QUEENSLAND

IRRIGATION AND WATER SUPPLY COMMISSION

REPORT ON

GROUNDWATER INVESTIGATIONS

HAUGHTON RIVER

1967

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SUMMARY

PURPOSE:

The purpose of this report is to present information available to date from an investigation in respect of the sugar cane producing area astride of and adjacent to the Haughton River around the Town of Giru dealing with -

(a) The location and adequacy of existing underground resources at Giru to meet present irrigation requirements.

(b) The possibility of obtaining additional supplies from deeper aquifers in the areas of existing development.

(c) The possibility of obtaining underground supplies in the Region from the Haughton River to Barratta Creeks.

The report also sets out further desirable investigations of possible additional supply for the present area of development; and action considered desirable to safeguard and equitably distribute available supplies.

ORIGIN:

The investigations began in 1964 following concern expressed by the Haughton Sugar Company and the Invicta Mill Suppliers' Committee as to the adequacy of existing underground supplies to meet present and anticipated future demands.

NATURE AND EXTENT OF DEVELOPMENT:

Irrigation in the Haughton River area around the Town of Giru is utilised virtually entirely on sugar cane production for the Haughton Sugar Milling Co. Mill at Giru.

The Mill has an allotted annual peak of 400,679 tons (1965/66). In the 1965/66 year, 193,229 tons of cane were produced from some 9,200 acres in the Giru area the balance being produced in the Burdekin Irrigation Area (Clare, Millaroo and Dalbeg).

Almost all the Giru canelands are situated either in a strip about 1 mile wide on each side of the Haughton River over a length of some eleven miles or a further strip some four miles long along Healey's Lagoon which approximately follows a former Anabranch of the River (see Figure 4).

Average annual rainfall at Giru (see Figure 2) is 50.4 inches as compared with 42.4 inches at Ayr thus indicating the necessity for irrigation for satisfactory sugar cane production.

NATURE OF INVESTIGATIONS:

The investigations have included geophysical surveys by the Bureau of Mineral Resources; geological reconnaissance and mapping; investigation drilling strata logging and pump testing; collection of information on private bores and use of water from these facilities; studies of water quality; and assessment of supply available from the present sources.

CONCLUSIONS FROM INVESTIGATIONS:

Location and Adequacy of Available Supplies:

(a) Location -

Generally as shown in Figure 3 the lands in the Giru area are older Cainozoic alluvials deposited originally by the Haughton River. More recently the River has cut a trench some 30 feet deep through these older alluvials and redeposited more recent (Quarternary) alluvials in this trench.

This area of more recent alluvials (see Figure 3) is in three main sections:

(i) along the river itself where they occupy a relatively narrow strip in the upstream section, broaden in a minor delta around the Town of Giru and then become a relatively narrow strip again about 1 mile downstream of the railway line;

(ii) the Anabranch section which is located in an old Anabranch of the River which leaves the River section a short distance downstream of the Ironbark Creek effluent and the remains of which form Healey's Lagoon;

(iii) the Hodel section which leaves the river section approximately one mile upstream of the railway line and crosses the line in the vicinity of the Hodel siding.

Adequate rates of supply of groundwater for irrigation can be obtained only from these recent alluvials which thus provide a rather unique limited and fairly well defined aquifer.

Although there is water in the older alluvials the quantities that can be extracted are small and the quality is poor.

(b) Storage in and Replenishment of Aquifer -

From the investigations it is estimated that at the fully recharged stage the volume of water stored in the aquifer which is available for extraction is some 10,000 acre feet. This is sufficient to meet full irrigation requirements of 9,200 acres for some 160 days. Replenishment of the aquifer comes virtually entirely from flow in the Haughton River although some additional contribution is derived from runoff from Mt. Elliot to the Anabranch section in the vicinity of Healey's Lagoon.

No-flow periods in the river between 1952 and 1967 have exceeded 160 days on eight occasions with a maximum for 1966/67 of 345 days. Occurrence of such periods between 1900 and 1952 are estimated to be more frequent than 1952 to 1967.

(c) Quality -

The base of the aquifer is below sea level to upstream of Ironbark Creek offtake, i.e. above the extent of present irrigation use.

Because of this, once river flow ceases and water levels in the aquifer are drawn down by pumping, quality of the groundwater deteriorates due principally to the intrusion of sea water.

(d) Adequacy of Supply -

If sea water intrusion could be prevented to allow full drawdown of the aquifer storage the supply available from the aquifer would be insufficient to meet requirements for full irrigation of the existing area on an average of at least 50 percent of years.

An additional supply of some 10,000 acre feet is estimated to be necessary to provide full irrigation requirements. This supply can only be provided by surface water storage.

To make any additional supply effective also requires measures to include sea water intrusion to reduce quality deterioration.

Possibility of Supplies from Deeper Aquifers:

The investigation has shown that there are no deeper aquifers of satisfactory quality water in the existing area of development.

Drilling below the base of the aquifer should be prohibited as it could facilitate sea water intrusion.

Groundwater Supplies Outside Present Development:

It has been firmly established that there are no deeper aquifers of suitable quality water outside the area of present development beneath uncultivated lands between the Haughton River and Healey's Lagoon.

It has also been established that except for some localised areas there is little prospect of further development of satisfactory groundwater supplies between the Haughton River and Barratta Creeks.

FURTHER INVESTIGATION OF IMPROVEMENT TO SUPPLY:

The following further investigations of possible improvement to the groundwater supplies are considered desirable:

(a) The possibility of sea water barriers across the aquifer in the Haughton River section about $1\frac{1}{2}$ miles downstream of the Railway Bridge; the Anabranch section a short distance upstream of the Bruce Highway and on the Hodel section in the vicinity of the Railway.

(b) The possibility of construction of surface storages to provide some 10,000 acre feet of additional supply -

- (i) on the Haughton River in conjunction with a possible sea water barrier about $1\frac{1}{2}$ miles downstream of the Railway;
- (ii) on the Haughton River about 1 mile above the Bruce Highway;
- (iii) further upstream on the Haughton River;
- (iv) on the lower end of Healey's Lagoon.

PROTECTION OF EXISTING SUPPLY:

In order to safeguard existing landholders by protecting the existing supply against further and unequitable over exploitation, facilitating sea water intrusion by drilling below the bed of the aquifer and sharing available supplies as equitably as practicable, it is also considered desirable to declare the area one of "Sub Artesian Supply" under the provisions of The Water Acts.

This will enable the licensing of existing and new bores and placing conditions on drilling and use of bores, as set out in detail in the report, to achieve the above objectives.

DESCRIPTION OF THE AREA

LOCATION:

Centre of operations and focal point of the sugar producing area is the Haughton Sugar Company's Invicta Mill which is situated at the Township of Giru, on the Haughton River, some 30 miles south of Townsville on the North Coast Railway. The Bruce Highway from Cairns to Brisbane by-passes Giru by some two miles. The Haughton River discharges into Bowling Green Bay between Cape Cleveland and Cape Bowling Green and Giru Township is on the left bank of the river some ten miles from its mouth. The area surrounding Giru Township has a population which varies from 800 in the off season to 1,000 in the crushing season.

CLIMATE AND RAINFALL:

The climate of the area is warm and sub-humid with the maximum rainfall in summer. There are two main seasons, a hot wet summer period of variable duration and intensity and a warm dry winter period. Seasonal changes are slow and are associated with a regular annual temperature movement. Temperatures are moderate to high throughout the year.

TABLE I

TEMPERATURE AND RELATIVE HUMIDITY IN TOWNSVILLE - BOWEN REGION

Summer Months			Winter Months		
Maxima ^{o}F	Minima ^{o}F	Relative Humidity	Maxima ^{o}F	Minima ^{o}F	Relative Humidity
85 - 90	70 - 75	70%	75 - 80	55 - 60	60%

Rain falls mostly between October and April with the greatest concentration between January and March. The intensity of rainfall in the summer months is high and the average fall per wet day for the Townsville-Bowen region is of the order of 70 points. During the summer months the intensity often exceeds 100 points per wet day.

Actual annual rainfall records at Giru and Ayr are shown in Figure 2 for 1882 to 1966 together with three and five year moving averages. For Giru records are not available prior to 1933. For the period 1882 to 1932 the values shown have been estimated from the records for Ayr.

For the years of record the average annual rainfall at Giru is 50.4 inches and 42.4 inches at Ayr.

The three years 1964 to 1966 have all been below average at Giru and the area has consequently been subject to drought. As shown in Figure 2 this is not an unusual occurrence as there appears to have been five other periods of three or more successive years when estimated or recorded rainfall was below average. Of these there was one of four, one of six and one of eleven successive years of below average rainfall.

HAUGHTON RIVER FLOWS:

River height records for the Haughton River are available since 1952 from a gauge at 14.5 miles on the River near the old Townsville road crossing. These show that although the river flows each year there are no long periods of no flow.

Details of the number of days in each month when no flow was recorded are shown in Appendix C.

These show the following substantial continuous periods of no flow:

August, 1952 - January, 1953	173 days
June, 1953 - January, 1954	225 days
October, 1956 - January, 1957	108 days
April, 1957 - February, 1958	320 days
September, 1958 - January, 1959	150 days
August, 1959 - December, 1959	139 days
July, 1960 - January, 1961	233 days
April, 1961 - January, 1962	283 days
July, 1962 - January, 1963	197 days
July, 1963 - January, 1964	123 days
August, 1964 - December, 1964	127 days
July, 1965 - January, 1966	168 days
March, 1966 - March, 1967	346 days

INDUSTRY:

Apart from minor beef cattle assignments, sugar cane production is the sole crop and industry of the Giru-Haughton River area. Sugar cane growing began in 1905 and cane first went to Pioneer Mill until crushing began at Invicta Mill in 1920. Until recently cane for Invicta Mill came by rail from Ingham as well as from the area around Giru. This cane from Ingham now goes to Victoria Mill and has been replaced by cane which is transported some twenty-four miles by tramline from the Burdekin Irrigation Areas of Claredale, Millaroo and Dalbeg. However, the area of 9,200 acres in the Giru area is still more than half the total assignment of 17,000 acres for Invicta Mill.

As shown in Figure 4, the main cultivation occurs in two strips each approximately one mile in width. The major strip occupies land on both banks of the Haughton River from half mile downstream of the railway line at Giru to ten miles upstream. The minor strip of four miles length is bounded by Healey's Lagoon which marks the location of a former Anabranch of the Haughton River.

As can be seen from this description, cultivation of the area was first centred about two sources of surface water, namely the Haughton River and Healey's Lagoon. With increased assignment and production, supplies of water have been progressively augmented by underground supplies from spears in the Haughton River and from its former anabranch. In addition consideration, time and money has been expended by private landholders in the search for additional underground supplies outside the known areas. Search has also been made for deeper supplies in the bed of the Haughton River. All these searches have been unsuccessful and support the results obtained by the Commission's investigation.

Sugar cane production at Giru has the reputation of being carried out mainly by dry farming methods with irregular assistance from irrigation sources. This is probably fallacious and is probably based on the memory of the years of higher rainfall from 1948-1958. As can be seen from Figure 2, the average rainfall at Giru is not dramatically higher than that at Ayr where irrigation is consistently practised. Undoubtedly the backdrop of Mt. Elliot aids the local rainfall but not to the extent claimed. With the present more normal rainfall pattern, irrigation is essential if the local sugar cane industry is to prosper.

INVESTIGATIONS

AIMS:

The investigations were initiated in 1964 following urgent requests from the Haughton Sugar Company, the owners of the Invicta Mill and Invicta Mill Suppliers' Committee, who expressed concern at the inadequacy of supplies and quality of water available for irrigation. At the time of the first request, continued expansion and granting of further assignments were still envisaged.

After consultation, the Sugar Company, Suppliers' Committee and the Irrigation Commission decided on four initial objectives:

(a) Search for deeper aquifers of suitable quality water in the areas of the present existing irrigation facilities.

(b) Search for deeper aquifers of suitable quality water in the uncultivated area between the Haughton River and Healey's Lagoon, e.g. Portions 31 and 40, Parish of Scott.

(c) Endeavour to locate underground supplies in areas of possible future expansion -

- (i) along the Giru-Clare tramline in proximity to the Haughton River up to the junction of the tramline with Barratta Creeks, i.e. over the first sixteen miles from Giru;
- (ii) Palm Creek and St. Margarets' Creek areas in the vicinity of the Townsville Road;
- (iii) Spring Creek farming area off the Woodstock Road.

(d) Carry out a regional search for underground supplies in the undeveloped uncultivated area between the Haughton River and the Barrattas, both for -

(i) future long term development of this area;

(ii) better understanding of the factors controlling underground supplies.

During the course of the investigation, these objectives were modified to include:

(e) The determination of aquifer characteristics.

(f) Preliminary assessment of the possibilities of artificial replenishment.

However, because of the general nature of the investigation, only a very preliminary assessment has been made of (e) and (f).

METHODS:

Details of the results achieved in different phases are given under separate headings in this report. The methods used fall into the following categories or phases:

1. Geophysical surveys from June to October, 1964, by Geophysicists from the Bureau of Mineral Resources. This was separately reported on by the Bureau.

2. Percussion drilling by private contractor. This was aimed mainly at determining the availability of underground water along the Giru-Clare tramline along the Haughton River and to Barratta Creeks.

3. Percussion drilling by Commission drilling plant which was mainly concerned with aims (a), (b) and (d). This included pump tests and the calculation of storage coefficients at selected localities.

4. Geological reconnaissance mapping and strata logging of all holes drilled by Commission plant.

5. Obtaining information from individual landholders on details of bores, use of underground water and areas irrigated.

Percussion drilling by private contractor was along joint lines laid down by the Haughton Sugar Company and the Irrigation Commission. This was originally under the direction of personnel from the Haughton Sugar Company but in its later stages was supervised by the Irrigation Commission. This was mainly concerned with aim (c) (i) above and in its early stages encountered many holes with only soakage supplies. Cbservation pipes were not inserted as the contractor considered these to be dry holes. Under Commission supervision observation pipes were left in all holes in the later stages. However, due to the lack of near surface water bearing sands and the difficulty in distinguishing between sand and weathered older rocks, these pipes are frequently set too deep.

Percussion drilling by the Commission included placing of observation pipes in all holes and pump tests of any worthwhile supplies. In these pump tests, observations of standing water level behaviour were also made in a second bore hole in order to determine transmissibility and storage coefficients. This coefficient is derived by mathematical calculation from the observations made during the pump tests and is an important property of the aquifer which gives a relationship between the volume of stored water and the volume of saturated material.

In this investigation only a limited number of such determinations was made because very few worthwhile supplies were encountered outside the limited area of recent alluvia. No determinations were made in the bed of the Haughton River and only two determinations were made in the Anabranch area. This was because the investigation was mainly concerned with areas outside the known aquifers.

The information known by the landholders about private irrigation facilities was also collected. This greatly augmented and broadened the information obtained by the investigation drilling. The information was particularly useful in its detailed confirmation of the geological interpretation and in the information obtained about aquifer thickness and standing water level.

GEOLOGY AND GEOMORPHOLOGY:

The general geology of the area is shown on the General Plan, Figure 1, whilst Appendix A contains notes on the geology and geomorphology of the area.

Mt. Elliot (4,000 feet) and Saddle Mountain (2,500 feet) which are formed of felspathic acidic granites rise abruptly from the coastal plain. Apart from the Cainozoic sediments in the area, these are the youngest rocks and are believed to be Permian to Mesozoic in age.

The oldest rocks in the area are the lavas, tuffs and other minor volcanics which outcrop as low rounded foothills.

The older Cainozoic alluvials cover most of the area from the foothills of Mt. Elliot across the Haughton River to the Burdekin Delta. These alluvials are generally silt, sandy clays and gravels, clays and conglomerate rocks, which do not yield water readily. Water in them is generally of very poor quality.

The Haughton River has cut a path some 30 feet deep through the Cainozoic sediments redepositing it in its own bed. These more recent alluvials contain substantial strata of sands and some gravels which are the only materials in the area from which adequate supplies of satisfactory quality water for irrigation can be obtained. It is from these deposits that virtually all present irrigation supplies are obtained.

GEOPHYSICAL INVESTIGATIONS:

In response to a request by the Queensland Irrigation Commission, Geophysicists from the Bureau of Mineral Resources, Geology and Geophysics carried out several surveys of the area from June to October, 1963. Results of this investigation were published in 1964 as record number 1964/111 titled "Giru Underground Water Survey, Queensland 1963" (J.T.G. Andrew and M. Wainwright).

Survey methods employed included:

(a) Seismic Refraction which measures the velocities of shock waves through different rock layers and so interprets the thickness, depth and type of strata. Fresh granite has the greatest velocity.

(b) Resistivity which measures the different electrical resistance of water saturated strata and relates this to the water quality. Fresh water has a high resistance.

(c) Gravity which measures the gravitational effects of different rock types, particularly of fresh bedrock and obtains an interpretation of the underlying major structural features.

The rock type with the fastest velocity is invariably the bedrock and can always be clearly identified. In their report the Bureau Geophysicists claimed that they could distinguish between the younger unconsolidated recent alluvials and the semi-consolidated to consolidated older alluvials. They also claimed that seismic velocity in the younger alluvials was related to clay content and that good aquifers were identified by a definite velocity range of 4,500 to 5,700 feet/second. Thus by combining the results of the seismic and resistivity surveys the location of good aquifers containing fresh water were claimed to be determined (i.e. velocities 4,500 to 5,700 feet/second association with high resistivities).

Results of Geophysical Surveys:

The bedrock levels determined by the Bureau compare quite closely with those obtained from Commission investigation drilling and reflect the same underlying strong north-easterly deepening of the base of the Cainozoic or top of the bedrock.

A comparison between the zones of fresh water in good aquifers as obtained by the Bureau and the delineation of the recent alluvial aquifer as outlined by the Commission investigation shows close agreement in the Healey's Lagoon portion of the Anabranch section but very distinct variation elsewhere. This is particularly so in Portions 44 and 28, Parish of Scott, where drilling on the Ironbark Lines has identified saline water associated with older Cainozoic alluvials. Test drilling of another area in Portions 45 and 48, where the Bureau showed good water, Parish of Selkirk gave no supplies.

In an attempt to aid the geological interpretation of the sub-surface drilling, a detailed comparison was made between the seismic interpretation of strata and the strata logging in bores. No systematic or regular comparison could be achieved so that the strata determination by seismic refraction cannot be regarded as reliable.

WATER LEVELS:

There are no known long term measurements of water levels in the area. Enquiries have been made from long term residents and from Invicta Mill but until the last few years only spasmodic interest was displayed in water levels. The Giru area was regarded as having a history of recurring water shortage and this was considered an annual event which would be corrected with the onset of the summer rainfall season and the anticipated flow in the Haughton River.

Measurements of standing water levels have been made by Commission staff since March, 1964 and these records are of longer duration and more systematic collection than any kept by local residents. With the co-operation of local landholders, Commission staff have measured water levels in eleven private facilities strategically located in the known aquifer at Anabranch, Giru and Hodel. Regular measurement has also been made in the observation pipes left inserted in the percussion drill holes.

This information shows seasonal fluctuations in water level from the low point before the "wet season" to the high point after the river flowed. However, the information also shows that there has been a steady downward trend since the first systematic measurements in March, 1964 and that the level in March, 1967 is generally lower than at any previous time since 1964.

The investigation has shown that for much of the time over the last three years, the water level in the aquifer has been below mean sea level. This is especially so at the time of greatest irrigation demand before the relief from summer rains. The Commission record is too short to be certain of the seasonal variation (highest to lowest reading of water level) but the information so far available shows it to be as much as 20 feet. Information collected from individual landholders quoted seasonal variations as great as 35 feet. Most users from the Haughton River claimed that in February, 1967, the water level was only just above the base of the sands, i.e. there was a seasonal variation from bed level to 30-40 feet depth.

Water levels in the older Cainozoic outside the aquifer show a similar pattern to that in the aquifer but the change is not so pronounced. As far as the water level is concerned, both the older Cainozoics and the recent alluvials act as one system though the transmissibility and water quality are quite different.

WATER QUALITY:

The water quality from a representative number of samples both from the aquifer and outside it is shown in Figure 3. Because of the highly saline nature of some of the samples, the water quality has been shown in terms of conductivity rather than in parts per million. Conductivity can be readily measured on a resistance meter and is a convenient indication of Total Dissolved Solids. Increasing conductivity denotes increasing salinity.

The Giru-Haughton area has a reputation as an area of poor quality water. This is especially true of the Hodel area and the area downstream from the Railway Line, on the left or town side of the river. It is not true of the whole aquifer system. However, Figure 1 shows that with the general proximity to the coast and to the low lying mud flats, this is only to be expected.

Recent Alluvials:

Regular collection and analysis of samples from selected private irrigation facilities and from the investigation observation holes have been made by Commission staff over the last three years. In addition the records of water quality for Giru held by the Bureau of Sugar Experimental Station (Brandon) have been examined. Some of these results are tabulated in Appendix B.

Most of the analyses have been done since 1963 with an occasional analysis in 1961 or 1962. There are no earlier records available. Most of the Bureau analyses were carried out in the poorer quality areas of the aquifer for the more conscientious farmers; only an occasional analysis was made in the better quality areas.

Both the Commission analyses and the Bureau analyses show that the water quality in the aquifer is subject to the same seasonal fluctuations as the water levels and that the poor quality water recovers very quickly after a flow in the Haughton River.

Overall in the poorer quality areas there has been a slight deterioration in quality since 1964 but elsewhere in the aquifer there is no evidence that the water quality is any worse in 1967 than 1964. It is fairly true to say that what is now poor quality water has always been so but it is also probably true that in the absence of other supplies, the farmers are using more and more of this water on their land.

Analyses by the Bureau show that most of these poor quality waters have a high sodium content and high sodium absorption ratio. (Ratio of sodium to calcium and magnesium). The Bureau analysts have repeatedly warned the farmers against continued use of such water, particularly in clayey soils with poor permeability whose tilth could be seriously and permanently impaired by clogging. This then presents a real hazard to the area. A few sample analyses are listed below:

TABLE II

WATER QUALITY ANALYSES BY SUGAR EXPERIMENTAL STATIONS

Location	Conductivity micromhos/cm	Sodium Absorption Ratio	Equivalent NaCl gr/gal.
Parish Scott			
Portion 17	884	4.5	22.7
River opp. Portion 17	1990	7.5	60.4
River opp. Portion 17	3041	8.9	104.8
Portion 12	5720	20.0	214.0
Parish Abbotsford			
Portion 11V	1831	6.7	41.1
Portion 11V	2074	8.2	46.9

The river is tidal to the vicinity of the railway bridge and affects the water quality in this vicinity. In recent years, a sand dam has been constructed here by Mr. R. McLennan and presumably this has assisted in maintaining better quality water though there is little evidence of this.

Older Alluvials:

Percussion drilling outside the aquifer has shown the presence of highly saline waters both in the shallow sand veneer and in the older Cainozoic. At depth the water is as saline as sea water, e.g. Townsville Road Line B2, S4 at depth 136 feet 6 inches (R.L. - 126.87).

TABLE III

SALINE WATERS IN OLDER CAINOZOIC ALLUVIALS

Depth (feet)	Supply gph.	Quality	
		Conductivity micromhos/cm	Chlorides (C1) ppm
Townsville Road Line B6, S3			
8	soak	21,000	8,000
23	soak	17,000	5,800
54 - 62	1,200	6,180	1,600
68 - 71	soak	7,300	2,200
77 - 82	soak	11,500	3,800
Townsville Road Line B5, S5			
15	soak	saline	
38	soak	saline	
53 - 56	soak	saline	
70 - 87	soak	brackish	
87 - 95	good	28,600	
Townsville Road Line B7, S6			
14	soak		
25	soak	saline	
47	soak	brackish	
75 - 96	200	saline	
Townsville Road Line B8, S10			
21	soak	9,700	3,500
82	soak	9,500	3,540
Ironbark Line B3, S5			
40	soak	3,500	1,140
Ironbark Line B4, S6			
52	soak	4,850	1,120

From the present topography it is obvious that much of the uncultivated area between the Haughton and its former Anabranch was tidal until very recently and mangrove mud has been logged from 8 feet - 15 feet depth in holes B6, S3 and B5 S5 on the Townsville Road Line. Therefore, many of the shallow saline soaks are probably due in part to residual salts and the proximity of the nearby coastal mud flats would also make conditions more saline. However, the very saline waters at depth are almost certainly due to sea water intrusion and thus represent a considerable threat to the area.

NATURAL REPLENISHMENT:

The principal source for natural replenishment is runoff in the Haughton River itself. This replenishment affects both the recent aquifer alluvials and the older Cainozoic alluvials but affects the aquifer to a much more marked degree. Rapid rises in water levels have been observed in the Anabranch and Giru Delta areas following flow in the river.

In the Anabranch-Healey's Lagoon area a contributory source of replenishment of some significance is undoubtedly due to runoff from the rainfall on Mt. Elliot. Because of its topographic position, plus the presence of outcropping impermeable granite and the poor permeability of the top of the older Cainozoic, runoff from Mt. Elliot would follow a path beneath the soil to the Anabranch aquifer and Healey's Lagoon. Evidence for this localised replenishment is shown by the more pronounced upswing in water levels in February-March, 1967 for Townsville Road Line B1, S2. Vagaries in storm rainfall in February-March had been responsible for heavier falls on the north face of Mt. Elliot and had filled that part of Healey's Lagoon in Portion 55, Parish of Scott.

