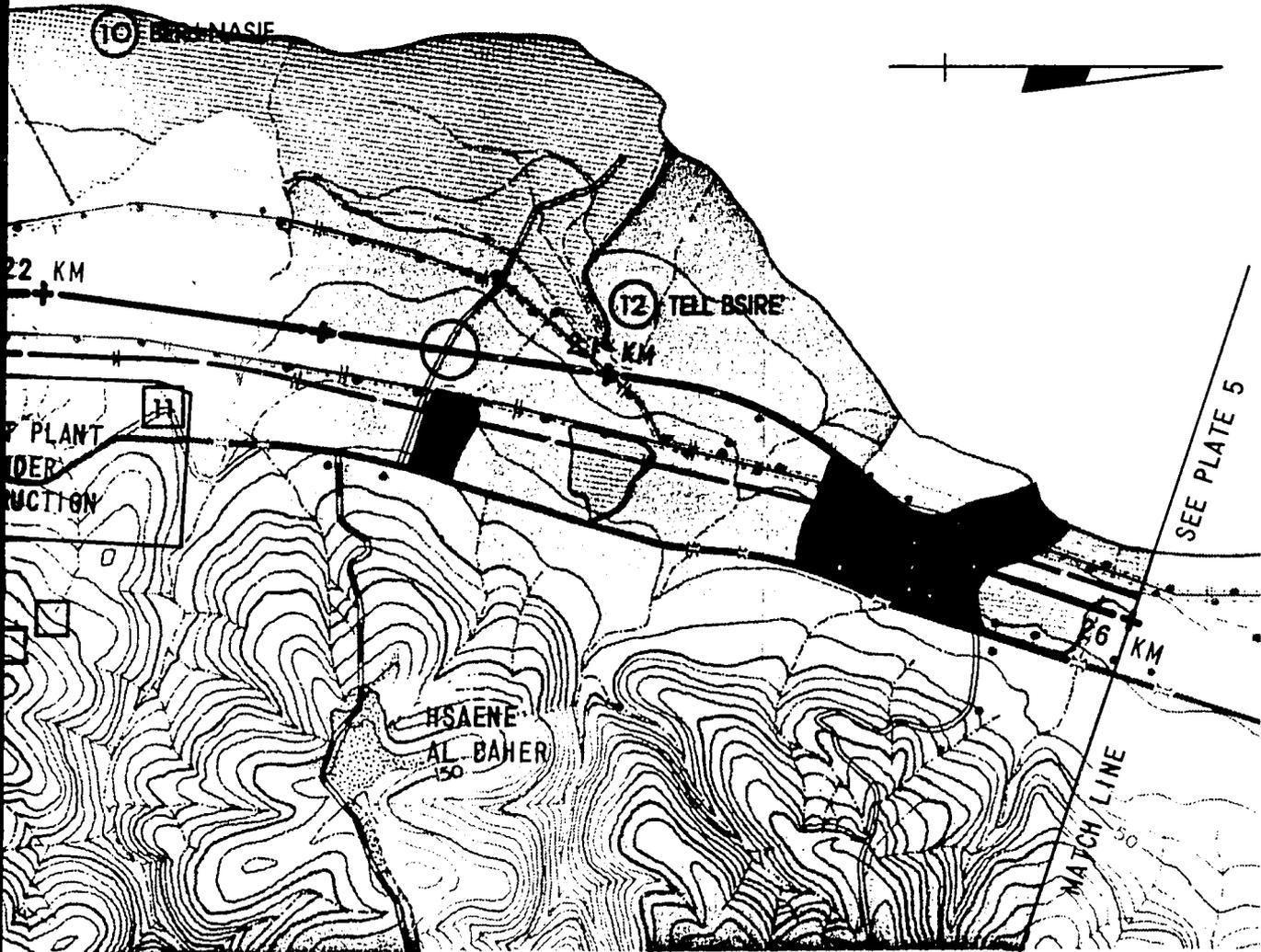
Km 14  
 produced no significant pottery.  
 5 and 6 should be saved.

⑦ Tell Al Kersi. This Tell is now a restricted area and the survey was therefore limited to its immediate surroundings, where a few sherds of Roman origin were found. The Tell is about 20 m high and of rectangular shape and the roadway should avoid the site by at least 200 m to allow for an archaeological dig.





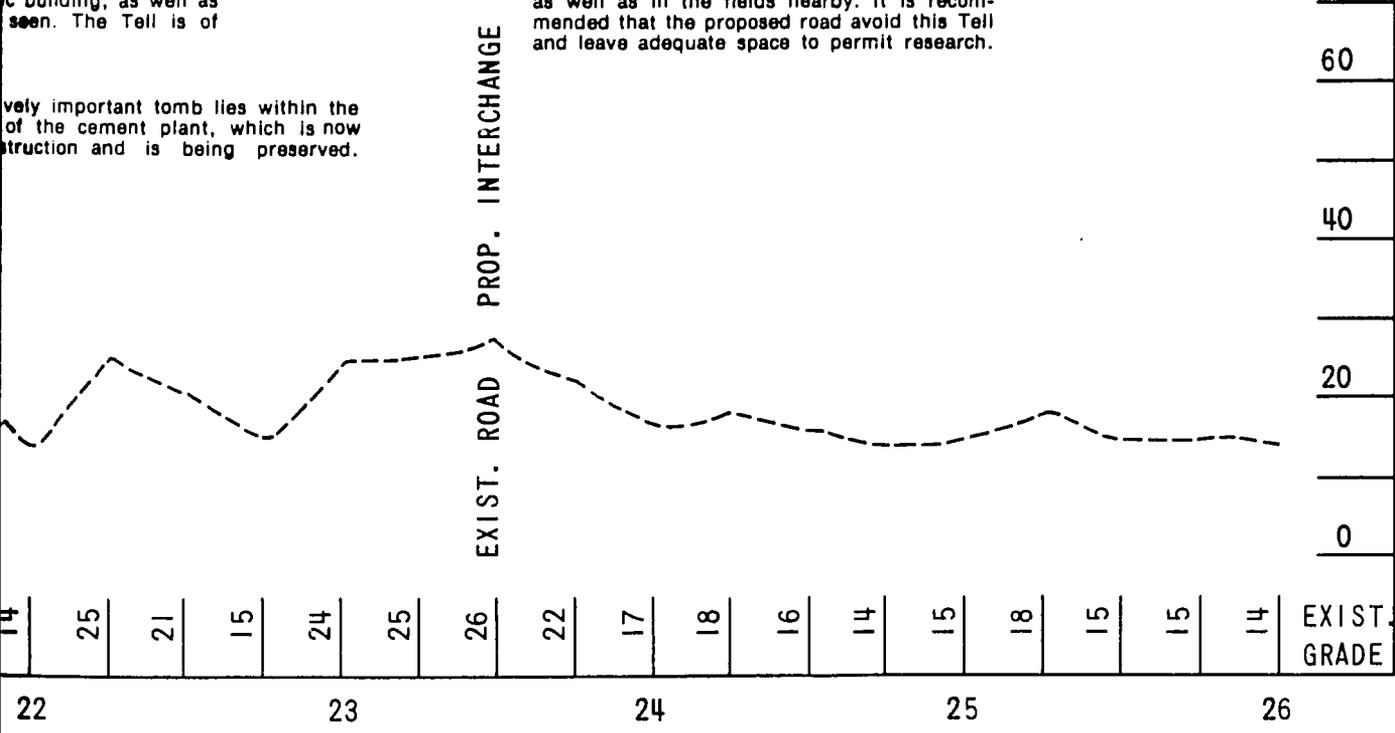
MEDITERRANEAN SEA



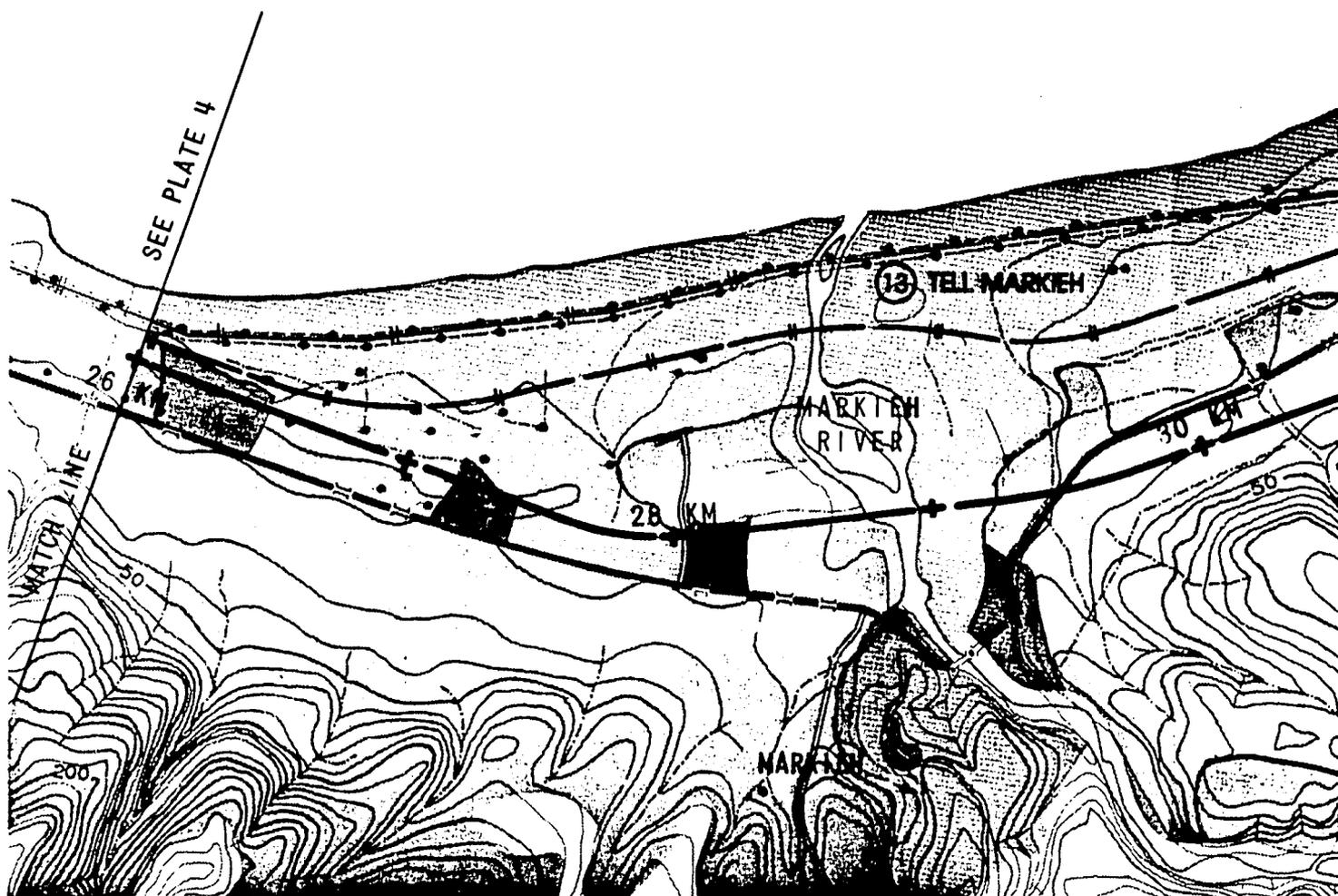
22 situated on the coast. oblong. Pottery sherds icant, but at the top, c building, as well as seen. The Tell is of

vely important tomb lies within the of the cement plant, which is now struction and is being preserved.

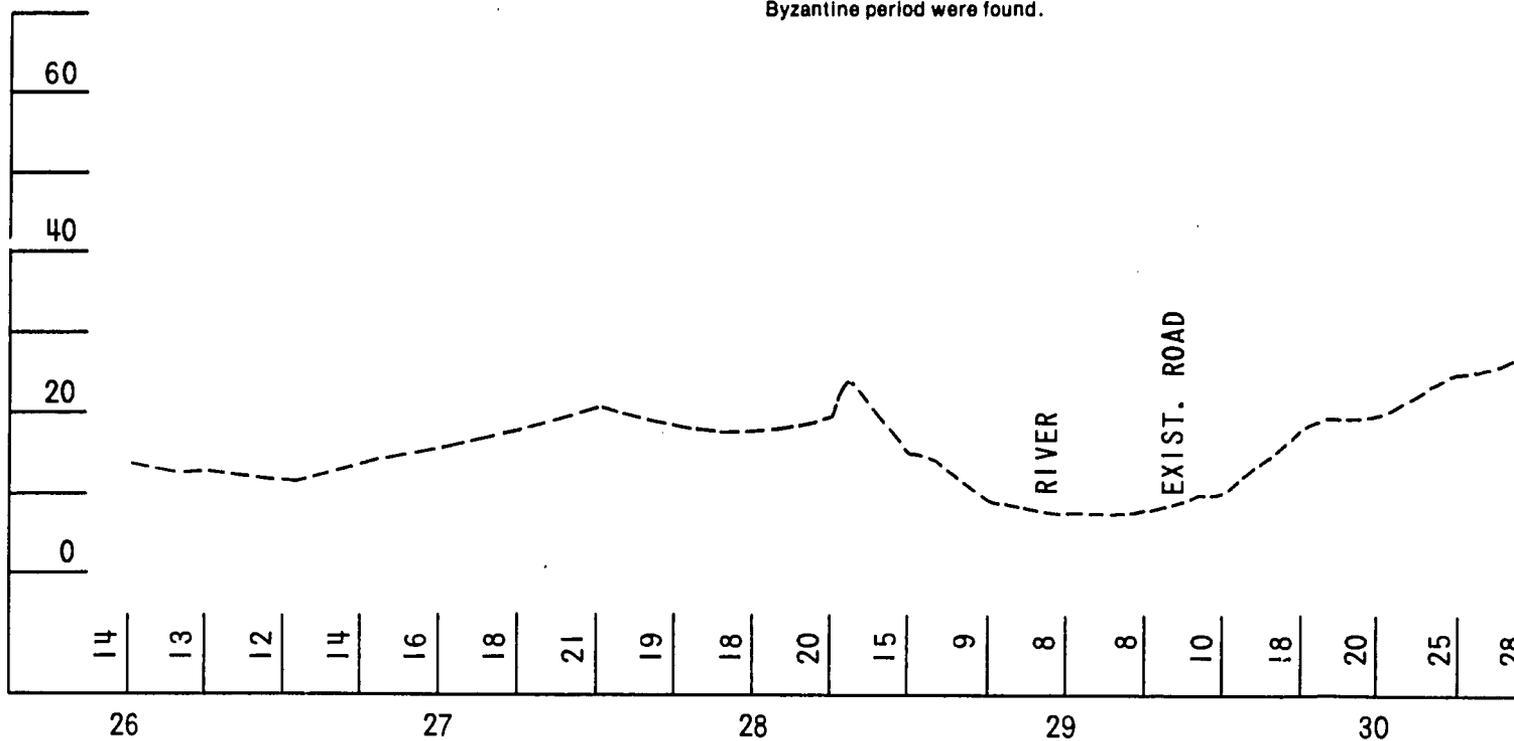
**12** Tell Bsire: This is an important Tell of rectangular shape about 15 m high. Hellenistic pottery sherds were found on the surface, as well as in the fields nearby. It is recommended that the proposed road avoid this Tell and leave adequate space to permit research.



