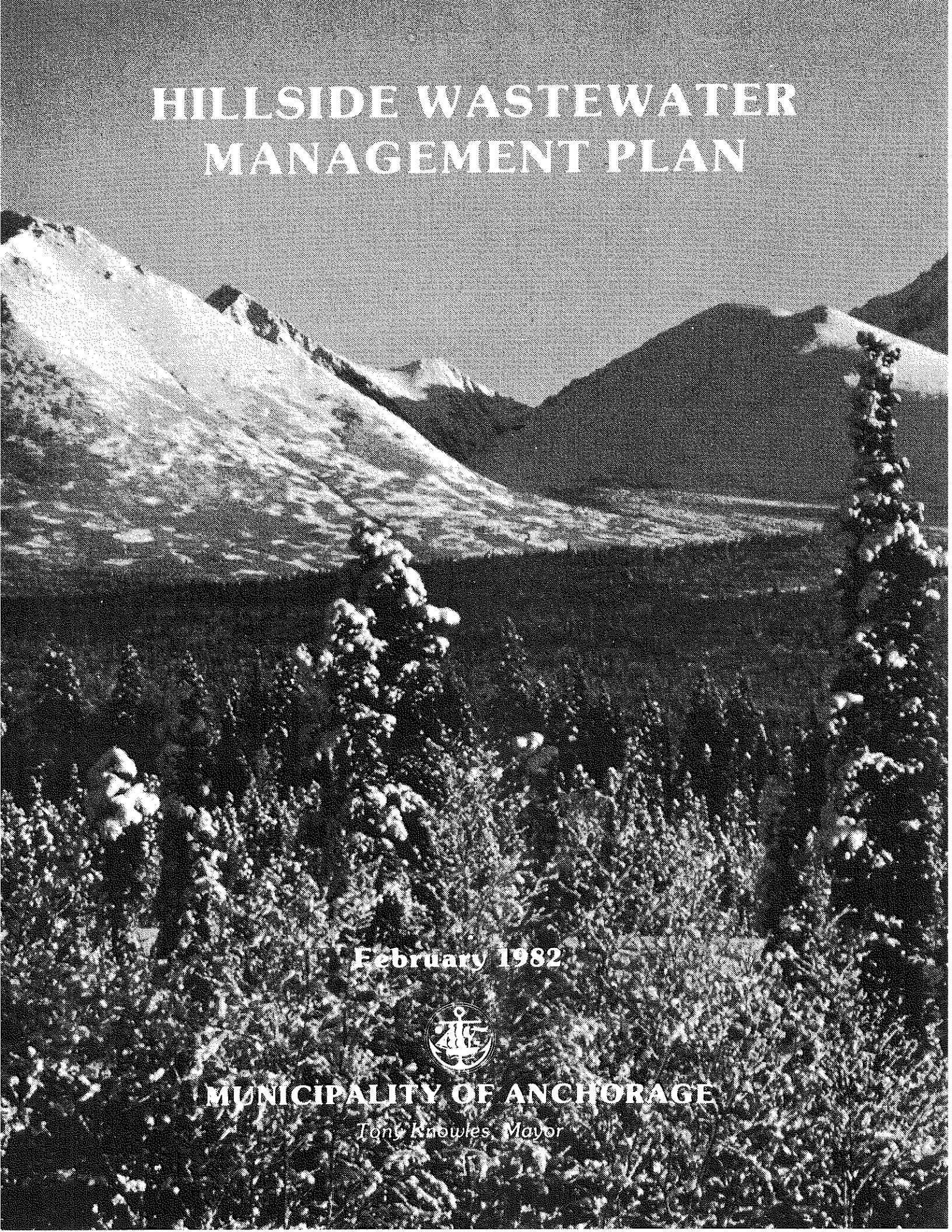
HILLSIDE WASTEWATER MANAGEMENT PLAN



February 1982

MUNICIPALITY OF ANCHORAGE

Tony Knowles, Mayor

HILLSIDE WASTEWATER

MANAGEMENT PLAN

January, 1982

Prepared by

Arctic Environmental Engineers

and

Physical Planning Division
Anchorage Municipal Planning Department

1 INTRODUCTION

The 1975 United States Geological Survey Report 175-105, Hydrology for Land-Use Planning: The Hillside Area, Anchorage identified the streams and groundwater of the Hillside Area as vulnerable to pollution from on-site sewage disposal systems. The Anchorage 208 Areawide Water Quality Management Plan also pointed to possible groundwater contamination from on-site systems and stated that water quality violations of Campbell Creek may be caused in part by septic tanks. The Hillside Wastewater Management Plan was undertaken to assess the performance of on-site disposal systems on the Hillside. The study has investigated alternative treatment systems, areas where on-site systems can be expected to function properly, and areas where on-site systems may not function properly. Recommended Municipal sewer system boundaries have been established.

During the development stages of this study and subsequent plan, a great deal of data and information was analyzed. Municipal records on septic tanks were studied and a sanitary survey was conducted to gather information on both on-site system performance and environmental conditions. Information on soils and hydrology in the area was collected from a large number of private and government reports, maps, well logs, and soils tests.

The Plan sets forth guidelines for orderly development in the general Hillside community. The Hillside area has complex geological conditions. The Plan designates areas as generally suitable or unsuitable and further breaks the suitable areas into several classifications depending upon soils, ground water, and slope. The designations are based on data available from other sources such as the Soil Conservation Service, United States Geological Survey, the Municipality's Wetlands Management Plan and Coastal Zone Management Plan, the Metropolitan Anchorage Urban Study, 1300 Sanitary Survey questionnaires and the Municipal platting files. The districts set forth in this plan are to be used for general guidance regarding zoning and platting changes. Specific decisions on these changes would be subject to the actual site conditions presented in the petition for change.

2 STUDY METHODOLOGY

2.1 Introduction

The purpose of the Hillside Wastewater Management Plan is to identify on-site and alternative wastewater disposal techniques, the boundaries of the areas where on-site disposal are not possible and those areas in which some method of on-site alternative system should be feasible, and to identify appropriate and supporting land use recommendations. The study was organized to evaluate both primary (as Municipal files) and secondary (as Soil Conservation Service and U.S. Geological Survey) sources without extensive field work to generate new primary data.

The study was implemented with a strong public participation program. The Hillside Citizens Advisory Committee has participated through the project in the capacity of providing review and recommendations. Their review has included the methodology, criteria, classification schemes, population projections, and plan map.

2.2 Data Inventory

Once a study plan had been developed and adopted, the available information was collected and analyzed. Sources of data were:

Municipality of Anchorage, Department of Health and Environmental Protection on-site system files. The files are computerized but the study team looked both at the computer print-outs and the individual lot files.

Municipality of Anchorage Department of Planning, platting files. The platting files of the Municipality provide soils information where subdivision activity has taken place in recent years.

United States Geological Survey and Soil Conservation Service well log information. While the available well logs were not used to obtain soils information in the upper twelve feet of soil, they were used as a resource by which other data could be evaluated.

United States Geological Survey Maps and reports by Dearborn and Barnwell (geology and hydrology of Hillside Area), Schmolls (geology), and Freethey (permeability). Additional research on the hydrology and geology of the south Hillside area was

generated by the Water Resources Division and constituted a major source of information on hydrology, groundwater, and geology south of Rabbit Creek Road.

United States Corps of Engineers Metropolitan Anchorage Urban Study (Soils Survey).

United States Soils Conservation Service South Anchorage and South Hillside Soil Surveys.

Municipality of Anchorage

a) Department of Health and Environmental Protection files for bedrock and water table depth.

b) Planning Department - Coastal Atlas, Wetlands Plan and land use/housing analyses.

Sanitary Survey. A comprehensive sanitary survey was accomplished through the combined efforts and management of the Municipal Planning Department, the Hillside Advisory Committee and the Community Councils.

The results of the sanitary survey and the on-site systems files research were computerized and areas of significant deviation pinpointed.

2.3 Data Inventory Evaluation

The above steps established the data base. The data base was analyzed to determine its reliability and the significant factors affecting on-site system operation. An interim report was developed to compile the results of these analyses. The objectives of the interim report were to provide information to the public, and to test the data and the interpretations of their data more fully. The interim report, "Report on Data Collection," March, 1981 contained the following maps with supporting narrative and analysis:

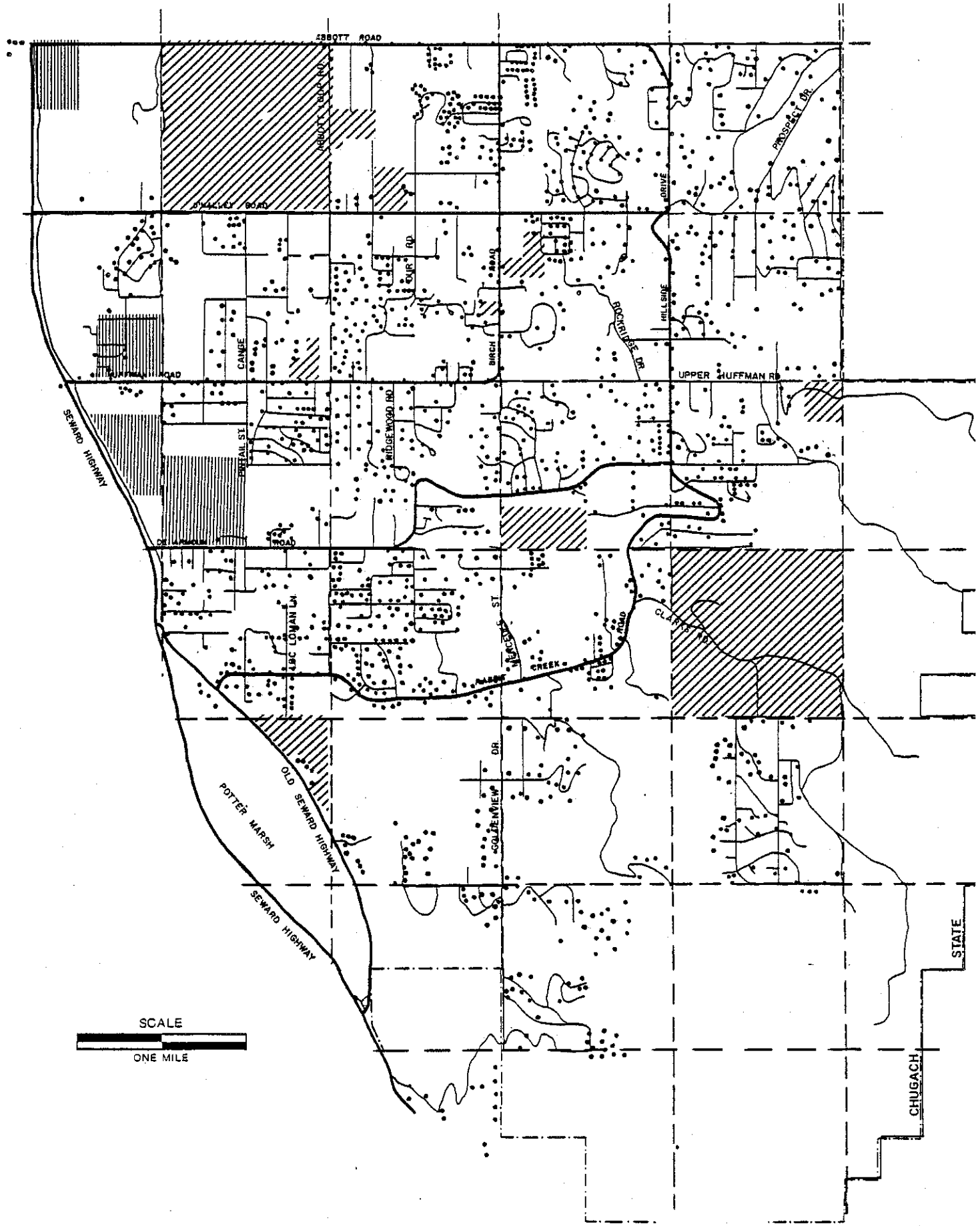
Figure III - 1	Upgrades and Unsuitable Areas from Municipal files.
Figure II -	Problems Identified Through Questionnaires
MAP 1	Data Base Map
MAP 2	Depth to Bedrock
MAP 3	Water Table and Wetlands
MAP 4	Soils
MAP 5	Slope
MAP 6	Poorly Drained Surficial Soils

MAP 7 Surficial Soils
MAP 8 Individual On-Site Systems Suitability

The figures and maps along with the pertinent facts of the report are included in the companion documents to this Plan.

2.4 Analysis of On-Site System Suitability

The next major phase of the Study involved the analysis of the Hillside Area on-site systems suitability. Coupled with the suitability analysis was an evaluation of alternative disposal systems such as shallow trenches with curtain drains, mounds, cluster systems, and deep trenches (see Section IV for a description of these alternative on-site systems). Areas that had shown a statistically significant number of on-site system problems were isolated and every attempt made to determine the nature of the problems, potential solutions and significance of modifications accomplished by owners. These data were then used to produce a base map showing suitable and unsuitable areas for on-site waste disposal. Areas identified as suitable are generally capable of rendering wastewater effluent, harmless when discharged, into the soils on-site through an adequately designed treatment system due to the site's combination of favorable soils, slope, groundwater, and geology. Unsuitable areas were those regions generally incapable of rendering wastewater effluent harmless given the same discharge into on-site soils through the same type of system due to the site's unfavorable combination of physical factors. Alternative on-site wastewater disposal techniques, presented in this report, can be used in some instances to overcome the unfavorable factors and allow development in the generally unsuitable areas.



