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MAPS SHOWING LITHOFACIES AND INFERRED SUBSURFACE DISTRIBUTION OF CHANNEL-FILL SANDS IN THE POTOMAC GROUP IN FAIRFAX COUNTY, VIRGINIA

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(PLATES IN APPENDIX)

INTRODUCTION

The Potomac Group is a succession of interbedded sand, silt, clay, and gravel that underlies the southeastern quarter of Fairfax County. These deposits thicken from a feather edge at the Fall Line on the northwest to about 600 feet (183 m) on the southeast near the Potomac River. They dip southeasterly at rates varying from about 100 feet per mile (19 m/km) at the base to less than 50 feet per mile (9 m/km) higher in the section. The sands and gravels are fluvial (channel-fill deposits) and the clays and silts are probably interfluvial (flood plain) deposits.

The Potomac Group of Cretaceous age makes up most of the sedimentary succession in the Coastal Plain of Fairfax County. In places younger (Cenozoic) upland gravels, colluvium and alluvium overlie the Potomac sediments. The distribution of the Coastal Plain sediments is shown on a preliminary geologic map by Force (1975). Primary sedimentary structures in the Potomac sands are described by Weir (1976).

The predominant lithologies in the Potomac are clayey sand and silty clay. In adjacent Maryland the Potomac Group has been subdivided into 3 formations.

However, Force (1975) found these units unmappable in Fairfax County and simply divided the Potomac Group into a predominantly sand unit (Kps) and a predominantly clay unit (Kpc). For many engineering and hydrologic purposes this simple two-fold subdivision is sufficient.

The principal sources of ground water underlying the Coastal Plain of Fairfax County are the sand lenses in the Potomac Group. The greatest number of sand lenses and thickest sand sections occur within the basal 100 feet (30 m) of the Potomac Group, referred to as the 'lower aquifer' (Johnston and Larson, 1977). Wells tapping the lower aquifer are the best producers in the county with yields ranging from 100 to 800 gallons per minute (6 to 50 l/s) in the thicker sands. However, some wells tapping the lower 100 feet penetrate mostly clay and clayey sand and yield little water. A few isolated wells have yielded in excess of 100 gal/min (6 l/s) from sand zones above the lower aquifer.

In order to understand the ground-water hydrology, and as a guide for selecting potential well sites, the subsurface extent of the major sand bodies must be known. The preliminary delineation of the principal sand bodies was done by preparing lithofacies maps based on surface exposures, lithologic and geophysical logs of water wells, and well performance data. The primary purpose of the lithofacies maps is to trace major sand-filled channels from surface exposures into the subsurface.

LITHOFACIES MAPS

The Potomac Group was arbitrarily divided into 100-foot (30 m) intervals and a lithofacies map was prepared for each interval. It is assumed that at least locally, deposition occurred more or less simultaneously within each interval. Five lithofacies maps are presented (Plates 1 through 5) that show the ratio of sand to clay for each 100-foot interval within the Potomac Group. The reference datum is the base of the Potomac (or top of the weathered bedrock).

Figure 1 shows an idealized cross-section through the Potomac Group and the manner in which lithofacies maps were prepared for each 100-foot interval. The percentages of sand and clay in an outcrop are shown by subdividing a square at the outcrop location. Note that wells which do not completely penetrate a 100-foot interval are shown by incomplete circles and that partial outcrop sections are shown by small squares.

Neither the wells nor outcrops are sufficiently numerous to delineate the subsurface extent of major sand bodies with precision. However, studies of cross-bedding in outcrops of the sand bodies have aided this delineation (Weir, 1976). The dip direction of the cross-beds is an indication of the current direction and also

