

PROJECT E-12: PROGRESS TO 31 DECEMBER 1966

Title: STUDIES ON METHODS OF SOIL WATER DETERMINATION

Project Leader: Jack I. -Hagen

Report:

This project consists of a study of various possible methods of measuring the flow, quantity, and state of ground water. Several new approaches to the problem are being examined with the specific goal of developing a practical instrument. In particular, it is desired to produce an instrument which can fit into the hydrologic telemetering system also under development at this institution. Low power requirements, and minimum complexity together with a high degree of reliability are evidently quite important particularly in this latter application.

Various segments of the study were originally visualized as becoming appropriate research topics for graduate students in addition to a stipend supported student as originally proposed. (The stipend recipient selected is scheduled to begin work during the second semester.) It has taken somewhat more time than expected to find suitable and interested graduate students however.

The project leader has carried out a comprehensive study of the available literature. This included published material on the various devices so far developed. The subject area of soil physics has been reviewed and a search made of the known special effects in the area of physical chemistry that might be exploited.

The principle of the tensiometer method (which depends on the capillary attraction of the soil for water) suggested that any special electro kinetic effects involved should be examined. Laboratory space has been prepared, some test equipment designed, and construction is underway. It is felt that attempts to measure any streaming potentials should be associated with the degree of soil compaction (as well as type) which, in turn, will determine the capillary diameters. Means for changing the pressure on the soil is thus a part of the design.

The various approaches to the problem now being considered may be listed as in the accompanying table. It is recognized that this represents only a stage in thinking, that several objections now unforeseen will arise and that the variable ionic constitution of the water will affect in most cases.

General Principles Considered for Ground Water Measurements

Principle	Measurement Expected			
	Quantity	Flow	State	
Electro-kinetic	x	x		Experimental work is in progress.
Imbibition & Syneresis of a Gel	x		?	
Possible catalytic effect of water on a reaction	x		?	
Decomposition of sample in a region & subsequent determination of H ₂ or O ₂	x		x	
Heat conduction	x	x		
Ultrasonic propagation and/or scattering	x		x	

General Principles Considered for Ground Water Measurements

Principle	Measurement Expected		
	Quantity	Flow	State
Nuclear Magnetic Resonance	x		← A graduate student has just elected to study this.
Capacitance	x		x
Resistance	x		

The next report period is expected to see the capillary potential measurements well under way and progress made on the various approaches so far suggested. Laboratory space has been acquired and needed alterations and preparations will be completed.

W. R. ENGR. (E-12) BUDGET STATEMENT AS OF 31 DECEMBER 1966Irregular Help

Original Budget	\$2,100.00
Roger D. Lackey (Nov. & Dec.)	<u>- 56.88</u>
Unexpended Balance	(\$2,043.12)

Travel

No Budget

Other Expense

Original Budget	\$900.00
Battery Jars	- 2.00
Chloroplatinic Acid	-20.00
Platinum	-28.00
Standing Orders	<u>-75.00</u>
Unencumbered Balance	(\$774.92)

Capital Outlay

Original Budget	\$500.00
	<u>-----</u>
Unencumbered Balance	(\$500.00)

Total Unencumbered Balance, All Categories Above \$3318.04