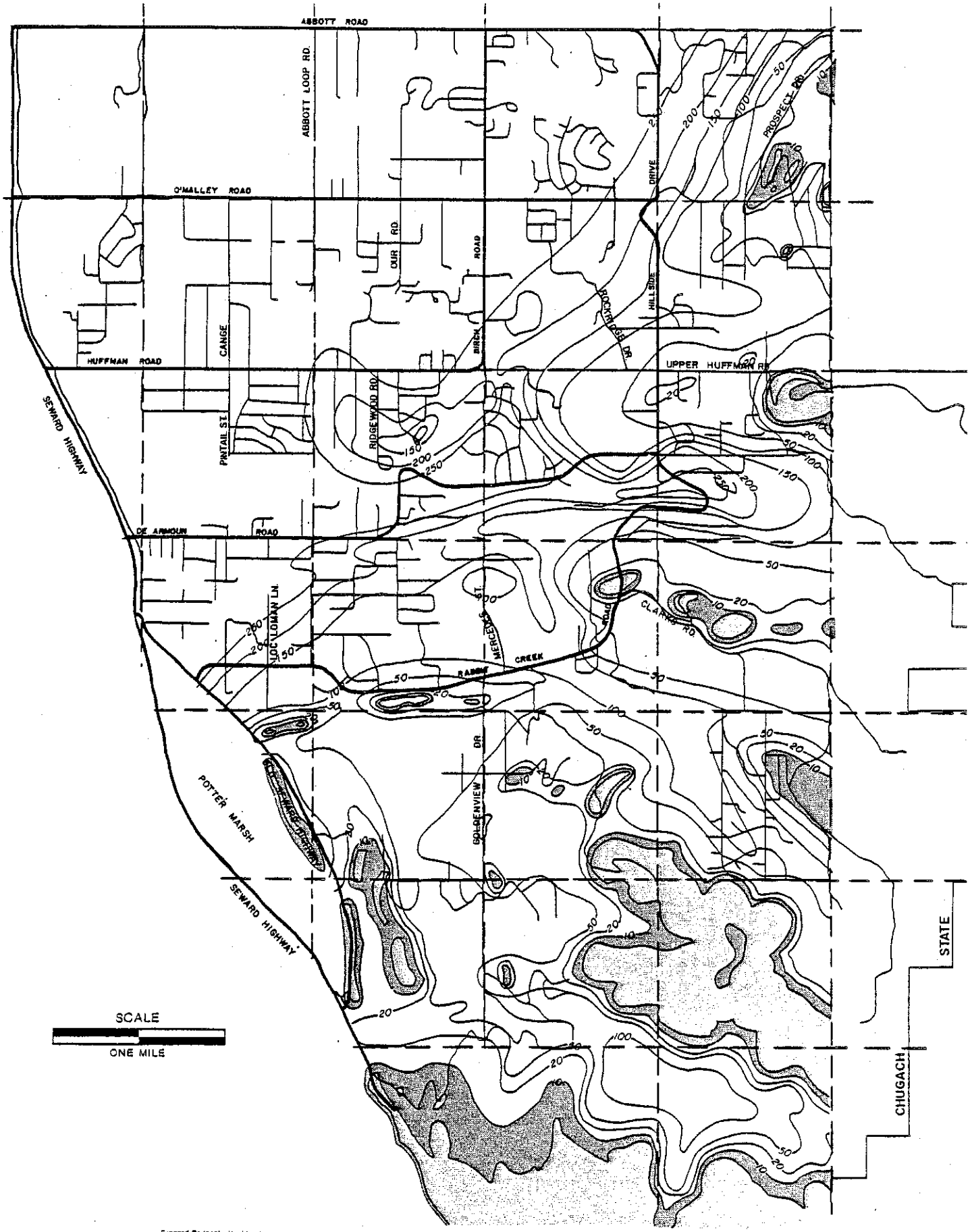
DATA BASE MAP

• Location of Test Holes used in compiling Maps 1, 2, & 3

Public Land

Area served by City Sewer

DATA BASE MAP



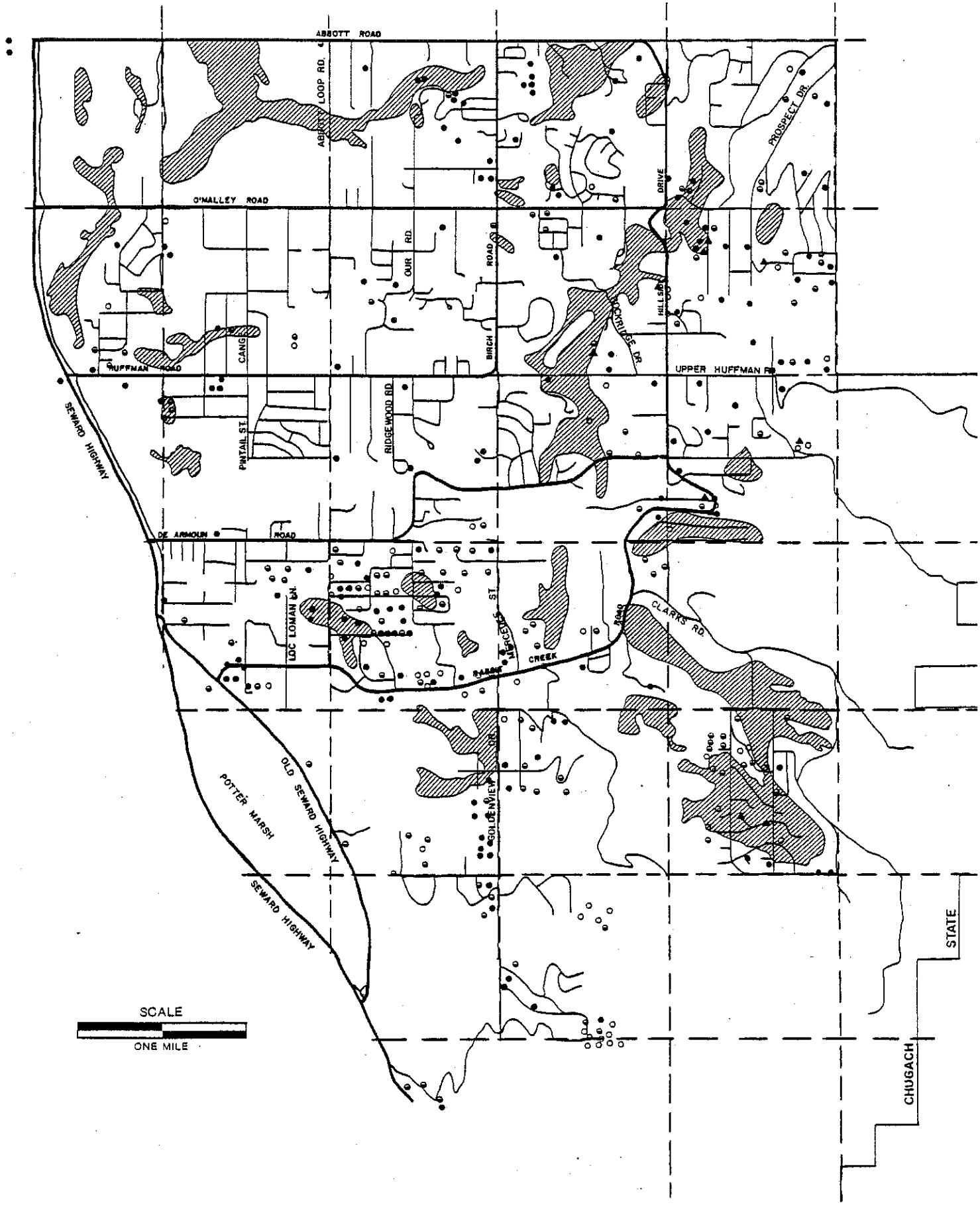
DEPTH TO BEDROCK

Exposed Bedrock, in places thinly mantled by colluvium or morainal deposits.

Depth to Bedrock less than 10 feet

150 Depth to Bedrock contours (feet)

Bedrock Data Sources: 1) Well Logs. 2) USGS Map I-787-A. 3) Soil Conservation Service, Soils Map.



WATER TABLE & WETLANDS

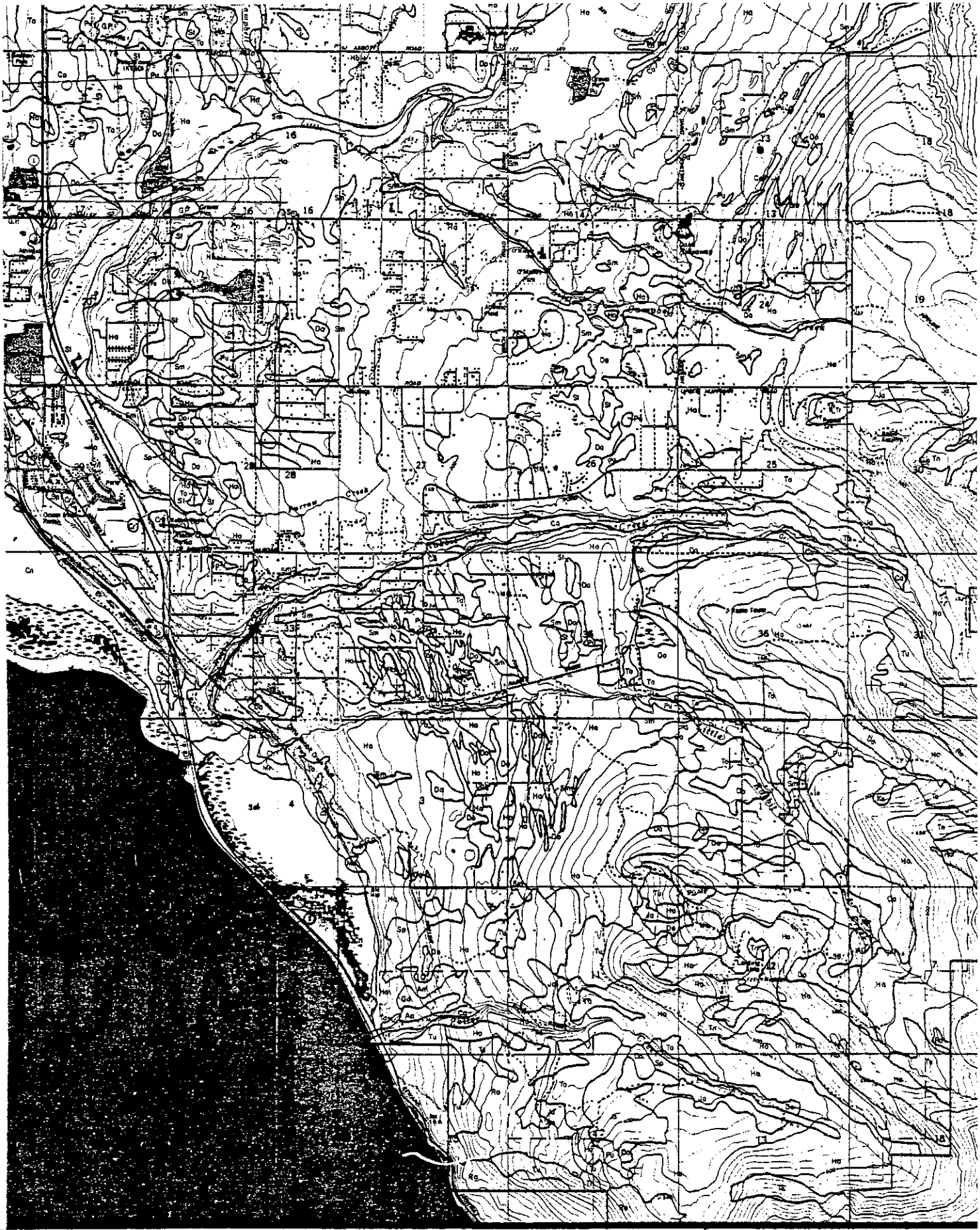
Wetlands as mapped for Municipality of Anchorage Wetlands Study and Shallow Groundwater Areas as mapped by USGS, Open File Report 75-105

▲ Artesian Well

WATER TABLE	
○	0 ft. to 6 ft.
◎	6 ft. to 10 ft.
●	10 ft. to 20 ft.

Water Table and Wetlands Data Sources: 1) Municipal Files. 2) State Materials Lab Files. 3) Municipality of Anchorage Wetlands Study. 4) USGS O.F.R. 75-105. 5) Well Logs.

WATER TABLE & WETLANDS



SURFICIAL SOILS

- An Anchorage fine sandy loam
- Ca Caswell silt loam
- Cn Chena silt loam
- Cr Cryaquents, loamy
- Cs Cryorthents
- Da Darcelon peat
- Gd Goodhope silt loam
- GP Gravel pits
- Gr Grewingk sandy loam
- Ja Jacobsen stony silt loam
- Ka Kalifansky silt loam
- Ka Kastlof silt loam
- Mr Moose River silt loam
- Pu Purches silt loam
- Ro Rock outcrop
- Sm Slikok mucky silt loam
- So Soenard silt loam
- St Stanchfield peat
- Te Torpedo Lake gravelly sandy loam
- Tn Turnagain silt loam
- Tu Tuomi silt loam

Base Map: U.S.G.S., Anchorage A-8 NE,NW,SE,SW 1:25,000
Data Source: Soil Conservation Service

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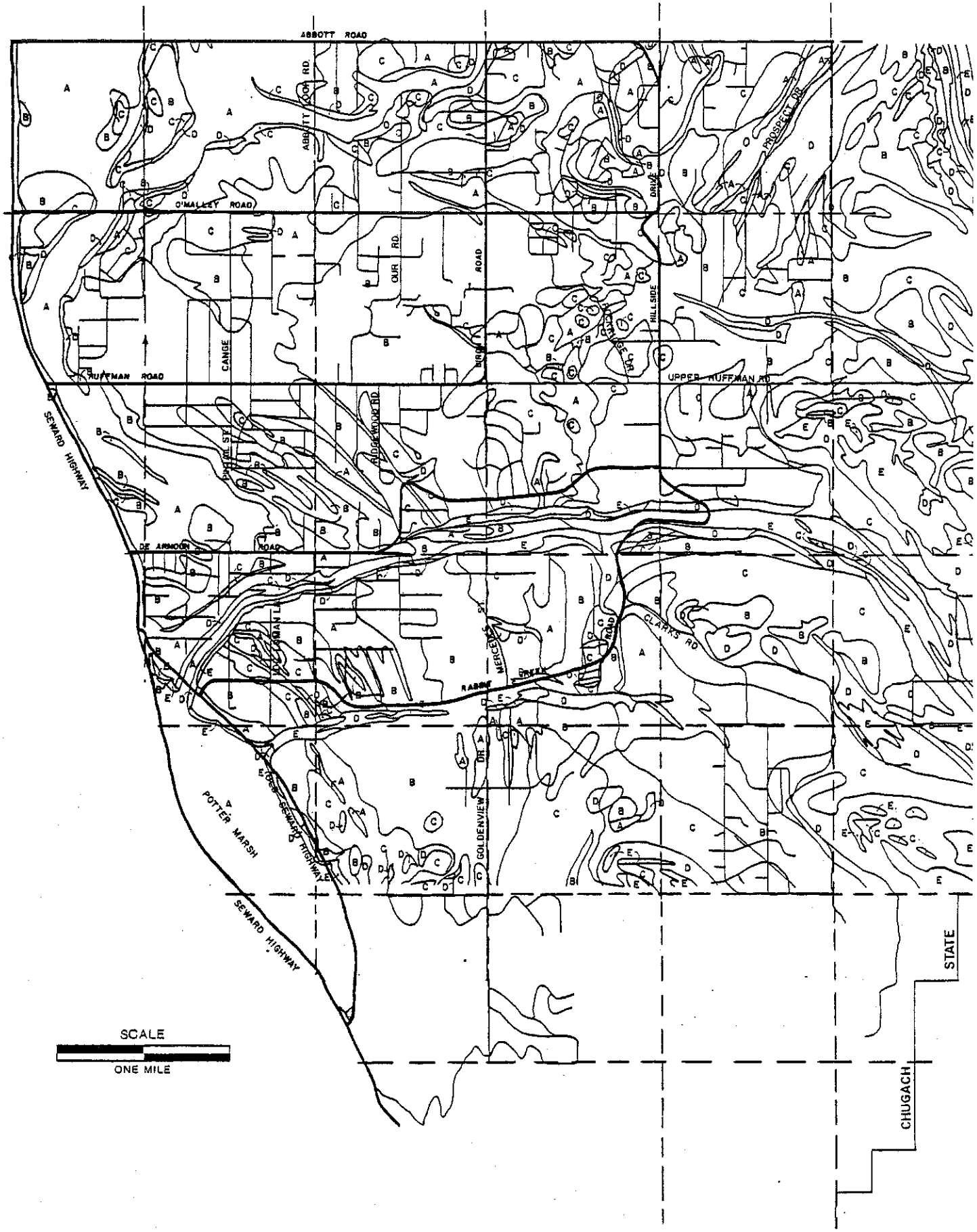
HILLSIDE WASTEWATER DISPOSAL STUDY