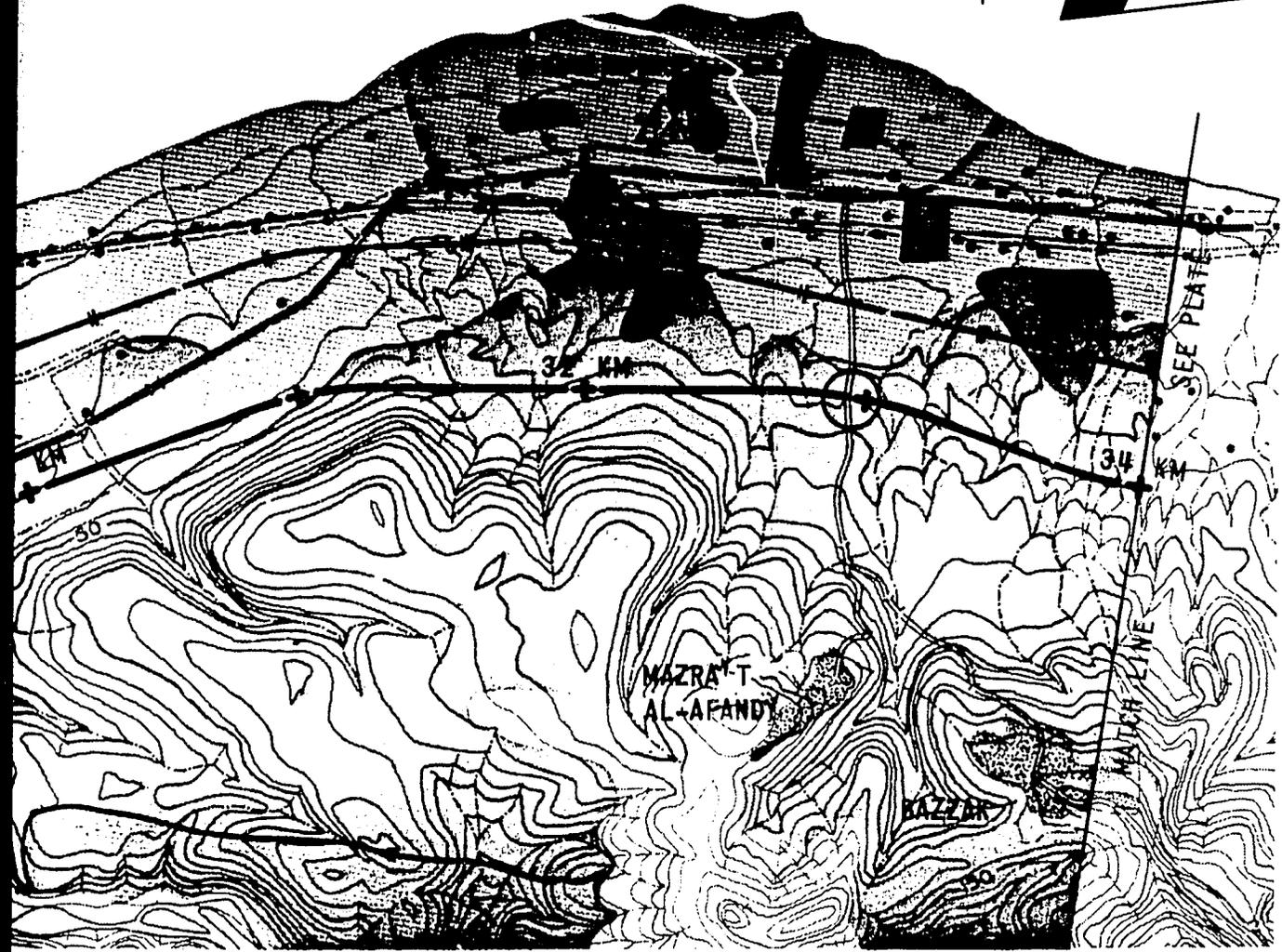
MEDITERRANEAN SEA



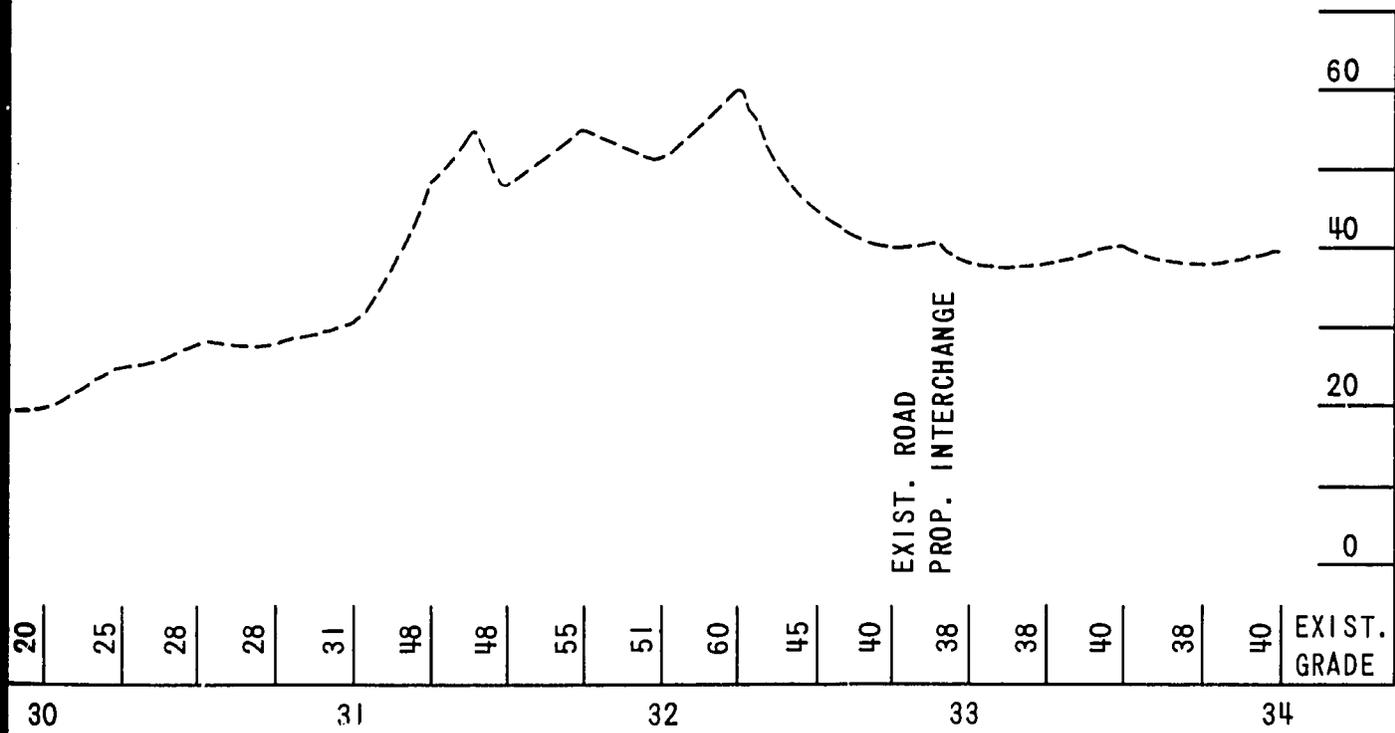
13 Tell Markleh: The pottery sherds found at this small site were insignificant. Most of it was coarse and of poor quality indicating recent origin. A few sherds of the Roman and Byzantine period were found.



MEDITERRANEAN SEA

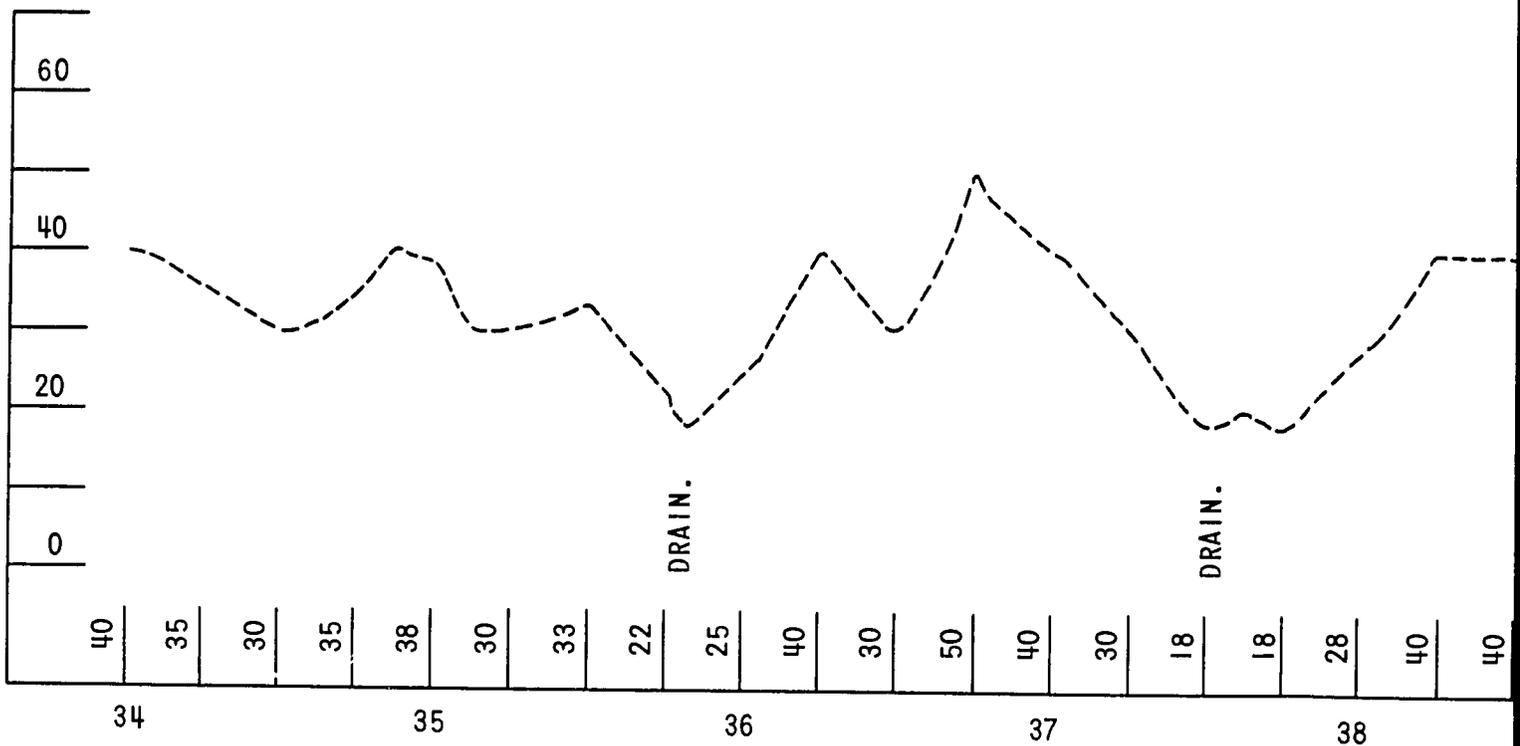
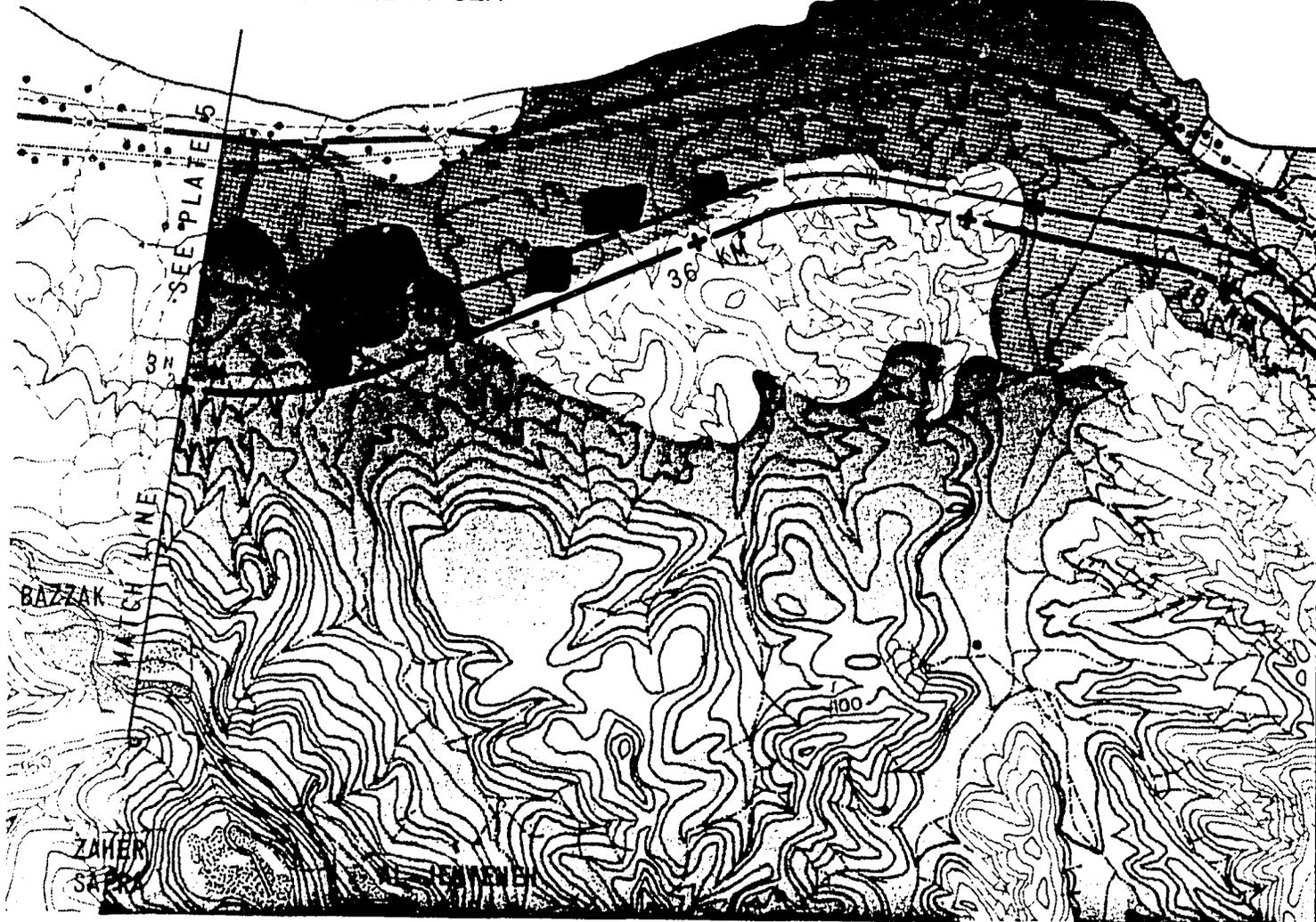


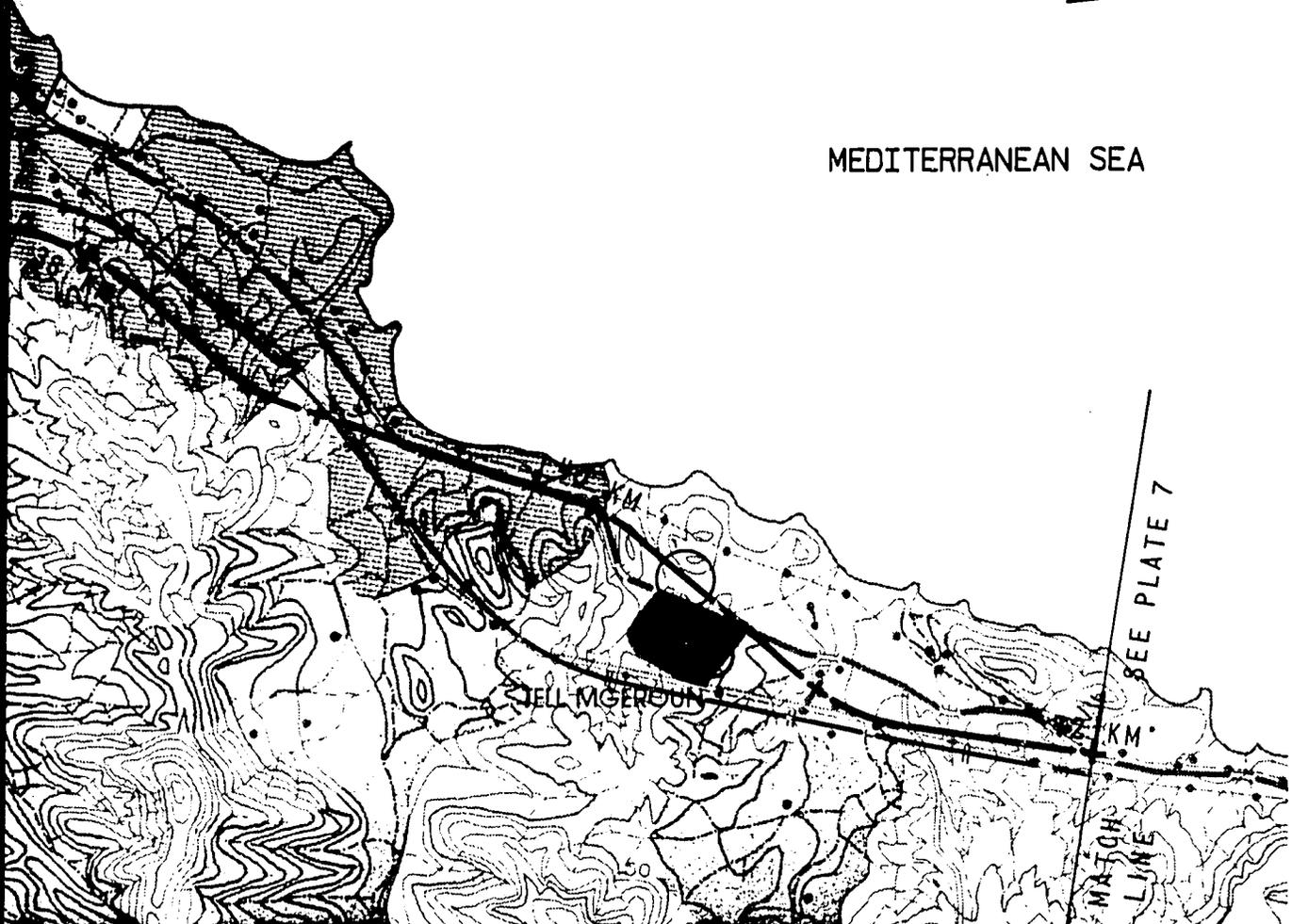
14 The region of Khrab Markleh, on the coast, is a field of ruins classified Greek and Roman. The area has not been fully studied, but alignment should avoid this portion of the coast.



