Linda Fisch

P.O. Box 876286

Wasilla AK 99687

akfish@mtaonline.net

907 376-2055 home

907 376-2056 Fax

Request for DEC Adjudicatory Hearing based on evidence that The Matsu Borough produced a Plat which shows where the Septic should be installed as many years of input into this Plat based on EPA advisories and Neighboring properties had the assurances that Paradise Lake would be protected from any drainage that contained pollutants would not go into our lake.

The Mat Su Borough's response to our request will be submitted whereby the Borough relies on the DEC to approve the Septic location. In contrast the Division of Water takes the position that the Borough should have enforced their Plat and chose not to.

Based on the Division of Waters Review and Decision I will submit responses to each of the Reviews I feel are incorrectly judged.

Linda Fisch
July 18, 2016

Response to Directors Informal Review and Decision.

Curt Holler Professional Engineer PE License No. CE 9607 was not truthful in his Certification of Septic which was noticed by Mr. McCabe. (Paper included in file) I believe a Professional Engineer must be truthful in his Certifications as that is what the DEC bases their analysis on. Mr. Holler omitted the Creek and the 18 foot water on his Certificate for Tom and Debra Rolston Lot 7.

On April 25, 2016 DEC staff visited the location and took measurements and to observe dry impressions of the Creek. Distance was found to be in excess of 100 feet. I had a Professional Surveyor survey the WWDS and found that the closest measurement to Centerline was 103 feet.

I was not notified of their arrival so that I could show them the Creek formation. According to Regulation 18 AAC 72.020(b) the distance between the mean annual high water levels is to be measured horizontally. I have submitted the Survey in this packet.
I find one of my arguments here. You cannot measure the high water of an unknown volume of water on the South side of the creek. Therefore the rational argument would be to resort to the Plat which shows only the North side of the creek as the placement of the WWDS. The installation was placed 103 feet from a ditch that the Rolston created. I have pictures to prove that the creek is a valuable asset to our lake and half the year supports our lake levels. This no name creek is the headwaters of Cotton wood Creek which is a juvenile salmon rearing Creek. This unknown Creek has been running for a hundred and most likely thousands of years. I have submitted my evidence that this Creek Exists. When the Creek again flows as my pictures show the distance will be less than 100 feet half of the year.
As we in Alaska know this past winter was the lowest snowfall on record, we are in drought like conditions. This situation is to be noted and not taken as a fact as the Creek will surely return in its vengeance
To disrespect this Creek because it is not recognized is an insult to Nature. Because this Creek is not recognized the DEC must take extra precaution to err on the side of the neighborhoods and the EPA and Paradise Lake Management Plan to relocate the WWDS to the proper location.
If you look at any LIDAR you can see the impressions of a seasonal creek. I feel the State of Alaska is indeed deficient in updating their maps.

The Evidence exists that this Creek is recognized by a 1914 Government Survey included in this packet. The Evidence also included is a 1964 Soil Survey which shows the Creek and Associated soils. This exact Location Lot 7 has the type of soil that has quick permeability of the substratum which has the probability of polluting the ground water.

The Division of Land did not take this Creek in their decision making, as at the time the creek was soaking into the Wetland and a deep diversion ditch that the Rolston created. The Rolston

then diverted the creek water into a hole off his western side of his driveway disrespecting the natural flow of the creek bed entering our lake.
I found then a 10 inch gap opened up in the wetland coming from the Rolston property draining South East right through their drain field entering my property and going into the Lake.

First of all I should have protections for not allowing any drainage from a neighbor property coming through my property and DEC allowing this.
The general concerns of the DEC Water Dept. raise the concerns that they cannot monitor the ground water or the impacts to the lake from this WWDS. Why then would you not err on the side of safety and follow the Plat.
Ms Hale said that I do raise general concerns that the regulations of the Dept. of Water cannot be addressed in the informal hearing.

My concerns are to follow the Plat as the Plat was approved by Engineers and Surveyors with input from the EPA and neighboring communities. Why would you allow a private WWDS to be located in a sensitive area that was noticed to be placed in the location that the Matsu Borough approved as a Plat.?
The Matsu Borough relies on the DEC to regulate this WWDS. You must pay attention to all that I have submitted as evidence. The only evidence the Rolstons have submitted is an Engineer who omitted the Creek and high ground water. The Officer of DEC Owen Wooley who described himself to be a top Engineer. I believe that he is a friend of the Rolstons as he told me the Rolstons have Lakefront property in a threatening way. . I tried to report him to the Division of Professional Licensing but I found out he is not an Engineer he is Tech. I did file a report to this division on Curtis Holler. That division responded to me that they are awaiting DEC's response to his emittance of the Creek and ground water. The Creek is on the Plat. The Creek on one hand is considered by the DEC measurements and on the other hand is not considered when the measurement must include the high water mark south of the Creek. The bank shows the measurement on the north side.

Thank you for your analysis and attention to our concerns

Linda Fisch

MATANUSKA-SUSITNA BOROUGH

Planning and Land Use Department

350 East Dahlia Avenue • Palmer, AK 99645

Phone (907) 861-7851 • Fax (907) 861-7876

www.matsugov.us • planning@matsugov.us

March 15, 2016

Linda Fisch
2700 E. Paradise Lane
Wasilla, AK 99687-6286

RE: Your request for borough enforcement to require relocation of the septic system recently installed on Lot 7, Block 3, Paradise Park Subdivision.

Dear Ms. Fisch:

The borough is in receipt of your request noted above, concerning the development on Lot 7, Block 3 Paradise Park Subdivision.

The Borough Planning Department generally oversees regulations in MSB Code, Title 8 Health and Welfare, Title 17 Zoning and Title 43 Subdivisions (previously Title 16 and Title 27). As Mr. Strawn has indicated in his March 8, 2016 email to you, he has reviewed the appropriate sections of Title 17 Zoning and concluded that he has not found any violations of Borough code that warrant enforcement.

Concerning compliance with the subdivision code, I would like to clarify a couple of issues.

First, Alaska Statutes 29.40.070 states that the assembly shall adopt platting requirements by ordinance that may include, but are not limited to, the control of:

- Form, size and other aspects of subdivision, dedications, and vacations of land;
- Dimensions and design of lots;
- Street width, arrangement, and rights-of-way, including requirements for public access to lots and installation of street paving, curbs, gutters, sidewalks, sewers, water lines, drainage and other public utility facilities and improvements; and
- Dedication of streets, rights-of-way, public utility easements and areas considered necessary by the platting authority for other public uses.

Second, the borough's Title 43 (previously Title 27 and Title 16), adopted by assembly ordinance, sets out clear subdivision requirements, including what is to be shown on plats. The Planning and Land Use Director's Certificate block required on plats reads as follows:

MATANUSKA-SUSITNA BOROUGH

Planning and Land Use Department

350 East Dahlia Avenue • Palmer, AK 99645
Phone (907) 861-7851 • Fax (907) 861-7876
www.matsugov.us • planning@matsugov.us

I certify that this subdivision plan has been found to comply with the land subdivision regulations of the Matanuska-Susitna Borough, and that the plat has been approved by the platting authority by plat resolution number _____, dated _____ 20__, and that this plat has been approved for recording in the office of the recorder in the _____________ district, Third Judicial District, State of Alaska in which the plat is located.
_____________________________, 20___

____
Planning and Land Use Director
ATTEST:

____
Platting Clerk

Nowhere does this certification indicate that, by signing the plat, the borough will be responsible for enforcement of all of the notes, easements, or other requirements on the plat, only that it has been found to comply with the land subdivision regulations, and has been approved by the appropriate authority. In fact, many of the notes, easements or other comments on plats are required by utilities or other state or federal agencies, and in some cases, by the developer themselves. While the Borough has the authority enforce plat notes, setback requirements, and other zoning ordinances, the decision to do so is based on a variety of factors including: (1) whether there is clear evidence of a violation, (2) the public interest affected by the violation, and (3) the availability of MSB resources to pursue such violations.

The borough does not have adequate resources to enforce notes from other entities on the hundreds of plats that go through our office, nor has the Borough Assembly indicated they wish staff to do so. Also, because we were unable to substantiate a violation of Borough code throughout our investigation, the Borough Planning Department cannot accommodate your request to require relocation of the septic system on Lot 7.

For your information, Alaska Statutes 29.40.190 Civil remedies and penalties, states (in part) the following:

> *(a) The municipality **or an aggrieved person** may institute a civil action against a person who violates a provision of this chapter, a subdivision regulation adopted under this chapter, or a term, condition, or limitation imposed by a platting authority. In addition to other relief, a civil penalty not to exceed $1,000 may be imposed for each violation. An action to enjoin a violation may be brought notwithstanding the availability of any other remedy. Upon application for injunctive relief and a finding of a violation or threatened violation, the superior court shall grant the injunction.*

Should you have further questions please let me know.

Respectfully,

Eileen Probasco
Director of Planning and Land Use

Cc: Alex Strawn, Development Services Manager
John Aschenbrenner, Borough Deputy Borough Attorney
John Moosey, Borough Manager
Barbara Doty, Assembly District 6
Chan Pohgkhamsing, EPA
Mark Jen, EPA
Matthew LaCroix, EPA
Gene McCabe, ADEC

Linda Fisch

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RECEIVED BY:
Division of Water
JUN 23 2015
Department of
Environmental Conservation

Appeal

Informal Review based on the decision made by Gene McCabe on April 27, 2016.

RE: Lot 7 Block 3 Site Visit. Paradise Park Subdivision. Owners Tom and Debra Rolston

The Specific Decision to be Informally Reviewed is based on AAS 72.020

The evidence will show that the 100 foot distance was created by Tom Rolston by an artificial ditch to direct the creek water though no mention of the creek was on Curtis Holler Certification of Septic. Hitting ground water at 18 feet was also not mentioned but told to ACE Jack Hewitt.

The fact is that the 100 foot separation distance is not enough protection for this lake and ground water. The Plat states where the Septic has to be installed. The Rolstons disregarded this Plat. This past year the snowfall was at an all –time record low. The creek came within 40 feet of the drainage field and septic tank. This Creek is not just an "occasional water flow event "The Creek has been flowing for over 102 years based on the 1914 GLO Government Survey that identified the Creek and measured its dimensions. This historic Creek bed is now dry to due Tom Rolston alteration of the natural flow of water.

The Creek has through the years flooded my driveway which has a higher elevation that the creek /wet-land area. (See pictures of Flooding my driveway)

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The Survey Plat by Karl Woods shows the elevations of the area where the stand-pipes are. The septic tank has width and the creek has width, intermingle them both and we have less than 100 feet with seepage problems into the drainage. The elevation is the same at the north and south of the creek to the septic field tanks.

My name is Linda Fisch. My Husband Thomas W Bouwens and I are the owners of 7.8 acres Paradise Lake Lot 1. Our property is adjacent to Lot 7 on its Eastern border. Our property extends south to the water's edge which I believe that is where the creek had been draining through from Lot 7. Tom Rolston diverted the creek and ditched the water into a hole west of his driveway. That water has traveled South- East through his drainage field onto my property entering Paradise Lake. My photos will show the drainage opening in the wetland. See Paradise Lake Management Plan (all land on Paradise Lake is Private Property) Rolstons do not own any lakefront...

The reason why I am requesting this review is because I have the evidence to show that a seasonal creek flows through Lot 7 and enters Paradise Lake. This flow is relevant to previous winter snowfall and rain events during the seasons. The Flow in the past has been so significant as to raise the level of the lake and flow over my driveway and my neighbor's property. In this past few months the creek has come within 40 feet of Tom and Debra Rolston's location of Septic and Leach field. See Pictures of creek ponding near septic and leach field. This past winter had a record low snowfall.

Mr. McCabe's analysis of "guiding occasional surface water though a culvert under his driveway" would not be my analysis or that of anyone that has studied this creek drainage. Oran Wooley is not in the position to be neither fair nor impartial. Mr. Wooley described himself to me to be a Senior Engineer with DEC and that he approved the Rolstons Septic. He met them on site 2 or 3 times and it appeared to me that he was a friend of theirs by responding to me in a threatening way. Mr. McCabe did not alert me to the fact that they were going to be on-site so that I can meet with them with my Surveyor and Engineer and explain the hydrology of this area and show them that the creek was still running but now leaching into the deep diversion ditches. This diversion ditch artificially gave the Rolstons the distance when the flow of the creek is low. It will not impede the creek when the flow of the creek is higher. It has ponded in the ditch rather than flow due to the Wetlands. Tom Rolston artificially altered the streambed and the water is now disappearing into a hole the Rolston created instead of going through the historic drainage of the creek bed into the lake. (Pictures of hole and water)

Though the Rolston's have the adequate distance, the elevation is the same on the creek bed to the standpipes and even if Tom Rolston raised his elevation the creek will flow within 100 feet. Tom and Debra Rolston made the decision to disregard the Paradise Park Subdivision Plat where it clearly shows the Creek and the 100 foot Separation Distance above the High water mark on the bank of the creek. There is no mark below this creek. This Surveyor Bob Hoffman (Bull Moose Surveying) competently designed this Plat with the co-compliance of the Engineers of the Matsu Borough Planning and Platting Dept. See Paradise Park Plat Lot 7. Numerous letters and appeals were instituted in the development of this subdivision as there were questions on the natural resources and drainage designs.

See EPA letters of 2006 and 2008. The Subdivision was actually denied in 2006 by the EPA objection because the drainage plan was not taking into consideration the topography and the ecology of this unique area. Recommendations were given to protect the creek and leave the natural vegetation so as to buffer the run off from the upper lots. This was not followed by the Rolstons. They essentially cleared the lot and creek drainage and altered the elevation.

The final Plat was approved and signed in April of 2012 by the Matsu Borough. At that point my neighbors and I had the assurances that the Lake and the water would be protected from contaminants and that our ground water would be clean as it enters the lake. It also took into consideration the seasonal creek that enters Paradise Lake. Specifically that no septic would be placed south of the high water mark of the creek which is designated by the 100 foot set-back on the Plat..

The hydrology of this area and on Lot 7 shows this to be the type of soils that have quick permeability of the substratum which will allow private septic systems to pollute the ground water. See EPA letter. Also submitted is a 1964 Soil Survey of this creek entering through Lot 7. This type of soil on this exact spot is SA and SM. Respectively Salamatof Peat which is only found along small streams (Page 30 and SM which is Slikok Muck found in drainage ways. (Page 31)

My neighbors and I instituted a Paradise Lake Management Plan with Eileen Probasco Planning Director of the MAT Su Borough which afforded protection for the health and welfare of our lake and the protection of the birds and natural habitat. See Paradise Lake Management Plan. The Management Plan describes the creek that flows into Paradise Lake originating on the North West inlet to the lake. (Page 5)

Also included for your review is a 1914 GLO Government Survey that identified the Creek though this drainage and measured it Page 6. This tells me that this Creek has been running for well over 102 years. The history of this area shows that this no named creek could have run literally for thousands of years.

My primary interest is for the Septic System to move to the designated area of the Plat which would in effect put it in no harm's way to our ground water or the health of our lake. Mixing the creek with the septic runoff which most definitely affects the lake and the ground water The Septic tank has width and the Creek has width, mixing these two together is where the problem lies... My well was within 70 feet of the creek when it was closing in to 40 feet of the Rolston septic. The Rolstons installed their septic in January at the time when the ground was frozen. Mr. McCabe noted that the Engineer Misrepresented the Certification of Septic by omitting the Creek. Also come to our attention most recently is the Fact that Jack Hewitt Supervisor of the ACOE told us on an onsite visit that Tom Rolston told him the ground water was hit at 18 feet. This also was not noted by Curt Holler Engineer. This omitting the creek and high ground water is significant as if he did note the creek and water at 18 feet there would not be enough separation distance on his property in this present location.

I would surmise that the Rolstons Warranty Deed does inform the Owner and the Owners Engineer that a Creek does exist. See Rolston Warranty Deed. See email from Gene McCabe acknowledgment of Engineer Curtis Holler not mentioning Creek.

This no named creek is the only source of water entering the Lake. Paradise Lake eventually empties into Cottonwood Creek which is a juvenile salmon rearing creek. The implication of the Rolston's septic and leach field in his present location will present the perfect application for polluting our lake and water. See a Biologists Analysis of what will then happen.

Ron Godden, Environmental Engineer who apparently used to be a former ADEC employee did come on site to examine this situation upon my request. He came at different times to examine the creek flow. Ron called Mr. McCabe up to state his displeasure in the location of Rolston's septic and leach field. I was a witness to the fact that Ron Godden told Mr. McCabe the system is in harm's way and needs to move.

My neighbors and I are calling on the good graces of the ADEC to promote the health and welfare of our lake water and wildlife and to please re-locate the Rolstons septic and leach filed to the area north of the creek 100 feet above the high water mark. This is not going to penalize the Rolstons but rather insure all of the lake owners that the ADEC is protecting our ground water and lake from septic seepage or sludge mixing with the creek water. It is not predictable when this will happen but it is a certain prediction that it will happen.

I would also request the ADEC to pay attention to the EPA's most recent email to me from Matt Lacroix. Stating that the DEC should not allow a waiver due to the fact that the Rolston's knew the septic system was being installed in the wrong location.

Written on May 6, 2016

Included with this letter is an Index to Documents relevant to this case.

Letters of Support

5 Page Brief Attorney Brad DeNoble (Environmental Attorney)

Pictures of Flooding

Pictures of Creek running and ponding on Lot 7 close to Drain Pipes.

In Summary

Though the Rolstons have obtained artificial 100 foot distance, this will not be so when the Creek Flows.

I understand that the ADEC may not have regulations for Seasonal Creeks but they should. Regardless of this non-recognition of the Creek and the 100 foot separation distance we believe that the health and welfare of our lake is at stake. The evidence shows many EPA notices due to the high response of the neighborhoods surrounding this subdivision. The Matsu Borough noted all of this in their files and turned down the subdivision for reasons affecting the lake and ground water.

The Culmination of many years of creating Paradise Park produced a product that all of the Lake Owners and adjacent neighborhoods had faith in. We believed that the EPA's advisories were accurate as the EPA has been involved in this Subdivision as late as this past spring 2016. Unfortunately for some reason the ACE would not label this drainage AS a Wetland (though they noted the wetlands on the front of Lot 7) for reasons we believe was incorrectly labeled as inland drainage. Based on the Corps analysis the EPA could not gain control though they would have. I know that they have called Mr. McCabe and told them they believe this area should not have a septic south of the creek.

The pictures show the creek at close to 40 feet. The pictures also show the creek running south East through the Rolston Drainage Field traveling through my Property into a lake from a man-made hole in the ground west of the culvert on the Rolston driveway. Tom Rolston eradicated the creek that has flowed into Paradise Lake. If the Rolston followed the Plat as was specifically designed to protect the lake, this situation would never have come to bear.

A Homeowner purchased Lot 6 which is where the creek had been flowing through a natural drainage. This no longer exists. The Lot Owner also identified that the Rolston's moved their Survey stakes and took over part of the adjacent property...

In retrospect there is nothing more than we as property owners can do. We produced a Plat that was supposed to provide us with security. I drink from this ground water I swim in this lake as all of us do.

If you let this go you will set a precedent that will discourage others from protecting the area we choose to protect and call home. Please remember that every little bit counts. The septic mixing with the ground water will produce bacteria especially with the Farm on the East End of the Lake.

The Rolstons thought they owned Lake Front and tried to squeeze between two lots. They are 10 feet on my border. Their septic is on the edge of my property line.

Warmest thank you for allowing me to describe our view of the allowance of this septic when in all due respects no one believes it should be allowed except the Rolstons and the people they have hired or are friends of their defunct homebuilding business

Index

#1 Pictures

#2 Hole in ground (ditching creek water)

#3Break in Wetland (coming from Rolston property draining into my Property entering Paradise Lake)

#4 Plat

#5 EPA 2006

#6 EPA 2008

#7 EPA 2016

#8 1964 Soil Survey of the Matanuska Valley

#9 Paradise Lake Management Plan

#10 1914 Government Survey GLO finds creek and measures

#11 McCabe acknowledge Holler –No mention of Creek on Certification of Septic

#12 ACOE Jack Hewitt Rolston hit ground water at 18 feet- Curtis Holler omitted this on Certification of Septic

#13 Rolston Warranty Deed

#14 Biologist analysis of Septic Seepage into Lake

#15 Environmental Attorney Brad DeNoble 5 Page Brief

#16 Survey Stand Pipes and Elevation

#17 Filing of Grievance to John Savage against Holler Engineering

#18 Pre-Plat discussion and public in-put on Paradise Park Subdivision

#19 Letters of Support on moving Septic

#20 Article in Frontiersman about Paradise Park development April 2006

Pictures

Picture Index

1. Lot 7 Notice drain field and elevated drainage
2. Lot 7 notice septic/lake
3. Creek entering ditch
4. Looking downstream towards Lot 7
5. Drainage Note septic
6. Hydric soil disturbed by Rolston Lot 7
7. Dammed up soil to prevent creek from overflowing its area Notice septic nearby
8. Septic pipe and drain filed notice dammed up soil to prevent creek from overflowing its containment
9. Septic Lot 7 facing creek notice piles of mud
10. Septic edge of creek
11. Looking upstream adjacent neighbor's property. Notice round rocks in creek bed
12. Upstream East of Fisch property
13. From Paradise Lane looking south along the creek
14. Downstream looking west to lot 7 along creek bed
15. Note CREEK ENDS HERE in Muddy hole (diversion)
16. Historic creek bed bone dry
17. Looking East to Lot 7 notice ditch water directed to hole
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19. Rolston edge of driveway and lot 6 note small culvert and ditch made for diversion
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21. Water ponding in Rolston ditch Note elevation of wetland
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23. Looking upstream East of Fisch driveway Notice large culvert
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25. Creek pouring into Rolston ditch
26. Looking downstream at adjacent property
27. Meander of creek
28. Creek ponding in Rolston ditch notice hydric soil
29. Looking East and upstream notice meander of creek
30. Looking East upstream notice round rocks in creek bed
31. Looking East upstream from Fisch property
32. Water ponding in ditch note 40 feet to septic
33. North of Paradise Lane upstream Serrell property
34. Paradise Lane looking south and downstream
35. East side of Fisch driveway notice creek bed and large culvert

Picture 1

Lot 7 Notice Drain Field and Elevated Flood Area

Picture #2

Lot 7 Notice Septic and Lake

Picture 3

Creek entering ditch notice hydric soils

Picture #4

Looking downstream towards Lot 7

Picture #5

Elevated Flood Zone

Picture 6

Hydric Soils disturbed

Picture #7

Soil dammed up to prevent overflow from creek

Picture #8

Dammed up area to prevent creek flow

Picture #9

Septic on Lot 7 facing creek

Picture #10

Septic and Dam

Page #11

Looking upstream towards adjacent neighbors property (Hoff) East of Fisch Notice round rocks in creek bed

Picture #12

Looking upstream at Hoff Property

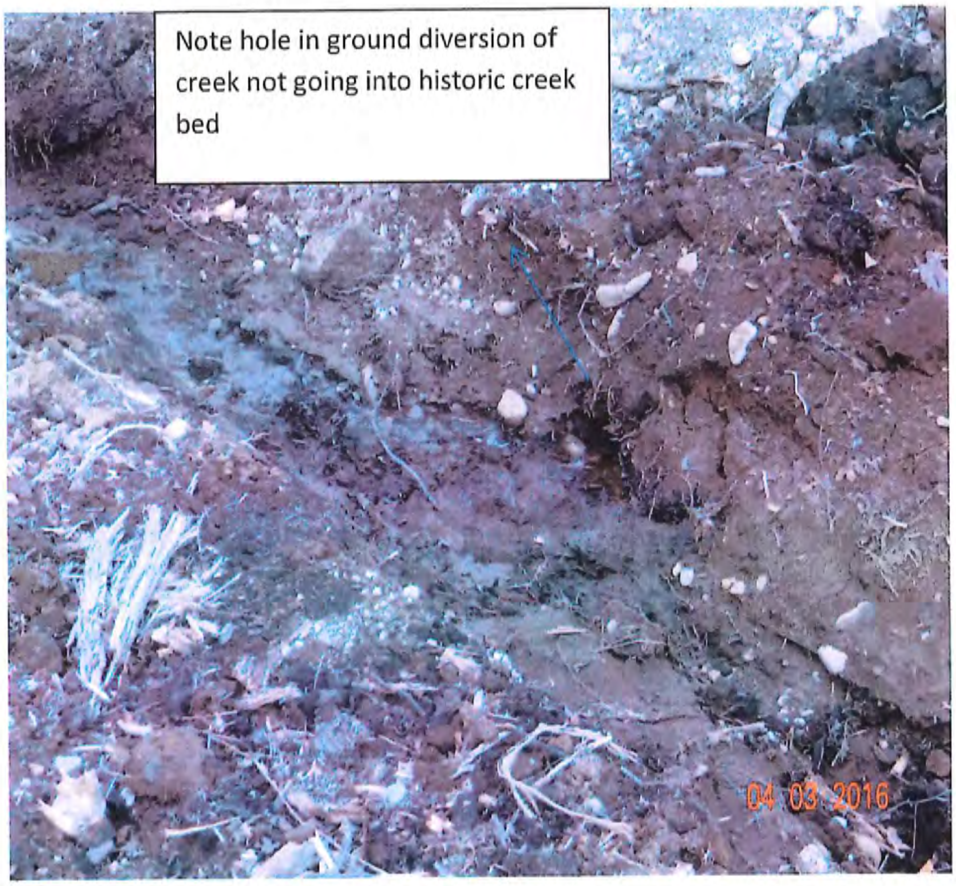
Picture #13

From Paradise Lane looking south along creek

Picture #14

Looking downstream towards Lot 7

2



Picture # 15

Note Creek ends here in a muddy hole on Lot 6 that Rolston created. (not draining into historic creek bed)

Picture #16

Historic creek bed bone dry

Picture #17

Looking upstream from Lot 6 . Rolston ditching water but drains in a hole right off his driveway

Picture #18

Historic creek drainage dry looking upstream at Lot 7

Picture #19

Rolston Driveway looking from Lot 6 East Note small culvert

Picture # 20

Dry creekbed looking south to Paradise Lake. This was the Inlet to the lake Historically

Picture # 21

Creek ponding in Rolston ditch

Picture #22

Water ponding 40 feet from septic. Lowest snowfall on record

Picture# 23

Looking upstream to Fisch driveway. Rolston painted shrub pink to note flow of creek

Picture#24

Digging up wet mud to drain creek from Rolston ditch

Picture#25

Creek pouring into Rolston ditch (note lowest snowfall in history and notice volume)

Picture#26

Looking upstream adjacent property notice rounded creek rocks in stream bed

Picture#27

Looking upstream meander of creek on Hoff property

Picture#28

Creek Ponding in Rolston ditch notice mud

Picture#29

Looking downstream towards Fisch Property

Picture #30

Meander of creek Hoffs property Notice rounded stream rocks

Picture#31

Looking upstream towards Hoff Property

Picture #32

Water ponding Note property marker Fisch Property East Side

Picture#33

North side of Paradise Lake looking upstream .