SURFICIAL SOILS

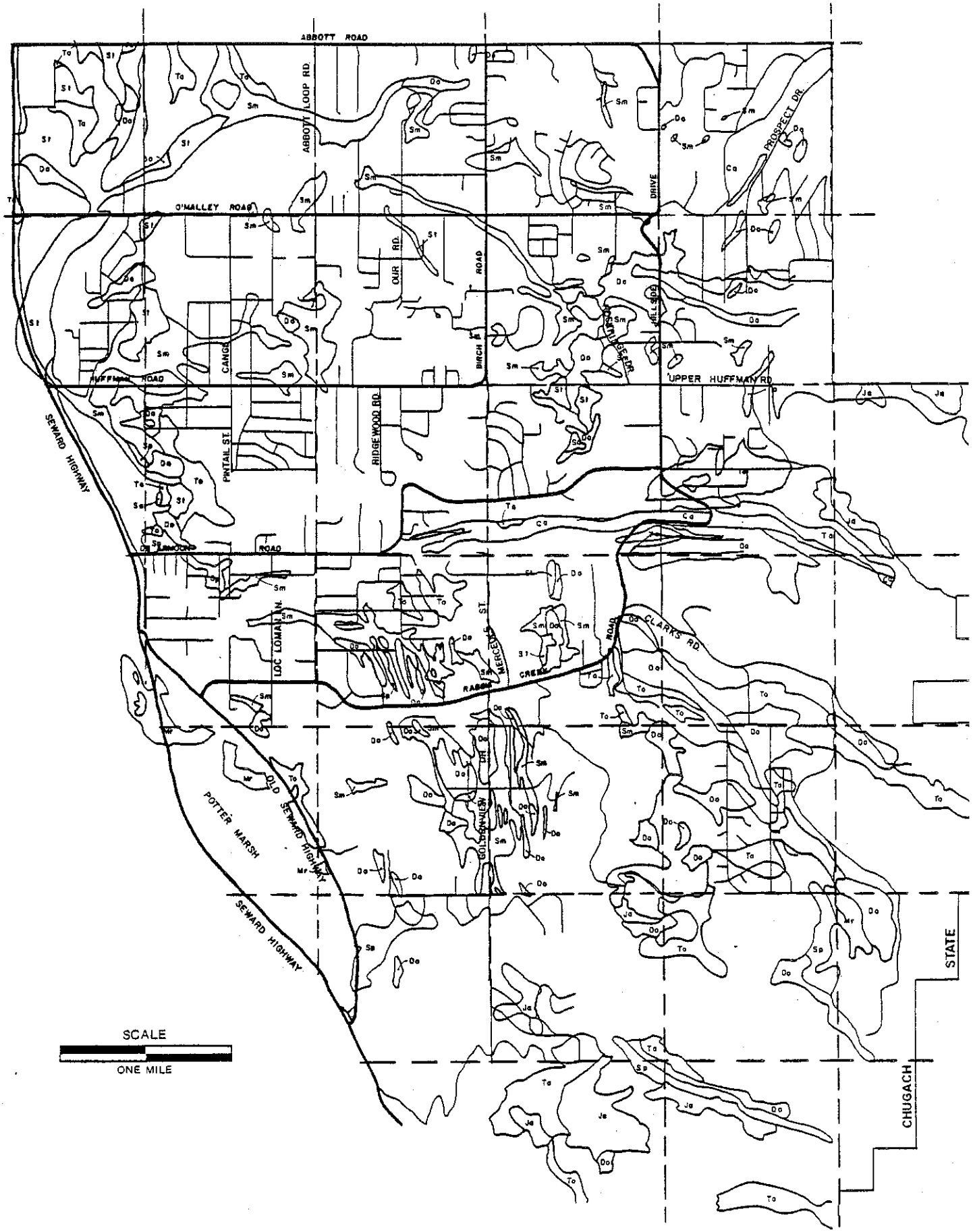
SCALE	PROJ. NO.	DATE	BY



SLOPE A 0% to 5% B 5% to 15% C 15% to 25% D 25% to 45% E 45% to 100%

Data Source: USGS Map I-787-B

SLOPE

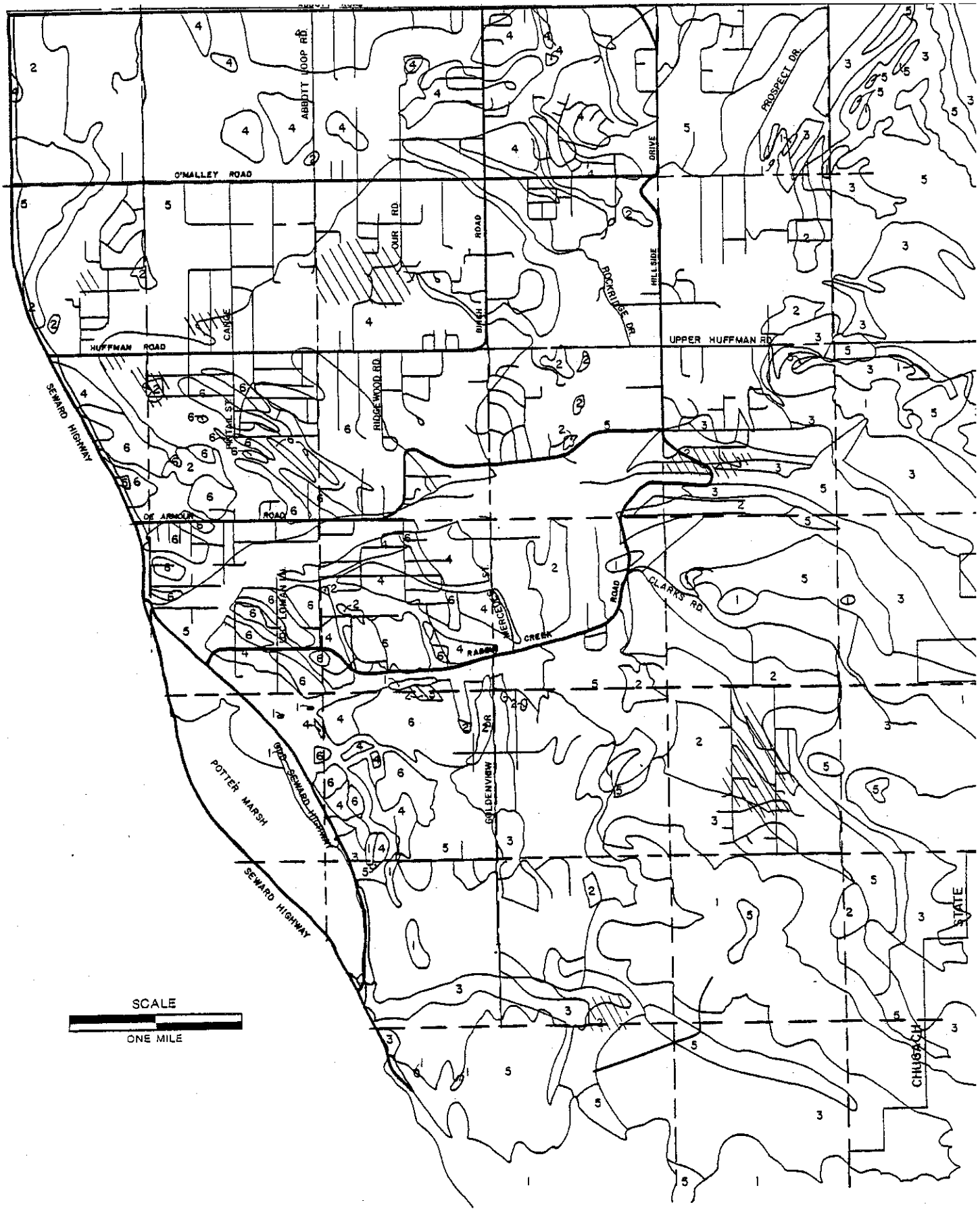


Data Source: Soil Conservation Service

POORLY DRAINED SURFICIAL SOILS

Ca	Caswell silt loam	Cm	Clam Gulch silt loam	Do	Doroshin peat
Ja	Jacobsen stony silt loam	Ka	Kalifonsky silt loam	Mr	Moose River silt loam
Sa	Salamatof peat	Sm	Silkan mucky silt loam	So	Soenard silt loam
St	Starichkof peat	Ta	Torpedo Lake gravelly sandy loam		

POORLY DRAINED SURFICIAL SOILS



Soils Data Sources: 1) USGS Map I-787-A, 2) USGS O.F.R. 75-105, 3) O.H.E.Q. Files, 4) State Materials Lab 5) Soil Conservation Service.

SURF. GEOL.

Known Problem Areas Due to Silt and Clay Soils

1 Bedrock

2 Lake and Pond Deposits

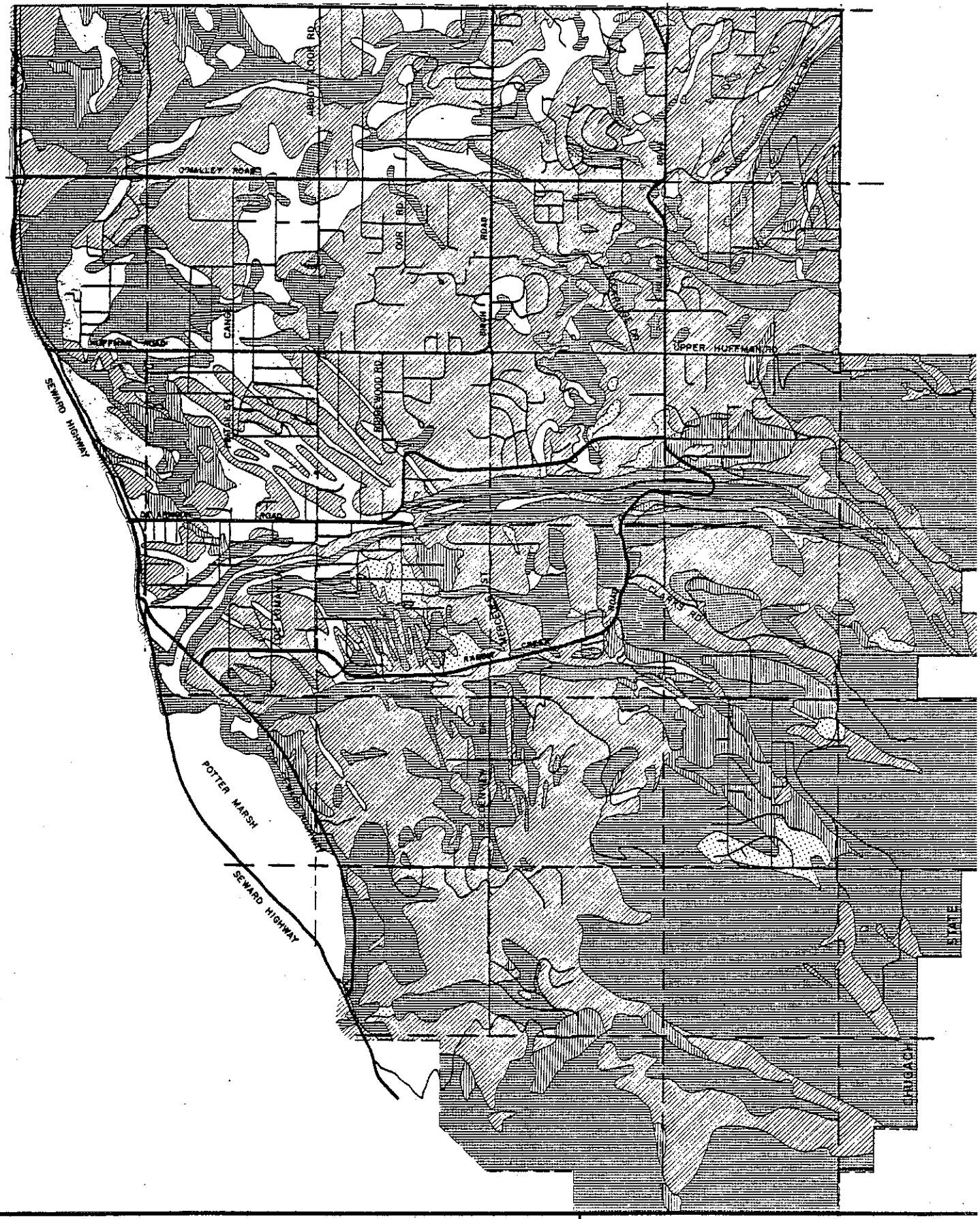
3 Slope Deposits

4 Water-Laid Glacially Derived Deposits

5 Alluvium and Marginal Deposits

6 Marginal Deposits Modified by Marine Inundation

SURFICIAL GEOLOGY



LEGEND

- SUITABLE FOR STANDARD TRENCHES
- SHALLOW TRENCHES WITH DROP BOXES
- CURTAIN DRAIN WITH SHALLOW TRENCHES & DROP BOXES
- MOUNDS
- MOUNDS OR CURTAIN DRAIN, SHALLOW TRENCHES & DROP BOXES
- NOT SUITABLE FOR INDIVIDUAL ON-SITE

Arctic Environmental Engineers
Anchorage, Alaska

HILLSIDE WASTEWATER DISPOSAL STUDY

MAP OF SUITABILITY FOR INDIVIDUAL ON-SITE WASTEWATER TREATMENT

3 ENVIRONMENTAL CONDITIONS

3.1 Introduction

The South Anchorage Hillside area has a wide variety of environmental conditions. The area varies from wetlands and bogs, to moderately sloped terrain having fairly good developmental conditions to steep mountain slopes with major bedrock outcrops. This variability influences the feasibility of on-site waste disposal by affecting the capacity of the soil to treat waste effluent. This capacity is tied to soil type involving its texture, degree of saturation, depth, and slope. These factors are in term the result of soil-forming processes which involve the surficial geology, hydrology, microclimate, slope and erosion regimes operative over time on site. Sewerage system hookups are most readily made where the soil is incapable of treating wastewater effluent reliably and where sewer extensions can be made both profitably and rationally.

Permitting development in areas not suitable for on-site disposal or sewer extension greatly increases the possibility of groundwater contamination and endangers the public health and welfare. Thus, this environmental variability is significant because the pattern, density and location of development are affected strongly by these environmental conditions.

