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RECORDS:

1965/83

MINOR INVESTIGATIONS BY NORTHERN TERRITORY RESIDENT GEOLOGICAL SECTION.

WATER SUPPLY INVESTIGATIONS AT VICTORIA RIVER DOWNS AND WAVE HILL, 1963.

by

J. Barclay and J.Hays

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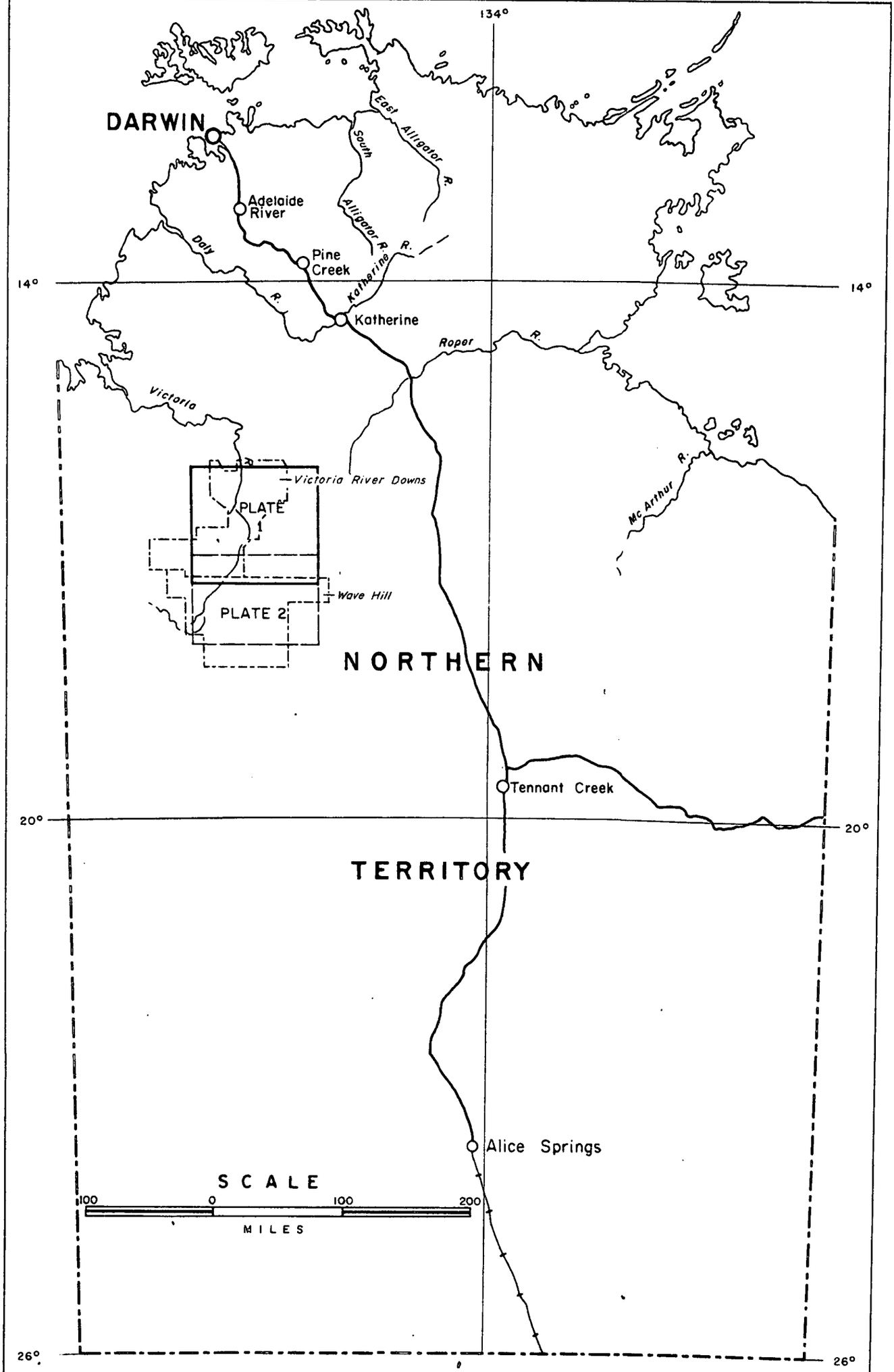
Figure 1



