DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1973/25

GREAT ARTESIAN BASIN GROUNDWATER PROJECT AUTOMATIC DATA PROCESSING STORAGE AND RETRIEVAL SYSTEM

by

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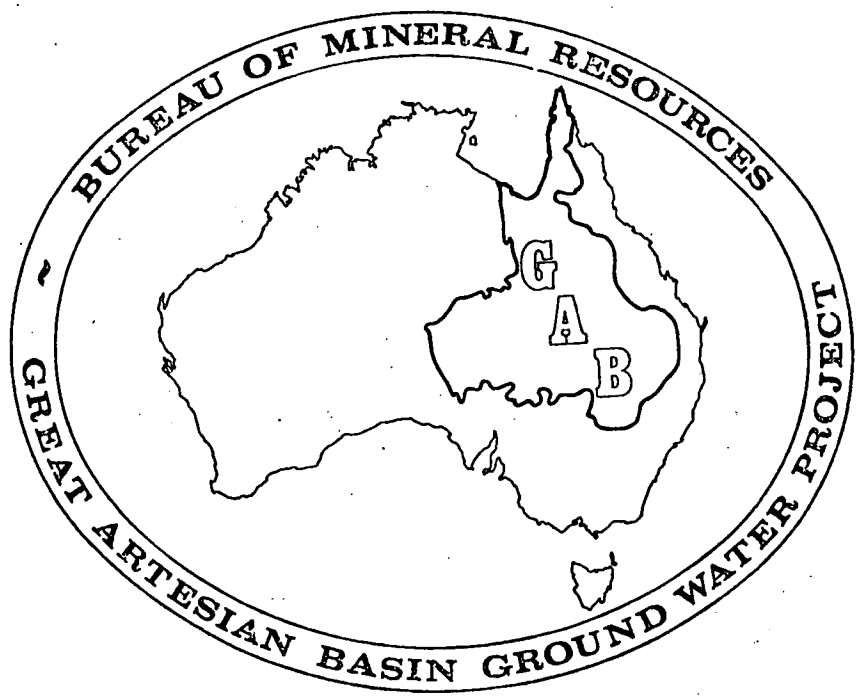

* Bureau de Recherches Géologiques et Minières
** Bureau of Mineral Resources, Geology and Geophysics

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SUMMARY

An automatic data processing, storage and retrieval system, designed for use in the Great Artesian Basin Hydrogeologic Project, will handle geological and hydrological data held in the files of State and Commonwealth authorities. The system is necessary for the operation of a computer simulation model of the basin. Although the ADP system has been designed primarily to fit the specific project requirements, interchange of data with existing or presently planned systems, both in the Bureau of Mineral Resources and State organizations, can be accomplished easily.

Information from wells is collected onto transfer sheets, then fed into the computer using the following data punch cards: master card, well casing and screen card, lithostratigraphy card, aquifer description card, well discharge data card, well production card, head and temperature card, well hydrodynamics card, pumping and flowing test card, well characteristic curve card, total dissolved solids card, water chemistry card-1 and 2. The first three cards and part of the fourth card contain fixed information, while the other cards deal with types of information which vary with time.

1. INTRODUCTION

1.1 Scope of the Great Artesian Basin Hydrogeological Project

The Commonwealth Bureau of Mineral Resources, Geology and Geophysics (BMR), with the collaboration of the water and geological authorities of Queensland, New South Wales, South Australia and the Northern Territory started in 1971 a hydrogeological study of the Great Artesian Basin of Australia. This involved collating and interpreting available geological and hydrological data from the basin with the objective of producing a simulation model as an aid to management decisions and an assessment of the water resources of the basin.

The model is planned to simulate the basin as a multi-layered aquifer system, reconstructing the original (pre-1880) steady state condition and the later development of the basin, as a basis for forecasting its future hydrodynamic behaviour.

Collection of hydrological data started in July, 1972. During the initial stages the suitability of the transfer sheets for allowing the input of all relevant data to the ADP system was checked by M. Audibert (B.R.G.M. Australia) and R.S. Abell (BMR) in relation to the data held in state offices. As a result, some of the original designs were appreciably modified in detail; the present Record incorporates these modifications.