There is no evidence of replenishment or withdrawal between Healey's Lagoon and the aquifer but it seems feasible that in places there is movement between the two, though the banks and bed of the lagoon appear of clay composition.

Comparison between standing water levels in the older alluvials and the aquifer show a definite cone of depression on each section. This is only to be expected but results in a definite head advantage to the older alluvials. Because of their clayey composition with resulting poor storage and transmissibility, movement of water through the older alluvials is undoubtedly slow and of low yield. However, the alluvials do contain water and therefore present a source of replenishment for the aquifer. No doubt this water has helped in the past to sustain yield from the aquifer. However, because of the poor quality water, this represents a very hazardous source of replenishment. There is no evidence of deterioration in quality due to this source but the form of measurements carried out by the Commission are not sufficiently detailed to detect such changes.

An area of particular significance is that between Ironbark Creek (Portion 26, Parish of Scott) and the aquifer to the north and east. Here drilling on the Ironbark Line has shown poor quality water at depths from 40 feet. Changes in water level in bores in this line, especially B1, S2, suggest connection with the aquifer, so there is a definite possibility of contamination. This is part of the area in which geophysical resistivity measurements showed good quality water, so shallow near surface better quality water may offset the deeper poorer quality water. However, drilling did not detect any shallow water supply, either good or bad quality.

SALINE WATER INTRUSION:

The deterioration of water quality between occurrences of natural replenishment in the Giru area is an important factor and comes from two sources:

(a) Sea water intrusion;

(b) Saline water from older alluvials.

The threats are accentuated because of:

(i) Very restricted localised aquifer which is heavily over exploited and whose sole replenishment is from runoff in the Haughton with little assistance from rainfall.

(ii) Close proximity to coastal mud flats and areas of saline water even though the cultivated area is six miles from the sea.

(iii) Base of the aquifer in the Haughton River around the Town of Giru and in the Anabranch section is below mean sea level for 18 miles upstream from its mouth, i.e. as far upstream as the present irrigation plants. This is upstream of the offtake of Ironbark Creek and of the Anabranch aquifer section. In February, 1967 users claimed that the aquifer was being pumped down to its base.

(iv) Drilling of deep holes through the aquifer to bedrock without later proper sealing off has facilitated the intrusion of water.

The river is tidal as far as the railway bridge and salt water intrusion is felt at least two miles upstream of this. Analyses from Fordyce and Son's river pump (opposite Portion 17, Parish of Scott) show a conductivity range from 630 to 3500 micromhos/cm depending on the season.

As shown in Figures 6 to 18 and in the section on water quality, water from most of the investigation bores is highly saline and generally deteriorating in quality.

SAFE YIELD:

The ultimate objective of the investigation of any aquifer system is the determination of its safe yield. This is defined as "the amount of water which can be withdrawn from it annually without permanently depleting or damaging the aquifer". There are many factors which affect the results and the calculation is not as simple as it might first appear. For worthwhile results observations must be taken over a number of years and include the time of worst conditions.

The determination of the following properties of the aquifer is necessary to the calculation of the safe yield:

(a) Properties obtained by observation include -

(i) extent, depth and thickness of the aquifer;

(ii) seasonal variation in water level from the level when full to the lowest level on record;

(iii) variation in water quality in the aquifer and adjacent strata.

(b) Properties obtained by calculation from properly conducted pump tests which are -

(i) transmissibility of the aquifer (a measure of the flow of water through the aquifer);

(ii) storage coefficient (a coefficient indicative of the percentage of the aquifer occupied by water).

From the combination of information from the drilling programme and from landholders in respect of private bores, it is possible to obtain fairly accurate values for (a) (i), (ii) and (iii).

However, investigation drilling was concentrated on areas outside the aquifer and only two pump tests were carried out in the aquifer both of which were in the Anabranch area. From this information and the data accumulated by the Commission on aquifer coefficients, it is estimated that 66 percent of the water stored in the aquifer can be extracted.

Table IV sets out the volume of water stored when the aquifer is full together with the volume available for use on the basis of the foregoing assumptions.

TABLE IV

Section	Surface Area (acs.)	Average Aquifer Thickness (feet)	Shape Factor	Specific Yield (%)	Volume of water stored (ac. ft.)	
					Maximum	Minimum
Haughton River	740	28	0.8	25	4,150	2,740
Anabranch	1,365	28	0.8	20	6,110	4,040
Giru Delta	1,103	28	0.8	20	4,940	3,260
TOTAL:	3,208				15,200	10,040

The volumes set out in the above table are based on storage alone and do not account for any down river flow in the Haughton River Sands.

On the assumption that the Haughton River has one major fresh each year which is capable of replenishing the underground storage, it is reasonable to assume that the safe yield from the aquifer following full recharge is of the order of 10,000 acre feet.

DEFICIENCY IN SUPPLY FROM AQUIFER:

The area irrigated in the Giru area according to information from landholders is some 9,200 acres.

For information on actual use in the Burdekin Delta and in the Burdekin Irrigation Area for full irrigation the average annual irrigation application (in addition to rainfall) in the Giru area is estimated to be of the order of 30 inches. For an irrigated area of 9,200 acres this gives an average annual requirement for full irrigation of some 23,000 acre feet.

On this basis and assuming the irrigation use is spread uniformly throughout the year the supply available from the aquifer, provided the full storage can be utilised, would be sufficient to meet full requirements for some 160 days after it has been fully replenished, i.e. after the Haughton River flow has fallen below 30 to 40 cusecs.

As indicated under Haughton River Flows, stream flow records for 1952 to 1966 show that no flow periods of 160 or more days per year have occurred on eight occasions and varied from 168 to 345 days.

These can be subdivided into -

160 to 210 days	-	2 years
210 to 260 days	-	3 years
260 to 345 days	-	3 years

Figure 2 shows that rainfall in the Giru area between 1952 and 1966 have been substantially better than those which occurred between 1809 and 1952.

It can be expected therefore that the underground water supplies will be inadequate to meet full irrigation requirements in somewhat more than 50 percent of years.

EXTENT OF SHORTAGE OF SUPPLY:

The amount which available supplies fall short of full requirements will vary with periods of no flow in the Haughton River.

Supply required for an irrigated area of 9,200 acres and annual irrigation applications of 30 inches per acre for varying periods is approximately as follows:

50 days	-	3,200 acre feet
100 days	-	6,400 acre feet
150 days	-	9,600 acre feet

Thus if additional supply of 6,000 acre feet could be made available during periods of no river flow full irrigation requirements could be met in all but years such as 1957/58, 1961/62 and 1966/67.

An additional supply of some 10,000 acre feet would be necessary to meet full requirements in all years.

This additional supply would, however, only be effective if the aquifer can be fully drawn down without serious deterioration in water quality from salt water intrusion.

POSSIBLE METHODS OF IMPROVEMENT TO SUPPLY:

Provision of adequate good quality water for the existing area appears to require -

(a) Prevention of salt water intrusion from the sea into the two main sections, the Haughton River alluvials and the Anabranch alluvials. This is to enable the full aquifer storage to be utilised with a minimum of deterioration in quality; and

(b) Provision of additional supply.

Prevention of Sea Water Intrusion:

The aquifer in the Giru area is rather unique in that it is very limited in extent and from the information available the outlets or seaward extremities are limited in width and depth.

There are three of these, the Anabranch, Haughton River and Hodel sections.

Although no detailed investigations have been made it would appear practicable to construct an artificial barrier across these aquifers to serve the dual purposes of reducing salt water intrusion and leakage of fresh water from the aquifer.

If this is the case it would enable the aquifer to be fully drawn down with a lesser degree of deterioration in quality during periods of no flow in the river.

Some deterioration could still occur with water moving from the older Cainozoic alluvials into the aquifer but this movement must be slow due to the relatively low transmissibility of the older alluvials.

More detailed investigation of the practicability of these artificial barriers is considered desirable.

Provision of Additional Supply:

Additional supply during no flow periods of the Haughton River can only be provided by surface water storage. Such storage should be of sufficient capacity to give a yield of some 10,000 acre feet in 160 days following cease to flow in the Haughton River from which artificial replenishment of the aquifers could be provided as water levels are drawn down. Again no investigations have been made. The following alternatives are suggested for investigation:

(a) Weirs on the Haughton River.

The following locations are proposed for investigation -

(i) Weir in conjunction with artificial barrier to exclude sea water intrusion about $1\frac{1}{2}$ miles downstream of the Railway Bridge between Portion 18V, Parish of Abbotsford and Portion 23V, Parish of Selkirk.

(ii) A second weir in the vicinity of the Therbourne Bore Line about 1 mile above the Bruce Highway and as close as practicable to and downstream of the offtake of the Anabranch section of the aquifer from the Haughton River section.

Both of these structures would probably be required to be designed with collapsible crests such as fabridams to avoid aggravating floods.

(iii) It is unlikely that weirs proposed in (i) and (ii) above would provide adequate additional supply and a third structure some distance further upstream would require investigation.

(b) Healey's Lagoon.

It would appear desirable to also investigate the possibility of increasing the storage of Healey's Lagoon by means of a weir structure with a collapsible crest between the old Townsville road and the Anabranch Bore Line together with levee banks on either side of the lagoon for some distance upstream.

This increased storage could at least provide additional supply for a number of pumping installations drawing water direct from the Lagoon.

It may also assist replenishment of underground supplies in the Anabranch section of the aquifer.

PROTECTION OF EXISTING SUPPLY:

Because of the limited supplies available from the aquifer in most years, the over development that has already occurred and the danger of increasing saline water intrusion by drilling beyond the base of the aquifer in the more recent alluvials into the older alluvials which contain much poorer quality water, it is considered desirable to establish control over any further drilling in the general Haughton River area.

This control can be established by declaration of the area as an "area of Sub-artesian Water Supplies" under the provisions of The Water Acts as has been the case with the Artesian Basin Area for over 40 years.

All new and existing bores must then be licensed and conditions imposed on the licenses to safeguard the existing supply as far as practicable, share it as equitably as practicable among users and avoid further over development.

It is considered that this control should be established even if works previously suggested for improvement to the supply are found practicable and implemented.

If established, it is envisaged that provisions of licenses would be directed ensuing that -

(a) the area which landholders attempt to irrigate is not allowed to increase beyond the existing area unless assured supply is available for any such increase;

(b) total annual use authorised for the whole area does not exceed $2\frac{1}{2}$ acre feet per acre on 80 percent of the present gross assigned area able to obtain underground and surface supplies, or any increased area for which assured supplies can be provided;

(c) annual quantities authorised to be used on individual holdings do not exceed $2\frac{1}{2}$ acre feet per acre on 80 percent of existing gross assignments, or increased assignments for which assured supplies can be provided;

(d) total authorised rates of withdrawals from existing or new bores on any individual holding will not exceed a rate which would allow irrigation of a maximum of 80 percent of the gross assigned area in a reasonable period such as pumping a quantity equivalent to 4 inches over the area in three weeks.

However, to ensure reasonably equitable sharing of supplies among the irrigators, once the river has ceased to flow, periods of pumping on individual holdings would require to be limited to ensure that overall rate of use for the area would not exceed a reasonable level such as 10,000 acre feet in five months;

(e) to avoid aggravating the deterioration of quality of supplies by increasing movement from the poorer quality, supplies in the older alluvials be prohibited generally below the base of the more recent alluvials forming the aquifer.

If such drilling occurs such as in the Commission's investigation bores, steps be taken to adequately seal the holes below the level of the main aquifer.

To ensure that supplies available for natural replenishment of supplies in the Giru area are not further reduced, it is proposed that no further licenses for private diversion of surface water for irrigation be granted on the Haughton River catchment upstream of the general Giru area.

GEOLOGY AND GEOMORPHOLOGY

The principal units occurring in the area are shown in figure 1 (Scale 1" = 2 miles). The geology on this plan has been taken from the TOWNSVILLE and AYR Sheets, preliminary editions 1966 (Scale 1:250,000), from the most recent mapping by the Bureau of Mineral Resources, and the Queensland Geological Survey; by courtesy of the Director, Bureau of Mineral Resources, Geology and Geophysics.

By far the most dominant topographic features in the area are the sub-circular granite stocks of Mt. Elliot (4,000 ft.) and nearby Saddle Mountain (2,500 feet) which form a backdrop to the canelands at Giru. These have been highly resistent to erosion and consequently now rise abruptly from the coastal plain as high rugged ranges, deeply dissected in places, and mantled by dense scrub. These stocks are predominantly light coloured felspathic acidic granites. Apart from the Cainozoic sediments, these are the youngest rocks in the area, believed to be Permian to Mesozoic in age. Because of their dominant topographic position, these rocks would have been a generous source of material for the early Cainozoic and more recent alluvials.

The oldest rocks occurring in the area are Carboniferous to Permian in age, consisting of intermediate lavas and tuffs, with other minor acid volcanics. These rocks outcrop as low rounded foothills and seaward fringes to the more resistent Mt. Elliot granite beyond. It is possible that they might have some slight water potential, but they certainly do not represent a potential source for irrigation supplies. (These rocks represent, in part, an area which was previously identified by D.M. Traves in the 1950 mapping of the Townsville-Bowen Region as being Middle Devonian in age, equated to the Reid beds of limestones, tuffs and sandstones. With the revised mapping by the B.M.R. and Q.G.S., much of this Middle Devonian has been assigned a Carboniferous-Permian age).

The next oldest rock type occurring in the area is a granite of uncertain Carboniferous to Permian age. (Which was previously assigned by Traves as part of the Middle Devonian Reid Beds.) Topographically the outcrop is indistinguishable from and is a continuation of the same low foothills as the Carboniferous Volcanics and leads in a south easterly direction towards the Majors' Creek and Haughton River junction near the Cunningham Line. Granite such as this is not water bearing.

The strata occupying the greatest area extent on the map are the Cainozoic alluvials that occupy a flood plain which spreads from the foothills of Mt. Elliot, across the Haughton River, and the Barrattas to the Burdekin River including the Burdekin Delta. This plain is generally level with a slight slope towards the coast. Source material for these alluvials has been derived from the headwaters of the Haughton and Reid Rivers (Silurian to Devonian granodiorite, quartz sandstones, arkosic conglomerate), as well as from the local rock types previously described. These Cainozoic alluvials probably range in age from early Cainozoic (Pliocene) to Pleistocene, i.e. older than the sand and gravels in the present bed of the Haughton River.

The sequence is further described in the section on sub-surface geology and illustrated in the various sections (Fig. 6 - 18). In these sections the top of the older Cainozoic appears as a distinctive spotty red clay and probably represents oxidation of an older land surface. Where exposed at the surface, the principal rock type appears to be an arkosic conglomerate with very poor sorting, indication of deposition under torrential conditions. Pebbles and cobbles with quite random orientations are deposited in rough layers separated by very clayey sands; the whole now much weathered and breaking down to clay. Exposures have been studied in a small creek on Portion 8, Parish of Scott, near the boundary with Parish of Abbottsford, in a small creek on the road crossing in Portion 7V, Parish of Scott, and in the Haughton River in the vicinity of the Cameron's Line, Poletti Line, Shirbourne Line and Old Road Line. The conglomerate is best exemplified at the Cameron's Line crossing, less so at the Poletti Line and even less so at the Shirbourne and Old Road Line Crossings. The rock type is not very robust, and under the influence of weathering it breaks down very easily. This is markedly shown in the rock bars which exist at the tram line crossing on the Old Road Line. Here, the rock underwater can be easily barred or picked out, and in places, breaks down to little more than a mud. The water potential of these Cainozoic sediments is not very great.

The Recent Cainozoic deposits consist of the Haughton River alluvials, the mud flats to the north which border Bowling Green Bay, and minor sand dunes. These alluvials are distributed in the present bed of the Haughton and in its former recent channels; the former Anabranch now marked by Healey's Lagoon and the minor delta in the vicinity of Giru township. On the ground and in aerial photographs, these former channels are marked by definite distinctive depressions, typical of these recent river deposits. The river alluvials contain the only worthwhile source for irrigation supplies in the area, and are extensively exploited as such by the cane farmers in the area. In depositing these alluvials, the Haughton has cut a path some 30 feet deep through the older Cainozoic reworking it and depositing it in it's own bed. The light dirtier clay fraction, has in most cases, been taken further downstream and deposited in the mud flats that are building up round Bowling Green Bay. The irrigation potential of these aquifers is illustrated in the various sections (Figures 6 - 18).

A thin veneer of sandy deposits resulting from deposition from minor streams and possibly older beach deposits overlies portions of the older Cainozoic. Sometimes this contains fresh water but in other places the water is quite saline.

SUB-SURFACE GEOLOGY:

The record of the strata encountered in the Commission directed percussion drilling programme and of the strata in a number of private irrigation facilities and unsuccessful private test holes is shown on the sections figures 6 to 18. The drillers' descriptions have been retained and the sections present a factual record of the strata as encountered, but for simplicity many of the shorter intervals with minor differences in detailed description have been grouped under the one description.

The keys to the understanding of the sub-surface geology are:-

(a) Recognition of the flood plain of older Cainozoic alluvials.

(b) Recognition of these older alluvials in the bed of the Haughton River.

(c) Recognition that the strata encountered in the bore holes must belong to these alluvials.

(d) Recognition of the older weathering surface now marked by the formation of a spotty red clay varying from 12 - 20 feet beneath the present surface. Once recognised, this is seen to occupy a consistent stratigraphic position.

(e) Recognition of the channels which the Haughton River has recently cut through this older surface.

(f) Recognition that these channels form one aquifer with similar aquifer characteristics and that in the Giru area this is the only worthwhile aquifer.

(g) Recognition of the change in and increasing depth of strata, and the improvement in transmissibility, in water quality, in yield which takes place along the Townsville Road Line as one moves east from the Haughton River to the Barrattas Creeks.

(h) Recognition of the Barrattas as marking the western limit of the influence from former channels of the Burdekin River. This is shown by the results above and results from The Dam Line B4 S7 and Cunningham Line B5 S7 and B1 S8; and is amply supported by regional geomorphology which suggests an older Burdekin River path breaking off above Claredale through Gladys Lagoon to the Barrattas.

Since they come from the same sources, there are many similarities in appearance and composition between the recent sands and gravels and the older alluvials. Thus some descriptions of sands and gravels in the older alluvials may not now be true sands and gravels but rather semi-consolidated to consolidated sediments, e.g. "clean coarse grained sand" or "dirty coarse grained sand and clay" (Townsville Road Line B3 S7, figure 13) and "brown sandy clay" or "claybound coarse grained sand and gravel" (Townsville Road Line B7, S6 Figure 13).

For simplicity however, the strata outside the known aquifer of the Haughton River, Anabranch and "Giru Delta" can be considered as consisting of clays, clayey sands and claybound gravels with very poor transmissibility, i.e. with very slow movement and poor yield of underground water. Along the Townsville Road from the Haughton River to Healey's Lagoon, the top 60' consists mainly of clay. In part this clay was present during deposition and in part it results from decomposition in situ, particularly noticeable in the breakdown of former pebbles to clay nodules.

APPENDIX B

WATER QUALITY

Analysis of water from Selected Facilities from Records of Bureau of Sugar Experimental Stations (Brandon) and Irrigation Commission.

Date	Conductivity mhos/cm.	Sodium Absorption Ratio	Equivalent NaCl from Cl. grains/gal.	ppm.
McLennan & Co., Portion 13V Parish of Selkirk				
4" Pump RM. 33				
22.8.62	3970	8.5	109.1	1360
Feb, 1967	6350		162.0	1459
6" Pump RM. 32				
April, 1962	810	4.1	15.7	225
12.9.66	3100		87.5	1251
15.12.66	1760		43.6	623
23.2.67	975		20.0	286
8" Old Pump RM. 34				
April, 1962	6950	24.0	266.6	3812
Feb, 1967	6650		212.0	3032

WATER QUALITY

Analysis of water from Selected Facilities from Records of Bureau of Sugar Experimental Stations (Brandon) and Irrigation Commission.

Date	Conductivity mhos/cm.	Sodium Absorption Ratio	Equivalent NaCl. from Cl. grains/gal.	ppm.
A. Fordyce & Son., Por. 17 Parish Scott.				
Pink Lily Pump RM52				
March, 64	920		9.4	134
25.1.65	884	4.5	22.7	325
10.12.65	619	3.1	11.9	170
16.5.66	790		17.2	246
20.7.66	780		16.2	232
12.9.66	1780		53.8	769
15.12.66	2360		71.9	1028
21.2.67	760		14.0	200
River Pump RM54				
16.1.61			34.0	486
25.5.61			28.0	400
30.10.63	1990	7.5	60.4	864
25.1.65	627	2.9	11.4	163
23.11.65	3041	8.9	104.8	1499
10.12.65	1503	7.3	46.7	668
25.7.66	3578	10.0	121	1730
3.11.66	2738	8.8	89.0	1273
21.2.67	415		14.0	200
Pierotti Brothers, Portion 12 Parish Scott				
Pump A - 5" Pump to 28 feet				
2.3.65	5720	20.0	214	306
10.4.65	4654	11.3	176.9	2530
Pump B - 6" Pump RM66				
10.4.65	1337	5.9	25.1	359
Pump D - 6" Pump				
10.4.65	1192	4.2	31.8	455

WATER QUALITY

Analysis of water from Selected Facilities from Records of Bureau of Sugar Experimental Stations (Brandon).

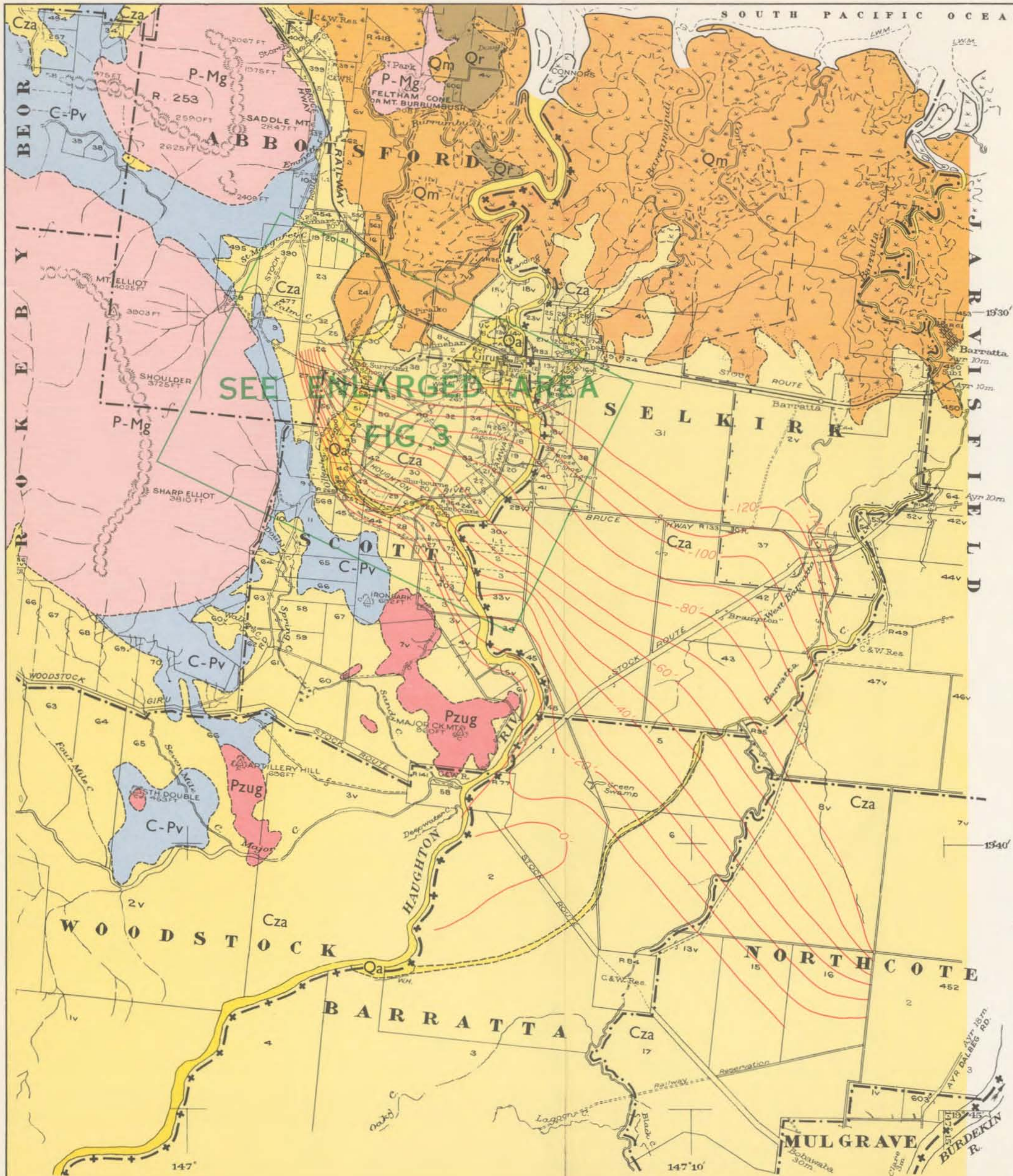
	Date	Conductivity mhos/cm.	Sodium Absorption Ratio	Equivalent NaCl. from Cl. grains/gal.	ppm.
	Donald Brothers, Portion 8V Parish Abbotsford.				
	6" Pump JW42.				
	1.11.65	557	3.5	11.2	160
	Feb, 67	910		18.0	257
	5" Pump JW43				
	29.11.65	444	2.0	6.8	97
	Feb, 67	650		12.0	170
	4" Pump JW44				
	March, 64	660		8.8	126
	21.10.65	350	2.3	5.1	73
	21.12.65	470		9.2	133
	16.5.66	1170		26.1	373
	21.7.66	710		13.9	199
x	19.9.66	1484	3.8	25.0	358
+	19.9.66	956	3.3	14.0	200
	15.12.66	880		15.0	215
	Feb, 67	1275		17.0	243
	March, 67	760		16.0	229

x First sample at start of pumping

\+ Second sample after 16 hours pumping

Date	Conductivity mhos/cm.	Sodium Absorption Ratio	Equivalent NaCl. from Cl. grains/gal.	ppm.
Burry Brothers., Portion 11V Parish Abbotsford.				
Pump A RM62				
10.7.61			39.9	371
29.11.63	1831	6.7	31.1	588
27.4.65	1963	6.4	56.8	812
Pump B RM63				
10.7.61			21.4	306
29.11.63	1331	6.0	29.0	415
27.4.64	1330	6.3	33.0	472
23.6.66	1696	5.6	41.2	589
Pump C				
10.7.61			50.2	718
Jan, 64	1720	8.4	42.2	603
20.7.66	2074	8.2	46.9	671
Pump D, RM64				

FIG. I



GEOLOGICAL LEGEND

CAINOZOIC	QUATERNARY	Qm	Coastal mud flats
		Qr	Coastal sand dunes
		Qa	Alluvials - aquifer
		Cza	Alluvials & deltaic deposits
PERMIAN TO MESOZOIC		P-Mg	Epizonal adamellite & granite
CARBONIFEROUS TO PERMIAN		Pzug	Granite, microgranite & adamellite
		C-Pv	Intermediate lavas & pyroclastics

Geological Boundary Approximate

NOTE:- Geology adapted from Townsville and Ayr sheets - preliminary editions 1966 (scale - 1:250,000) - mapping by Bureau of Mineral Resources & Qld. Geological Survey

CONTOUR LEGEND

Level of base of cainozoic sediments 40 feet below State Datum shown thus -40

(Equivalent to top of permo-carboniferous weathered granite and volcanics.)