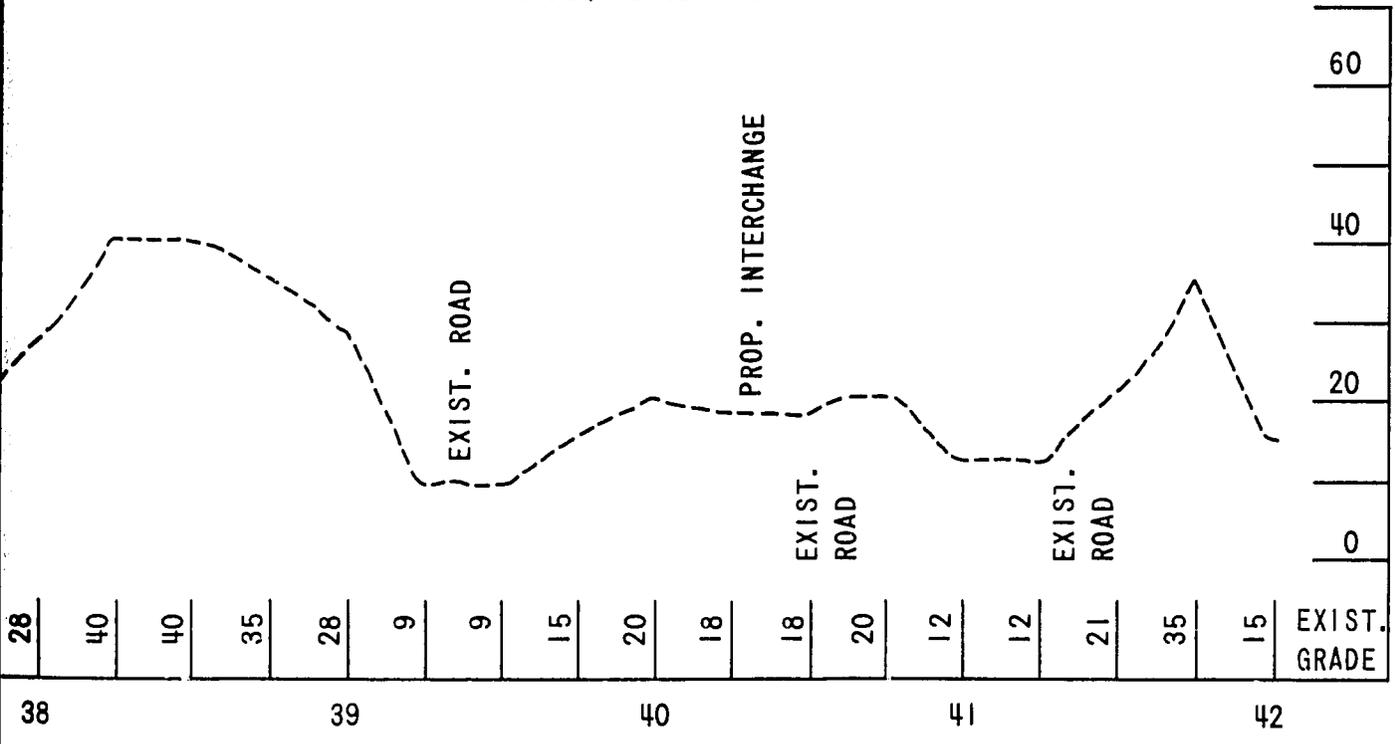
**PLATE 5**    **KM 26 to KM 34**    **LATTAKIA HIGHWAYS STUDY**  
 LYON Associates, Inc.    MORRISON - MAIERLE, Inc.    JAMES R. SNITZLER Assoc., Inc.    Syrian Arab Republic

MEDITERRANEAN SEA

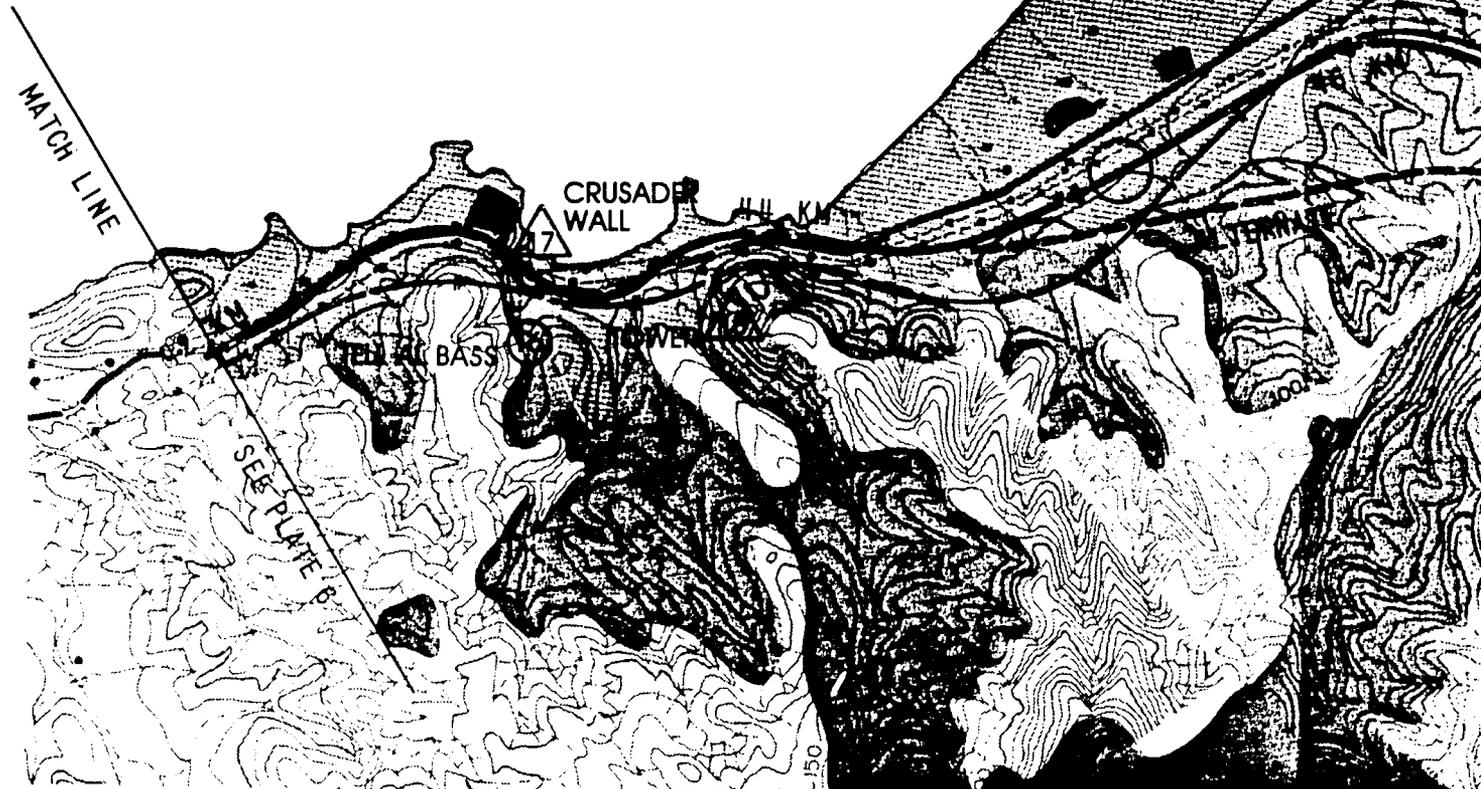




15 **Tell Mgeroun:** This small Tell produced only a few sherds of poor quality, indicating recent origin; probably from the Islamic period. However, the road should avoid the area.



MEDITERRANEAN SEA

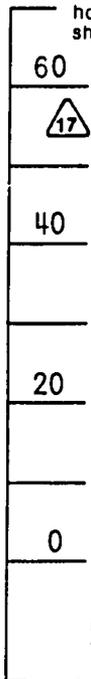


**16** **Tell Al Bass:** No pottery sherds were found near this Tell. It is quite probable that it is not an archaeological Tell but a natural hill. If the proposed highway should cross the area, however, an archaeological proof trench should be dug prior to construction.

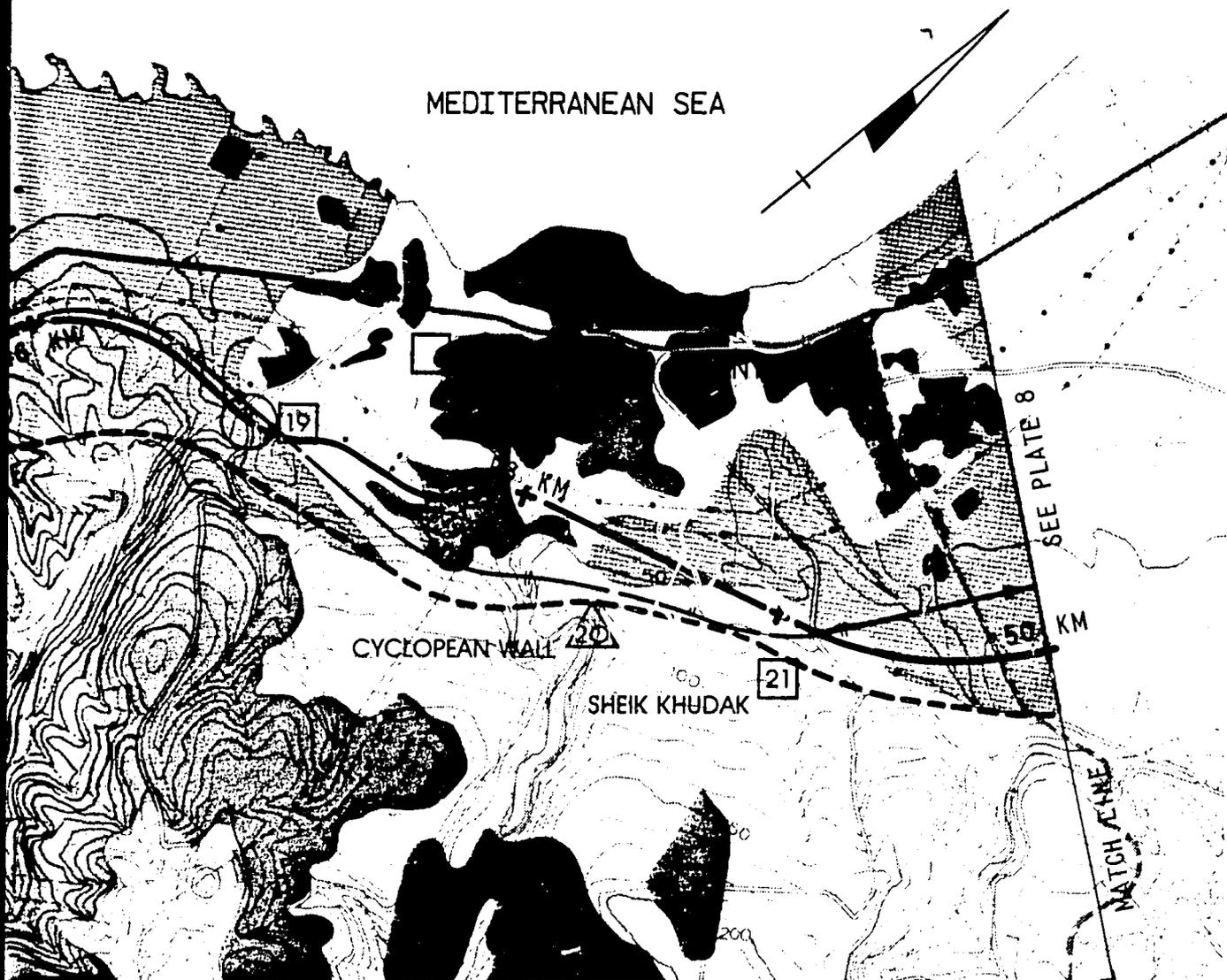
**17** **Crusader Wall:** The wall is constructed of large blocks of stone with mortar. It was apparently part of a small harbour built by the Crusaders in the same period as the nearby Markab Castle. This site should be preserved.

**18** **Tower Overlooking the Sea:** The square tower measures 16 m on a side and was built by Sir Bartelemy of Marachee in the 11th century as a watch tower for the Castle of Markab, which is situated on a mountain top about 5 Km to the east. The legend tells that there is an underground tunnel linking the castle to the tower. The entrance to the tunnel from the castle has been found, but was never found near the tower. Most villages in this region were built by Crusaders and remains of churches and houses still exist. Markab Castle, the most imposing structure of the Crusader complex, is accessible by road from Banyas.

**19** Here the alignment crosses a mound containing about 60 tombs, which have great archaeological importance and are undoubtedly of local cultural significance.



PROP. INTERCHANGE

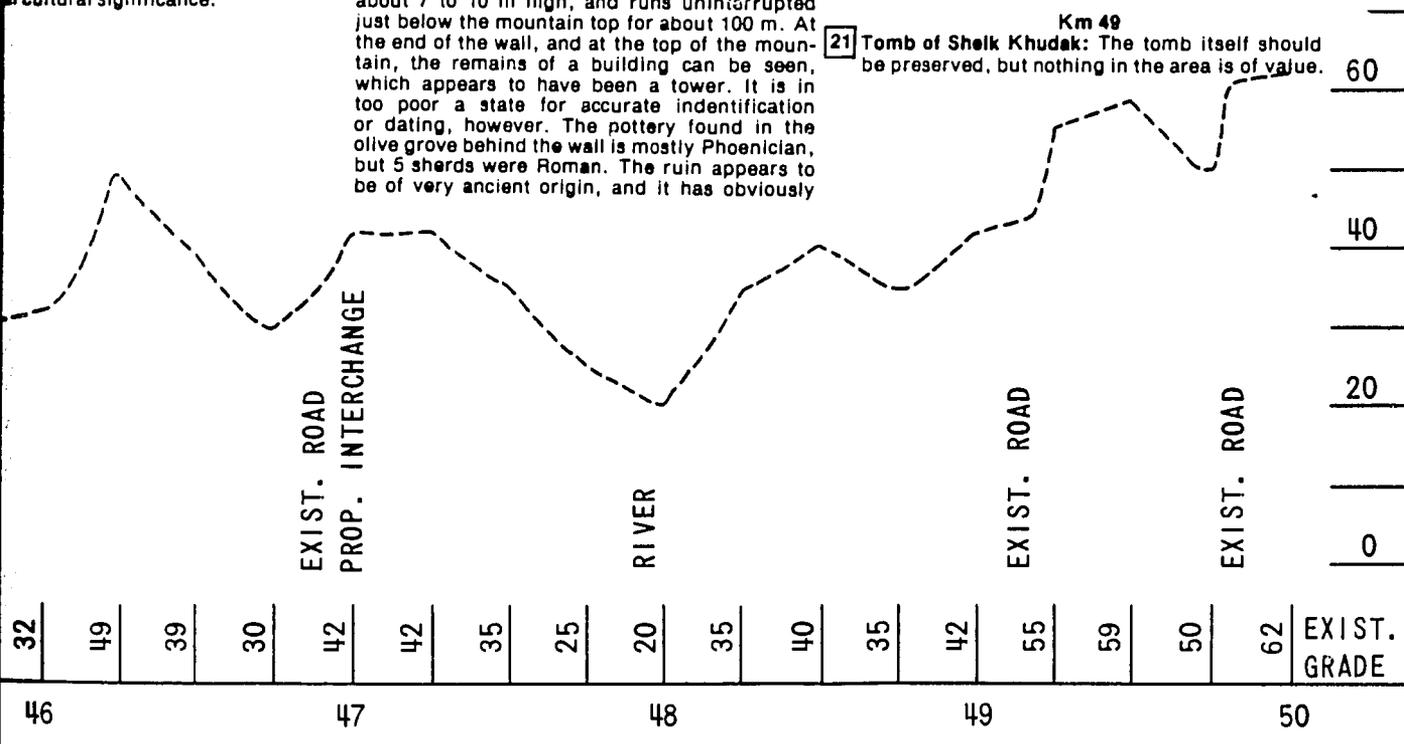


Km 47  
 crosses a modern cemetery. It contains about 60 tombs, which are not of great archaeological importance but are of unusual cultural significance.

