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DENNIS JOULE, P.E.  
CIVIL ENGINEER

Geotechnical Engineering

Ground and Surface Water Hydraulics

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DIVISION & LAND DEVELOP.

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LIMITED GEOTECHNICAL INVESTIGATION

SHADOW RIDGE SUBDIVISION  
King County, Washington

July 26, 1988  
1088-23

INTRODUCTION

This report is intended to satisfy the geotechnical requirements for the preliminary subdivision of Shadow Ridge, File Number 1088-23, as requested in the July 5th, 1988 letter to Craig Sears of Triad Associates from Lisa Pringle, Planner, King County Subdivision Products Section.

The planned subdivision will created 58 single family residential lots and associated County streets. Within the proposed subdivision there are two areas having steep slopes in excess of 40 percent.

The first area is a small area in the southwest corner of the plat involving only lots 26 and 27. These are stable slopes from 40 to 47 percent and a minimal building setback is recommended. Hereafter, this area will be referred to as the *southwest slope area* in this report.

The second area lies along the north property line and has slopes from 40 percent to vertical. While these slopes appear stable the setback recommendations are more complex due to the height and steepness of the slopes. This area is referred to as the *north slope area* in this report.

INFORMATION PROVIDED

A preliminary plat titled *Preliminary Plat of Shadow Ridge, King County, Washington*, dated 5-26-88, prepared by Triad Associates, Civil Engineers of Kirkland, was provided by Triad Associates. In addition a copy of the letter from Linda Pringle, to Triad Associates regarding the geotechnical plat requirements, dated July 5, 1988 was provided.

## SCOPE

The scope of work in this investigation included the following:

1. Subsurface exploration by means of four backhoe test pits near the slopes,
2. Field mapping the steep slopes, and logging the exposed slope faces in two locations,
3. A review of published geotechnical documents regarding the site and it's environs, and
4. Preparation of this report which presents the findings, conclusions, and recommendations regarding slope stability, building setbacks, and related geotechnical aspects of site development.

## FINDINGS

### General Surface Conditions

The property slopes down toward the north and northeast at an overall average slope of twelve percent. At the time of the field investigation the ground surface was covered with a heavy growth of native grasses, firs, and berry bushes, with young alder, mature maple trees, and some fir trees. No structures, ponds, streams, standing water, or wetlands were observed within the property.

### Subsurface Conditions

The site is mapped by the U.S. Soil Conservation Service as Alderwood sandy gravelly loam soils, 6 to 15 percent slopes (AgC). The exposed slope faces and test pit logs show that the site is underlain by from one to four feet of loose to medium dense silty sandy soil over compact, slightly cemented siltstone and sandstone.

The seasonal water table is likely perched on top of the relatively impervious siltstone and sandstone.

### Condition of the Existing Steep Slopes

*Southwest Slope Area* - These slopes are 75 feet high with average ground slopes as steep as 47 percent. The slopes are underlain by siltstone and sandstone and appear to be very stable. The surface is covered with a very dense growth of native ground cover and has a moderate to heavy growth of alder, maple, and a few fir trees. No erosion problems were observed anywhere on the slopes.

*North Slope Area* - These slopes are 50 feet high with overall average ground slopes of 50 percent. Portions of the slopes were steepened to near vertical conditions when a borrow pit was created some years ago along the north property line. It is reported that the borrow pit material was used in the construction of the existing dirt road running east-west just north of the property. This road reportedly connected a peat mining operation, located northwest of the property, and 190th Avenue S.E. The road is no longer in use. The slopes are underlain by siltstone and sandstone and appear to be stable.

## CONCLUSIONS

### Slope Stability

The slopes within this property are currently stable. The *northern slope area* has some minor erosion problems due to natural drainage over the near vertical slopes faces. If the recommendations presented below are followed, the slopes should not present an adverse impact on the development and the development should not adversely effect the slopes.

### Seismic Considerations

As with all land in the Puget Sound region, this property lies in Seismic Zone 3.