Scale of Miles

2 1 0 2 4 6

QUEENSLAND

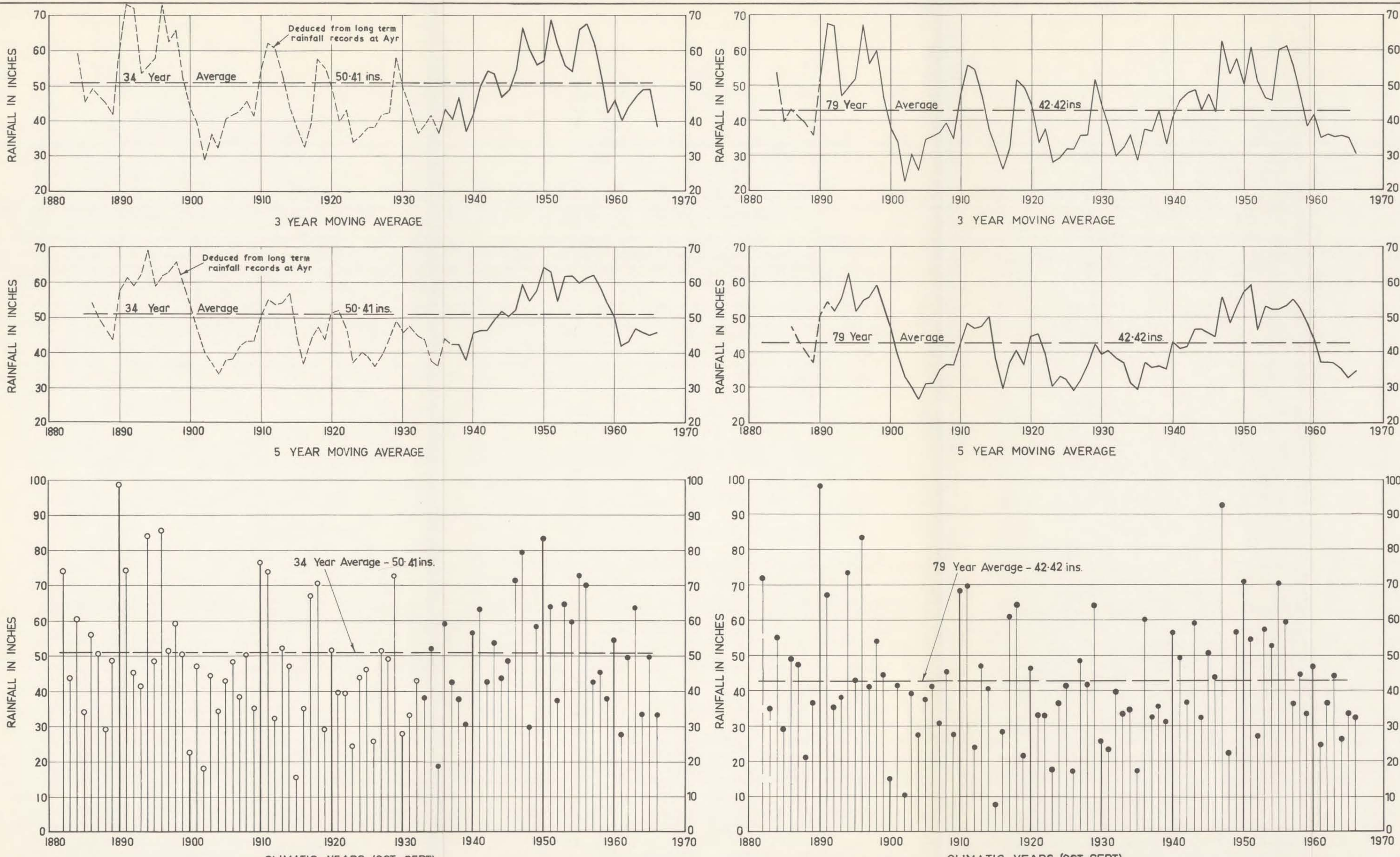
IRRIGATION AND WATER SUPPLY COMMISSION

HAUGHTON RIVER

GROUNDWATER INVESTIGATION

GENERAL PLAN SHOWING GEOLOGY AND BEDROCK CONTOURS

FIG. 2



Deduced from long term rainfall records at Ayr

Based on Woodhouse Records

GIRU RAINFALL

AYR RAINFALL

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUNDWATER INVESTIGATIONS

AYR AND GIRU RAINFALL

FIG.3

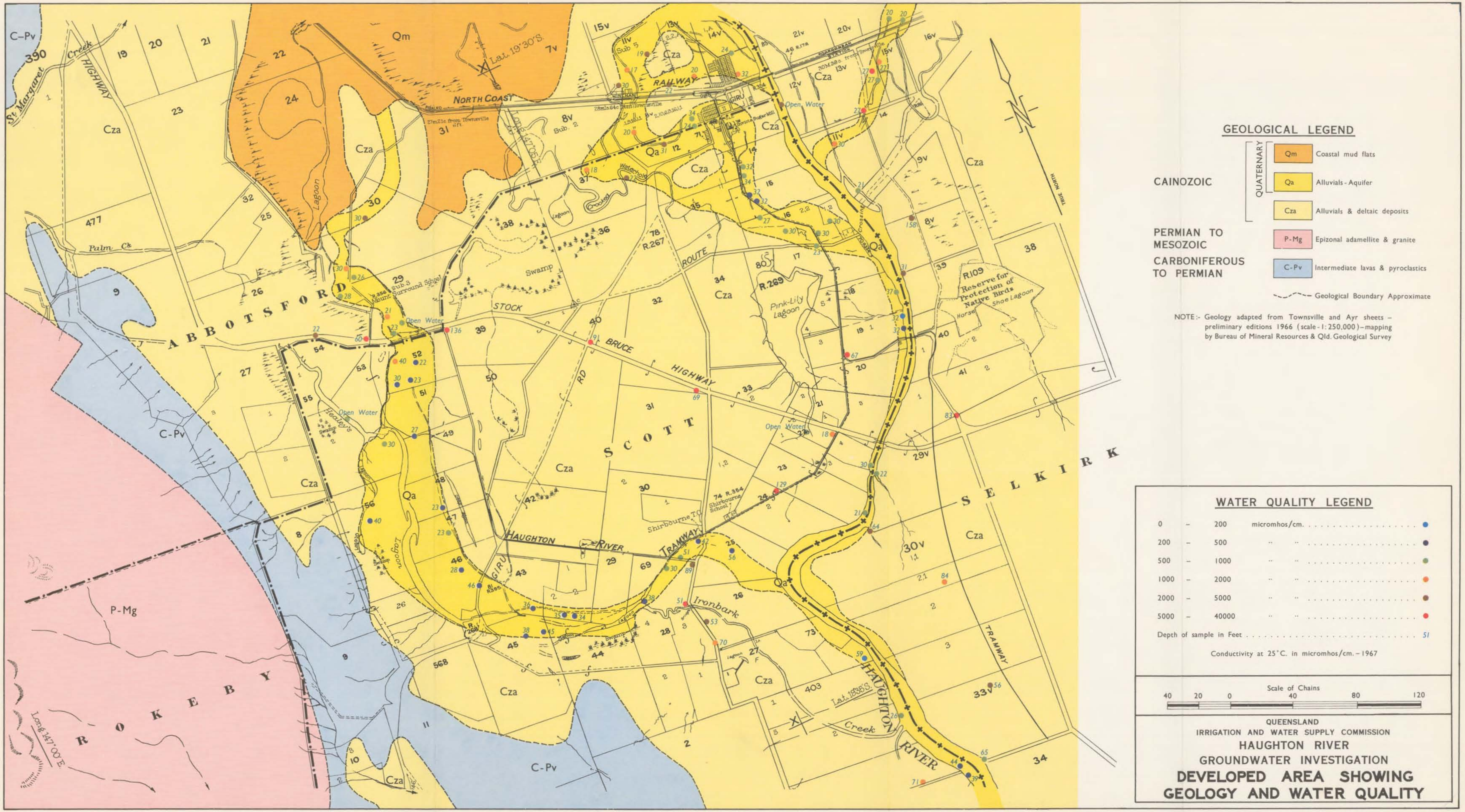
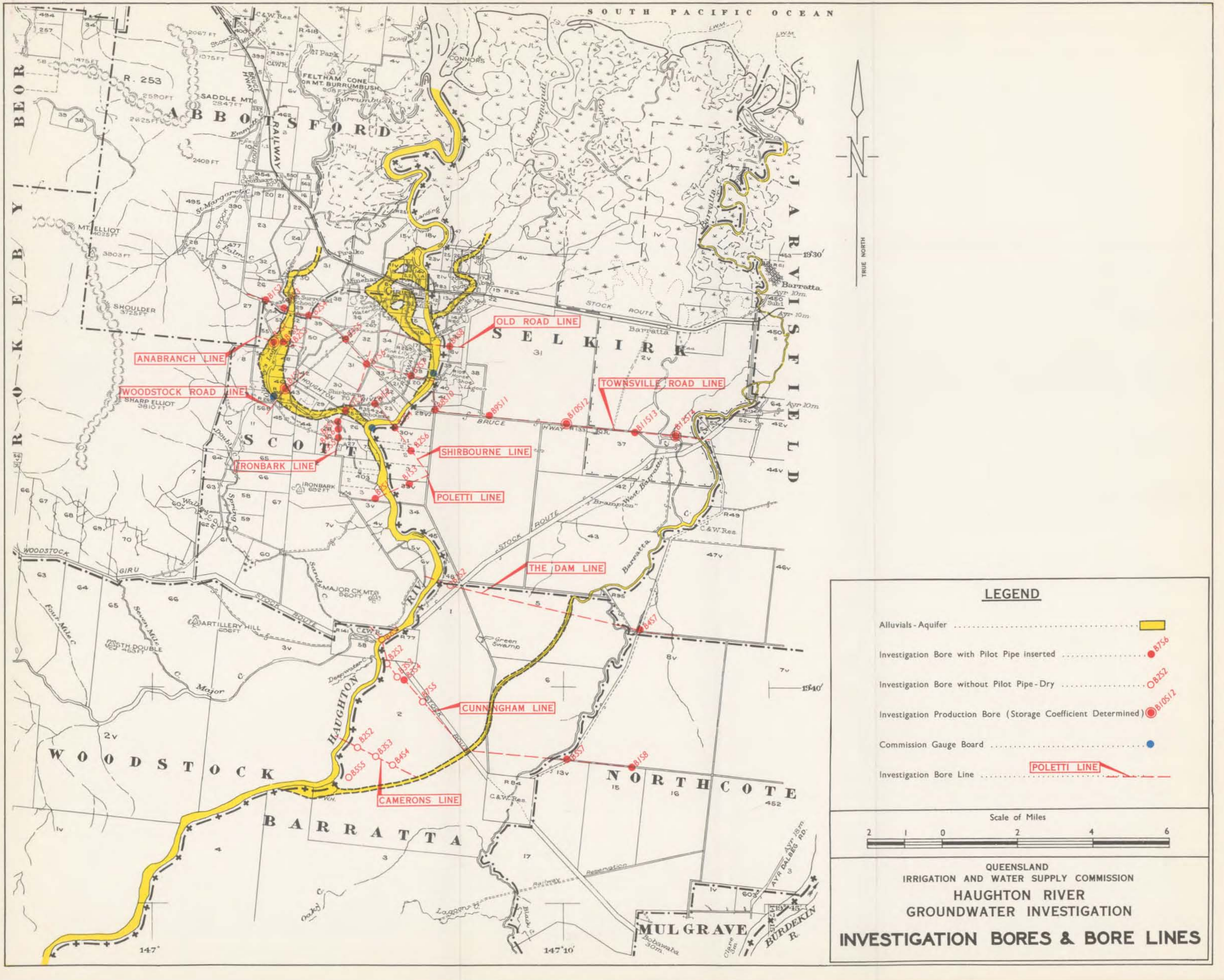

GEOLOGICAL LEGEND
CAINOZOIC
QUATERNARY
Qm Coastal mud flats
Qa Alluvials - Aquifer
Cza Alluvials & deltaic deposits
PERMIAN TO MESOZOIC
P-Mg Epizonal adamellite & granite
CARBONIFEROUS TO PERMIAN
C-Pv Intermediate lavas & pyroclastics
Geological Boundary Approximate
NOTE:- Geology adapted from Townsville and Ayr sheets - preliminary editions 1966 (scale - 1:250,000) - mapping by Bureau of Mineral Resources & Qld. Geological Survey
WATER QUALITY LEGEND
0 - 200 micromhos/cm.
200 - 500
500 - 1000
1000 - 2000
2000 - 5000
5000 - 40000
Depth of sample in Feet 51
Conductivity at 25°C. in micromhos/cm. - 1967
Scale of Chains
40 20 0 40 80 120
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUNDWATER INVESTIGATION
DEVELOPED AREA SHOWING GEOLOGY AND WATER QUALITY
ABBOTSFORD
SCOTT
SELKIRK
ROKEBY
BRUCE HIGHWAY
NORTH COAST RAILWAY
HAUGHTON RIVER
TRUE NORTH

FIG.4


LEGEND
Areas Irrigated 1965 - 1966.
Irrigation pump from Surface Water
Irrigation pump from spears in Haughton River
Irrigation pump from shallow bore
Scale of Chains
40 20 0 40 80 120
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUNDWATER INVESTIGATION
DEVELOPED AREA SHOWING
IRRIGATED AREAS
ABBOTSFORD
SCOTT
SELKIRK
ROKEBY
NORTH COAST RAILWAY
BRUCE HIGHWAY
HAUGHTON RIVER
GIRU
Pink-Lily Lagoon
Reserve for Protection of Native Birds
Horse Shoe Lagoon
Shirbourne Tramway
Ironbark Creek
St. Margaret Creek
Palm Ck
Healey's Lagoon
Lat. 19°30'S.
Lat. 19°35'S.
Long. 147°05'E.
Long. 147°00'E.
TRUE NORTH
TRAMWAY

FIG.5

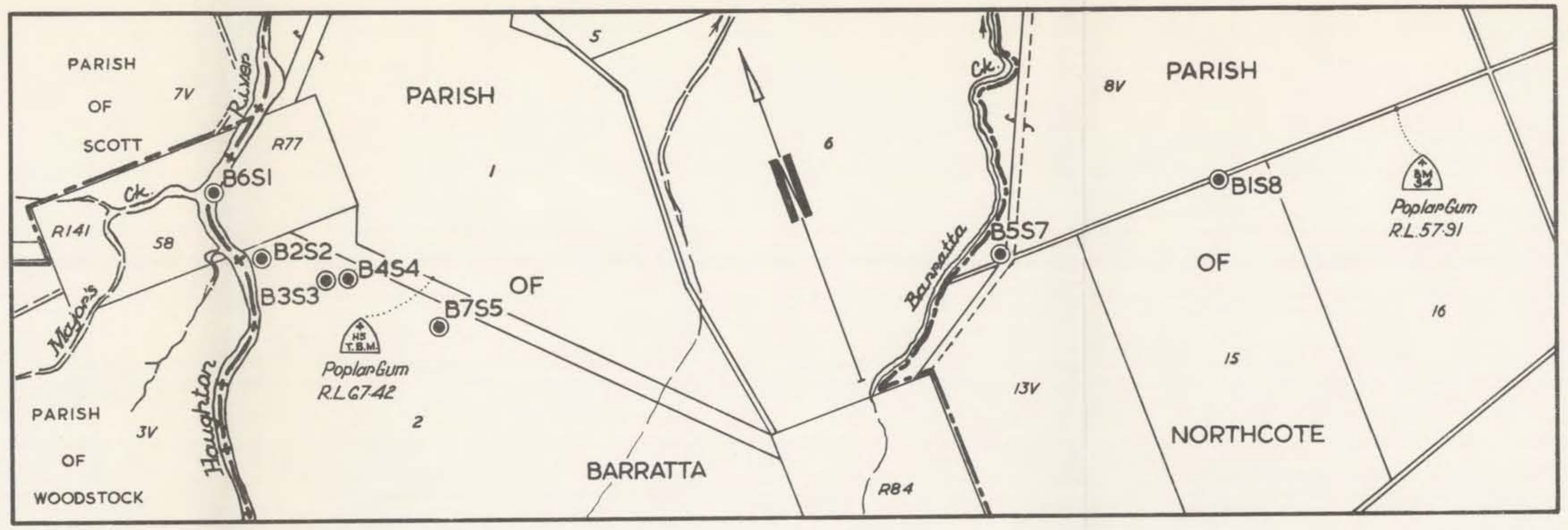


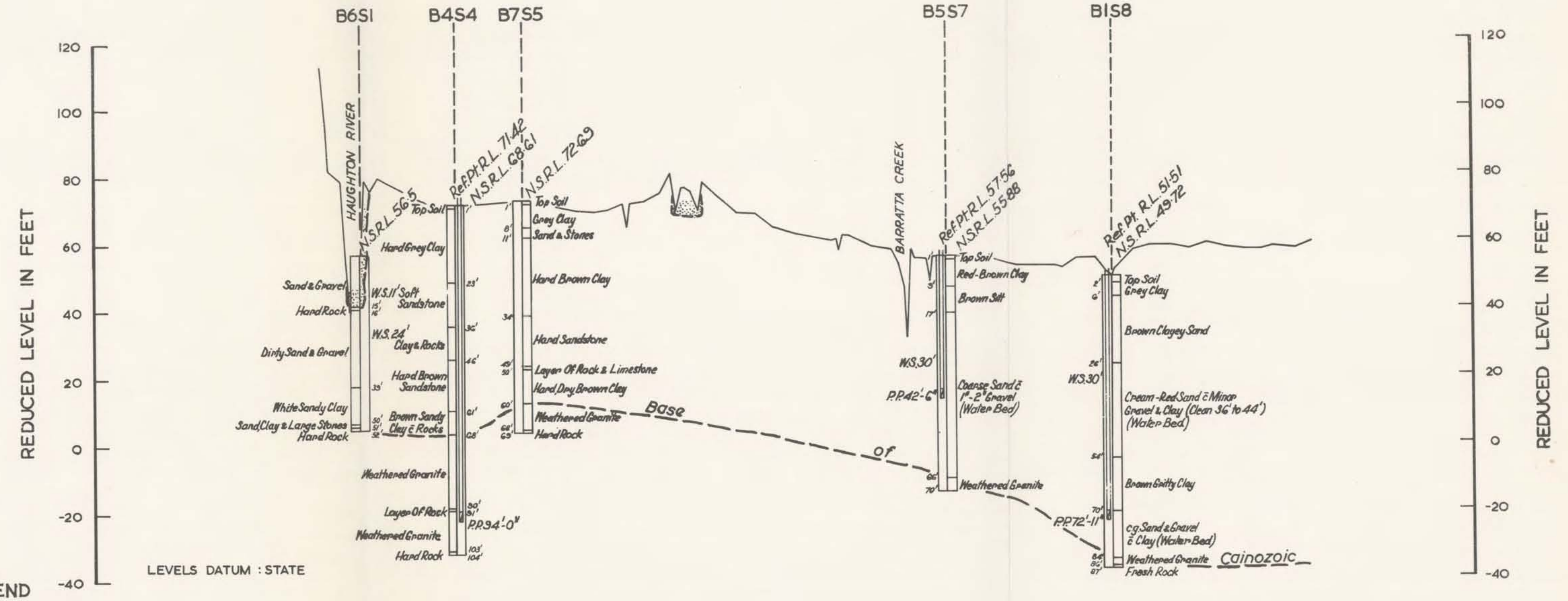
SOUTH PACIFIC OCEAN
TRUE NORTH
ABBOTSFORD
SELKIRK
SCOTT
WOODSTOCK
NORTHCOTE
BARRATTA
MULGRAVE
BEOR
OKEEBY
JARVISFIELD
HAUGHTON RIV
BRUCE HWAY
RAILWAY
STOCK ROUTE
BURDEKIN R.
OLD ROAD LINE
ANABRANCH LINE
WOODSTOCK ROAD LINE
TOWNSVILLE ROAD LINE
SHIRBOURNE LINE
IRONBARK LINE
POLETTI LINE
THE DAM LINE
CUNNINGHAM LINE
CAMERONS LINE
SADDLE MT 2847FT
MT. ELLIOT 4025FT
SHOULDER 3725FT
SHARP ELLIOT 3810FT
FELTHAM CONE OR MT. BURRUMBUSH 508FT
MAJOR CK MT 560FT
ARTILLERY HILL 406FT
IRONBARK 652FT
Green Swamp
Barratta
19°30'
19°40'
147°
147°10'
LEGEND
Alluvials - Aquifer
Investigation Bore with Pilot Pipe inserted
Investigation Bore without Pilot Pipe - Dry
Investigation Production Bore (Storage Coefficient Determined)
Commission Gauge Board
Investigation Bore Line
Scale of Miles
2 1 0 2 4 6
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUNDWATER INVESTIGATION
INVESTIGATION BORES & BORE LINES

FIG. 6

BORE No. / SITE No.	Commenced / Completed	B6 S1	B2 S2	B3 S3	B4 S4	B7 S5
BORE No. SITE No.	Commenced Completed	B6 S1 July 1964	B2 S2 June 1964	B3 S3 June 1964	B4 S4 July 1964	B7 S5 August 1964
Drilling Time	hrs.					
Other Productive Time	hrs.					
SCREEN SETTINGS		Bore not Screened	Bore not Screened	Bore not Screened	Bore not Screened	Bore not Screened
PUMP TEST No.		No Test	No Test	No Test	No Test	No Test
PUMP TYPE						
SUCTION AT						
DATE		15-7-64	8-6-64	10-6-64	15-7-64	18-8-64
S.W.L. (below N.S.)		24'-0"	Dry	24'-0"	25'-0"	Dry
AVAILABLE D.D.						
DURATION						
FINAL PUMP RATE G.P.H.						
FINAL D.D.						
RECOVERY TIME						
RESIDUAL D.D.						
WATER QUALITY in Micromhos per cm & p.p.m.	Location	No Sample		No Sample	No Sample	
	Conductivity at 25°C					
	Total Solids					
	Chlorides as Cl⁻					
	Alkalinity					
	Hardness					
	pH					
REMARKS All bores drilled 8" dia. for full depth by contract diller.		Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted. N.S.R.L. 79·01	Casing removed. No pilot pipe inserted. N.S.R.L. 70·68	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed.	Casing removed. No pilot pipe inserted.