3.2 Relationship of Environmental Conditions to On-Site Systems

The shallow surface soils are of tremendous importance in the analysis of on-site systems suitability. The soils in the poorly drained surficial class are composed primarily of silt loam, peat, and tight sandy loam. These soils create adverse conditions to on-site system operations that include a very shallow water table, (i.e. less than 4 feet and usually less than 2 feet).

Ground slopes affect the capabilities of shallow soil systems to accommodate on-site systems. Areas that are nearly flat may be poorly drained, otherwise these areas will accommodate any system. Areas having slopes of 5-15% can accommodate most types of on-site systems with mounds generally ruled out as the slope approaches 15%. Slopes in the 15-25% category limit the potential on-site systems and will generally dictate that more land is required per lot to obtain the required on-site system. Slopes above 25% makes the use of on-site systems extremely difficult, but not impossible.

The environmental conditions which prescribe the various alternative waste disposal systems are described below.

Where loam soils on slopes of 5% or less without shallow groundwater are found, the standard trench drain field is suitable (see Section IV for a description of this system). A Tuomi silt loam on a flat slope is well suited for this type of system for example.

Where slopes in the 5% to 25% range are the only problem to system operation, the standard trench with drop boxes offers the best on-site alternative (see Section IV for a description of this system). Silt loams on steep slopes such as the Homestead or Tuomi soils would be examples of soils suited to this system (see also Map 5 in the March, 1981 Interim Report).

Where shallow groundwater on moderate to steep slopes is encountered the standard trench with drop boxes and curtain drains is required (see Section IV for a description of this system). Soils with wetness problems on steep slopes such as the Grewingk soil exemplify this problem (see also Maps 5 and 6 in the March, 1981 Interim Report).

Shallow groundwater areas may require a shallow trench system coupled with curtain drains (see Section IV for a description of this system). The Caswell silt loam, where encountered, may require such a system (see also Map 6 in the March, 1981 Interim Report).

Where soil percolation is a problem and creates the potential for surface ponding of untreated effluent, the mound system offers the best alternative (see Section IV for a description of this system). The Goodhope soil is an example of this situation.

Finally, the deep trench system is suitable for those areas where more well-drained material is located at depth in the soil profile (see Section IV for a description of this system). The Spenard silt loam, which has a gravelly sandy loam character from 16" to 50" in its profile, exemplifies this situation.

3.3 Geology, Soils, and Hydrology

The surficial geology of the Hillside area is discussed below for each of the six units or deposits encountered. The implications for of these units or deposits to on-site operation and the hydrological characteristics are described.

3.3.1 Bedrock. The bedrock is mainly exposed on knobs and steep sided ridges; in places it is thinly mantled by coluvium or morainal deposits. It comprises approximately 11% of the study area.

Runoff is high if bedrock is exposed. Infiltration and permeability are usually very low except where the rock is decomposed or extensively fractured. Hydrologic characteristics are considered poor for liquid waste disposal. Contaminants may travel some distance through bedrock fractures.

3.3.2 Lake and Pond Deposits. Lake deposits occur primarily above 800 feet in altitude and consist of silt and clay with some fine sand and gravel. They comprise approximately 8% of the study area. These deposits generally have high runoff and limited infiltration due to low permeability. Springs and/or artesian wells may occur along the uphill contact with alluvium and slope deposits and there may be a potential problem with near surface saturated soils and seepage. Percolation rates are often very low, resulting in ponding.

This unit includes a sand deposit located in the northwestern corner of the study area, next to the Seward Highway. Soils derived therefrom in this area, such as the Starichof peat, are poorly drained. The combination of these characteristics and this location makes sewerage of this area likely.

3.3.3 Slope Deposits. The slope deposits consist of inter-mixed accumulations of fresh and weathered bedrock fragments and reworked glacial drift which contain clean, well sorted or dirty sand and gravel.

Slope deposits are common on steep hillsides above 1,000 feet in altitude and along steeper valley walls and comprises approximately 15% of the study area.

Where it is loosely compacted, it has little runoff, rapid infiltration and high permeability. Hydrological characteristics are such that contaminants may not be adequately treated before the liquid reaches fractured bedrock or a shallow water table in underlying material. These characteristics are considered poor for liquid waste disposal.

3.3.4 Water-Laid Glacially-Derived Deposits. These deposits consist primarily of interbedded fine sand and clay with some gravel and cobbles. They are commonly gradational to other deposits and comprise approximately 15% of the study area.

Runoff is moderate, infiltration is low to moderate and permeability varies from very low to moderate; locally higher water absorption and conduction rates exist in sandy material. Percolation rates can be significantly lower where silt or clay is present.

3.3.5 Alluvium and Morainal Deposits. These are well-mixed deposits of fragmented rock and water-washed sand and gravel. They are commonly well-bedded and sorted, but may locally contain silt and clay. They comprise approximately 41% of the study area.

Runoff is low to moderate, infiltration is moderate to high, and permeability is moderate to high except where silt is present. Percolation rates are generally adequate for liquid waste disposal.

3.3.6 Morainal Deposits Modified by Marine Inundation. These deposits are a mixture of silt, sand, gravel cobbles, and boulders of glacial origin that have been reworked by marine waters. They commonly contain or are overlain by beds of silt, sand, and gravel. This unit comprises approximately 8% of the study area.

Generally runoff is low, infiltration rates are moderate, and moderate permeability exists near the surface in this unit. Percolation rates are good except in localities of high sediment compaction and/or high silt content.

Water availability on-site is generally inadequate for more than single-family use throughout the Hillside area unless developed with on-line system storage. Ground water yields are generally low (3-10 gal./min.) and in the shallow bedrock areas of the eastern and southern Hillside may be inadequate for single-family use without a means for water storage. Areas suitable for development as a public water supply are uncommon and are to be found only in the western Hillside area from sand and gravel aquifers underlying thick sequences of

glacial till. In the south Hillside area of Potter Creek, most wells are obtained from bedrock aquifers with low yields generally suitable only for domestic use. Streamflow throughout the Hillside area is not suitable for a public water supply due to low discharge and the probable lack of surface storage sites (see Hydrology for Land Use Planning: The Hillside Area, Anchorage, Alaska, 1975, and Hydrogeology for Land Use Planning: The Potter Creek Area, Anchorage, Alaska, 1981, both published by the U.S. Geological Survey).

Thus the growth of the Hillside area, and especially the area south of Rabbit Creek is very much dependent upon the availability of water, as indicated by recent U.S. Geological Survey analyses. The availability of water appears to be a significant factor affecting the size and location of development, but not necessarily a constraint to it. It is probable that development will have to occur as larger, planned unit developments in order to reach sufficient economies of scale to provide both water production and water storage facilities.

3.4 Other Environmental Conditions

Other environmental conditions must be considered when planning for population increases and waste disposal. Among the important environmental conditions are water supply, potential wind damage, lifestyle changes, transportation, police and fire protection, schools and other social services. It was beyond the scope of this study to consider most of the categories listed above. However, the environmental factors of water supply, wind damage potential, and lifestyle changes can be influenced very directly by decisions regarding maximum densities allowed in this plan.

The water supplies can be affected directly by pollution. They can also be affected by increased demand that draws on the deep well supply and through the on-site or sewer systems transfers the water to shallow unusable acquifers or out of the basin. Adequate separation of wells and on-site systems must be assured.

Potential wind damage cannot be eliminated when development occurs, but it can be minimized by the use of minimum lot sizes and specific construction considerations

where practicable. Though not a consideration affecting the sewerage boundaries or alternatives on-site waste disposal suitability areas, this concern needs to be addressed in all new drain field placements. Tree removal should be confined to small plots with substantial zones of natural vegetation left untouched to break the wind whenever possible. Selection of alternative drain fields must be done with care to minimize potential wind damage. The trees indigenous to Alaska do not grow tap roots. The root systems spread out on the surface. Trenches or other excavations should be spaced at a ten foot minimum from the trunks of major trees.

When the population of the Hillside areas increases, the existing lifestyle will change. The impact of the changes will be minimized in the areas where on-site wells and disposal systems continue to be utilized because of the constraints associated with the on-site system. In the areas where public sewer systems and higher density zoning area recommended, buffer zones and transitional uses should be established. The buffer zones should provide both screening and transition from the higher density to the lower density zoning.

3.5 General Summary and Evaluation

Environmental conditions in the Hillside are highly variable and complexly interrelated. These conditions result in varying capabilities for a given area to support on-site waste disposal. Much of the Hillside area is unsuitable for conventional on-site systems. However, alternative disposal systems are available that would be effective for specific environmental conditions and geographic areas. Other portions of the Hillside, because of their unsuitability for on-site disposal for all alternative systems and because of their location, are likely areas for sewerage. In those areas where standard or alternative systems are suitable, proper design and system siting are critical. Due to the variability of environmental conditions, the siting of on-site disposal systems is perhaps the key element to the future development of those portions on the Hillside beyond the recommended sewered areas.

4 EXISTING DISPOSAL PRACTICES

4.1 Introduction

Wastewater disposal practices currently in use in Anchorage utilize both sewerage and on-site systems. These systems serve different geographic areas. Both types of systems are found in the Hillside. Approximately 800 of the 4300 dwelling units in the Hillside area are using sewerage for wastewater disposal. The remaining 3500 dwelling units rely on on-site systems. The land area currently served by sewerage is generally confined to specific subdivisions in the western portion of Hillside just east of the Seward Highway.

This section is intended to provide descriptions of the two types of wastewater disposal systems and how they are utilized in Anchorage. The purpose of this review is to compare and contrast the two systems so that their relationship to recommended land use patterns and densities are better understood. This section concludes with a description of certain types of innovative systems that may have potential for use in certain areas of the Hillside as an alternative to the two more traditional systems.

4.2 Sewerage System

4.2.1 Physical Characteristics. A sewerage system is made up of two components; the collection system (the pipes) and the treatment plant. Most of the developed land in the Anchorage Bowl (including the western portions of Hillside) is served by a sewerage system. Wastewater is collected and transported through an extensive network of pipes, primarily by gravity flow, to a treatment plant located at Point Woronzof. There, the wastewater goes through a treatment process to remove most of the organic pollutants and suspended solids, and then discharged via an outfall into Cook Inlet.

The most significant difference between a sewerage system and an on-site system is that a sewerage system will allow for development to take place in certain areas where environmental characteristics (dense impermeable or organic soils, shallow groundwater table, or bedrock) would prohibit development that is reliant on on-site wastewater disposal. The major reason is that wastewater, or sewage, is transported to another location for treatment and discharge. Sewerage is most effective for higher densities, generally more than

three dwellings per acre. On-site systems generally allow only one dwelling or less per acre. Consequently, sewerage systems can play a major role in implementing land use policies.

Expansion of the sewerage system over a geographic area is done by either adding onto the existing network of sewer pipes or by creating a new network. Sewer pipes are classified from smallest to largest in a hierarchy. There are a variety of terms in use to classify the hierarchy, but the most common are laterals, trunks, and interceptors. The smallest of the three is the lateral. A lateral is the pipe to which individual dwelling connections are attached. In most instances, laterals form the wastewater collection system for individual subdivisions. Laterals are, in turn, connected to trunks. A trunk sewer pipe is larger in size and is designed and located to accept wastewater from several laterals, usually within a common drainage sub-basin. Finally, trunks are connected to interceptors which carry the wastewater to the treatment plant. Occasionally, force mains are used to remove wastewater under pressure against the force of gravity, allowing for transfer between natural drainage basins or for conveyance at minimal slopes over long distances.

4.2.2 Management of Sewerage Systems. The sewerage system serving the Anchorage Bowl is owned by the Municipality of Anchorage. Management of the system is placed within Anchorage Water and Sewer Utility (AWSU). AWSU is responsible for the design, construction, and operation and maintenance of this system. Funds for the provision of this public service are derived from various sources, and are applied to the various functional elements of the system in accordance with an established management scheme. The institutional mechanism used by the Municipality of Anchorage to provide sewerage service is the formation of districts. Within the Municipality of Anchorage there is an integrated sewer service area.

Approximately 87½% of the costs for design and construction of the treatment plants and interceptor systems have been paid from Federal and State grants. The balance has been assessed to property owners within the respective sewer service areas.

The design and construction of sewer trunks are paid by owners of property located within the boundaries of Trunk Improvement Districts. Before a new trunk can be added to the sewerage system, a Trunk Improvement District (TID) must be established The TID may be created or extended only with the approval of the property owners who would bear more than 50% of the estimated costs of the improvement.

The design and construction of laterals are in most instances provided and paid for by land developers in lieu of lateral assessments. Following construction and inspection, the laterals are turned over to the Municipality of Anchorage. The only time Lateral Improvement Districts (LID) are formed with benefitting property owners being assessed for lateral design and construction costs are instances where public health hazards have arisen in a specific geographic area (usually due to failure of on-site systems), and no other reasonable alternative for wastewater disposal is available. Such an instance in the Hillside area occurred in Brookwood Subdivision.

Generally, there is no requirement for mandatory hook up to sewers unless the failure of an on-site system creates health problems. In such a case the Department of Health & Environmental Protection can require hook up. However, because of the manner in which most LID's and TID's are formed, by majority vote, an individual lot may be assessed for the service even though no hook up is required.

4.2.3 Costs. Currently, the estimated cost for design and construction of public sewerage service to a single-family dwelling on a 10,000 square foot lot in Anchorage is $2,000. The cost includes the property owner's share toward the trunk and lateral costs from which a direct benefit would be derived, in addition to the house connection. This would be a one-time only cost, usually paid as part of the cost of purchasing a lot or new home. There is an additional monthly service fee (currently $7.50) which is charged to each homeowner. The monthly service charge is intended to pay for operations and maintenance of the sewerage system in the Anchorage Sewer Service Area. The monthly service charge is subject to change if operations and maintenance costs change. However, any changes in the monthly service charges must be approved by the Alaska Public Utilities Commission.

4.2.4 Land Use Implications. Sewerage is needed most where soils conditions make on-site disposal methods inappropriate or very expensive or where development densities necessitate public facilities. Sewerage systems have high fixed costs and are therefore installed for long design periods (generally fifty years), and with sufficient capacity to allow higher densities to make them more cost-effective than on-site systems. It is for these reasons that sewerage policies are closely linked to land use and public facility policies.

The most effective sewerage system design is gravity-flow. Consequently, gravity systems must conform to natural geographic and topographic boundaries. Such boundaries usually do not coincide with property ownership boundaries nor existing development patterns. Consequently, in the Hillside area, the expansion of the area to be sewered will be constrained by the social and economic factors involved in land use policy-making.

Because sewerage leads to a more intensive use of land than use of on-site systems, there will also be a need for other public facilities and services. Most notable are water, roads, storm drainage, schools, and parks. Consequently, the installation of sewerage to a new area should be preceded by proper planning for the other facilities and services. Emphasis should be placed upon minimizing impacts on existing neighborhoods with a low density residential character.