Seismic hazards can be divided into two general categories, hazards due to ground rupture and hazards due to ground shaking. Since no faults are known to pass thru the site, the possibility of earthquake induced ground rupture appears to be remote.

Even if severe ground shaking were to occur at the site, the slightly cemented siltstone and sandstone underlying the slopes should remain stable. If the building setbacks and drainage recommendations presented below are followed the residential structures and road systems within this subdivision should not be endangered by the slopes during anticipated seismic activity.

### Slope Safety

*North Slope Area* - Vertical slopes (cliffs) up to fourteen feet high were observed in the borrow pit area. This condition presents a safety hazard. Recommendations are made under *Slope Reconstruction* to minimize this hazard.

## RECOMMENDATIONS

### Slope Reconstruction

*North Slope Area* - For safety the vertical slopes (slopes 85 degrees or steeper) should be flattened to the natural angle of repose (1:1 or 100% slope) of the disturbed soil. These slopes are easily identified since they are too steep to support vegetation. Since the maximum observed height of the vertical slopes was fourteen (14) feet, and the

natural angle of repose of the disturbed soil is 1:1, this "chamfering" of the top of the slopes will move the top of the slope less than fourteen feet to the south (into the plat). The "chamfering" operation should be performed by simply breaking away the top of the slope and allowing the disturbed soil and vegetation to fall over the slope face and come to rest at the natural angle of repose. This could be done with a trackhoe with the machine sitting well back from the top of the slope. All areas of disturbed soil should then be hydroseeded. Details for the "chamfering" operation should be shown in the SWM drainage plans for the plat.

#### **Drainage Near the Slopes**

*Southwest Slope Area* - No special drainage facilities are required around these slopes. However, when developing the west portion of lot 27 drainage should not be directed toward the tops of the steep slopes.

*North Slope Area* - Once the "chamfering" operation has been completed a shallow drainage ditch should be constructed about ten feet upslope, and parallel to the top of the slope, to intercept and divert surface drainage away from the top of the slope. The ditch may discharge on the flatter slopes adjacent to the very steep slopes or may be piped to the toe of the very steep slopes. All areas of disturbed soil should then be hydroseeded. Details of the ditch should be shown in the SWM drainage plans for the plat.

#### **Building Setbacks**

All slopes 40 percent or steeper should be located in the field by the project Civil Engineer or Surveyor. In addition, all existing slopes 85 degrees or steeper should be located separately. These locations should then be drawn on the plat map.

*Southwest Slope Area* - A building setback of 25 feet from the top, sides, and bottom of these slopes 40 percent or steeper should be shown on the final plat map. Slopes 40 percent or steeper should be designated as a 'Native Slope Protection Easement'.

*North Slope Area* - Setbacks from steep slopes in this area should be based on two criteria, setbacks from natural slopes 40 to 80 percent, and setbacks from slopes over 80 percent. Slopes 40 to 80 percent should have building setbacks of 25 feet from top, sides, and bottom of slope. Slopes over 80 percent should have building setbacks of seventy five (75) feet from the top, sides, and bottom of slope. A single setback line should be drawn on the final plat map based on the controlling distance from the two slope conditions.

#### **General Foundation Conditions**

The proposed single family residential structures may be supported on conventional shallow foundations bearing on firm natural soil.

Reinforced concrete continuous footings may be designed to impose pressures on foundation soils up to 2000 pounds per square foot from dead plus normal live loading. Where footings are constructed adjacent to downslope cut banks or slopes, there is to

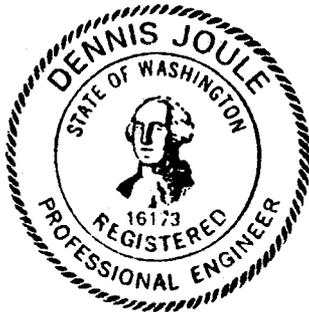
→ 2003 before or after regarding

July 26, 1988  
Project 1269

be a minimum 2:1 slope drawn between the bottom of the footing (point nearest the slope) and the toe of the cut bank or slope. Foundations should be embedded at least 12 inches below existing grade.