BORE No. / SITE No.	Commenced / Completed	B5 S7	B1 S8	
BORE No. SITE No.	Commenced Completed	B5 S7 21-10-65 5-11-65	B1 S8 30-9-65 20-10-65	
Drilling Time	hrs.	13¼	22½	
Other Productive Time	hrs.	68	50¼	
SCREEN SETTINGS		59'-9" Top Packer; 60'-3" Bot. Casing; 1 x 0·036; 1 x 0·050; 66'-5" Bot Cap. 6" Willscreens.	74'-0" Top Packer; 75'-6" Bot. Casing; 3 x 0·098"; 83'-6" Bot Cap. 6" Willscreens.	
PUMP TEST No.		2	1	2
PUMP TYPE		Pomona	Pomona	Pomona
SUCTION AT		59'-0"	72'-6"	72'-6"
DATE		3-11-65	14-10-65	19-10-65
S.W.L. (below N.S.)		34'-9"	29'-2"	29'-2"
AVAILABLE D.D.		24'-3"	43'-4"	43'-4"
DURATION		360 mins.	360 mins.	360 mins.
FINAL PUMP RATE G.P.H.		27,300	31,500	31,800
FINAL D.D.		22'-3"	19'-4½"	19'-5½"
RECOVERY TIME		60 mins.	60 mins.	60 mins.
RESIDUAL D.D.		2¼"	4"	3½"
WATER QUALITY in Micromhos per cm. & p.p.m.	Location	42'-6"	70 ft. to 84 ft.	
	Conductivity at 25°C.	425	535	
	Total Solids		320	
	Chlorides as Cl⁻		65	
	Alkalinity		250	
	Hardness		80	
	pH		8·3	
	Date	15-12-66	6-10-65	
REMARKS Both bores drilled 8" dia. for full depth.		51½ galls. of sand removed in 21½ hours by bailing, shock and solid surging in screens. Casing & screens removed. Pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	22¼ galls of sand removed in 6 hours by bailing, shock and solid surging in screens. Casing & screens removed. Pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	





LEGEND

Aquifer

c.g. Coarse grained

c̄ With

LEVEL BOOKS : 14297 14298 14299 14300 14301 14302 14303 14312

SCALE

HORIZONTAL Chains 80 0 1 2 3 Miles

VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

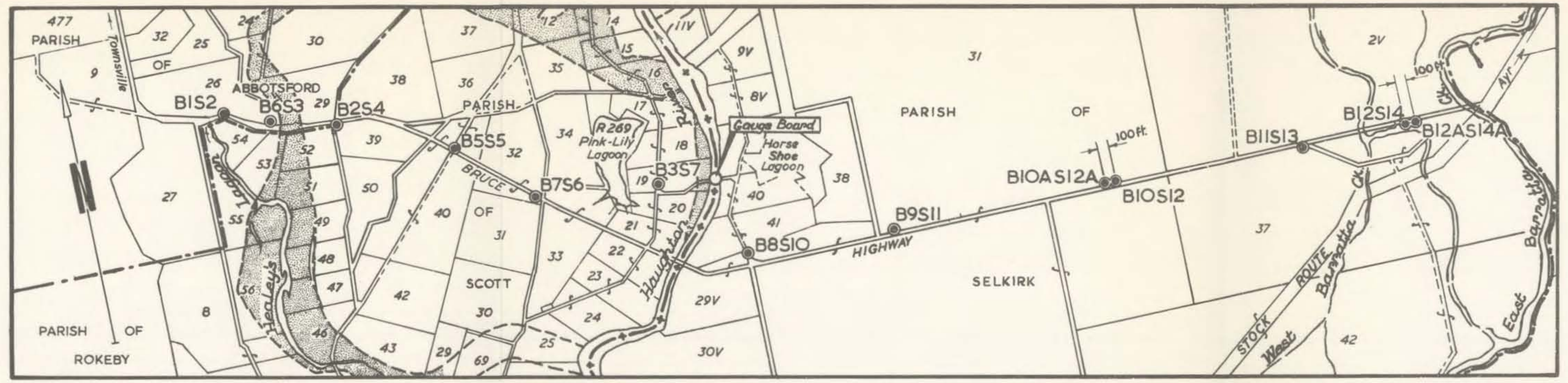
HAUGHTON RIVER
GROUND WATER INVESTIGATION

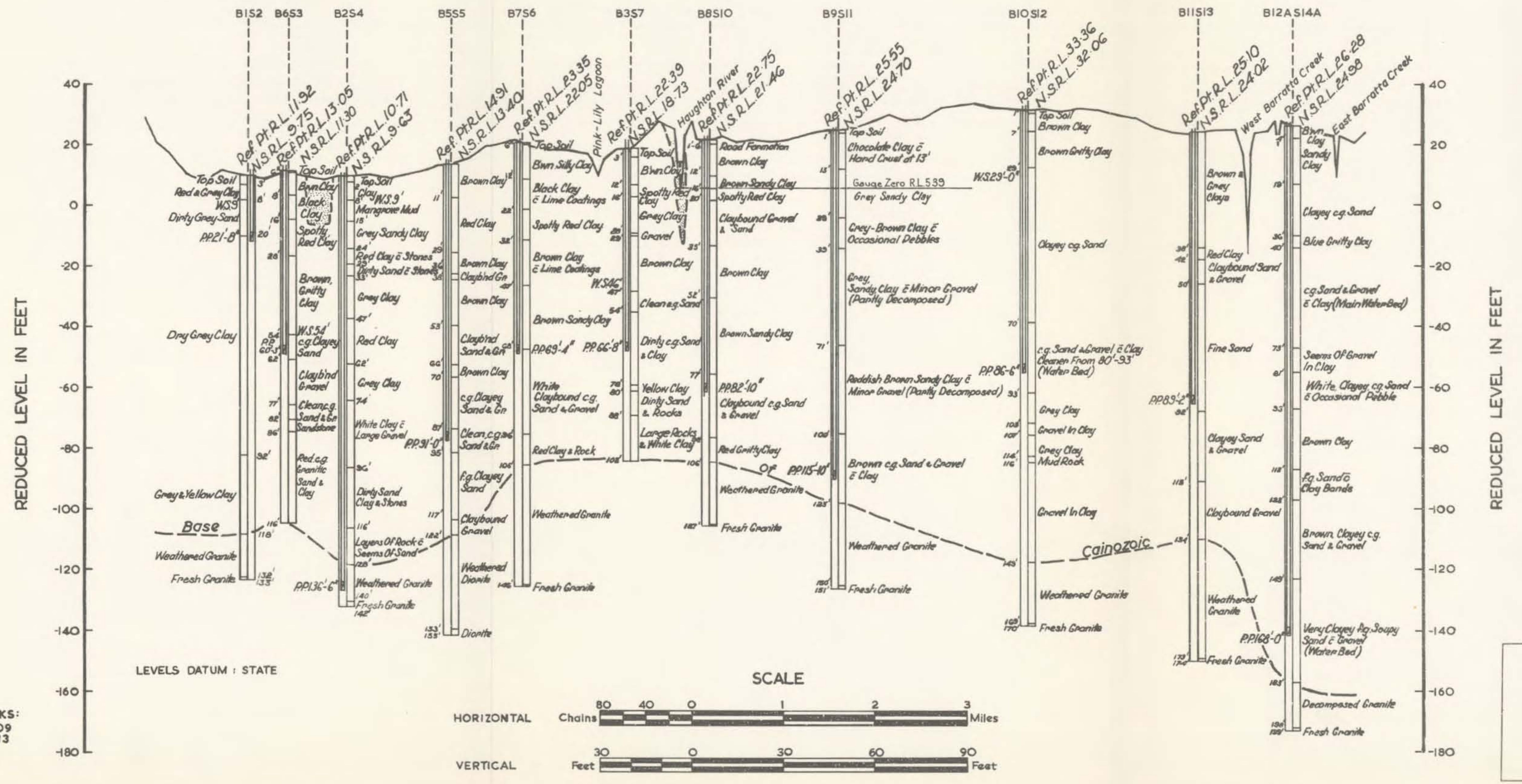
CUNNINGHAM LINE

BORE No. / SITE No.	Commenced / Completed	B1 S2	B6 S3	B2 S4	B5 S5	B7 S6	B3 S7	B8 S10	B9 S11
Commenced		20-8-64	9-2-65 and 23-3-65	1-9-64	20-1-65	26-2-65	16-9-64	1-4-65	13-5-65
Completed		31-8-64	26-2-65 and 1-4-65	14-9-64	9-2-65	9-3-65	21-9-64	14-4-65	2-6-65
Drilling Time	hrs.		32		32¼	34½		21½	33½
Other Productive Time	hrs.		74¼		22½	15		16½	50¾
SCREEN SETTINGS		Bore not screened	56'-6" Top of Packer. 59'-2" Bottom of Casing. 2 x 0·050"x 6" Willscreens. 63'-0" Bottom of Cap.	Bore not screened	Bore not screened.	Bore not screened.	Bore not screened	Bore not screened.	111'-7" Top Packer. 113'-10" Bot. Casing. 1x0·050" 1x0·060" 2x0·073" 123'-5" Bot Cap. 6" Willscreens.
PUMP TEST No.		No Test	1	No Test	No Test	No Test	No Test	No Test	1
PUMP TYPE			Bailer Test						Bailer Test
SUCTION AT									
DATE		31-8-64; 15-12-66	31-3-65; 15-12-66	23-11-64; 14-9-66	16-3-65; 15-12-66	16-3-65; 15-12-66	17-9-64; 15-12-66	3-11-65; 15-12-66	31-5-65
S.W.L. (below N.S.)		4'-8"; 8'-11"	3'-1"; 7'-11"	4'-11"; 5'-6"	5'-6"; 8'-11"	11'-4"; 16'-8"	12'-4"; 9'-8"	15'-0"; 17'-5"	17'-9"
AVAILABLE D.D.			53'-5"						93'-10"
DURATION			60 mins.						60 mins.
FINAL PUMP RATE G.P.H.			1,200						2,260
FINAL D.D.			45'-4"						49'-0"
RECOVERY TIME			30 mins.						12 mins.
RESIDUAL D.D.			0'-5½"						3'-7"
WATER QUALITY in Micromhos per cm & p.p.m.	Location	21'-8"; 21'-8"	8'-0"; 23'-0"; 54 to 62 ft.; 68 to 71 ft.; 77 to 82 ft.	136'-6"	91'-0"	25'-0"; 84 to 96 ft.	66'-8"	21'-0"; 82'-10"	39 to 41 ft.; 113 to 123 ft
	Conductivity at 25°C	11,500; 4,000	21,000; 17,000; 6,180; 7,300; 11,500	33,000	12,450	21,000; 5,920	9,700	9,700; 9,500	860; 436
	Total Solids	; 2,649	15,520; 11,200; 2,850; 4,450; 7,420	20,000	7,500	15,100; 3,400	5,900	6,380; 5,700	512; 246
	Chlorides as Cl^-	; 1,030	8,000; 5,800; 1,600; 2,200; 3,800	17,400	4,720	8,900; 1,600	4,000	3,500; 3,540	192; 64
	Alkalinity	; 25	0; 0; 120; 256; 256	150	315	116; 336	76	260; 310	176; 128
	Hardness	; 900	3,200; 0; 400; 750; 1,310	11,360	1,540	3,660; 530	1,896	940; 880	60; 68
	pH	; 6·5	5·1; 6·1; 7·9; 7·1; 7·0	7·0	8·1	7·2; 7·0	7·5	7·7; 8·0	8·1; 7·5
	Date	14-9-66; 18-4-67	10-2-65; 10-2-65; 11-2-65; 11-2-65; 11-2-65	4-10-66	4-10-66	1-3-65; 4-3-65	4-10-66	9-4-65; 4-10-66	18-5-65; 31-5-65
REMARKS	All bores drilled 8" dia. for full depth	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract drilled.	Cement-bentonite seal placed 68 to 75 ft. 27½ gallons of sand removed in 23½ hours by bailing, shock and valve surging in screens and casing. Casing and screens removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract drilled.	Cement-bentonite seals placed 77 to 87 ft. and 91 to 101 ft. Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract Drilled.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed	49¾ galls. of sand removed in 12 hours by bailing, shock and valve surging. Casing and screens removed. Pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed

BORE No. / SITE No.	Commenced / Completed	B10A S12A	B10 S12	B11 S13	B12 S14	B12A S14A ①	B12A S14A ②	B12A S14A ③	B12A S14A ④
Commenced		28-6-65	2-6-65	5-11-64	5-8-65	20-8-65			
Completed		14-7-65	25-6-65	23-11-64	20-8-65	21-11-65			
Drilling Time	hrs.	12	26	47	32½	34½			
Other Productive Time	hrs.	35¾	66	44¼	27¼	314			
SCREEN SETTINGS		76'-11" Top Packer. 78'-3" Bot. Casing. 1x0·060" 2x0·073" 86'-0" Bot. Cap. 6" Willscreens.	81'-2" Top of Packer. 83'-0" Bottom of Casing. 2x0·073" 1x0·060" 1x0·050" 93'-0" Bottom of Cap.	Bore not screened.	Bore not screened.	51'-2" Top Packer. 52'-2" Bot. Casing. 1x0·073" 3x0·098" ① 63'-0" Bot. Cap. 6" Willscreens.	81'-6" Top Packer. 82'-9" Bot. Casing. 1x0·073" 3x0·098" ② 93'-4" Bot. Cap. 6" Willscreens.	131'-3" Top Packer. 131'-8" Bot. Casing. 1x0·060" 3x0·073" ③ 143'-0" Bot Cap. 6" Willscreens.	171'-8" Top Packer. 173'-3" Bot Casing. 3x0·098" 1x0·073" ④ 183'-6" Bot. Cap. 6" Willscreens.
PUMP TEST No.		2; Pilot Pipe	2	No Test	No Test	2; Pilot Pipe	2; Pilot Pipe	1; Pilot Pipe	2; Pilot Pipe
PUMP TYPE		Pomona; in B10 S12	Pomona			Pomona; to 63' in	Pomona; to 63' in	Bailer Test; to 63' in	Pomona; to 63' in
SUCTION AT		73'-8"	76'-0"			49'-0"; B12 S14	81'-6"; B12 S14	; B12 S14	139'-2"; B12 S14
DATE		9-7-65; 9-7-65	23-6-65		11-8-65	1-9-65; 1-9-65	29-9-65; 29-9-65	28-10-65; 28-10-65	12-11-65; 12-11-65
S.W.L. (below N.S.)		25'-9"; 25'-10"	25'-0"		23'-10"	19'-1"; 19'-5"	18'-1"; 19'-5"	19'-7"; 19'-11"	19'-7"; 20'-4"
AVAILABLE D.D.		47'-11"	51'-0"			30'-11"	63'-5"	111'-8"	119'-7"
DURATION		360 mins.; 360 mins.	390 mins.			360 mins.; 360 mins.	360 mins.; 360 mins.	120 mins.; 120 mins.	360 mins.; 360 mins.
FINAL PUMP RATE G.P.H.		15,600	18,100			28,400	21,960	1,820	10,860
FINAL D.D.		44'-0½"; 0'-11¾"	44'-9"			18'-0"; 1'-4¼"	63'-5"; 0'-9"	92'-0"; 1'-3¼"	84'-4½"; 1'-6¾"
RECOVERY TIME		30 mins; 30 mins.	30 mins.			30 mins.	30 mins.; 30 mins.	40 mins.; 40 mins.	60 mins.; 60 mins.
RESIDUAL D.D.		0'-1¼"; 0'-1¼"	0'-2½"			0'-4"	0'-7¾"; 0'-1⅛"	0'-0"; 0'-1¼"	1'-1¾"; 1'-0½"
WATER QUALITY in Micromhos per cm & p.p.m.	Location	No Sample	29'-0"; End of test 2; 103 to 107 ft.; 149'-0"	89'-2"	41'-0"; 80 to 86 ft.; 112'-0"	End of test 2	End of test 2	No sample	End of test 2
	Conductivity at 25°C.		540; 378; 428; 665	436	310; 400; 338	208	250		610
	Total Solids		323; 220; 240; 384	260	171; 230; 203	136	138		366
	Chlorides as Cl^-		68; 32; 48; 52	80	38; 38; 32	24	22		125
	Alkalinity		196; 160; 144; 260	124	108; 146; 132	88	98		115
	Hardness		120; 100; 92; 80	120	86; 106; 24	56	52		80
	pH		8·0; 8·2; 8·1; 8·1	7·5	7·6; 8·1; 8·0	7·8	8·4		8·5
	Date		3-6-65; 23-6-65; 7-6-65; 8-6-65	4-10-66	6-8-65; 9-8-65; 10-8-65	1-9-65	29-9-65		12-11-65
REMARKS	All bores drilled 8" dia. for full depth.	41¾ galls. of sand removed in 14 hours by bailing, shock and valve surging. Casing and screens removed. No pilot pipe inserted.	66¾ gallons of sand removed in 15 hours by bailing, shock and valve surging. Casing and screens removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and two pilot pipes inserted to 63'-0" and 129'-0". Deeper pipe filled with sand to 83'-1". Ref. pt is top of 6" guard with lid removed. Ref. pt. R.L. 27·37 N.S.R.L. 26·06.	56 galls. of sand removed in 17 hours by bailing, shock and valve surging. Screens removed and drilling continued.	330 galls. of sand removed in 79 hours by bailing, shock, valve surging and flushing in screens and casing. Drilling continued.	264 galls. of sand removed in 52 hours by bailing, shock, valve surging and flushing in screens and casing. Drilling continued.	176 galls. of sand removed in 24 hours by bailing, shock, valve surging and flushing in screens and casing. Casing & screens rmvd.
						Reference point is top of 6" dia. pipe guard with lid removed.			

LEVEL BOOKS:
14309
14313





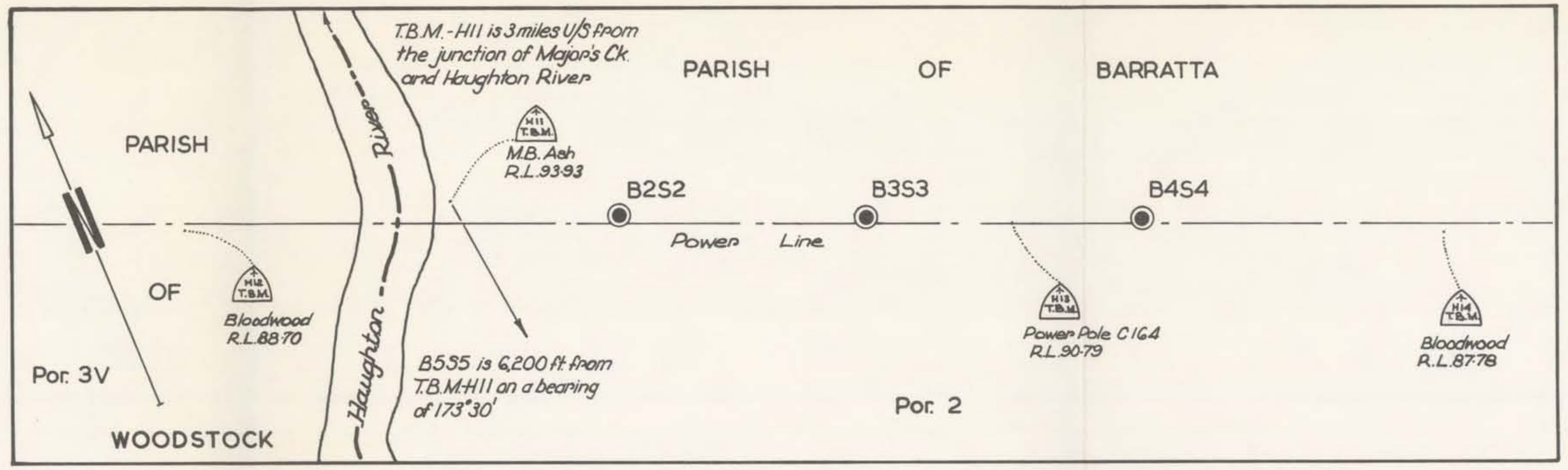
LEGEND

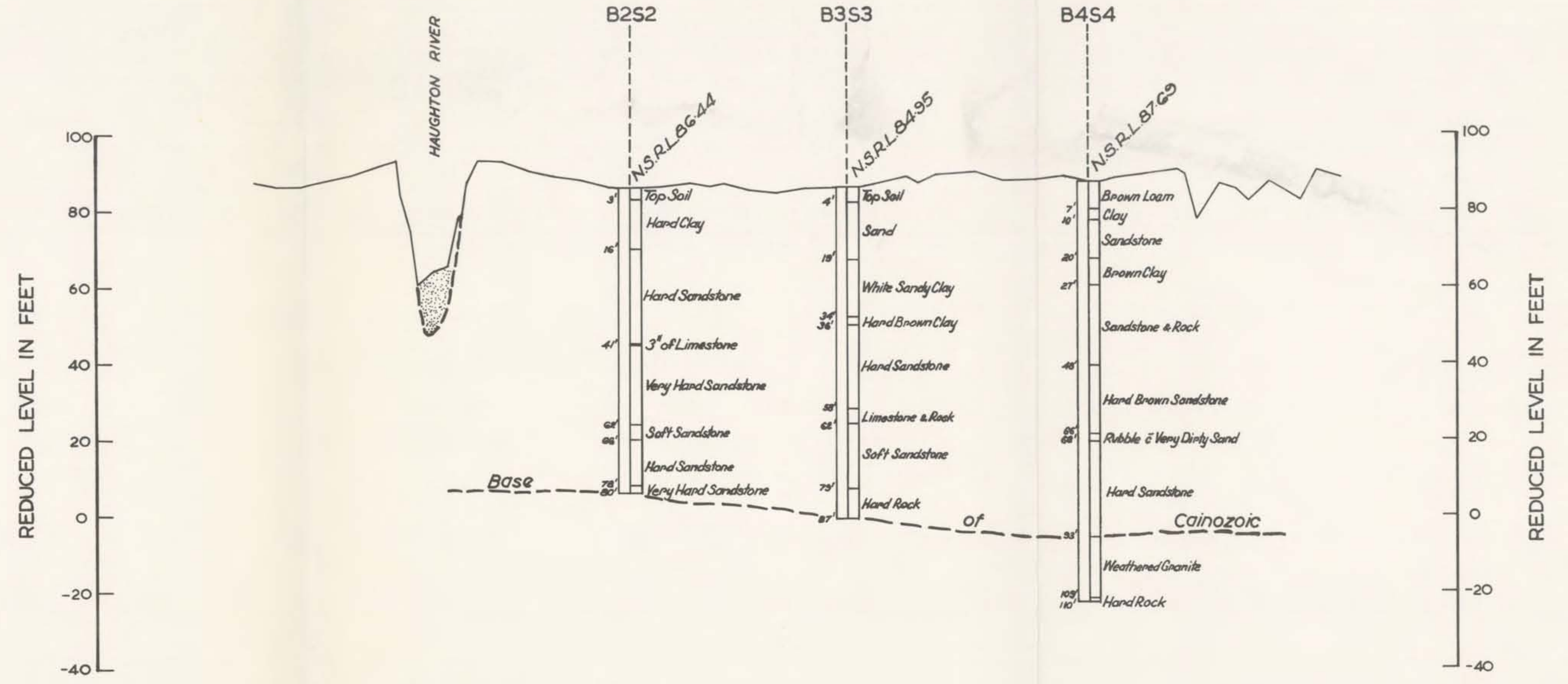
Aquifer
Gr Gravel
c.g. Coarse Grained
f.g. Fine Grained
c̄ With
Natural Surface Levels taken from Main Roads Survey.

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION
TOWNSVILLE ROAD LINE

BORE No. Commenced / SITE No. Completed	B2 S2 June 1964	B3 S3 June 1964	B4 S4 June 1964	B5 S5 June 1964	
Drilling Time hrs.					
Other Productive Time hrs.					
SCREEN SETTINGS	Bore not screened	Bore not screened	Bore not screened	Bore not screened	
PUMP TEST No.	No Test	No Test	No Test	No Test	
PUMP TYPE					
SUCTION AT					
DATE	17-6-64	24-6-64	25-6-64	7-6-64	
S.W.L. (Below N.S.)	Dry	Dry	Dry	Dry	
AVAILABLE D.D.					
DURATION					
FINAL PUMP RATE G.P.H.					
FINAL D.D.					
RECOVERY TIME					
RESIDUAL D.D.					
WATER QUALITY in Micromhos per cm & p.p.m. — Location					
Conductivity at 25°C					
Total Solids					
Chlorides as Cl^-					
Alkalinity					
Hardness					
pH					
REMARKS All bores drilled 8" dia. for full depth. All bores contract drilled.	Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted.	