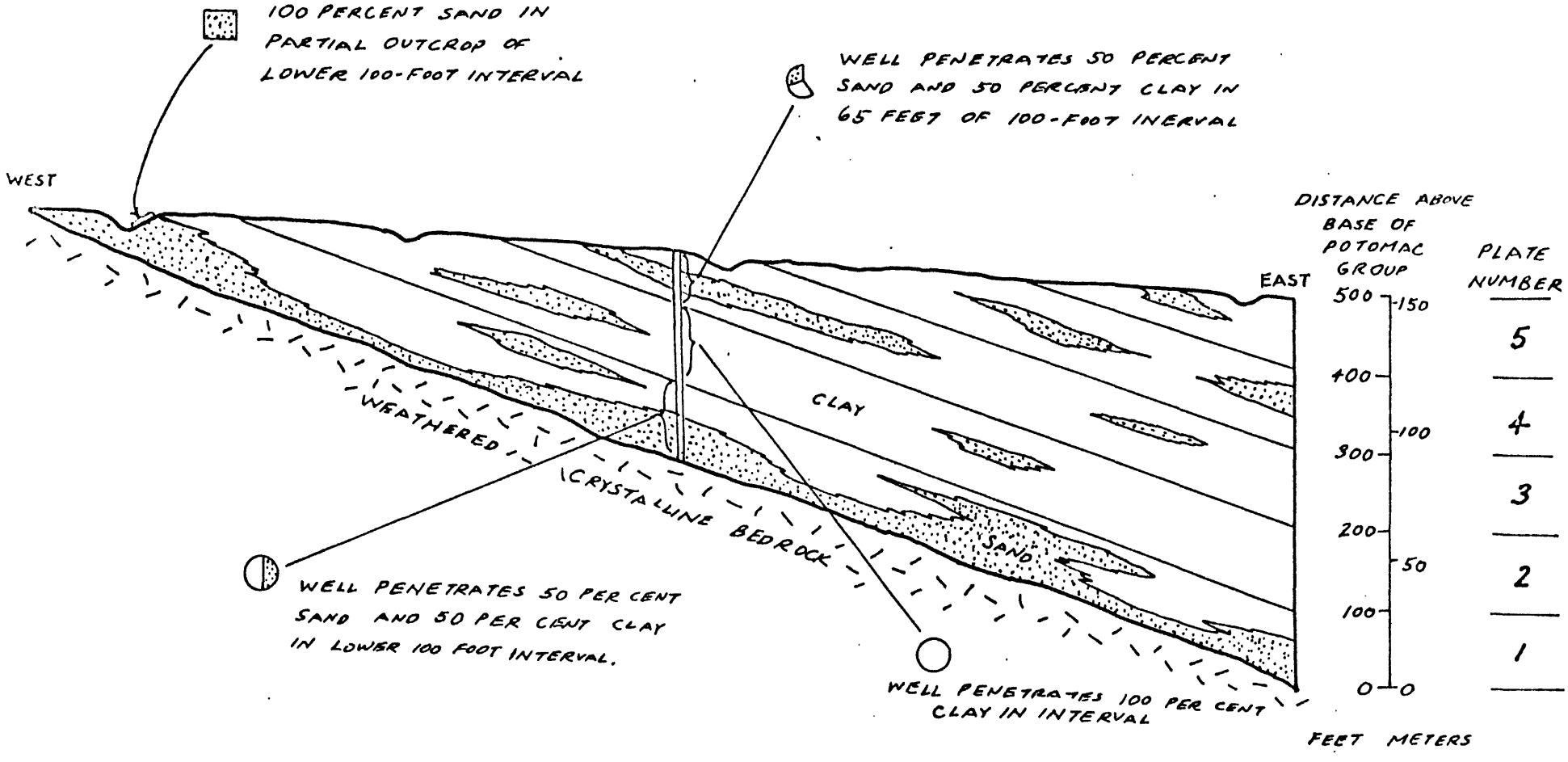

FIGURE 1. DIAGRAMMATIC GEOLOGIC SECTION ACROSS THE COASTAL PLAIN SHOWING: (1) SUBDIVISION OF THE POTOMAC GROUP INTO 100-FOOT INTERVALS AND (2) METHOD OF DEPICTING WELL AND OUTCROP LITHOLOGIES ON LITHOFACIES MAPS

the presumed direction of elongation of the sand bodies. Weir (1976) measured dip direction of cross bedding in the Potomac sands and concluded that the predominate current direction is eastward (average dip direction of 292 crossbeds is N 85°E). Average dip directions mapped by Weir (figure 4, 1976) are shown by arrows on Plates 1-5.

In addition, data on well yields and specific capacity (pumping rate divided by drawdown of water level) were used to infer the presence or absence of sand channels. Finally, transmissivity and potentiometric surface maps (Johnston and Larson, 1977) were used to confirm the presence of major channel-fill sands in the interval of the lower aquifer (Plate 1).

SUMMARY

The occurrence of major channel-fill sands in the Potomac Group of Fairfax County can be summarized as follows:

(1) A major east-west trending sand body occurs beneath the present-day course of Cameron Run and at depth beneath southeastern Alexandria in the lower Potomac aquifer (Plate 1). This sand body persists throughout the lower 300 feet of the Potomac Group (Plates 1,2, and 3) although it is best developed in the interval of the lower aquifer.

(2) Southeast-trending sand bodies occur in the Fort Belvoir - Gunston Hall area (Plates 1-4). However the paleochannels in which these sands were deposited apparently migrated laterally with time and no major channel-fill sands can be positively identified in the area.

(3) In the intervening area between the sand channels described above, no major sand bodies have been identified. Although a few individual wells have penetrated sand bodies, in general the sequence is predominantly clay.

The maps presented in this report are specifically designed to aid in ground-water exploration. Areas underlain by major channel-fill sand bodies are the best target areas for constructing moderate to high-yielding wells. Such wells have been constructed in the sands underlying the southeastern corner of the city of Alexandria. Elsewhere the presence of the channel-fill sands and their potential for ground-water development is not yet confirmed. However, areas shown as underlain by major sand bodies on plates 1-5 should offer the most promising sites for obtaining above average yields from water wells.

REFERENCES

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