### LIMITATIONS

Subsurface exploration of any site is necessarily confined to selected locations, and conditions may and often do vary between these locations. Should varied conditions come to light during project development these conditions should be reported to this office for evaluation.



Report prepared by:

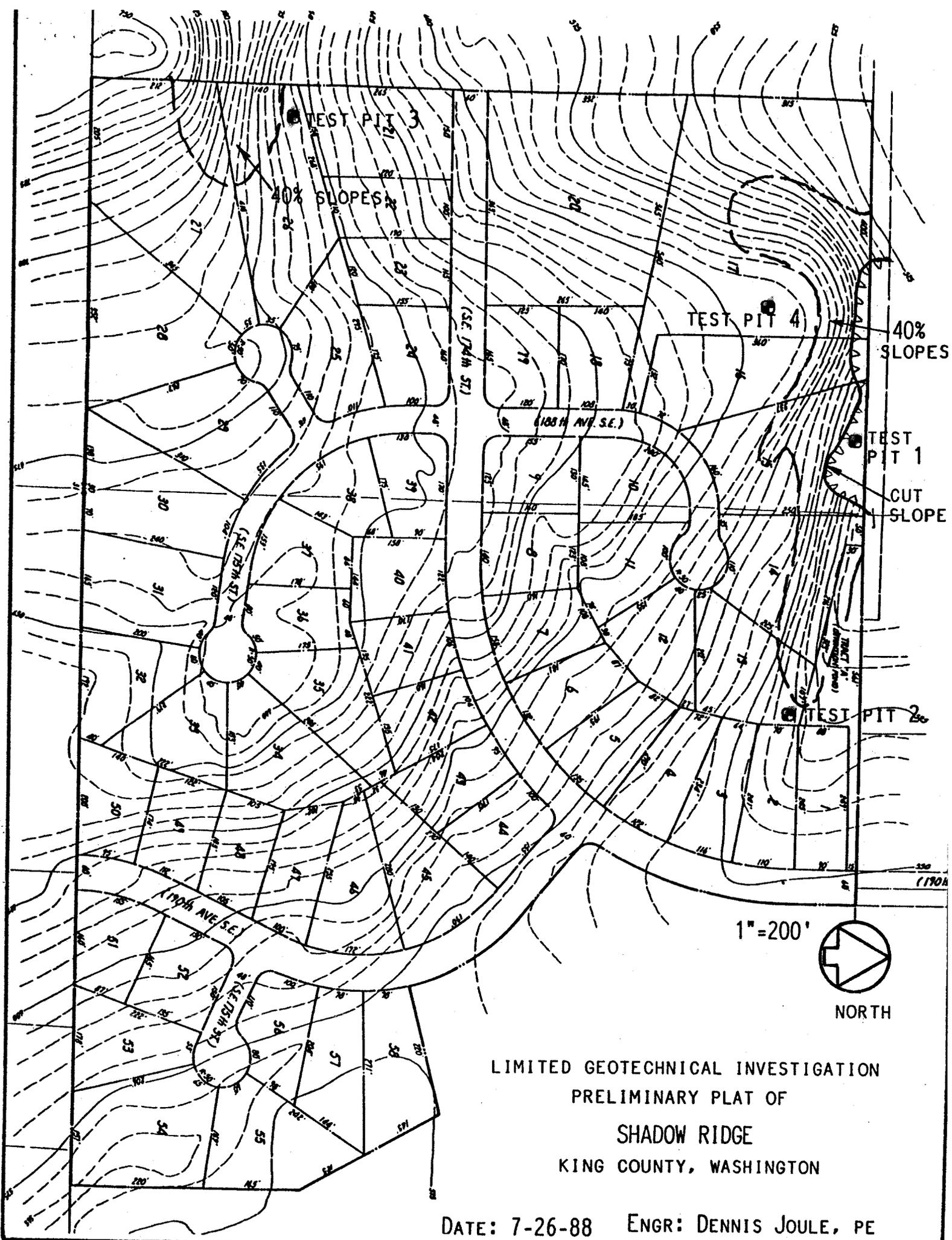
A handwritten signature in black ink, appearing to read "Dennis Joule".