BORE No. Commenced / SITE No. Completed	
Drilling Time hrs.	
Other Productive Time hrs.	
SCREEN SETTINGS	
PUMP TEST No.	
PUMP TYPE	
SUCTION AT	
DATE	
S.W.L.	
AVAILABLE D.D.	
DURATION	
FINAL PUMP RATE G.P.H.	
FINAL D.D.	
RECOVERY TIME	
RESIDUAL D.D.	
WATER QUALITY in Micromhos per cm. & p.p.m. — Location	
Conductivity at 25°C.	
Total Solids	
Chlorides as Cl^-	
Alkalinity	
Hardness	
pH	
REMARKS	





LEVELS DATUM : STATE

LEGEND

Aquifer

c̄ With

LEVEL BOOK : 14303

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

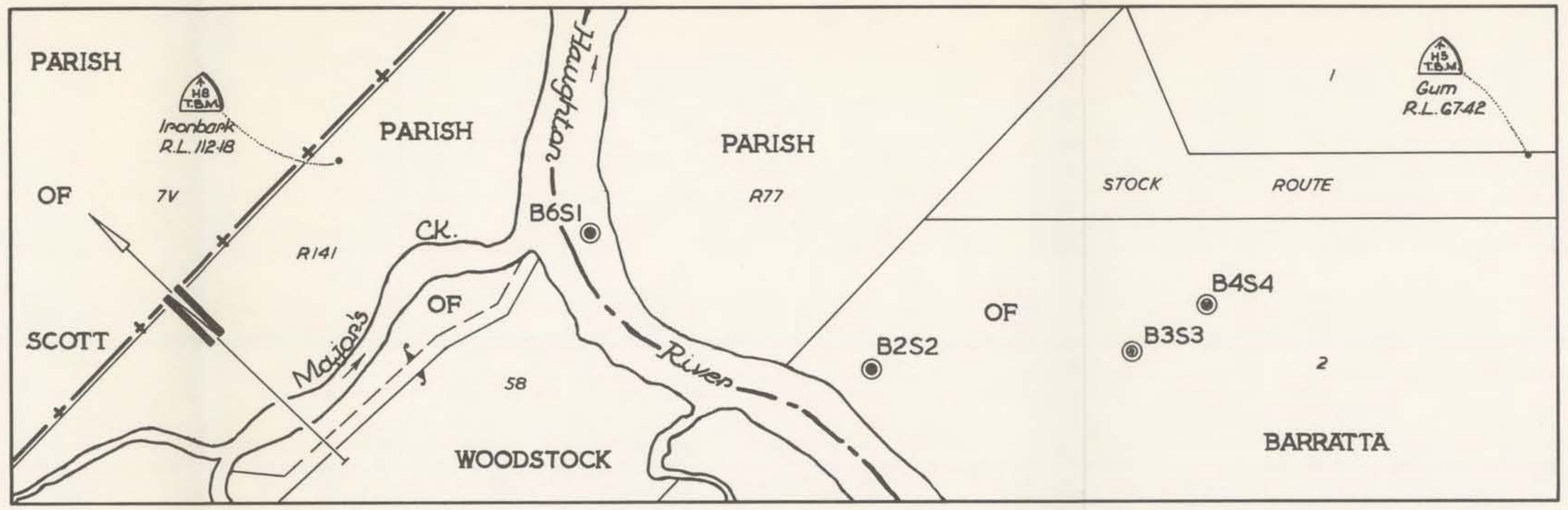
VERTICAL Feet 30 0 30 60 90 Feet

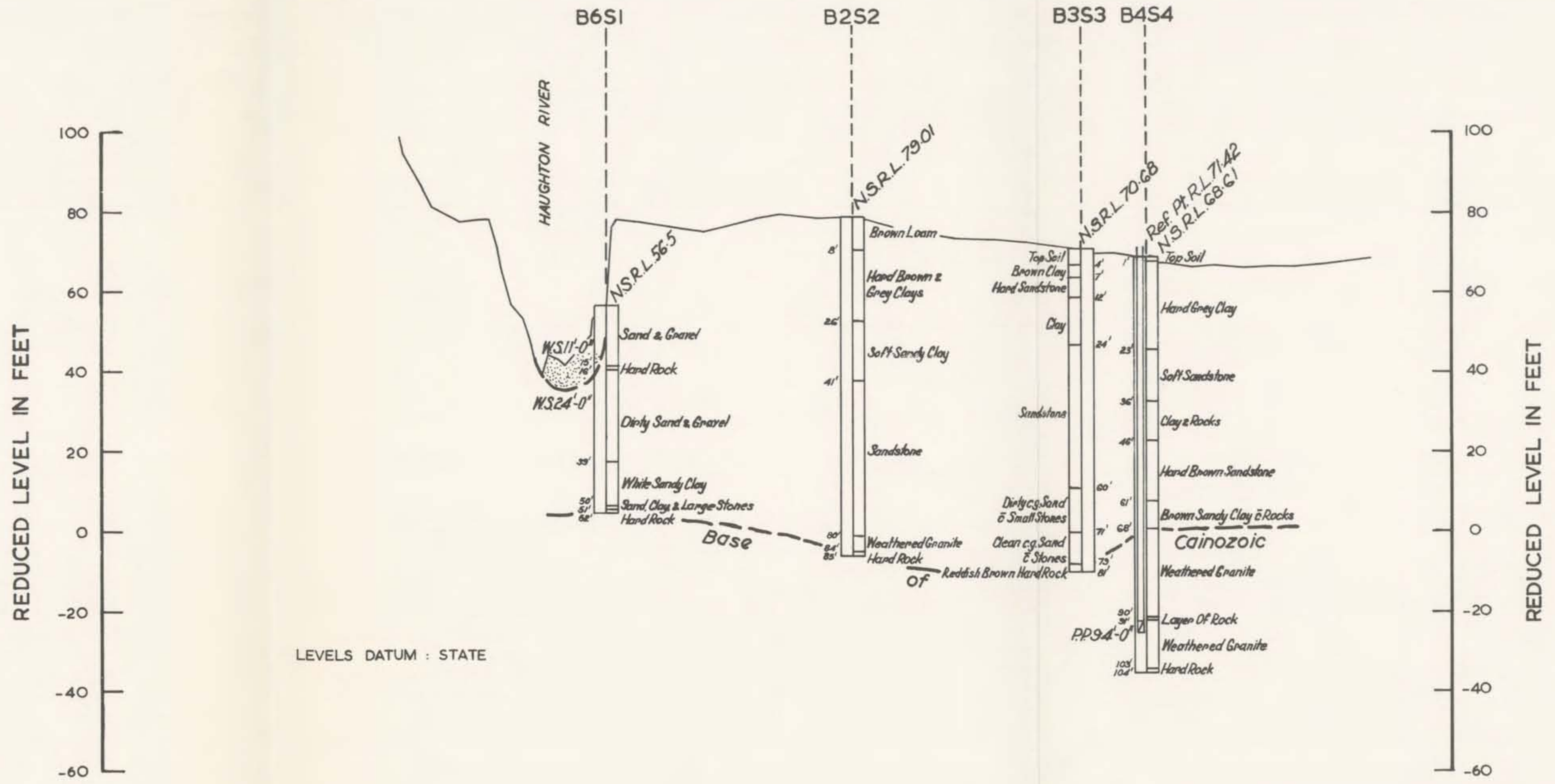
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION

CAMERONS LINE

BORE No. / SITE No.	B6 S1	B2 S2	B3 S3	B4 S4	
Commenced / Completed	July 1964	June 1964	June 1964	July 1964	
Drilling Time hrs.					
Other Productive Time hrs.					
SCREEN SETTINGS	Bore not screened.	Bore not screened.	Bore not screened.	Bore not screened.	
PUMP TEST No.	No Test	No Test	No Test	No Test	
PUMP TYPE					
SUCTION AT					
DATE	15-7-64	8-6-64	10-6-64	15-7-64	
S.W.L. (Below N.S.)	24'-0"	Dry	24'-0"	25'-0"	
AVAILABLE D.D.					
DURATION					
FINAL PUMP RATE G.P.H.					
FINAL D.D.					
RECOVERY TIME					
RESIDUAL D.D.					
WATER QUALITY in Micromhos per cm & p.p.m. — Location	No Sample		No Sample	No Sample	
Conductivity at 25°C					
Total Solids					
Chlorides as Cl⁻					
Alkalinity					
Hardness					
pH					
REMARKS — All bores drilled 8" dia. for full depth by contract driller.	Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted.	Casing removed. No pilot pipe inserted.	Casing removed. Pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed.	

BORE No. / SITE No.	
Commenced / Completed	
Drilling Time hrs.	
Other Productive Time hrs.	
SCREEN SETTINGS	
PUMP TEST No.	
PUMP TYPE	
SUCTION AT	
DATE	
S.W.L.	
AVAILABLE D.D.	
DURATION	
FINAL PUMP RATE G.P.H.	
FINAL D.D.	
RECOVERY TIME	
RESIDUAL D.D.	
WATER QUALITY in Micromhos per cm & p.p.m. — Location	
Conductivity at 25°C.	
Total Solids	
Chlorides as Cl⁻	
Alkalinity	
Hardness	
pH	
REMARKS	





LEGEND

Aquifer

c.g. Coarse grained

c̄ With

LEVEL BOOKS: 14297, 14298, 14299, 14300, 14301, 14302, 14312

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

VERTICAL Feet 30 0 30 60 90 Feet

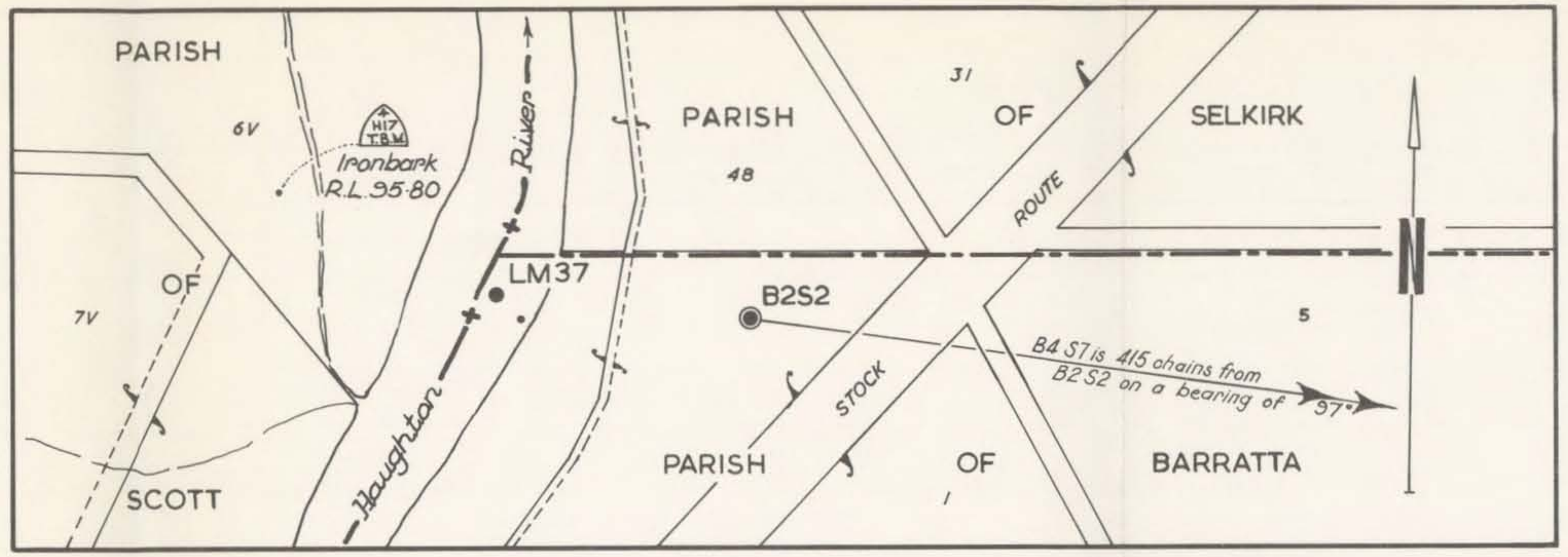
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

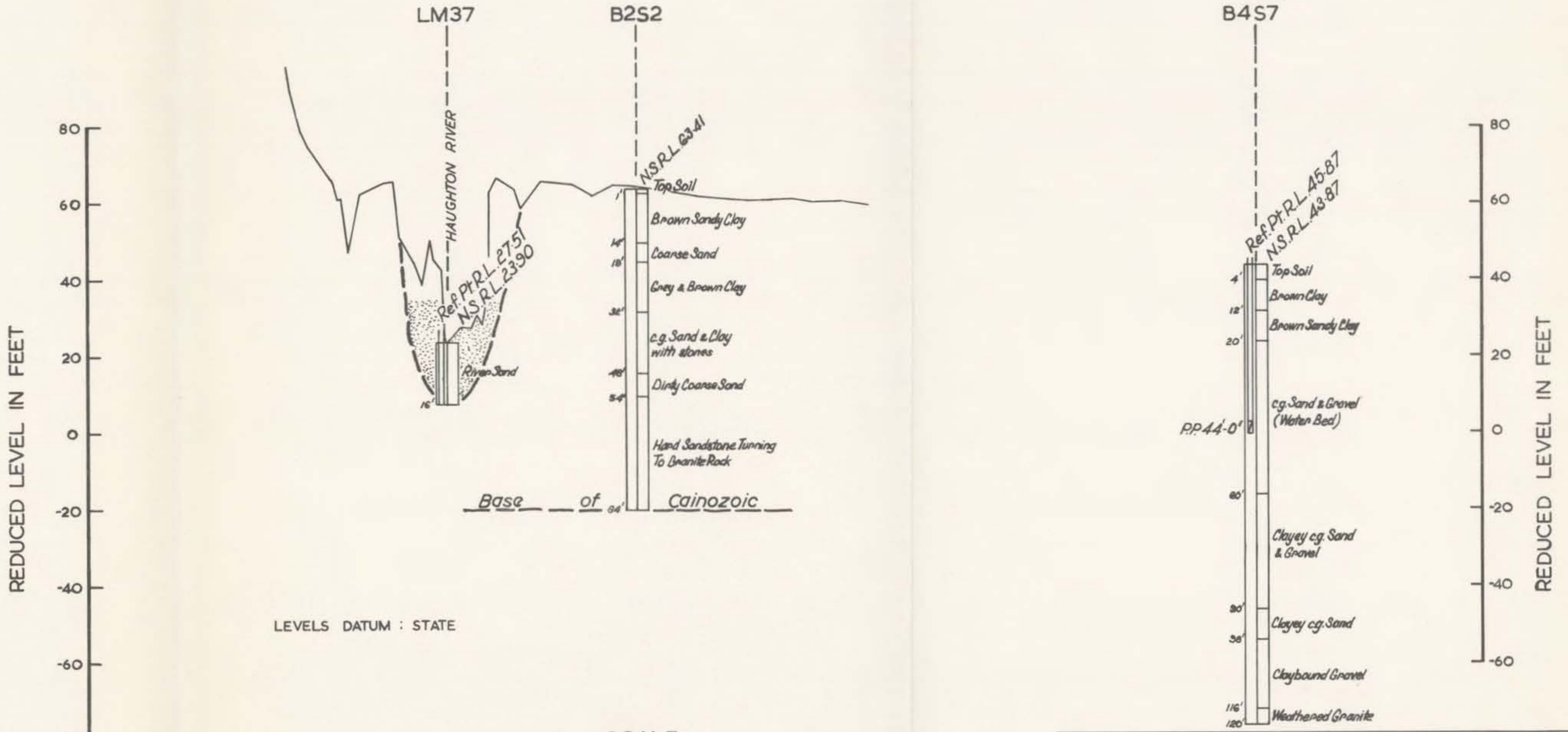
HAUGHTON RIVER
GROUND WATER INVESTIGATION

CUNNINGHAM LINE
(HAUGHTON RIVER SECTION)

BORE No. / SITE No. (Commenced / Completed)		LM37	B2 S2	B4 S7		
Commenced		May 1966	22-7-64	8-11-65		
Completed				26-11-65		
Drilling Time hrs.				23		
Other Productive Time hrs.				79¼		
SCREEN SETTINGS		0' N.S. 2 × 5" spears. 13' 16' Gauze.	Bore not screened.	81'-0" Top Packer. 83'-1" Bot. Casing. 1 × 0·060" 2 × 0·050" 1 × 0·036" 95'-0" Bot. Cap. 6" Willscreens. (1)	53'-0" Top of Packer. 54'-7" Bot. of Casing. 1 × 0·050" 1 × 0·036" 61'-5" Bot. of Cap. 6" Willscreens. (2)	
PUMP TEST No.		No Test	No Test	1	1	2
PUMP TYPE				Bailer test.	Pomona.	Bailer Test.
SUCTION AT					48'-8"	
DATE		1-2-67	22-7-64	16-11-65	23-11-65	25-11-65
S.W.L. (below N.S.)		8'-0"	40'-0"	29'-5"	30'-8"	29'-2"
AVAILABLE D.D.				51'-7"	18'-0"	23'-10"
DURATION				20 mins.	360 mins.	120 mins.
FINAL PUMP RATE G.P.H.				400	4,800	2,400
FINAL D.D.				51'-7"	15'-1½"	6'-0"
RECOVERY TIME				30 mins.	20 mins.	
RESIDUAL D.D.				3'-3"	0'-1½"	
WATER QUALITY in Micromhos per. cm & p.p.m.	Location	No sample	No sample	Bailer Test 1	No sample	No sample
	Conductivity at 25°C			240		
	Total Solids			145		
	Chlorides as Cl^-			25		
	Alkalinity			75		
	Hardness			25		
	pH			8·5		
	Date			16-11-65		
REMARKS	All bores drilled 8" dia. for full depth.	Private Water Facility. Normal pump rate 45,000 g.p.h. Seasonal variation N.S. to 8 ft.	Casing removed. No pilot pipe inserted. Contract drilled.	79 galls. of sand removed in 13 hours by bailing, shock and solid surging in screens.	94½ galls. of sand removed in 11 hours by bailing, shock, solid and valve surging.	121½ galls. of sand removed in 15 hours by bailing, shock, solid and valve surging. Casing and screens removed. Pilot pipe instd.
				Ref. pt. is top of 6" guard with cap removed.		

BORE No. Commenced		
SITE No. Completed		
Drilling Time hrs.		
Other Productive Time hrs.		
SCREEN SETTINGS		
PUMP TEST No.		
PUMP TYPE		
SUCTION AT		
DATE		
S.W.L.		
AVAILABLE D.D.		
DURATION		
FINAL PUMP RATE G.P.H.		
FINAL D.D.		
RECOVERY TIME		
RESIDUAL D.D.		
WATER QUALITY in Micromhos per. cm & p.p.m.	Location	
	Conductivity at 25°C.	
	Total Solids	
	Chlorides as Cl^-	
	Alkalinity	
	Hardness	
	pH	
REMARKS		





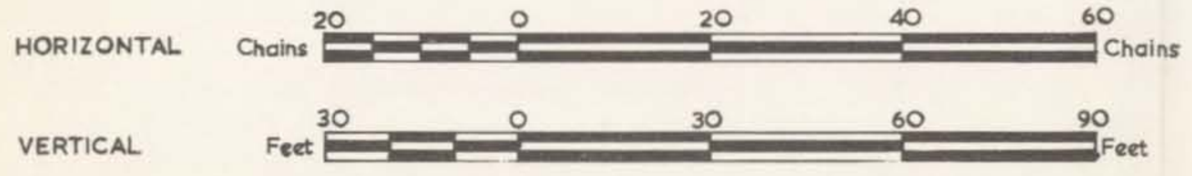
LEGEND

Aquifer

c.g. Coarse Grained

LEVEL BOOK: 14304

SCALE



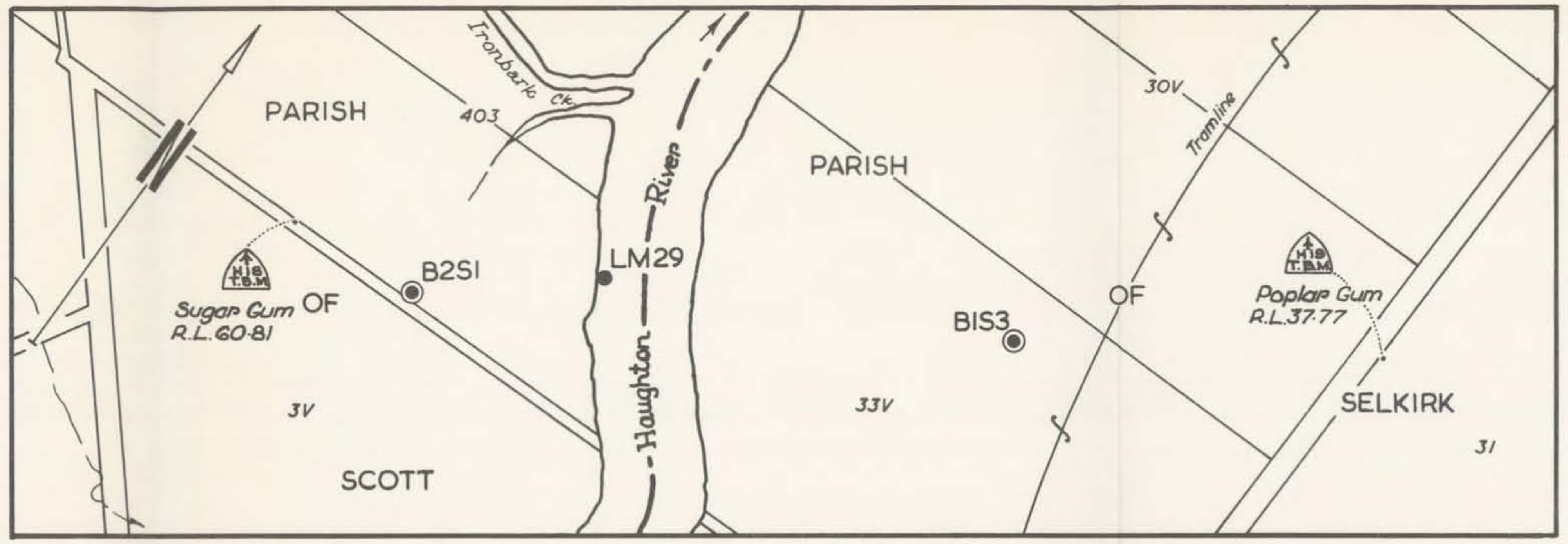
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

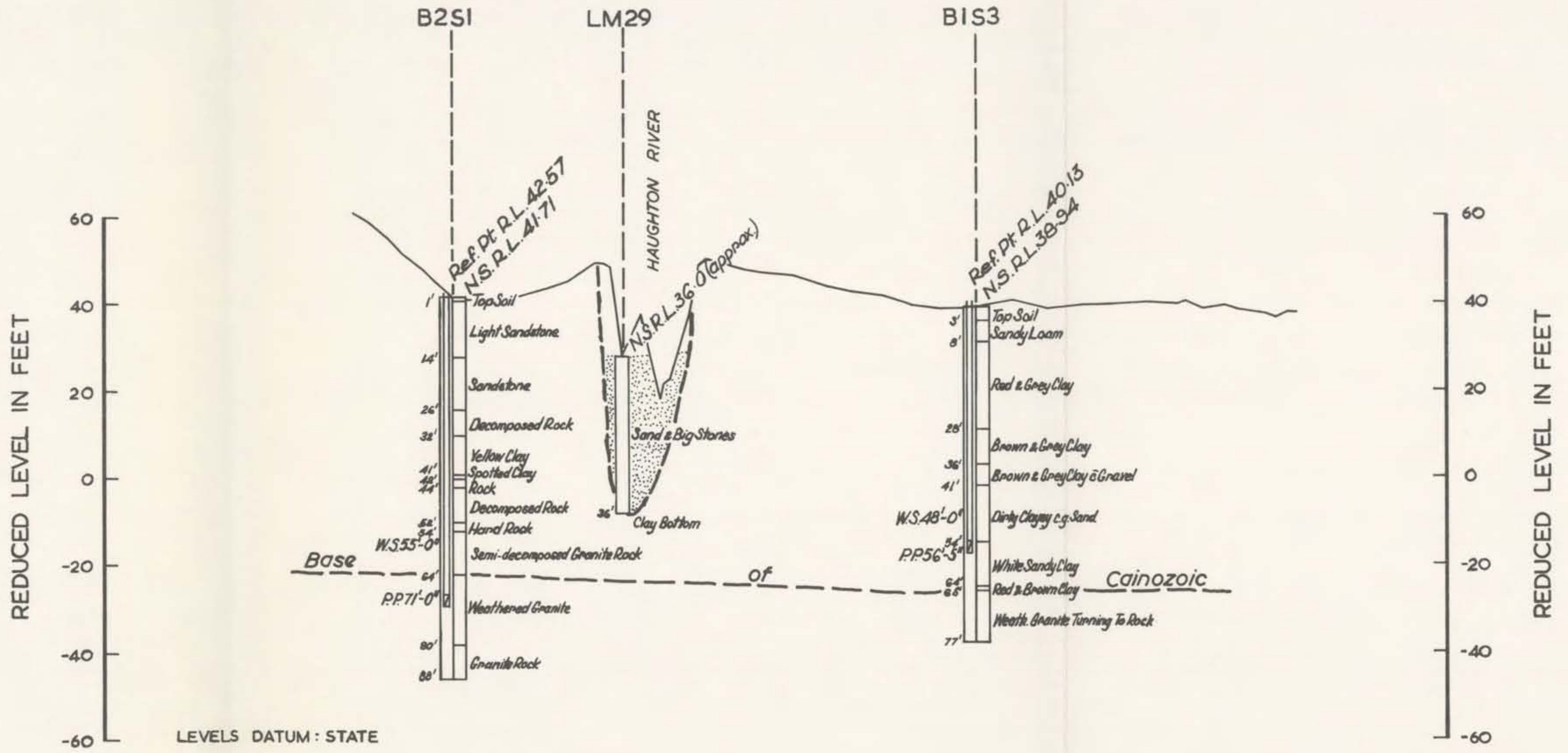
HAUGHTON RIVER
GROUND WATER INVESTIGATION

THE DAM LINE

		B2 / S1		LM29	B1 / S3		
BORE No. / SITE No.	Commenced / Completed	B2 25-11-64 S1 3-12-64		LM29 1965	B1 12-11-64 S3 16-11-64		
Drilling Time hrs.							
Other Productive Time hrs.							
SCREEN SETTINGS		Bore not Screened		0'-N.S. Conc. Well. 12' 3 x 5" spears. 33' 36' Gauze.	Bore not Screened		
PUMP TEST No.		No Test		No Test	No Test		
PUMP TYPE							
SUCTION AT							
DATE		2-12-64	15-12-66	1-2-67	14-11-64	15-12-66	
S.W.L. (below N.S.)		21'-0"	23'-7"	Est. 33'-0"	21'-0"	21'-7"	
AVAILABLE D.D.							
DURATION							
FINAL PUMP RATE G.P.H.							
FINAL D.D.							
RECOVERY TIME							
RESIDUAL D.D.							
WATER QUALITY in Micromhos per. cm & p.p.m.	Location	71'-0"		No Sample	56'-5"		
	Conductivity at 25°C	1060			2225		
	Total Solids	638			1365		
	Chlorides as Cl^-	88			420		
	Alkalinity	488			620		
	Hardness	196			140		
	pH	7·3			8·2		
	Date	4-10-66			4-10-66		
REMARKS All bores drilled 8" dia. for full depth unless otherwise stated.		Casing removed & pilot pipe inserted. Ref. pt. is top of 6" guard.- Lid removed. Contract Drilled.		Private Water Facility Normal pump rate 30,000 g.p.h. Seasonal variation N.S. to 33 ft.	Casing removed & pilot pipe inserted. Ref. pt. is top of 6" guard.- Lid removed. Contract Drilled.		