LOCALITY MAP, SHOWING VICTORIA RIVER DOWNS AND WAVE HILL STATIONS

NT/A138

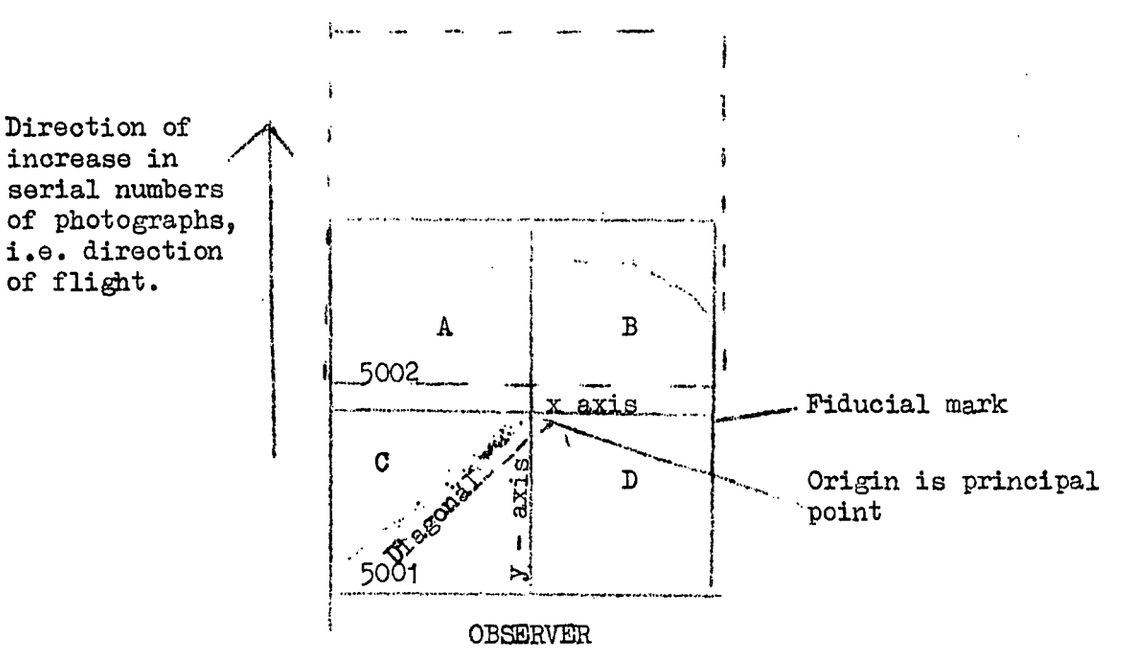
Bureau of Mineral Resources, Geology and Geophysics To accompany Record 1965/83

PREFACE

This record is one of a series in which reports of minor investigations by the Northern Territory Resident staff are brought together, to make the information contained in them more readily available to interested persons. Records are issued as circumstances justify. The localities covered by the two reports in this Record are shown in Figure 1.

In Barclay's report locations of points of interest such as sites selected for bores, are given by reference to aerial photographs. To locate any point on the photograph from the reference given the following steps should be taken:

1. The photograph is oriented in such a manner that, when the photograph with the next successing serial number is superimposed on the photograph of interest it lies above (i.e. away from) the observer - see sketch.
2. The photograph is divided into quadrants by joining opposing fiducial marks. The quadrants are labelled A,B,C,D, from left to right, starting in the top left-hand quadrant and following with the lower quadrants.
3. The origin for all measurements is the principal point - the point of intersection of the lines joining the fiducial marks. Measurements given are the ordinates - x horizontal and y vertical - and the diagonal, and are in inches: they are made to 1/100th of an inch.



WATER SUPPLY INVESTIGATIONS AT VICTORIA RIVER DOWNS AND ADJOINING AREAS, NORTHERN TERRITORY.

- by -

J. Hays

SUMMARY

Thirty five bores have been drilled for water on Victoria River Downs Station. The results indicate that the arenaceous members of the Victoria River Group sediments are good aquifers but that joints, fractures and bedding planes have an extremely important effect on permeability. The argillaceous members of the group are poor aquifers whose water-bearing capacity is not greatly improved by jointing and fracturing. The Antrim Plateau Volcanics are moderate or poor aquifers except where faulting has produced fractured zones of high permeability.

INTRODUCTION.

The Victoria River Downs cattle station has an area of 5,493 square miles and is situated 275 miles due south of Darwin and 175 miles due west of Daly Waters. Access is by the Stuart Highway to Katherine, a distance of 220 miles from Darwin, and then by all-weather road south-westerly either through Top Springs, a distance of 275 miles, or through Jasper Gorge, a distance of about 260 miles. North Australian Estates Limited purchased the station in 1958 and requested advice on the location of thirty six bore sites in 1961. The sites were selected in September and October, 1961, and in May, 1962. Drilling was started by the Dowsett Engineering Company in September,1961, and by November, 1962, thirty five holes had been completed, of which three were duplicates of unsuccessful holes.

This was the first major drilling programme undertaken under the terms of the Northern Territory Water Supplies Development Ordinance of 1960 which, under certain conditions, authorises the Commissioner for Water Development to bear the cost of bores which in the opinion of the Commissioner will yield water of a quantity inadequate for the purpose intended.

In addition to the work done on Victoria River Downs, six sites have been selected on Camfield Station and one site at Wave Hill. These have not yet been drilled.

The only published geological map available was the geological map of the Ord-Victoria Region, Northern Territory and Western Australia, on a scale of 16 miles to 1 inch, accompanying the report on the geology of that area (Traves, 1955). This is not suitable for water supply purposes because of the small scale of the map. Two unpublished 4-mile maps of Wave Hill and Victoria River Downs, prepared by N. J. Mackay from an unpublished 2-mile map and photomosaics, to assist in water supply work, were available but were found to require considerable amendment. The accompanying map (Plate 1), which includes parts of Camfield and Wave Hill Stations, has been compiled from air photographs, supplemented by air reconnaissance and by traverses made during the location of bore sites on Victoria River Downs, Camfield, and Wave Hill Stations. Formation names have not been created because this is not warranted by the accuracy of the mapping, but some of the formation names used by N. J. Mackay have been retained on the map.

Climate and Vegetation

The area has a monsoonal climate with a short, hot wet season lasting from November or December to February or March. The annual rainfall ranges from about 15 to 25 inches; most of the rain falls in December and January. Maximum daily temperatures may exceed 100° during the period October to April and may be as low as 75° during June - July. Minimum daily temperatures range from 50 in June - July to about 80° in December - January. There is a marked diurnal variation for most of the year.

The area is open grassland, dissected by tributaries of the Victoria River, some of which occupy tree-lined valleys. Flinders and Mitchell grasses grow on [illegible] basalt, limestone and rich alluvium. Spinifex grass grows on sandstone and ferruginous deposits.