Dennis Joule, P.E.

**SITE PLAN**

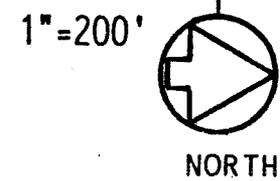
**SLOPE FACE LOGS**

**TEST PIT LOGS**



LIMITED GEOTECHNICAL INVESTIGATION  
 PRELIMINARY PLAT OF  
 SHADOW RIDGE  
 KING COUNTY, WASHINGTON

DATE: 7-26-88 ENGR: DENNIS JOULE, PE



# SOIL LOG - SLOPE FACE No. 1

PROJECT: SHADOW RIDGE

DATE: 7-23-88

EXCAVATED BY: *Mapping of Existing Slope Face*  
 DEPTH TO GROUNDWATER: INITIAL *none*

FINAL -- TOP ELEVATION: 560'(+/-)  
 LOGGED BY: *DJ*

SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE
Silty SAND with rounded Gravel-Organic with roots	Red Brn	Damp	Medium Dense	SPF	-1-		
Fractured SILTSTONE with Occasional Embeded Rounded Gravel	Light Brown	Damp	Hard	MLS	-2-		
					-3-		
					-4-		
					-5-		
					-6-		
					-7-		
Coluvial Pile (slough zone) Fine Sandy SILT with some Small Rounded Gravel (natural angle of repose = 100%)	Brown	Damp	Medium Dense	MLS	-8-		
					-9-		
					-10-		
					-11-		
					-12-		
Bottom Log 12.5'					-13-		
					-14-		
					-15-		
					-16-		
					-17-		
					-18-		
					-19-		
					-20-		

CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

**DENNIS JOULE, P.E.**  
 CIVIL ENGINEER

## SOIL LOG - SLOPE FACE No. 2

PROJECT: SHADOW RIDGE

DATE: 7-23-88

EXCAVATED BY: *Mapping of Existing Slope Face*  
 DEPTH TO GROUNDWATER: INITIAL *none*

TOP ELEVATION: 555'(+/-)  
 LOGGED BY: *DJ*

FINAL --

SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE
Silty SAND with rounded Gravel-Organic with roots	Red Brn	Damp	Medium Dense	SPF	-1-		
Fractured SILTSTONE with Occasional Embedded Rounded Gravel (Vertical and Overhanging Face)	Light Brown	Damp	Hard	MLS	-2- -3- -4- -5- -6- -7- -9-	4.5+ TSF	
SANDSTONE with Embedded Small Rounded Gravel	Red Brown	Damp	Very Dense	SPF	-10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-	4.5+ TSF	
Bottom Log 14.5'							

CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

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 CIVIL ENGINEER

# SOIL LOG - TEST PIT No. 1

PROJECT: Shadow Ridge

DATE: 7-23-88

EXCAVATED BY: Backhoe

HOLE ELEVATION: 512'(+/-)

DEPTH TO GROUNDWATER: INITIAL none

FINAL --

LOGGED BY: DJ

SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE
Slough Material - Very Silty Fine SAND with Embedded Chunks of Siltstone	Brown	Moist	Medium Dense	SPF	-1-	1.5 TSF	
					-2-		
Very Fractured SILTSTONE with Embedded Layers of SANDSTONE	Brown	Moist	Medium Dense to Dense	MLS	-3-	4.5+ TSF	
					-4-		
					-5-		
					-6-		
					-7-		
					-8-		
					-9-		
					-10-		
					-11-		
					-12-		
Bottom Hole 12' No Water					-13-		
					-14-		
					-15-		
					-16-		
					-17-		
					-18-		
					-19-		
					-20-		

CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

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## SOIL LOG - TEST PIT No. 2

PROJECT: Shadow Ridge

DATE: 7-23-88

EXCAVATED BY: Backhoe

HOLE ELEVATION: 512'(+/-)