4.3 On-Site Systems

4.3.1 System Operation. In Anchorage, the traditional on-site wastewater system consists of a two compartment septic tank, a deep trench drainfield and interconnecting pipes, cleanouts and stand pipes. Together these components physically remove and biologically treat the wastewater. The septic tank alone can remove about 30 to 50% of the wastes if properly maintained. The drainfield, actually the soil surrounding the drainfield, must treat the remaining waste and dispose of the treated water.

In the soil, bacteria eat the food (literally break down the BOD and solids, and incorporate them). Pathogens become trapped in the soil, either by being absorbed onto soil particles, or becoming stuck to the microbial slimes laid down

by soil bacteria. Once trapped, some pathogens die off because of differences in temperature, lack of moisture and food, and other causes. Others are inhibited or killed by antibiotics given off naturally by soil fungi and other organisms. Still others are actually preyed upon by soil bacteria and literally eaten.

In order for treatment to be effective, the soil bacteria must have air and sufficient time. These conditions will exist if the soil beneath the soil treatment system is unsaturated. In an unsaturated soil, water moves only through the smallest pores or in a thin film around soil particles surrounding the larger pores which are usually filled with air. This type of movement occurs because the driving force behind unsaturated flow is not gravity, but a soil tension force (sometimes called capillary attraction, wicking action, or "sucking power"). If all soil pores were filled with water (i.e., saturated conditions), most of the water would flow by gravity through the larger pores (much the same way one could put more water through a 12-inch culvert than a 1-inch hose). However, under saturated conditions, the largest pores drain first, since they are able to exert the least tension (or "sucking power"). Water is pulled or "sucked" through the smaller pores. Because water is moving due to tension or "sucking" power, it does not have to go down but can move sideways or even up to wherever the soil is driest.

The proper soil type and certain physical conditions in the drainfield are, therefore, of critical importance in the long-term performance of on-site disposal systems. Unless the soil performs its treatment function, the system will fail. Three conditions are necessary to enable the soil system to function properly. The soil must have a permeability adequate to dispose of the water. There must be a minimum of four feet of unsaturated, aerated soil between the drain field bottom and saturated soil, bedrock or an impermeable soil horizon. Finally, the land slope must be adequate for system construction.

Based on the analysis of these factors, the Hillside has been divided into three regions: 1) areas suitable for on-site systems; 2) areas

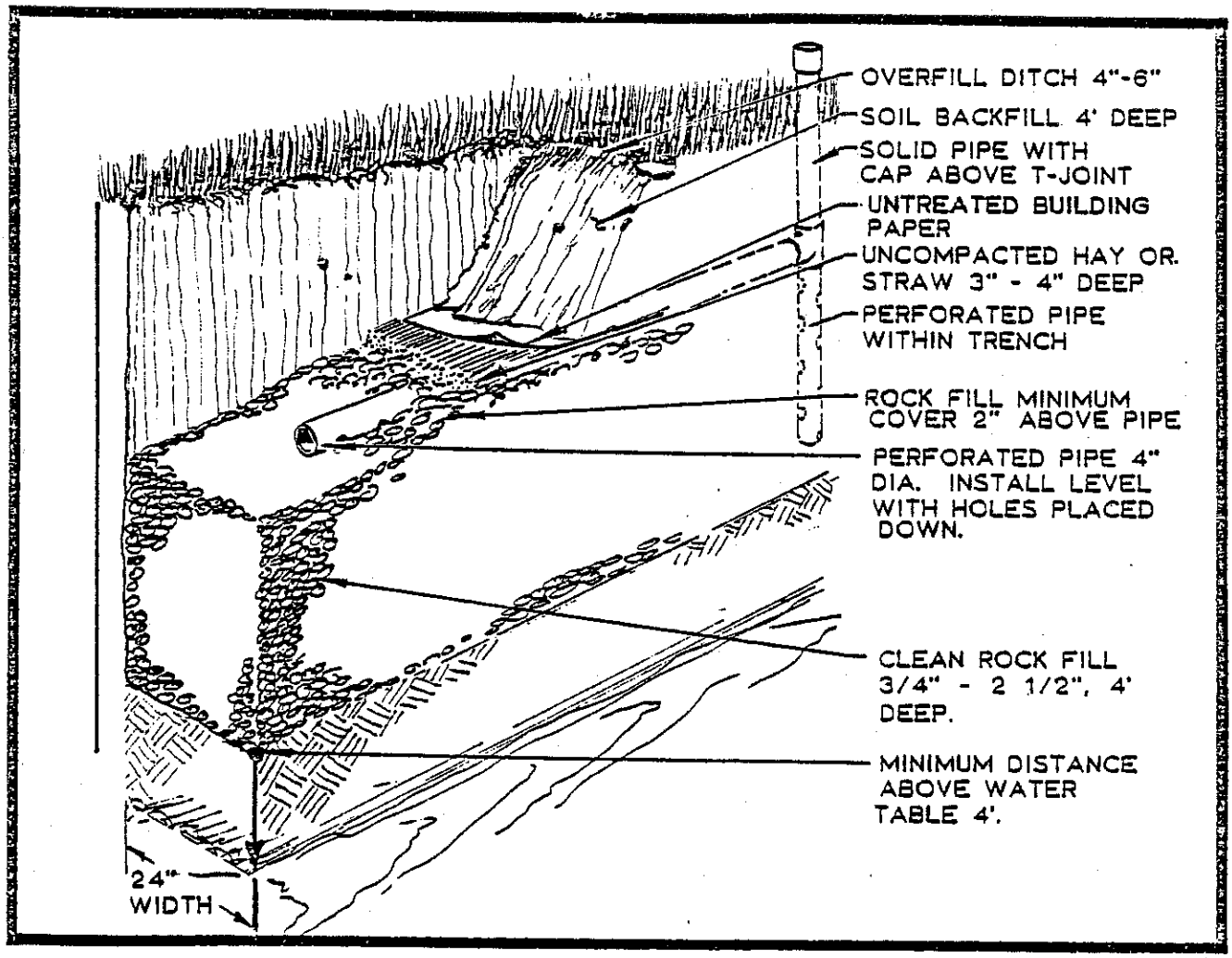
generally unsuitable for on-site systems; and 3) areas marginally suitable for on-site systems using alternative systems. These three areas are shown on the attached map.

4.3.2 Available On-Site Disposal Systems. There are several on-site disposal systems now available that will successfully handle variations in soil characteristics, ground slope and ground water conditions. All of the systems operate on the principles of soil treatment discussed earlier. The different physical location of the drainfield in the innovative systems avoids certain difficult soil, slope or water conditions and therefore allows these systems to be used in the more marginal areas. Following is a discussion of the traditional and innovative systems and the conditions appropriate to their use.

a. Deep Trench System

Since 1974, Municipal regulations have required the installation of the deep trench drainfield system. In simple terms, this system is a deep (8 or 9 feet), rock-filled trench into which wastewater percolates and is disposed of primarily through the soil forming the side walls of the trench. It is simple to install, and it has performed adequately on moderate slopes subject to the limitations of construction equipment operation. This system works well in well drained, uniform soil conditions where ground water levels are well below the trench bottom.

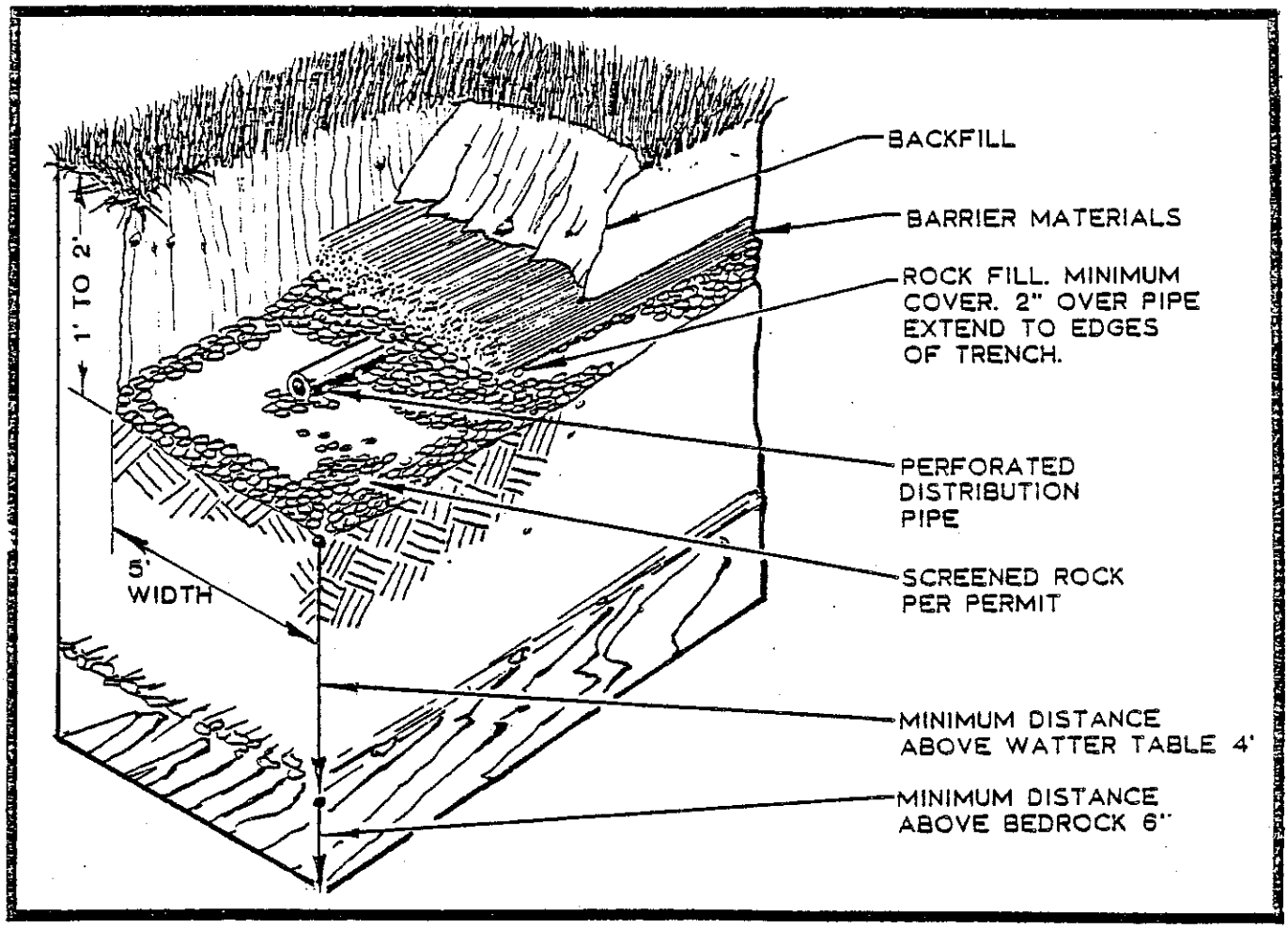
Since the requirement for the deep trench system was initiated there have been no reported failures where the soil test accurately represented underlying soil conditions. It can continue to be used in most of the area mapped as suitable, except for the occasional areas of marginal conditions that may be included in the generally suitable area. Conversely, where soil conditions can be shown to adequately treat wastewater effluent within the generally unsuitable areas, the conventional deep trench system may be utilized. Properly designed and maintained, the deep trench system will continue to offer a simple, economical method of wastewater disposal.



DEEP TRENCH DETAIL

b. Shallow Trench Systems

Where suitable soils are shallow or where bedrock or groundwater levels are near the surface, the shallow trench system is a good alternative to the deep trench system. As shown in the figure below, the shallow trench system uses a wider, thinner, rock-filled area and a shallower burial depth to move the entire drainfield higher in the



SHALLOW TRENCH DETAIL

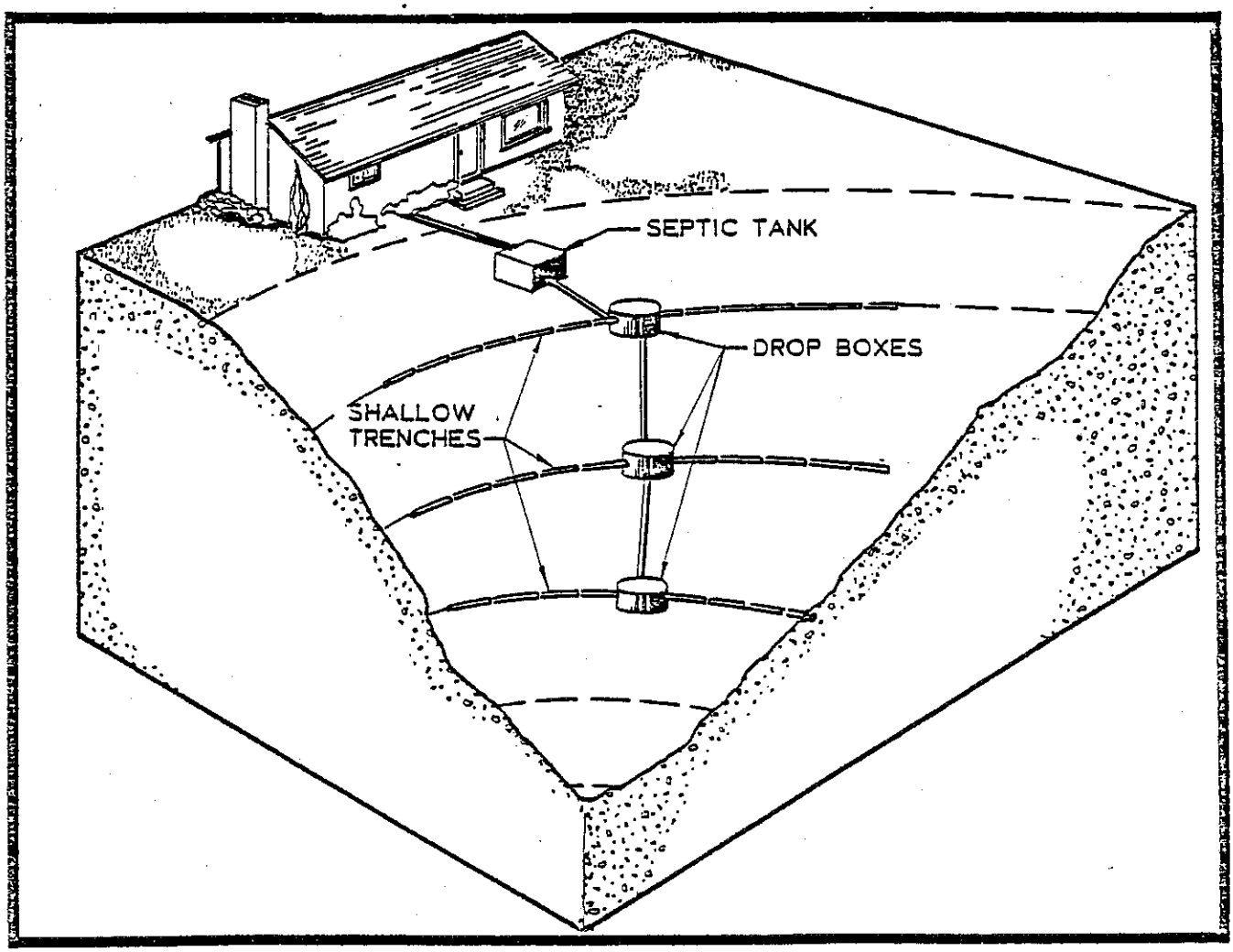
soil profile. The separation distance of 4 to 6 feet from groundwater and bedrock remains unchanged due to State of Alaska standards, but the bottom of the trench is about 8 feet higher than the average deep trench, a difference that can be critical where groundwater or bedrock are close to the ground surface. These types of conditions are likely to be found in marginal areas shown on the attached map. The shallow trench system may even find some limited use in the areas mapped as unsuitable depending on the lot-specific conditions. It can also be used in the areas suitable for the traditional deep trench system.