GEOLOGY

The area has been described by Traves (op.cit.) who defined the Upper Proterozoic Victoria River Group of sandstone, limestone and shale, the Lower Cambrian Antrim Plateau Volcanics, and the Middle Cambrian Montejinni Limestone. The rocks of the Victoria River Group occupy the north-western and western part of the area. The Antrim Plateau Volcanics form a broad band stretching diagonally north-eastwards across the area; the Montejinni Limestone is restricted to a narrow belt on the east and south-east.

Victoria River Group.

The Victoria River Group crops out in the rough dissected plateau country west of Victoria River Downs, around Mount Sanford, and in the wide flat Victoria River valley.

The lowest member of the group in this area crops out in the Victoria River near the main road crossing, about 10 miles downstream from the homestead, and in several creeks east of the river. It is also present in the Wave Hill area south of the southern boundary of Victoria River Downs. The rock is a medium-grained ripple-marked quartz sandstone, whose base is not exposed.

The sandstone is overlain, apparently conformably, by a sequence of interbedded siliceous and sandy limestone, calcareous siltstone, shale and thin sandstone. These beds occupy the flat Victoria River valley and large parts of the Wickham River and Gibbie Creek valleys, and have a very distinctive finely-banded photo-texture where not concealed by a great thickness of alluvium. The characteristic photo texture is grossly distorted in many places, indicating complex folding. The folding is thought to be the result of pre-consolidation slumping. Small-scale intraformational folds were observed in shale beds between undisturbed sandstone bands in the Mount Sanford area. Changes of lithology are common in the sequence. The dominant change appears to be an increase in carbonate content towards the north or north-west, where massive limestone is abundant in the upper part of the sequence. The top member of the sequence is a bed of grey-green and purple shale and siltstone; it crops out in the north of the area around Jasper Gorge (north-west of Victoria River Downs homestead). The total thickness of the sequence could not be measured because of local minor variations in dip, but bore data indicate that the sequence is at least 600 feet thick.

The highest member of the Victoria River group is a sandstone that crops out in Jasper Gorge and for which the name "Jasper Gorge Sandstone" has been used by N. J. Mackay. The "Jasper Gorge Sandstone" is a ripple-marked, medium to coarse-grained, friable to highly silicified, quartz sandstone. In the north-west part of the area it dips very gently (less than 5^{o}) north or north-west, but in the central and south-east parts of the area, where it is thought to underlie basalts, a regional south-east dip prevails. The maximum thickness in the Jasper Gorge area is about 400 feet. The similarity between the highest and lowest sandstone members of the Victoria River Group has led to some confusion in the past although Traves (op. cit.) includes two sandstones in the sequence in the Victoria River Downs area.

The regional structure of the Victoria River Group appears to be a broad gentle arch, which dies out to the north of the area under consideration, and whose axis trends north-east through or near Victoria River Downs homestead. The plunge of the arch is gently north-east. Minor local variations of dip may indicate that subsidiary folds exist in the flanks of the main fold. Some dips exceed 5^{o} in the Wave Hill area where the slightly more intense folding seems to have been accompanied by crestal faulting.

The large area of Jasper Gorge Sandstone in the western part of Victoria River Downs station has not been examined in detail, but photo-examination showns that there is a sequence which exhibits a photo-texture unlike that of the main outcrops. This sequence is thought to be younger than the main sandstone and is discussed in the section on Antrim Plateau Volcanics. Apart from this, there is no indication of a major time break within the Victoria River Group sediments, but minor disconformities may occur. The group is here regarded as one complete sedimentary unit, gently folded after completion of sedimentation.

Antrim Plateau Volcanics.

The main area of outcrop of the Antrim Plateau Volcanics is about 50 miles wide, and extends diagonally north-east across the area. The volcanics consist mainly of several nearly - horizontal overlapping basalt flows with subordinate beds of agglomerate and tuff. The basalt in the zone between individual flows is platy, amygdaloidal, and fractured and may contain chert lenses and chert basalt breccias. Individual flows range in thickness from about 50 feet to 150 feet. The maximum thickness encountered in any one borehole is 380 feet but the total thickness is not known. Traves quotes a thickness about 1,000 feet near Wave Hill homestead, but this is not substantiated by borehole data. The maximum thickness in the area appears to be the greatest borehole intersection plus about 200 feet of basalt in the highest residual standing above the basalt surface - a total of about 580 feet.

Traves considered that there was a well-marked time break between the Jasper Gorge Sandstone and the volcanics, and refers to valleys in Victoria River Group rocks filled by basalt of the Antrim Plateau Volcanics, in the Willeroo area. This view is confirmed by observations in the Victoria River Downs area. The sub-Antrim Plateau surface in the south was one of very low relief, bevelled across the gently folded Victoria River Group and broken by a few hills less than 100 feet high. These now appear as small inliers of Jasper Gorge Sandstone in the southern and eastern basalt areas.

Very little work has been done on the volcanics west of the main anticlinal axis of the Victoria River Group, i.e., west of a line roughly through Victoria River Downs homestead. East of this axis the basalt overlaps on to successively older beds from the south-east, indicating that the Victoria River Group was gently folded before the pre-Antrim erosion. The basalt dips very gently east, and some post-basalt movement possibly took place along the same axis. Later work on basalt in the Limbuyna area, 30 miles south-west of Mount Sanford homestead, where the regional dip is north-westerly, has confirmed that the basalt has been folded along the Victoria River Group axis.