DEPTH TO GROUNDWATER: INITIAL none

FINAL --

LOGGED BY: DJ

SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE
Slightly Silty Fine to Medium Grained SAND	Red Brown	Damp	Loose	SPF	-1-	1.5 TSF	
			Medium Dense		-2-		
					-3-		
					-4-		
Silty Fine to Medium Grained SAND	Gray Tan	Damp	Medium Dense	SPF	-5-		
					-6-		
					-7-		
Slightly Cemented, Fractured, Very, Sandy SILT with Rounded Gravel	Gray Brown	Damp	Hard	MLS	-8-	4.5+	TSF
					-9-		
					-10-		
					-11-		
Bottom Hole 11' No Water					-12-		
					-13-		
					-14-		
					-15-		
					-16-		
					-17-		
					-18-		
					-19-		
					-20-		

CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

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## SOIL LOG - TEST PIT No. 3

PROJECT: Shadow Ridge

DATE: 7-23-88

EXCAVATED BY: Backhoe

HOLE ELEVATION: 655'(+/-)

DEPTH TO GROUNDWATER: INITIAL none

FINAL --

LOGGED BY: DJ

SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE
Slightly Silty Fine to Medium Grained SAND	Red Brown	Damp	Loose	SPF	-1-	1.8 TSF	
			Medium Dense		-2-		
					-3-		
					-4-		
Silty Fine to Medium Grained SAND	Gray Tan	Damp	Medium Dense	SPF	-5-		
					-6-		
					-7-		
Slightly Cemented, Fractured, Very, Sandy SILT with Rounded Gravel	Gray Brown	Damp	Hard	MLS	-8-	4.5+	TSF
					-9-		
					-10-		
					-11-		
Bottom Hole 11' No Water					-12-		
					-13-		
					-14-		
					-15-		
					-16-		
					-17-		
					-18-		
					-19-		
					-20-		

CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

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CIVIL ENGINEER

# SOIL LOG - TEST PIT No. 4

PROJECT: Shadow Ridge

DATE: 7-23-88

EXCAVATED BY: Backhoe

HOLE ELEVATION: 597'(+/-)

DEPTH TO GROUNDWATER: INITIAL none

FINAL --

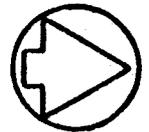
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SOIL DESCRIPTION	COLOR	MOISTURE	CONSISTENCY	SOIL TYPE	DEPTH	PENITR.	TORVANE	
Silty Fine to Medium Grained SAND	Red Brown	Damp	Medium Dense	SPF	-1-			
Slightly Cemented, Fractured, Very, Sandy SILT with Rounded Gravel	Gray Brown	Damp	Hard	MLS	-2-	4.5+ TSF		
					-3-			
					-4-			
					-5-			
					-6-			
					-7-			
					-8-			
					-9-			
					-10-			
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					-18-			
					-19-			
					-20-			
Bottom Hole 12' No Water								