1.2 Scope of the Great Artesian Basin Automatic Data Processing System

The geology of the Great Artesian Basin is known in sufficient detail to establish the basin's geometry and the correlation of lithostratigraphic units and aquifers. Assessments of the permeability of the lithostratigraphic units have still to be made.

Hydrologic data from some 40 000 wells drilled in the basin will be used to provide the main basic information for simulation of the hydrodynamic behaviour of the basin. The size of the Great Artesian Basin (Fig. 1), and the amount and diversity of geological and hydrological data already collected by State and Commonwealth authorities makes it necessary to use an automatic data processing system (ADP).

Development of the Great Artesian Basin (GAB) started in 1880 and since that date nearly 40 000 wells have been drilled. From the early days, data in the form of drillers logs, water levels, pressure tests, pumping tests and chemical analyses have been collected and are now held by various water authorities: the Irrigation and Water Supply Commission of Queensland, the Water Conservation and Irrigation Commission of New South Wales, the Department of Mines of South Australia and the Water Resources Branch of the Northern Territory Administration.

A vast amount of detailed geologic data has become available in recent years (1950-1970) by work of B M R , the Geological Survey of Queensland, the Geological Survey of New South Wales, and the Department of Mines of South Australia.

The search for oil and gas in Australia has included drilling several hundred exploration and production wells in the basin by petroleum companies. These wells provide detailed geological and geophysical information; stratigraphic drilling by BMR and state geological surveys complement the geological knowledge in specific areas.