Traves makes no mention of sediments interbedded with the basalt, but at three localities there is clear evidence of sandstone interbeds:

1. A group of hills extending west from Tishawanta bore, four miles south of George Creek, (Plate 1), consists of interdigitating basalt flows and sandstone. The eastern hills are dominantly basalt, but the western hills consist of sandstone in which are found two thin sills of typical Antrim Plateau Volcanics basalt.

2. East of Pigeon Hole, several thin basalt flows occur on the east bank of the Victoria River, and sandstone outcrops are more extensive in this area than indicated by Traves.

3. The road between Black Springs and Pigeon Hole traverses sandstone country with a few small patches of basalt, which appear to be inliers of sills at different levels. A ridge extends for about 6 miles south-east from Black Springs and this is capped by about 30 feet of sandstone. The sandstone rests on basalt in the south-east, and on Victoria River Group sandstone in the north-west. The sandstone is a slightly arkosic quartzite, with cross-bedding on a large scale, and is heavily iron-stained. It consists of rounded and sub-angular quartz grains about one millimeter in diameter. A few pebbly bands were noted.

These three localities have one major common feature. In each, where the underlying sediments are sandstones, no unconformity can be detected because of lack of continuity in the exposures. However, a disconformity must be supposed to exist because the sandstones in the Victoria River and at Pigeon Hole are ripple-marked and appear to grade upwards into wind-blown dune sands. Evidence of unconformity is stronger at Black Springs where the upper sandstone rests on sediments in the north-east and basalt in the south-west. This could be explained by north-westerly thinning of a basalt flow.

It is suggested that the basalt was extruded sub-aerially and that, early in the history of the Antrim Plateau Volcanics, aeolian sandstones were formed in situ from upstanding masses of Victoria River Group sandstone. The upper members of the Jasper Gorge Sandstone indicated on air photos may be a western extension of the aeolian sandstone.

Montejinni Limestone.

The Montejinni Limestone has been observed in the eastern part of Camfield and between Camfield Homestead and Top Springs. It is a grey-white slabby limestone, finely crystalline, with chert nodules distributed irregularly through it. Brown and pink varieties have been observed. The limestone is massive in some areas, and very finely bedded, with beds ranging from one inch to several feet thick, in others. Several contacts between the limestone and the Antrim Plateau Volcanics have been observed and in each place the limestone overlies the volcanics.

SELECTION OF BORE SITES.

All bore sites were selected after consultations with the managers of the stations concerned. The main factors to be considered were existing water supplies, existing fences, available feed, accessibility for mustering cattle, and a fencing programme designed to sub-divide feed areas for better cattle management. Each site represents a compromise between geological considerations and these factors. At some sites it was possible to allow geology to be the controlling consideration. At others it was necessary to select the best site in a relatively unfavourable area. Records of existing bores are generally too scanty to be of assistance in selecting new sites, and no reliable details of lithology are available for any of the existing bores.

RESULTS AND CONCLUSIONS

A summary of the drilling results is given below (see Appendix 1). Because of the distance from Darwin, field supervision was not possible, and reliance has had to be placed on samples forwarded by the foreman driller. Some of the samples were lost in transit and a complete record is not available. Drillers' logs are available for most of the holes, but the identification of rock types is suspect in many cases.

When the area was first visited, it was thought that direct natural recharge through the skeletal soils and the well-jointed basalt would be adequate at most sites on basalt. It was noted, however, that run-off was extremely high even at the start of the wet season. Run-off from a brief light storm which swept across Camfield Station in September, 1959, was enough to cause water to flow in all streams in the path of the storm. When drilling started it was found that, although small quantities of water were recorded from weathered and brecciated zones between successive basalt flows, water in economic quantities was only obtained either from beneath the basalt or from suspected faults in the basalt. Direct recharge by percolation through joints appears to be negligible. Of the thirty five holes drilled by November, 1962, thirty four were drilled into basalt. Only five of these, all sited on strong photolineaments, produced adequate supplie of water from within the basalt. Holes classed as completely dry included five holes drilled through less than 100 feet of basalt into rocks that were dominately argillaceous with thin calcareous and arenaceous bands. The maximum thickness of this succession recorded was 500 feet, but data from an artesian bore at Wave Hill police station on the Victoria River, 12 miles south of the area, indicate a possible maximum thickness between 700 feet and 1000 feet. Two holes were listed as

yielding only 100 gallons an hour. Both were drilled through more than 300 feet of basalt into argillaceous beds with arenaceous bands, and the water is thought to have been obtained entirely from the basalt. Three holes drilled through more than 280 feet of basalt into argillaceous and fine-grained arenaceous beds yielded about 500 gallons an hour each. The remaining twenty were drilled through basalt into dominantly arenaceous beds and yeilded from 750 gallons to more than 4000 gallons an hour.

Although the lithology of the rocks below the basalt is important in controlling yield, other factors such as attitude and jointing of the beds are also significant - the lithology of some of the high yielding bores is similar to that of some of the lowest yielding holes. It was observed that the recharge area of the high-yielding bores was up-dip from the bore and that the aquifer cropped out in the local creeks. The recharge area of the low-yielding bores was down-dip and even where the aquifer cropped out in the Victoria River in an area of permanent water, yields were low.

Some of the highest yields were from bores located on or near well-defined photo-lineaments, in areas in which jointing was expected to be important.

These observations indicate that yield in the arenaceous aquifers is controlled to a very great extent by the presence of open bedding planes and joints, and that grain size is of minor importance. Basalt is also a good aquifer where highly fractured, but even highly fractured argillaceous rocks are poor aquifers. If these conclusions are applied to the dry or low-yielding holes, only two holes, Nos. 31 and 33, appear to be unlikely to produce more water on deepening because recharge areas are down-dip and jointed arenaceous rocks are not present. Nos. 6 (1), 15 (1) and 30 offer reasonable prospects of greater yields if deepened by about 100 feet because of the probable presence of suitable aquifers. Nos. 5 (1), 7, 10, 11 and 14 would have to be deepened by more than 100 feet to produce adequate supplied because of the unfavourable attitude of the beds, even if a suitable aquifer is present.