BORE No. / SITE No.	Commenced / Completed	
Drilling Time hrs.		
Other Productive Time hrs.		
SCREEN SETTINGS		
PUMP TEST No.		
PUMP TYPE		
SUCTION AT		
DATE		
S.W.L.		
AVAILABLE D.D.		
DURATION		
FINAL PUMP RATE G.P.H.		
FINAL D.D.		
RECOVERY TIME		
RESIDUAL D.D.		
WATER QUALITY in Micromhos per. cm. & p.p.m.	Location	
	Conductivity at 25°C.	
	Total Solids	
	Chlorides as Cl^-	
	Alkalinity	
	Hardness	
	pH	
REMARKS		





LEGEND

Aquifer

c.g. Coarse grained

c̄ With

LEVEL BOOK: 14294
14305

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

VERTICAL Feet 30 0 30 60 90 Feet

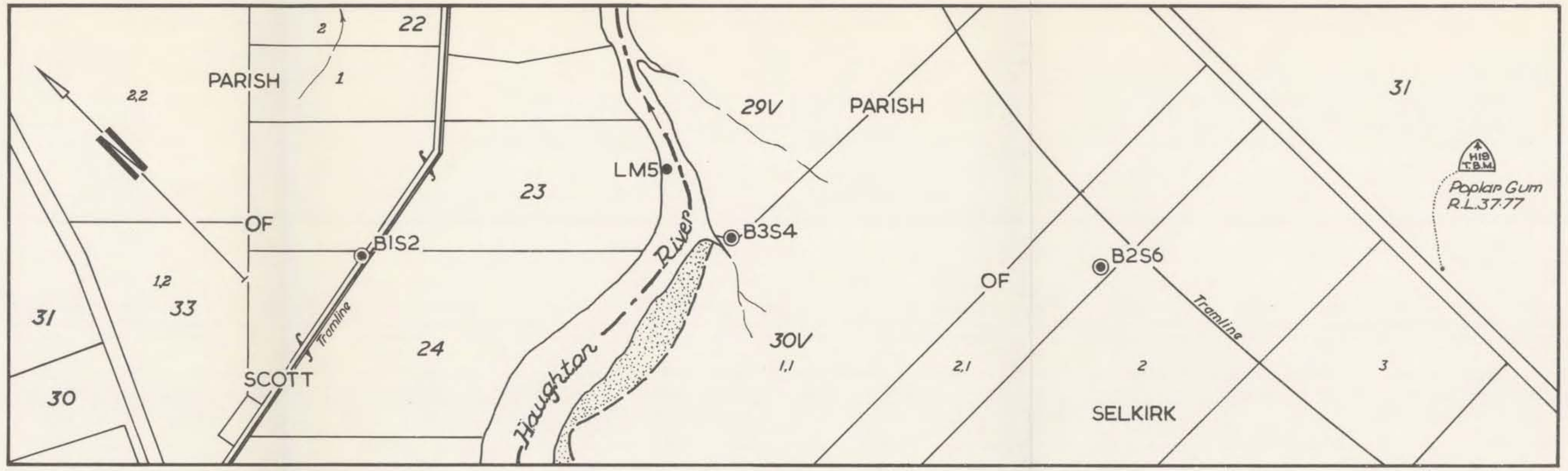
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

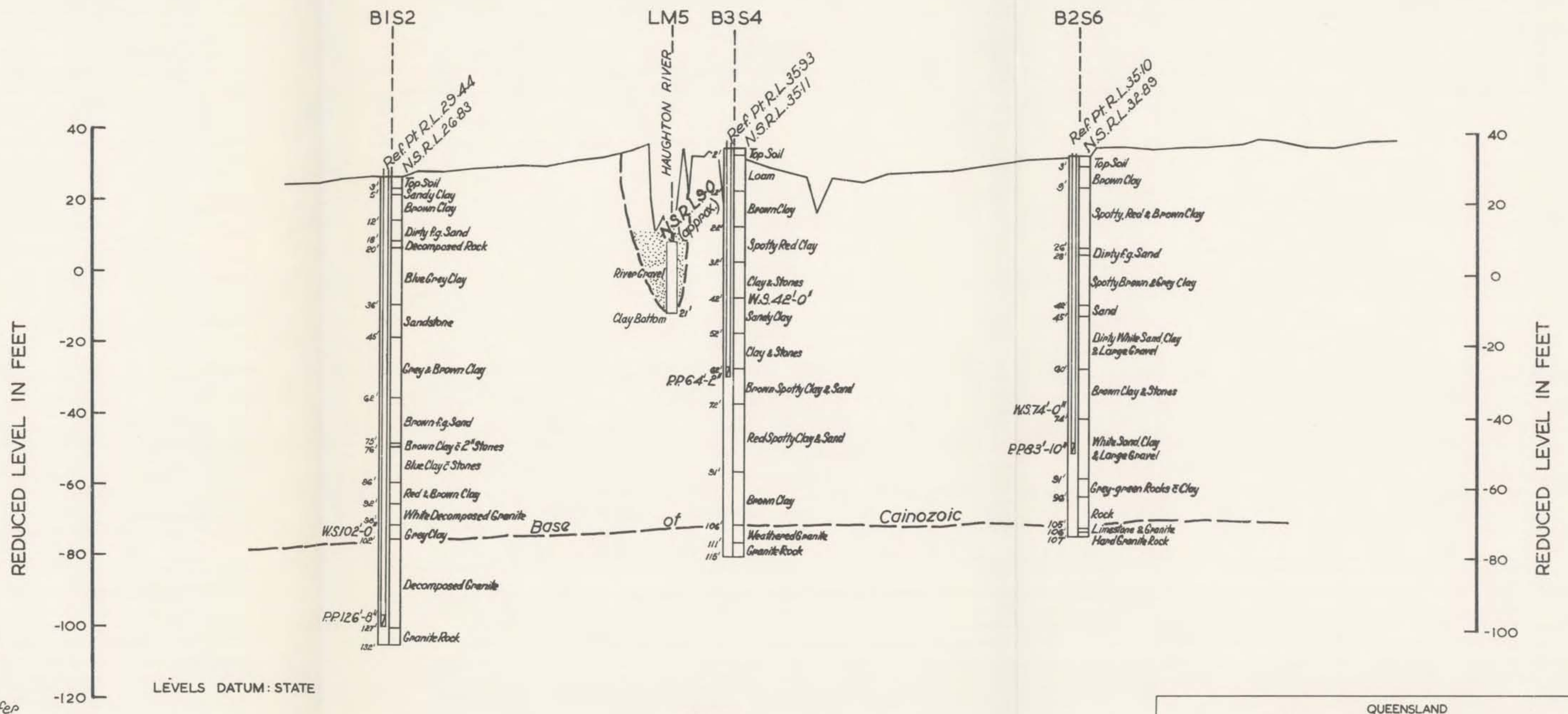
HAUGHTON RIVER
GROUND WATER INVESTIGATION

POLETTI LINE

BORE No. / SITE No.	Commenced / Completed	B1 15-10-64 / S2 27-10-64	LM5 1952	B3 5-12-64 / S4 21-12-64	B2 6-11-64 / S6 11 11-64	
Drilling Time	hrs.					
Other Productive Time	hrs.					
SCREEN SETTINGS		Bore not screened	0' N.S. 3 x 6" spears 18' 21' Gauze.	Bore not screened	Bore not screened	
PUMP TEST No.		No Test	No Test	No Test	No Test	
PUMP TYPE						
SUCTION AT						
DATE		21-10-64 / 15-12-66	2-2-67	14-12-64 / 15-12-66	9-11-64 / 15-12-66	
S.W.L. (below N.S.)		18'-6" / 19'-6"	Est. 17 ft.	28'-0" / Blocked.	21'-6" / 22'-4"	
AVAILABLE D.D.						
DURATION						
FINAL PUMP RATE G.P.H.						
FINAL D.D.						
RECOVERY TIME						
RESIDUAL D.D.						
WATER QUALITY in Micromhos per cm & p.p.m.	Location	126'-8"	18 ft. to 21 ft.	64'-2"	83'-10"	
	Conductivity at 25°C	6,300	615	3,100	1,820	
	Total Solids	395		1,875	1,059	
	Chlorides as Cl^-	2,120		740	440	
	Alkalinity	480		430	315	
	Hardness	600		400	235	
	pH	7·7		7·5	7·3	
	Date	4-10-66	17-2-67	18-4-67	4-10-66	
REMARKS All bores drilled 8 dia. for full depth by Contractor unless otherwise stated.		Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed.	Private Water Facility Normal pump rate 45,000 g.p.h. Seasonal variation N.S. to 19 ft.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted Ref. pt. is top of 2" G.I. pipe with cap removed.	

BORE No. / SITE No.	Commenced / Completed	
Drilling Time	hrs.	
Other Productive Time	hrs.	
SCREEN SETTINGS		
PUMP TEST No.		
PUMP TYPE		
SUCTION AT		
DATE		
S.W.L.		
AVAILABLE D.D.		
DURATION		
FINAL PUMP RATE G.P.H.		
FINAL D.D.		
RECOVERY TIME		
RESIDUAL D.D.		
WATER QUALITY in Micromhos per cm. & p.p.m.	Location	
	Conductivity at 25°C.	
	Total Solids	
	Chlorides as Cl^-	
	Alkalinity	
	Hardness	
	pH	
REMARKS		





LEVELS DATUM: STATE

LEGEND

Aquifer

f.g. Fine Grained
c̄ With

LEVEL BOOK: 14307
14294

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

VERTICAL Feet 30 0 30 60 90 Feet

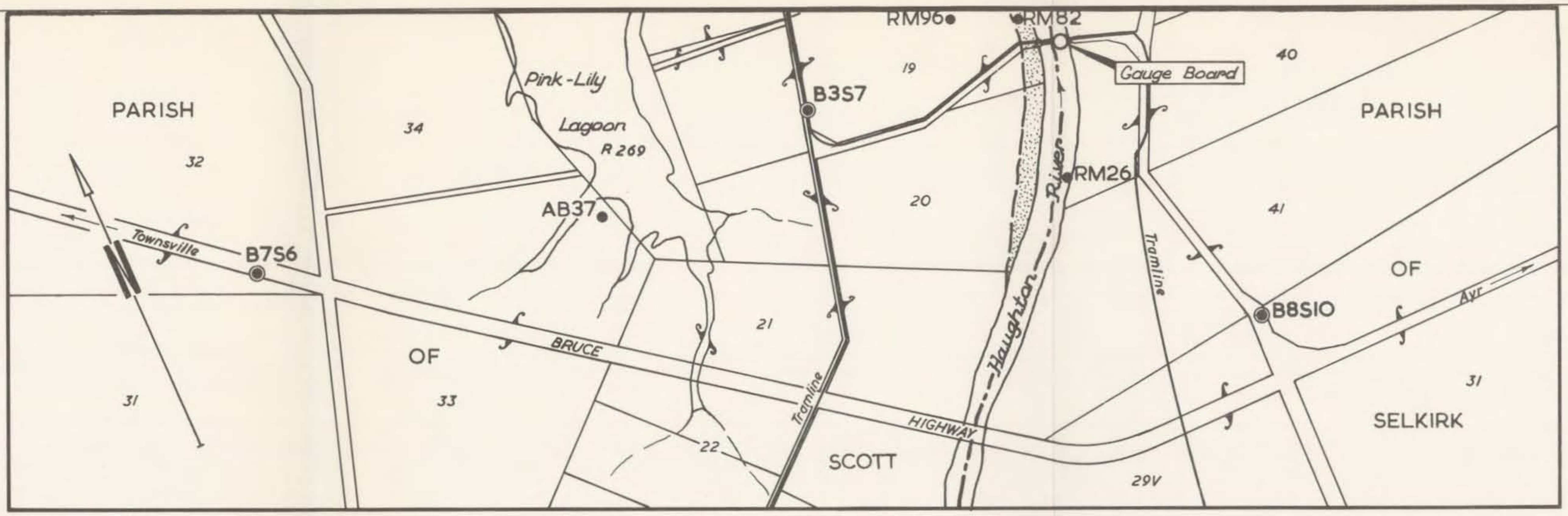
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

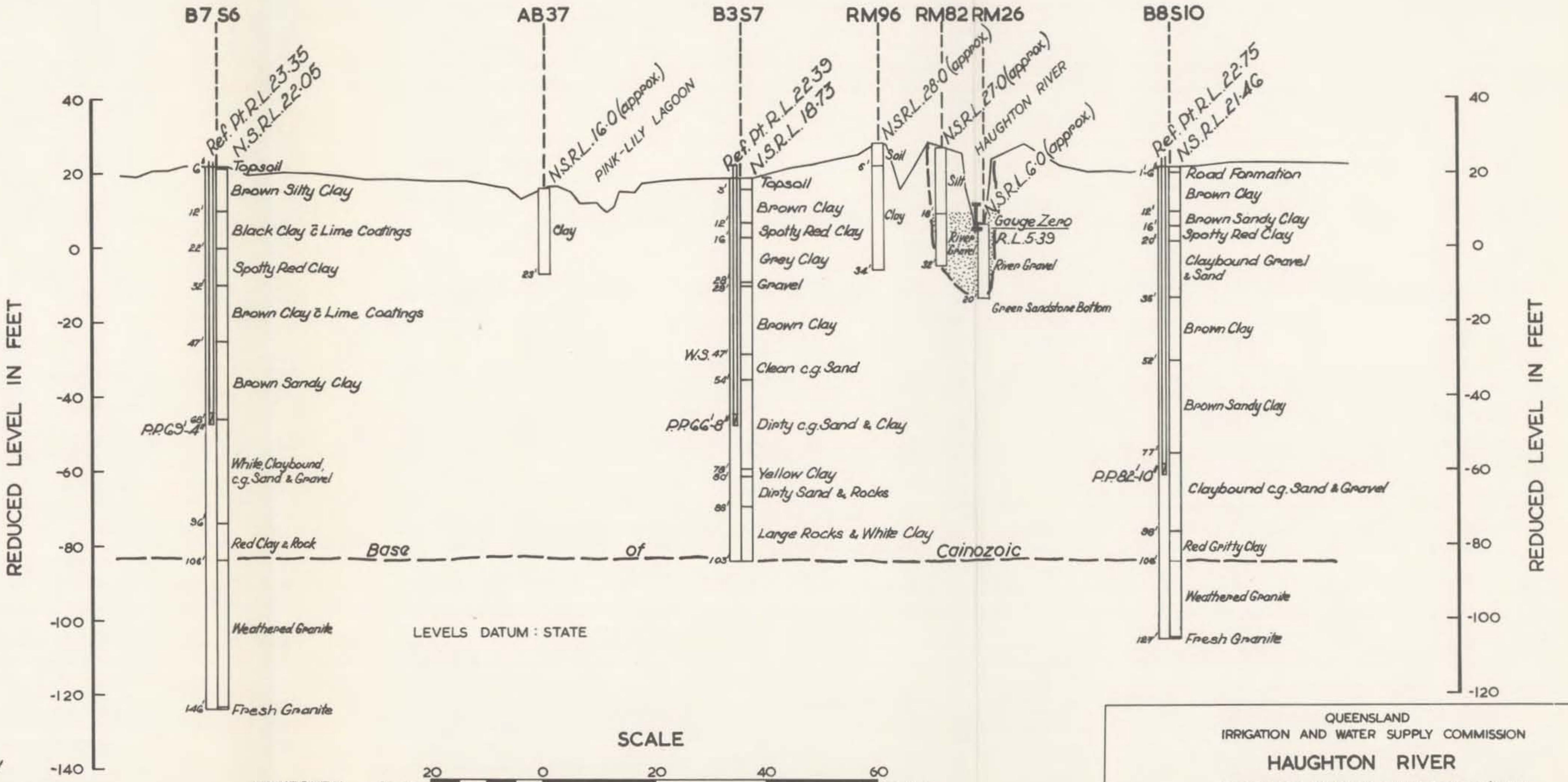
HAUGHTON RIVER
GROUND WATER INVESTIGATION

SHIRBOURNE LINE

BORE No. Commenced	B7	26-2-65	B3	16-9-64	B8	1-4-65
SITE No. Completed	S6	9-3-65	S7	21-9-64	S10	14-4-65
Drilling Time hrs.	34½				21½	
Other Productive Time hrs.	15				16½	
SCREEN SETTINGS	Bore not Screened		Bore not Screened		Bore not Screened	
PUMP TEST No.	No Test		No Test		No Test	
PUMP TYPE						
SUCTION AT						
DATE	16-3-65	15-12-66	17-9-64	15-12-66	3-11-65	15-12-66
S.W.L. (below N.S.)	11'-4"	16'-8"	12'-4"	9'-8"	15'-0"	17'-5"
AVAILABLE D.D.						
DURATION						
FINAL PUMP RATE G.P.H.						
FINAL D.D.						
RECOVERY TIME						
RESIDUAL D.D.						
WATER QUALITY in Micromhos per cm & p.p.m. — Location	25 ft.	84 ft.-96 ft.	66'-8"		21'-0"	82'-10"
Conductivity at 25°C	21,000	5,920	9,700		9,700	9,500
Total Solids	15,100	3,400	5,900		6,380	5,700
Chlorides as Cl^-	8,900	1,600	4,000		3,500	3,540
Alkalinity	116	336	76		260	310
Hardness	3,660	530	1,896		940	880
pH	7·2	7·0	7·5		7·7	8·0
Date	1-3-65	4-3-65	4-10-66		9-4-65	4-10-66
REMARKS All bores drilled 8" dia. for full depth.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.		Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract Drilled		Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	

BORE No. Commenced / SITE No. Completed	AB37 14-10-66	RM96 1964	RM82	RM26
Drilling Time hrs.				
Other Productive Time hrs.				
SCREEN SETTINGS			0' N.S. Earth Well. 9' 2x4" spears. 28' 32' Gauze.	0' N.S. 6 x 3" spears. 18' 20" Gauze.
PUMP TEST No.	No Test	No Test	No Test	No Test
PUMP TYPE				
SUCTION AT				
DATE			1-2-67	27-1-67
S.W.L. (below N.S.)			26'-0"	17'-0"
AVAILABLE D.D.				
DURATION				
FINAL PUMP RATE G.P.H.				
FINAL D.D.				
RECOVERY TIME				
RESIDUAL D.D.				
WATER QUALITY in Micromhos per cm. & p.p.m. — Location	No sample	No sample	28 ft. to 32 ft.	No sample
Conductivity at 25°C.			370	
Total Solids				
Chlorides as Cl^-				
Alkalinity				
Hardness				
pH				
Date			21-2-67	
REMARKS	Unsuccessfull private 3" test bore. Struck soak at 18 ft. Struck saline water at 23 ft.	Unsuccessful private 3" test bore. Struck soak at 30 ft.	Private Water Facility. Normal pump rate 20,000 g.p.h. Seasonal variation 14 ft. to 26 ft.	Private Water Facility. Normal pump rate 40,000 g.p.h. Seasonal variation N.S. to 17 ft.





LEGEND

Aquifer

c.g. Coarse grained
f.g. Fine grained
c̄ With

LEVEL BOOK : 14309

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

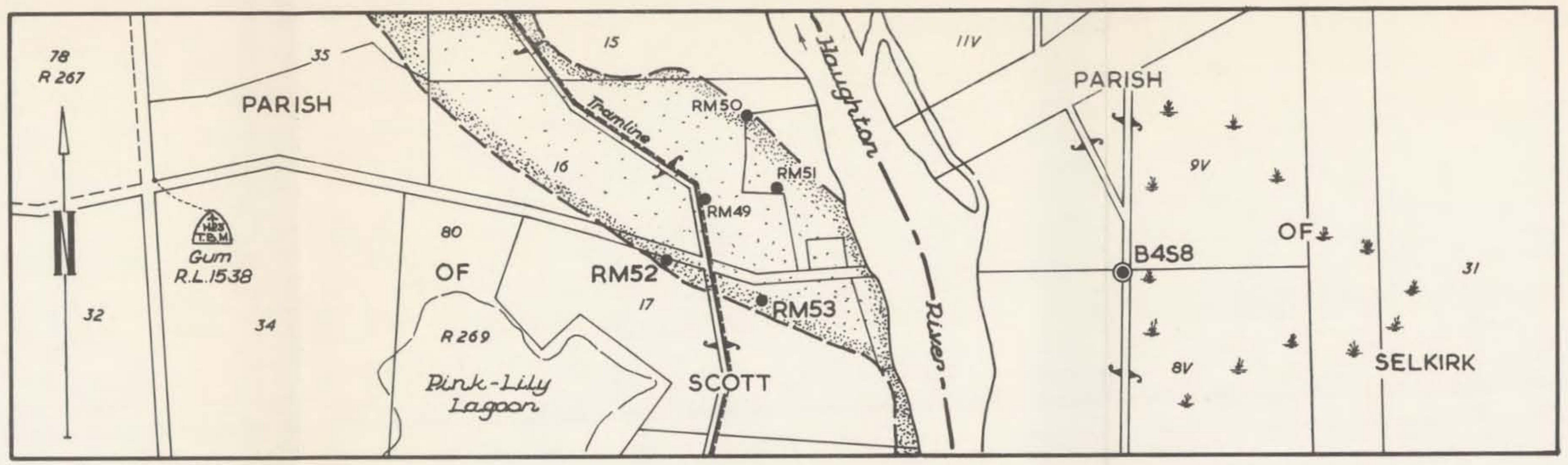
VERTICAL Feet 30 0 30 60 90 Feet

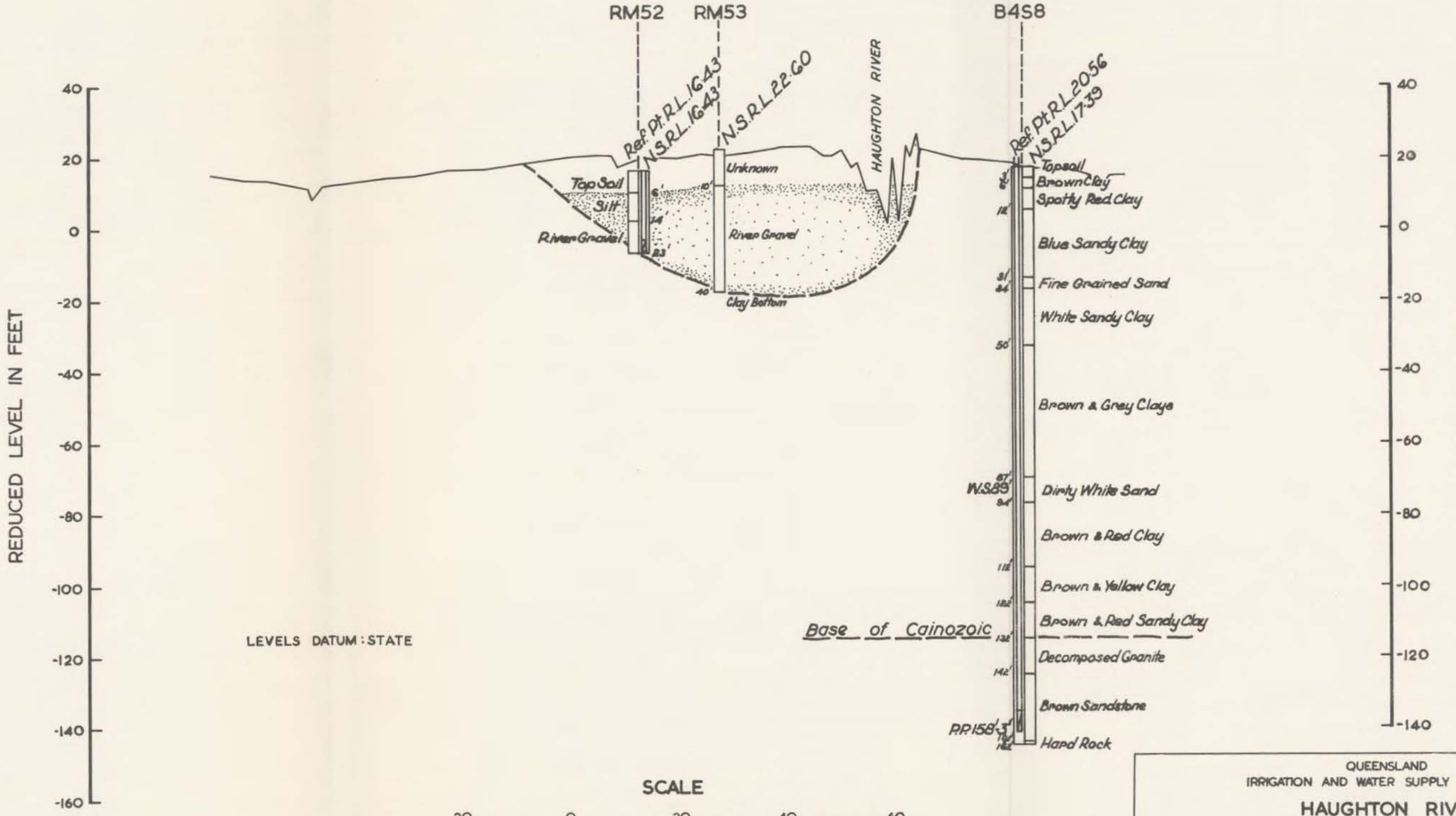
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

HAUGHTON RIVER
GROUND WATER INVESTIGATION
TOWNSVILLE ROAD LINE
(HAUGHTON RIVER SECTION)

BORE No. Commenced SITE No. Completed	RM52. After 1960	RM53 1965	B4 2-10-64 S8 13-10-64	
Drilling Time hrs.				
Other Productive Time hrs.				
SCREEN SETTINGS	0' N.S. 16 x 2" Spears. 2 x 3" Spears. 20' 23' Gauze	0' N.S. G.I. Well. 10' 7 x 3" Spears. 37' 40' Gauze	Bore not screened.	
PUMP TEST No.	No Test	No Test	No Test	
PUMP TYPE				
SUCTION AT				
DATE	1-2-67	1-2-67	23-11-64 | 15-12-66	
S.W.L. (below N.S.)	Est. 19 ft.	Est. 26 ft.	13'-5" | 14'-2"	
AVAILABLE D.D.				
DURATION				
FINAL PUMP RATE G.P.H.				
FINAL D.D.				
RECOVERY TIME				
RESIDUAL D.D.				
WATER QUALITY in Micromhos per. cm & p.p.m. — Location	20 to 23 ft.	No sample.	158'-3"	
Conductivity at 25°C	760		2,360	
Total Solids			1,380	
Chlorides as Cl^-			692	
Alkalinity			112	
Hardness			224	
pH			7·0	
Date	21-2-67		4-10-66	
REMARKS	Private Water Facility Normal pump rate 60,000 g.p.h. Seasonal variation 8 to 19 ft. Ref. pt. is top of open 2" test spear.	Private Water Facility. Normal pump rate 60,000 g.p.h. Seasonal variation 14 to 26 ft.	Drilled 8" dia. for full depth by Contractor. Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Previously recorded as B4S8 – Townsville Road Line.	