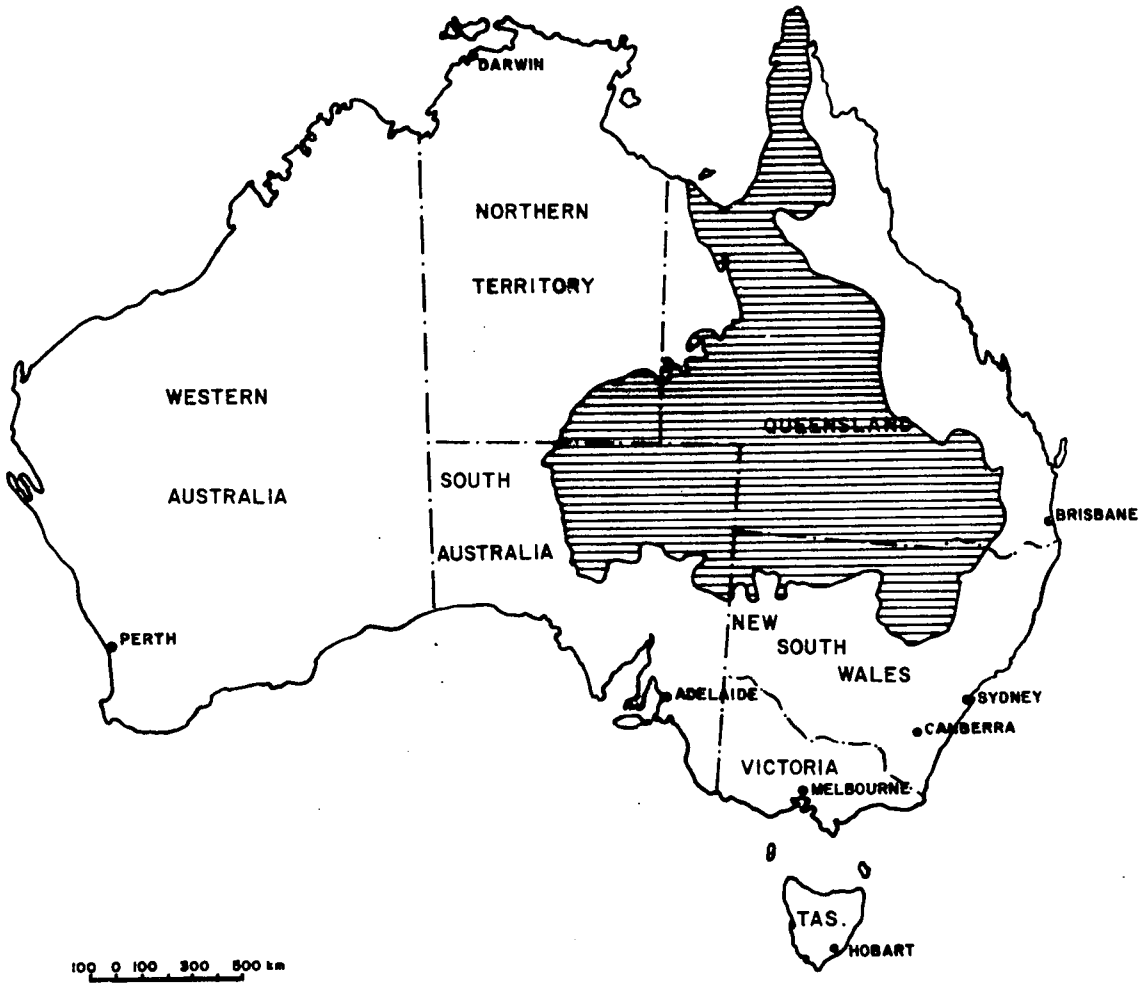


Fig. I
PROBABLE EXTENT OF THE GREAT ARTESIAN BASIN - AUSTRALIA

Wireline logging of existing waterwells has been carried out since 1960, principally by government authorities. As most wells are cased, the most extensively used technique has been gamma-ray logging, but in recent years this has been supplemented by temperature/differential temperature, continuous flowmeter and neutron logging. About 950 wells had been logged to the end of 1972, more than 850 of them in Queensland.

The geological and hydrological data will be used to construct a simulation model for the basin, in order to simulate the basin's hydrodynamics. The first stage of simulation will be performed on a digital model, a decision determined by the availability of computing facilities in BMR and the Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Computing Research in Canberra, and the fact that many of the model input data have to be computer-processed and generated.