Picture #34

~~Soth~~ side of Paradise Lane looking downstream towards Hoff property

Smth

Note large size Culvert

Picture # 35

East side of Fisch driveway note large size culvert


04 08 2016

3

View south from Lot 7 to Paradise Lake Note drainage ditch


04 23 2016


05 07 2016


04 23 2016


05 07 2016


05 07 2016

North
side of
Paradise
lane
after
a mere
rainfall
event
creek
is
back
running
5/10/2016

south
side
aradise
ane
reek
5/10/2016

Drainage Into Paradise Lake (lake water backing into ditch)

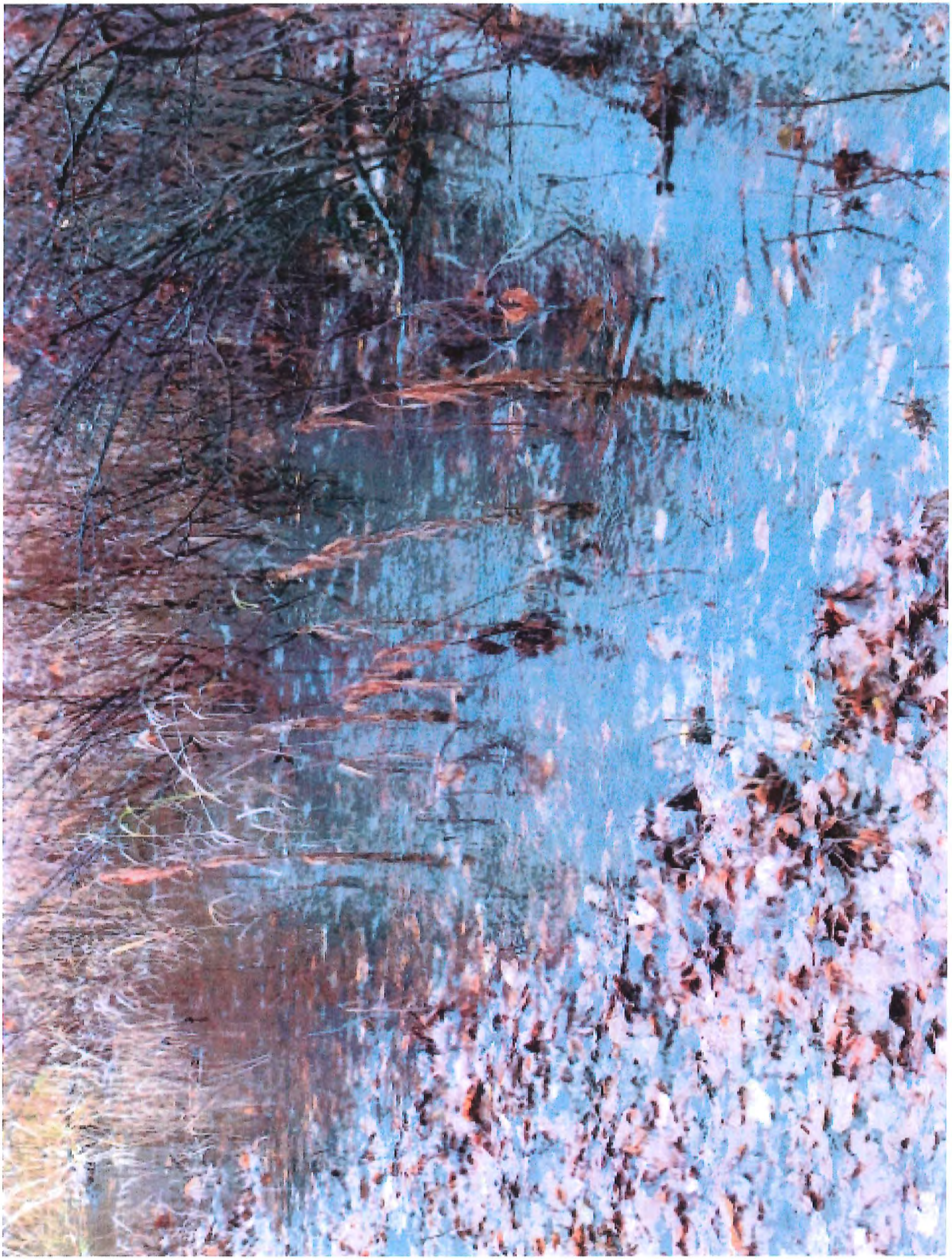
View south from Lot 7 to Paradise Lake Note drainage ditch

Drainage ditch opens in wetlands. Coming from Hole in ground where Creek water was ditched flowing southeast into Paradise Lake. Lot 7 in the foreground

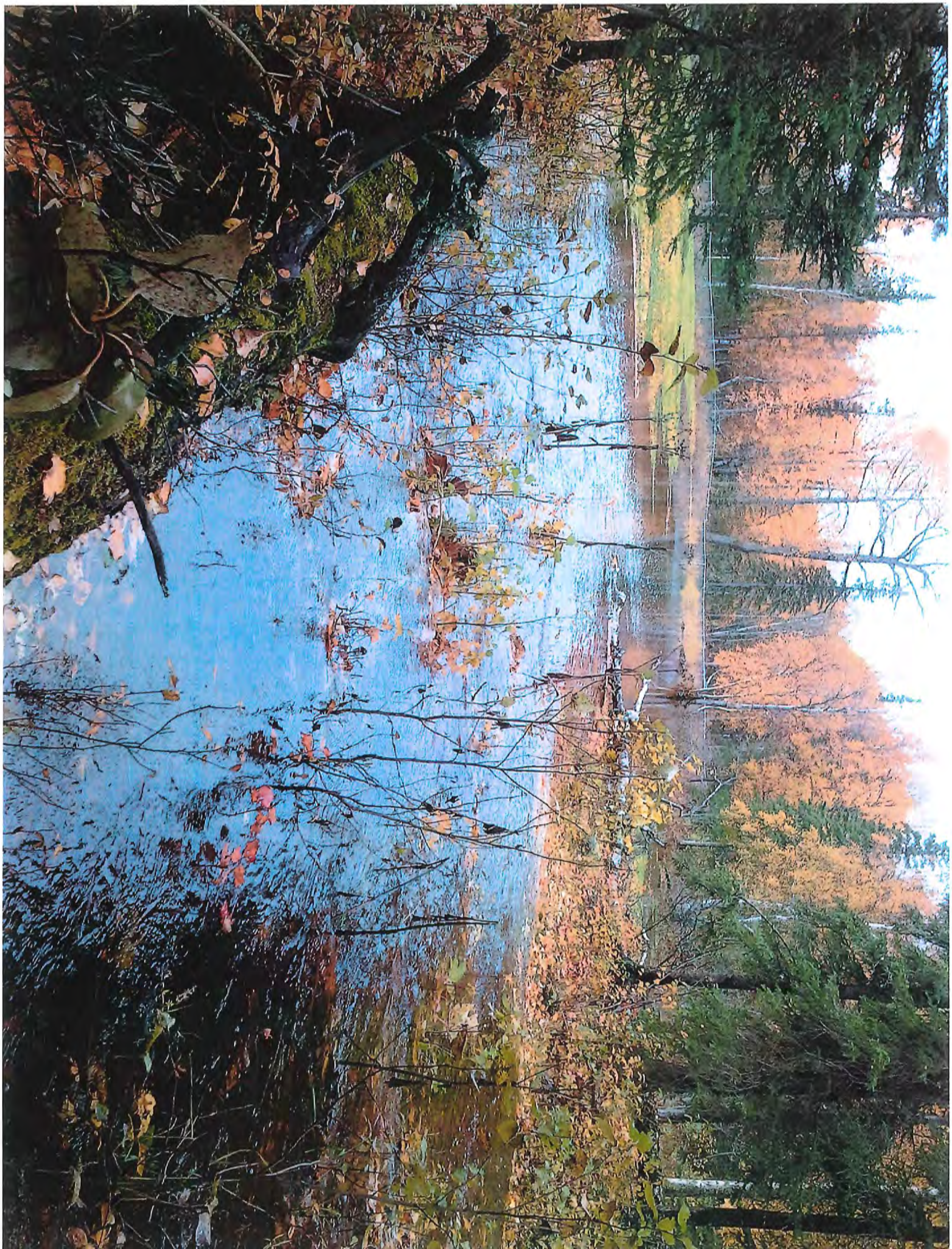
Drainage from Lot 7 coming from diverting creek to hole in the ground running south through their leach field into the lake.

This is my property to lake!


My Driveway

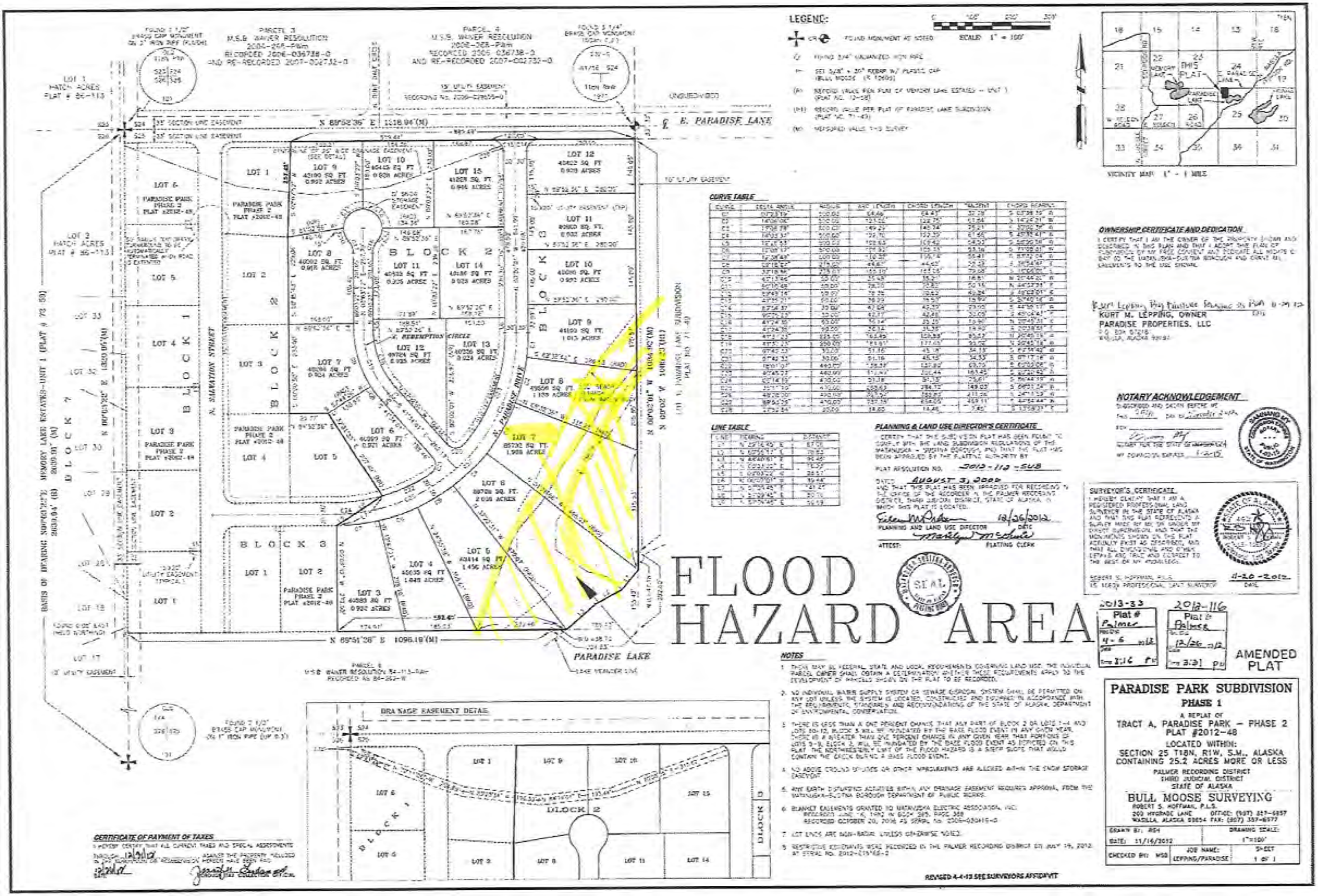



08.19.2006
Creek East

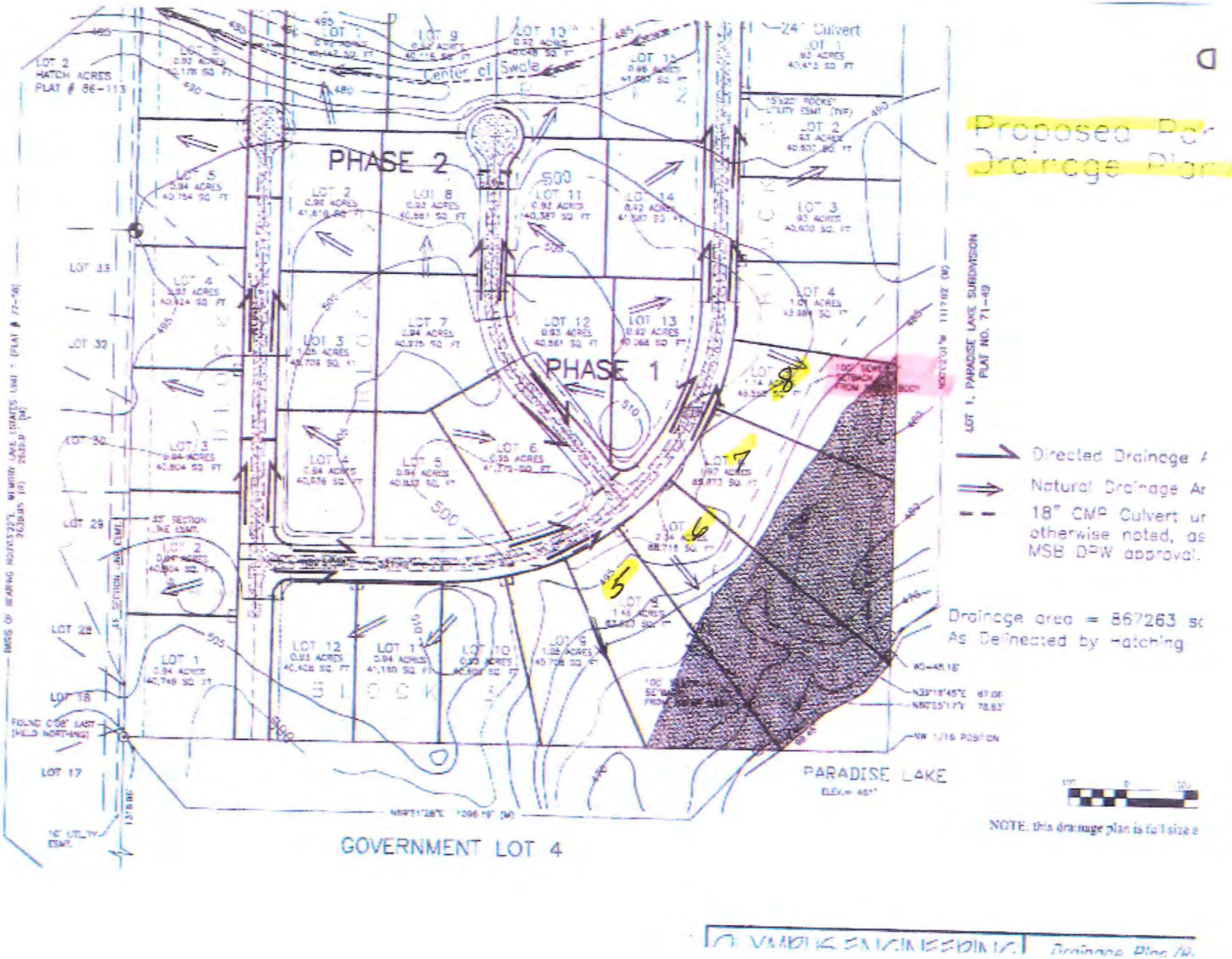



PATRICK
STOP
Main Rd

4 Plat



FLOOD HAZARD AREA
PARADISE PARK SUBDIVISION
PHASE 1
A REPLAT OF
TRACT A, PARADISE PARK – PHASE 2
PLAT #2012-48
LOCATED WITHIN:
SECTION 25 T18N, R1W, S.M., ALASKA
CONTAINING 25.2 ACRES MORE OR LESS
PALMER RECORDING DISTRICT
THIRD JUDICIAL DISTRICT
STATE OF ALASKA
BULL MOOSE SURVEYING
AMENDED PLAT
LEGEND:
CURVE TABLE
LINE TABLE
OWNERSHIP CERTIFICATE AND DEDICATION
NOTARY ACKNOWLEDGEMENT
PLANNING & LAND USE DIRECTOR'S CERTIFICATE
SURVEYOR'S CERTIFICATE
NOTES
CERTIFICATE OF PAYMENT OF TAXES
DRAINAGE EASEMENT DETAIL
VICINITY MAP 1" = 1 MILE
E. PARADISE LANE
PARADISE LAKE
N. SALVATION STREET
PARADISE DRIVE
E. REDEMPTION CIRCLE
BLOCK 1
BLOCK 2
BLOCK 3
KURT M. LEPPING, OWNER
PARADISE PROPERTIES, LLC
REVISED 4-4-13 SEE SURVEYORS AFFIDAVIT



Proposed Dr
Drainage Plan
PHASE 2
PHASE 1
Center of Swale
24" Culvert
LOT 2 HATCH ACRES PLAT # 86-113
LOT 1, PARADISE LAKE SUBDIVISION PLAT NO. 71-49
100' SEWER SETBACK FROM WATER BODY
PARADISE LAKE
GOVERNMENT LOT 4
LOT 33
LOT 32
LOT 30
LOT 29
LOT 28
LOT 18
LOT 17
NW 1/16 POSITION
Directed Drainage
Natural Drainage Ar
18" CMP Culvert ur otherwise noted, as MSB DPW approval.
Drainage area = 867263 sc
As Delineated by Hatching
NOTE: this drainage plan is full size a
Drainage Plan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
222 West 7th Avenue, Room 537, Box 19
Anchorage, Alaska 99513-7588

Matanuska-Susitna Borough
Planning Administration
MAY 16 2006
RECEIVED

Reply To
Attn. Of: AOO/A

May 15, 2006

Mr. Murph O'Brien
Director of Planning and Land Use
Matanuska-Susitna Borough
350 East Dahlia Avenue
Palmer, AK 99645

COPY

Ref: Paradise Park Subdivision Comments

Dear Mr. O'Brien:

This letter is in response to the proposed development of the Paradise Park Subdivision. The proposed subdivision would be located in the northwest ¼ of section 25, Township 18N., Range 1W., Seward Meridian, adjacent to the northwest portion of Paradise Lake. A number of concerns have been expressed regarding wetlands, surface drainage and groundwater in the area of the proposed subdivision. Based on our research of the proposed development and a site visit to Paradise Lake on April 19, 2006, The Environmental Protection Agency has the following comments.

There is a small intermittent stream which flows through the southeastern portion of the proposed subdivision. This stream enters Paradise Lake via a small emergent wetland. The stream, the wetland and Paradise Lake are considered waters of the United States under section 404 of the Clean Water Act, and as such, any discharge of dredge or fill material into these waters would require authorization via a Department of the Army permit from the Alaska District, Corps of Engineers, Regulatory Branch. A permit application packet can be obtained by calling (907) 753-2712. A Corps of Engineers approved jurisdictional determination, including a wetland delineation, should be obtained for the subdivision and any required permits should be obtained prior to beginning construction activities.

The developer must address handling of the project's storm water runoff both during and after construction. The National Storm Water Pollution Discharge (NPDES) provisions of Section 402 of the Clean Water Act require developers to prepare and submit a Notice of Intent (NOI) along with copies of construction plans and a Storm Water Pollution Prevention Plan (SWPPP) to the EPA and the State Department of Environmental Conservation prior to beginning land disturbing activities on projects over one acre in size. The Plans should address

From: **Linda Fisch** akfish@mtaonline.net
Subject: Emailing - File 11.pdf
Date: April 15, 2016 at 10:34 PM
To:

potential storm water pollution issues both during and after construction. Additional information can be found at the following website; *http://cfpub.epa.gov/npdes/stormwater/const.cfm* .

It appears that Paradise Lake is fed primarily by surface water runoff, the small intermittent stream mentioned above, and by springs upwelling from confined aquifers. As such, any disturbance or interference with surface water flows to the lake could have significant impact on lake levels and water quality.

According to the Alaska Department of Natural Resources (ADNR), the geology of the area around the proposed subdivision is very complex. The surface or shallow groundwater aquifers are variable and unreliable. Residents of the area have reported problems with decreased production of their wells as well as discoloration and sediments in their water which they attribute to nearby well drilling activity. The new Shaw Elementary School which is located near this area has a very low producing well which requires treatment and a separate wastewater disposal system to handle post treatment wastes. We recommend that any wells developed in conjunction with the proposed new subdivision be drilled to a depth of 160 feet or greater and that closed casings rather than perforated casings be used to preclude disrupting groundwater flow in shallow aquifers which may feed Paradise Lake and water supplies to nearby homes.

Information has been received that indicates the proposed developer may wish to dredge a portion of Paradise lake in conjunction with the proposed development. According to the ADNR, such actions could cause unexpected changes to the lake water levels, especially if the lake is perched above a confining layer and the layer is breached.

The Natural Resource Conservation Service (NRCS), July 2000, Soil Survey for the Matanuska-Susitna Valley Area, shows the soil in the proposed subdivision is a Knik Silt Loam. This soil has a number of building site development limitations including rapid permeability of the substratum which may allow sewage effluent from individual sewage disposal systems in moderate or high density housing to pollute the water table".

We recommend that adequate engineering studies, including soils and drainage studies, be conducted prior to any construction activities to determine the potential impact on water quality and quantity in the vicinity of the project and that appropriate mitigating measures be included in development plans. We also recommend that a minimum 75 foot undisturbed vegetated buffer be retained adjacent to the above referenced stream and wetlands as well as along the shoreline of Paradise Lake itself. We further recommend that full consideration be given to all the NRCS listed building site limitations and management practices, especially those pertaining to wastewater disposal, and that all necessary steps be taken to minimize any potential impact to water quality.

In conclusion we recommend that the Borough and the developer carefully weigh the issues associated with the proposed development and insure that the proposed development is conducted in such a way as to protect water quality and quantity in the newly proposed subdivision as well as on adjacent properties.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
ALASKA OPERATIONS OFFICE
Room 537, Federal Building
222 W. 7th Avenue, #19
Anchorage, AK 99513-7588

March 12, 2008

Reply To: ETPA-083

Mr. Paul Hurlbert, Platting Officer
Platting Division
Matanuska-Susitna Borough
350 East Dahlia Avenue
Palmer, AK 99645

RE: Drainage Plan for Paradise Park Subdivision

Dear Mr. Hurlbert,

The U.S. Environmental Protection Agency (EPA) received the materials distributed by the Matanuska-Susitna Borough's (Borough) Platting Division on March 10, 2008. These materials relate to the drainage plan for the preliminary plat master plan for Paradise Park Subdivision and included a notice for the public hearing to be held 20 March 2008. We understand that our comment letter of February 26, and a response letter from Olympus Engineering dated March 5, may be addressed at this hearing.

The EPA would like to take this opportunity to apologize for and clarify any misunderstanding generated by our comment letter of February 26. As previously identified, that letter was in response to materials on the revised drainage plan received from the Platting Division on February 15th, and was submitted in the context of our previous comments (15 May 2006) and project file.

The Platting Division did not solicit an agency position regarding the proposed Paradise Park Subdivision or the revised drainage plan; and our February 26 comments do not identify an agency position on either matter. It was not our intent to make statements that would be construed as representing support for or opposition to the overall project. Nor was it our intent to impugn the skill, professional judgment, or integrity of any individual involved in the project or review process. We regret if our comments were interpreted as such.

As the EPA does on a daily basis, we provided technical information for the consideration of the Platting Division staff and members of the Platting Board. We strive to be objective and present information which is supported by the project file and which can be independently verified. If we have stated something in error, it is important to us that the public record be corrected. With this in mind, we will evaluate the statements from our earlier letter to which exception has been taken by Mr. Matthew J. Nardini, P.E.

We stated in our comments that the proposed 25 foot wide drainage easement may be inadequate because the runoff calculations did not account for runoff from outside the 867, 263 square-foot Drainage Area delineated on the Drainage Plan. We indicated that the swale would likely receive runoff from parcels to the north of the subdivision, as well as from lots 1, 2, and part of lot 3 in Block 3. We concluded this statement by saying: "The area likely draining to the swale from the north is smaller than that within the subdivision, but the volume of water generated from this area should not be discounted in calculating the necessary size of the drainage easement."

Mr. Nardini acknowledges that a small portion of the northern parcels does drain to the swale, but indicates that site visits with Borough staff have demonstrated that the runoff from this area is not an "appreciable amount." We do not doubt the accuracy of Mr. Nardini's response, but stand by our earlier comment that the entire drainage area should have been used to maximize the accuracy of the runoff calculations.

The next issue is where we reach a distinctly different conclusion than Mr. Nardini. We stated in our comments that we felt the calculated swale widths identified as necessary to contain runoff were unrealistic. The swale widths of 7.256 feet (summer) and 11.755 feet (frozen) were calculated from the assumed depth of 1.5 feet for water storage in the swale area. This calculation supposedly yields the swale width needed to accommodate the given volume of water at a 1.5 foot depth.

The conclusion stated in the runoff calculations dated 19 October, 2007 is as follows: "Based on the Above Calculations, a 15' area centered along the bottom of the drainage swale as shown on the attached runoff calculation sheet, will be adequate to retain all of the anticipated runoff in the design storm events." We do not agree with this conclusion.

This conclusion would be correct if the application was to design a container or receiving body such as a ditch with sufficient volume to accommodate a known discharge. In this case, however, we are interested not in calculating the theoretically necessary capacity of the swale, but in measuring the swale's actual physical capacity.

Surface runoff from the delineated drainage area is being directed to the existing natural swale in the northern part of the proposed subdivision. The volume of this runoff under frozen conditions has been calculated as 17, 560 ft^3. The critical question is whether the swale has sufficient capacity to accommodate this runoff volume. (If the capacity is sufficient to accommodate the larger volume, it is also true that it will accommodate all lesser volumes. Our calculations yielded 17, 952 ft^3, likely due to differences in rounding.)

To answer this question, we have to physically measure the swale. It is an existing landscape feature, and it has a capacity (volume) that is controlled by its length and cross-sectional characteristics. This volume can be calculated based on measurements of its length, width, and depth. Once the cross-sectional area and the length of the swale are known, an inundation depth and width can be calculated for any projected runoff volume. This is what we meant when we stated that the equation should have been reversed.