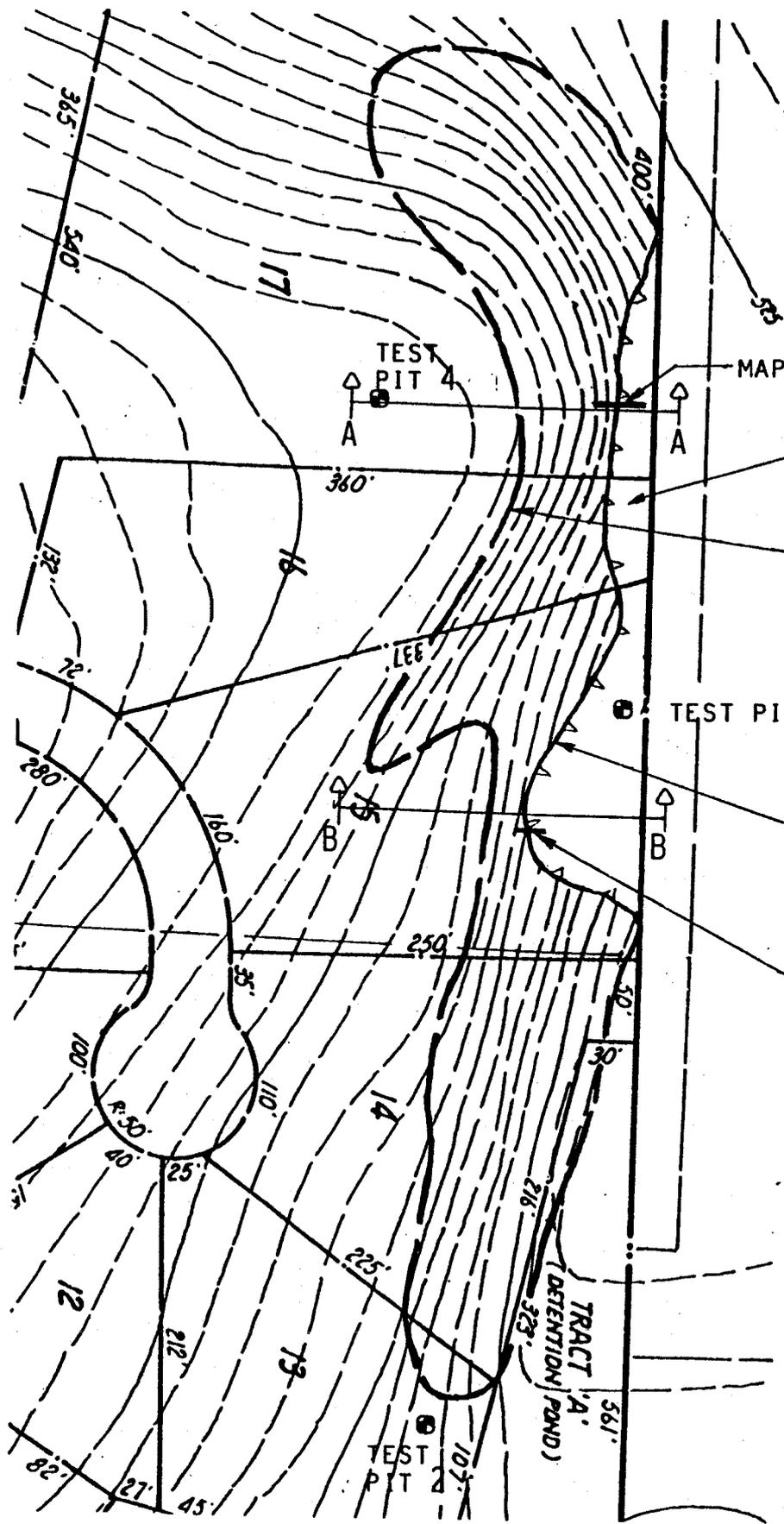
CONSISTENCY AND SOIL TYPE INDICATE SOIL CLASSIFICATION BASED ON THE SUGGESTED REVISIONS TO THE UNIFIED SOILS CLASSIFICATION SYSTEM - PENITR. INDICATES READINGS TAKEN WITH A SOILTEST POCKET PENITROMETER INSTRUMENT - TORVANE INDICATES READINGS TAKEN WITH A SOILTEST HAND TORVANE INSTRUMENT

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CIVIL ENGINEER

**NORTH SLOPE AREA**  
**SLOPE CROSS SECTIONS**



NORTH  
1" = 100'