All the holes for which deepening is recommended would be too deep for the equipment in use on the programme at present. This has a maximum drilling depth of about 600 feet and the low-yielding holes were all drilled to at least 500 feet.

REFERENCE

TRAVES, D.M., 1955 - The geology of the Ord-Victoria region, Northern Territory, Australia. Bur. Min. Resour., Aust. Bull. 27.

APPENDIX 1 - SYNOPSIS OF BORE DATA VICTORIA RIVER DOWNS.

V.R.D. BORE NO.	REGISTERED NO.	DEPTH TO BASE OF BASALT	SUB-BASALT LITHOLOGY	STANDING WATER LEVEL	TOTAL DEPTH	SALINITY	YIELD G.P.H.
1	2753	196	Sst.	70	215	*	4000
2	2754	208	Sst.	40	352	+	2000
3	2755	150	Sst.	70	309	+	3600
4	2801	270	Sst.	80	350	*	1500
5 (1)	2756	348	Shale	160	601	+	100
5 (2)	3018	250 (f)	Sst. & Shale & Siltstone.	185	460	-	1550
6 (1)	2802	340	Shale	76	510	-	500
6 (2)	3019	140 (f)	Sst.	80	290	-	2000
7	2806	380	?	160	550	490	514
8	2803	345	Sst.	80	363	360	1440
9	2804	50	Shale to 509 Limest to 568	120	568	490 550	450) 750)
10	2805	288	Sst. & Sh.	290	507	600	536
11	2847	91 ?	Shale	-	507	-	Nil ?
12	2848	170 (f)	Sst.	100	281	-	7000
13	2849	230	Sst.	150	403	*	2000
14	2609	306	Shale.	150	603	*	100
15 (1)	3003	100	Sh. & Sst.	-	507	+	Nil ?
15 (2)	3004	83	Sh. & Sst.	80	552	520	1440
16	3005	112	Sh. & Sst.	122	600	430	150●
17	3006	80	Sst.	100	250	480	2400
18	3007	235 ?	Sst.	50	250	-	1800
19	3008	80	Sst. & Sh.	155	515	450	1200
20	3020	156 (f)		50	156	*	2500
21	3021	200	Sst.	150	250	4850	1500
22	3367	330	Sst.	*	340	260	4000
23	3368	150 (f)		60	150 ?	300	2500
24	3369	334 (f)		60	334 ?	300	2200
25	3370	309 (f)		120	309 ?	300	3600
30	3022	105	Shale	*	565	*	Nil ?
31	3023	Nil	Shale	*	500	*	Nil ?
32	3371	70 (f)		20●	70	390●	3000
33	3202	100	Shale	*	600	*	Nil ?
34	3024	280	Sh. & Sst.	103	560	*	1600
35	3372	51	Sst.	100	290	*	1800
36	3373	51	Sst.	50	211	*	3600

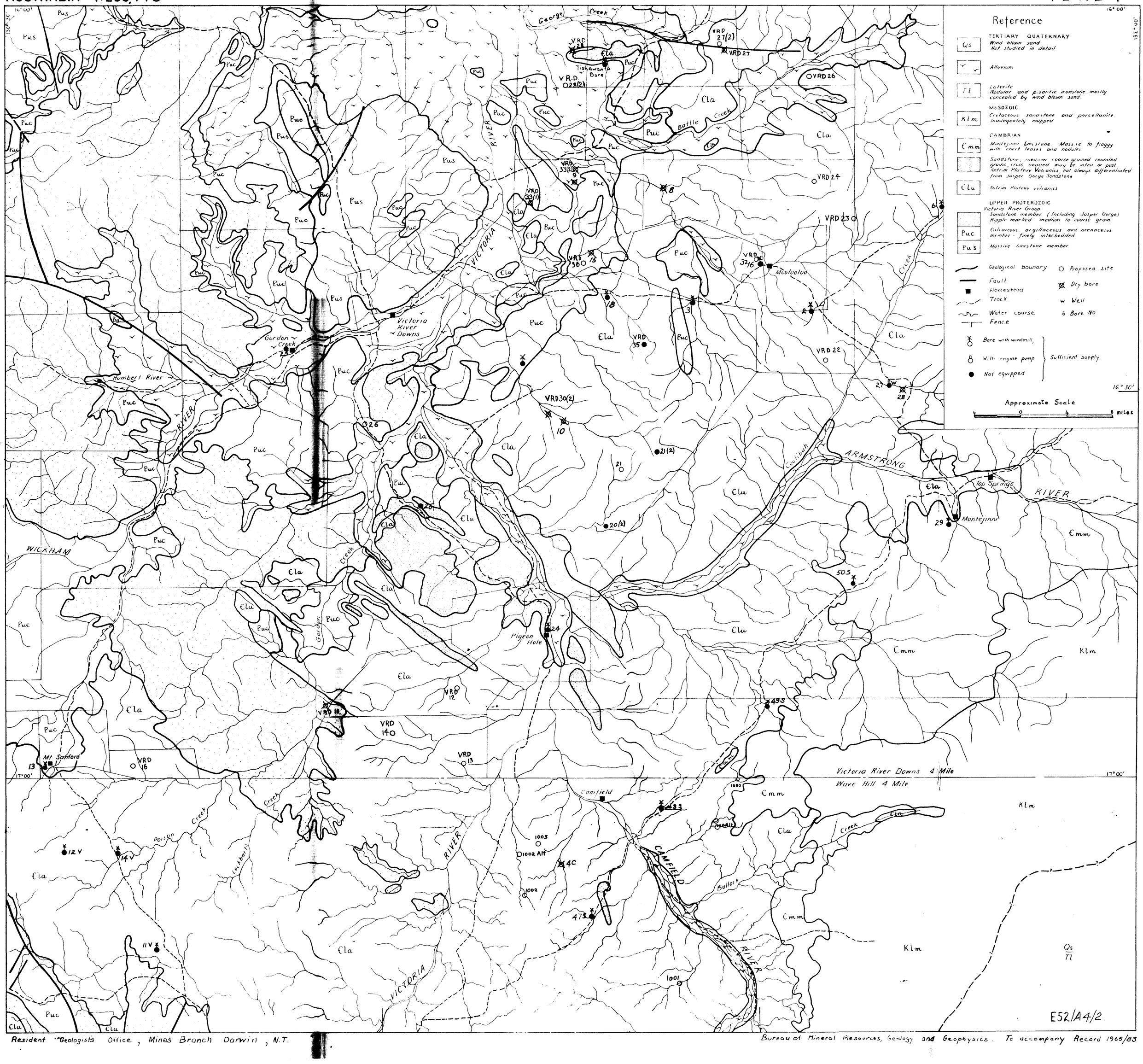
Sh. = Siltstone & Shale
Sst. = Sandstone
Limest. = Limestone.
(f) = Bore sited on fault or photo-lineament.
? = Unreliable observations
* = Salinity has been obtained by multiplying electrical conductivity by 0.75 - result gives parts per million very approx.