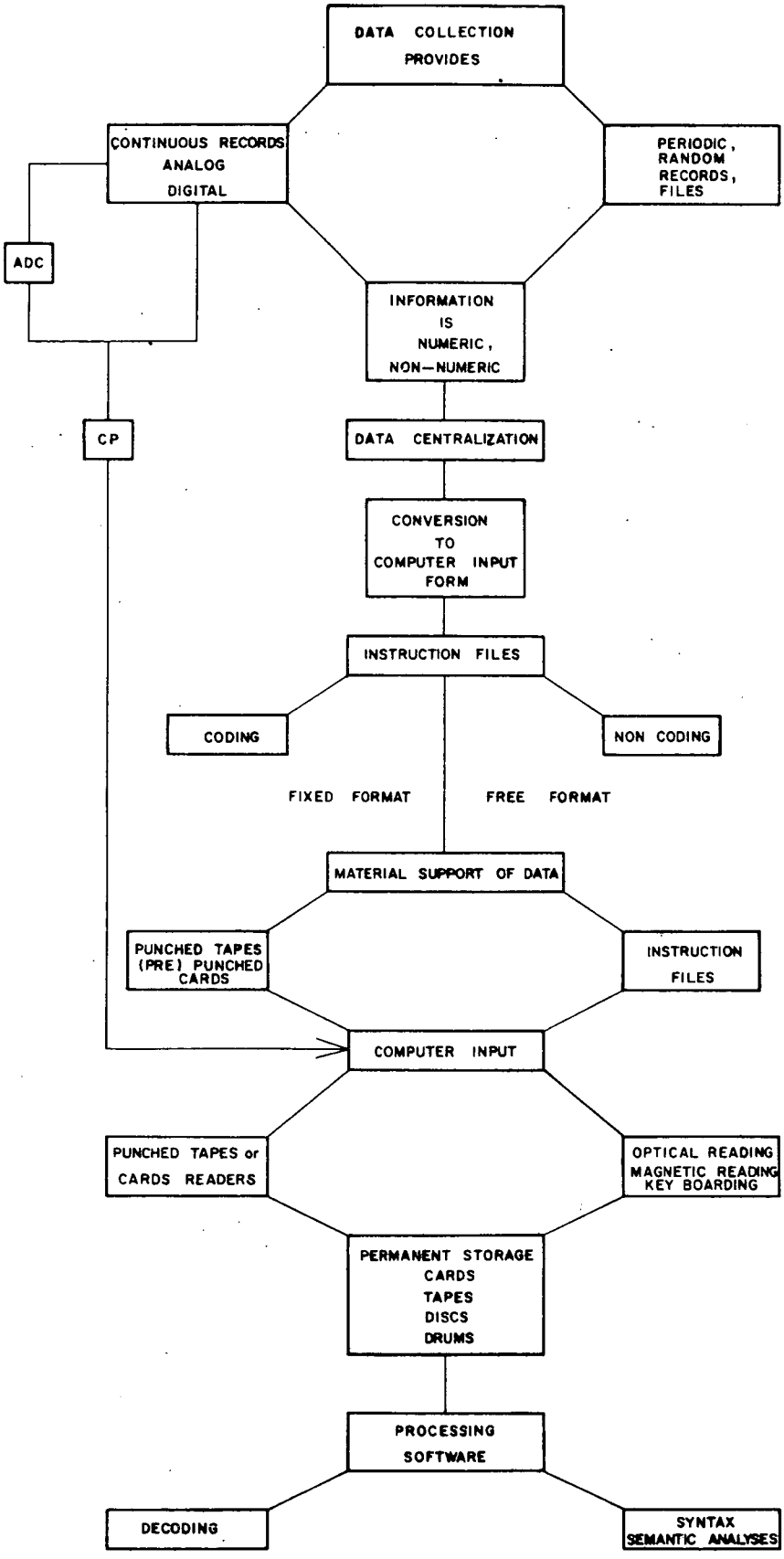
The Great Artesian Basin Simulation Model (GABSIM) is programmed in FORTRAN IV (Ungemach, in prep.) and will be run on Control Data Computer 3600 and 6600 (Cyber 76) series in CSIRO and by remote batch terminal in BMR.

Although the quantity of data is enormous, selections for quality of data have to be made. The assumptions made for reliability of the data will be a major part of the data collection exercise and the study as a whole.

In order to manipulate even a selection of the available data, in view of the comprehensive model simulation to be performed, extensive use of computer processed data has to be made.

Because the original data is stored in a variety of forms and systems, and because of the need, during the computer modelling, of central storage and retrieval of collected data, it was clear that a specifically

SCOPE OF A.D.P.



ADC = ANALOG - DIGITAL CONVERSION

CP = COMPUTER PROCESSING

FIG. 2

designed ADP system for the project had to be developed. The design of the present ADP system is solely to serve the specific purposes of the GAB hydrogeologic project. However interchange of data with other systems, whether in BMR or State authorities, can easily be accomplished. For example the Master card is designed in such a way that it is compatible with other BMR and Geological Survey of Queensland (GSQ) systems for water and petroleum wells.

The following had to be considered in the design of the GAB-ADP system:

- The system has to operate with minimum personnel, in minimum time, at minimum cost.
- The system is to be used for a specific study, dealing with geological and hydrological items, and should avoid becoming a general, national or idealistic system, although compatability with other natural resources data banks had to be considered.
- Standard computer equipment should be usable.
- Instruction (or data inventory) files must require minimum transfer operations between data location and computer storage, and be designed in such a way that complicated coding of information is avoided.
- Questionnaires should not pursue perfection but realism. In particular, geological information, pre-eminently non-numeric, must be considered from a practical hydrogeological viewpoint and not from the fundamental geology aspect.
- Items should not be included in the transfer sheets in such a way that there is any change in the degree of reliability or subjectivity.