MAPPED SLOPE FACE #1

BORROW PIT AREA

UPPER LIMITS OF THE SLOPES 40% OR STEEPER BASED ON THE TOPOGRAPHIC MAP PROVIDED

TEST PIT 1

UPPER LIMITS OF THE NEAR VERTICAL CUTS BASED ON THE TOPOGRAPHIC MAP AND FIELD MEASUREMENTS

MAPPED SLOPE FACE #2

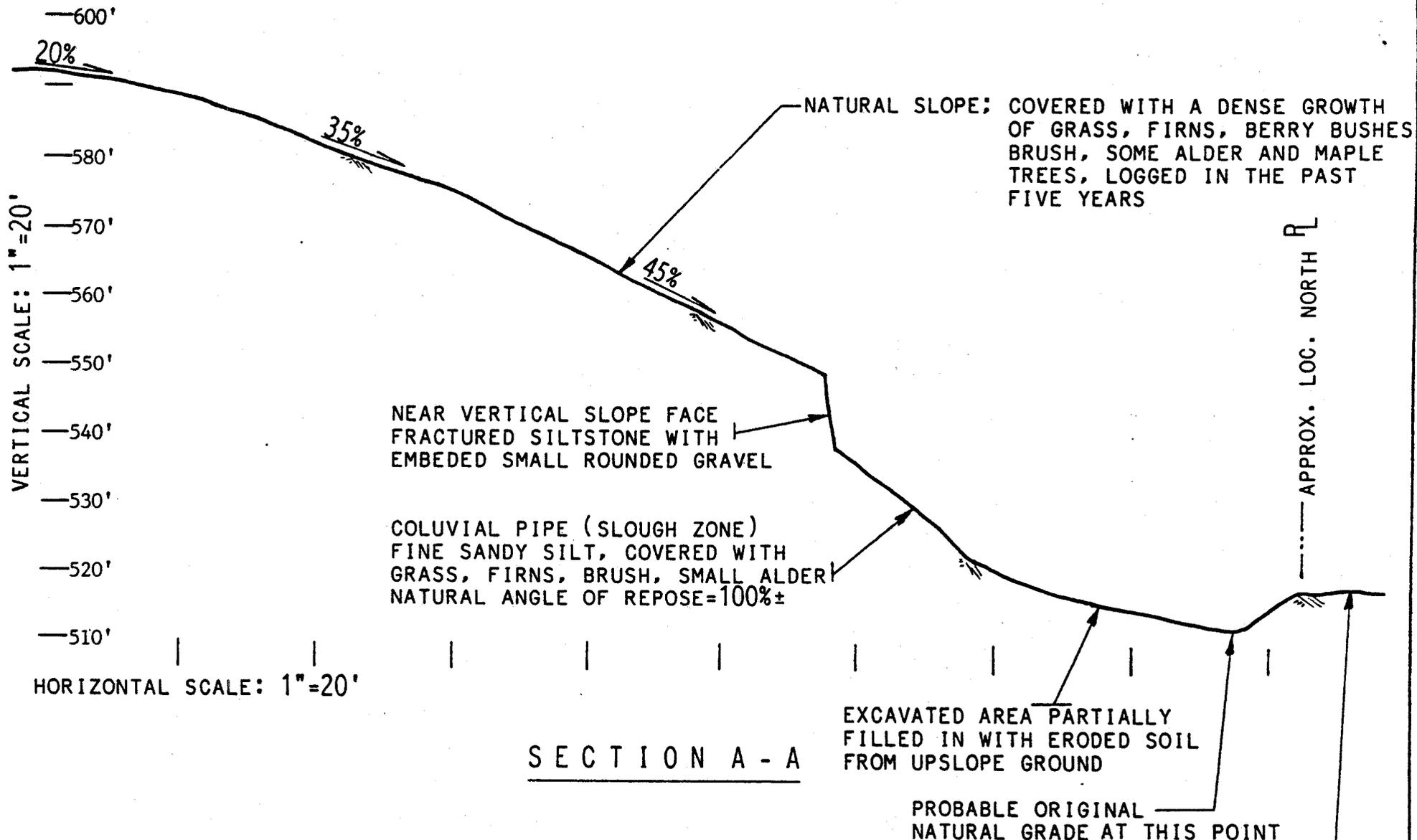
SHADOW RIDGE

(NORTH SLOPE AREA)

SEE SECTIONS A-A & B-B ON SEPARATE PAGES.