VICTORIA RIVER DOWNS

NORTHERN TERRITORY

AUSTRALIA 1:253,440

PLATE 1



Resident Geologists Office, Mines Branch Darwin, N.T.

Bureau of Mineral Resources, Geology and Geophysics. To accompany Record 1965/83

E52/A4/2.

PRELIMINARY WATER SUPPLY INVESTIGATIONS AT POSSIBLE NEW HOMESTEAD SITES, WAVE HILL STATION, N.T.

- by -

J. Barclay

SUMMARY

A study of the geology of six possible new homestead sites shows that four of the sites are underlain by basalt of the Antrim Plateau Volcanics; one is on an escarpment of limestone of the Victoria River Group, near a large permanent water hole in the Victoria River (Wave Hill 4 mile : 1 inch Geological Sheet).

It has been estimated by station management that water supply requirements at a new site would be about 50,000 gallons a day. The supply at the existing homestead is no more than 10,000 gallons a day which is considered by management to be inadequate for the needs of the station population of about 250 people.

The recent investigations indicate that the two sites with the best prospect of obtaining adequate water supplies are Site No. 2, at a locality 2 miles north of No. 12 Bore, and Site No. 6, on the limestone escarpment east of the Victoria River.

INTRODUCTION

Wave Hill Station (area 6,138 square miles) is administered from the present homestead and there are no out-stations. A population of about 250 people, of whom 200 are natives, is catered for at the homestead.

The present daily use of water amounts to an estimated 10,000 gallons. This is obtained from three shallow bores and the supply is limited by the low yield of water obtainable from the basalt underlying the homestead.

A move to a new homestead site has been contemplated for several years, and is necessary for several reasons, of which an improved water supply is the most important. A daily requirement of 50,000 gallons is suggested by the station manager as a reasonable quantity for personal needs, small gardens and a necessary sewerage system. The latter cannot be installed at the present homestead because of the shortage of water.

A possible new homestead site was cleared recently on top of a limestone escarpment across the Victoria River from the Wave Hill Police Station. A bore was sunk on the flank of the escarpment with the intention of tapping the aquifer which supplies the Poilce Station. The bore however, gave only a low yield of highly saline water and drilling was terminated at 1,144 feet in hard quartzitic sandstone.

Following this adverse result, further investigations were carried out from 2nd - 5th October, 1963, at the request of Water Resources Branch, Darwin. At the same time, Mr. B. Brooks, Water Resources Engineer, examined the possibilities of retaining adequate surface waters at a dame site near the present homestead and of using a large permanent waterhole in the Victoria River, near the limestone escarpment.

GENERAL GEOLOGY

Wave Hill homestead is situated on Antrim Plateau Volcanics of Lower Cambrian age. The volcanics are mainly basalt flows with some beds of agglomerate and tuff (Traves, 1955). There are two prominent erosion surfaces; the "upper level" is about 60 feet higher than the "lowel level". In the Wave Hill area the greatest recorded thickness of volcanics is 434 feet, in Bore WQ.

Below the volcanics are Upper Proterozoic sedimentary rocks of the Victoria River Group. Near the Wave Hill police station, the general sequence of these rocks appears to consist of massive quartzitic sandstone passing upwards into interbedded thin limestone and calcareous shale (N.J.MacKay, unpublished map and report.)

An inlier of the Victoria River Group at Site No. 5 shows that the upper part of the thin limestone-shale sequence consists of green and red shale overlain by about 30 feet of quartzitic sandstone. The lower massive sandstone beds, about 200 feet thick, underlie the shale in Bore WQ and in the police station area; it resembles a quartzite in hand specimen. In the bore at New Homestead site - Site No. 6 - the thin limestone and shale beds are about 1,000 feet thick.

Near the police station, the thin limestone and shale beds have undergone minor folding. In general, however, the Victoria River Group dips eastwards at an angle of about 5° and disappears below the Antrim Plateau Volcanics on the eastern side of the Victoria River.