BORE No. Commenced SITE No. Completed	
Drilling Time hrs.	
Other Productive Time hrs.	
SCREEN SETTINGS	
PUMP TEST No.	
PUMP TYPE	
SUCTION AT	
DATE	
S.W.L.	
AVAILABLE D.D.	
DURATION	
FINAL PUMP RATE G.P.H.	
FINAL D.D.	
RECOVERY TIME	
RESIDUAL D.D.	
WATER QUALITY in Micromhos per cm. & p.p.m. — Location	
Conductivity at 25°C.	
Total Solids	
Chlorides as Cl^-	
Alkalinity	
Hardness	
pH	
REMARKS	





LEGEND

Aquifer

LEVEL BOOK: 14308
14312

SCALE

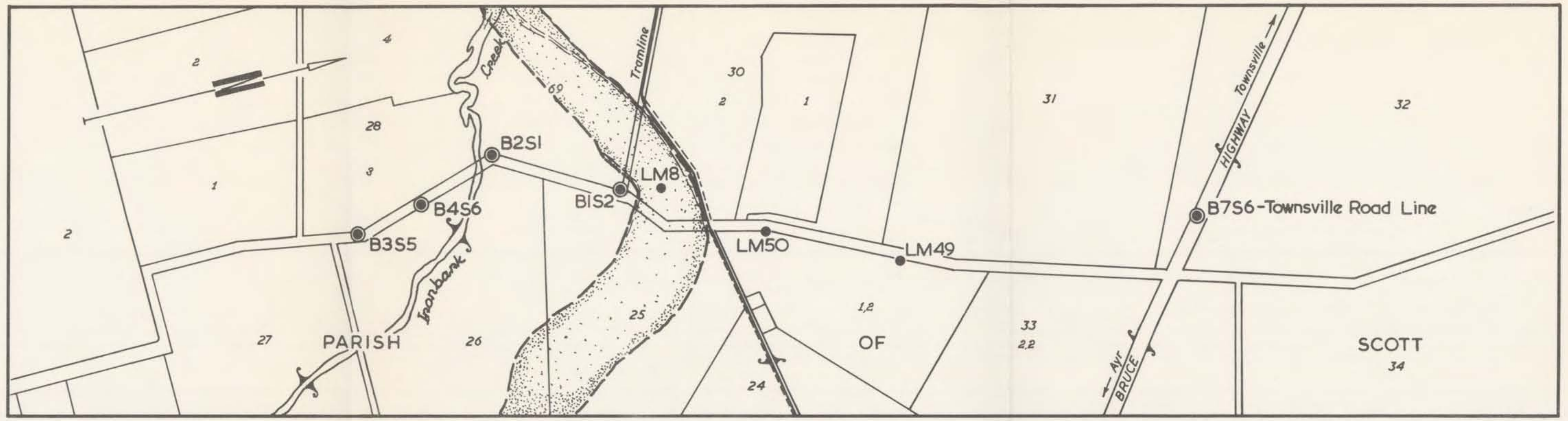
HORIZONTAL Chains 20 0 20 40 60 Chains

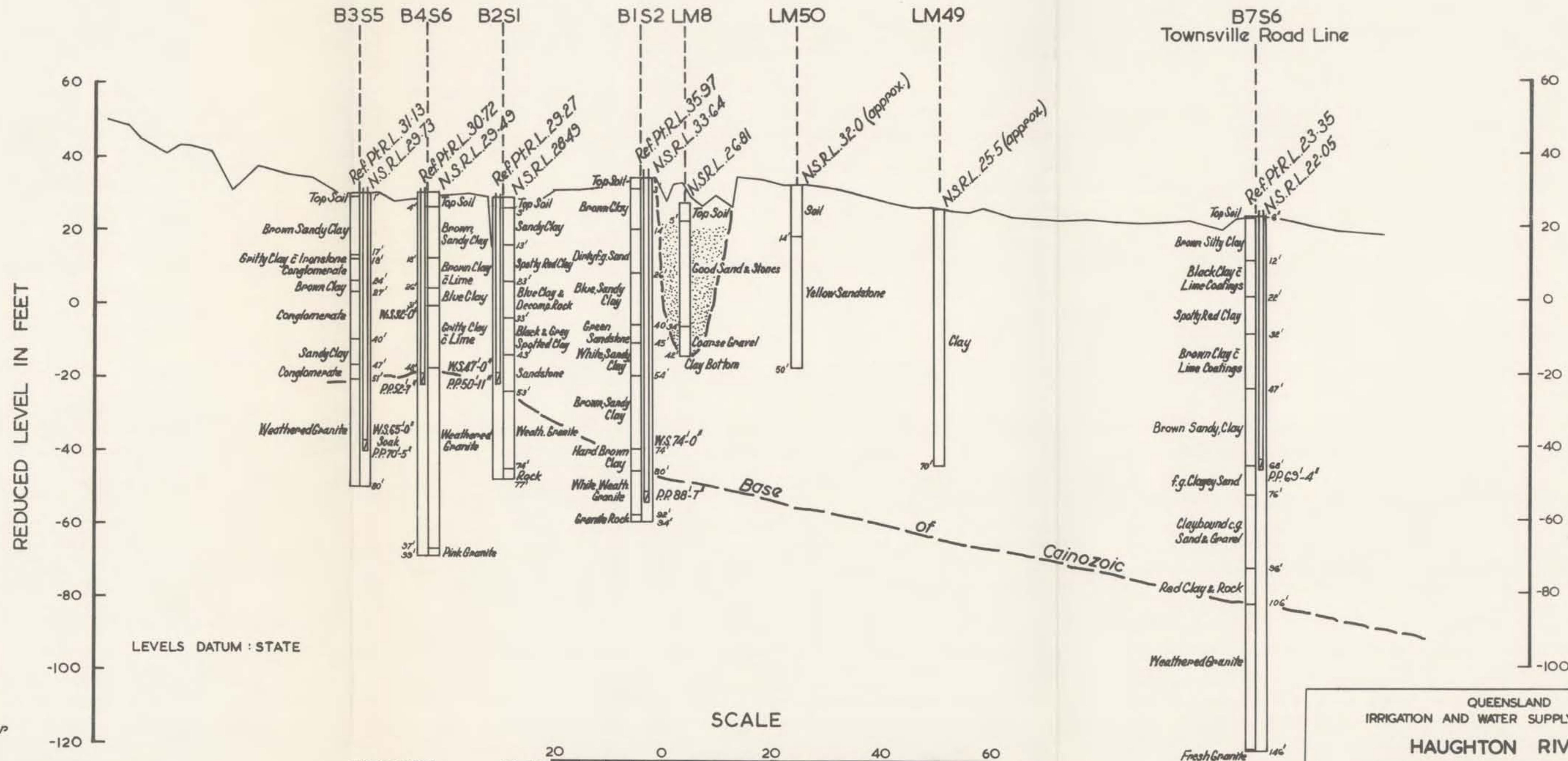
VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION
OLD ROAD LINE

BORE No. Commenced / SITE No. Completed	B3 15-4-65 & 4-5-65 / S5 22-4-65 & 4-5-65	B4 5-5-65 / S6 12-5-65	B2 17-11-64 / S1 19-11-64	B1 28-10-64 / S2 4-11-64	LM8 22-8-60
Drilling Time hrs.	16½	22½			
Other Productive Time hrs.	6¾	6½			
SCREEN SETTINGS	Bore not screened.	Bore not screened.	Bore not screened.	Bore not screened.	0' N.S. Conc. Well. 10' 2 x 6" spears. 38' 42' Gauze.
PUMP TEST No.	No Test.	No Test	No Test	No Test	No Test
PUMP TYPE					
SUCTION AT					
DATE	11-5-65 15-12-66	11-5-65 13-9-66	19-11-64 15-12-66	23-11-64 15-12-66	1-2-67
S.W.L. (below N.S.)	10'-1" 11'-3"	11'-0" 12'-8"	17'-3" 14'-0"	23'-6" 27'-7"	Est. 35 ft.
AVAILABLE D.D.					
DURATION					
FINAL PUMP RATE G.P.H.					
FINAL D.D.					
RECOVERY TIME					
RESIDUAL D.D.					
WATER QUALITY in Micromhos per cm & p.p.m. — Location	40'-0"	52'-7"	50'-11"	88'-7"	38 ft. to 42 ft.
Conductivity at 25°C	3,500	4,850	6,250	5,300	495
Total Solids	2,328	2,890	4,017	3,184	
Chlorides as Cl⁻	1,140	1,120	1,970	1,652	
Alkalinity	440	880	520	412	
Hardness	220	252	1,130	444	
pH	8·2	8·4	7·1	7·8	
Date	21-4-65	7-5-65	4-10-66	4-10-66	17-2-67
REMARKS — All bores drilled 8" dia. for full depth unless otherwise stated.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed. Contract drilled.	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract drilled.	Private Water Facility. Normal pump rate 30,000 g.p.h. Seasonal variation N.S. to 35 ft.

BORE No. Commenced / SITE No. Completed	LM50 1965	LM49 1965	B7 26-7-65 / S6 9-3-65	
Drilling Time hrs.			34½	
Other Productive Time hrs.			15	
SCREEN SETTINGS			Bore not screened	
PUMP TEST No.	No Test	No Test	No Test	
PUMP TYPE				
SUCTION AT				
DATE			16-3-65 15-12-66	
S.W.L. (below N.S.)		Dry	11'-4" 16'-8"	
AVAILABLE D.D.				
DURATION				
FINAL PUMP RATE G.P.H.				
FINAL D.D.				
RECOVERY TIME				
RESIDUAL D.D.				
WATER QUALITY in Micromhos per cm. & p.p.m. — Location	No Sample	No Sample	25 ft. 84 to 96 ft.	
Conductivity at 25°C.			21,000 5,920	
Total Solids			15,100 3,400	
Chlorides as Cl⁻			8,900 1,600	
Alkalinity			116 336	
Hardness			3,660 530	
pH			7·2 7·0	
Date			1-3-65 4-3-65	
REMARKS — All bores drilled 8" dia. for full depth unless otherwise stated.	Unsuccessful 6" private test bore.	Unsuccessful 3" private test bore.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.	





LEGEND

Aquifer

f.g. Fine grained
c̄ With

LEVEL BOOKS : 14310

SCALE

HORIZONTAL — Chains 20 0 20 40 60 Chains

VERTICAL — Feet 30 0 30 60 90 Feet

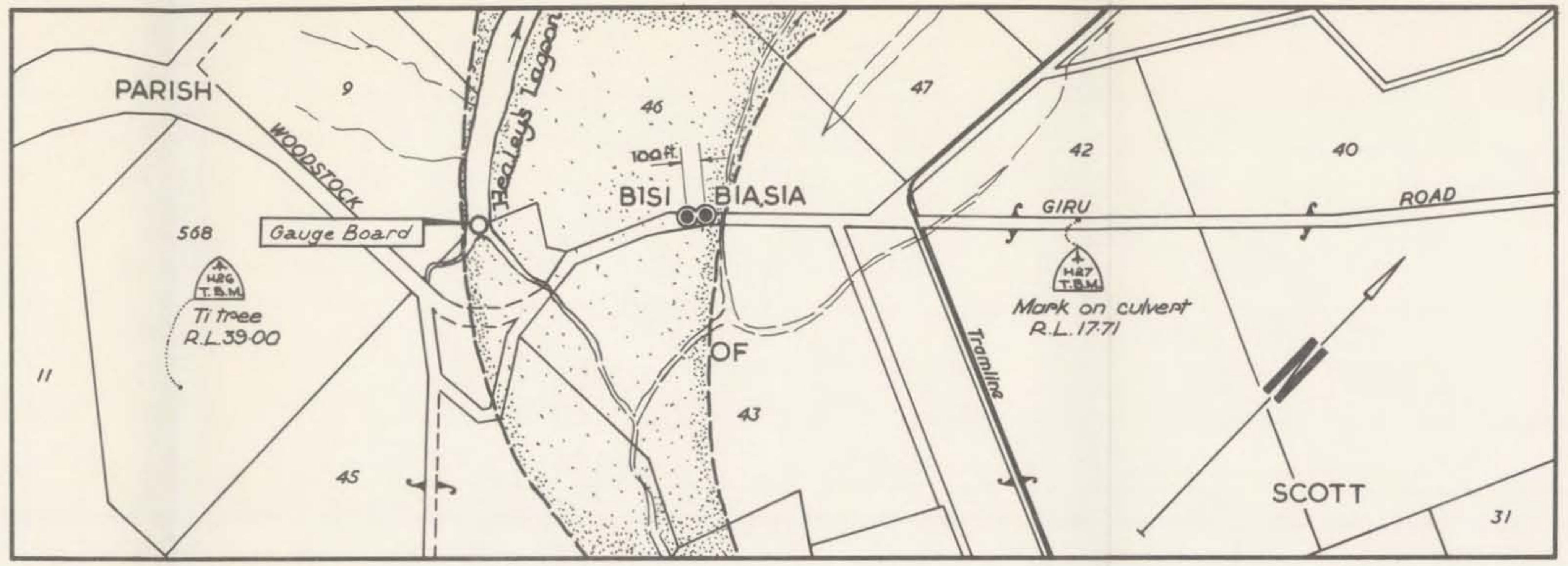
QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

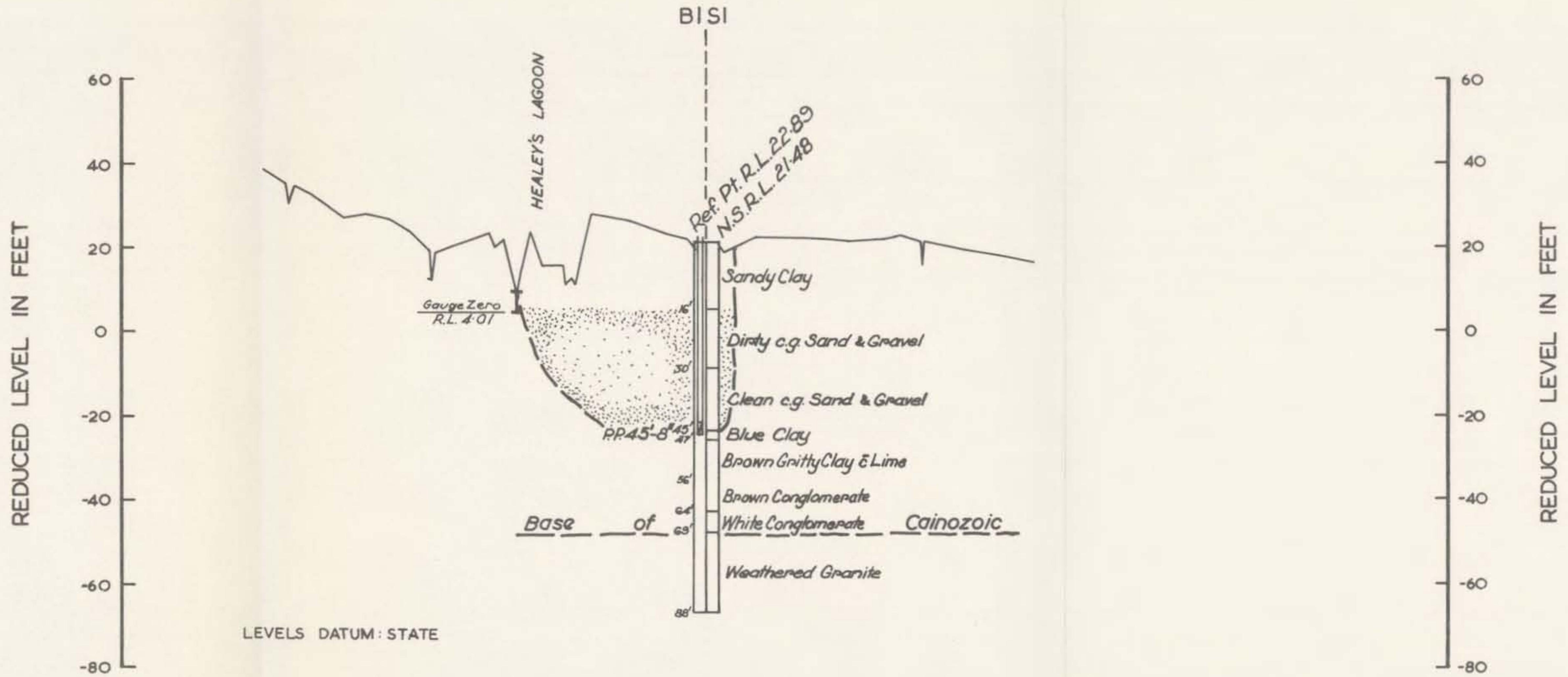
HAUGHTON RIVER
GROUND WATER INVESTIGATION

IRONBARK LINE

BORE No. / SITE No.	B1. / S1.		B1A / S1A	
Commenced	15-7-65		16-7-65	
Completed	16-7-65		3-8-65	
Drilling Time hrs.	6½		23½	
Other Productive Time hrs.	4¼		35¼	
SCREEN SETTINGS	Bore not Screened		36'-0" Top Packer. 37'-3" Bot Casing. 1x0·050 1x0·060 1x0·073 45'-0" Bot Cap 6" Willscreens.	
PUMP TEST No.	No Test		1	Pilot Pipe
PUMP TYPE			Pomona	B1 S1
SUCTION AT			34'-0"	
DATE	16-7-65	15-12-66	23-7-65	23-7-65
S.W.L. (below N.S.)	10'-9"	18'-3"	9'-3"	11'-0"
AVAILABLE D.D.			24'-9"	
DURATION			360 mins.	360 mins.
FINAL PUMP RATE G.P.H.			31,700	
FINAL D.D.			9'-3"	1'-2"
RECOVERY TIME			50 mins.	50 mins.
RESIDUAL D.D.			6½"	5¼"
WATER QUALITY in Micromhos per. cm & p.p.m. — Location	37'-6" to 48'-0"		37'-6" to 45'-0"	
Conductivity at 25°C	270		252	
Total Solids	170		151	
Chlorides as Cl⁻	20		24	
Alkalinity	108		124	
Hardness	64		60	
pH	7·8		7·8	
Date	23-7-65		23-7-65	
REMARKS All bores drilled 8"dia. for full depth.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.		8 galls. of sand removed in 4 hours by bailing, shock and solid surging in screens. Casing and screens removed. No pilot pipe inserted.	

BORE No. Commenced	
SITE No. Completed	
Drilling Time hrs.	
Other Productive Time hrs.	
SCREEN SETTINGS	
PUMP TEST No.	
PUMP TYPE	
SUCTION AT	
DATE	
S.W.L.	
AVAILABLE D.D.	
DURATION	
FINAL PUMP RATE G.P.H.	
FINAL D.D.	
RECOVERY TIME	
RESIDUAL D.D.	
WATER QUALITY in Micromhos per cm. & p.p.m. — Location	
Conductivity at 25°C.	
Total Solids	
Chlorides as Cl⁻	
Alkalinity	
Hardness	
pH	
REMARKS	





LEGEND

Aquifer

c.g. Coarse grained
& With

LEVEL BOOK: 14311

SCALE

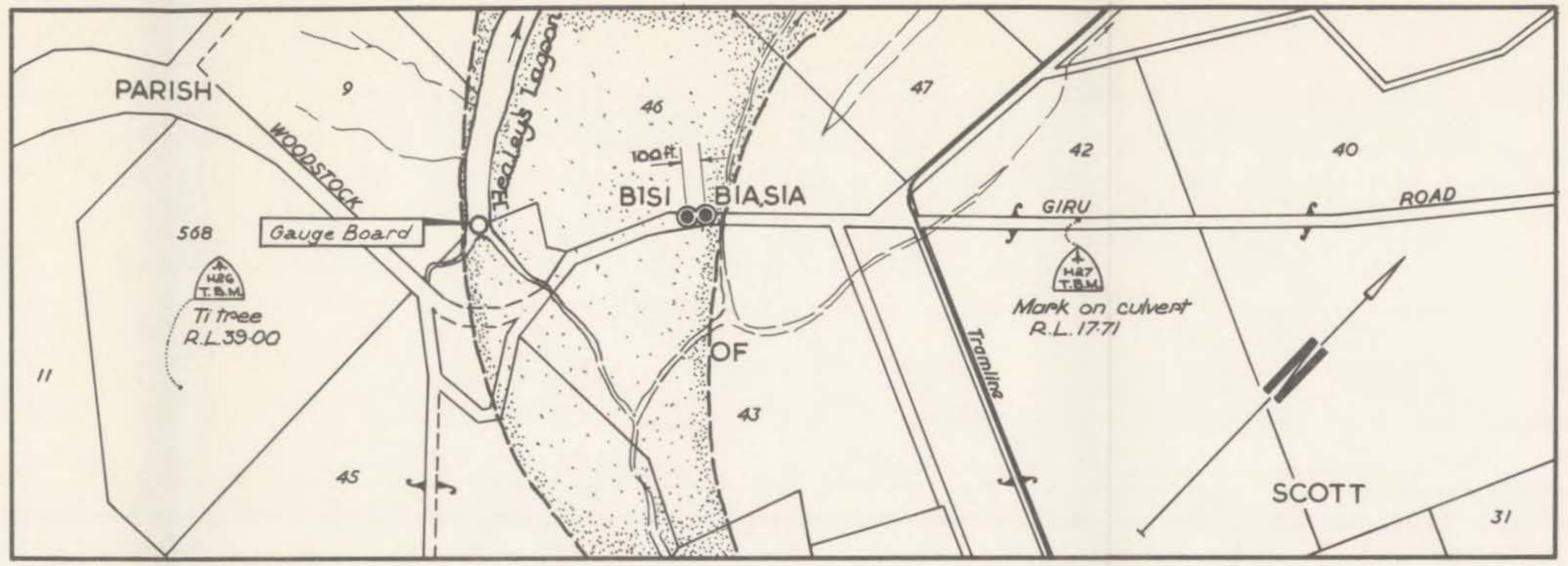
HORIZONTAL Chains 20 0 20 40 60 Chains

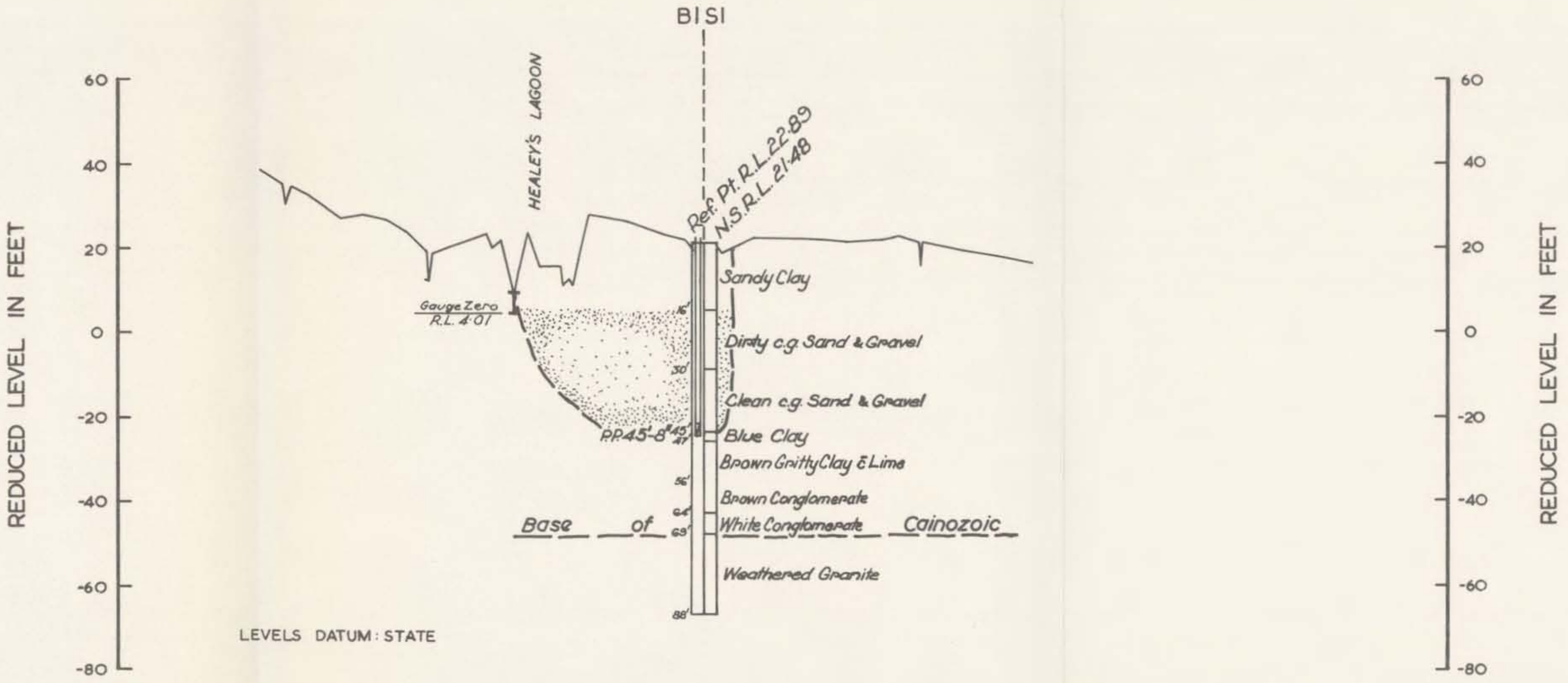
VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION
WOODSTOCK ROAD LINE