The cost of the shallow trench system is likely to be higher than the cost for the deep trench system. As contractors gain experience with these systems, the installation cost will become competitive with deep trench costs.

Because the amount of cover over the shallow trench system is variable some additional research will be necessary before final recommendations can be made on cover thickness. The pilot programs discussed in the next section of this report will resolve this and other questions. Until that time, a minimum of four feet of earth cover or the equivalent combination of cover and insulation should be provided over the top of the drainfield. If necessary this cover can be elevated to allow maximum use of the shallow trench where bedrock or groundwater levels dictate.

c. Alternate Shallow Trench Applications.

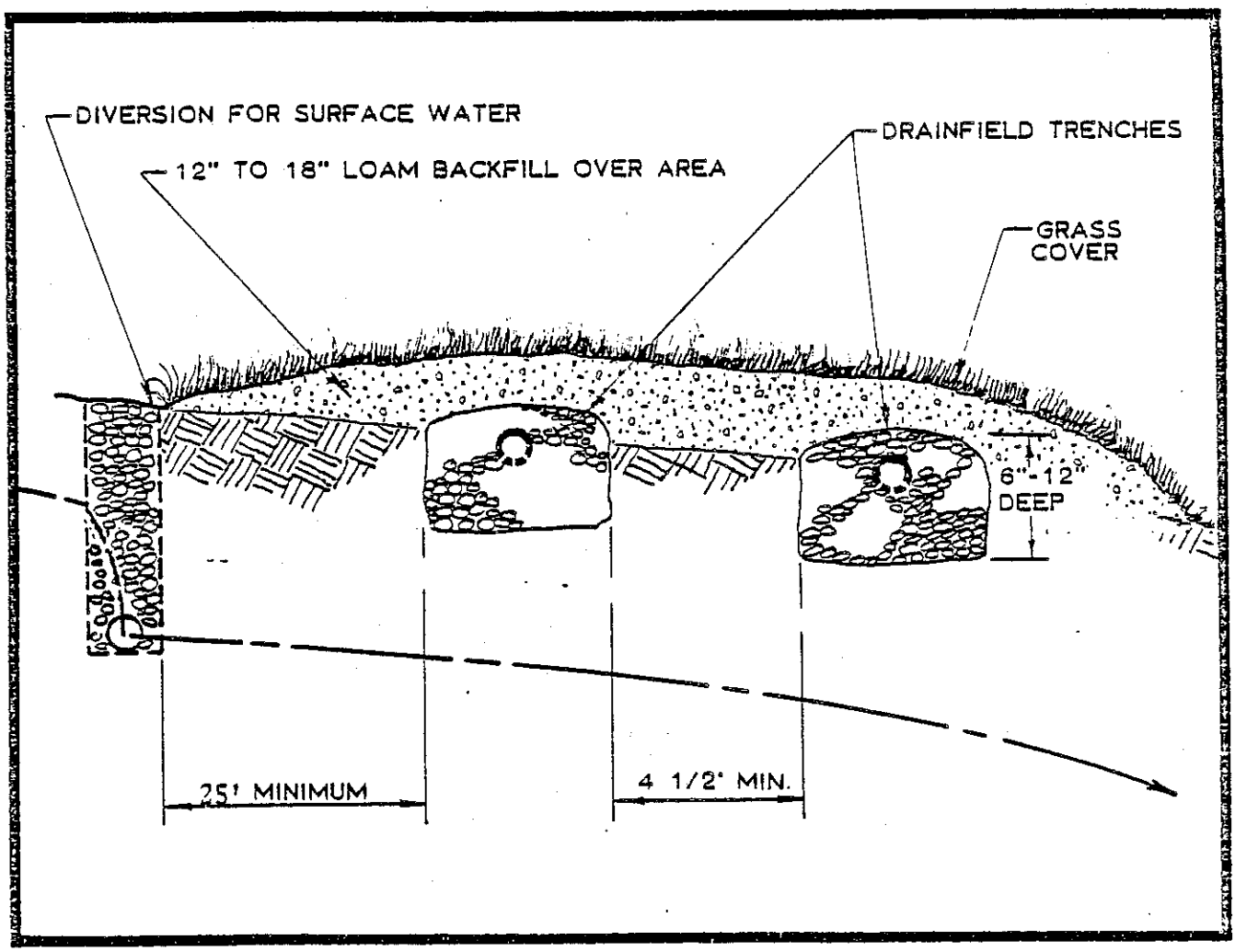
The shallow trench system is very flexible and with suitable modifications, it can be adapted to steep slope and high groundwater situations. The figure below shows the utilization of a series of multiple trenches placed on a hillside



SHALLOW TRENCHES WITH DROP BOXES

below a dwelling. Drop boxes connect the trenches and allow variable dosing of wastewater for optimum use and rest cycles in the drain field. Generally slopes of 5-25% can easily be handled by this system.

Another application of the shallow trench system is on moderately sloping sites with seasonablly high ground water levels. In these instances, the use of a curtain drain to divert groundwater away from the drainfield can be helpful. Such a situation is shown in the figure below. A deep, rock-filled trench located up-slope from the drainfield diverts groundwater around the trenches and directs it to the ground surface down-slope of the field. The curtain drain depth should be determined on a site specific basis. The curtain drain should not be expected to work on flat ground or in areas of permanently high ground water levels.



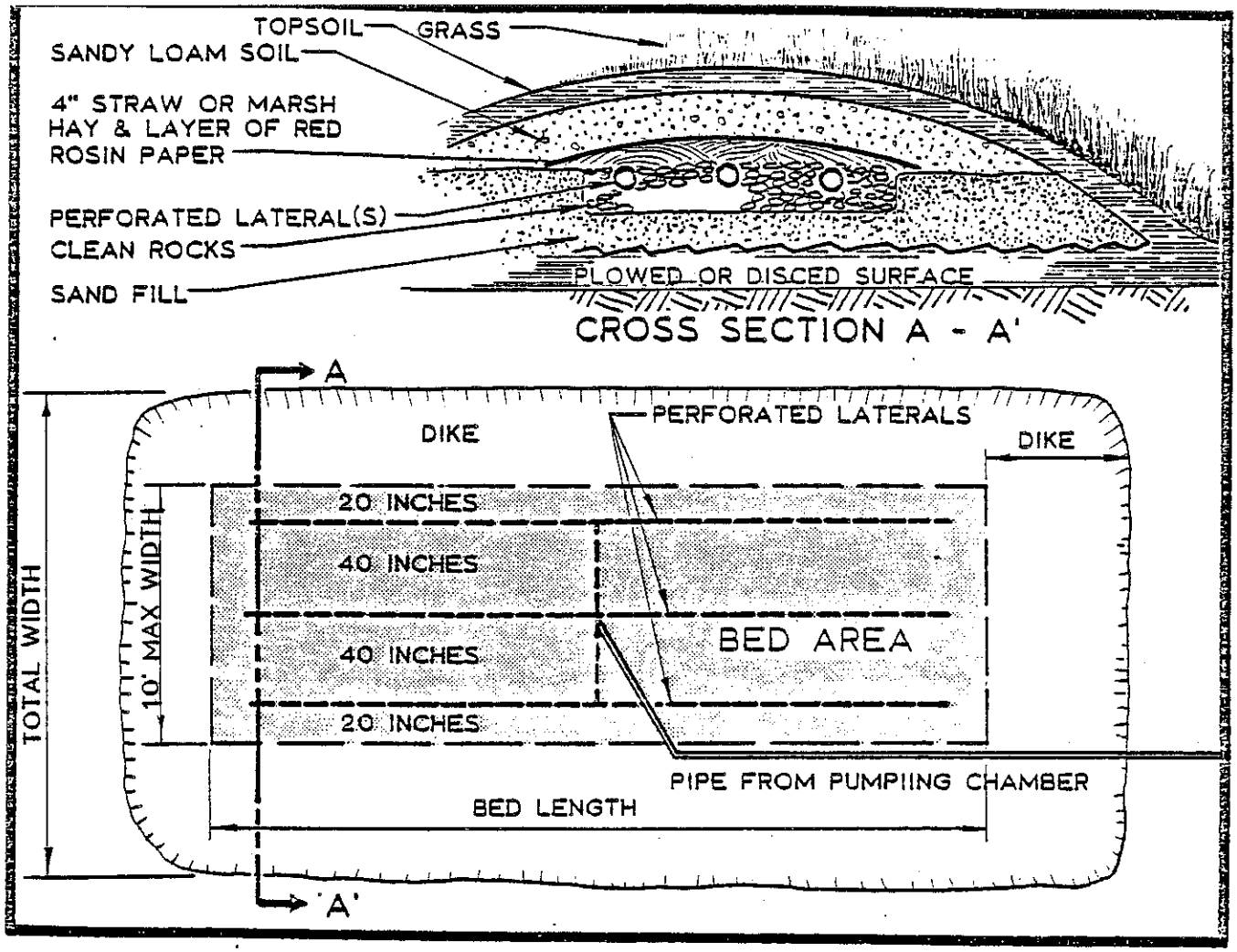
SHALLOW TRENCHES AND CURTAIN DRAINS

d. Mound System

Ultimately, there is no reason why a wastewater treatment system needs to be located in the original soil. A treatment mound is a bed elevated by fill above the original ground surface. The mound system will primarily be used in areas of permanently high ground water or where soils have very low percolation rates. In order for the mound to function hydraulically and to provide proper wastewater treatment, the following factors are essential: proper location, size, and shape, soil surface preparation, construction procedures, distribution of effluent, and dosing quantity. In addition, the soil must be able to physically support the mound. Some types of peat soils do not have sufficient load bearing strength.

Whenever possible, the mound should be located on a flat area or on the crest of a slope. Such a location will have the least interference from surface and ground water. On flat ground, mounds should have a percolation rate that is faster than 60 min/in. in all layers of natural or fill soil to a depth of at least 2 ft. below the sand fill of the mound. As the slope of the land gets steeper, the percolation rate of the soil under the mound must be faster in order to prevent sidehill seepage. For slopes of 3-6%, the percolation rate in all layers of natural or fill soil to a depth of 2 ft. below the sand fill of the mound must be faster than 60 min/in. For slopes of 6-12%, the percolation rate must be faster than 30 min/in. A mound should not be located on natural slopes exceeding 12% under any soil conditions, nor should the soil be moved or graded to change the original ground slope. It should also be noted that there must be a 12 inch layer having a perc rate slower than 5 min/in. (loamy sand) below the sand layer of the mound to provide adequate treatment.

Adequate cover depth must be maintained over the drainfield area to prevent system freeze up. Until the pilot program can be completed, cover material equivalent in insultation value to four feet of soil should be provided.



MOUND SYSTEM

A relatively long and narrow mound is hydraulically more effective than other geometries. Particularly when the original soil percolation rate is slower than 60 min/in., the long, narrow configuration provides for better lateral movement of liquid. It is recommended that the width of the rockbed in the mound should be no more than 10 feet.

Several mound systems have recently been installed in the Municipality of Anchorage. The cost of these systems has ranged from $15,000 to $20,000. Because of this high cost, the mound system must be regarded as a backup method, to be used when other methods are not adequate. As designers become familiar with mounds and contractors become accustomed to them, the costs of installation should come down by a substantial amount, possibly to one-half the current costs.

5 ACTION PLAN

5.1 Introduction

It is the intent of this section to identify the means by which wastewater disposal can be achieved for the Hillside area. The recommendations included in this section reflect differing approaches to solving wastewater disposal in different geographic areas of Hillside. The recommendations acknowledge the need to protect the rural character of much of the Hillside, while also recognizing the need to provide a certain amount of land with the public utility infrastructure necessary to accommodate additional housing at higher densities that will be in demand from expected population growth in the Anchorage area. It is in this sense that the Action Plan is to provide a general sewerage, on-site system, and land use plan for the Hillside.

The Action Plan identified in this section centers on the following general strategies:

- Provide sewerage service to those areas of the Hillside that have been identified as environmentally unsuitable for any type of on-site disposal system, and which are geographically located within reasonable distance to be feasible for sewerage;

- Provide sewerage to geographic areas that are largely undeveloped and remain in large tracts and which are contiguous to areas currently served by a sewerage system;

- Develop additional measures to ensure effective design, siting, installation, and maintenance of traditional on-site systems in the rural portion of the Hillside where they are identified as environmentally suitable;

- Establish additional wastewater disposal mechanisms for areas marginally suitable for traditional on-site systems which are not located in any of the proposed sewer areas; and

- Identify land use policies and minimum land use density recommendations necessary to support and implement the sewerage and on-site system recommendations.

These strategies are intended to result in a balanced use approach to Hillside development between rural, large lot, low density use and urban use at higher densities. The plan assumes that additional development will occur on a site specific, selected basis throughout the Hillside, especially in the areas identified for higher urban densities. Nonetheless, it should be recognized that because of serious environmental constraints to on-site system operation, development options may be limited, although not altogether precluded, in such environmentally sensitive zones.

5.2 Recommended Plan Maps

Hillside Wastewater Disposal Plan Maps have been prepared to outline the geographic areas recommended for various forms of wastewater disposal.