GENERAL HYDROLOGY

Antrim Plateau Volcanics

Drilling records for Wave Hill station show that 50% of all bores drilled solely in basalt are dry; 25% give supplies between 1,000 and 2,000 gallons an hour; and the remaining 25% yield less than 1,000 gallons an hour.

The water is obtained from fractured zones and vesicular layers in the basalt and possibly from sand deposits between successive basalt flows, as in Bore WG. The quality is generally good.

The records also indicate that the yield of many of these bores decreases by varying amounts after prolonged periods of pumping.

The successful bores in basalt have generally been sited near creek beds and near superficial deposits of travertine which are thought to indicate zones of fracturing or close jointing in the basalt.

It is likely, therefore, that any single bore drilled in basalt at a new homestead site would yield less than 2,000 gallons an hour.

Victoria River Group

The records of eight bores drilled in rocks of the Victoria River Group show that four yield up to 1,800 gallons an hour of good quality water; one yields 3,600 gallons an hour of very saline water; and the remaining three are dry holes. Details of these bores are given in Appendix 2.

In view of the present limited knowledge of the hydrology of the Victoria River Group and the fact that the sediments occur below a basalt cover several hundred feet thick it is not possible to predict the quantity or quality of water that might be obtained from them.

The expense of further testing within these rocks may be considered unwarranted at present. However, as testing for the possibility of shallow ground-water in basalt is recommended at No. 2 site, it is suggested that at least one bore at this site be drilled deep enough to test the underlying Victoria River Group, particularly as the nearby No. 14 bore is believed to derive its supply of 1,800 gallons an hour from these rocks.

POSSIBLE NEW HOMESTEAD SITES.

Inspections were carried out of five sites, and re-examination was made of a sixth, which had been chosen by station management because of easy access and good building ground.

Four of these sites are located on basalt, and the fifth on an inlier of the Victoria River Group. A sixth site, located on an escarpment of limestone near the Victoria River, was re-examined.

All the sites are within a radius of twelve miles from the present homestead and the possibilities of obtaining adequate water supplies at each site are reviewed below.

No. 1 Site

Location :- Wave Hill 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000',
R.A.A.F. 1948. Run 8, Photo 5135,
Quadrant D; X = 1", Y = 0.5",
diagonal = 1.2"

The site is on a low, flat-topped hill formed on the "upper basalt level" about 2.5 miles south-east of the homestead. Basalt at the "lower level" crops out around the base of the hill.

The site is not recommended as it is believed that the high surface elevation would preclude adequate recharge of the basalt, and the prospects of success of a deep bore into the underlying Victoria River Group cannot be evaluated because of the paucity of geological data.

No. 2 Site.

Location :- Wave Hill 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000', R.A.A.F.
1949. Run 7, Photo 5107, Quadrant C;
X = 0.6", Y = 1.8", Diagonal = 1.9"

This site is 2 miles north of No. 12 bore and 6 miles south of No. 14 bore, which is 288 feet deep and yields 1,800 gallons of water an hour; the water is believed to be derived from rocks of the Victoria River Group below the basalt cover. No. 12 bore is 71 feet deep in basalt and yields 720 gallons of water an hour (originally 1,320 galons an hour).

Basalt capped by extensive travertine deposits underlies the site. Three creeks traverse the site and join near the northern end to form a watercourse which passes through a narrow gap in a basalt ridge and flows northwards to the Victoria River.

The site is recommended to be tested for shallow groundwater supplies and it is considered that 2 bores would be adequate for the purpose. As mentioned above, in view of the records of Bore 14, one bore could be continued to test the underlying Victoria River Group in addition to the basalt.

No. 3 Site

Location :- Wave Hill 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000', R.A.A.F. 1948. Run 7, Photo 5105, Quadrant B;
X = 0.8", Y = 0.2", Diagonal = 0.8"

Site No. 3 is 7 miles from No. 12 Bore and 1 mile from No. 1 Bore, which is 72 feet deep and yields 1,200 gallons of water an hour. The site is on the north bank of a creek and is underlain by basalt, capped in places by travertine.

Recharge of probable shallow ground-water supplies would most likely be not as great as at No. 2 site and the ground area for building purposes would be smaller.

No. 4 Site.

Location :- Wave Hill 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000', R.A.A.F. 1948. Run 9, Photo 5018, Quadrant A;
X = 1.8", Y = 1", Diagonal = 2.1"

This site is 4 miles south of the present homestead. It is on the north flank of a low butte which is capped by laterite. Debris from the capping is widespread and fairly dense around the flanks of the hill, with the result that the site is fairly well drained and would be suitable for building. The underlying rock is basalt and a bore could be positioned by a creek to the north of the site. However, recharge of groundwater supplies would be less than for Site No. 2.

No. 5 Site.

Location :- Wave Hill, 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000' R.A.A.F. 1948. Run 9, Photo 5015, Quadrant D;
X = 0.4", Y = 1.7", Diagonal = 1.8"

Site No. 5 is 12 miles south-west of the homestead and 5 miles west of bore No. 6. It is underlain by the Victoria River Group which also forms an inlier, with extensive outcrops of red shale.

A bore at this site may be successful but the possibility is considered to be more speculative and likely to be more expensive than the testing of No. 2 site.

No. 6 Site.

Location :- Wave Hill 1:250,000 sheet (E52-8)
Aerial Survey No. 416, 25,000', R.A.A.F. 1948. Run 7, Photo 5111, Quadrant C;
X = 3.5", Y = 0.3", Diagonal = 3.5".