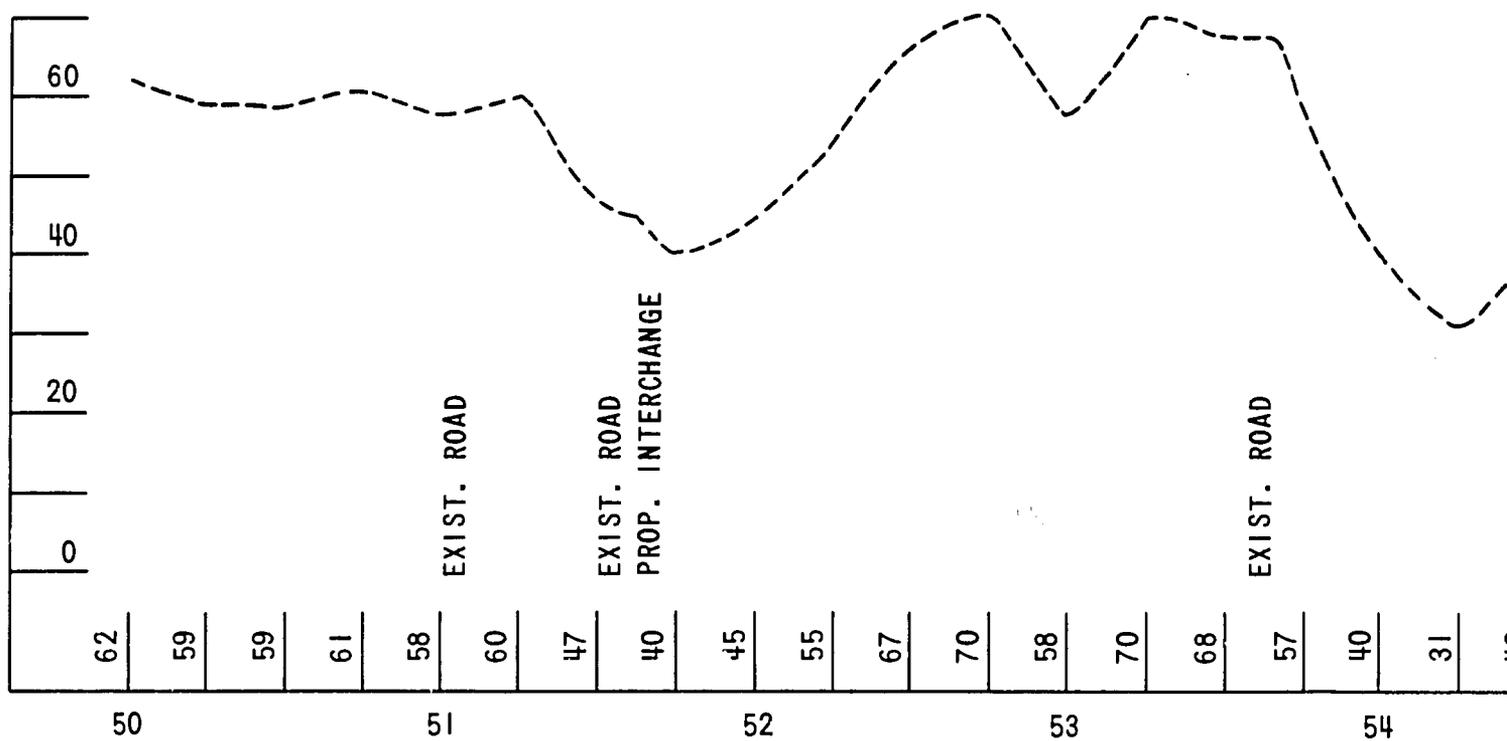
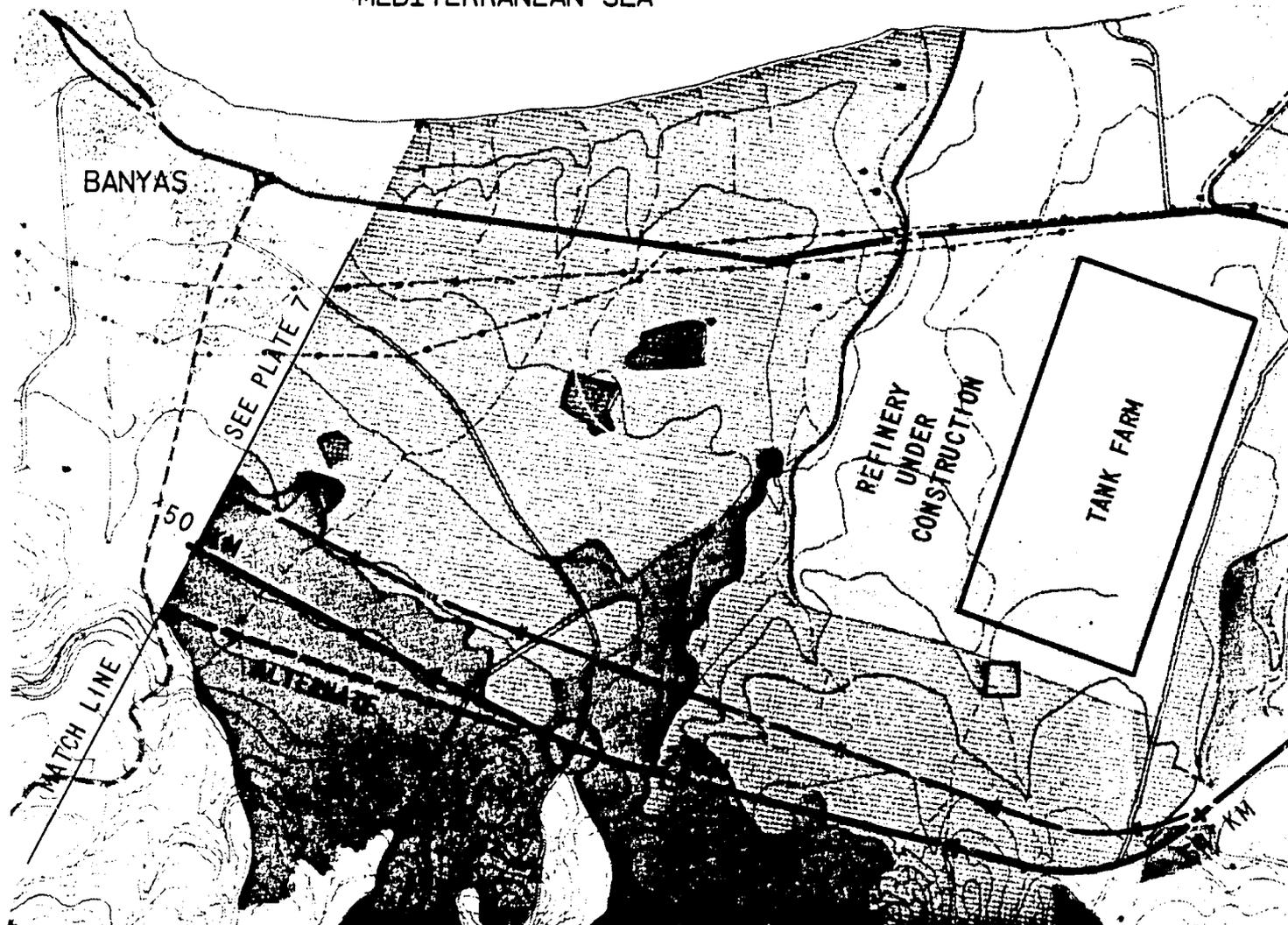
**20** Qalat Al Quz: These ruins include an imposing Cyclopean wall formed of roughly cut huge stone blocks. The wall is from 1 to 2 m thick, about 7 to 10 m high, and runs uninterrupted just below the mountain top for about 100 m. At the end of the wall, and at the top of the mountain, the remains of a building can be seen, which appears to have been a tower. It is in too poor a state for accurate identification or dating, however. The pottery found in the olive grove behind the wall is mostly Phoenician, but 5 sherds were Roman. The ruin appears to be of very ancient origin, and it has obviously

been used for many centuries. Further archaeological research should be made at this site, if the alignment is within 150 m of the ruin, as it may be of great importance.

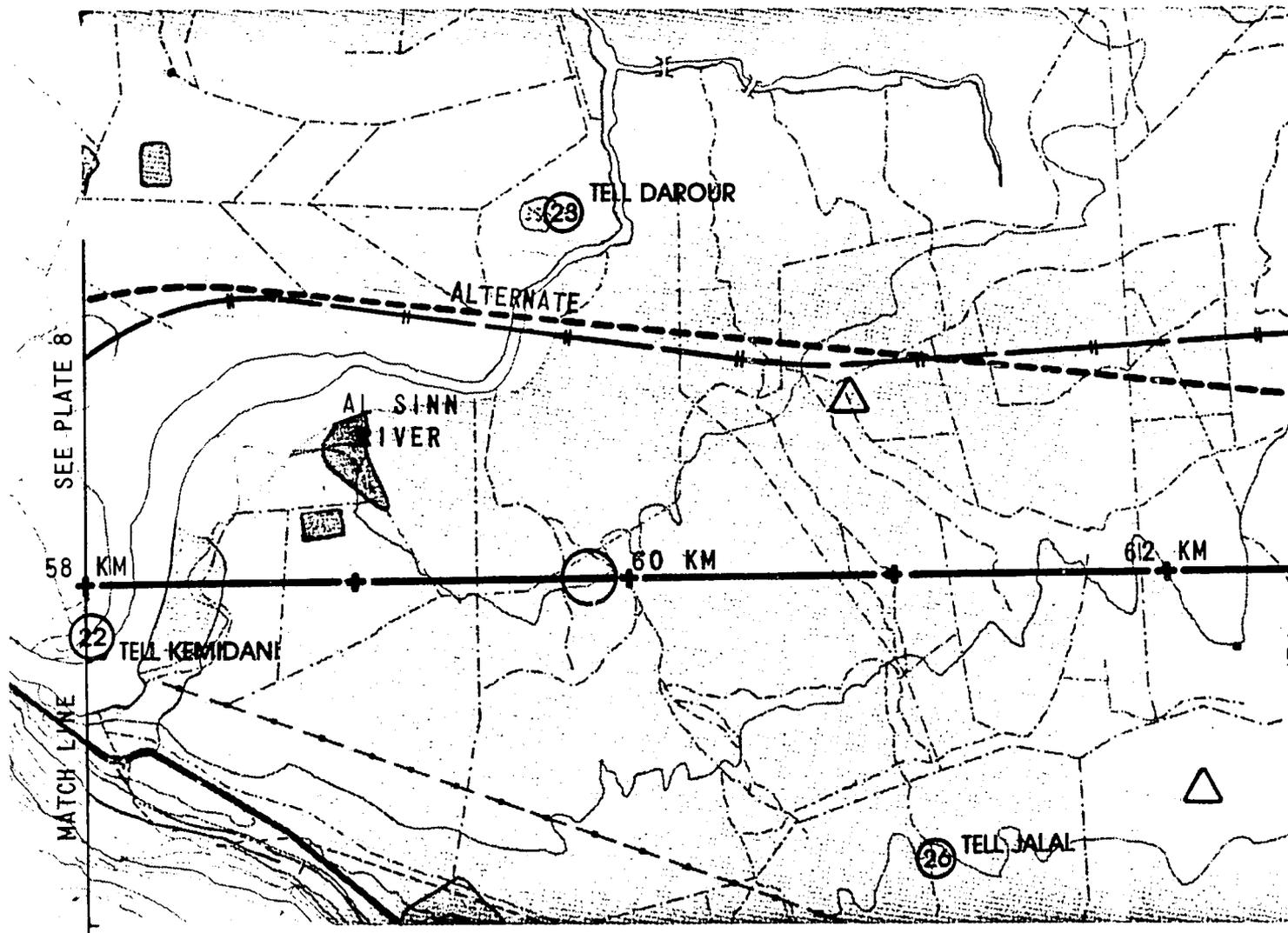
**21** Tomb of Sheik Khudak: The tomb itself should be preserved, but nothing in the area is of value.



MEDITERRANEAN SEA



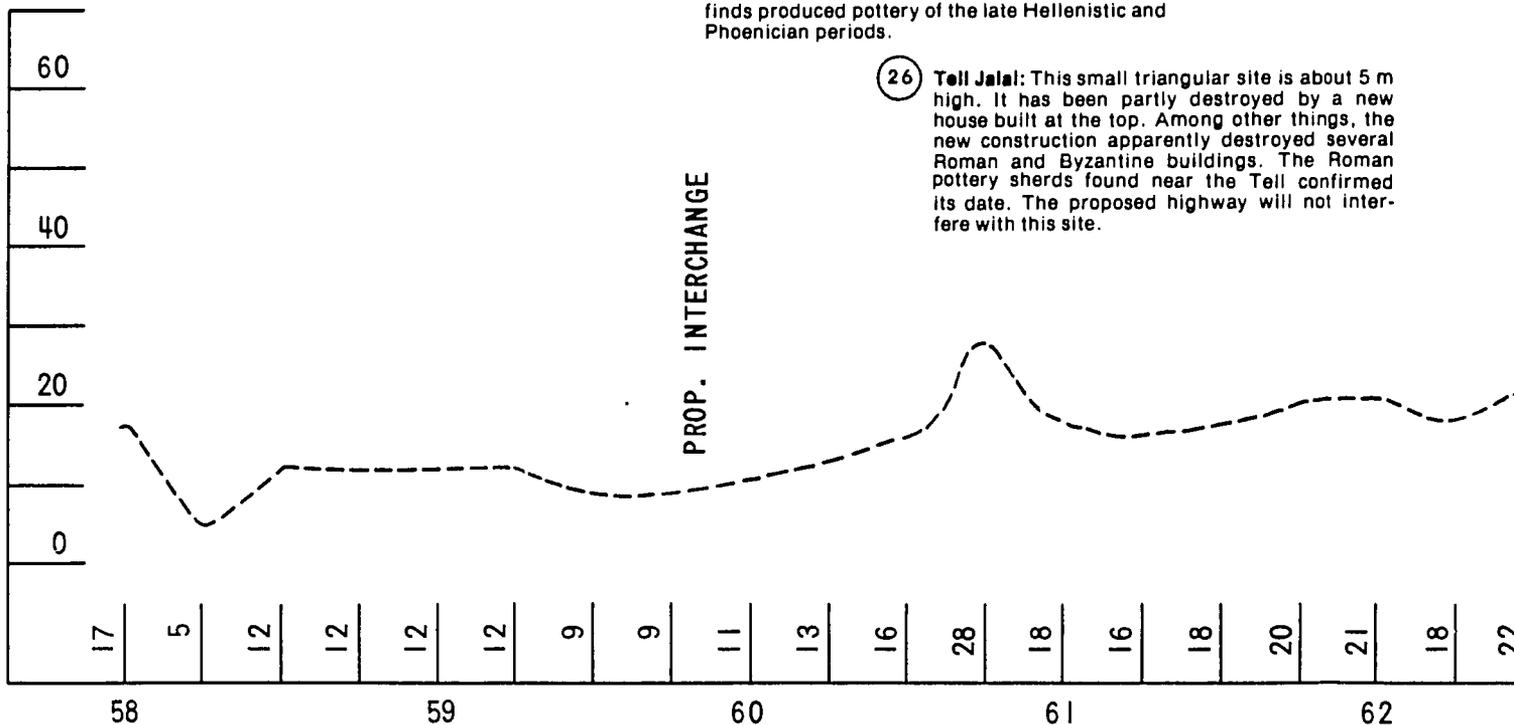




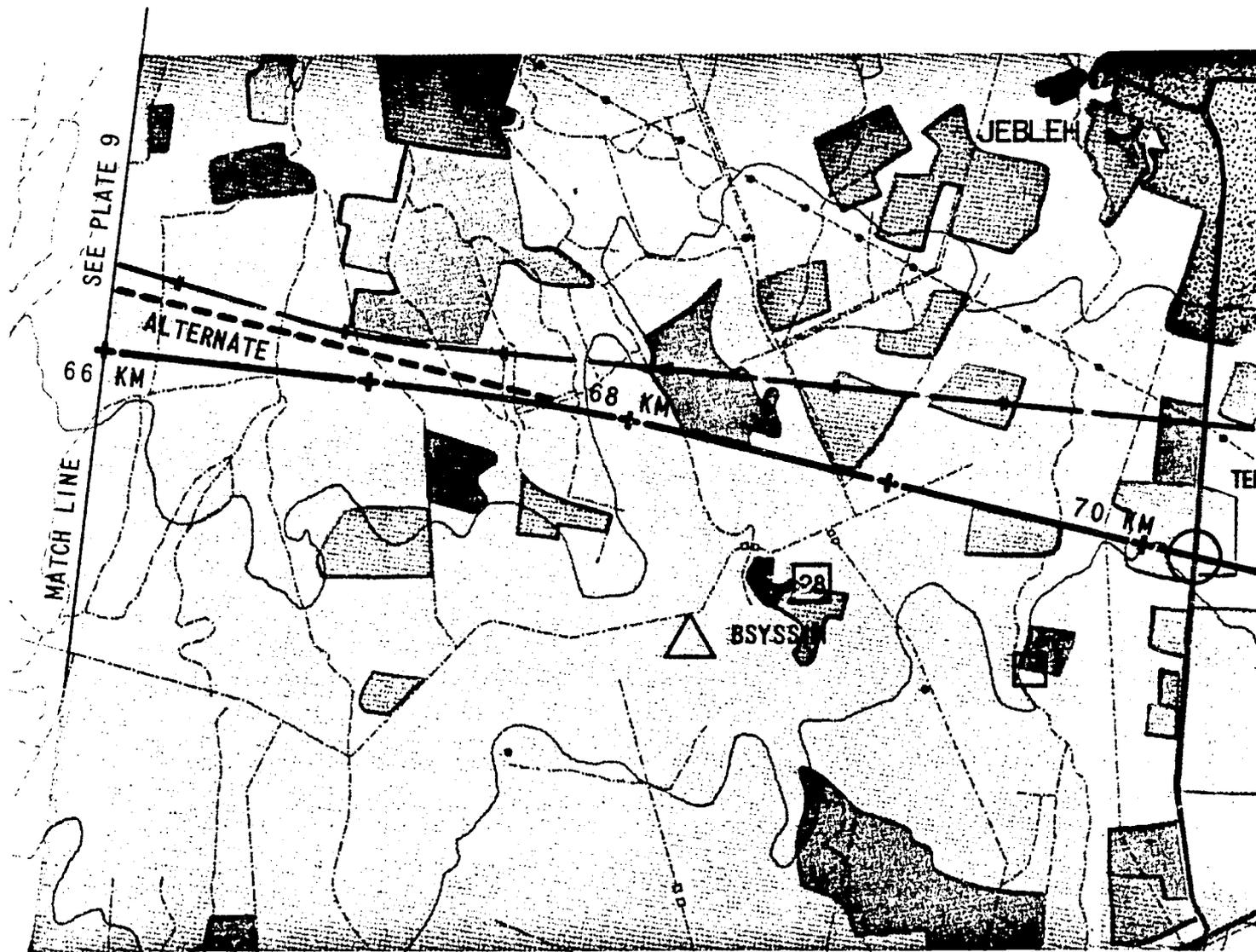
**22** **Tell Kemidani:** This Tell is apparently a natural hill. A local road has been excavated through a portion of the hill; no value found.