Although we have not measured the swale, we can utilize Mr. Nardini's numbers to test if his conclusion is reasonable. Please refer to the attached figure for the following discussion.

In response to our comments, Mr. Nardini states that the Borough will regulate activities within the drainage easement and may require whatever is necessary, including larger or multiple culverts "to allow for flow and adequate water volumes." The Borough will also ensure that "development within the drainage swale, including driveways…would allow for adequate drainage of the subdivision." While this is perfectly correct, our comments were not directed at the authority of the Borough to manage the drainage easement, but whether the drainage plan as submitted was sufficient to "to allow for flow and adequate drainage of the subdivision."

Mr. Nardini pointed out that since no septic systems would be installed within the drainage easement, there would be no impact to systems on the lots mentioned if they were installed according to state law.

While it may be true that no systems will be installed within the drainage easement itself, 18 AAC 72(b) does not require any separation distance from a drainage swale for an onsite septic system. This means that a septic drain field could be installed right up to the edge of the drainage easement. If that was the case, the drain field could drain to the swale, which is a topographic low point. And if water were impounded in the swale, this could infiltrate laterally and affect the percolation rate of the drain field, in the same way that seasonally high groundwater does.

In our February 26 comments we stated that "The Drainage Plan does not appear to include any provisions for runoff from the sixteen lots outside of the delineated Drainage Area." In making this statement, we perhaps misunderstood the expectations of the Platting Division and Board regarding what the drainage plan should address. Before leaving this issue, however, we will respond to several of Mr. Nardini's statements concerning existing protections for the stream and Paradise Lake.

In his response to our comments, Mr. Nardini states that "the MSB has a 75' setback from water bodies, and this distance in Natural Vegetation would filter and mitigate any runoff. The new land use permit will also insure proper protection from runoff directly into the lake." His first statement is substantially correct, although vegetated buffers of less than 100 feet are not very effective at removing nitrogen from runoff. Regardless, the Borough's existing 75' setback applies only to residential structures and does not require the retention of vegetation. The setback requirement by itself does not protect surface water from runoff. And beyond requiring compliance with existing Borough standards, the land use permit contains no specific measures that could "insure proper protection from runoff."

Wetlands are impacted by runoff in the same way as other surface waters, but it does not therefore follow that the U.S. Army Corps of Engineers (Corps) regulatory program protects surface waters from runoff. The development of land adjacent to the lake or creek does not necessarily require consultation with the Corps. The 404 Program only regulates the placement of dredged or fill materials into waters, including wetlands that are jurisdictional under the Clean Water Act. The program does not address runoff generated by upland activities, and it also does not prevent all impacts to wetlands.

One point which we neglected to make in our earlier comments is that we believe stormwater will pond against the embankment of Road A at lots 5 and 6 of Block 2. The Drainage Plan indicates that water will move along the road back to the intersection with East Paradise Lane. This will not occur, however, as the runoff is originating at a lower elevation than that of the road. The natural drainage from these lots is almost due south towards Paradise runoff. The merits of this recommendation are pointed out in the Federal Emergency Management Agency's (FEMA) 1995 technical manual titled *Managing Floodplain Development In Approximate Zone A Areas: A Guide For Obtaining And Developing Base (100-Year) Flood Elevations*. This document states: "If a community can work with the developer and others when land is being subdivided, many long-term floodplain management benefits can be achieved, particularly if the floodplain is avoided altogether."

FEMA identifies that one way to achieve these benefits is for "the entire approximate Zone A to be dedicated as open space. If the planned subdivision shows the floodplain is contained entirely within an open space lot, it may not be necessary to conduct a detailed engineering analysis to develop BFE data."(pp. III-3)

The EPA respects Mr. Nardini's right to disagree with the recommendations contained in our February 26 comments, including our recommendation that the necessary swale widths be re-calculated and our recommendation that the soil test pit and percolation results be evaluated to determine whether separation distances should be increased for any of the lots. All we can say in response is that these recommendations are not "based on a 'non-development" view."

The EPA appreciates the opportunity to provide input pursuant to this review and to clarify our earlier comments. We are prepared to assist the Borough in any way we can to address the issues raised in this letter. If you have any questions regarding our comments, please contact me at (907) 271-1480, or by email at lacroix.matthew@epa.gov.

Sincerely,

Matthew LaCroix

Matthew LaCroix, Biologist
Aquatic Resources Unit, Alaska Operations Office
Office of Ecosystems, Tribal and Public Affairs

From: **Linda Fisch** akfish@mtaonline.net
Subject: Fwd: Updated email from Mat LaCroix note the first line
Date: April 2, 2016 at 12:01 PM
To: Gene C (DEC) Mccabe gene.mccabe@alaska.gov

Email on latest septic situation EPA

Linda Fisch

From:	LaCroix, Matthew <LaCroix.Matthew@epa.gov>
Sent:	Friday, January 29, 2016 5:07 PM
To:	Linda Fisch
Subject:	RE: question are you still working there?

Linda,

Good afternoon. I received your photos and the subdivision plat. The 100-foot septic setback from the creek is clearly shown on the plat. ADEC has to justify any waiver to separation distances, and I think a waiver would be hard to justify given the owners of the lot should have been aware of the restriction.

The information in my previous comment letter may be applicable, in which case ADEC should take it into consideration when evaluating a requested waiver. It is not binding on them. I will review the letter, as my memory does need refreshing. That was a few years back now.

I never said that mines were more exciting, but the EPA has an obligation to review proposals when thousands of acres are at stake. I certainly understand that you want to protect your local lake, and I applaud your willingness to raise awareness about this potential problem. Active neighbors are critical to ensuring that environmental standards are followed.

I will pass all of this information to Mark Jen in our office. I will talk with him on Monday and make sure that he talks to Michael Gala and Michael's supervisor. We will have some eyes on it. You are correct that the situation will be different if the fill is not in a wetland, but we will certainly do what we can.

Thanks

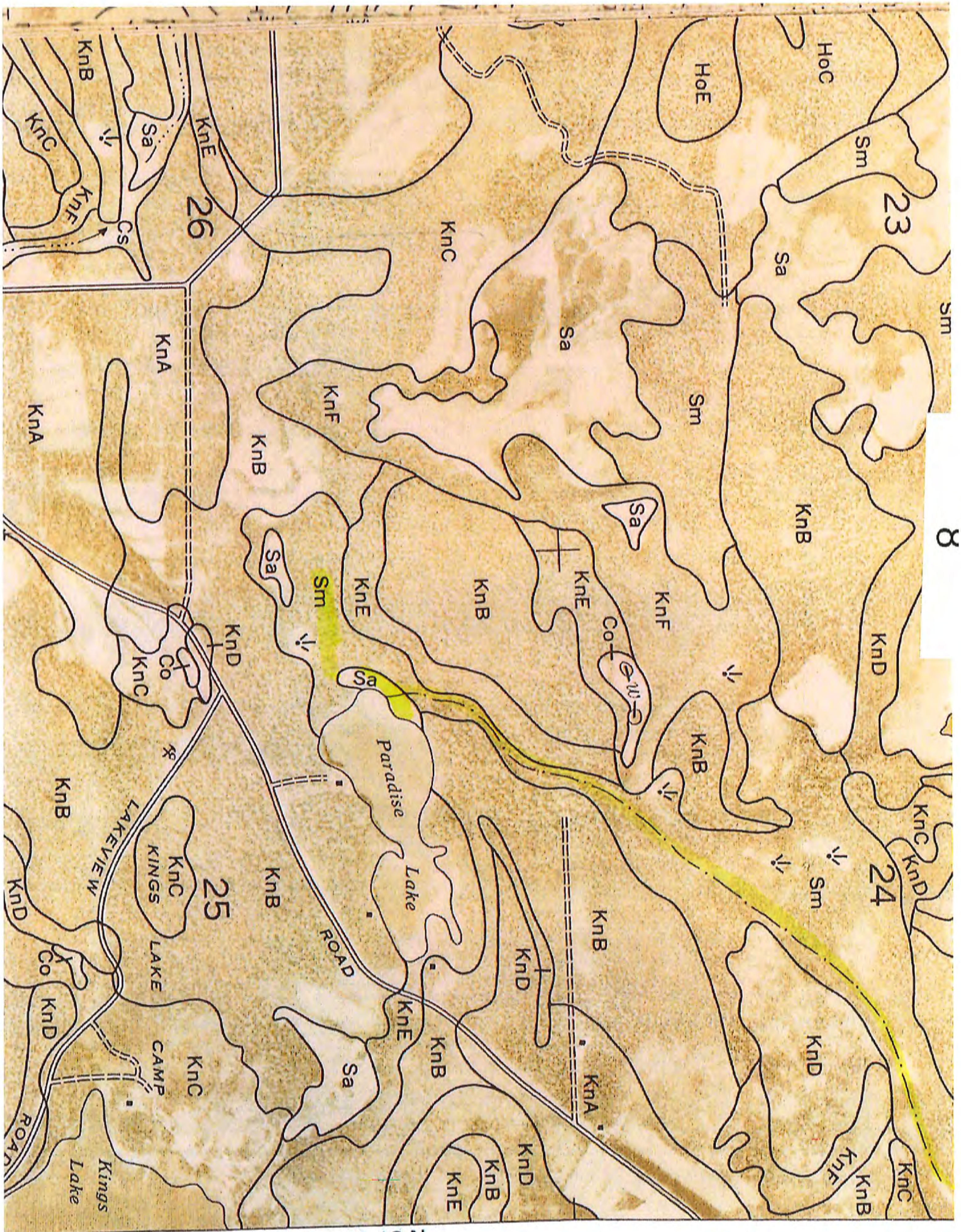
Matthew LaCroix
Aquatic Resources Unit
Office of Ecosystems, Tribal & Public Affairs Alaska Operations Office
(907) 271-1480

-----Original Message-----
From: Linda Fisch [mailto:akfish@mtaonline.net]
Sent: Friday, January 29, 2016 4:48 PM
To: LaCroix, Matthew <LaCroix.Matthew@epa.gov>
Subject: RE: question are you still working there?

I am worried that if the Corp does not recognize it as wetlands these people may be able to keep their septic and such south of the line . No permits have been issued at all. I am just shocked that the EPA considered this wetland and a septic has been installed approx. 30 ft south of the creek/ flood Hazard. The DEC has not passed anything yet as I am having the Engineer investigated as I do not believe there is enough distance between bodies of water.

I am hoping some of the language would stick YOU wrote a letter in 08 I will forward to you describing this situation inlet to the lake. You recommended that the vegetation be retained for the drainage of the other lots on the hill , now all vegetation is gone clear cut. Does any of your language hold any merit over DEC?

Thank you



sheet 31)

T. 18 N.

row sandy strips adjoining some streams were included in mapping.

All crops commonly grown in the Area can be grown on this soil, but yields are limited by lack of moisture during extended dry periods. (Management group 10)

Rough Mountainous Land

Rough mountainous land (Rm) consists of very steep rough areas on buttes and mountain slopes. Slopes vary abruptly. They range from 45 to more than 100 percent in gradient and are broken by numerous cliffs. Bedrock is exposed in many places, but in most places it is covered by a thin mantle of loess. This land commonly borders Jim soils, and patches of Jim soils were included in mapping. Patches of grass or clumps of white birch, white spruce, and quaking aspen are common where there is a thin covering of silt.

This land is not suited to farming and is poorly suited to forestry. (Management group 35)

Salamatof Series

The Salamatof series consists of very poorly drained, deep peat soils in nearly level muskegs. They are the most extensive organic soils in the Area. The peat material is dominantly coarse and is derived chiefly from sphagnum moss and sedges.

The native vegetation consists of a thick mat of sphagnum moss, plus bog birch, willows, scattered sedges, and many kinds of low-growing plants common in northern muskegs. In places there are forests of black spruce.

Representative profile of Salamatof peat in the SW¼ SW¼ sec. 16, T. 17 N., R. 3 W., Seward Meridian:

0 to 10 inches, undecomposed moss peat; strong brown (7.5YR 5/6) when wet, light yellowish brown (10YR 6/4) when squeezed dry; a few pockets of coarse sedge peat; roots of woody shrubs plentiful; extremely acid; gradual boundary.

10 to 50 inches +, moss peat; dark reddish brown (5YR 3/3) when wet, dark yellowish brown (7.5YR 4/4) when squeezed dry; interlayered with sedge peat; contains a few layers of finely divided peat; many woody fragments; thin mineral layer near bottom of horizon; extremely acid; 30 inches to many feet thick.

Salamatof peat (Sa).—This is the most extensive soil in the Area. It is in level muskegs that range from a few acres to several hundred acres in size. A few areas of poorly drained mineral soils along small streams or around muskegs were included in mapping.

Except for scattered black spruce trees, 80 percent of the acreage is not forested. Stands of paper birch, willows, and stunted slow-growing black spruce occupy the other 20 percent. The water table is usually near the surface, but it fluctuates and, in places, drops to a depth of several feet during extended dry periods.

This soil has no potential value for crops. Artificial drainage is not feasible. (Management group 34)

Salamatof peat, ever frozen variant (20 to 45 percent slopes) (Sf).—This soil is on the north-facing slopes of sharp ridges southwest of Palmer. The peat consists mostly of extremely acid, undecomposed moss. It is perennially frozen below a depth of 15 to 30 inches. The native vegetation consists of stunted black spruce, low-growing shrubs, and a surface layer of live moss.

This soil is not suitable for crops or pasture and should remain in native vegetation. (Management group 34)

Schrock Series

The Schrock series consists of well drained to moderately well drained soils that formed in thick deposits of water-laid silty and fine sandy material underlain by coarse sand and gravel. The upper layers are dominantly silty, and the lower layers are dominantly very fine sand.

These soils are on nearly level and undulating plains along some of the streams that flow from the Talkeetna Mountains. They are browner than the Susitna soils.

The Schrock soils support forests that consist mostly of paper birch and white spruce, but patches of alder, willow, and large cottonwood (balsam poplar) trees are fairly common.

Representative profile of Schrock silt loam in the NE¼ NW¼ sec. 19, T. 18 N., R. 1 W., Seward Meridian:

O11—3 to 2 inches, mat of undecomposed leaves, stems, and twigs; abrupt, smooth boundary. 1 to 3 inches thick.

O12—2 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing organic material; many fine roots and mycelia; extremely acid; abrupt, wavy boundary. 1 to 4 inches thick.

A11—0 to 1 inch, dark reddish-brown (5YR 3/2) silt loam; weak, fine, granular structure; very friable; many fine roots; extremely acid; abrupt, irregular boundary. ½ inch to 3 inches thick.

A12—1 inch to 3 inches, dark-brown (7.5YR 3/2) silt loam; patches of dark grayish brown; weak, medium, granular structure; friable; roots abundant; extremely acid; clear, wavy boundary. 2 to 6 inches thick.

B2—3 to 8 inches, dark-brown (10YR 4/3) silt loam; common, fine, distinct mottles of reddish brown; weak, medium, granular structure; friable; roots plentiful; very strongly acid; clear, wavy boundary. 2 to 12 inches thick.

B3—8 to 22 inches, patchy dark yellowish-brown (10YR 4/4) and dark grayish-brown (2.5Y 4/2) silt loam; lenses of very fine sand; weak, thin, platy structure; friable; few roots; very strongly acid; gradual, smooth boundary. 6 to 18 inches thick.

C1—22 to 34 inches, dark grayish-brown (2.5Y 4/2) very fine sand and silt strata; few, thin, dark-brown streaks; massive; friable; micaceous; strongly acid; clear, smooth boundary. 10 to 20 inches thick.

IIC2—34 to 52 inches, olive-brown (2.5Y 4/4) sandy and gravelly strata with thin lenses of olive-gray silt loam; micaceous; single grain; loose; strongly acid. Many feet thick.

These soils are extremely acid near the surface and strongly acid in the lower layers. The upper mineral layers are dominantly silty but contain fine sandy layers that vary in number and thickness. Black fragments of charcoal and reddish-brown pockets of organic matter are buried in the upper part of the profile. The depth to coarse sandy and gravelly material ranges from 24 to 50 inches.

Schrock silt loam, nearly level (0 to 3 percent slopes) (ShA).—This is the more extensive soil in the Schrock series. It is on low terraces and plains near secondary streams and, in places, is dissected by a few abandoned stream channels as much as 3 feet deep. Small patches of Susitna soils and Gravelly alluvial land were included in mapping.

In a few places this soil is flooded for short periods. Most of it is forested, but a few small tracts have been

SOIL SURVEY

Matanuska Valley Area Alaska

OUR SOIL ★ OUR STRENGTH

Issued June 1968

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Alaska Agricultural Experiment Station

Contents

NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued June 1968

SOIL SURVEY OF MATANUSKA VALLEY AREA, ALASKA

BY DALE B. SCHOEPHORSTER

FIELDWORK BY DALE B. SCHOEPHORSTER, JAMES A. DEMENT, JOHN A. FERWERDA, ROBBIE L. FLOWERS, ORVILLE L. HASZEL, JAMES H. LEE, WILFRED J. SHEEHAN, AND CHARLES M. THOMPSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE ALASKA AGRICULTURAL EXPERIMENT STATION

THE MATANUSKA VALLEY AREA is a part of the Cook Inlet-Susitna Lowland of south-central Alaska (fig. 1). The Area includes approximately 700 square miles of land within the Palmer and Wasilla Soil Conservation Subdistricts. It is bounded on the north by the Talkeetna Mountains, on the east by the Chugach Mountains, and on the south by waters of the Knik River, Knik Arm, and Cook Inlet. On the west it borders the Susitna Valley Area.

The principal centers of population are the city of Palmer and the villages of Wasilla, Willow, and Sutton. Numerous cabins, business establishments, and homes are concentrated around Big Lake and several of the other larger lakes. The rural population is generally located near roads and highways. Several fairly large tracts in the southwestern and western parts of the Area are almost roadless and very sparsely settled. According to the U.S. Census, the total population of the Matanuska Valley Area in 1960 was about 5,138.

General Nature of the Area

Two large glacier-fed streams, the Matanuska River and the Knik River, flow from the east and empty into tidal water at the head of Knik Arm. In the northeastern extension of the survey Area, the Matanuska River flows through a narrow valley bordered on each side by steep mountains. Between the braided flood plains of the river and the mountain foot slopes are a series of terraces interrupted by steep escarpments, V-shaped valleys, and hilly moraines. To the south and west, the valley opens to a broad lowland that makes up the major part of the survey Area. Although most of this lowland lies between 150 and 500 feet above sea level, extreme elevations in the Area range from sea level at the tidal flats along Knik Arm to about 2,000 feet on mountain foot slopes.

Broad, nearly level alluvial plans border the braided flood plains of the lower Matanuska River and the Knik River. Rising above these low-lying tracts are a series of broad, nearly level terraces that extend to rolling and hilly glacial moraines and outwash plains, which dominate the central and western parts of the Area. Poorly drained muskegs, lakes, and small streams are also features of the landscape in most sections of the Area. Broad, nearly level tidal plains border much of Knik Arm and Cook Inlet.

Geology

The entire Matanuska Valley Area has been glaciated several times (*5*).[1] As a result, most of the bedrock is buried beneath thick deposits of glacial drift and alluvial sediments. These deposits are made up largely of loose, coarse, sandy and gravelly material.

Near Goose Bay and southeast of Houston, however, there is a belt of rolling moraines that consist mostly of moderately firm and firm glacial till. Weathered shale underlies a thin deposit of firm till on a few benchlike ridges near Houston. Thick beds of sand and gravel deposited by glacial rivers and streams form broad nearly level and undulating terraces in the eastern part of the Area. Bordering the Matanuska and Knik Rivers there are nearly level alluvial plains that consist largely of silty and fine sandy sediments underlain by thick deposits of gravel and stones. Less extensive tracts of alluvial soils also border most of the smaller rivers and streams. The tidal plains along Knik Arm consist of silty and clayey sediments.

Almost the entire Matanuska Valley Area is covered with a mantle of loess derived from the barren flood plains of glacier-fed streams (*11*, *13*). Large amounts of windblown material like that in figure 2 are still being deposited in places along the Matanuska and Knik Rivers. Adjacent to these streams are dunelike bluffs where wind-laid material is dominantly sandy and as much as 50 feet thick. Within short distances from the source, however, the mantle thins out rapidly and is dominantly silty. Within a mile or two of the source, the loess mantle is about 30 inches thick. Westward, it gradually thins out to about 10 inches. Near the western boundary of the Area, however, the loess mantle again is thicker and evidently consists of older deposits that probably were derived from the flood plains of the Susitna River and its major tributaries.

Geological deposits

Large deposits of gravel and sand, suitable for road construction and for concrete, occur throughout most of the Area. Bituminous coal is being mined near Sutton, and explorations for oil have recently been made in several parts of the Area. A deposit of marl near Wasilla is

[1] Italic numbers in parentheses refer to Literature Cited, p. 66.

Figure 2.—**Small amounts of loess originating on the flood plains of the Knik and Matanuska Rivers are deposited annually on Bodenburg and Knik soils.**

To the west, toward the flatlands of the lower Susitna Valley, the sheltering effect of the mountains diminishes rapidly. The western edge of the Area may receive precipitation from almost any inland movement of air up Cook Inlet, and the southerly winds bring abundant rainfall. Consequently, precipitation in the west is heavier and more uniform throughout the year than in the eastern part of the Area.

Precipitation in the Area is seldom excessive for crop needs. In the eastern part of the Area, which is the major farming section, the average annual precipitation is only about 16 inches. Precipitation is especially light in the early part of the growing season. This is partly offset by moisture in the soil from thawing and from melting snow, but a moderate to severe moisture deficiency may develop in June and July. During this period sprinkler irrigation generally improves crop yields. Precipitation is heaviest in late summer and early autumn. Artificial driers are needed for hay and grain harvested during this time of year.

Temperature

Cold air drainage down steep mountain slopes and through canyons affects the temperature of the Matanuska Valley, especially the eastern part. This downslope movement of air, however, does not always result in colder temperature. While cold air drainage brings freezing temperature to some areas, it prevents local radiation in other areas from driving the temperature below freezing. The areas most exposed to cold air drainage, especially to canyon drainage, escape the freezes that occur in spring and fall in other areas where the air is calm and heat leaves the soil through radiation. Table 2 shows, for four weather stations, the average dates for the beginning and the end of periods during which temperature is equal to or above 24, 28, or 32° F. These data indicate that, as a rule, the shortest freeze-free seasons occur in areas farthest from the mountains, such as the Susitna station in the west, or at higher elevations, such as the Chickaloon station in the extreme northeast.

The probability of having seasons of various lengths in which the temperatures will not fall below stated limits is shown in figures 3 and 4. The probabilities in figure 3 are based on records from 1921 through 1963. Those in figure 4 are based on records from 1942 through 1963. This information is useful to farmers and others operating outdoor enterprises. For example, in 5 out of 10 years, or 50 percent of the time, one can expect a season of 108 days in which the temperature will not drop below 32 degrees at the Matanuska Agricultural Experiment Station; however, a season of 125 days in which the temperature does not drop below 32 degrees can be expected in only 1 year out of 10, or 10 percent of the time.

in the Matanuska Valley Area, Alaska

Chickaloon [3] (elevation—929 feet)					Susitna [4] (elevation—50 feet)				
Temperature			Precipitation		Temperature			Precipitation	
Average	Average maximum	Average minimum	Average	Average snowfall	Average	Average maximum	Average minimum	Average	Average snowfall
°F.	*°F.*	*°F.*	*Inches*	*Inches*	*°F.*	*°F.*	*°F.*	*Inches*	*Inches*
8. 1	17. 0	0. 9	0. 87	11. 2	12. 6	22. 8	2. 4	1. 38	14. 5
13. 6	23. 5	3. 7	1. 03	12. 6	22. 1	31. 2	13. 0	1. 28	10. 1
19. 8	30. 3	9. 2	1. 19	13. 4	23. 3	34. 9	11. 7	1. 16	9. 8
31. 1	42. 2	19. 9	. 41	3. 0	36. 1	48. 0	24. 2	. 88	2. 3
44. 7	57. 0	32. 3	. 38	([5])	45. 8	59. 6	32. 1	1. 45	. 6
53. 3	66. 6	39. 9	1. 06	([5])	55. 4	69. 4	41. 4	1. 69	0
56. 2	68. 0	44. 3	1. 73	0	58. 1	70. 1	46. 2	2. 55	0
54. 1	65. 3	42. 8	1. 91	0	55. 3	65. 7	45. 0	5. 51	0
45. 4	56. 2	34. 5	2. 32	. 1	47. 1	56. 6	37. 6	5. 07	0
33. 2	41. 5	24. 8	1. 18	5. 4	36. 2	44. 2	28. 2	3. 46	3. 8
19. 2	26. 8	11. 5	. 77	7. 6	22. 1	31. 0	13. 2	1. 82	10. 4
10. 8	18. 7	2. 9	. 94	15. 4	14. 6	24. 3	4. 9	1. 71	12. 3
32. 5	42. 8	22. 1	13. 79	68. 7	35. 7	46. 5	24. 9	27. 96	63. 8

[3] Precipitation and snowfall are based on 11 years of record through 1933; temperature is based on 13 years of record through 1933; station closed July 1933.

[4] The Susitna station is on the Susitna River about 15 miles west of the survey Area. Precipitation and snowfall are based on 14 years of record through 1947; temperature is based on 12 years of record through 1947; station closed July 1947.

[5] Trace.