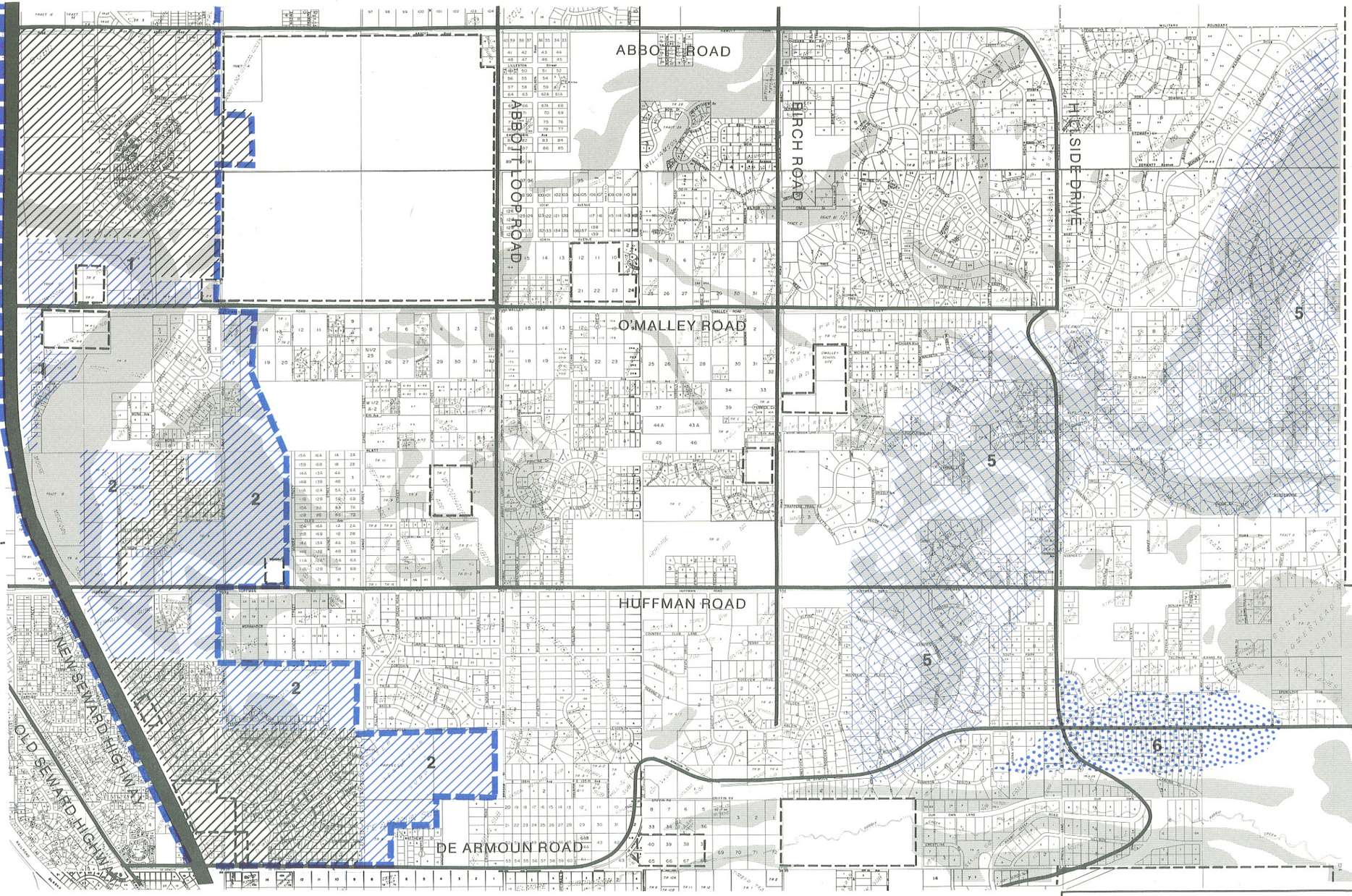
Two maps are used to cover the study area; Map 1 covers the northern portion from Abbott Road to De Armoun Road, and Map 2 covers the southern portion from DeArmoun Road to south of Potter Creek. Additionally, the maps identify the areas previously described as generally unsuitable for any on-site disposal systems, areas currently served or programmed for public sewerage, and minimum residential density patterns for the areas to be sewered.

5.2.1 Sewerage

Sewerage is proposed for approximately 3,600 acres, or 18 per cent of the Hillside area. The sewerage areas are generally located in the lower or western Hillside between Abbott Road and DeArmoun Road, and south of Rabbit Creek Road.

5.2.2 On-Site System

Cluster system sewers are proposed for land located west of Hillside Drive between O'Malley and DeArmoun Roads and east of Hillside Drive between Upper Huffman and Abbott Road. The land area invovled is approximately 1150 acres, of which 550 acres are designated as being generally unsuitable for individual on-site treatment systems. Since the unsuitable areas are interspersed with areas of suitable soil conditions, cluster systems are recommended for this area.



For Areas South of De Armoun Road, See Sheet 2.

N

Scale

0 1/2 Mile

HILLSIDE WASTEWATER MANAGEMENT STUDY

MAP 9:
RECOMMENDED SEWERAGE AND ON-SITE SYSTEM AREAS
SHEET 1 OF 2 SHEETS: ABBOTT ROAD TO DE ARMOUN ROAD

- Existing Public Sewerage
- Public Lands and Institutions (Not Evaluated for Suitability For Individual On-Site Treatment Systems)
- Generally Suitable* for Individual On-Site Treatment Systems
- Generally Unsuitable* for Individual On-Site Treatment Systems
- Known Problem Areas Containing Both Marginal* and Unsuitable* Lands
- Area Recommended for Use of Privately-Owned Cluster-System Sewers (1 Dwelling Unit/Acre)
- Areas Recommended for Public Sewerage at Minimum Densities of 3 Dwelling Units/Acre
- Recommended Maximum Perimeter of Public Sewerage
- Numbers Refer to Text Discussion

*DEFINITIONS

Marginal Areas: Those areas where particular soil, water table or bedrock conditions limit the effective operation of traditional on-site water treatment and disposal systems.

Unsuitable Areas: Those areas where wetlands, high (or seasonally high) water table, shallow or surface bedrock, organic soils, and/or steep slopes generally preclude the use of on-site waste treatment and disposal systems.

Suitable Areas: Those areas where favorable environmental conditions generally permit the use of traditional on-site waste treatment and disposal systems.

NOTES

Homeowners in large lot subdivisions (R-6, R-8, R-9 zoning districts) which are within the proposed sewerage area and are utilizing on-site waste treatment and disposal systems will not be required to connect to sewers unless identifiable public health hazards exist. Trunk and lateral improvement districts, which are formed to provide sewerage to the sewer service area will, in most cases, exclude large lots unless such property owners petition for inclusion.

Areas designated on this map as suitable and not suitable indicate that such areas are generally satisfactory or not satisfactory, respectively, for on-site waste treatment and disposal. This plan map represents general environmental conditions favorable or unfavorable to on-site systems; the practicability of lots for such systems must be determined by standard individual percolation tests. Thus certain zones of suitable areas may be unsuitable to on-site treatment and certain zones of unsuitable areas may be suitable to on-site treatment, depending upon the results of these tests.

Areas within the recommended maximum perimeter of public sewerage which are *not* identified as recommended for public sewerage *are intended to remain on on-site systems for sewage treatment and disposal. Connection to sanitary sewerage is only to be required in the event of public health problems or upon the petition of residents for sewerage.*

For Areas North of De Armoun Road, See Sheet 1

NOTES

Homeowners in large lot subdivisions (R-6, R-8, R-9 zoning districts) which are within the proposed sewerage area and are utilizing on-site waste treatment and disposal systems will not be required to connect to sewers unless identifiable public health hazards exist. Trunk and lateral improvement districts, which are formed to provide sewerage to the sewer service area will, in most cases, exclude large lots unless such property owners petition for inclusion.

Areas designated on this map as suitable and not suitable indicate that such areas are generally satisfactory or not satisfactory, respectively, for on-site waste treatment and disposal. This plan map represents general environmental conditions favorable or unfavorable to on-site systems; the practicability of lots for such systems must be determined by standard individual percolation tests. Thus certain zones of suitable areas may be unsuitable to on-site treatment and certain zones of unsuitable areas may be suitable to on-site treatment, depending upon the results of these tests.

Areas within the recommended maximum perimeter of public sewerage which are *not* identified as recommended for public sewerage *are intended to remain on on-site systems for sewage treatment and disposal. Connection to sanitary sewerage is only to be required in the event of public health problems or upon the petition of residents for sewerage.*

HILLSIDE WASTEWATER MANAGEMENT STUDY

MAP 9:
RECOMMENDED SEWERAGE AND ON-SITE SYSTEM AREAS
SHEET 2 OF 2 SHEETS: SOUTH OF DE ARMOUN ROAD

- Existing Public Sewerage
- Public Lands and Institutions (Not Evaluated for Suitability For Individual On-Site Treatment Systems)
- Generally Suitable* for Individual On-Site Treatment Systems
- Generally Unsuitable* for Individual On-Site Treatment Systems
- Known Problem Areas Containing Both Marginal* and Unsuitable* Lands
- Areas Recommended for Public Sewerage at Minimum Densities of 3 Dwelling Units/Acre
- Recommended Maximum Perimeter of Public Sewerage
- Numbers Refer to Text Discussion

**DEFINITIONS*

Marginal Areas: Those areas where particular soil, water table or bedrock conditions limit the effective operation of traditional on-site water treatment and disposal systems.

Unsuitable Areas: Those areas where wetlands, high (or seasonally high) water table, shallow or surface bedrock, organic soils, and/or steep slopes generally preclude the use of on-site waste treatment and disposal systems.

Suitable Areas: Those areas where favorable environmental conditions generally permit the use of traditional on-site waste treatment and disposal systems.

DE ARMOUN ROAD
OLD SEWARD HIGHWAY
RABBIT CREEK ROAD
NEW SEWARD HIGHWAY
GOLDENVIEW DRIVE
TURNAGAIN ARM
CHUGACH STATE PARK BOUNDARY
7
3
8
4

N

Scale
0 1/2 Mile

Certain areas that are only marginally suitable for on-site treatment systems are also denoted. These are primarily partially developed areas characterized by on-site wastewater treatment problems. Some of the more "innovative" on-site systems may be useful in solving the current problems in these areas, and may allow for further development. Moreover, these innovative systems as well as the conventional deep trench system may be used in those areas identified as generally unsuitable where it can be demonstrated that particular site conditions allow for such on-site wastewater treatment.

The remaining area of the Hillside is proposed to be developed with low density, large-lot housing by utilizing individual on-site wastewater disposal systems.

Following are recommendations for the various wastewater disposal systems that are identified for use in the Hillside area. The recommendations along with the plan maps constitute an action plan that is intended to act as a guide for decisions regarding future development of the Hillside area.

5.3 Recommendations for Sewerage Areas

The following recommendations are specifically intended to deal with development in those geographic areas identified on the recommended maps for sewerage. A number of the recommendations address land use issues not directly related to wastewater disposal practices. It should be understood that implementation actions leading to expansion of the sewerage system in the Hillside area must be linked with other facilities planning and land use policies. Sewering of new areas will lead to higher densities, which in turn will create a need for additional public facilities and services. Establishment of new areas of higher densities could possibly have a negative impact on the more rural character of neighborhood low density subdivisions. Consequently, there is also a need to establish and implement certain land use policies that are designed specifically to maintain the integrity of the more rural areas.

5.3.1 Wastewater Disposal Recommendations. The areas identified for sewerage on the Hillside Wastewater Disposal Plan Maps are to be provided public sewerage sufficient to allow development at the densities indicated on the maps.

- Trunk Improvement Districts shall be established for areas 1-4 as noted on the Plan Maps. Boundaries for the districts shall not extend beyond the areas indicated for sewerage on the maps.

- The Anchorage Sewer Service Area 201 Facility plan study shall evaluate interceptor system (and possibly waste treatment) needs for sewering of areas 1-4 in accordance with the recommended densities.

- A sewerage facilities phasing plan shall be developed for sewerage of areas 1-4.

- The phasing, design, and construction of additional sewerage facilities by the Municipality of Anchorage shall be reflected in the Urban Development Plan, Capital Improvement Program, and Capital Improvement Budget. And specifically, adoption of land use recommendations in areas 3 and 4 will necessitate the immediate scheduling, planning, and installation of transmission facilities to the area south of Rabbit Creek.

5.3.2 Other Facilities Planning Recommendations. Additional public facilities will be needed in order to accommodate the additional development that sewerage will allow in areas 1-4.

- Prepare a Hillside Area Transportation Plan with timed phasing of improvements coordinated with other facility phasing. Phasing of design and construction of transportation improvements shall be reflected in the AMATS Long Range Element and Transportation Improvement Program, Urban Development Plan, Capital Improvement Program, and Capital Improvement Budget.

- Prepare storm drainage plan for areas 1-4 with timed phasing of improvements coordinated with other facility phasing. Phasing of design and construction of storm drainage improvements shall be reflected in the Urban Development Plan, Capital Improvement Program and Capital Improvement Budget.

° Prepare a water resource, transmission, and distribution analysis for areas 1-4. Phasing of design and construction of any Municipal water system improvements shall be coordinated with other facility phasing, and shall be reflected in the Urban Development Plan, Capital Improvement Program, and Capital Improvement Budget.

° Prepare park and school facility needs assessment in accordance with expected population growth resulting from expansion of sewerage and other public facilities. The need for improved police and fire protection should also be carefully evaluated as the area continues to develop.

5.3.3 Land Use Recommendations.

° The Hillside Wastewater Disposal Plan shall be adopted as a functional element to the Anchorage Comprehensive Development Plan. The minimum density patterns established on the Hillside Wastewater Disposal Maps shall be reflected on the Anchorage Comprehensive Development Plan Map. The land use objectives and policies, and land management recommendations included in the Anchorage Comprehensive Development Plan shall be applied to the Hillside Area. In particular are:

* Site design criteria which adequately addresses flexible lot design, landscaping, transitional boundaries, and internal circulation standards;

* Plat review process which adequately evaluates the effects of proposed projects upon adjacent lands, and requires proper mitigation measures for secondary impacts. This review shall include, but not be limited to, internal and off-site circulation, drainage, public facility, and land use impacts; and

* Public facility planning principles designed to locate and size major water sewer and road project according to adopted land use plans.

- All areas currently zoned Unrestricted shall be rezoned. Their rezoning shall reflect, in part, the minimum density patterns established in the Hillside Wastewater Disposal Plan.

- Rezoning shall be evaluated as to appropriateness and need based upon the land use, sewerage, on-site and public facility criteria identified in the the Hillside Wastewater Management Plan.

- Area 3 on the Hillside Wastewater Disposal Plan Map shall be designated as a Controlled Development Area. The establishment of the Controlled Development Area is intended to preserve the use of that area for higher density development until such time as facilities and services are available. During the interim (approximately two to three years), subdivision plats must be designed, and structures located on lots, so as to allow for additional development when sewerage becomes available.

- Neighborhood or sub-area plans shall be prepared which will integrate all the activities mentioned above. The neighborhood plans will reflect in greater detail the specific land use patterns and design criteria which will be applied to decisions regarding land development.

5.4 Recommendations for On-Site System Area

The intent of this Plan in regard to on-site wastewater disposal systems is to encourage their continued use consistent with land use policies, cost-effective facility development, and public health considerations. These objectives of safe and cost-effective use can best be met by integrating the design, construction, and operation of traditional and innovative on-site systems. To neglect any of these three subjects will decrease the likelihood of indefinite use of on-site systems on the Hillside. Following are recommendations which, taken together, constitute a plan for on-site wastewater management on the Hillside.