**23** **Tell Darour:** This site has been inhabited since the end of the 4th millenium (4000 BC). Surface finds produced pottery of the late Hellenistic and Phoenician periods.

**26** **Tell Jalal:** This small triangular site is about 5 m high. It has been partly destroyed by a new house built at the top. Among other things, the new construction apparently destroyed several Roman and Byzantine buildings. The Roman pottery sherds found near the Tell confirmed its date. The proposed highway will not interfere with this site.

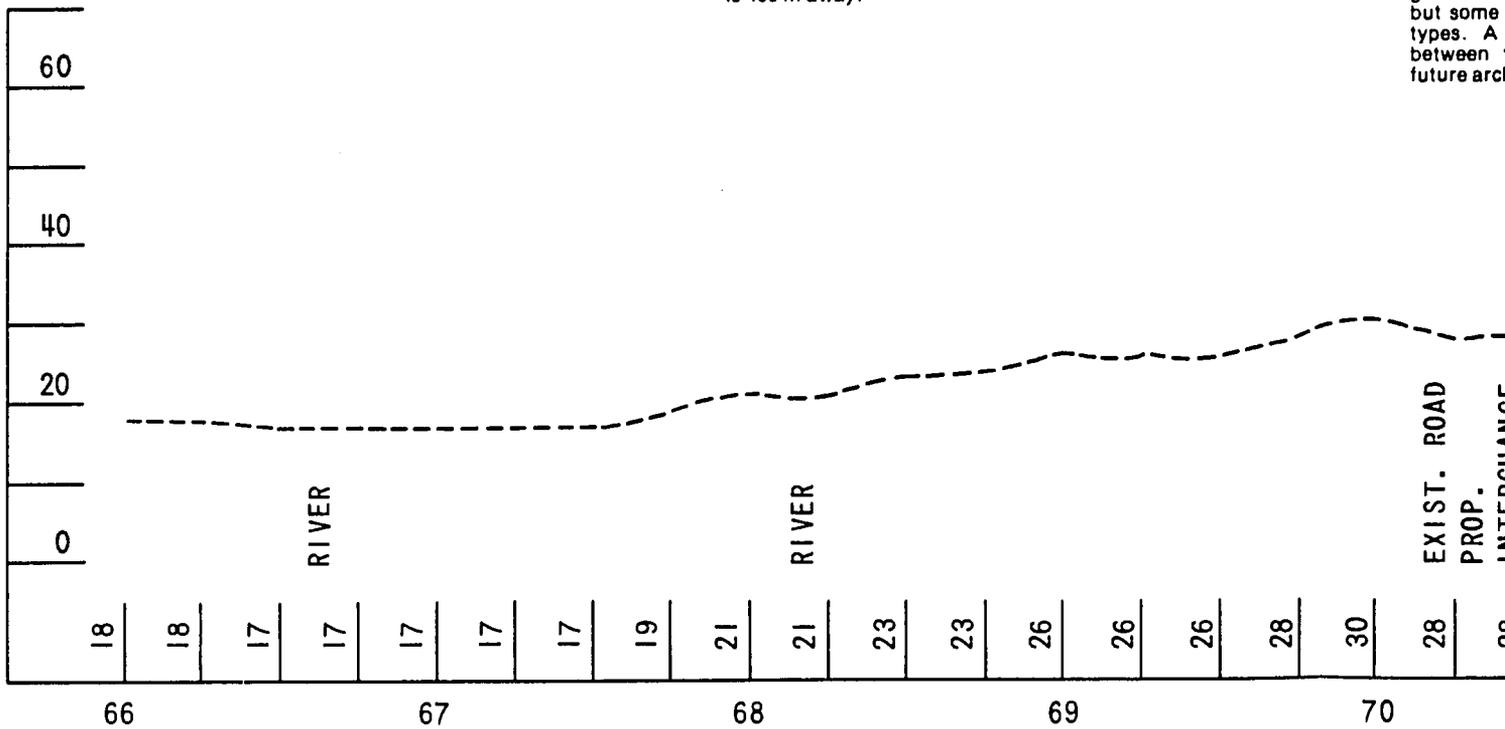


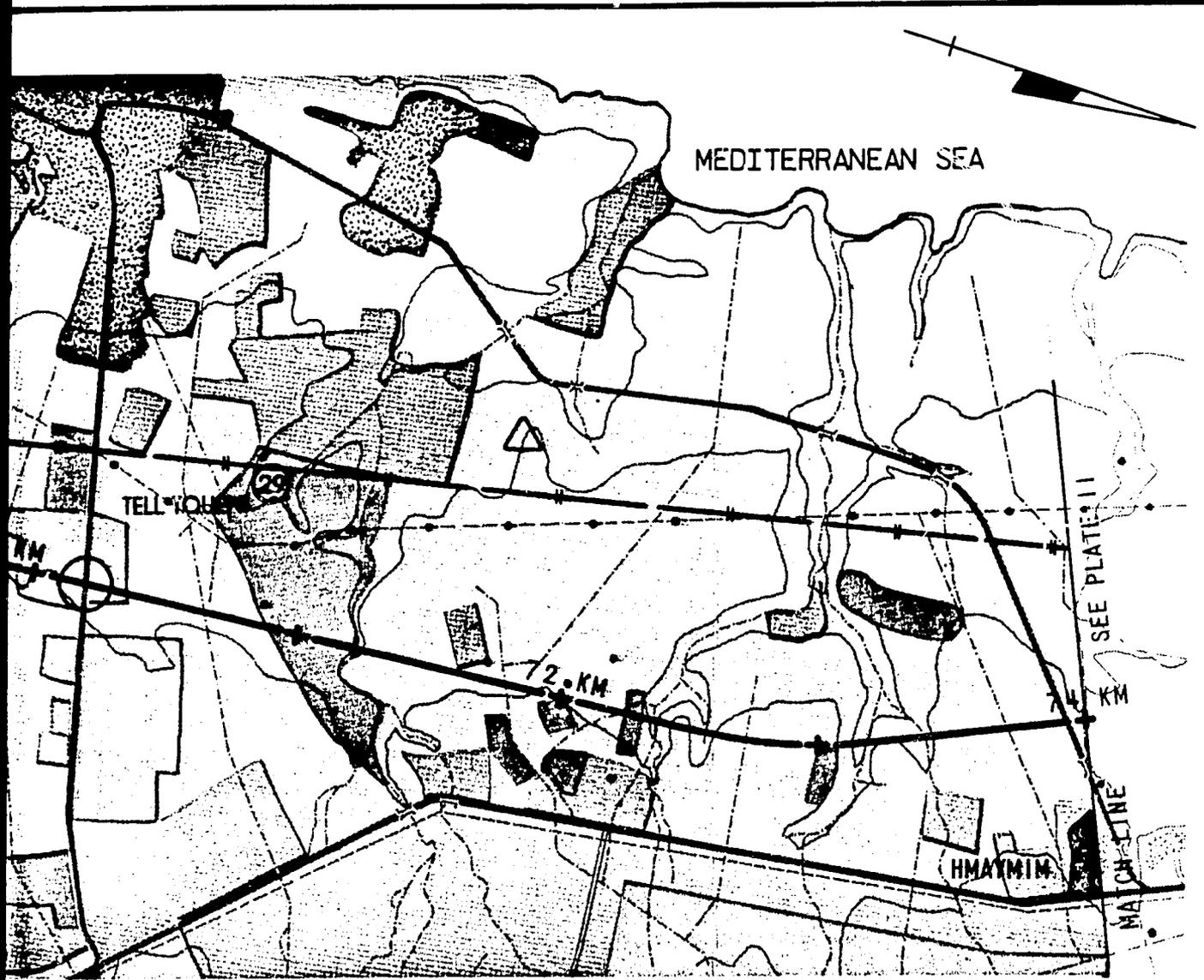




**28** Km 69  
 The ruin and the tomb at this site are within the village of Bsyssin. This find is not dated as yet, but the proposed highway is 400 m away.

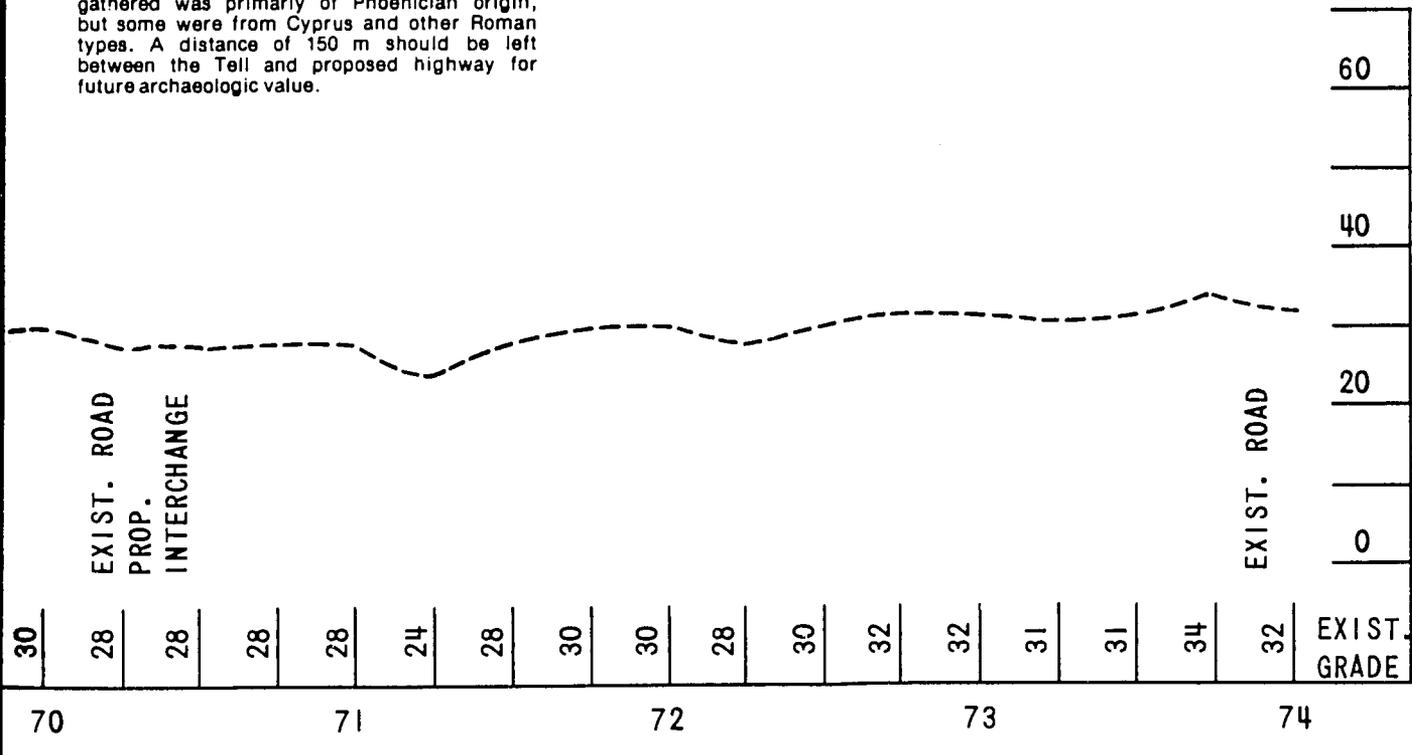
**29** Tell Tower  
 in shape. Phoenician gathered but some types. A between future arch