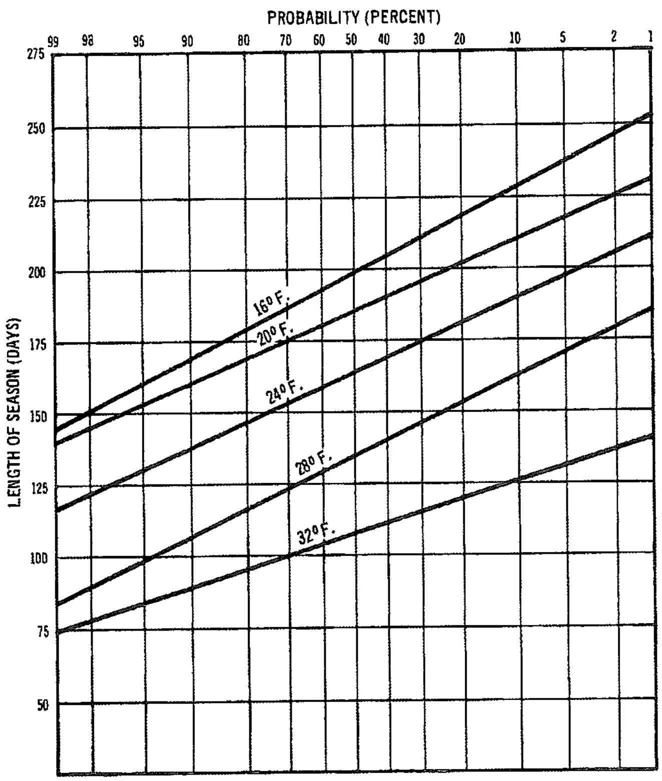


Figure 3.—**Probable number of days per year that temperature will not drop below specified degrees at Matanuska Agricultural Experiment Station, Matanuska, Alaska.**

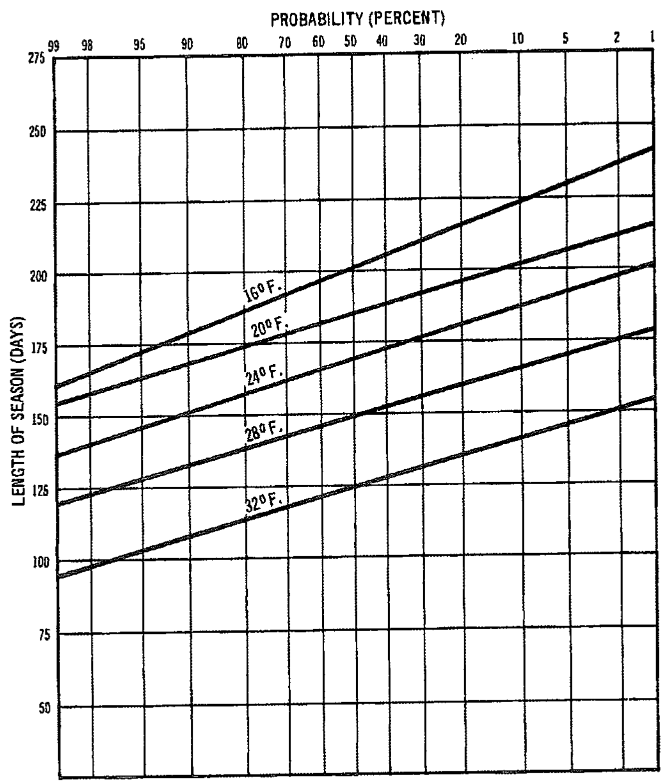


Figure 4.—**Probable number of days per year that temperature will not drop below specified degrees at Palmer, Alaska.**

in many muskegs, either as small isolated trees or as dense clumps surrounded by open muskeg.

The vegetation in grassy openings on elevated benches and mountain foot slopes above 1,000 feet is mostly bluejoint reedgrass. Fireweed and other forbs are also common in these areas. Dense thickets of alder, devilsclub (*Oplopanax horridus*), and willow are interspersed with the patches of grass and forbs, and they are dominant along many of the small drainageways.

The vegetation on clayey soils of the tidal plains consists mostly of sedges (*Carex* spp.), forbs, and grasses. This vegetation is described in detail by Hanson (*3*). Tidal flats that are inundated regularly by high tides ordinarily have no plant cover.

Farming

Early prospectors and settlers of the Area had practically no interest or experience in farming, but small-scale farming began about 1900, mainly in the form of gardening by villagers and roadhouse operators, who sold surplus vegetables to miners and prospectors. Some native hay was also harvested for horses that were used in hauling freight.

As mining expanded and the population increased, the demand for farm products increased. By 1914 about 300 acres of land had been cleared and a number of settlers interested primarily in farming were establishing homesteads. Potatoes and other vegetables were the major crops, and some oats were raised for horse feed.

A Matanuska Farmers' Association was organized in 1915. Farming activities expanded following the construction of the Alaska Railroad and the establishment of an experimental farm near Matanuska by the Alaska Agricultural Experiment Station. During the 1920's most of the homesteaders in the Area relied on other employment to supplement farm income, but a few of them became successful farmers. Dairy cattle and machinery were brought in, and this led to greater diversification and a more stable farm income.

The greatest single impact on farming in the Area came in 1935 with the development of the federally sponsored Matanuska Colony. In the spring of that year, 202 families numbering about 900 persons, mostly from the north-central States, were moved to the Area and began intensive farm development near Palmer. A few of these original colonists expanded their operations and formed the nucleus of what is now the most highly developed agricultural area in Alaska (*4*).

In 1963 the farm income of the Area was nearly 70 percent of the State's total farm income. Dairying and truck farming were the most important farm enterprises. More than 60 percent of the farm income was from milk. Potatoes were the most valuable cash crop. Poultry products, beef and veal, and some pork provided income for a few farmers.

The total cropland harvested in 1963 was a little more than 12,000 acres (*9*). The crops and acreage were approximately as follows: Grasses for hay and silage, 5,300 acres; oats, barley, and mixtures of small grains for hay, silage, and feed, 6,200 acres; potatoes, 400 acres; cabbage, carrots, and lettuce, 115 acres; radishes, celery, and other vegetables, 25 acres.

History, Settlement, and Industry

Fur trading was the principal enterprise in Alaska during the period of Russian settlement, 1741 to 1867. Except for fur trading with the Athabascan Indians, the Matanuska Valley Area was virtually untouched and unexplored during this period. After the purchase of Alaska by the United States in 1867, conditions remained generally stagnant until the discovery of gold in the upper Cook Inlet Region in 1896. This marked the beginning of white settlement in the Matanuska Valley Area.

The first major center of population was located at Knik, where a trading post was established about 1900 and a post office in 1905. This village was a major point of departure for prospectors and miners. Many trails, several of them still evident, radiated from Knik to places in the interior. The best known of these was the Iditarod Trail, a 364-mile route through Rainy Pass, in the Alaska Range, to Flat, which was the center of mining activities in the Kuskokwim Mountains. Knik continued as the transportation and trading center of the Area and reached a peak population of about 700 in 1915. During this early period of settlement, a number of homesteads were established around Knik and along the radiating trails.

When the Alaska Railroad was constructed in 1916, it bypassed Knik, and the trade and population shifted to the new villages of Wasilla and Matanuska, which were along the railroad right-of-way. Also that year, a railroad siding was constructed at the present site of Palmer on a branch line to the Chickaloon coalfields. Soon afterward, a post office was established there. Mining camps and trading centers were also established at Chickaloon, Sutton, Eska, Houston, Pittman, and Willow.

In 1935 a group of families, known as the Matanuska Colony, settled on the land surrounding Palmer, and Palmer soon became the major business and population center of the Area (*4*).

Nearly all of the Matanuska Valley Area now has access to electric power, telephones, and transportation. Modern schools are located at Palmer, Wasilla, and Willow, and rural schools are in several other communities. Roads serve most of the rural communities, and major highways connect the Area with Anchorage, Fairbanks, and other cities in the State.

Although farming is the principal enterprise in the Area, coal mining and tourist trade are also important. Coal mines operate near Sutton, and various businesses that serve tourists are located throughout the Area. Until recently, forestry in the Area consisted chiefly of small logging operations and sawmills that supplied building logs, mine timbers, and some lumber to local markets. Recently a larger sawmill was established near Wasilla.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in the Matanuska Valley Area, where they are located, and how they can be used.

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is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

Following are descriptions of the 12 soil associations in this Area.

1. Bodenburg association

Gray, well-drained, silty or very fine sandy upland soils that are deep over sand and gravel

Broad, nearly level and undulating plains, broken by a few narrow terrace escarpments, low ridges, and scattered hills, are characteristic of this soil association, which covers some 20 square miles near Palmer.

Bodenburg silt loam and Bodenburg very fine sandy loam, the major soils in this association, formed in a mantle of grayish wind-laid material 2½ to 10 feet thick over water-worked sand and gravel. Bodenburg silt loam, the most extensive soil, is mostly on the plains but also occupies a few hills and escarpments. Bodenburg very fine sandy loam commonly is nearer the Matanuska River than the silt loam.

Adjacent to flood plains of the Matanuska River are a few sandy, stabilized, dunelike hills and ridges of Anchorage sand. Also included in this association are minor areas of somewhat poorly drained Kalifonsky soils in slight depressions and a few poorly drained soils in small, scattered, low-lying sites.

This soil association is the most intensively farmed part of the Matanuska Valley Area (fig. 5). Dairying is the principal farm enterprise, but vegetable farming on a commercial scale is also important. Most of the nearly level and undulating soils are cultivated; the steeper soils are forested.

This association is in the path of strong, gusty winds that occasionally reach gale velocity as they funnel from the upper reaches of the Matanuska River and Knik River valleys. Consequently, unprotected cultivated soils are subject to blowing.

2. Doone-Knik association

Brown to grayish-brown, well-drained, silty upland soils that are deep to shallow over sand and gravel

This soil association is on high, nearly level to undulating terraces broken by many steep escarpments and rolling to hilly moraines. These terraces border the Bodenburg soils north of Palmer and extend northeastward up the Matanuska River valley, several miles beyond Sutton.

Doone soils, which are the most extensive, formed in 30 to 48 inches of silty wind-laid material over loose sand. Knik soils occupy about 25 percent of the association. They formed in 12 to 24 inches of silty material over loose coarse sand and gravel and are generally on higher terraces and slopes farther from the Matanuska River than the Doone soils. Homestead soils are on a few of the highest terraces and slopes. Poorly drained soils occur in scattered depressions and along minor drainageways.

Many farms are scattered on the nearly level to rolling tracts of land. They are commonly separated by ridges, ravines, or other rough terrain. Most of them are dairy farms (fig. 6), but a few are vegetable farms.

***Figure 5.*—An aerial view of farms on Bodenburg soils a few miles south of Palmer.**

The major soils in this association produce good yields if fertilized and otherwise properly managed. Cultivated fields are subject to blowing by the strong northeasterly winds.

Paper birch, quaking aspen, and white spruce are the principal forest trees. In places these trees are of merchantable size. The understory consists of many kinds of shrubs and plants useful primarily for wildlife.

3. Homestead association

Brown, well-drained, silty upland soils that are shallow over sand and gravel

This soil association is on a broad, nearly level outwash plain in the southwestern part of the Area. It is the largest tract of nearly level land within the survey boundary.

Homestead soils make up more than 75 percent of the association. These soils formed in a mantle of wind-laid silty material 10 to 18 inches thick over loose coarse sand and gravel. They are slightly deeper than Homestead soils in other parts of the Area.

Included in the association are small, widely scattered areas of Salamatof peat in poorly drained depressions.

Most of the association is sparsely settled, nearly roadless, and almost entirely forested, although Homestead soils are suitable for farming. The forest consists mainly of paper birch, quaking aspen, white spruce, and an understory of willows, alder, and low-growing shrubs. Merchantable stands of paper birch are fairly common.

4. Homestead-Knik association

Brown to grayish-brown, well-drained, silty upland soils that are shallow over gravel and sand

Hilly moraines, high terraces, and benchlike ridges bordering mountain foot slopes make up this association. It is in the eastern and northeastern parts of the Area.

Homestead soils, which are dominant, formed in a mantle of silty loess 10 to 15 inches thick over coarse gravelly material. Knik soils generally are at slightly lower elevations than Homestead soils. They formed in

In places the trees are merchantable. Dense forests of slow-growing black spruce are common on poorly drained sites, including some muskegs. Most of the muskegs, however, are nearly treeless and are covered with moss, sedges, and low-growing shrubs. Some of the burned-over areas support a dense growth of brushy vegetation that provides excellent browse for moose and habitats for other kinds of wildlife.

Many of the larger lakes are used for boating, camping, fishing, swimming, and other recreation.

6. Homestead-Nancy association

Brown to reddish-brown, well-drained, silty upland soils that are shallow or moderately deep over gravel and sand

This soil association is in the northwestern part of the Area. It is made up of hilly moraines, benchlike ridges, and high terraces. Many lakes, streams, and muskegs add to the complexity of the landscape.

Homestead soils and Nancy soils are almost equal in extent and have a wide range of slope. Both are well drained, and both formed in silty loess over gravelly material. Homestead soils are shallower to gravel than Nancy soils, which formed in 16 to 30 inches of silty loess and have a redder subsoil.

Among the minor soils is poorly drained Salamatof peat, which is in scattered muskegs. Other minor soils are poorly drained Slikok, Torpedo Lake, and Jacobsen soils along drainageways and streams and in depressions.

Most of this association is forested, but there are a few homesteads along the roads. The few fields are used mainly for hay or pasture. Much of the acreage is too sloping, too shallow, or too poorly drained for farming, but scattered tracts of Nancy soils are nearly level to rolling and are suitable for crops grown in the Area. The Homestead soils that are not too sloping are generally suited to crops that require only shallow tillage.

Forests in this association are in various stages of growth, depending chiefly upon their fire history. Paper birch, white spruce, and quaking aspen are the dominant trees. In places, the trees are of merchantable size. Some of the more recently burned sites support dense patches of seedlings and willows that provide excellent browse for moose and habitat for other kinds of wildlife.

7. Knik-Coal Creek association

Grayish-brown, well-drained, silty upland soils that are shallow over sand and gravel; and dark-gray, poorly drained soils in depressions

Small, gently undulating plains, hilly moraines, steep ridges, scattered lakes and depressions, and many small streams form the landscape of this association.

Knik soils are well drained and are nearly level to steep. They formed in a mantle of silty loess 15 to 24 inches thick over water-worked gravelly material. In general, these soils occupy a broad belt between the soils that formed in deep material recently deposited by wind near the Matanuska River and the soils that formed in older, thinner deposits of silty loess farther west. The poorly drained Coal Creek soils are in numerous small depressions, drainageways, and low areas bordering small streams.

Patches of poorly drained Slikok mucky silt loam are in seepage areas and drainageways, and Salamatof peat is in scattered muskegs. Somewhat poorly drained Kalifonsky soils occur in a few shallow depressions and on a few slopes shaded from direct sunlight.

Nearly all of the land in this association is privately owned. Farms and homesteads are in various stages of development. More than 50 percent of it is wooded, as much of it is too steep or too poorly drained for cultivation. Most of the cleared land is on well-drained, nearly level to rolling terraces and plains. Oats, barley, and perennial grasses are the principal crops, but potatoes and other vegetables are also grown.

Paper birch, quaking aspen, and white spruce are the dominant forest trees. The forest stands vary greatly in age, depending mainly upon their fire history. Some of the trees are merchantable, but there are large areas of seedling and saplings. These areas are brushy and are especially beneficial for wildlife.

Many cabins, summer homes, and permanent dwellings are located on the shores of the larger lakes.

8. Naptowne-Spenard association

Brown and dark-gray, well-drained and somewhat poorly drained, silty upland soils that are moderately deep to very shallow over glacial till

Glacial moraines are interspersed with low, nearly level muskegs in this association, most of which is in the southwestern part of the Area.

The well-drained Naptowne soils, which are dominant, are on undulating to moderately steep, irregular slopes. They formed in a shallow to moderately deep mantle of silty loess underlain by fairly firm gravelly glacial till. In places they are stony near the surface. The somewhat poorly drained Spenard soils are in broad drainageways and in nearly level and gently sloping areas bordering muskegs. Salamatof soils, which are fairly extensive in this association, are in the muskegs.

Most of this association has been homesteaded in recent years, but many scattered tracts are still publicly owned. More than 70 percent of it is forested, and much of it is too steep, stony, or wet for cultivation. Cleared fields are widely scattered and confined mostly to the less strongly sloping areas of Naptowne soils, which are generally suitable for crops, though stony in places. Artificial drainage is required for the Spenard soils if they are used for crops.

In general, the forests in this association are relatively mature. Paper birch, quaking aspen, and white spruce are dominant on the well-drained soils; black spruce is common on the poorly drained soils. In places, there are merchantable birch and quaking aspen, but the white spruce is widely scattered, and the black spruce is of little commercial value. The forest understory provides food and cover for many kinds of wildlife, but in general it is not so suitable for browsing as the understory in other areas where fires were more recent.

9. Salamatof-Jacobsen association

Very poorly drained, deep peat soils; and stony, very poorly drained soils on flood plains

This soil association occurs on several broad, nearly level, very poorly drained muskegs in the western part of

12. Susitna-Niklason association

Dark-gray, well-drained, silty or fine sandy soils that are shallow or moderately deep over coarser sediments on alluvial plains

Nearly level plains bordering major rivers and streams make up this soil association. Most of it is near the outlets of the Matanuska and Knik Rivers south of Palmer. Another tract is along Willow Creek in the northwestern corner of the Area.

Susitna soils formed in silty and fine sandy, water-deposited sediments underlain by gravel and coarse sand at a depth of 27 inches or more. Niklason soils formed in similar sediments but are shallower in depth to gravel. In places both the Susitna and Niklason soils are flooded occasionally for short periods.

Areas of these soils that escape flooding are suitable for cultivation, and all of the crops adapted to the Area can be grown on them. Average yields are slightly lower on the Niklason soils, which are shallower than the Susitna soils and tend to be droughty. The areas that are flooded are suited to perennial grasses.

Descriptions of the Soils

In this section the soil series and their component mapping units in the Matanuska Valley Area are described. Each soil series is described, and then the mapping units in that series. An important part of each series description is a description of a representative profile. All the mapping units in a series are assumed to have a profile essentially like the representative profile. For this reason, it is necessary to read the description of both the mapping unit and the soil series to get full information about any mapping unit.

The profile descriptions in this survey are detailed and contain technical terms for soil drainage, texture, structure, and other characteristics. These terms are defined in the Glossary. The significance of some of these is mentioned in the following paragraphs.

Slope greatly affects the management of a soil. The steepness of slope, and its shape and complexity, are indicated in the terms used. Soils with simple slopes are described as *nearly level* (0 to 3 percent), *gently sloping* (3 to 7 percent), *moderately sloping* (7 to 12 percent), or *strongly sloping* (12 to 20 percent). Soils having complex, irregular slopes are described as *undulating* (3 to 7 percent), *rolling* (7 to 12 percent), or *hilly* (12 to 20 percent). Soils that have both simple and complex slopes are described as *moderately steep* (20 to 30 percent) or *steep* (30 to 45 percent).

Drainage of a soil affects management. A *well-drained* soil, for example, commonly retains enough moisture for plant growth, but a *poorly drained* soil is wet so much of the time that growth of field crops is prohibited in most years.

Color frequently indicates drainage of a soil. Many well-drained soils, for example, are shades of brown, yellow, or red throughout their profile, as opposed to the blue and gray shades that show in poorly drained soils. Soil scientists describe soil colors approximately in words, and precisely in Munsell color notations; for example, "very dark brown (10YR 2/3)."

Texture indicates, among other things, behavior of a soil under tillage, its capacity to hold moisture for plants, and its resistance to water erosion or soil blowing. Texture is determined by relative content of sand, silt, and clay particles in a soil. Soils that are nearly all sand or all clay are difficult to manage.

Structure of a soil affects its tilth. The terms used indicate how individual soil particles are arranged into larger aggregates, such as blocks, plates, or prisms. The terms show, respectively, strength, size, and shape of aggregates; for example, "weak, fine, platy structure."

The location of all the soils described in this section is shown on the detailed soil map at the back of this publication. The acreage and extent of the soils are shown in table 3. The "Guide to Mapping Units" at the back of this publication shows the management group in which each mapping unit has been placed, and the page where that group is described.

TABLE 3.—*Acreage and proportionate extent of the soils*

[Dashes indicate the soil does not occur in the subdistrict]

Map symbol	Soil name	Palmer Soil Conservation Subdistrict	Wasilla Soil Conservation Subdistrict	Total Matanuska Valley Area	Proportionate extent
		Acres	*Acres*	*Acres*	*Percent*
AcC	Anchorage sand, undulating to rolling	530	-----	530	0.1
AcE	Anchorage sand, hilly to steep	150	-----	150	(1)
AhA	Anchorage silt loam, nearly level	-----	490	490	.1
AnB	Anchorage very fine sandy loam, undulating	-----	2,430	2,430	.5
AnC	Anchorage very fine sandy loam, rolling	20	920	940	.2
AnD	Anchorage very fine sandy loam, hilly	90	630	720	.2
AnE	Anchorage very fine sandy loam, moderately steep	200	200	400	.1
BbA	Bodenburg silt loam, nearly level	5,420	-----	5,420	1.2
BbB	Bodenburg silt loam, undulating	1,340	-----	1,340	.3
BbC	Bodenburg silt loam, rolling	470	-----	470	.1
BbD	Bodenburg silt loam, hilly	610	-----	610	.1
BdA	Bodenburg very fine sandy loam, nearly level	530	-----	530	.1
BdB	Bodenburg very fine sandy loam, undulating	770	-----	770	.2
BdC	Bodenburg very fine sandy loam, rolling	310	-----	310	.1

See footnote at end of table.

TABLE 3.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Palmer Soil Conservation Subdistrict	Wasilla Soil Conservation Subdistrict	Total Matanuska Valley Area	Proportionate extent
		Acres	*Acres*	*Acres*	*Percent*
SpA	Spenard silt loam, nearly level		1,300	1,300	.3
SpB	Spenard silt loam, gently sloping		760	760	.2
Su	Susitna silt loam	1,790	2,740	4,530	1.0
Sv	Susitna very fine sand	1,520		1,520	.3
SwA	Susitna and Niklason very fine sands, overflow, 0 to 3 percent slopes	910	370	1,280	.3
TaE	Talkeetna silt loam, moderately steep to steep		200	200	(1)
Te	Terrace escarpments	2,430		2,430	.5
Tf	Tidal flats	1,730	3,480	5,210	1.1
Tm	Tidal marsh	11,280	5,040	16,320	3.6
ToA	Torpedo Lake silt loam, nearly level	520	3,530	4,050	.9
ToB	Torpedo Lake silt loam, gently sloping	940	6,170	7,110	1.6
ToC	Torpedo Lake silt loam, moderately sloping	790	390	1,180	.3
ToD	Torpedo Lake silt loam, strongly sloping	520	190	710	.1
TpB	Torpedo Lake-Homestead silt loams, undulating	100	4,820	4,920	1.1
TpC	Torpedo Lake-Homestead silt loams, rolling	140	4,380	4,520	1.0
TpD	Torpedo Lake-Homestead silt loams, hilly	110	2,870	2,980	.7
TpE	Torpedo Lake-Homestead silt loams, moderately steep		350	350	.1
Wa	Wasilla silt loam	1,960	1,040	3,000	.7
	Total land area	135,100	314,200	449,300	100.0
	Water area	5,500	19,490	24,990	
	Total map area	140,600	333,690	474,290	

[1] Less than 0.05 percent.

Anchorage Series

The Anchorage series consists of deep, excessively drained sandy soils on stabilized dunes. Choppy, undulating to steep slopes predominate, but a few small areas are nearly level.

These soils are moderately extensive on low hills along Knik Arm and Big Lake, and they also occur as scattered, hilly to steep areas along the Matanuska and Knik Rivers. They support forests that consist mainly of paper birch, white spruce, and aspen. A few tracts are used for crops and pasture.

Representative profile of Anchorage very fine sandy loam in the SE¼NE¼ sec. 34, T. 16 N., R. 3 W., Seward Meridian:

O1—2 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing organic materials; extremely acid; abrupt, wavy boundary. 1 to 3 inches thick.

A2—0 to 1 inch, gray (10YR 5/1) silt loam; very weak, medium, platy structure; very friable; plentiful roots; extremely acid; abrupt, irregular boundary. 1 to 2½ inches thick.

B21—1 inch to 2 inches, dark-brown (7.5YR 4/4) very fine sandy loam; pockets of yellowish red (5YR 4/6); weak, medium, granular structure; very friable; plentiful roots; extremely acid; abrupt, irregular boundary. ½ inch to 2 inches thick.

B22—2 to 6 inches, brown (10YR 4/3) very fine sandy loam with yellowish-brown streaks and patches; very weak, medium, granular structure; very friable; very strongly acid; plentiful roots; clear, wavy boundary. 3 to 8 inches thick.

B3—6 to 12 inches, light olive-brown (2.5Y 5/4) fine sand; single grain; loose; few roots; strongly acid; clear, wavy boundary. 4 to 12 inches thick.

C—12 to 40 inches, olive (5Y 4/3) sand; structureless; loose; yellowish-brown, weakly cemented, undulating bands, ⅛ inch thick, at a depth between 30 and 37 inches; very few roots; strongly acid. Many feet thick.

The surface layer is dominantly very fine sandy loam, but in nearly level places it is silt loam, and on a few hilly to steep sites in the eastern part of the Area it is sand. Coarse sand, gravel, and stones are at a depth of 30 inches or more. The Anchorage soils in the eastern part of the Area are grayer, coarser, and less strongly acid than those in the western part.

Anchorage sand, undulating to rolling (3 to 12 percent slopes) (AcC).—This soil is grayer, has a coarser textured surface layer, and is less acid than the one described for the series. About three-fourths of this soil is on scattered, rolling knolls and ridges that have short, irregular slopes. The rest is on small, undulating plains. Most of it adjoins Bodenburg soils or steeper Anchorage sand. A few steep slopes were included in mapping.

This soil has a low moisture-supplying capacity and is highly susceptible to blowing if protective cover is not maintained.

Cleared areas are used chiefly for hay and pasture. (Management group 16)

Anchorage sand, hilly to steep (12 to 45 percent slopes) (AcE).—This soil is on irregular, hilly ridges along the Matanuska and Knik Rivers. The steeper ridges generally are closer to the rivers. This soil is grayer, has a coarser textured surface layer, and is less acid than the one described for the series.

Some areas are highly susceptible to blowing unless protective cover is maintained. Droughtiness limits suitability for crops or pasture.

Most of the acreage is forested, but a few acres have been cleared and are used for grazing. (Management group 30)

Anchorage silt loam, nearly level (0 to 3 percent slopes) (AhA).—This soil is in a few small, nearly level

Figure 8.—**Profile of Bodenburg silt loam showing a thin, dark-colored layer of organic material at a depth of 18 inches and gravel and sand at a depth of about 3½ feet.**

This soil is suited to all crops grown in the Area. If cleared, it is susceptible to blowing and to water erosion, but the loss of soil generally can be controlled without difficulty. (Management group 6)

Bodenburg silt loam, hilly (12 to 20 percent slopes) (BbD).—This soil is on irregular hills and ridges that have short slopes. It commonly borders Knik or Doone soils. The depth to gravel varies more than in the less hilly Bodenburg soils. In some places the texture is slightly coarser than normal, and in some there are thin lenses of very fine sand. Small areas of Bodenburg very fine sandy loam, Doone silt loam, and Knik silt loam were included in mapping. Also included were a few steep slopes.

If exposed, this soil is highly susceptible to water erosion and moderately susceptible to blowing. It is suited to perennial grasses. (Management group 13)

Bodenburg very fine sandy loam, nearly level (0 to 3 percent slopes) (BdA).—This soil is on nearly level terraces, and commonly it borders Bodenburg silt loam. It formed in deep, wind-laid, very fine sandy material that contained a moderate amount of silt. It is more uniform in depth to gravel than steeper Bodenburg soils. A few short slopes and a few patches of Bodenburg silt loam were included in mapping.

Most of this soil is used for grain and grass and for potatoes and other vegetables, which are grown commercially. It usually can be worked earlier in spring than silty soils, and for this reason it is well suited to vegetables. If cultivated, this soil is susceptible to blowing. Stripcropping and windbreaks are effective in controlling soil blowing. (Management group 1)

Bodenburg very fine sandy loam, undulating (3 to 7 percent slopes) (BdB).—This soil has short, gentle, irregular slopes. It commonly borders Bodenburg silt loam or other phases of Bodenburg very fine sandy loam on broad terraces. In places it contains less silt than Bodenburg very fine sandy loam, nearly level. A few sandy spots and a few short, moderate slopes were included in mapping.