DATE: 7-26-88

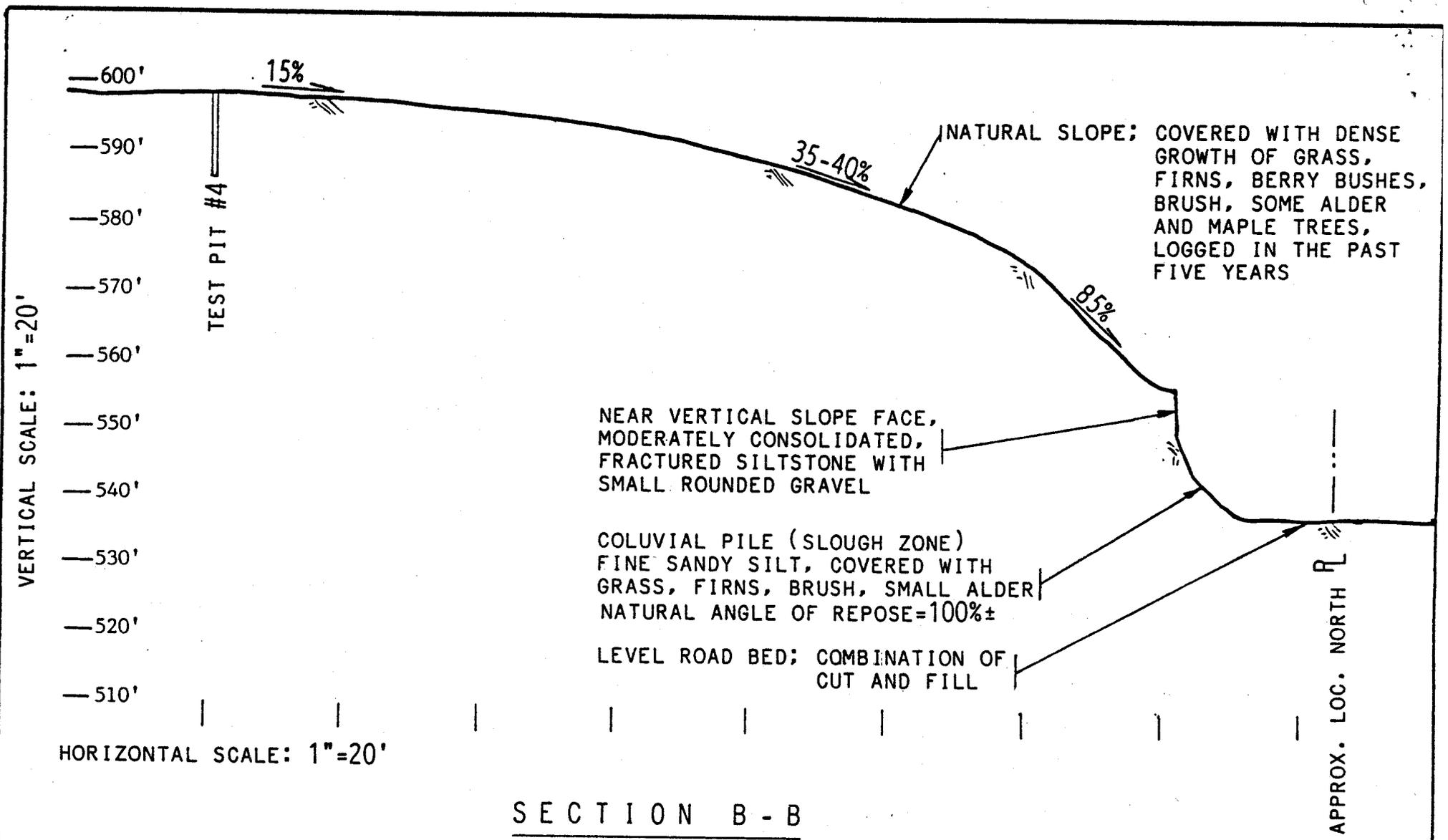
ENGR: DENNIS JOULE, PE



SHADOW RIDGE

ENGR: DENNIS JOULE, PE  
DATE: 7-26-88

FILLED ROAD BED; OLD ACCESS ROAD TO THE PEAT MINING AREA NORTHWEST OF THE PROJECT SITE SEE REPORT TEXT FOR DISCUSSION



SHADOW RIDGE

ENGR: DENNIS JOULE, PE

DATE: 7-26-88