5.4.1 Individual on-site system recommendations.

Vacant Land-Suitable Areas. Vacant land, as used in this report, means the larger tracts of land that provide flexibility in the siting of on-site systems with regard to the environmental factors that effect their operation. On vacant land within the areas identified as suitable on the Plan Map, any of the alternates set forth in 4.3.2, may be used, subject to new criteria designed to increase the life of these systems. The new criteria integrate the design, construction, and operation of these systems to ensure, to the extent now possible, their continued performance. Because of the site-specific nature of on-site suitability, there may be subareas within the area designated as suitable which will require the use of innovative on-site systems or which may not be suitable at all. Prospective home builders should be aware that the continued use of on-site systems on the Hillside may require that some sub-areas remain undeveloped.

Recommendations are identified that should provide for continued, effective use of on-site systems. It is essential that these recommendations be followed if the long-term use of on-site systems is to be assured. The recommendations are separated into the various phases of the system.

Planning and Design Criteria

- DHEP will conduct periodic trainng courses for homeowners, engineers, contractors, septic tank pumpers, and site evaluators; that is, for those persons and forms respoinsible for the design, installation & maintenance of on-site systems. The course will deal with the planning, design, installation and operation of on-site septic systems. Successful completion of the course will inlcude demonstration of knowledge on a written examinatin, covering, among other things, the ability to differentiate soils types and design of a septic system relative to surface/subsurface drainage conditions.

- Municipal ordinances will be modified to allow DHEP to review recommended drainfield locations and mandate, if necessary, changes in

location to avoid surface water problems. All new plats, located within the study area of this plan, shall be required to incorporate a drainage plan and shall demonstrate effective mitigation of surface water problems relative to on-site system operation.

- Surface water disposal plans shall be prepared for areas of the Hillside intended to continue on-site treatment and disposal system. Those plans shall include erosion and sediment controls, water quality controls, surface water conveyance and disposal, and on-site system operation. Priority in plan development shall be given to known or potential problem areas.

- Currect regulations require soils testing and reporting of results prior to issuance of a permit for an on-site system. This practice should be made more effective by requiring that the soils engineer also successfully complete the education program. Reporting requirements should also be strengthened so that reports are required to indicate soil layering and mottled soils, which may indicate a seasonal high water table.

- A two to three year pilot program of innovative on-site systems will be conducted to test design and operation parameters. Freezing potential, insulation requirements, snow and vegetative cover, soil aeration, and cost efficient construction methods are some of the factors that will be studied.

  The program shall consist of the analysis of several systems for each category: 1) shallow trench, 2) shallow trench with curtain drains and 3) mounds. Also included in the program shall be alternate methods of supplying hot water to the systems during occupant vacations, and drainfield dosing systems. In addition, various mounds and deep trenches representative of various kinds of soil conditions that are currently in operation shall be instrumented, monitored, and analyzed.

- Until the pilot program is completed, insulation equivalent to four feet of soil is recommended cover for any drainfield.

- Municipal ordinances will be modified to require one original and two alternative drainfield locations on all lots prior to DHEP approval. (The present regulation applies only to unplatted areas. This recommendation would extend this regulation to lots already platted.)

On-site System Construction

- Periodic training programs will be conducted for contractors. Contractors must be included on DHEP's list of acceptable installers. The job site installer in charge shall be certified and must have attended the Municipality education program and passed a written examination.

- Municipal codes will be modified to require insulation of all new septic tanks. This will result in increased biological activity within the tank, giving more complete treatment to the waste, and increasing drainfield life.

Operation & Maintenance

- Municipal ordinances will be modified to require mandatory pumping of septic tanks once every two to three years. The DHEP will be authorized to maintain pumping records and to require pumping at the homeowners expense.

- Requirements for proper licensing should be broadened to include additional training. This training would consist of course work and a field observation of pumping method by DHEP and Water and Sewer Utility personnel.

Vacant Land-Marginal and Non-Suitable Areas.

Within vacant lands*, two types of subareas exist relative to on-site system functioning: marginal and non-suitable zones.

Marginal areas are those where particular soils, water table or bedrock conditions limit the use of traditional on-site systems. It should be reemphasized that the marginal area designation does not necessarily preclude the use of on-site

systems, but because of adverse environmental problems, requires a more rigoroius design and review process. The innovative systems described earlier in this report may allow development in these areas. The innovative systems may also be useful in the marginal subareas included in the generally suitable areas.

Unsuitable areas are those where wetlands, high (or reasonally high) water table, shallow or surface bedrock, organic soils, and/or steep slopes generally preclude the use of on-site waste treatment. The scale of the mapping did not permit site-by-site investigations, so it must be emphasized that these areas are considered generally unsuitable. Any given site could have good conditions for on-site treatment, but if it lies within a generally unsuitable area, it will be subject to the same rigorous design and review process which will be used to evaluate individual lots in the marginally suitable areas. Even in the non-suitable areas, certain on-site systems may be used, based on the atrributes of the particular site as well as certain developed lands.

It should be reemphasized that these area designations do not necessarily preclude the use of on-site system operation, but because of adverse environmental problems, requires a more rigorous design and review process. The innovative systems described earlier in this report may allow development in these areas.

All of the program elements identified in the sections on suitable areas will apply in the marginal and non-suitable areas. However, additional restrictions will be needed in these areas. These restrictions include the following:

- A soil test and system plan will be required for all lots within a subdivision.
- Innovative on-site wastewater disposal systems will be required unless the traditional system can be shown to be acceptable.
- More detailed individual system reviews will be performed by DHEP personnel.

Developed Land-Suitable Areas. Developed lands are those already built up to such an extent as to limit the possibilities for clustering or replatting. The Action Plan in developed, suitable areas consists of the operation and maintenance program elements described earlier. These include the recommendations for training and education, and mandatory septic tank pumping. In addition, the guidelines for wastewater disposal practices described in the Technical Report and elsewhere will help ensure continued use of these on-site systems.

Developed Land - Marginal and Non-Suitable Areas.

The approach in solving problems on developed land in the marginal and non-suitable areas can be separated into two cases. The first is when the system works at least sufficiently well that no immediate health problems occur. In this case the system could continue operating, although at a reduced efficiency, indefinitely or until the homeowner decided to rehabilitate it. Alternatively, the system would be found deficient and repaired when the house was sold. The latter approach relates existing municipal practices involving bank loan acceptances to adequately functioning on-site wastewater systems. Under it, a loan cannot be guaranteed, and therefore the house cannot be sold, until evidence of an effective septic system exists.

The other case is where the system fails to a sufficient extent a to create localized health problems. In this case, laws and regulations already exist that provide for the voluntary repair of these deficient systems, or in the instance where there is reluctance to repair them, an enforcement procedure exists to force compliance with Municipal regulations. Currently, there are problems of enforcement related to the manpower available to investigate and prosecute these violations. The adoption of this Plan will signal the commitment of the Municipality to enforce existing laws and regulations related to on-site system failure.

The techniques described later in this section can be used should system failures be discovered in marginal and non-suitable areas. Because the problems are likely to be lot specific or specific over small areas of land, the recommended solutions will usually be very location specific and accomplished in response to individual problems. Where problems are not limited to one or a small number of lots, the solutions must, of necessity, involve larger neighborhoods. This Plan identifies general problem areas of malfunctioning septic tanks, but a more detailed evaluation is required to develop on-site solutions, because of the site-specific character of the failure. The Department of Health and Environmental Protection should identify the areas and causes of failure at a neighborhood level and should then make (or have a contractor make) a site evaluation to determine the cause of system failure and its possible solution. The homeowner would then be required to take corrective action. Following are some potential problem conditions, and some possible solutions.

- Poorly drained soils - The actions recommended for problems with on-site systems related to poorly drained soils are 1) shallow trench systems, 2) curtain drains, 3) mounds systems, 4) control of site drainage, or 5) cluster designs using nearby suitable soils.

- Peat soils - If peat soils are creating system malfunctions, they can be removed and a mound system constructed.

- Slowly draining soils - Mound systems can be used in most soils which drain slowly.

- Bedrock near the surface - Mound or shallow trench systems can be used where bedrock is 4 to 5 feet below the surface.

- Improper or old designs - Where improper or old drainfield design is responsible for poor performance, the drainfield should be reconstructed.

- Poor construction - Problems due to poor construction usually require replacement.

In addition to the specific techniques discussed above, all the operation and maintenance practices should also be used. In fact, their use in the developed, marginal, and non-suitable areas is even more important, because of the minimum safety factors for on-site systems in these areas.

5.4.2 Cluster System Recommendations. Cluster on-site wastewater disposal systems may be used in either the suitable or non-suitable areas. In suitable areas the cluster systems will be allowed as a conditional use, most probably through cluster or planned unit development ordinances. These systems make use of individual septic tanks for each dwelling unit, and a common drainfield. In the non-suitable areas, especially, proper performance will be ensured by purchase and operation/maintenance agreements among the dwelling owners. In addition, a surity bond should be posted by the owners to cover the cost of a replacement system, and two additional alternative system sites would be acquired.

5.4.3 Management Strategy. Many recommendations regarding education, certification, design, construction, maintenance, and changes in regulations and procedures have been described in this Action Plan. Together they constitute a Management System that is our best guarantee of safe, long-term use of on-site wastewater management techniques in the Hillside area. Examples of these recommendations include: 1) education of system designers and installers, 2) changes in subdivision regulations, and 3) mandatory pumping requirements. A more complete listing of these recommendations, the time frame for their implementation, and agency responsibilities are given in Table 1. Individually, the recommendations can be used to solve selected problems, but all must be implemented as our strategy to manage wastewater disposal over the long-term.

5.4.4 Conclusions - On-Site System. This Plan recommends a number of planning, design, and construction practices which, if taken together, constitute a management strategy for continued use of on-site wastewater disposal systems in the Hillside area of Anchorage. Unless the strategy is adopted as a unit, the implementation of a suc-

cessful, long-term plan is questionable. Adoption of these strategies will indicate the commitment of the Municipality to prepare and implement the planning, design, and construction requirements affecting on-site systems. An equal commitment is needed on the part of the Hillside residents to ensure proper system construction, operation, and maintenance.

All of Anchorage has an interest in this Plan being adopted and implemented. Although the solutions were formulated relative to the Hillside area, in fact, they can be applied to on-site wastewater disposal throughout the Municipality and in many other areas of Alaska. Implementation of the Plan will constitute the adoption of a strategy for on-site wastewater management in Anchorage to protect areawide public health and water quality goals.

5.4.5 Additional Personnel. The Action Plan outlined in this document will require additional personnel both for the Planning Department and for the Department of Health & Environmental Protection. It is not possible to detail, at this time, the exact number of additional personnel required. However, two positions for Health & Environmental Protection would not be unreasonable. The new personnel would be necessary for conducting training courses and site evaluation. The cost of these positions would be approximately $100,000 per year.

Table 1
MANAGEMENT STRATEGIES TIMEFRAME AND RESPONSIBILITIES

Land Type	Plan Recommendation	Time Frame 1982	Time Frame 1983	Agency Responsibility
Vacant Land - Suitable	Training/Licensing Program	———		DHEP
	Modify Subdivision Regulations-Surface Drainage, Alternative Locations	———		Planning
	Pilot Program	———	———	DHEP
	Review of Plats	———	———	Planning
	Insulation Requirements - Ordinance Addition	———	———	DHEP
	Mandatory Pumping - Ordinance Addition	———		DHEP
	Additional Site Inspection - Guidelines	———	———	DHEP
	Operation & Maintenance - Guidelines	———		DHEP
Vacant Land - Marginal and None-Suitable	Soil Test and System Plan for all Lots - Ordinance Amendment	———		DHEP
	Require Use of Innovativee Systems as necessary	*	———	DHEP
	More Detailed System Reviews	———	———	DHEP

Table 1 Cont.
MANAGEMENT STRATEGIES TIMEFRAME AND RESPONSIBILITIES

Land Type	Plan Recommendation	Time Frame 1982	Time Frame 1983	Agency Responsibility
Developed Land-Suitable	Reconstruction of Improperly designed or Installed Systems	As Necessary		-
Developed Land-Marginal and Non-Suitable	Individual Site Analysis Analysis/Site Specific Solution	As Necessary		DHEP

*A provisional requirement, pending completion of the pilot program.

AMENDED AND APPROVED

DATE 5-18-82

Submitted by: Chairman of the Assembly at the Request of the Mayor

Prepared by: Department of Law

For Reading: March 30, 1982

ANCHORAGE, ALASKA
AO NO. 82-52

AN ORDINANCE ADOPTING THE HILLSIDE WASTEWATER MANAGEMENT PLAN AS AN ELEMENT OF THE COMPREHENSIVE PLAN.

THE ANCHORAGE ASSEMBLY ORDAINS:

Section 1. That the Hillside Wastewater Management Plan dated February, 1982 and the Transition Area Standards in the Hillside Wastewater Management Plan Technical Report dated January, 1982, copies of which are attached hereto, are hereby adopted as elements of the Municipal Comprehensive Development Plan.

Section 3.
~~Section 2.~~ Section 21.05.105 of the Anchorage Municipal Code is hereby amended by the addition of a new subsection T to read as follows:

21.05.105 Incorporation of additional elements as part of Comprehensive Development Plan.

. . . .

T. The Hillside Wastewater Management Plan dated February, 1982 and the Transition Area Standards in the Hillside Wastewater Management Plan Technical Report dated January, 1982.

Section 4.
~~Section 3.~~ This ordinance shall become effective upon passage and approval by the Anchorage Assembly.

PASSED AND APPROVED by the Anchorage Assembly this 18th day of May, 1982.

Tom Smith
Chairman of the Assembly

ATTEST:

Ruby E. Smith
Municipal Clerk

1

Amendment to AO 82-52, adopting the Hillside Wastewater Management Plan as an element of the Comprehensive Plan.

1. Add a new Section 2, to read: Chapter 21.05 of the Anchorage Municipal Code is hereby amended to add a new section to read as follows:

21.05.102 Implementation - Hillside Wastewater Management Plan.

The Hillside Wastewater Management Plan recommends extension of the public sewer system to the areas shown on sheets 1 and 2 of Map 9 of the plan. Extension of the public sewer system into these areas will make possible higher density development than is allowed by the present zoning. To protect neighboring lower density developments existing as of the date of adoption of the Hillside Wastewater Management Plan, any rezoning of property within the sewerage area shown on Map 9 from lower to higher density shall be allowed only with sepcial limitations which address the issues of buffering, internal circulation, drainage and protection of vegetation if the property for which the rezoning is sought is contiguous to an existing lower density development. The standards to be applied in determining the precise form of the special limitations are those found in Chapter 6 of the Hillside Wastewater Management Plan Technical Report dated January, 1982.

2. The Hillside Wastewater Plan was amended as follows:

   a. Page 1 of Map 9 was amended by drawing a blue line around the Green Forest Subdivision and stating that the transitional standards specified on page 45 be applied to the area.

   b. By deleting the first paragraph on page 31 of the plan.