		B1		B1A	
BORE No. / SITE No.	Commenced / Completed	B1. 15-7-65 / S1. 16-7-65		B1A 16-7-65 / S1A 3-8-65	
Drilling Time hrs.		6½		23½	
Other Productive Time hrs.		4¼		35¼	
SCREEN SETTINGS		Bore not Screened		36'-0" Top Packer. 37'-3" Bot Casing. 1x0·050 1x0·060 1x0·073 45'-0" Bot Cap 6" Willscreens.	
PUMP TEST No.		No Test		1	Pilot Pipe
PUMP TYPE				Pomona	B1 S1
SUCTION AT				34'-0"	
DATE		16-7-65	15-12-66	23-7-65	23-7-65
S.W.L. (below N.S.)		10'-9"	18'-3"	9'-3"	11'-0"
AVAILABLE D.D.				24'-9"	
DURATION				360 mins.	360 mins.
FINAL PUMP RATE G.P.H.				31,700	
FINAL D.D.				9'-3"	1'-2"
RECOVERY TIME				50 mins.	50 mins.
RESIDUAL D.D.				6½"	5¼"
WATER QUALITY in Micromhos per. cm & p.p.m.	Location	37'-6" to 48'-0"		37'-6" to 45'-0"	
	Conductivity at 25°C	270		252	
	Total Solids	170		151	
	Chlorides as Cl⁻	20		24	
	Alkalinity	108		124	
	Hardness	64		60	
	pH	7·8		7·8	
	Date	23-7-65		23-7-65	
REMARKS	All bores drilled 8"dia. for full depth.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.		8 galls. of sand removed in 4 hours by bailing, shock and solid surging in screens. Casing and screens removed. No pilot pipe inserted.	

BORE No. / SITE No.	Commenced / Completed	
Drilling Time hrs.		
Other Productive Time hrs.		
SCREEN SETTINGS		
PUMP TEST No.		
PUMP TYPE		
SUCTION AT		
DATE		
S.W.L.		
AVAILABLE D.D.		
DURATION		
FINAL PUMP RATE G.P.H.		
FINAL D.D.		
RECOVERY TIME		
RESIDUAL D.D.		
WATER QUALITY in Micromhos per cm. & p.p.m.	Location	
	Conductivity at 25°C.	
	Total Solids	
	Chlorides as Cl⁻	
	Alkalinity	
	Hardness	
	pH	
REMARKS		





LEGEND

Aquifer

c.g. Coarse grained

& With

LEVEL BOOK: 14311

SCALE

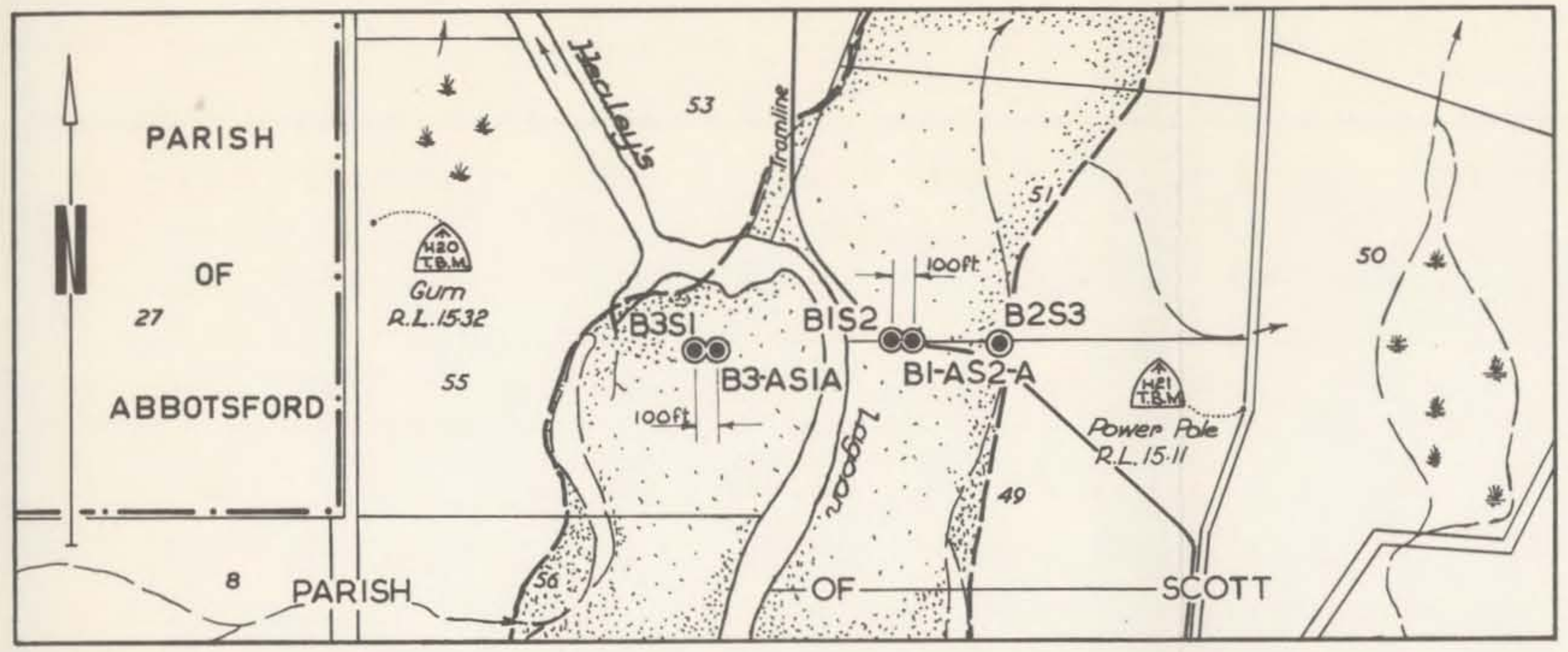
HORIZONTAL Chains 20 0 20 40 60 Chains

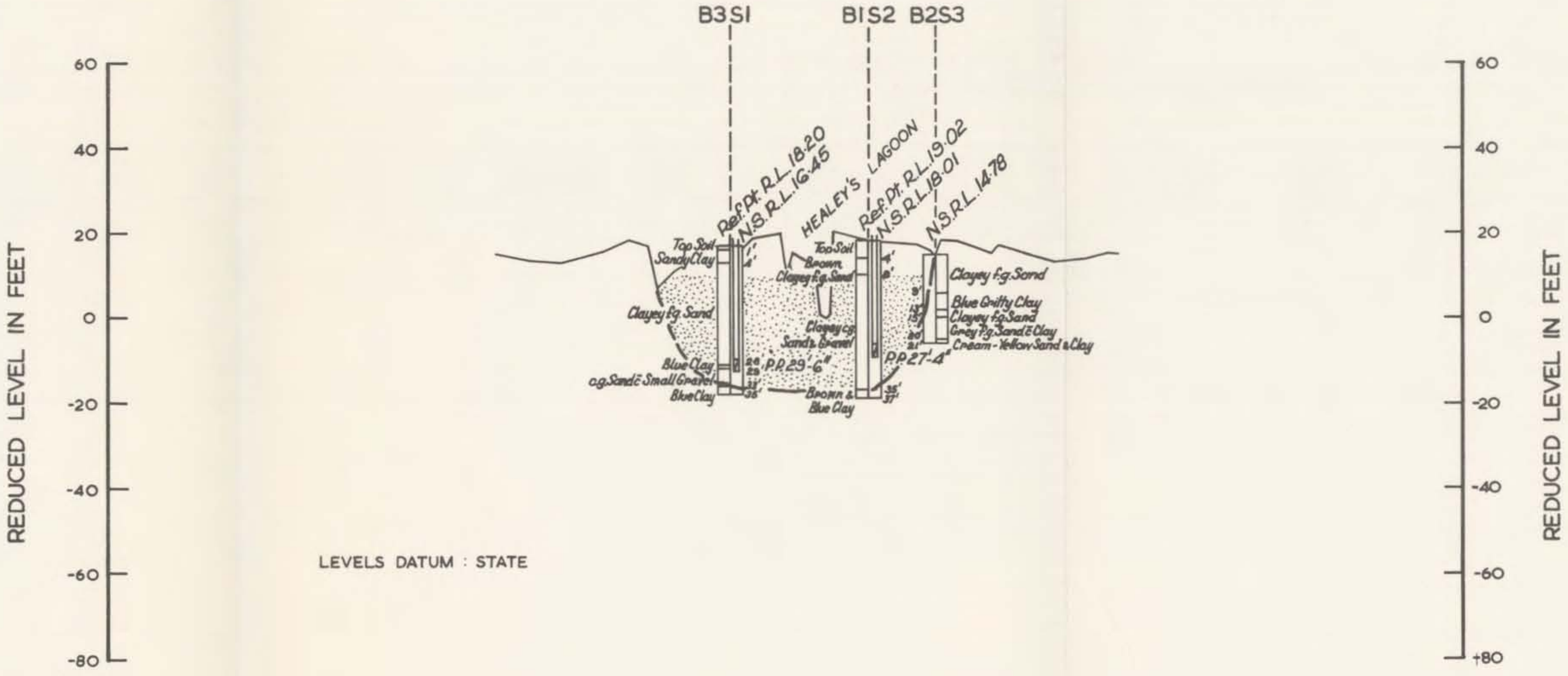
VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION
WOODSTOCK ROAD LINE

BORE No. / SITE No.	Commenced / Completed									
BORE No. / SITE No. (Commenced / Completed)	B3 S1	3-12-65 7-12-65	B3-A S1-A	7-12-65 & 17-1-66 10-12-65 & 19-1-66	B1 S2	18-11-65 22-11-65	B1-A S2-A	23-11-65 30-11-65	B2 S3	1-12-65 2-12-65
Drilling Time hrs.	6		3¾		7¼		4½		3½	
Other Productive Time hrs.	8		21		4½		31½		4½	
SCREEN SETTINGS	Bore not Screened.		28'-10" Top packer; 30'-4" Bot casing; 1x0·060; 32'-9" Bot cap.; 6" Willscreen.		Bore not Screened.		30'-3" Top packer; 31'-4½" Bot casing; 1x0·050; 1x0·060; 36'-6" Bot cap.; 6" Willscreens.		Bore not Screened.	
PUMP TEST No.	No Test		1	Pilot Pipe	No Test		1	Pilot Pipe	No Test	
PUMP TYPE			Pomona	B3S1			Bailer	B1S2		
SUCTION AT			24'-2"							
DATE	7-12-65	15-12-65	18-1-66	18-1-66	22-11-65	15-12-66	30-11-65	30-11-65		
S.W.L. (below N.S.)	13'-5"	15'-11"	8'-8"	10'-4"	13'-1"	16'-10"	13'-8"	14'-1"	Dry	
AVAILABLE D.D.			15'-6"				16'-7"			
DURATION			360 mins.	360 mins.			120 mins.	120 mins.		
FINAL PUMP RATE G.P.H.			15,900				1,200			
FINAL D.D.			10'-8¾"	1'-1"			11'-7"	0"		
RECOVERY TIME			60 mins	60 mins.			6 mins.	6 mins.		
RESIDUAL D.D.			0'-6"	0'-4¾"			0"	0"		
WATER QUALITY in Micromhos per. cm & p.p.m. — Location	20'-0" to 33'-8"		30'-4" to 32'-9"		17 ft to 30 ft.		13 ft to 35 ft.			
Conductivity at 25°C	820		590		780		515			
Total Solids	492		354		448		309			
Chlorides as Cl⁻	100		68		140		72			
Alkalinity	296		216		115		156			
Hardness	104		88		190		30			
pH	8·1		7·5		7·2		7·5			
Date	7-12-65		18-1-66		19-11-65		30-11-65			
REMARKS — All bores drilled 8" dia. for full depth.	Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.		Casing and screens removed. No pitot pipe inserted.		Casing removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.		91 galls of sand removed in 19¾ hours by bailing, shock, solid and valve surging in screens and casing. Casing and screens removed. No pilot pipe inserted.		Casing removed. No pilot pipe inserted.	

BORE No. / SITE No. — Commenced / Completed	
Drilling Time hrs.	
Other Productive Time hrs.	
SCREEN SETTINGS	
PUMP TEST No.	
PUMP TYPE	
SUCTION AT	
DATE	
S.W.L.	
AVAILABLE D.D.	
DURATION	
FINAL PUMP RATE G.P.H.	
FINAL D.D.	
RECOVERY TIME	
RESIDUAL D.D.	
WATER QUALITY In Micromhos per. cm & p.p.m. — Location	
Conductivity at 25°C.	
Total Solids	
Chlorides as Cl⁻	
Alkalinity	
Hardness	
pH	
REMARKS	





LEGEND

Aquifer

f.g. Fine grained
c.g. Coarse grained
c̄ With

LEVEL BOOK: 14306

SCALE

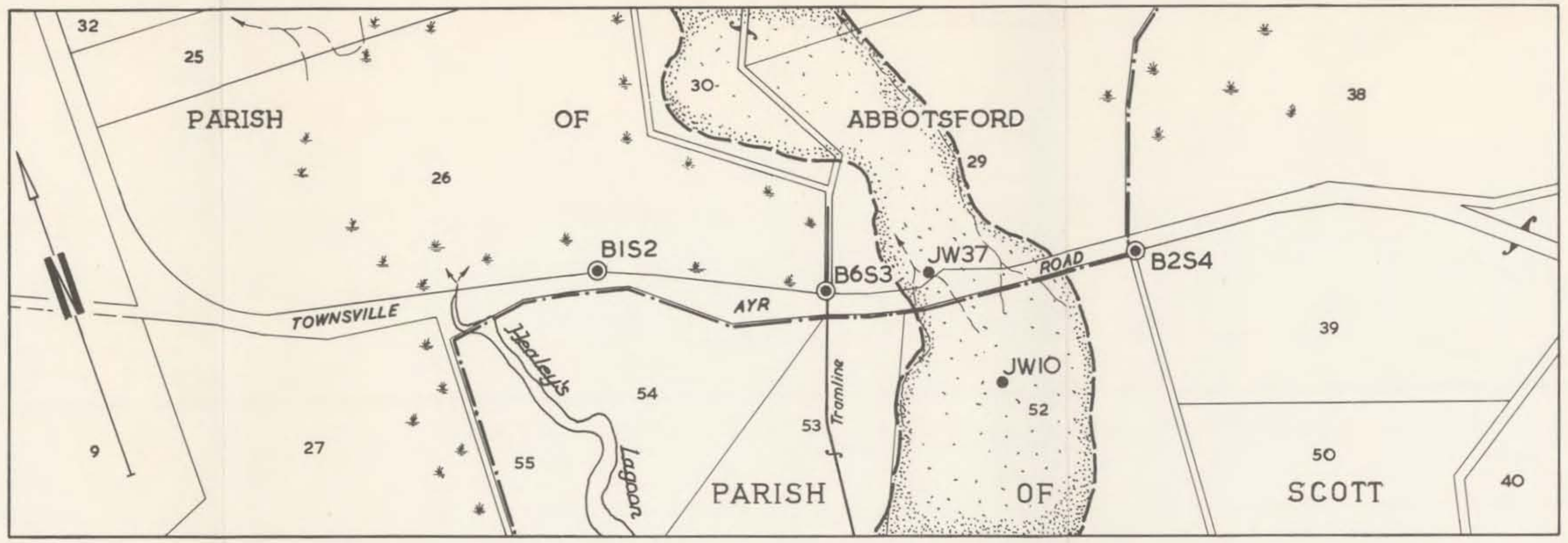
HORIZONTAL Chains 20 0 20 40 60 Chains

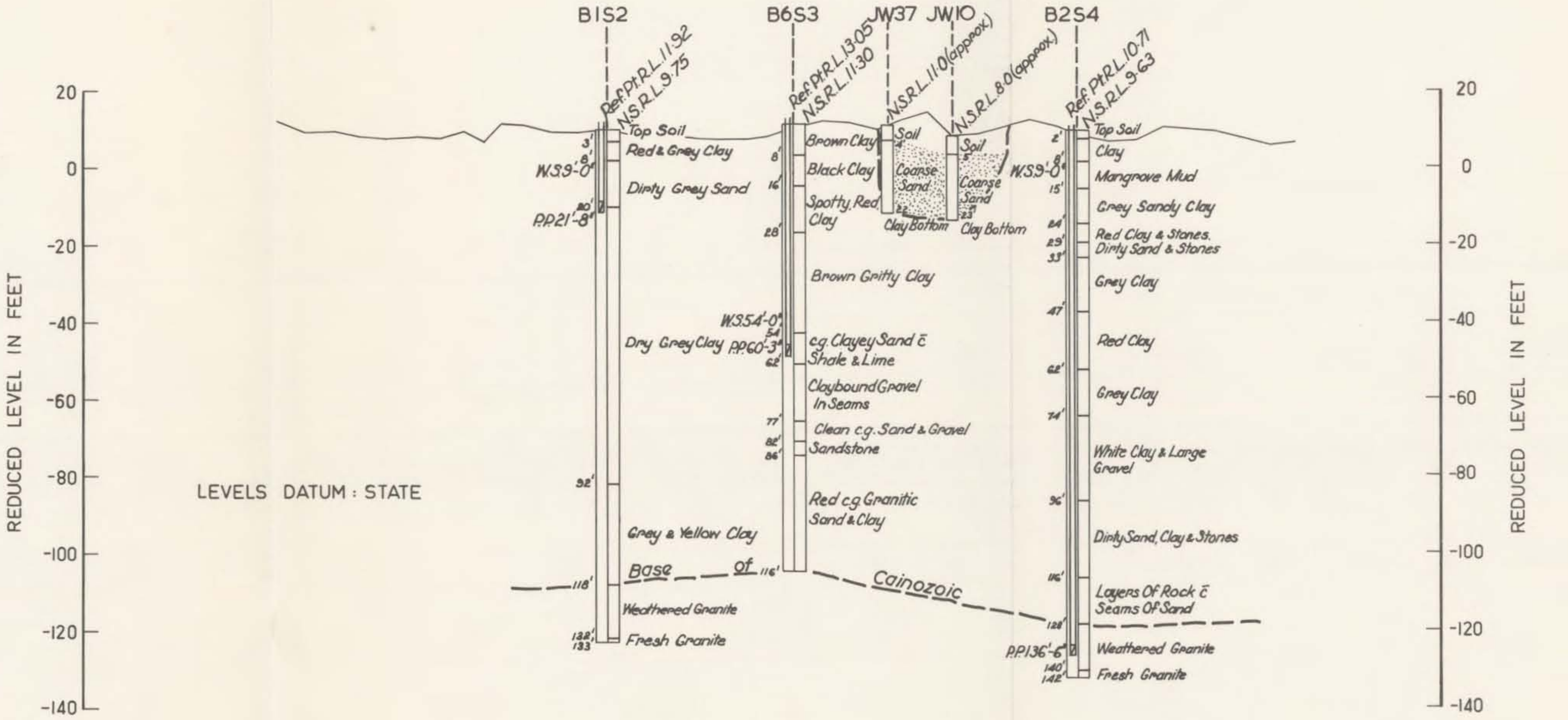
VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION
HAUGHTON RIVER
GROUND WATER INVESTIGATION
ANABRANCH LINE

BORE No. / SITE No.	Commenced / Completed	B1 / S2	20-8-64 / 31-8-64	B6 / S3	9-2-65 / 26-2-65 and 23-3-65 / 1-4-65				B2 / S4	1-9-64 / 14-9-64
Drilling Time hrs.				32						
Other Productive Time hrs.				74¼						
SCREEN SETTINGS		Bore not screened		56'-6" Top of Packer. 59'-2" Bottom of Casing. 2 x 0·050" x 6" Willscreens. 63'-0" Bottom of Cap.					Bore not screened	
PUMP TEST No.		No Test		1					No Test	
PUMP TYPE				Bailer Test						
SUCTION AT										
DATE		31-8-64	15-12-66	31-3-65		15-12-66			23-11-64	14-9-66
S.W.L. (below N.S.)		4'-8"	8'-11"	3'-1"		7'-11"			4'-11"	5'-6"
AVAILABLE D.D.				53'-5"						
DURATION				60 mins.						
FINAL PUMP RATE G.P.H.				1,200						
FINAL D.D.				45'-4"						
RECOVERY TIME				30 mins.						
RESIDUAL D.D.				0'-5½"						
WATER QUALITY in Micromhos per. cm & p.p.m.	Location	21'-8"	21'-8"	8'-0"	23'-0"	54 to 62 ft.	68 to 71 ft.	77 to 82 ft.	136'-6"	
	Conductivity at 25°C	11,500	4,000	21,000	17,000	6,180	7,300	11,500	33,000	
	Total Solids		2,649	15,520	11,200	2,850	4,450	7,420	20,000	
	Chlorides as Cl⁻		1,030	8,000	5,800	1,600	2,200	3,800	17,400	
	Alkalinity		25	0	0	120	256	256	150	
	Hardness		900	3,200	0	400	750	1,310	11,360	
	pH		6·5	5·1	6·1	7·9	7·1	7·0	7·0	
	Date	14-9-66	18-4-67	10-2-65	10-2-65	11-2-65	11-2-65	11-2-65	4-10-66	
REMARKS	All bores drilled 8" dia. for full depth.	Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract drilled.		Cement-bentonite seal placed 68 to 75 ft. 27½ gallons of sand removed in 23½ hours by bailing, shock and valve surging in screens and casing. Casing and screens removed and pilot pipe inserted. Ref. pt. is top of 6" guard with lid removed.					Casing removed and pilot pipe inserted. Ref. pt. is top of 2" G.I. pipe with cap removed. Contract drilled.	

BORE No. / SITE No.	Commenced / Completed	JW 37	JW10
		1960	1947
Drilling Time hrs.			
Other Productive Time hrs.			
SCREEN SETTINGS		0' N.S. 3 x 6" spears. 17' 23' Gauze.	0' N.S. 6 x 3" spears. 19' 22' Gauze.
PUMP TEST No.		No Test	No Test
PUMP TYPE			
SUCTION AT			
DATE		1-2-67	1-2-67
S.W.L.		17'-0"	20'-0"
AVAILABLE D.D.			
DURATION			
FINAL PUMP RATE G.P.H.			
FINAL D.D.			
RECOVERY TIME			
RESIDUAL D.D.			
WATER QUALITY in Micromhos per. cm. & p.p.m.	Location	No sample	No sample
	Conductivity at 25°C.		
	Total Solids		
	Chlorides as Cl⁻		
	Alkalinity		
	Hardness		
	pH		
REMARKS		Private Water Facility. Normal pump rate 40,000 g.p.h. Seasonal variation 6 ft. to 17 ft.	Private Water Facility. Normal pump rate 40,000 g.p.h. Seasonal variation 5 ft. to 20 ft.





LEGEND

Aquifer

c.g. Coarse grained
c̄ With
Natural Surface Levels taken from Main Roads Survey

SCALE

HORIZONTAL Chains 20 0 20 40 60 Chains

VERTICAL Feet 30 0 30 60 90 Feet

QUEENSLAND
IRRIGATION AND WATER SUPPLY COMMISSION

HAUGHTON RIVER
GROUND WATER INVESTIGATION

TOWNSVILLE ROAD LINE
(ANABRANCH SECTION)