Most of this soil is used for grass and small grain and for potatoes and other vegetables. It is well suited to vegetables, as it tends to warm up earlier in spring than silty soils.

If the surface is exposed, this soil is susceptible to blowing, which can ordinarily be controlled by simple conservation measures. (Management group 3)

Bodenburg very fine sandy loam, rolling (7 to 12 percent slopes) (BdC).—This soil has short, irregular slopes and commonly borders other Bodenburg soils on terraces. In places it contains less silt than Bodenburg very fine sandy loam, nearly level. A few small hills of Anchorage sand and a few small depressions were included in mapping.

This soil is suited to all climatically adapted crops, but it is susceptible to blowing and to water erosion if the surface is exposed. Conservation practices are needed to control soil loss if row crops are grown. The small sandy spots are droughty and are less productive than the areas of finer textured soil. (Management group 5)

Bodenburg very fine sandy loam, hilly (12 to 20 percent slopes) (BdD).—This soil is in small areas that include a few knolls of Anchorage sand.

Row crops are difficult to plant and harvest because the slopes are short and irregular. If the surface is exposed, this soil is susceptible to blowing and to water erosion. It is better suited to hay or pasture than to tilled crops. (Management group 13)

Bodenburg very fine sandy loam, moderately steep (20 to 30 percent slopes) (BdE).—This soil occurs as small, irregular areas and has short slopes. It commonly borders other Bodenburg soils on broad terraces, and it occurs on ridges and slopes with the sandy Anchorage soils. In places it is coarser textured than the more gently sloping Bodenburg soils. Sandy spots and a few steep slopes were included in mapping. Because of the severe erosion haz-

C1g—9 to 14 inches, gray (10YR 5/1) silty clay loam; many, medium, distinct mottles of yellowish brown; massive; firm; few roots; clear, smooth boundary. 3 to 10 inches thick.
C2g—14 to 28 inches, dark-gray (10YR 4/1) silt loam and pockets of sandy clay loam; common, fine, distinct mottles of strong brown; weak, medium, platy structure that breaks to weak, medium, granular; many fine pores; friable; very strongly acid; gradual, smooth boundary. 10 to 20 inches thick.
C3g—28 to 41 inches +, grayish-brown (10YR 5/2) clay loam; many, medium, distinct mottles of strong brown; massive; very firm; slightly sticky and plastic when wet; very strongly acid. Many feet thick.

The upper layers are generally extremely acid, and the lower layers are very strongly acid or strongly acid. Under a cover of native grasses, the upper third of the profile is dark brown rather than dark gray. In some places thin strata of silty clay loam occur within 10 inches of the surface, but in other places the silty clay loam strata are lacking and the entire profile is silt loam to a depth of 28 to 40 inches. The substratum, below a depth of 28 to 40 inches, generally consists of firm silty clay loam, clay loam, or sandy clay loam, but in places it consists of very gravelly and stony deposits. Some areas have many stones within 20 inches of the surface.

Coal Creek silt loam (0 to 3 percent slopes) (Co).—This soil is in scattered low valleys along small streams, in depressions that range from 10 to 40 acres in size, and in areas that border muskegs. Some areas are ponded occasionally for short periods. Typically, the profile is similar to the one described for the series, but in many scattered grass-covered depressions, the profile is browner near the surface. The soil in these depressions formed in medium-textured sediments underlain by coarse-textured or stony deposits. Most of the small areas that have gravelly substrata at a depth of 20 to 30 inches are in depressions on low terraces in the eastern part of the Area.

About 2 percent of the acreage consists of gently sloping areas that receive runoff and seepage from adjoining uplands. Small patches of peat or mucky soils and of stony and gravelly soils were included in mapping.

This soil is suitable for hay or pasture if cleared and artificially drained. Most of it is in native vegetation. Some areas of native grasses can be grazed. (Management group 18)

Coal Creek stony silt loam (0 to 3 percent slopes) (Cs).—This soil occupies minor drainageways, muskeg borders, and small scattered depressions within larger areas of Homestead soils throughout the western half of the survey Area. The total acreage is small. The mineral surface layer is commonly dark brown, and many stones occur in the upper 20 inches. Some areas are ponded occasionally for short periods. Small patches of peat and of mucky soils were included in mapping. This soil is too stony to be improved for crops, but in most places it supports native grasses that can be used for light grazing. (Management group 32)

Doone Series

The Doone series consists of well-drained silt loams underlain by coarse gravelly material at a depth of 28 to 40 inches.

These soils are on high terraces bordering the Matanuska River between Sutton and Palmer. They are also on many steep escarpments and ridges. They are deeper to gravel than the Knik soils and browner than the Bodenburg soils.

The native vegetation is forest consisting mainly of paper birch, white spruce, quaking aspen, and cottonwood (balsam poplar). Although not extensive, these soils are important as cropland.

Representative profile of Doone silt loam in the SW¼ NW¼ sec. 10, T. 18 N., R. 2 E., Seward Meridian:

O11—3 to 2½ inches, loose litter of leaves, twigs, and other plant remains; clear, smooth boundary.
O12—2½ inches to 0, black (10YR 2/1) mat of decomposing organic matter that contains some silt; many roots and mycelia; abrupt, smooth boundary. 2 to 4 inches thick.
A2—0 to 7 inches, dark-gray (5Y 4/1) silt loam; common, medium, distinct mottles of dark reddish brown; weak, very thin, platy structure; very friable; roots plentiful; abrupt, wavy boundary. 3 to 8 inches thick.
B2—7 to 13 inches, dark-brown (7.5YR 4/4) silt loam; dark yellowish-brown patches and streaks; weak, very thin, platy structure; very friable; few small concretions that have reddish-brown interiors; roots plentiful; clear, wavy boundary. 5 to 8 inches thick.
B31—13 to 21 inches, dark yellowish-brown (10YR 4/4) silt loam; dark-brown patches; weak, very thin, platy structure; very friable; few roots; gradual boundary. 6 to 10 inches thick.
B32—21 to 26 inches, brown (10YR 4/3) silt loam; moderate, thin, platy structure; very friable; many, small, smooth-walled vesicles; gradual boundary. 4 to 8 inches thick.
C1—26 to 33 inches, dark grayish-brown (2.5Y 4/2) silt loam streaked with very dark grayish brown; weak, thin platy structure; very friable; abrupt, wavy boundary. 5 to 12 inches thick.
IIC2—33 to 40 inches +, coarse sand and gravel; structureless; loose. Many feet thick.

The lower layers range from silt loam to very fine sandy loam. Coarse sand and gravel occur at a depth of 28 to 40 inches.

Doone silt loam, nearly level (0 to 3 percent slopes) (DeA).—This soil occupies fairly large, nearly level plains on high terraces. The depth to gravel is about 36 inches and is fairly uniform throughout broad areas. In places there is a layer of very fine sandy loam just above the gravel. Small undulating areas, a few patches of Knik soils, and scattered depressions are common mapping inclusions.

Most of the acreage is cropland, and all of the crops adapted to the Area can be grown. In large fields, the soil is susceptible to blowing if the surface is exposed. (Management group 2)

Doone silt loam, undulating (3 to 7 percent slopes) (DeB).—This soil occupies fairly broad plains on high terraces. It is not so uniform in depth to gravel as Doone silt loam, nearly level. A few narrow escarpments and small nearly level tracts were included in mapping.

Most of this soil is cropland. Small grain and hay are the principal crops, but all of the crops adapted to the Area can be grown.

Water erosion is a slight hazard in large cultivated fields, but this can ordinarily be controlled by simple conservation measures. Soil blowing is also a hazard if the surface is exposed. (Management group 4)

This soil is susceptible to erosion and, if cleared, should be kept in perennial grasses. (Management group 20)

Gravelly Alluvial Land

Gravelly alluvial land (Ga) consists mostly of loose gravelly and stony material on low-lying areas along major rivers and streams that have a rapidly fluctuating water level. The areas are only slightly above the normal water level and are flooded several times a year. They are dissected by many secondary channels and sloughs. In places they are covered by recent deposits of silty and fine sandy sediments. Parts of these areas are barren of vegetation, but willow brush, alder thickets, grassy patches, and scattered cottonwoods are common.

This land is not suitable for crops or for grazing and rarely supports timber of merchantable size. Some of the native vegetation provides excellent browse for moose, which frequent these areas, especially in winter. (Management group 36)

Gravel Pits and Strip Mines

Gravel pits and Strip mines (Gp) are open excavations, more than 3 acres in size, from which the soil and some of the underlying material have been removed. Most of these areas are nearly barren of vegetation, but a few that have been abandoned for a long time support clumps of willow, birch, quaking aspen, and many kinds of low-growing plants that provide habitat for wildlife. Areas of this kind that are less than 3 acres in size are indicated on the soil map by a pick-and-hammer or a pick-and-shovel symbol. (Not in a management group)

Homestead Series

The Homestead series consists of well-drained silty soils that are shallow and very shallow over loose sand and gravel. These are the most extensive soils on uplands. They are on broad outwash plains and gravelly moraines, where the range of slope is from nearly level to steep.

In the eastern half of the Area there is a broad, gradual boundary between the Homestead soils and the grayer Knik soils. A similar boundary occurs between the Homestead soils and the Nancy soils in the western part of the Area. The thin, gray surface layer and brownish subsoil in the Homestead soils are more prominent than those in the Knik soils, but they are not so thick or so prominent as those in the Nancy soils.

On the foot slopes of the Talkeetna Mountains, the Homestead soils occur in an intricate pattern with the poorly drained Torpedo Lake soils and are mapped with them in complexes.

Homestead soils generally support forests of paper birch, white spruce, and quaking aspen and a ground cover consisting of low-growing shrubs and a thin blanket of moss. In some slight depressions and on low terraces, however, the vegetation consists of black spruce and a thick cover of moss. The soil under this kind of vegetation has a darker colored mineral surface layer, with some mottling, and a redder B horizon than is typical. It is more strongly acid than most Homestead soils.

Representative profile of Homestead silt loam in the SW¼ sec. 9, T. 17 N., R. 2 W., Seward Meridian:

O11—3 to 2½ inches, forest litter.

O12—2½ inches to 0, very dark brown (10YR 2/2) mat of roots and partly decomposed organic material; few mycelia; abrupt, smooth boundary. 1 to 4 inches thick.

A2—0 to 3 inches, dark-gray (5Y 4/1) silt loam; weak, very fine, granular structure; friable; roots plentiful; extremely acid; abrupt, irregular boundary. 1 to 4 inches thick.

B2—3 to 7 inches, mixed dark yellowish-brown (10YR 4/4), brownish-yellow (10YR 6/8), and reddish-yellow (5YR 6/8) silt loam, dominantly dark yellowish brown; colors occur as large patches rather than as mottles; weak, fine, subangular blocky structure; friable; few roots; strongly acid; clear, wavy boundary. 2 to 5 inches thick.

B3—7 to 10 inches, mixed brown (10YR 5/3) and yellowish-brown (10YR 5/4) silt loam; few patches and streaks of dark brown (10YR 3/3); weak, fine, subangular blocky structure; friable; few roots; strongly acid; clear, wavy boundary. 3 to 6 inches thick.

IIC—10 to 24 inches +, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) gravelly sandy loam; loose; very few roots; strongly acid. Many feet thick.

The silty loess mantle ranges from 5 to 18 inches in thickness over coarse material. Homestead soils that formed in less than 10 inches of silty material are mapped as very shallow phases. In some places rounded stones and cobblestones are within 8 inches of the surface, and in others a layer of loose fine sand as much as 15 inches thick is immediately beneath the silty material.

Homestead silt loam, nearly level (0 to 3 percent slopes) (HoA).—This soil is the second most extensive in the Homestead series. On broad outwash plains it occurs as large tracts, some more than 1,000 acres in size; it also occurs as many small tracts that commonly border the more strongly sloping Homestead soils. In most places this soil formed in loess 10 to 15 inches thick over gravel, but on a large outwash plain southwest of Goose Bay, the loess was about 18 inches thick. Small patches of the nearly level, very shallow Homestead silt loam were included in mapping. A few short slopes of more than 3 percent and some small poorly drained depressions were also included.

Most of the acreage is in trees, but much of it has been cleared and is used for crops and pasture. Small grains and perennial grasses are the principal crops, but yields are frequently low, as this soil is low in natural fertility and tends to be droughty. If it is adequately fertilized and carefully managed to conserve moisture, it produces satisfactory yields of most crops adapted to the Area. (Management group 8)

Homestead silt loam, undulating (3 to 7 percent slopes) (HoB).—This soil is one of the most extensive in the Area. It occurs as scattered, irregular tracts that range from a few acres to several hundred acres in size. It is on outwash plains and low moraines that have short, irregular slopes. The depth to gravelly material ranges from 10 to 18 inches, except where fine sand lies immediately below the silt loam.

Patches of very shallow Homestead silt loam and small, poorly drained depressions were included in mapping. Inclusions make up as much as 15 percent of some areas mapped. They are a nuisance to farmers.

shallow for deep tillage. Cleared areas can be seeded to perennial grasses and used for permanent pasture, but yields are limited by droughtiness. (Management group 21)

Homestead silt loam, very shallow, moderately steep (20 to 30 percent slopes) (HsE).—This soil occupies rough moraines in the western half of the Area. The silt loam is only 5 to 10 inches thick over coarse gravelly material. Gravelly spots, small patches of Naptowne soils and of other Homestead soils, and a few poorly drained sites were included in mapping.

This soil is droughty and is highly susceptible to erosion if cover is removed. It should remain in native vegetation. (Management group 21)

Homestead silt loam, very shallow, steep (30 to 45 percent slopes) (HsF).—This soil is extensive and occurs on long, narrow escarpments, hills, and ridges. The silt loam is only 5 to 10 inches thick over coarse gravelly material. Many stony and gravelly spots were included in mapping, as well as a few patches of moderately steep Homestead silt loam. This soil should be kept in native vegetation. (Management group 29)

Jacobsen Series

The Jacobsen series consists of very poorly drained, very stony silt loams in broad depressions, in muskeg borders, and in low areas along secondary streams.

These soils are extensive and are widely distributed in the western half of the Area. They are stonier near the surface than the Slikok soils and are lighter colored and less mucky.

The Jacobsen soils are generally covered with a thick mat of sphagnum moss and support scattered stands of willows, stunted black spruce, and low-growing shrubs.

Representative profile of Jacobsen very stony silt loam in the NW¼NW¼ sec. 23, T. 17 N., R. 3 W., Seward Meridian:

- O11—16 inches to 8 inches, mat of sphagnum moss, roots, and decomposing leaves and twigs; strongly acid; gradual, smooth boundary. 3 to 12 inches thick.
- O12—8 inches to 0, black (5YR 2/1) decomposing mat of moss, woody particles, and leaves; roots plentiful; strongly acid; clear, wavy boundary. 6 to 12 inches thick.
- A1—0 to 10 inches, very dark grayish-brown (10YR 3/2) very stony silt loam; very dark gray (10YR 3/1) streaks and patches; massive; nonsticky, nonplastic; few roots; strongly acid; clear, wavy boundary. 8 to 24 inches thick.
- C1—10 to 26 inches, dark olive-gray (5Y 3/2) very stony loam; massive; slightly sticky, slightly plastic; contains many pebbles; extremely acid. 8 to 20 inches thick.
- IIC2—26 to 32 inches, light-colored and dark-colored subrounded stones, gravel, and sand. Many feet thick.

These soils are extremely acid to strongly acid. The organic mat on the surface ranges from 10 to 24 inches in thickness.

Jacobsen very stony silt loam, nearly level (0 to 3 percent slopes) (JaA).—This soil occurs in nearly level depressions that range from a few acres to more than a hundred acres in size. Many areas also border large muskegs occupied by Salamatof peat. Small areas of Slikok soils and Salamatof peat were included in mapping.

This soil is not suited to crops. In places the native vegetation provides limited grazing. Artificial drainage is not feasible. (Management group 32)

Jacobsen very stony silt loam, gently sloping (3 to 7 percent slopes) (JaB).—This soil is inextensive. It generally occurs in small tracts bordering secondary streams. Small patches of Slikok and Salamatof soils were included in mapping. In places large stones are scattered on the surface.

This soil is not suited to crops. In places the native vegetation may be suitable for light grazing. Drainage is not feasible. (Management group 32)

Jim Series

The Jim series consists of well-drained soils that formed in silty, wind-laid deposits 20 to 30 inches thick over bedrock.

These soils are on foot slopes of mountains and buttes in the eastern part of the Area. They differ from Bodenburg soils in that they are underlain by solid rock at a depth of less than 30 inches.

On south-facing slopes, Jim soils support thick stands of grass, mainly bluejoint, but on most north-facing slopes they support forests of paper birch, white spruce, and quaking aspen.

Representative profile of Jim silt loam in the SW¼SW¼ sec. 23, T. 17 N., R. 2 E., Seward Meridian:

- O1—1½ inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing organic matter; gray silt admixture.
- A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; very dark grayish-brown (10YR 3/2) patches; weak, fine, subangular blocky structure; very friable; many roots; clear, wavy boundary. 3 to 7 inches thick.
- C1—5 to 22 inches, olive-gray (5Y 4/2) silt loam; few, fine, faint spots of dark yellowish brown; weak, medium, subangular blocky structure; friable; few, thin, very dark reddish-brown streaks of organic matter; roots plentiful; gradual, wavy boundary.
- C2—22 to 26 inches, olive-brown (2.5Y 4/4) silt loam; massive; friable; few thin lenses of very fine sand; few large roots; abrupt boundary.
- IIC3—26 inches +, bedrock; dark-colored consolidated metamorphic rock.

These soils are strongly acid near the surface and medium acid in the lower layers. A few thin lenses of very fine sand generally occur in the lower layers, and some may occur at any depth.

Jim and Bodenburg silt loams, hilly (12 to 20 percent slopes) (JbD).—This mapping unit is of minor extent and occurs on buttes and on mountain foot slopes. The two dominant soils formed in a mantle of silt loam that ranges from 20 to about 60 inches in thickness over bedrock. At the base of Bodenburg Butte the soils are coarser in texture and are similar to the adjoining Susitna very fine sand. A few rolling tracts, steep slopes, and scattered rock outcrops were included in mapping.

These soils are highly susceptible to water erosion and blowing if the vegetative cover is removed. If used for crops, they should be kept in perennial grasses most of the time. (Management group 13)

Jim and Bodenburg silt loams, steep (30 to 45 percent slopes) (JbF).—These soils formed in a silt mantle 20 to 60 inches thick over bedrock. Patches of shallow soils in which the silt is less than 20 inches thick were included, Kenai soils are strongly acid throughout. In places, stones are fairly numerous on or near the surface.

Kenai silt loam, undulating (3 to 7 percent slopes) (KeB).—This soil commonly occurs as scattered tracts where slope is between 3 and 7 percent. Included in mapping were a few small rolling to hilly tracts that have a slope of as much as 20 percent. Also included were a few stony patches. Small drainageways and wet seepage spots occur within the mapped areas. This soil is suited to crops that require only shallow tillage. (Management group 15)[4]

Knik Series

The Knik series consists of well-drained silty soils that are shallow over coarse gravelly material. These soils are on nearly level to rolling plains and hilly to steep, rough moraines.

The Knik soils are extensive over a broad zone in the central part of the Area. They grade to the Bodenburg and Doone soils in the east and to Homestead soils in the west. They are browner than the Bodenburg soils, are shallower to gravel than the Doone soils, and have less prominent soil horizons than the Homestead soils.

The Knik soils support a forest consisting mostly of paper birch, white spruce, and quaking aspen, but many areas are in crops or pasture. A profile of Knik silt loam is shown in figure 9.

Representative profile of Knik silt loam in the NW¼ SE¼ sec. 17, T. 17 N., R. 1 E., Seward Meridian:

O11—4 to 3½ inches, forest litter.

O12—3½ inches to 0, very dark brown (10YR 2/3) to very dark grayish-brown (10YR 2/2, 3/2) mat of roots and partly decomposed organic material; many very fine granules of very dark brown silt loam; few mycelia; abrupt, smooth boundary.

A2—0 to 3 inches, gray (N 5/0) silt loam mottled with reddish brown; weak, fine, subangular blocky structure; friable; many roots, especially in upper part of horizon; strongly acid; abrupt, wavy boundary. 2 to 6 inches thick.

B2—3 to 7 inches, mixed dark-brown (10YR 3/3) and dark-gray (5Y 4/1) silt loam; fine spots of dark reddish brown; weak, medium, subangular blocky structure; friable; few roots; few, fine, dark-colored concretions; strongly acid; clear, wavy boundary. 3 to 6 inches thick.

C1—7 to 12 inches, gray (5Y 5/1) silt loam; spots of dark yellowish brown (10YR 4/4) and a few horizontal streaks of very dark brown (10YR 2/2); massive, but breaks under pressure into poorly defined thin plates; few roots; medium acid; gradual boundary. 4 to 6 inches thick.

C2—12 to 19 inches, mixed dark-brown (10YR 4/3) and olive-brown (2.5Y 4/4) silt loam; thicker streaks of very dark brown (10YR 2/2) than in C1 horizon, and few streaks of reddish yellow (7.5YR 6/6); massive; friable; few roots; medium acid; abrupt boundary. 5 to 8 inches thick.

IIC3—19 to 32 inches +, very gravelly coarse sand. Many feet thick.

In places as much as 12 inches of fine sand underlies the silt mantle.

Knik silt loam, nearly level (0 to 3 percent slopes) (KnA).—This is one of the most extensive well-drained soils in the Area. It occurs mostly on broad terraces and plains. It formed in a silty mantle that is ordinarily about 16 inches in thickness over very gravelly coarse sand but ranges from 12 to 24 inches. A few narrow escarpments and poorly drained depressions were included in mapping. In places, they limit farming.

All of the crops adapted to the Area can be grown on this soil, but yields are usually less than on deeper soils, largely because of a lower moisture-supplying capacity. Satisfactory yields of most crops can be obtained if moisture is conserved and fertility is maintained.

In large fields this soil is moderately susceptible to blowing. (Management group 8)

Knik silt loam, undulating (3 to 7 percent slopes) (KnB).—This is one of the most extensive well-drained soils in the Area. It consists of scattered tracts, from a few acres to more than a hundred acres in size, on terraces

Figure 9.—**Profile of Knik silt loam. Depth to underlying gravel and sand is about 18 inches.**

[4] Because the Kenai soil in the Matanuska Valley Area is shallower than Kenai soils in other areas, it is in a different management group.

A ground cover of sphagnum moss, sedges, and low-growing shrubs is common.

Representative profile of Moose River silt loam in the SE¼SW¼ sec. 11, T. 17 N., R. 4 W., Seward Meridian:

O1—3 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing moss, leaves, and twigs; many roots; abrupt, wavy boundary.

A1—0 to 6 inches, very dark grayish-brown (2.5Y 3/2) silt loam; weak, fine, granular structure; nonsticky and nonplastic; many roots; few streaks and patches of black (10YR 2/1); extremely acid; clear, smooth boundary.

C1—6 to 14 inches, olive-gray (5Y 4/2) fine sand; single grain; loose; few streaks and patches of dark brown (10YR 3/3); few thin lenses of silt; few roots; extremely acid; gradual boundary.

C2g—14 to 38 inches, dark-gray (5Y 4/1), stratified fine sand and silt loam; few, large, distinct, olive-brown mottles; massive; nonsticky and nonplastic; strata are ¼ inch to 3 inches thick; very strongly acid; clear, smooth boundary.

IIC3g—38 to 48 inches +, dark-gray (5Y 4/1) very gravelly coarse sand; single grain; loose.

The water table is at or near the surface for long periods during the growing season, but in places it drops rapidly to several feet below the surface during extended dry periods. The surface layer ranges from silt loam to fine sandy loam. Below the surface layer the soil is dominantly sandy but contains lenses of silty material of varying thickness. The depth to coarse sand and gravel ranges from 27 inches to more than 40 inches.

Moose River silt loam (nearly level) (Mr).—This soil is moderately extensive and is widely scattered in depressions and on small, low alluvial plains bordering secondary streams. Included in mapping were a few gently sloping tracts adjoining uplands. Patches of Salamatof peat and Jacobsen very stony silt loam were also included.

Artificial drainage is generally not feasible. In places the native grasses and sedges provide limited grazing. (Management group 27)

Nancy Series

The Nancy series consists of well-drained silty soils that are moderately deep to deep over thick deposits of loose sand and gravel.

These soils are on nearly level high terraces and gently sloping to steep moraines in the northwestern part of the Area. They formed in a thicker mantle of silt than the Homestead soils. They differ from the Naptowne soils in that they are underlain at a depth of 20 to 30 inches by loose gravelly deposits rather than firm glacial till.

The Nancy soils support a forest of paper birch, white spruce, and quaking aspen. They are of relatively minor extent in the Area, and only a few small tracts have been cleared for crops.

Representative profile of Nancy silt loam in the NW¼SE¼ sec. 17, T. 19 N., R. 4 W., Seward Meridian:

O1—3 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing organic material; many fine roots; mycelia; clear, smooth boundary. 1 to 5 inches thick.

A2—0 to 1½ inches, light-gray (10YR 6/1) silt loam; weak, fine, platy structure; friable; roots plentiful; abrupt, irregular boundary. 1 to 4 inches thick.

B21—1½ to 2½ inches, reddish-brown (5YR 4/4) silt loam; weak, medium, granular structure; very friable; roots plentiful; abrupt, wavy boundary. ½ inch to 1½ inches thick.

B22—2½ to 6 inches, strong-brown (7.5YR 5/6) silt loam; weak, medium, granular structure; very friable; roots plentiful; abrupt, wavy boundary. 3 to 10 inches thick.

A2b—6 to 7 inches, grayish-brown (2.5Y 5/2) silt loam; weak, fine, granular structure; very friable; roots plentiful; abrupt, broken boundary. 0 to 1½ inches thick.

B2b—7 to 7½ inches, dark-brown (7.5YR 4/4) silt loam; weak, medium, granular structure; very friable; roots plentiful; abrupt, wavy boundary. ½ inch to 2 inches thick.

B3b—7½ to 16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; few roots; clear, wavy boundary. 6 to 12 inches thick.

C1—16 to 21 inches, olive-brown (2.5Y 4/4) silt loam; massive; friable; few roots; clear, smooth boundary. 2 to 12 inches thick.

IIC2—21 to 32 inches, olive-brown (2.5Y 4/4) and olive (5Y 4/3) gravelly sand; single grain; loose; a few weakly cemented fragments. Many feet thick.