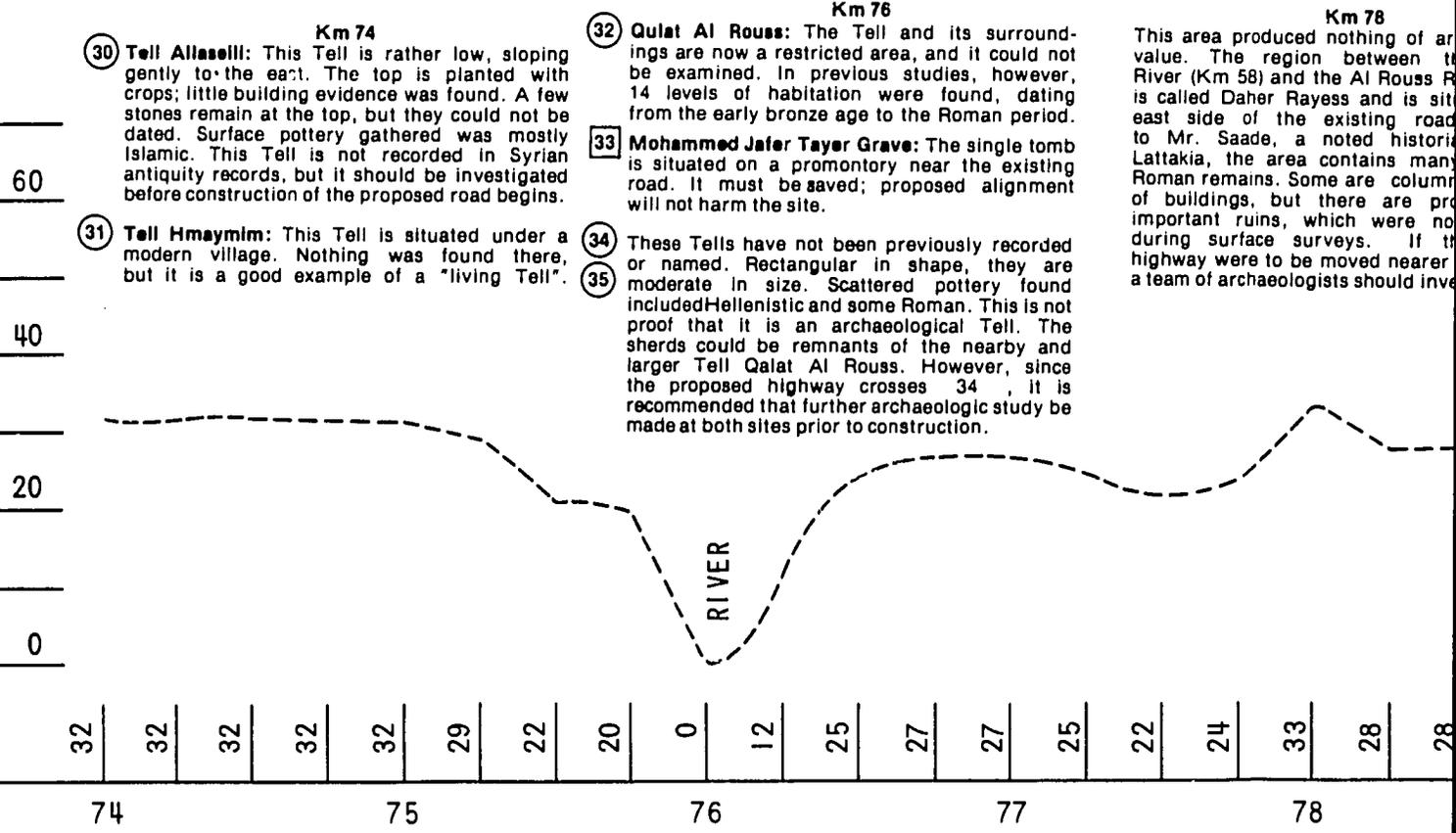
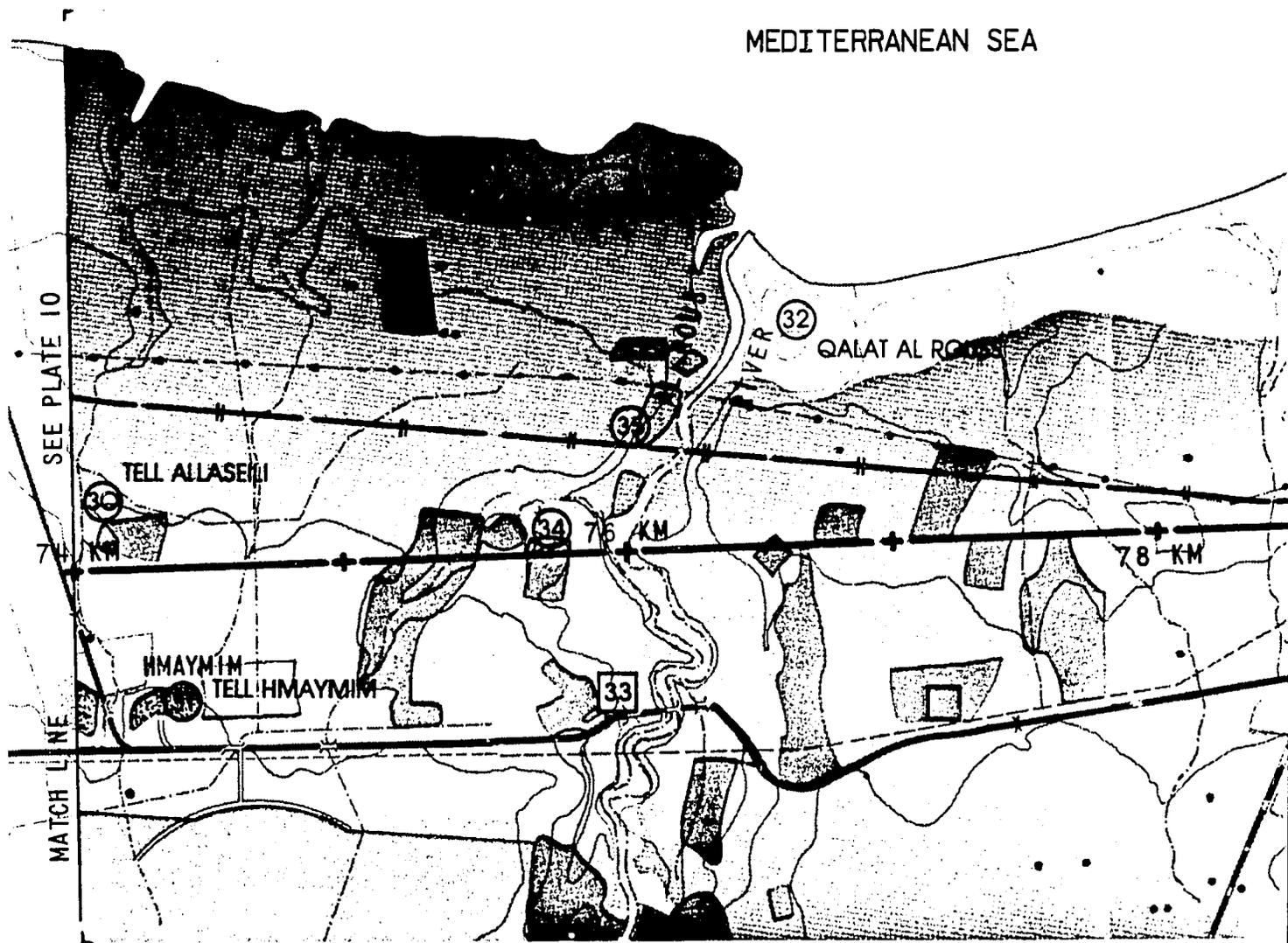


**29** **Tell Touene:** This Tell is wooded and rectangular in shape. It is thought to be the ancient Pheonician town of Jebleh. Surface pottery gathered was primarily of Phoenician origin, but some were from Cyprus and other Roman types. A distance of 150 m should be left between the Tell and proposed highway for future archaeological value.

Km 71



MEDITERRANEAN SEA



**30** **Tell Allaseili:** This Tell is rather low, sloping gently to the east. The top is planted with crops; little building evidence was found. A few stones remain at the top, but they could not be dated. Surface pottery gathered was mostly Islamic. This Tell is not recorded in Syrian antiquity records, but it should be investigated before construction of the proposed road begins.

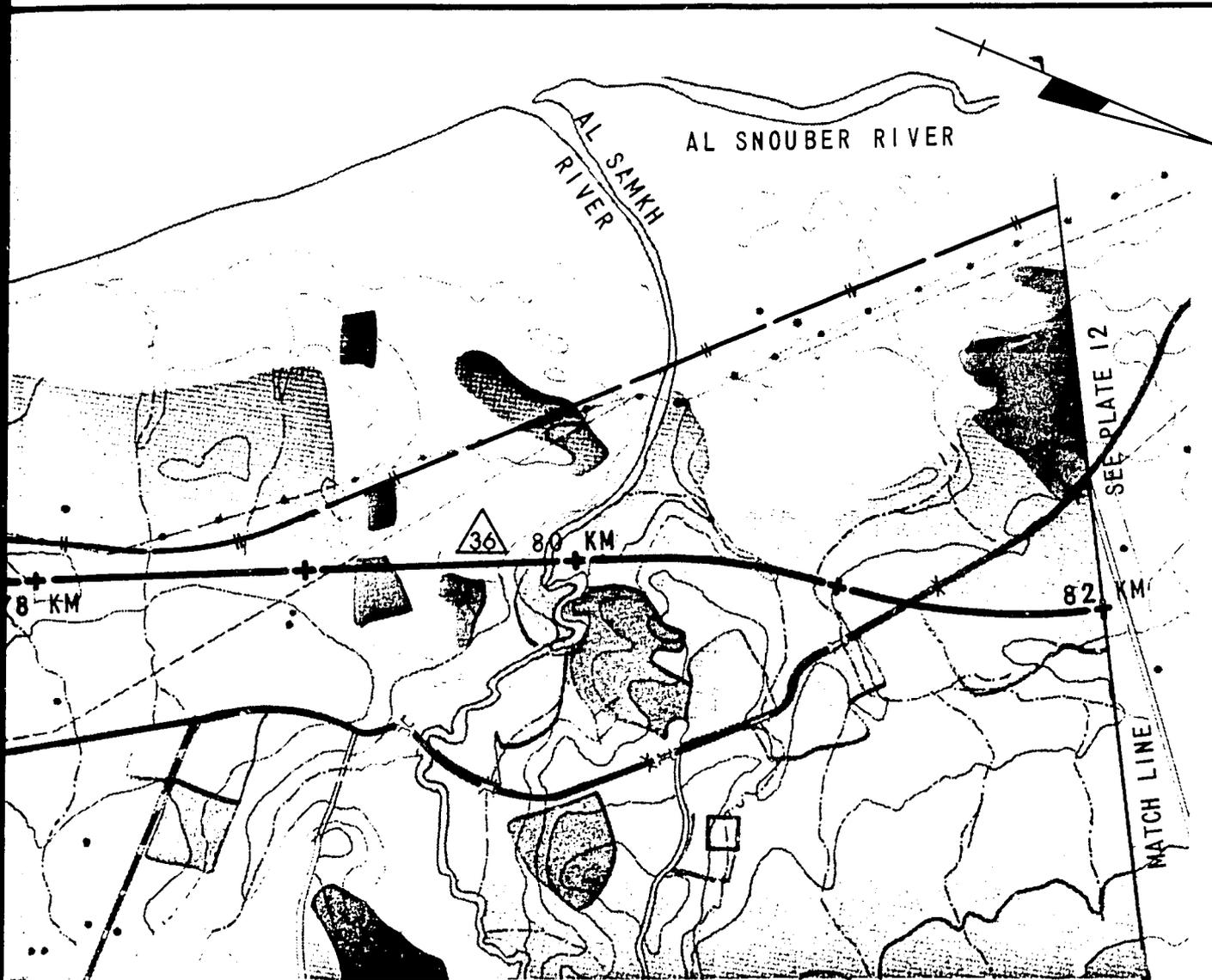
**31** **Tell Hmaymim:** This Tell is situated under a modern village. Nothing was found there, but it is a good example of a "living Tell".

**32** **Qalat Al Rouss:** The Tell and its surroundings are now a restricted area, and it could not be examined. In previous studies, however, 14 levels of habitation were found, dating from the early bronze age to the Roman period.

**33** **Mohammed Jafer Tayer Grave:** The single tomb is situated on a promontory near the existing road. It must be saved; proposed alignment will not harm the site.

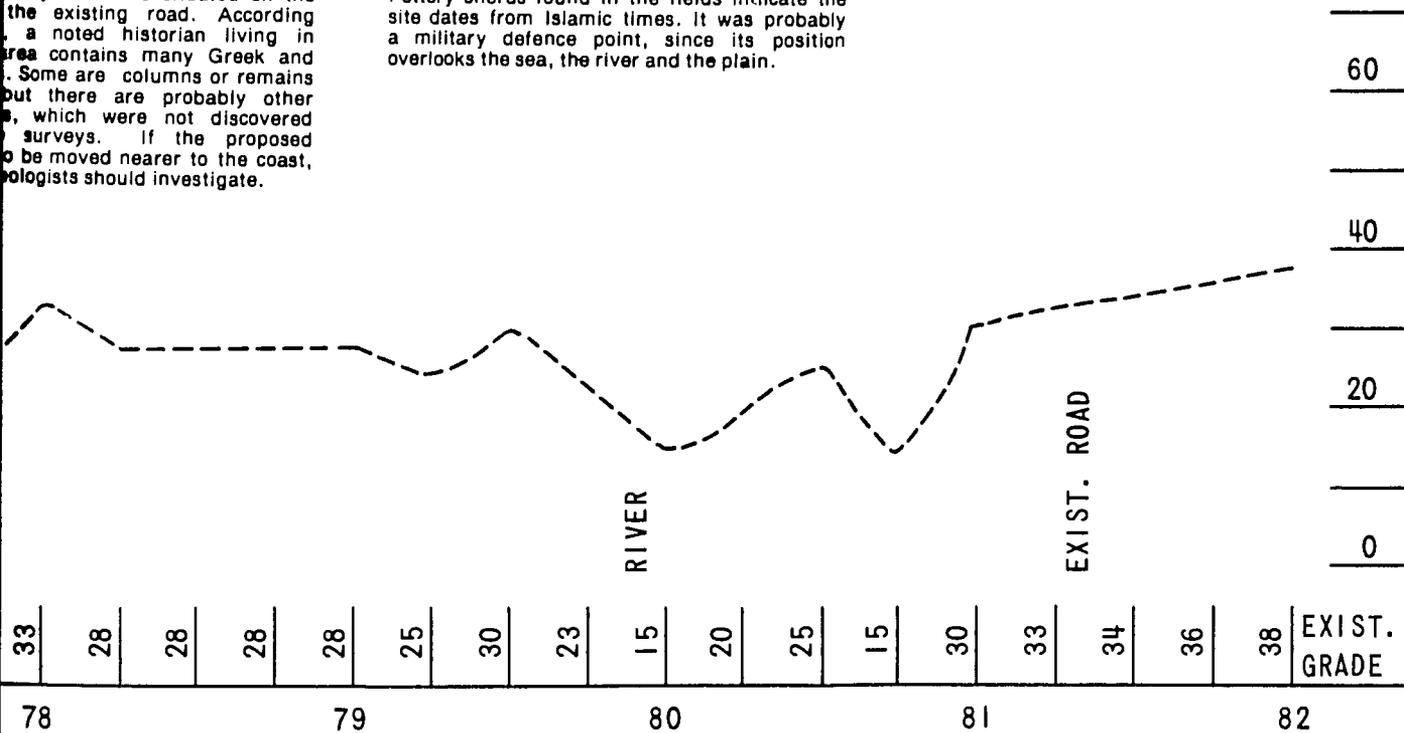
**34** **These Tells have not been previously recorded or named. Rectangular in shape, they are moderate in size. Scattered pottery found included Hellenistic and some Roman. This is not proof that it is an archaeological Tell. The sherds could be remnants of the nearby and larger Tell Qalat Al Rouss. However, since the proposed highway crosses 34, it is recommended that further archaeological study be made at both sites prior to construction.**

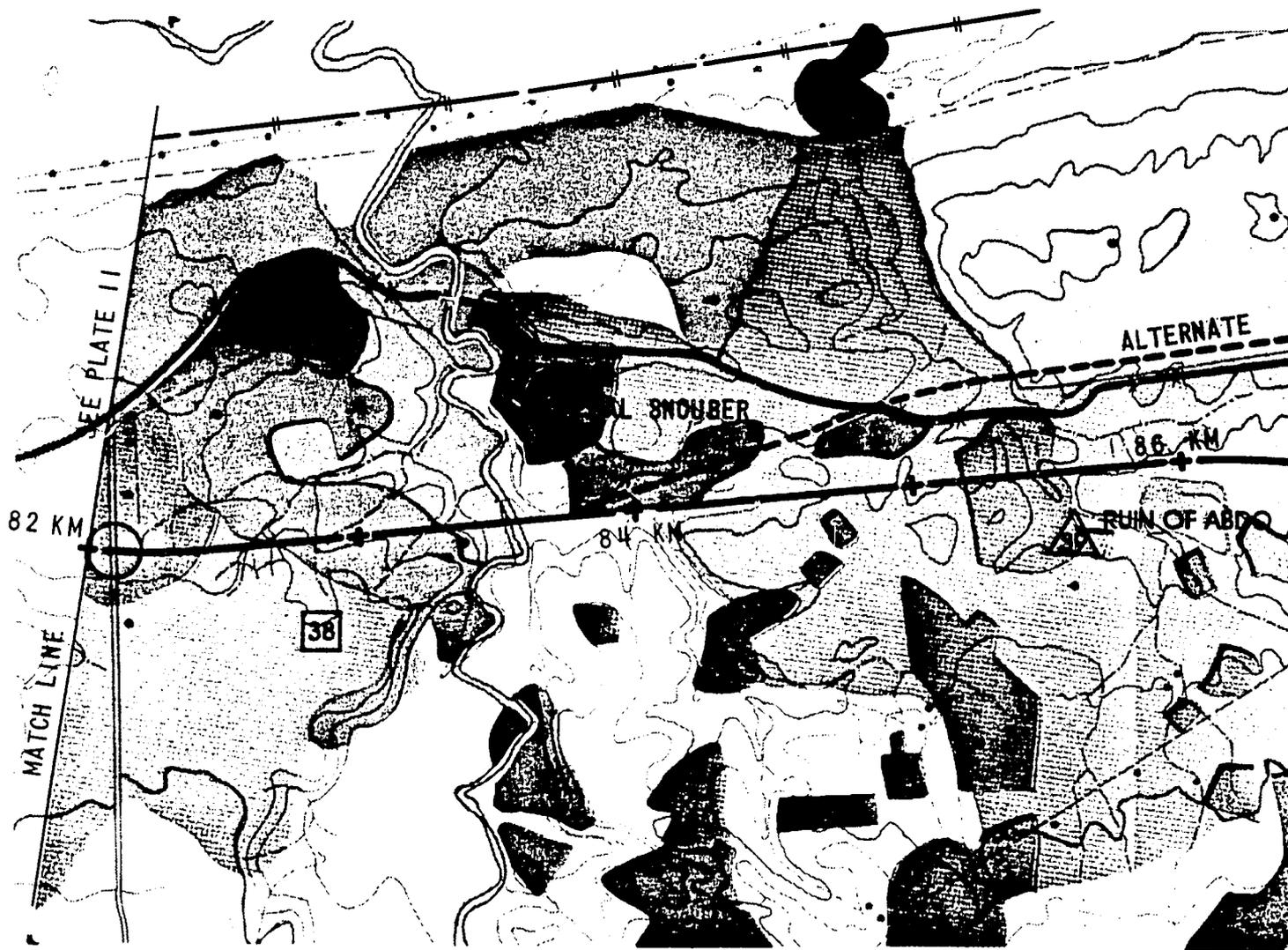
**35** **This area produced nothing of any value. The region between the Euphrates River (Km 58) and the Al Rouss River is called Daher Rayess and is situated east side of the existing road. It belongs to Mr. Saade, a noted historical figure from Lattakia, the area contains many Roman remains. Some are columns and fragments of buildings, but there are no important ruins, which were not discovered during surface surveys. If the proposed highway were to be moved nearer to the river, a team of archaeologists should investigate the area.**



**Km 78**  
 Excavations in the region between the Al Sinn and the Al Rouss River (Km 76) at Rayess and is situated on the existing road. According to a noted historian living in the area contains many Greek and Roman columns or remains but there are probably others, which were not discovered in previous surveys. If the proposed road is to be moved nearer to the coast, archaeologists should investigate.