This is the site where the "New Homestead"bore was drilled to 1,144 feet in thin limestone and shale beds and underlying massive quartzitic sandstone. A small supply of highly saline water was encountered.

The site is underlain by limestone and is positioned on top of an escarpment. The steep side of the escarpment faces west and falls about 100 feet to an alluvial flat of the Victoria River. The site is about 1 mile from a large permanent water hole in the Victoria River, which was observed on 4th October, 1963, to be about 1 mile long, 40 feet wide, and reported to be 9 feet deep at its deepest part.

It is strongly recommended that the possibility of obtaining an adequate water supply from this waterhole to fully investigated. The possibility of obtaining ground-water supplies in the alluvium should also be investigated. If sufficient ground-water could be found in the alluvium, it would have the advantage of being less liable to contamination than a supply from the open waterhole.

CONCLUSIONS AND RECOMMENDATIONS

In order of suitability, Site No. 6, followed by Site No. 2, is recommended to be tested for the reasons outlined above. These should, if necessary, be followed by Site Nos, 3, 4, 5, and 1 in that order of preference.

No. 2 Site may be considered more suitable from the aspect of easier access, but, in the event of a failure to obtain adequate water supplies at this site, the better prospects of obtaining an adequate water supply at No. 6 Site should outweigh all other considerations.

REFERENCES

HAYS, J., 1962 - New Wave Hill Homestead water supply, 18.7.62, Wave Hill records, Nor. Terr. Resident Geol. Sect. Darwin (unpubl.)

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APPENDIX 2. WATER BORES IN VICTORIA RIVER GROUP SEDIMENTARY ROCKS, WAVE HILL STATION, NORTHERN TERRITORY.

Bore No.	Depth in feet	Description of Strata.	Depth, Supply in Gallons per hour.	Quality	Comments
Police Station	701	0'- 659' Interbedded thin limestone and shale	Tested at 1,000 g.p.h. At present - 500 g.p.h	Good	Supply reported to be from sandstone but analysys of 750 parts per r million total salts indicates supply is from lime-rich rocks.
New Homestead. (Site 6)	1,144	0'1000' Interbedded thin limestone and shale 1000'-1144' Massive quartzitic sandstone.	Nil	-	
14	288	No log	1,800 g.p.h. from 288'	?	Supply believed to be from sediments below the basalt.
24	744	No log	Nil	-	Basalt overlying Victoria River Group sediments.
48	330	0'-25' Clay 25'-46' Limestone 46'-232' Basalt 232'-321' Sandstone 321'-330' Chalk	1,400 g.p.h.from 321'	Good	232'-330' Victoria River Group sediments. Stock route bore between Wave Hill and Camfield.
WQ	900	0'- 31' River gravel 31'-465' Basalt 465'-583' Interbedded thin limestone and shale. 583'-785' Massive quartzitic sandstone. 785'-900' Interbedded limestone, chert, siltstone, sandstone.	31' - 100 g.p.h. 327'- 400 g.p.h. ? - 3,600 g.p.h.	Saline	Supply of 3,600 g.p.h. probably from limestone below 785'.
WR	304	0'- 10' Clay 10'-205' Basalt 205'-304' Victoria River Group Sediments.	1,600 g.p.h. from 285'	?	Supply from interbedded sandstone and mudstone
WS	900	0'-167' Basalt 167'-900' Interbedded thin limestone and shale.	Nil		

PLATE 2.

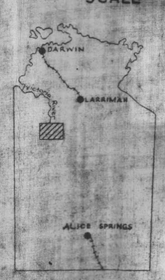
FIRST EDITION
December 1958

WAVE HILL

AUSTRALIA 1:253,440 — NORTHERN TERRITORY — 4 MILE GEOLOGICAL SERIES — SHEET E 52/8.

SCALE

4 0 4 8 12 16 MILES



eg. 24, Mentioned in text.

REFERENCE

QUATERNARY	Recent	Qra	Alluvium
		Qs	Sand
TERTIARY		Ta	Alluvium
		Tl	Laterite
MIDDLE CAMBRIAN	Montejinni Limestone	Emm	Crystalline limestone with chert nodules.
LOWER CAMBRIAN	Antrim Plateau Volcanics	Ela	Basalt, agglomerate, tuff.
	UNCONFORMITY		
UPPER PROTEROZOIC VICTORIA RIVER GROUP		Pun	Siltstone, calcareous, siltstone, limestone.
		Puj	Quartz sandstone.
	UNCONFORMITY		
		Put	Purple siltstone, flaggy limestone, chert, sandstone.
		Pu	Undifferentiated sediments.

REFERENCE

- Vehicle track
- Homestead
- Approximate station boundary

Bores for water

- Proposed site
- Equipped with windmill
- Equipped with engine pump
- Salt water
- Abandoned
- Insufficient supply
- Dry bore
- 6 Bore number. The full number is given in the bore data sheets under each 4-mile sheet (e.g. E52/8-6).
- (H.S.1) Possible new homestead site.

Sufficient supply

- Established geological boundary
- Probable geological boundary
- Strike and dip of strata.
  - Dip 0°-15°
  - Dip 15°-45°
  - Trend of bedding

from photo-interpretation.

- Established anticlinal crest - position approximate.
- Established fault - position accurate.
- Probable fault.
- Joint patterns from photo-interpretation.

GEOLOGICAL RELIABILITY DIAGRAM

C

C Few traverses and photo-interpretation.

Geology by D.M. Traves, N.J. Matheson

Compiled by N.J.

...rces, Resident Geologists Office, Darwin, N.T.

To accompany Record 1965/83