These soils are very strongly acid, especially near the surface. The silty loess mantle ranges from 18 to more than 30 inches in thickness. Thin layers of very fine sand and fine sand occur in some places below a depth of 15 inches. In places the silty material is underlain by deep, fine to medium sand that contains many pebbles.

Nancy silt loam, nearly level (0 to 3 percent slopes) (NaA).—This soil is on a few, broad, nearly level, high terraces in the northwestern part of the Area. It formed in a silty mantle that is 20 to 24 inches thick over loose gravelly or sandy deposits. The silty layer is more uniform in depth to gravel than is the corresponding layer of the steeper Nancy soils. A few patches of Homestead soils were included in mapping.

Most of this soil is forested, but a few tracts are used for crops. All crops adapted to the Area can be grown if an adequate level of fertility is maintained. (Management group 2)

Nancy silt loam, undulating (3 to 7 percent slopes) (NaB).—This soil is on undulating terraces. It formed in a silty mantle about 20 inches thick over gravelly or sandy material. A few spots of shallow Homestead silt loam and a few short slopes of as much as 12 percent were included in mapping.

Most of this soil is in native vegetation, but a few tracts are used for crops. All crops adapted to the Area can be grown, but the soil is slightly susceptible to water erosion if the surface is exposed. Simple conservation measures are generally adequate. (Management group 4)

Nancy silt loam, rolling (7 to 12 percent slopes) (NaC).—This soil occurs as small, scattered areas on moraines. The slopes are short. The silty mantle ranges generally from 18 to 30 inches in thickness within short distances but is shallower in places. Small, scattered, poorly drained depressions and a few short slopes of as much as 20 percent were included in mapping.

This soil is not extensive and is mostly forested. It is suited to all crops grown in the Area, but conservation practices are needed to control water erosion if row crops are grown. (Management group 6)

Nancy silt loam, hilly (12 to 20 percent slopes) (NaD).—This soil is on moraines. The slopes are short. The depth to gravel ranges from 18 to 36 inches within short distances. A few rolling areas, a few moderately steep

The use of this soil is limited to pasture or woodland, because of the slope. (Management group 20)

Naptowne silt loam, steep (30 to 45 percent slopes) (NpF).—This soil is on rough, irregular terrain. Stony places, patches of shallow soils, and small, deep depressions were included in mapping.

This soil should be kept in native vegetation, as it is highly susceptible to erosion if the vegetative cover is removed. (Management group 28)

Niklason Series

The Niklason series consists of well-drained soils that formed in shallow to moderately deep, well-sorted layers of water-laid silt, very fine sand, and fine sand over coarse gravelly material.

These soils are on low plains bordering the major rivers and streams. They commonly adjoin the Susitna soils, which formed in deeper sediments.

The Niklason soils support forests of paper birch and white spruce and, in places, large cottonwood (balsam poplar) trees. A heavy understory of alder, willow, and shrubs is common. A considerable area has been cleared and is farmed.

Representative profile of Niklason silt loam in the NW¼SW¼ sec. 35, T. 18 N., R. 2 W., Seward Meridian:

O1—2½ inches to 0, very dark brown (10YR 2/2) mat of decomposing organic matter; many fine roots; abrupt, smooth boundary.

A1—0 to 1½ inches, very dark grayish-brown (10YR 3/2) silt loam that has a few black and very dark brown streaks; weak, fine, granular structure; very friable; many roots; clear, smooth boundary.

C1—1½ to 4½ inches, very dark grayish-brown (2.5Y 3/2) and dark grayish-brown (2.5Y 4/2) silt loam that has a few fine streaks of dark brown; weak, thin, platy structure; very friable; roots common; clear, smooth boundary.

C2—4½ to 10 inches, dark grayish-brown (2.5Y 4/2) very fine sandy loam that has streaks and patches of olive gray and very dark grayish brown; very weak, thin, platy structure; very friable; roots common; abrupt, smooth boundary.

C3—10 to 14 inches, olive-gray (5Y 4/2) silt loam that has a few small patches of brown; weak, thin, platy structure; friable; few thin lenses of very fine sand; few roots; abrupt, smooth boundary.

C4—14 to 19 inches, olive-gray (5Y 4/2) very fine sand; loose; few, thin, dark grayish-brown streaks; few roots; clear, smooth boundary.

IIC5—19 to 30 inches +, olive (5Y 4/3) gravelly coarse sand; loose; many light-colored and dark-colored pebbles and cobblestones.

These soils are very strongly acid to strongly acid. The texture of the surface layer ranges from silt loam to very fine sand. The sorted layers of silt, very fine sand, and fine sand vary in number and thickness. The depth to gravelly material ranges from 15 to 27 inches.

Niklason silt loam (0 to 3 percent slopes) (Ns).—This soil is moderately extensive on plains along the Matanuska River. It is dominantly silty but contains layers of very fine sand. In most places it is underlain by gravelly deposits at a depth of 15 to 20 inches; in some places it is deeper to gravel. Patches of shallower soils, small tracts of Susitna soils, and scattered spots of Niklason very fine sand were included in mapping. Also included were a few undulating slopes of between 3 and 7 percent. Abandoned stream channels, 1 or 2 feet lower than the surrounding plains, are fairly common. The soil in these channels is essentially the same as on the plains, but the steep banks interfere with farming operations.

Most crops adapted to the Area can be grown on this soil, although it is shallow and has a low moisture-supplying capacity. Yields are limited by droughtiness. Large fields in the vicinity of Palmer are susceptible to blowing. (Management group 9)

Niklason very fine sand (0 to 3 percent slopes) (Nv).—Although this soil is dominantly very fine sand, it contains many thin layers of silt. Except for the difference in texture, it is similar to Niklason silt loam and occurs in the same general areas. The depth to gravel is between 15 and 20 inches in most places, but in some it is as much as 27 inches. Small tracts of Susitna soils, Niklason silt loam, and Chena silt loam were included in mapping. A few undulating slopes were also included, and abandoned stream channels are fairly common.

This soil is suited to most crops adapted to the Area, although it is moderately droughty. Cultivated fields near Palmer are susceptible to blowing. (Management group 9)

Reedy Series

The Reedy series consists of moderately well drained soils that formed in silty and very fine sandy, water-laid sediments underlain by moderately fine textured tidal deposits.

These soils are on natural levees along streams that flow through nearly level, stabilized plains of Tidal marsh. The levees are only a few feet higher than the surrounding plains.

The native vegetation consists of scattered clumps of cottonwood (balsam poplar) trees and dense thickets of willow and alder brush. Patches of native grass are common.

Representative profile of Reedy silt loam SW¼NW¼ sec. 26, T. 17 N., R. 1 E., Seward Meridian:

O1—1 inch to 0, black (5YR 2/1) mat of decomposing leaves and twigs mixed with finely divided organic matter and a few mineral grains; abrupt, smooth boundary. 1 to 2 inches thick.

A1—0 to 3 inches, dark grayish-brown (2.5Y 4/2) very fine sandy loam; very dark grayish-brown (10YR 3/2) streaks; thin silty lenses; very weak, medium, platy structure that breaks to weak, fine, granular; friable; many roots; clear, wavy boundary. 2 to 5 inches thick.

C1—3 to 18 inches, olive-gray (5Y 4/2) silt loam; thin lenses of very fine sandy loam; few, fine, distinct mottles of dark brown; weak, medium, platy structure; roots common; clear, smooth boundary. 10 to 30 inches thick.

IIC2—18 to 40 inches, greenish-gray (5GY 5/1) silty clay loam; common, medium, distinct mottles of dark yellowish brown; massive; friable. Many feet thick.

The upper layers are dominantly silty but range to very fine sand. In places, pockets of very fine sand occur in the underlying, slowly permeable, moderately fine textured material.

Reedy silt loam (0 to 3 percent slopes) (Re).—This soil is inextensive. It occurs as narrow strips on natural levees along streams that flow through the tidal plains along Knik Arm. Small patches of Tidal marsh and very narcleared and are used for crops. It is suited to all crops adapted to the Area. (Management group 1)

Schrock silt loam, undulating (3 to 7 percent slopes) (ShB).—This soil is of minor extent. It occurs as small scattered areas near secondary streams. Generally, it contains more fine sand in the upper layers and is shallower to coarse sand and gravel than Schrock silt loam, nearly level. Small inclusions of Homestead soils are fairly common.

This soil is suited to all crops adapted to the Area, but it is slightly susceptible to erosion if cultivated. (Management group 3)

Sea Cliffs

Sea cliffs (Sl) rise more than 100 feet above several of the beaches along Knik Arm near Goose Bay. Moderately fine textured silty and sandy sediments are exposed in the lower parts of these cliffs; gravelly material is generally exposed in the upper parts.

Most areas are barren of vegetation, but a few partly stabilized areas support patches of alder and willow and a few birch trees. This land is not suitable for crops or for grazing. (Management group 35)

Slikok Series

The Slikok series consists of poorly drained, very dark colored soils that formed in mucky and silty sediments along secondary drainageways, in seepage areas, and on lowlands around lakes and muskegs. These soils are moderately extensive and are scattered throughout the Area.

These soils have a thick, black, mucky surface layer and a very dark colored silty and mucky subsoil. They are darker than the Wasilla and Torpedo Lake soils, and they lack the firm, moderately fine textured subsoil that is typical of those soils. They are darker than the Coal Creek soils.

The dominant vegetation consists of alder, willow, and paper birch, but in places there are patches of grass growing in large tussocks.

Representative profile of Slikok mucky silt loam in the SE¼SE¼, sec. 1, T. 17 N., R. 1 W., Seward Meridian:

- O1—12 to 7 inches, black (5YR 2/1) mat of decomposing organic material; clear, smooth boundary. 2 to 6 inches thick.
- O2—7 inches to 0, black (5YR 2/1), finely divided, decomposing organic matter containing a few coarse woody particles; many roots; gradual, smooth boundary. 3 to 15 inches thick.
- A1—0 to 8 inches, black (5YR 2/1) mucky silt loam; a few pockets of dark reddish-brown, finely divided organic matter; weak, fine, granular structure; nonplastic, nonsticky; roots plentiful; strongly acid; gradual, wavy boundary. 6 to 20 inches thick.
- AC—8 to 42 inches, very dark gray (10YR 3/1) mucky silt loam; lenses of dark grayish-brown (10YR 4/2) silt loam; massive; nonsticky, nonplastic; few thin lenses of fine sand and thin layers of sedge and woody peat; roots plentiful to few; strongly acid. 12 to 48 inches thick.

In places there are many stones within 20 inches of the surface. The depth to grayish gravelly material underlying the AC horizon, ranges from 30 to 60 inches. The upper layers of these soils are strongly acid, but acidity decreases with depth. The water table is near the surface most of the time.

Slikok mucky silt loam (0 to 3 percent slopes) (Sm).—This is the more extensive soil of the Slikok series. It commonly occurs along drainageways, and there are many springs and seepage places and a few small streams within the mapped areas. Several small, gently sloping areas constitute about 3 percent of the total acreage. Stony patches and small areas of Wasilla silt loam are also included.

Artificial drainage ordinarily is needed before crops can be grown. (Management group 18)

Slikok stony mucky silt loam (0 to 3 percent slopes) (Sn).—This soil is in small drainageways and along secondary streams. It is inextensive but widely scattered throughout the Area. Because of the many stones and boulders within 20 inches of the surface, artificial drainage is not feasible, but some areas of native grasses probably can be grazed to a limited extent. (Management group 32)

Spenard Series

The Spenard series consists of somewhat poorly drained and poorly drained soils that formed in a thin mantle of silt underlain by firm, moderately fine textured glacial till. They are of minor extent and occur only in the northwestern part of the Area.

These soils are in nearly level areas bordering muskegs and on fairly long, smooth, gentle to moderate slopes of glacial moraines. They are not so poorly drained as the Torpedo Lake soils and the Coal Creek soils.

The Spenard soils commonly support a dense forest of black spruce and a thick ground cover of moss, but in some places the forest consists of paper birch, white spruce, and dense clumps of alder brush.

Representative profile of Spenard silt loam in the SW¼SE¼, sec. 16, T. 18 N., R. 3 W., Seward Meridian:

- O1—5 inches to 0, dark reddish-brown (5YR 2/2) mat of moss and decomposing organic material; extremely acid; clear, smooth boundary. 3 to 10 inches thick.
- A1—0 to 3 inches, very dark gray (10YR 3/1) silt loam; pockets of black (5YR 2/1) silt loam; weak, medium, subangular blocky structure; friable when moist, nonsticky when wet; many roots; extremely acid; abrupt, wavy boundary. 2 to 6 inches thick.
- AC—3 to 5 inches, very dark brown (10YR 2/2) silt loam; splotches of dark reddish brown (5YR 3/3); massive; firm when moist, nonsticky and slightly plastic when wet; roots plentiful; extremely acid; abrupt, wavy boundary. 1 to 4 inches thick.
- IIC1g—5 to 14 inches, dark-gray (10YR 4/1) sandy clay loam; common, coarse, distinct mottles of dark yellowish brown; common, medium, prominent mottles of reddish brown; massive; firm when moist, slightly sticky and slightly plastic when wet; few roots; very strongly acid; abrupt, wavy boundary. 6 to 12 inches thick.
- IIC2g—14 to 31 inches, very dark gray (10YR 3/1) gravelly silty clay loam; common, medium, distinct mottles of dark reddish brown; massive; slightly sticky and slightly plastic when wet; very few fine roots; many pebbles and few cobblestones and stones; very strongly acid. Many feet thick.

The silty mantle ranges from 2 to 10 inches in thickness. The glacial till ranges from sandy clay loam to silty clay loam in texture and becomes firmer and more

B21—5 to 7 inches, dark reddish-brown (2.5YR 2/4) silt loam; releases water and becomes smeary when rubbed; moderate, fine, granular structure; very friable; roots common; clear, wavy boundary.

B22—7 to 11 inches, dark reddish-brown (5YR 3/3) silt loam streaked with 5YR 2/2; smeary when rubbed; weak, fine, subangular blocky structure; very friable; many, very fine, tubular pores and vesicles; roots common; clear, wavy boundary.

B23—11 to 14 inches, dark reddish-brown (5YR 3/4) silt loam; smeary when rubbed; weak, fine, platy structure; very friable; few roots; very fine tubular pores and vesicles; abrupt, broken boundary.

IIB3—14 to 21 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; massive; moderately firm; few roots; very fine tubular pores and vesicles; gradual boundary.

IIC—21 to 30 inches +, olive (5Y 4/3) stony sandy loam; massive; friable; no roots; reddish stains on underside of stones.

The silty material ranges from a few inches to 20 inches in thickness. Stones and boulders are common on and near the surface. In places the profile has been disturbed by heaving and by downslope movement of soil.

Talkeetna silt loam, moderately steep to steep (20 to 45 percent slopes) (ToE).—This very inextensive soil occurs above the treeline in the Talkeetna Mountains, in the north-central part of the Area. Rock outcrops, a few wet spots, and small mountain streams were included in mapping.

This soil is too steep to be cultivated, and the growing season is too short for crops. The native grasses can be used for limited grazing. (Management group 28)

Terrace Escarpments

Terrace escarpments (Te) is a land type at the edge of river terraces. It includes many active landslides and rock outcrops that are bare of vegetation. Very shallow gravelly soils in some stabilized areas support some vegetation, mainly alder, willow, and birch. Patches of grass, ferns, and devilsclub are common.

Terrace escarpments is not suitable for crops or for grazing. (Management group 35)

Tidal Flats

Tidal flats (Tf) consists of layered tidal deposits on broad flats bordering Knik Arm. These deposits range from sandy to clayey in texture.

Tidal flats is inundated regularly by high tides. Large areas are bare of vegetation, but in places there are very sparse stands of beach ryegrass and a few clumps of sedge. The vegetative cover is not so dense as that on Tidal marsh, which is slightly higher and is only occasionally flooded by high tides. Tidal flats has no potential value as cropland or as pasture. (Management group 36)

Tidal Marsh

Tidal marsh (Tm) consists of poorly drained clayey sediments. It is extensive on low-lying plains bordering Knik Arm, and a fairly large tract occurs a few miles inland, east of the mouth of the Knik River.

In places Tidal marsh is inundated several times each year by very high tides. On rare occasions it is flooded for short periods by overflow from fresh-water streams. On the seaward side, Tidal marsh adjoins Tidal flats, which is slightly lower, is inundated regularly, and is almost bare of vegetation. On the inland side, Tidal marsh adjoins Clunie peat.

Tidal marsh commonly supports moderately dense stands of grasses, sedges, and other plants common in coastal meadows. It is not suited to crops, but the native vegetation can be grazed, and in places it can be harvested for hay. (Management group 24)

Torpedo Lake Series

The Torpedo Lake series consists of poorly drained, nearly level to moderately steep soils in depressions and drainageways.

On foot slopes of the Talkeetna Mountains, the Torpedo Lake soils occur in an intricate, irregular pattern with the Homestead soils and are mapped with them in complexes. The total acreage of the complexes is small. The Torpedo Lake soils are dominant in the complexes and occupy the drainageways, swales, and low-lying places that separate the small tracts of well-drained Homestead soils. Small patches of the Schrock and Slikok soils also occur in these areas, as well as a few spots of Gravelly alluvial land.

The Torpedo Lake soils have a thicker surface layer than the Coal Creek and Spenard soils, and a firmer, finer textured subsoil than the Slikok soils.

Dense stands of black spruce, and a thick ground cover of moss are interspersed with patches of grass, thickets of alder, and scattered birch trees on the poorly drained Torpedo Lake soils. Willow, devilsclub, and wild celery are also common. Forests of paper birch and white spruce are dominant on the well-drained Homestead soils.

Representative profile of Torpedo Lake silt loam in the NE¼NW¼ sec. 20, T. 18 N., R. 3 W., Seward Meridian:

O1—5 inches to 0, black (5YR 2/1) mat of decomposing twigs, leaves, grass, and moss; many mycelia; strongly acid; abrupt, smooth boundary. 3 to 10 inches thick.

A11—0 to 8 inches, dark reddish-brown (5YR 2/2) mucky silt loam; weak, very fine, granular structure; nonsticky and nonplastic when wet; roots plentiful; few stones; strongly acid; clear, smooth boundary. 5 to 14 inches thick.

A12—8 to 12 inches, dark reddish-brown (5YR 3/2) and dark grayish-brown (10YR 3/2) silt loam; weak, fine, subangular blocky structure; slightly sticky and slightly plastic when wet; roots plentiful; few subrounded stones; strongly acid; abrupt, smooth boundary. 4 to 12 inches thick.

IICg—12 to 26 inches, dark greenish-gray (5GY 4/1) sandy clay loam; many, coarse, prominent mottles of yellowish brown; massive; very firm when moist, sticky and plastic when wet; very few decaying roots; contains pebbles and stones below 16 inches; strongly acid. Many feet thick.

The Torpedo Lake soils are strongly acid throughout. The moderately fine textured lower layers commonly become firmer and finer with depth. In places stones are near the surface, and pebbles and cobblestones are common below a depth of 15 inches. The water table is near the surface most of the time.

Torpedo Lake silt loam, nearly level (0 to 3 percent slopes) (ToA).—This soil is fairly extensive and occurs in depressions and broad, poorly defined drainageways.

moderate, medium, platy structure that breaks readily to moderate, very fine, subangular blocky; firm; contains a few stratified lenses of silty and very fine sandy loam as much as ¼ inch thick; buried woody plant parts; few roots; strongly acid; gradual, smooth boundary. 6 to 18 inches thick.

IIIC2g—22 to 48 inches +, dark-gray (5YR 4/1), stratified fine to coarse sand; single grain; loose; pockets of very dark gray (5YR 3/1) silt loam comprise as much as 30 percent of the mass; massive; friable; many woody fragments; few pebbles and rounded cobblestones; very few roots; strongly acid. One foot to many feet thick; commonly underlain by coarse sand and gravel.

Below the silt loam surface layer the substratum is commonly well stratified and consists of moderately firm silty clay loam to sandy clay loam interlayered with strata of silt, very fine sand, and fine sand that vary in number and thickness. The depth to coarse sand, gravel, and stony material is generally more than 30 inches. In places a few large stones or boulders occur near the surface. These soils are very strongly acid to strongly acid.

Wasilla silt loam (0 to 3 percent slopes) (Wa).—This soil occurs on many creek bottoms and on the flood plains of the major rivers. Along the smaller streams it is commonly associated with the Slikok soils, which are more poorly drained. Small tracts of Slikok silt loam were included. On the flood plains of the Knik and Matanuska Rivers it borders the well-drained Susitna and Niklason soils.

If artificially drained, this soil is suited to small grains and perennial grasses. (Management group 12)

Management of Soils for Crops and Pasture

The first part of this section contains a discussion of land clearing, fertilization, irrigation, suitable crops, and estimated yields. The second part contains a description of the capability classification system by which the soils are grouped according to the management they need. Following this, each management group is described and suggestions are given for the use and conservation of the soils.

Land Clearing

Much of the potential farmland in the Area is forested. In many places there are stands of merchantable trees. Harvesting these trees for lumber or other purposes before the land is cleared not only prevents waste but generally makes land clearing easier.

Except for poorly drained areas, land usually can be cleared at any time of year. When the ground is not frozen, brush and trees that remain after logging are most efficiently removed by a bulldozer equipped with a scarifier blade similar to that shown in figure 10.

When the ground is frozen, brush and trees are sheared off at ground level with a bulldozer equipped with a shearing type blade. This method is suitable for clearing off light brush and small trees. Where trees larger than 6 inches in diameter are sheared off at ground level, however, the subsequent removal of stumps and heavy roots is often very difficult and time consuming. After the soil has thawed, the stumps and roots remaining in the soil can be removed by several methods. Removing and windrowing them with a scarifier blade is usually the most efficient method. Small roots and stumps can be removed by working the land with a large breaking plow or heavy disc, but this generally involves the difficult task of removing many roots and other debris by hand before the soil can be successfully tilled. If left in the soil, these materials decompose very slowly, and the larger pieces interfere with cultivation for a long time.

Figure 10.—**Bulldozer with scarifier blade used for land clearing.**

Much of the success of any land-clearing project in the Area depends upon freeing the roots and stumps of as much soil as possible before pushing them into windrows for burning. This is especially important on shallow soils where gravel and stones will hinder tillage if much surface soil is removed during land clearing.

Poorly drained soils like the Slikok and Wasilla, generally cannot be cleared with heavy equipment unless they are frozen or are artificially drained. These soils commonly have a thick surface mat of moss or sedges that should be removed during clearing, as it tends to prevent the soil from drying.

In the undisturbed soils of the uplands, the organic matter is commonly concentrated in a surface mat 2 to 4 inches thick. In clearing the land of trees or brush, it is important that some of this material be allowed to remain on the ground. This organic matter, mixed with the underlying mineral soil, is effective in maintaining good tilth and in promoting the infiltration of water.

In cultivated fields of Bodenburg, Doone, and other soils where blowing is a hazard, natural windbreaks of adequate width and spacing should be left to control soil blowing and drifting.

Also important are the precautionary measures necessary to prevent the spreading of fires to nearby forests. For safe burning it is essential that all windrows or piles of debris are well within cleared areas and are not too close to woodland or brush.

Fertilization

The successful production of crops in the Area depends considerably upon fertilization. Newly cleared soils need

***Figure 12.*—Harvesting a crop of green oats and peas for silage on Bodenburg silt loam, nearly level. Yields of 7 tons per acre are obtained under good management.**

Spring barley and oats are the main cereal crops. The harvested grain commonly needs artificial drying for safe storage. Although nearly all of the grain harvested is used for livestock, the oat varieties adapted to the Area are also suitable for milling, and the barley varieties are suitable for malting.

Field corn is not suited to the Area, and rye and flax generally will not mature. Small acreages of early-maturing wheat are grown, but yields of total digestible nutrients per acre are generally lower than those produced by oats or barley (*1*).

In general, root vegetables and leafy vegetables are especially suitable for the Area. Potatoes are the leading cash crop, but cabbage, carrots, and head lettuce are also grown on a commercial scale. Garden vegetables include celery, cauliflower, beets, turnips, radishes, onions, garden peas, beans, Brussels sprouts, broccoli, and others. Tomatoes, cucumbers, and sweet corn can be grown safely only in greenhouses. Recent experiments, however, indicate that sweet corn can be grown outdoors with the aid of a plastic mulch.

Tame varieties of raspberries, strawberries, and currants are grown on a small scale. Except for Siberian crabapple, fruit trees have not been grown successfully. Small fruits native to the Area include lingenberries, mooseberries (highbush cranberries), raspberries, blueberries, cloudberries, currants, and rose hips.

Estimated Yields

Estimated average yields per acre of principal crops grown on soils of the Area are given in table 4. These estimates are averages expected over several years. The increase in yields that can be obtained by irrigation has not been considered in these estimates. The yields in columns A are expected under average management, and those in columns B are expected under improved management. The estimates were made on the basis of information from the Alaska Agricultural Experiment Station, the Alaska Agricultural Crop Reporting Service, agricultural fieldworkers, and farmers.

Practices and conditions under average management include the following: (1) Minimum amounts of fertilizer are applied according to results of occasional soil tests, but fertility is commonly not adequate for optimum plant growth; (2) sod crops, barnyard manure, and crop residue are used to a limited extent, but the quality and quantity are generally inadequate for the most efficient use of moisture and plant nutrients; (3) conservation practices to control soil blowing and water erosion are applied to a limited extent, but they are generally not adequate on all fields; (4) weeds and harmful insects are controlled to some extent on cropland, but seldom on pastures; (5) cutting and grazing of forage is only partly regulated, and stands are weakened by overgrazing; (6) artificial drainage is adequate on soils that require it.

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*

[Dashed lines indicate the soil is not suited to, or is not used for, the crop]

Soil	Oats		Barley		Bromegrass hay (2 cuttings)		Silage: Oats and peas		Silage: Grass [1]		Potatoes		Pasture productivity [2]
	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	
Anchorage sand, undulating to rolling	30	40	25	35	1. 50	2. 50	3. 50	4. 50	3. 00	4. 50	------	------	Fair.
Anchorage sand, hilly to steep	------	------	------	------	------	------	------	------	------	------	------	------	Poor.
Anchorage silt loam, nearly level	35	45	30	40	1. 50	2. 50	3. 75	5. 00	3. 00	4. 50	6. 00	9. 00	Fair.
Anchorage very fine sandy loam, undulating	35	45	30	40	1. 50	2. 50	3. 75	5. 00	3. 00	4. 50	6. 00	9. 00	Fair.
Anchorage very fine sandy loam, rolling	30	40	25	35	1. 25	2. 25	3. 50	4. 50	2. 50	4. 00	------	------	Fair.
Anchorage very fine sandy loam, hilly	------	------	------	------	1. 00	1. 75	------	------	2. 00	3. 00	------	------	Poor.
Anchorage very fine sandy loam, moderately steep	------	------	------	------	------	------	------	------	------	------	------	------	Poor.
Bodenburg silt loam, nearly level	55	65	45	55	2. 50	3. 50	5. 50	7. 50	5. 00	7. 00	9. 00	13. 00	Good.
Bodenburg silt loam, undulating	55	65	45	55	2. 50	3. 50	5. 50	7. 50	5. 00	7. 00	9. 00	13. 00	Good.
Bodenburg silt loam, rolling	50	65	40	55	2. 25	3. 50	5. 00	7. 00	4. 50	7. 00	8. 00	12. 00	Good.
Bodenburg silt loam, hilly	35	50	30	45	2. 00	3. 00	4. 00	6. 00	4. 00	6. 00	------	------	Good.