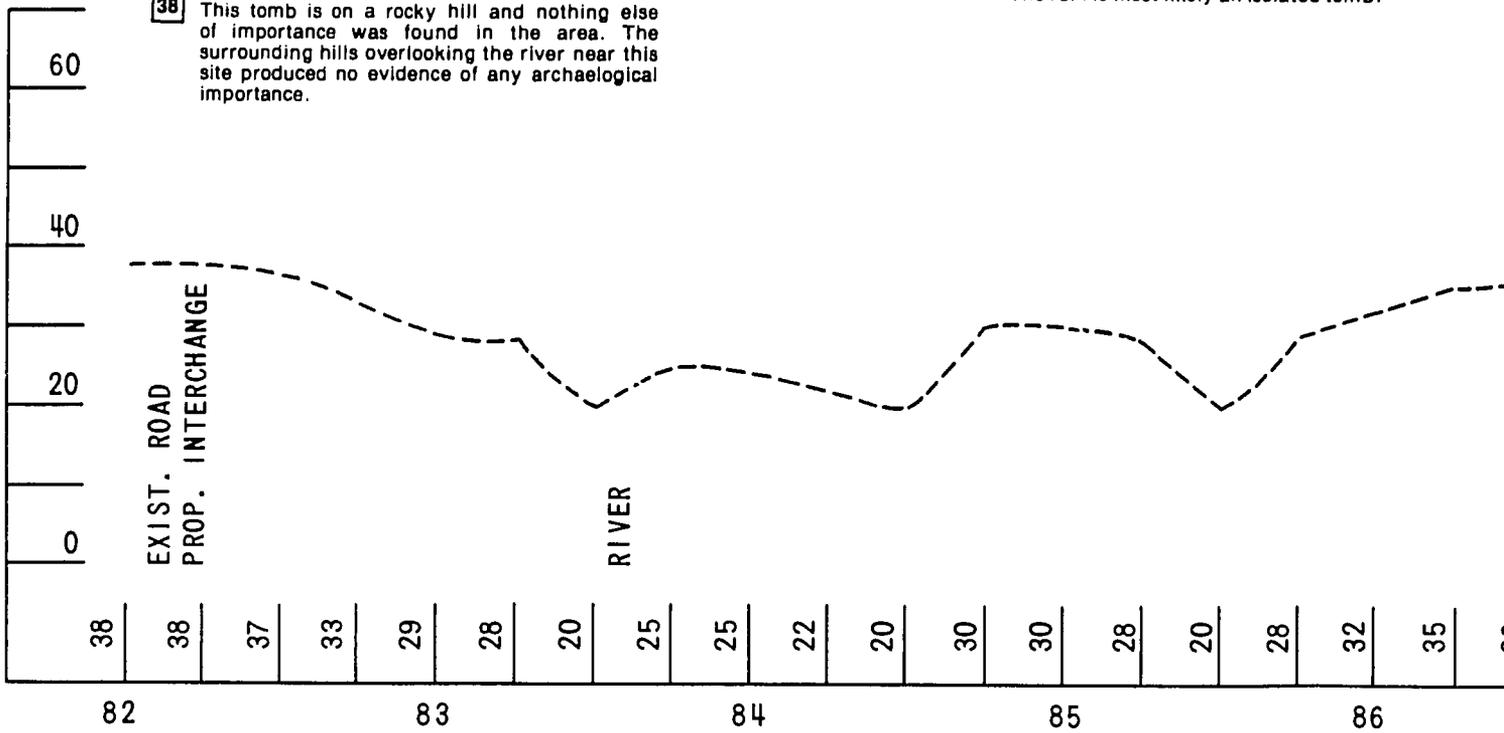
**Km 80**  
 36 The ruins of a stone building with walls about 1.5 m thick stands at this location. The building is square measuring about 6 m a side. Pottery sherds found in the fields indicate the site dates from Islamic times. It was probably a military defence point, since its position overlooks the sea, the river and the plain.

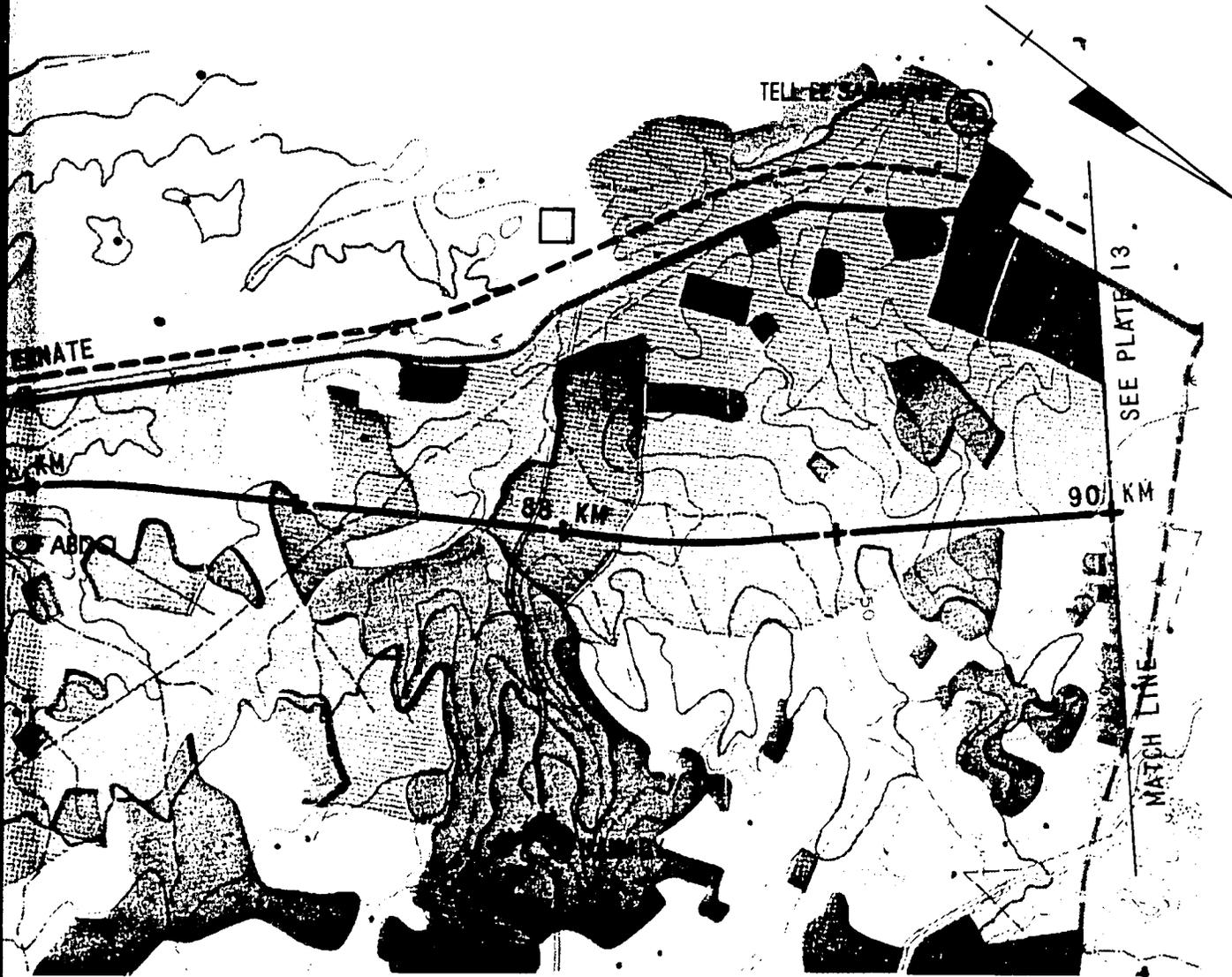




- Km 83**
- 37** A large modern cemetery borders the existing road. The proposed highway is removed.
  - 38** This tomb is on a rocky hill and nothing else of importance was found in the area. The surrounding hills overlooking the river near this site produced no evidence of any archaeological importance.

- Km 86**
- 39** The Ruin of Abdo: This site is located in a restricted area and could not be examined. The ruin is most likely an isolated tomb.





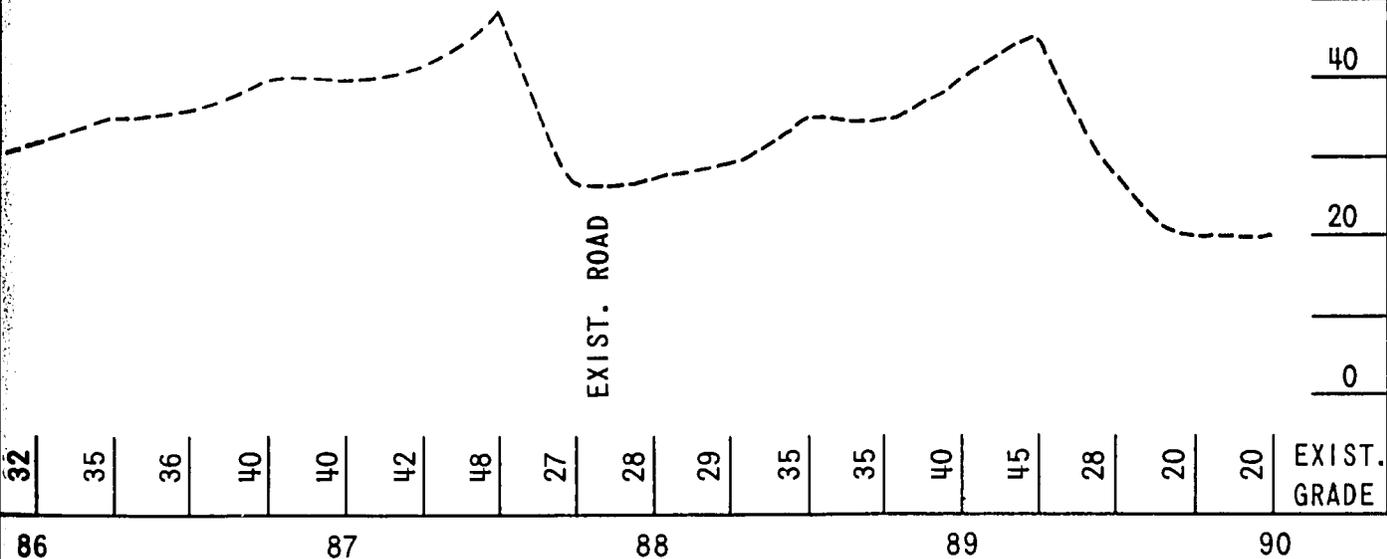
**ALTERNATE ROUTE**

Km 84 to 92: This alternate was considered and the proposed alignment selected for engineering reasons. From the environmental view, either would be satisfactory. This area where the highway enters Lattakia was also studied, concerning a bypass to the east of the city, which would be compatible with the city's master plan. The alignment shown was selected at least until more study can be devoted to the bypass considerations.

**Km 88**

- ④ Tell Al Samhani: This tell is planted with olive trees and has a flat square shaped top. The south side is very sandy. Surface finds included sherds from Roman and Islamic periods. This site is more than 1 Km from the proposed highway.

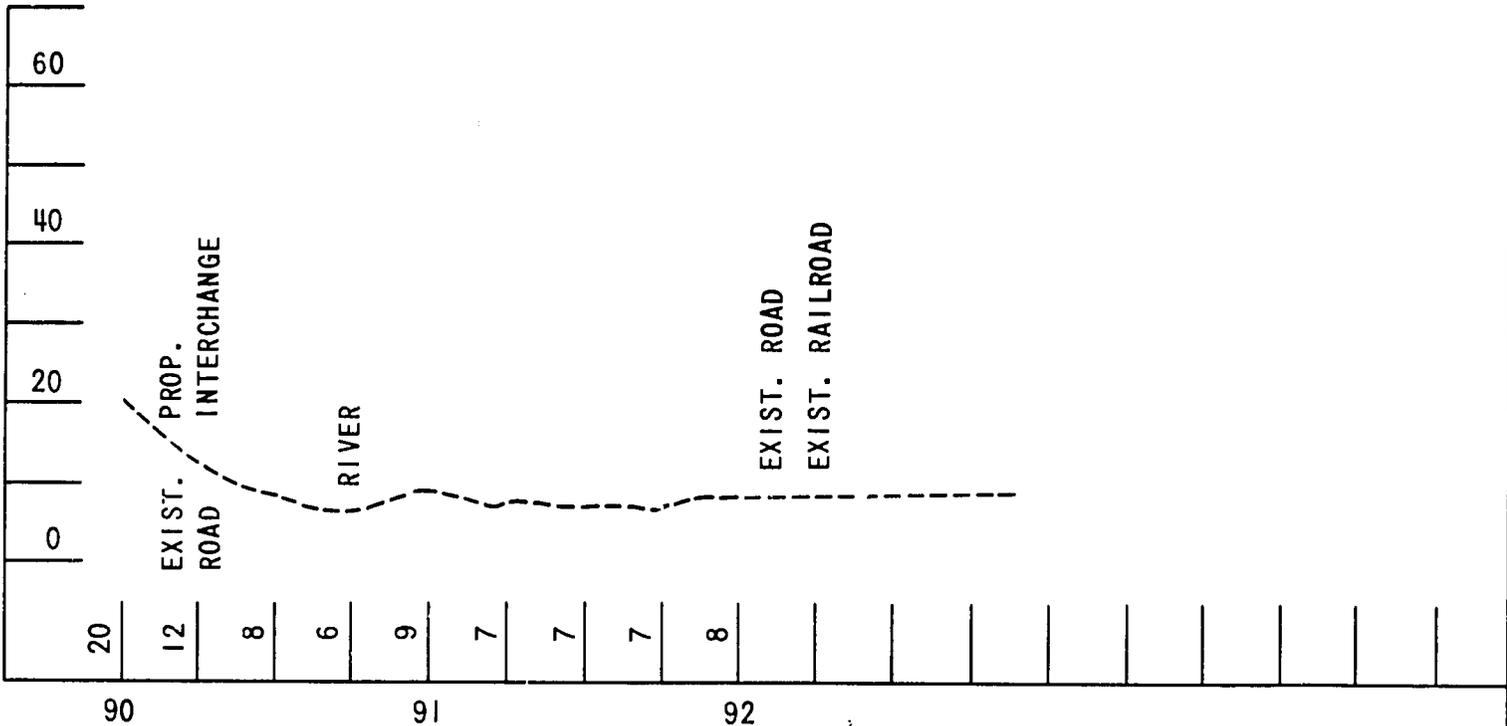
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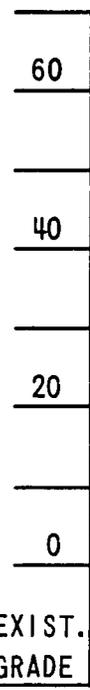
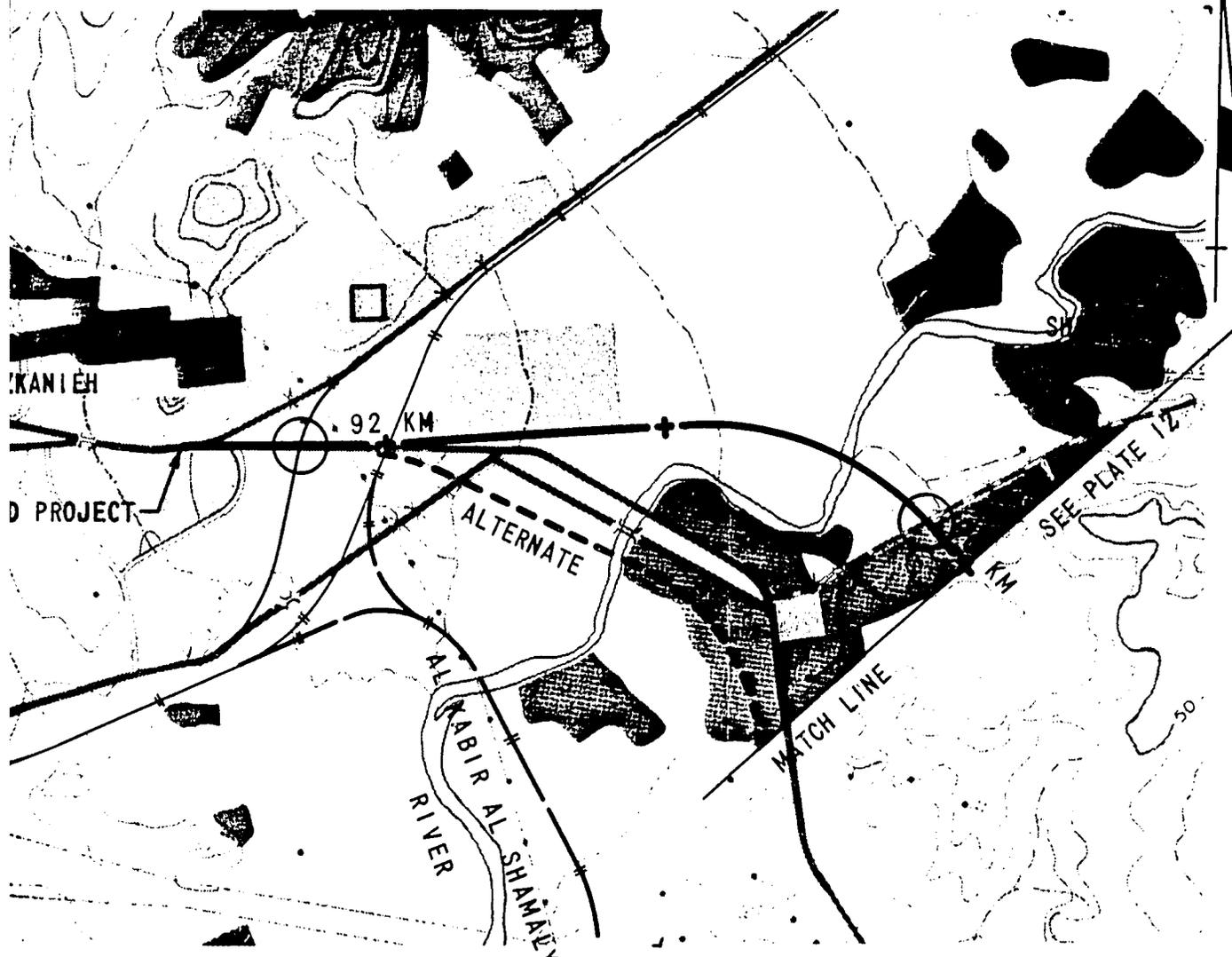


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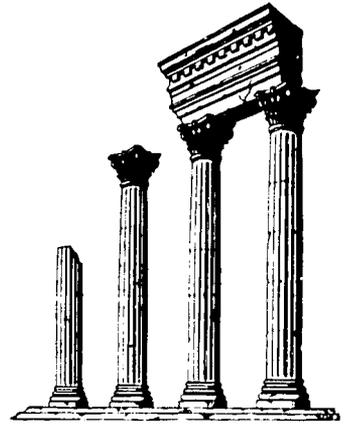
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END PROJECT





**PLATE 13 KM 90 to END**      **LATTAKIA HIGHWAYS STUDY**  
 LYON Associates, Inc.      MORRISON - MAIERLE, Inc.      JAMES R. SNITZLER Assoc., Inc.      Syrian Arab Republic



VI

**IMPACT ON THE  
ENVIRONMENT**



## IMPACT ON THE ENVIRONMENT

Eight categories of the environment were selected to study the impact the planned highway might have on this portion of Syria. These categories include Social-Cultural, Archeological, Aesthetic and Human Interest, Native Animals and Plants, Tourism and Recreation, Land Use, Man-Made Facilities, and Physical Features.

### Social-Cultural

The impact on the urban areas will be moderate to low. It is estimated that 140 buildings in the urban areas will be acquired for right-of-way of the new road and from 40 to 50 families will be affected. Displacement of these people should not be a serious problem since they can be relocated in one of the many new apartment complexes being constructed in areas set aside for residential development. The area most seriously affected is near the city of Banyas where the mountainous terrain makes it necessary to place the roadway through a residential area. Near the other two major cities of Tartous and Lattakia, it was possible to avoid interference with buildings in all but a few instances.

The impact of the Social-Cultural aspect in villages and rural areas will be more severe. It is estimated that about 72 buildings will be taken for construction of the new road and as many as 25 to 30 families may be affected. Displacement of farm families and the taking of agricultural land will be more serious because there are fewer areas where a farmer can relocate. The Syrian Ministry of Communications indicates that displaced property owners will be fully reimbursed for property or buildings acquired. There is, however, no government program



to relocate farmers or small businesses to other suitable areas. Farm land in this fertile region of Syria is valuable and it appears that nearly all arable land is presently occupied. One solution may be to relocate displaced farmers in other areas in Syria where irrigation projects are being developed and new farm land may be available.

#### Archeological

This category is considered by most Syrian officials as vital to the country, and the environmental impact should be low. The research was conducted both through the Department of Antiquities in Damascus where all published data was studied and with on-site field investigations to determine whether or not the planned highway alignment would interfere with any known or undiscovered potential archeological sites. The method was to review the area for archeological "tells", which is the Arabic name for a hill. In archeologists' terms, it generally refers to an unnatural hill formed by the accumulation of cities which have been constructed, one atop the other, over many centuries.

The proposed roadway alignment was moved in many instances to avoid possible damage to known or potential sites. It is recommended that a consulting archeologist be present during design and construction of the proposed highway to advise the engineers and prevent damage to valuable historic places. The impact to the archeological category will be low, provided proper caution is taken during construction.

#### Aesthetics and Human Interest

The existing natural aesthetic qualities of the corridor have been described earlier, and it is believed that the new highway, with its higher design standards, will provide the driver with a greater opportunity



to appreciate the scenic vistas and particular points of interest than is possible with the existing road. Access to recreation areas, as well as archeologic and historic points of interest will be provided.

The recommended alignment fits aesthetically well into the natural landscape. However, between Km 58 and Km 74 the essentially tangent alignment crosses an area of flat farm land. An alternate alignment located to the east of the existing roadway and near to the foothills is a possibility. This alternate would have gentle curves and grades to fit the rolling terrain and would be more aesthetically pleasing. This configuration was considered during the alignment selection process and was rejected for economic reasons; namely, that the improved aesthetics could not be justified by the added length of travel for the driver and the additional construction cost.

It is believed that the general aesthetic appearance of the highway itself will not detract from the natural beauty of the landscape.

The environmental recommendation is that the cut and fill slopes be landscaped or planted to natural grasses and that top of cuts be rounded.

Under these conditions the aesthetic impact on the environment will be low.

#### Native Animals and Plants

The study corridor and particularly the construction zone along the proposed alignment will have practically no effect on the native plants and animals of the area. Wild animals are virtually nonexistent except for rodents and small predators, and almost all the land in the region has been cultivated or in some way altered to eliminate natural shrubs and trees. Interviews with forestry officials indicated that there are



no known endangered species of either plants or animals that would be affected by the proposed facility.

Impact on this aspect of the environment will be low.

#### Tourism and Recreation

The expected growth of the tourism industry is important to Syrian officials, and expansion of this industry is considered desirable by the Syrian Government. Predictions by the government reflect a planned increase in tourist and recreation facilities to accommodate many times the number of tourists who visited the study area in 1975. (See Table 2, Section IV, Visitors to Historical Sites.)

Access to recreational areas, as well as leaving existing or possible future recreation sites untouched, was a consideration of alignment selection. It is believed that access to existing and proposed sites will be better than present conditions when the new road is completed. Travel to and from the desired areas will be much easier and safer for the driver.

Impact on the tourism and recreation industry will be positive and will produce beneficial effects.

#### Land Use

This is the only category studied in which a potentially "high" impact would result by building this highway.

Six general land use categories are shown on plan maps, plates 3 through 13. Preliminary estimates by the environmental team indicate that the land for the 83 Km of roadway plus interchanges may amount to about 850 hectares or about 2100 acres. The areas are broken down by land use category in the following table:



## ESTIMATED AREAS REQUIRED FOR RIGHT OF WAY BY CATEGORY

<u>Land Use Category</u>	<u>% Of Total Area</u>	<u>Area in Hectares</u>
Open	11.3	96
Olive Grove	30.4	258
Forest	0.6	5
Fruit Orchards	7.2	62
Farm	47.2	401
Residential-Commercial	<u>3.3</u>	<u>28</u>
Total	100	850 (2,100 acres)

(1 hectare equals 2.47 acres)

These figures are based on an estimated average right-of-way width and the lengths were scaled from the plan maps.

The area of farm land needed is quite high. During the alignment selection, every effort was made to reduce the effect on farm land. Construction costs, road user costs and maintenance costs indicate, however, that the suggested location is economically the best. The only practical alternates which were considered would cut into the land used as fruit orchards, which is only a little less valuable than the farming areas.

The environmental impact on land use is considered high because of the amount of farm land which will be removed from productivity.



### Man-made Facilities

Future plans for growth by all cities along the route were studied and avoided whenever possible by the alignment. Field studies pinpointed existing plants or industrial sites and these have been avoided. The existing two-lane highway, utility lines, both buried and overhead, residential and commercial areas have all been identified and considered during the preliminary design. It is recommended that where the existing roadway would be disturbed, a frontage road be constructed and that this entire existing north-south route be maintained for local traffic.

The impact of the highway, therefore, is determined to be low for this category of the environment.

### Physical Features

A major transportation facility, such as the proposed four-lane highway, cannot be constructed without having an effect on the geography. The alignment and grades of the new roadway were established to minimize the possibility of large cuts and fills, but in some areas this could not be avoided.

Km 10 to 30--The alignment here passes through rolling hills planted with olive trees. Cuts and fills should be generally moderate and will be minimized with rolling grades.

Km 30 to 46--The proposed highway enters an area where the foothills are quite close to the sea coast. The alignment remains in the foothills to avoid encroaching into areas near the coast which could be used for recreational purposes. The foothills are broken by many wadis (gulches), and although they contain some farms and orchards, it is an area of low agricultural productivity. Cuts and fills should be moderately high.



Km 46 to 50--The proposed alignment passes through some residential developments but was considered superior to other plans, which crossed the high mountains and deep canyons, and would have required extremely large cuts and fills. Moderate cuts and fills will be necessary with the present plan.

Km 50 to 57--The alignment in this seven Km section passes to the east of the refinery and tank farm. Relatively large cuts and fills will be needed since construction will be in the foothills to avoid interference with this industrial site.

Km 57 to 59--The alignment crosses a marshy area downstream from the outlet of the Al Sinn River reservoir. The river will probably be bridged with light cuts and fills on either side.

Km 59 to 74--Here the essentially tangent alignment passes across the large flat farming plain near the city of Jebleh. Very low fills will be used and the characteristics of the terrain will be changed very little.

Km 74 to 83--This area is also cultivated but is not the prime farm land of the preceding section. The roadway enters low rolling foothills with some orchards present. Cuts and fills will be light.

Km 83 to 90--The alignment crosses low rolling hills, some of which are cultivated for farm crops or orchards. Cuts and fills will be moderate and at Km 90 may be quite large as the roadway crosses larger hills.

Km 90 to 92--Here the new facility crosses the large Al Kabir River followed by a flat plain. This area is tentatively zoned for industrial use in the Lattakia master plan. The road then crosses under the



railroad through an existing structure and ties into the existing four-lane facility leading into the city of Lattakia.

Interchanges--The planned interchanges are shown as circles on the plan maps and in most cases will be the simple diamond type which requires a minimum of right of way. It is recommended that fill and cut slopes be rounded and planted or landscaped to minimize the adverse effects of the relatively large fills usually required for interchanges.

The environmental impact in this category is estimated to be moderate.

Surface Water Quality--The quality of the surface water will be unaffected by the project. Some water turbidity and even sedimentation may occur when rain falls during construction. Erosion control features such as bank protection at bridge structures, side drainage ditches for roadway drainage, and top of cut ditches will be incorporated into the design plans to prevent deterioration of the surface water quality and sedimentation.

The impact on surface water quality will be low.

Ground Water Quality--The coastal plain between Km 58 and Km 80 is the area where well water is used to the greatest extent, although ground water is present and is used in many other lower elevations along the route. The new facility is not expected to affect the availability nor the quality of ground water adversely. Wells which fall within the needed right-of-way should be re-drilled to provide an equivalent supply, according to its prior use.

The impact on ground water quality will be low.



Air Quality--Syria is presently expanding its industrial base which will tend to increase pollutants discharged into the atmosphere. The proposed new expressway will not affect this aspect of the air quality problem.

The new facility will, however, affect pollutants from automobile exhaust emission by providing a better transportation facility to accommodate more vehicles. The new roadway, however, will not be the sole cause of increased travel. If the present road system were to remain in use, increase in travel would still occur resulting in even more congestion which would cause higher emission rates per vehicle.

Completion of the new expressway would allow vehicles to be operated under optimum conditions which would result in the lowest possible exhaust emission rate. Therefore, it is believed that even though vehicular travel will increase, the new facility will provide operating conditions which will minimize emission rates.

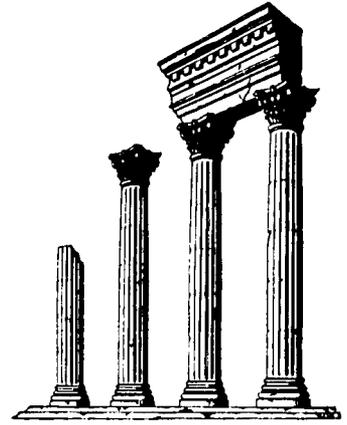
Impact in this category will be moderate.

Noise Levels--Much of the reasoning presented in the air quality section also applies to noise levels. Traffic congestion is a serious problem with the existing road network, and with the expected increase in travel, especially trucks, the sound levels could only be expected to increase. The new highway will provide for more ideal operating conditions and a much smoother riding surface where vehicles will not be forced to constantly accelerate and decelerate. These improved conditions are expected to reduce noise levels considerably, probably to a range below the currently existing levels.



The impact in this category will be low and the overall impact in the category of Physical Features is considered moderate.

Alternatives--Alternate alignments are shown on the plan sheets with a description of each. The "No Build" alternate was considered but does not appear to be a reasonable consideration. The overall impact of the proposed alignment is considered low to moderate and the benefits to the Syrian people far outweigh the adverse effects.



VII

**CONCLUSIONS**

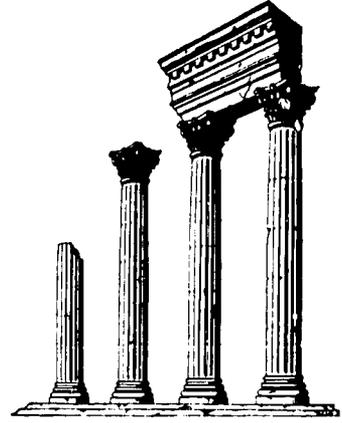


## CONCLUSIONS

The proposed four lane limited access expressway with planned interchanges, bridge structures and other related items will have an overall low to moderate impact on the relationship between the Syrians and their natural environment. This total evaluation was determined by examining each category individually and assigning a general impact rating to each as follows:

<u>Study Category</u>	<u>Impact Rating</u>
1. Social-Cultural	Low
2. Archeologic	Low
3. Aesthetics	Low
4. Native Animals & Plants	Low
5. Tourism and Recreation	Positive
6. Land Use	High
7. Man-Made Facilities	Low
8. Physical Features	Moderate

The study showed that the most severe impact would occur in the land use category because a large amount of fertile farm land would be removed from production. Physical features would suffer moderate impact and the remaining categories were rated low with the exception of tourism and recreation. It was felt that this industry would benefit from the proposed roadway and was assigned a positive rating.



VIII

# RECOMMENDATIONS

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**NO. VIII-1**

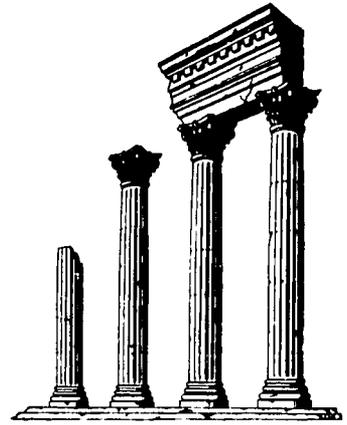


4. The design plans should contain provisions for rounding at the toe of fill slopes and at the top of cut slopes. Flatter slopes should be planted with natural grasses or shrubs or landscaped. Steeper slopes should be serrated. This is a process which has been used successfully in other countries. It consists of building cut slopes in steps instead of with a plane surface. The steps retain planted seeds as well as moisture from rainfall to promote growth.

5. It is recommended that the roadway be fenced on both sides to prevent livestock from entering the traveled way. At present it is common practice to graze animals on the road shoulders and this constitutes a safety hazard.

6. Water wells which are disturbed by the new roadway should be replaced in kind to provide a continuous water supply to the user.

7. Vehicular, stock and pedestrian separation structures or at-grade crossings must be provided to maintain present movements throughout the project length.



IX

# ACKNOWLEDGEMENTS



## ACKNOWLEDGEMENTS

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