See footnotes at end of table.

TABLE 4.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Oats		Barley		Bromegrass hay (2 cuttings)		Silage				Potatoes		Pasture productivity [2]
							Oats and peas		Grass [1]				
	A	B	A	B	A	B	A	B	A	B	A	B	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	
Knik silt loam, moderately steep	---	---	---	---	1.50	2.00	---	---	3.00	4.00	---	---	Fair.
Knik silt loam, steep	---	---	---	---	---	---	---	---	---	---	---	---	Poor.
Matanuska silt loam	45	60	40	55	2.25	3.25	5.00	7.00	4.50	6.50	7.00	10.00	Good.
Mixed alluvial land	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Moose River silt loam	---	---	---	---	1.50	2.50	4.00	6.00	3.00	5.00	---	---	Fair.
Nancy silt loam, nearly level	50	65	40	55	2.25	3.50	5.00	7.50	4.50	7.00	8.00	11.00	Good.
Nancy silt loam, undulating	50	65	40	55	2.25	3.50	5.00	7.50	4.50	7.00	8.00	11.00	Good.
Nancy silt loam, rolling	45	65	35	55	2.00	3.25	4.50	7.00	4.00	6.50	7.00	11.00	Good.
Nancy silt loam, hilly	30	50	25	45	1.75	2.75	3.50	5.75	3.50	5.50	---	---	Fair.
Nancy silt loam, moderately steep	---	---	---	---	1.50	2.00	---	---	3.00	4.00	---	---	Fair.
Naptowne silt loam, nearly level	40	55	35	45	2.25	3.25	4.50	6.50	4.50	6.50	6.50	10.50	Good.
Naptowne silt loam, undulating	40	55	35	45	2.25	3.25	4.50	6.50	4.50	6.50	6.50	10.50	Good.
Naptowne silt loam, rolling	35	50	30	45	2.00	3.00	4.00	6.50	4.00	6.00	6.00	10.00	Good.
Naptowne silt loam, hilly	30	45	25	40	1.75	2.50	3.25	5.50	3.50	5.50	---	---	Fair.
Naptowne silt loam, moderately steep	---	---	---	---	1.25	2.00	---	---	2.50	4.00	---	---	Fair.
Naptowne silt loam, steep	---	---	---	---	---	---	---	---	---	---	---	---	Poor.
Niklason silt loam	45	55	40	50	2.00	3.00	4.50	6.50	4.00	6.00	7.00	10.00	Good.
Niklason very fine sand	40	50	35	45	1.75	3.00	4.00	6.00	4.00	6.00	7.00	10.00	Good.
Reedy silt loam	40	55	35	50	2.00	3.00	4.50	6.50	4.00	6.00	7.00	10.00	Good.
Rough mountainous land	---	---	---	---	---	---	---	---	---	---	---	---	
Salamatof peat	---	---	---	---	---	---	---	---	---	---	---	---	
Salamatof peat, ever frozen variant	---	---	---	---	---	---	---	---	---	---	---	---	
Schrock silt loam, nearly level	55	65	45	55	2.50	3.50	5.50	7.50	5.00	7.00	9.00	12.50	Good.
Schrock silt loam, undulating	55	65	45	55	2.50	3.50	5.50	7.50	5.00	7.00	9.00	12.50	Good.
Sea cliffs	---	---	---	---	---	---	---	---	---	---	---	---	
Slikok mucky silt loam	---	---	---	---	2.00	3.00	5.00	7.00	3.00	5.00	---	---	Fair.
Slikok stony mucky silt loam	---	---	---	---	---	---	---	---	---	---	---	---	Poor.
Spenard silt loam, nearly level	---	---	---	---	2.00	3.00	5.00	7.00	4.00	6.00	---	---	Good.
Spenard silt loam, gently sloping	---	---	---	---	2.00	3.00	5.00	7.00	4.00	6.00	---	---	Good.
Susitna silt loam	55	65	45	55	2.50	3.50	5.50	7.50	5.00	7.00	9.00	13.00	Good.
Susitna very fine sand	55	65	45	55	2.50	3.50	5.50	7.50	5.00	7.00	9.00	13.00	Good.
Susitna and Niklason very fine sands, overflow, 0 to 3 percent slopes	---	---	---	---	1.75	2.50	4.50	6.50	3.50	5.00	---	---	Fair.
Talkeetna silt loam, moderately steep to steep	---	---	---	---	---	---	---	---	---	---	---	---	Poor.
Terrace escarpments	---	---	---	---	---	---	---	---	---	---	---	---	
Tidal flats	---	---	---	---	---	---	---	---	---	---	---	---	
Tidal marsh	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Torpedo Lake silt loam, nearly level	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Torpedo Lake silt loam, gently sloping	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Torpedo Lake silt loam, moderately sloping	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Torpedo Lake silt loam, strongly sloping	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Torpedo Lake-Homestead silt loams, undulating:													
Torpedo Lake	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Homestead	40	55	35	50	2.00	3.00	4.50	6.50	4.00	6.00	6.50	10.00	Good.
Torpedo Lake-Homestead silt loams, rolling:													
Torpedo Lake	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Homestead	35	50	30	45	1.75	2.75	4.00	6.00	3.50	5.50	6.00	10.00	Fair.
Torpedo Lake-Homestead silt loams, hilly:													
Torpedo Lake	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Homestead	30	45	25	40	1.50	2.50	3.50	5.50	3.00	5.00	---	---	Fair.
Torpedo Lake-Homestead silt loams, moderately steep:													
Torpedo Lake	---	---	---	---	---	---	---	---	---	---	---	---	Fair.
Homestead	---	---	---	---	1.25	2.00	---	---	2.50	4.00	---	---	Fair.
Wasilla silt loam	---	---	---	---	2.00	3.00	5.00	7.00	4.00	6.00	---	---	Good.

[1] Yields of grass silage are for a second cutting only, as first cuttings are commonly harvested for hay.

[2] Pasture productivity ratings are based on the number of acres of improved pasture required to produce sufficient forage for one dairy cow, or an equivalent animal unit, for the entire pasture season under average management. The ratings are as follows: Good, 1 acre or less; fair, 1 to 2 acres; poor, more than 2 acres.

indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I. Soils that have few limitations that restrict their use. There are no class I soils in the Matanuska Valley Area.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Class IV. Soils that have very severe limitations that restrict the choice of plants, or require very careful management, or both.

Class V. Soils that are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. There are no class V soils in the Matanuska Valley Area.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, range, woodland, or wildlife food and cover.

Class VII Soils that have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within a class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

CAPABILITY UNITS are soil groups within the subclasses. In this survey they are designated as management groups. The soils in one capability unit, or management group, are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Such a grouping is convenient for making many statements about management of soils.

Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIs-2. In the subsection that follows, the capability unit numbers are in parenthesis following the management group numbers.

Management groups

In the following discussions of management groups, suggestions are given for the use, management, and conservation of the soils. The names of the soil series represented are given in the description of each group, but this does not mean that all the soils of a given series are in the same group. The group designation of each soil in the Area can be found in the "Guide to Mapping Units."

No specific recommendations are made as to the amounts and kinds of fertilizer needed, the most suitable crop varieties, or the best seeding rates, for these factors change with new developments in farming. Current information and recommendations are available from the local Extension Service and from the Alaska Agricultural Experiment Station.

It is assumed that the fertilizer needs of soils on a specific farm are to be determined through soil tests.

MANAGEMENT GROUP 1 (IIc-1)

This group consists of soils of the Bodenburg, Flat Horn, Schrock, and Susitna series. These soils are nearly level and moderately deep to deep. Drainage is good, and the moisture-supplying capacity is moderate. The texture is very fine sandy loam, very fine sand, or stratified silt and sand.

These soils are suited to all the climatically adapted crops. They are well suited to early vegetables, as they can be worked slightly earlier in spring than finer textured soils. They all need fertilizer, and the Flat Horn and Schrock soils need lime. Organic matter is needed in order to keep the soils in good tilth and promote efficient use of moisture and plant nutrients. The organic-matter content can be maintained by applying manure, utilizing crop residue, and including grasses and legumes in the cropping sequence. Irrigation in dry years helps to sustain yields and minimize seeding losses.

The Bodenburg and Susitna soils in the eastern part of the Area are susceptible to blowing. Large cultivated fields of these soils need a protective cover of stubble or grass throughout the winter, as they frequently lack a snow cover. Windbreaks and stripcropping also are effective in controlling soil blowing.

MANAGEMENT GROUP 2 (IIc-2)

This group consists of soils of the Bodenburg, Doone, Nancy, and Naptowne series. These soils are nearly level and moderately deep to deep. Their texture is silt loam. Drainage is good, and the moisture-supplying capacity is favorable.

These soils are suited to all the climatically adapted crops. They all need fertilizer, and the Nancy and Naptowne soils need lime. Organic matter is needed to maintain good tilth. It can be supplied by applying manure, utilizing crop residue, and including grasses and legumes in the cropping sequence. Irrigation in dry years helps to sustain yields and minimize seeding losses.

The Bodenburg and Doone soils are susceptible to blowing. Windbreaks and stripcropping are effective in protecting these soils. Fall plowing is not advisable, because there is often no snow cover in winter and the soils are exposed to blowing.

Small depressions that are occasionally ponded for short periods are common in areas of Bodenburg and Doone soils. Ordinarily these depressions can be ditched or smoothed, so as to facilitate the operation of farm equipment and to limit soil losses.

MANAGEMENT GROUP 8 (IIIs–1)

This group consists of shallow soils of the Homestead and Knik series. These soils are nearly level and are underlain by coarse material. Their texture is silt loam, and they are well drained.

These soils can be used for all of the crops climatically adapted to the Area, but they are shallow over sand and gravel and therefore have a lower moisture-supplying capacity than most of the deeper silty soils. They should be used for row crops not more than 1 year in 3. They need fertilizer, and the Homestead soil needs lime for most crops. Because they are droughty, maintaining a supply of organic matter is especially important. Applying manure regularly, including grasses and legumes in the cropping sequence, and returning crop residue are means of supplying organic matter and thus maintaining good tilth for efficient use of moisture and plant nutrients.

Crops on the Knik soil have responded well to sprinkler irrigation in dry years. Those on the Homestead soil probably would respond similarly.

Gravel in some very small, shallow spots interferes with tillage. Water erosion on these nearly level soils is not a significant hazard, but the Knik soil in the eastern part of the Area is susceptible to blowing if cultivated. Windbreaks, stripcropping, and winter cover are needed to protect it.

MANAGEMENT GROUP 9 (IIIs–2)

This group consists of shallow, well-drained soils of the Niklason series. These soils are nearly level. They are made up of stratified silt and sand underlain by coarse sand and gravel at a depth of 15 to 27 inches.

These soils can be used for all of the crops climatically adapted to the Area, but they are droughty, and yields are likely to be severely limited in dry years. Fertilizer and organic matter are needed. Applying manure regularly, returning crop residue to the soil, and including grasses and legumes in the cropping sequence are means of supplying the organic matter that is necessary for good tilth and the efficient use of moisture and plant nutrients. In dry years most crops respond to sprinkler irrigation.

In the eastern part of the Area, these soils are in the path of strong, gusty winds and are susceptible to blowing if cultivated. Windbreaks, stripcropping, and grass crops help to control soil blowing. Fall plowing is not advisable in this part of the Area, as it leaves the soils exposed to the winter winds.

Most of the areas are forested. Many stands of cottonwood (balsam poplar) and a few stands of paper birch and white spruce are merchantable.

MANAGEMENT GROUP 10 (IIIs–3)

This group consists of nearly level, well-drained silty soils of the Matanuska and Reedy series. The Matanuska soils are shallow over gravelly material; the Reedy soils are underlain by slowly permeable material.

All of the crops climatically adapted to the Area can be grown on these soils, but the root growth of some crops is restricted by the moderately firm, slowly permeable subsoil. Thus, yields are limited, especially during dry years. Yields of grass and small grains are usually good, however, if adequate levels of fertilizer and organic matter are maintained.

MANAGEMENT GROUP 11 (IIIw–1)

This group consists of silty soils of the Kalifonsky series. These soils are nearly level to moderately sloping. They are moderately deep to deep over coarse gravelly material and are well drained.

These soils are suitable as cropland, but they dry out slowly in spring and tend to remain cool throughout the growing season. Artificial drainage is feasible and generally is necessary for satisfactory yields and for the operation of farm machinery. Even if drained, these soils are suited to only short-season crops. Good yields of forage can be obtained from perennial grasses if the soils are fertilized. Small grains ordinarily do not mature but can be harvested for hay or silage.

The native forest consists mostly of slow-growing black spruce and has little commercial value.

MANAGEMENT GROUP 12 (IIIw–2)

Wasilla silt loam is the only soil in this group. This soil is deep, nearly level, and poorly drained. It is underlain by slowly permeable material.

Most of the acreage is in native forest, and there are some stands of merchantable paper birch. If cleared, this soil could be used for crops, but drainage is required. Even after drainage, only short-season crops can be grown. Good yields of forage can be obtained from perennial grasses if fertilizer is applied. Small grains rarely mature but can be harvested for hay or silage.

MANAGEMENT GROUP 13 (IVe–1)

This group consists of soils of the Bodenburg, Doone, Knik, Jim, Nancy, and Naptowne series. These soils are deep to moderately deep. Their texture is silt loam or very fine sandy loam, and they are well drained. They have short, hilly slopes of 12 to 20 percent.

If cleared and used for crops, these soils are susceptible to very severe water erosion. Leaving them in native vegetation is advisable. If they are needed as cropland, they should be kept in perennial grasses most of the time to control erosion.

Good yields of forage can be obtained if fertilizer is applied and harvesting is regulated. Lime also is needed on the Nancy and Naptowne soils. Grain can be grown occasionally if erosion is controlled by tilling on the contour and keeping waterways in grass. Merchantable stands of paper birch and quaking aspen are fairly common, and in a few places there are sparse stands of white spruce.

MANAGEMENT GROUP 14 (IVe–2)

This group consists of shallow, silty soils of the Homestead and Knik series. These soils are well drained. They have hilly, irregular slopes of 12 to 20 percent.

These soils are not suited to row crops. They are droughty and susceptible to very severe water erosion if cultivated. Leaving them in native vegetation is desirable. If needed as cropland, they should be kept in perennial grasses most of the time. They produce satisfactory yields of forage if fertilized. In addition, the Homestead soil needs lime. Top dressings of fertilizer and manure applied frequently, help to maintain vigorous stands of perennial grasses. Cutting and grazing should be carefully regulated. Small grains can be grown occasionally if erosion is controlled by tilling on the contour. Yield of all crops are severely limited in dry years.

Almost solid stands of white spruce are common on this soil, but cottonwood (balsam poplar) or paper birch is dominant in places.

MANAGEMENT GROUP 23 (VIs-3)

Anchorage very fine sandy loam, hilly, is the only soil in this group. It has short, irregular slopes of 12 to 20 percent.

This soil should be left in native vegetation. It is droughty and blows readily if the surface is exposed. If cleared, it should be kept in perennial grasses and used for hay, silage, or pasture. Fertilization and carefully controlled grazing and cutting are needed to maintain satisfactory stands. Low yields can be expected in dry years.

The forest cover consists of paper birch, scattered white spruce trees, and a few stands of quaking aspen.

MANAGEMENT GROUP 24 (VIw-1)

Tidal marsh is the only mapping unit in this group. This land type consists of poorly drained clayey sediments on tidal plains. In places Tidal marsh is occasionally inundated by high tides.

The native vegetation consists mostly of sedges and grasses that are fairly good for hay or pasture. Yields are low but probably could be improved by fertilization.

Because of its low position and moderately fine texture, Tidal marsh is difficult to drain and is not suited to cultivated crops. During dry years it could be seeded to perennial grasses.

MANAGEMENT GROUP 25 (VIw-2)

In this group are poorly drained silty soils of the Torpedo Lake series. These soils are in nearly level to strongly sloping drainageways and seepage areas. They have a tight clayey subsoil and are too wet for cultivation. Artificial drainage is not feasible. Some patches of native grasses are suitable for light grazing, and forage yields could probably be improved by removing scattered brush and trees.

MANAGEMENT GROUP 26 (VIw-3)

This group consists of poorly drained soils of the Torpedo Lake series and well-drained soils of the Homestead series that are intermingled in a complex pattern. These soils are silty. The poorly drained soils are in swales, drainageways, and seepage areas that separate the small, undulating to moderately steep knolls and ridges occupied by the well-drained soils.

These complexes are not suitable for extensive cultivation and ordinarily should be left in native vegetation. The irregular patches of Torpedo Lake soils are too wet for cultivation unless drained, and drainage is not feasible. The native grasses that commonly grow on these soils can be used for light grazing, but they are readily destroyed by overgrazing. Removing brush and scattered trees from these poorly drained places probably would improve the stands of grass.

Most of the well-drained sites are occupied by the Homestead soils and support forests, mostly of paper birch. In some places the trees are of merchantable size. The well-drained sites are too irregular and small for farming. If needed, they could be cleared and improved for pasture.

MANAGEMENT GROUP 27 (VIw-4)

Moose River silt loam is the only soil in this group. It is a poorly drained soil in low areas along streams.

This soil is not suited to cultivated crops. It should be left in native vegetation. It has a rapidly fluctuating water table, and artificial drainage generally is not feasible. If needed, it could be cleared of brush and seeded to perennial grasses for hay or pasture.

MANAGEMENT GROUP 28 (VIIe-1)

This group consists of silty, well-drained soils of the Bodenburg, Knik, Doone, Homestead, Jim, Naptowne, and Talkeetna series. All of these soils are steep except the Talkeetna, which is moderately steep to steep.

These soils are susceptible to severe erosion if cultivated. They should be left in native vegetation, which consists mainly of forests in which paper birch, quaking aspen, and white spruce are dominant. In places there are stands of merchantable trees. Also, there are large areas of shrubs and brushy vegetation that provide excellent browse and cover for wildlife. Patches of native grasses are suitable for grazing, but they are widely scattered and can be severely damaged by overgrazing.

If these soils are cleared, they should be seeded to perennial grasses to control erosion. Forage yields vary widely, depending on seasonal rainfall and slope exposure. Normally, the south-facing slopes produce forage earlier in spring than north-facing slopes but are droughtier. Fertilizing at regular intervals and controlling grazing can improve yields and help to insure longer lasting stands. The control of grazing also helps to prevent gullying.

MANAGEMENT GROUP 29 (VIIs-1)

Homestead silt loam, very shallow, steep, is the only soil in this group. This soil is extremely droughty and is extremely susceptible to erosion. It should be left in native vegetation, which consists mostly of paper birch, aspen, and a few white spruce trees. In addition, there are many patches of brushy vegetation that are excellent wildlife habitats.

If needed, this soil can be seeded to perennial grasses and used for pasture, but regular applications of fertilizer and careful management of grazing are required to maintain satisfactory stands and to control gullying. Even under careful management, average yields of forage are low.

MANAGEMENT GROUP 30 (VIIs-2)

This group consists of excessively drained sandy soils of the Anchorage series. For the most part, these soils are moderately steep, but some are hilly and some are steep. They are extremely droughty, and they blow readily if the surface is exposed. They are suitable for forests or for wildlife habitats.

MANAGEMENT GROUP 31 (VIIw-1)

Kalifonsky silt loam, strongly sloping to steep, is the only soil in this group. It is a somewhat poorly drained soil on north-facing slopes.

This soil remains cool and moist throughout the growing season because of seepage from adjoining slopes and insufficient sunlight. It is susceptible to erosion if the native vegetation is removed. In places the native vegetapatches of brush provide moderate browse for moose. A few of these animals stay throughout the year, but by far the greatest numbers are present in the winter when deep snow at higher elevations forces them to come down. A few small ponds are occasionally used by ducks. Several of the small streams tributary to the Matanuska River support a few Dolly Varden trout, a few graylings, and small runs of spawning salmon. Most of these streams, however, provide little in the way of sport fishing because they have a rapidly fluctuating water level and often carry large quantities of silt.

Homestead association.—Most of this association is unsettled and is forested with stands of paper birch and white spruce that are nearing maturity. Consequently, the forest understory is sparse, except in scattered burned areas and around a few forest openings. This type of vegetation provides a small to moderate amount of browse for moose and limited cover for smaller animals. Spruce grouse and songbirds are numerous. Only a few scattered lakes and ponds are suitable for ducks. A few beavers also inhabit the lakes and some of the small streams. Except for one or two lakes that harbor rainbow trout, these waters generally are not suitable for fish. The insects in many fallen and mature trees and the scattered patches of wild berries are food for black bear that frequently travel through this part of the Area in spring and summer.

Homestead-Knik association.—With the exception of waterfowl and shore birds, this association is moderately populated with all species of wildlife common to the Matanuska Valley Area. The vegetation is typically forest, but many streams, wet places, small muskegs, and scattered lakes provide a variety of habitats for many large and small mammals. Rainbow trout, Dolly Varden trout, and grayling are common in many of the streams and scattered lakes, but only a few of the streams have small runs of spawning salmon.

Homestead-Jacobsen association.—Though other associations are similar to it, this association probably has the greatest variety of vegetation in the Matanuska Valley Area. The shallow, well-drained Homestead soils, which are dominant on uplands, support forests in all stages of growth, including many small tracts of young birch and willow brush, as shown in figure 14.

The associated, poorly drained mineral soils are commonly covered with patches of willow, alder, grass, and sedge. A few areas support solid stands of black spruce or a thick ground cover of moss. This variety in vegetation makes excellent year-round habitat for moose, black bear, fox, coyotes, rabbits, squirrels, spruce grouse, and other animals and birds.

Trout are fairly plentiful in most of the larger lakes and streams, many of which are spawning waters for substantial runs of salmon in summer and fall. In addition, there are many small lakes and ponds used by waterfowl. Beaver, mink, and other furbearers are also plentiful in and around these waters. The many muskegs, in which poorly drained peat soils are dominant, are used by terns, yellowlegs, sandhill cranes, and similar birds. Along Knik Arm are small tracts of Tidal marsh frequented by shore birds.

Homestead-Nancy association.—The wildlife habitat in this association is similar to that in the Homestead-Jacobsen association. Except that there are no shore birds, the kinds of wildlife also are similar.

Knik-Coal Creek association.—Except for a greater number of farms and the lack of frontage on Knik Arm, the habitat for wildlife in this association is comparable to that in the Homestead-Jacobsen association. Some of the lakes have been stocked with silver salmon, in addition to rainbow trout.

Naptowne-Spenard association.—The Naptowne soils, which are dominant in this association, support nearly mature stands of paper birch and white spruce. The density of most stands is fairly low, and consequently there is a heavy understory of brushy vegetation that is excellent habitat for moose, black bear, and many small animals. Several of the larger lakes have a good stock of rainbow trout, but only one or two streams are large enough for fish. A few ducks nest in the ponds and lakes, but the shoreline bordering Knik Arm consists mainly of a narrow, gravelly beach used mostly by a few shore birds.

Salamatof-Jacobsen association.—The peat soils in this association support a muskeg type of vegetation that provides little browse or cover suitable for moose and other animals. Bordering the muskegs, however, are poorly drained mineral soils that support willow and other brushy vegetation useful to many kinds of wildlife. In the small ponds in this association grow aquatic plants that supplement the diet of moose early in summer and provide food for certain species of ducks. The large, open muskegs are also chosen as nesting grounds by sandhill cranes.

Torpedo Lake-Homestead association.—This soil association is at higher elevations than most other parts of the Matanuska Valley Area. The complex pattern of poorly drained Torpedo Lake soils and well-drained Homestead soils supports an equally complex pattern of vegetation and wildlife habitat. Dense thickets of alder and willow, separated by many patches of grass and sedge, are common on the poorly drained sites. The well-drained soils on knolls and ridges support overmature stands of paper birch and white spruce, interspersed with large patches of grass and herbaceous plants. This type of habitat is especially suitable for moose, bear, spruce grouse, and ptarmigan, all of which are fairly abundant in this association. In winter the moose migrate to lower elevations, where the snow is not so deep.

This association has no suitable habitat for migratory waterfowl or shore birds. The streams, which are small and rapid, have only a few trout. Beaver, mink, wolf, and fox are fairly abundant.

Tidal Marsh-Clunie association.—These low, poorly drained, nearly level areas are almost treeless and are especially desirable as habitat for waterfowl and shore birds. Grass, sedge, and many kinds of aquatic plants grow on the extensive tracts of Tidal marsh. Large flocks of ducks, geese, sandhill cranes, and shore birds and a few small flocks of whistling swans use the marsh as a stopover place during spring and fall migrations; many also nest in the marsh.

Susitna-Niklason association.—Nearly all species of wildlife common to the Area can be found in this soil association. Moose are generally scarce in the summer but concentrate here in the winter.

meanings of the same terms in engineering. These terms are defined in the Glossary according to their meaning in soil science. For additional information about the soils, engineers may want to refer to "Descriptions of the Soils," "Formation and Classification of the Soils," and other sections of this survey.

Engineering Soil Classification Systems

Most highway engineers classify soil material according to the system approved by the American Association of State Highway Officials (*2*). In this system, soil materials are classified in seven principal groups. The groups range from A-1, which consists of gravelly soil of high bearing capacity, to A-7, which consists of fine-grained soils having low strength when wet. Within each group, the relative engineering value of the soil material is indicated by a group index number. These numbers range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the group classification symbol.

Some engineers prefer to use the Unified soil classification system (*16*). In this system, soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. An approximate classification of soils by this system can be made in the field.

Estimated Properties of the Soils

The estimated properties in table 5, are based on test data in table 7.

Permeability, measured in inches per hour, was determined for soils without compaction and after the removal of free water.

Available water capacity is the approximate amount of capillary water in a soil that is wet to field capacity. It is the amount of water that will wet air-dry soil to a depth of 1 inch without deeper percolation. Poorly drained soils normally contain more than this amount of water before drainage.

Dispersion refers to the degree and rate of the breakdown, or slaking, of the soil structure in water.

The shrink-swell potential indicates the extent to which a soil will shink or swell with changes in moisture content.

Engineering Interpretations of the Soil Properties

The interpretations of soil properties in table 6 are based on the estimates in table 5, on actual test data in table 7, and on field experience.

Sources of gravel and sand.—The Bodenburg, Doone, and Knik soils and nearly all of the other well-drained soils on river terraces and outwash plains are underlain by water-laid, loose very gravelly material. This material is free of silt and clay but commonly contains layers and pockets of sand. The gravel is rounded, and in places there are many cobblestones 3 to 6 inches in diameter. Gravel pits can be located almost anywhere in these areas, but the overburden of medium-textured wind-laid material is generally thicker near large rivers in the eastern part of the Area and in places near the tidal plains.

Sand and gravel can also be obtained in many places on the flood plains of major streams. Many of these areas, however, are subject to a seasonally high water table or to overflow, which may make excavation difficult.

Most of the well-drained soils on moraines are underlain by gravelly glacial drift that contains a varying amount of medium-grained and fine-grained particles. In places, there are many large stones and boulders. Generally, the Homestead and Nancy soils are underlain by gravelly drift that contains only a small quantity of fine particles and is fairly suitable for gravel. The Naptowne soils, which occur on moraines in the western part of the Area, are underlain by glacial drift that is usually less desirable or is unsuitable as a source of gravel because it contains a higher proportion of fine-grained particles. It also generally contains many large stones and boulders.

Frost action.—This is a major engineering problem in the Matanuska Valley. Most of the uplands are covered with a mantle of loess that is less than 10 inches thick in Homestead soils and more than 50 inches thick in Bodenburg soils; but it is commonly between 10 and 30 inches thick throughout the Area. This loess is susceptible to severe frost action and generally is not good material for construction. When wet, it is soft and slippery and may not support heavy equipment; when dry, it is dusty.

On the extensive river terraces, especially in the eastern part of the Area, the loess in the well-drained soils is underlain by water-laid gravel, which is nearly free of silt and clay and is not susceptible to frost action.

Moraines in the eastern part of the Area are made up of material nearly as coarse textured as that on the terraces, though there is generally a slight admixture of fine-grained particles. Most moraines in the central and western parts of the Area contain a higher proportion of fine-grained material, but susceptibility to frost action is still slight to moderate. In areas of Naptowne soils, however, the substratum contains lenses and pockets of fine material and is more susceptible to frost heaving. Large, angular boulders are fairly common throughout the moraines.

Most soils in depressions and on flood plains and the Torpedo Lake soils on hills in the north-central part of the Area are wet throughout summer and can be traversed in summer only by vehicles designed to operate in wet areas. These soils are highly susceptible to frost action in spring.

Peat soils in muskegs are common in the Matanuska Valley Area. These soils are nearly always wet to the surface, and the muskegs are difficult to drain. Peat has no value as construction material or as foundation material. If possible, it should be excavated before construction.

Because of the difficulty in maintaining proper control of moisture for compaction when soil is frozen, the construction of embankments and other earthworks with frost-susceptible material should be avoided in winter.

Agricultural drainage.—Drainage of the soils for agricultural purposes is physically possible, but it probably cannot be justified economically until a much greater proportion of the uplands is cleared. Drainage of peat soils for agriculture in the Area is not advisable.

properties of the soils

estimates were not made]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
No. 4 (4.76 mm.)	No. 10 (2 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH*		
100	80 to 90	10 to 15	5 to 10	.02 to .04	5.0 to 6.0	Low	Low.
100	100	70 to 80	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
100	100	5 to 15	5 to 10	.04 to .05	5.0 to 5.5	Low	Low.
100	90 to 100	5 to 10	5 to 10	.02 to .04	5.0 to 5.5	Low	Low.
100	100	60 to 70	0.8 to 1.2	.20 to .25	4.0 to 5.0	Moderate to high	Low.
100	100	5 to 15	5 to 10	.04 to .05	5.0 to 5.5	Low	Low.
100	90 to 100	5 to 10	5 to 10	.02 to .04	5.0 to 5.5	Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	100	60 to 80	0.8 to 1.2	.20 to .25	4.5 to 6.0	Moderate to high	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
					4.5 to 5.5		
100	100	85 to 95	0.2 to 0.5	.28 to .32	4.5 to 5.5	Moderate	High.
100	100	80 to 90	0.5 to 0.8	.25 to .30	4.0 to 4.5	High	Low.
100	100	85 to 95	0.2 to 0.5	.28 to .32	4.5 to 5.0	Moderate	Moderate.
90 to 100	80 to 90	70 to 80	0.2 to 0.5	.25 to .30	4.5 to 5.0	High to moderate	Moderate.
90 to 100	80 to 90	60 to 70	0.2 to 0.5	.28 to .32	4.5 to 5.0	Moderate	Moderate.
80 to 90	70 to 80	50 to 60	0.5 to 0.8	.25 to .30	4.0 to 5.0	High	Low.
40 to 50	20 to 30	5 to 15	5 to 10	.10 to .14	4.5 to 5.0	Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
100	100	50 to 60	0.8 to 1.2	.15 to .20	5.0 to 5.5	Low to moderate	Low.
100	100	40 to 50	0.8 to 1.2	.15 to .20	5.0 to 6.0	Low	Low.
60 to 75	40 to 50	5 to 10	>10			Low	Low.
100	90 to 100	65 to 75	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
40 to 50	25 to 40	0 to 20	>10	<.02	5.0 to 5.5	Low	Low.
100	90 to 100	65 to 75	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
40 to 50	25 to 40	0 to 20	>10	<.02	5.0 to 5.5	Low	Low.
50 to 60	40 to 50	20 to 30	0.5 to 0.8	.15 to .20	4.5 to 5.5	Low to moderate	Low.
40 to 50	30 to 40	5 to 10	5 to 10	.02 to .04	4.5 to 5.5	Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.

of the soils—Continued

Percentage passing sieve— No. 4 (4.76 mm.)	No. 10 (2 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH*		
100	85 to 95	60 to 70	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low to moderate.
85 to 95	75 to 85	45 to 55	0.2 to 0.5	.25 to .30	5.0 to 5.5	Low to moderate	Moderate.
60 to 70	40 to 50	30 to 40	0.2 to 0.5	.20 to .25	5.0 to 5.5	Low to moderate	Moderate.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
40 to 70	40 to 60	0 to 15	>10	<.02		Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
80 to 90	70 to 80	60 to 70	0.2 to 0.5	.28 to .32	5.0 to 6.0	Moderate	Moderate.
50 to 60	30 to 40	10 to 20	>10	<.02		Low	Low.
100	100	80 to 100	0.5 to 0.8	.25 to .30	4.0 to 4.5	High	Low.
90 to 100	80 to 90	5 to 10	5 to 10	.02 to .04	4.0 to 4.5	Low	Low.
90 to 100	80 to 90	30 to 60	0.5 to 0.8	.16 to .20	4.5 to 5.0	Moderate	Low.
40 to 50	25 to 40	5 to 10	>10	<.02	4.5 to 5.0	Low	Low.
100	100	80 to 90	0.5 to 0.8	.25 to .30	4.5 to 5.5	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	90 to 100	60 to 80	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
65 to 75	55 to 65	25 to 35	1.2 to 2.5	.08 to .12	5.0 to 6.0	Low	Low.
100	100	70 to 80	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	90 to 100	30 to 60	0.5 to 0.8	.16 to .20	5.0 to 6.0	Moderate	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	100	60 to 70	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
100	100	85 to 95	0.2 to 0.5	.28 to .32	5.5 to 6.5	Moderate	High.
					4.0 to 5.0		
100	100	80 to 90	0.5 to 0.8	.25 to .30	4.0 to 5.0	High	Low.
100	100	70 to 80	0.5 to 0.8	.25 to .30	5.0 to 5.5	High	Low.
50 to 60	30 to 40	10 to 20	5 to 10	.02 to .04		Low	Low.
100	100	80 to 90	0.5 to 0.8	.28 to .32	5.0 to 5.5	High	Low.
90 to 100	80 to 90	60 to 70	0.5 to 0.8	.25 to .30	5.0 to 5.5	High	Low.
50 to 60	40 to 50	25 to 35	0.5 to 0.8	.20 to .25	5.0 to 5.5	High	Low.
80 to 100	70 to 90	55 to 65	0.5 to 0.8	.25 to .30	4.0 to 4.5	High	Low.
75 to 85	65 to 75	40 to 60	0.2 to 0.5	.25 to .30	4.5 to 5.0	Moderate	Moderate.
60 to 90	50 to 75	35 to 60	0.2 to 0.5	.20 to .25	4.5 to 5.0	Moderate	Low to moderate.
100	100	70 to 80	0.5 to 0.8	.25 to .30	5.0 to 6.0	High	Low.
100	90 to 100	30 to 60	0.5 to 0.8	.12 to .16	5.0 to 6.0	Low to moderate	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.
100	90 to 100	30 to 60	0.5 to 0.8	.16 to .20	5.0 to 6.0	Moderate	Low.
40 to 50	25 to 40	5 to 10	>10	<.02		Low	Low.

of the soils—Continued

Percentage passing sieve— No. 4 (4.76 mm.)	No. 10 (2 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
			Inches per hour	*Inches per inch of soil*	*pH*		
90 to 95 50 to 60 40 to 50	80 to 90 40 to 50 30 to 40	60 to 70 15 to 25 15 to 25	0.8 to 1.2 5 to 10 5 to 10	.25 to .30 .08 to .12 .08 to .12	4.5 to 5.5 5.0 to 5.5 5.0 to 5.5	High Low Low	Low. Low. Low.
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100	100	85 to 95	0.2 to 0.5	.28 to .32	5.5 to 6.5	Moderate	High.
100	100	70 to 80	0.5 to 0.8	.28 to .32	5.0 to 5.5	High	Low.
80 to 90	70 to 80	45 to 55	0.2 to 0.5	.20 to .25	5.0 to 5.5	Moderate	Moderate.
100 90 to 100 90 to 100	100 80 to 90 75 to 80	80 to 90 45 to 55 20 to 30	0.5 to 0.8 0.2 to 0.5 0.5 to 0.8	.28 to .32 .20 to .25 .12 to .16	4.5 to 5.5 5.0 to 5.5 5.0 to 5.5	High Moderate Low	Low to moderate. Moderate. Low.

of the soil properties

Soil features affecting— Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Wind drifting on cleared areas along roads; poor trafficability.	Rapid permeability; excessive seepage.	Excessive seepage	Not required	Low water-holding capacity and rapid intake rate; frequent irrigation required.	Low water-holding capacity.
Erodibility of exposed embankments.	Moderate permeability above a depth of 36 inches; porous substratum.	Poor stability; piping; porous substratum.	Soils erodible; shallow ditches or land smoothing needed to drain slight depressions.	Medium water-holding capacity; medium intake rate.	Moderate erodibility.
Excessive drainage; stoniness; stable subsoil and substratum.	Rapid permeability; excessive seepage.	Excessive seepage; porous material.	Not required	Very low water-holding capacity; rapid intake rate.	Not required.
Peat over clayey substratum; water table at or near surface.	Permanently high water table.	Poor stability; peat is porous.	Outlets generally lacking; very low fertility.	Not required	Not required.
Seasonal high water table; clayey subsoil.	Poor drainage; slow permeability of subsoil; stones in places.	Fair stability; clayey material; stoniness in places.	Seasonal high water table; slow permeability of subsoil; stones in places interfere with ditch construction.	Not required	Not required.

of the soil properties—Continued

Soil features affecting—					
Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Erodibility of exposed embankments.	Moderate permeability above a depth of 30 inches; porous substratum.	Poor stability; piping; porous substratum.	Not required	Medium water-holding capacity; medium intake rate.	Moderate erodibility.
Severe erodibility of exposed embankments.	Rapid permeability of substratum; excessive seepage.	Excessive seepage; poor stability.	Not required	Medium water-holding capacity; medium intake rate.	High erodibility.
Subject to frequent flooding.	Rapid permeability	Porous material	Not required	Not required	Not required.
Deep fill	Rapid permeability	Porous material	Not required	Not required	Not required.
Stoniness; deep cuts and fills.	Rapid permeability of substratum; excessive seepage.	Excessive seepage	Not required	Low water-holding capacity; shallow or very shallow.	Shallowness or extreme shallowness to gravelly substratum; vegetation difficult to establish; low fertility.
Poor drainage; high water table.	Many stones; high water table.	Stoniness; fair stability; moderate permeability.	Stoniness	Not required	Not required.
Bedrock below a depth of 20 to 30 inches.	Seepage likely through cracks in bedrock.	Poor stability of silty mantle; piping; bedrock at a depth of 20 to 30 inches.	Not required	Hilly to steep slopes	High erodibility.
Seasonal high water table.	Seasonal high water table; excessive seepage in substratum.	Fair stability; piping; rapid permeability of substratum.	Seasonal high water table.	Not needed	Not needed.
Erodibility of exposed embankments; stones.	Slow permeability of substratum.	Fair stability; slow permeability; fair compaction.	Slow permeability of substratum; shallow ditches required for slight depressions.	Slow permeability	Stoniness; vegetation difficult to establish; deep cuts expose clayey material; erodibility.
Deep cuts and fills in places in hilly topography.	Shallowness over rapidly permeable substratum.	Poor stability of silty material; piping; excessive seepage through gravelly substratum.	Not required	Shallowness; medium water-holding capacity; medium intake rate.	Moderate erodibility; shallowness to gravelly substratum.
Clayey subsoil; cobblestones below a depth of 20 inches.	Slow permeability of clayey subsoil layer; shallowness to pervious material.	Slow permeability of clayey subsoil layer; fair stability; seepage through substratum.	Clayey subsoil; shallow to gravel.	Medium water-holding capacity; slow intake rate of clayey material.	Not required.

of the soil properties—Continued

Soil features affecting—					
Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Occasional flooding	Seasonal high water table; rapid permeability.	Stoniness; rapid permeability.	Not required	Not required	Not required.
Poor drainage	Fluctuating water table; excessive seepage.	Excessive seepage	Rapid permeability of subsoil and substratum; ditches needed to control water table.	Not required	Not required.
Erodibility of embankments.	Moderate permeability above a depth of 20 inches; rapid permeability of substratum.	Poor stability of silty material; porous, gravelly substratum.	Not required	Medium water-holding capacity; medium intake rate; low fertility.	Moderate erodibility.
Many cuts and fills in hilly topography; many stones in substratum.	Moderate permeability of substratum.	Poor stability of upper layers of silty material; moderately porous substratum; stoniness.	Not required	Medium water-holding capacity; medium intake rate; low fertility.	Moderate erodbility.
Flooding in places	Seepage in places	Moderate permeability of silty and very fine sandy material; seepage.	Not required	Medium water-holding capacity.	Not required.
Clayey substratum	Moderate permeability above a depth of 20 inches; slow permeability of substratum.	Poor stability of upper layers; clayey substratum difficult to compact.	Slowly permeable substratum.	Medium water-holding capacity; medium intake rate; clayey substrata.	Not required.
Exposed bedrock; deep cuts and fills.	Exposed bedrock	Bedrock	Not required	Not required	Not required.
Very poor drainage of peat; water table always near surface.	Peat material porous.	Peat material porous.	Outlets generally lacking; very low fertility.	Not required	Not required.
Erodibility of exposed embankments.	Moderate permeability above a depth of 20 to 50 inches; rapid permeability of substratum.	Poor stability of silty material when wet; excessive seepage through substratum.	Not required	Medium water-holding capacity; medium intake rate.	Moderate erodibility.
Very steep slopes; high erodibility.	Very steep slopes	Very steep slopes	Not required	Not required	Very steep slopes; high erodibility.
Poor drainage; high content of organic matter.	High content of organic matter; stoniness in places.	High content of organic matter; stoniness in places.	Moderate permeability; drainage ditches required to lower water table but not feasible in stony areas.	Not required	Not required.

of the soil properties—Continued

Soil features affecting—					
Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Impeded drainage; clayey subsoil and substratum; seasonal high water table.	Slow permeability of subsoil and substratum; seasonal high water table.	Good stability; slow permeability; fair compaction.	Slow permeability; ditches needed to lower water table.	Not required	Clayey subsoil.
Flooding in places	Excessive seepage	Moderate permeability of silty and very fine sandy material; seepage.	Not required	Moderate water-holding capacity.	Not required.
Steepness of slopes	Porous substratum; steep slopes.	Steep slopes	Not required	Not required	High erodibility; stony in places.
Very steep slopes	Very steep slopes; porous material.	Very steep slopes; porous material.	Not required	Not required	High erodibility; very steep slopes.
Frequent inundation by high tides.	Frequent inundation by high tides.	Poor stability	Too low for outlet ditches.	Not required	Not required.
Occasional flooding	High water table	Fair stability; clayey material.	Clayey substratum; occasional flooding.	Not required	Not required.
Poor drainage; clayey substratum.	High water table; slow permeability of substrata.	Fair stability; slow permeability of substratum.	Slow permeability	Not required	Stoniness; clayey substratum.
Poor drainage; seasonal high water table.	Slow permeability of clayey subsoil layer; seepage through sandy layers.	Slow permeability of clayey layer.	Seasonal high water table; ditches needed to control water table.	Not required	Not required.

test data

of Public Roads; tests performed in accordance with standard procedures of the American Association of State Highway Officials (*2*)]

Mechanical analysis [2]														Liquid limit	Plasticity index	Classification	
Percentage passing sieve—										Percentage smaller than—						AASHO	Unified
3-in.	2-in.	1½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
------	------	------	------	------	------	------	100	95	72	55	28	6	3	53	[3] NP	A-5(10)	MH.
------	------	------	------	100	97	96	95	91	77	55	34	6	3	43	NP	A-5(9)	ML.
------	100	94	80	69	52	39	26	7	2	------	------	------	------	[4] NV	NP	A-1-a(0)	GW.
------	------	------	------	------	------	------	------	100	74	------	39	8	3	37	NP	A-4(8)	ML.
------	------	------	------	------	------	------	100	98	15	7	4	1	------	NV	NP	A-2-4(0)	SM.
72	69	65	53	46	34	27	22	9	1	------	------	------	------	NV	NP	A-1-a(0)	GW.
------	------	------	------	------	------	100	98	92	63	55	25	5	1	38	5	A-4(6)	ML.
------	------	------	------	100	96	94	94	88	73	------	30	4	1	47	NP	A-4(8)	ML.
82	------	75	72	70	59	53	44	34	19	15	10	3	1	NV	NP	A-1-b(0)	GM.

test data—Continued

Mechanical analysis [2]														Liquid limit	Plasticity index	Classification	
Percentage passing sieve—										Percentage smaller than—						AASHO	Unified
3-in.	2-in.	1½-in.	1-in.	¾-in.	⅜-in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
------	------	------	------	------	------	------	------	100	92	60	37	7	4	44	1	A-5(9)	ML.
------	------	------	------	100	98	97	96	84	69	------	32	8	3	30	NP	A-4(7)	ML.
------	------	------	------	100	94	90	86	53	4	2	1	0	0	NV	NP	A-3(0)	SP.
------	------	------	------	------	------	------	------	100	89	------	24	5	2	39	NP	A-4(8)	ML.
------	------	------	------	------	------	------	100	98	89	------	35	6	1	32	NP	A-4(8)	ML.
------	------	------	------	100	99	99	98	59	3	1	1	0	0	NV	NP	A-3(0)	SP.
------	------	------	------	------	------	------	------	100	94	69	40	8	2	55	NP	A-5(11)	MH.
------	------	------	------	------	------	100	99	96	83	------	41	10	3	42	NP	A-5(8)	ML.
------	100	86	86	71	62	55	44	30	15	12	6	1	0	NV	NP	A-1-a(0)	GM.
------	------	------	------	------	------	------	100	99	76	56	19	5	2	32	4	A-4(8)	ML.
------	------	------	------	------	------	100	99	96	63	40	13	4	1	22	3	A-4(6)	ML.
------	------	100	94	87	80	72	62	50	32	43	20	10	3	16	NP	A-2-4(0)	SM.
------	------	------	------	------	------	100	99	97	58	46	22	5	3	31	NP	A-4(5)	ML.
------	------	------	------	------	------	------	------	100	80	50	11	2	0	25	NP	A-4(8)	ML.
------	------	100	94	87	79	71	65	53	30	22	16	6	3	15	NP	A-2-4(0)	SM.
------	------	------	------	------	100	98	96	89	67	53	35	8	4	56	NP	A-4(6)	MH.
------	------	100	91	91	84	79	72	53	24	20	10	3	1	45	NP	A-2-4(0)	SM.
------	100	88	88	82	73	66	56	44	26	20	13	4	2	14	NP	A-2-4(0)	SM.
------	------	100	94	93	88	84	80	73	54	49	30	12	6	33	3	A-4(3)	ML.
------	------	100	97	95	91	86	80	69	39	35	24	11	8	21	NP	A-4(0)	SM.
------	------	------	------	100	93	90	88	83	57	47	32	9	2	39	NP	A-4(4)	OL or ML.
------	------	------	100	97	95	93	91	84	64	------	43	25	17	29	5	A-4(6)	ML.
------	100	81	73	69	67	65	61	59	48	------	25	6	2	41	NP	A-4(3)	GM or OL.
------	------	------	------	100	97	94	91	83	54	47	36	18	13	26	1	A-4(4)	ML.
------	------	------	------	100	99	98	96	87	36	30	21	12	8	19	NP	A-4(0)	SM.

and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[3] NP=Nonplastic.

[4] NV=No value.

increase until the optimum moisture content is reached. After that, density decreases as moisture content increases. The highest density reached is referred to as "maximum dry density," and the corresponding moisture content is the "optimum moisture content." Moisture-density relationships are important in earthwork, for as a rule optimum stability of soil material is obtained if the material is compacted to maximum dry density, and this is most easily done at the optimum moisture content.

Mechanical analyses were made to determine the percentages of clay and coarser material in the soils. The analyses were made by a combination of the sieve and hydrometer methods. Percentages of clay determined by the hydrometer method should not be used in naming soil textural classes.

Liquid limit and plastic limit tests measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a dry state, the material changes from a semisolid to a plastic state. As the moisture content further increase, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It

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TABLE 8.—*Classification of soil series according to the current and the 1938 systems of classification*

Series	Current classification			1938 classification	
	Family	Subgroup	Order	Great soil group	Order
Anchorage	Sandy, mixed	Entic Cryorthod	Spodosol	Podzol	Zonal.
Bodenburg	Coarse-silty over sandy or sandy-skeletal, mixed, nonacid.	Typic Cryorthent	Entisol	Regosol	Azonal.
Chena	Sandy-skeletal, mixed, nonacid	Typic Cryopsamment	Entisol	Regosol	Azonal.
Clunie			Histosol [1]	Bog	Intrazonal.
Coal Creek	Coarse-silty, mixed, nonacid	Humic Cryaquept	Inceptisol	Humic Gley	Intrazonal.
Doone	Coarse-silty over sandy or sandy-skeletal, mixed, acid.	Typic Cryorthent	Entisol	Regosol	Azonal.
Flat Horn	Coarse-loamy, mixed	Typic Cryorthod	Spodosol	Podzol	Zonal.
Homestead	Loamy-skeletal, mixed	Typic Cryorthod	Spodosol	Podzol	Zonal.
Jacobsen	Loamy-skeletal, mixed, acid	Histic Cryaquept	Inceptisol	Humic Gley	Intrazonal.
Jim	Coarse-silty, mixed, nonacid	Typic Cryorthent	Entisol	Regosol	Azonal.
Kalifonsky	Coarse-silty over sandy or sandy-skeletal, mixed, acid.	Typic Cryaquept	Inceptisol	Low-Humic Gley	Intrazonal.
Kenai	Coarse-silty, mixed	Typic Cryorthod	Spodosol	Podzol	Zonal.
Knik	Coarse-silty over sandy or sandy-skeletal, mixed, acid.	Typic Cryorthent	Entisol	Regosol	Azonal.
Matanuska	Fine-silty over sandy or sandy-skeletal, mixed, nonacid.	Typic Cryorthent	Entisol	Regosol	Azonal.
Moose River	Sandy, mixed, nonacid	Typic Cryaquent	Entisol	Low-Humic Gley	Intrazonal.
Nancy	Coarse-silty over sandy or sandy-skeletal, mixed.	Typic Cryorthod	Spodosol	Podzol	Zonal.
Naptowne	Coarse-loamy, mixed	Typic Cryorthod	Spodosol	Podzol	Zonal.
Niklason	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid.	Typic Cryofluvent	Entisol	Alluvial	Azonal.
Reedy	Fine-silty, mixed, nonacid	Typic Cryaquept	Inceptisol	Alluvial	Azonal.
Salamatof			Histosol [1]	Bog	Intrazonal.
Schrock	Coarse-loamy, mixed	Typic Cryorthod	Spodosol	Brown Podzolic	Zonal.
Slikok	Coarse-silty, mixed, acid	Histic Cryaquept	Inceptisol	Humic Gley	Intrazonal.
Spenard	Fine-loamy, mixed, acid	Humic Cryaquept	Inceptisol	Low-Humic Gley	Intrazonal.
Susitna	Coarse-loamy, mixed, nonacid	Typic Cryofluvent	Entisol	Alluvial	Azonal.
Talkeetna	Loamy-skeletal, mixed	Cryic Humic Fragiorthod	Spodosol	Podzol	Zonal.
Torpedo Lake	Fine-loamy, mixed, acid	Histic Cryaquept	Inceptisol	Humic Gley	Intrazonal.
Wasilla	Fine-loamy, mixed, acid	Typic Cryaquept	Inceptisol	Low-Humic Gley	Intrazonal.

[1] The classification of Histosols below the order has not yet been established.

system was replaced because it was incomplete and did not sufficiently emphasize characteristics of the soil in determining its classification.

Following are brief definitions of the orders and subgroups in the current classification, as represented in the Matanuska Valley Area.

Entisols

Entisols have few, if any, clearly expressed characteristics. In the Matanuska Valley Area, Entisols occur in material recently deposited by wind or water. They are represented by the *Typic Cryaquents*, which are poorly drained, by the *Typic Cryopsamments*, which are well drained and coarse textured, by the *Typic Cryorthents*, which are well drained and medium textured or fine textured, and by the *Typic Cryofluvents*, which are well drained and consist of stratified, moderately coarse textured and finer textured materials.

Histosols

Histosols are composed primarily of organic material. The classification of these soils in categories below the order has not yet been established.

Inceptisols

Inceptisols are soils in which there has been modification of the parent material in place. In the Matanuska Valley Area, the only Inceptisols that are recognized are soils that developed under cold, wet conditions. These soils, the Cryaquepts, are characterized by gray, olive, or greenish colors with brown or reddish-brown mottles and streaks. In *Typic Cryaquepts*, no dark upper horizon has developed, and no thick mat of moss has accumulated on the surface. *Humic Cryaquepts* have a thick, dark-colored surface horizon. *Histic Cryaquepts* have a fairly thick deposit of peat or muck on the surface.

Spodosols

These are soils in which leaching (eluviation) has caused an accumulation of organic carbon, together with iron and aluminum, in an illuvial horizon of the profile. This horizon generally is dark brown or reddish brown. Above the illuvial horizon, a gray eluvial layer also commonly occurs at the surface of the mineral soil, but it may not occur in young Spodosols. Between the main illuvial horizon and the unaltered parent material, there is a transitional horizon. As a rule, the entire solum is