WATER RESOURCES DATA BANK

PHYSICAL MEANING

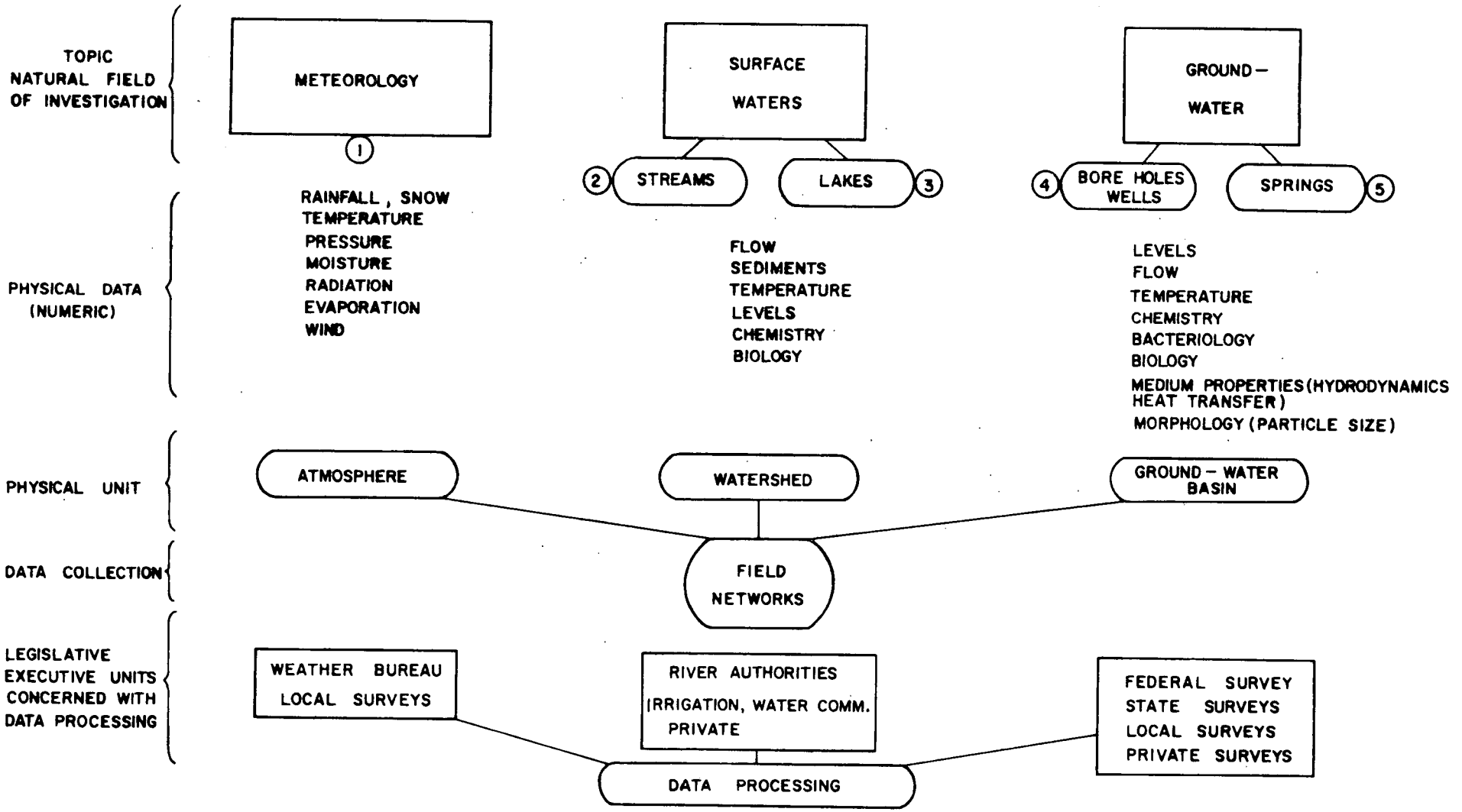


FIG. 3

The final product is therefore an ADP system, with the characteristics of:

elementary approach, simple coding following a basic fixed pattern, designed for a specific purpose, and usable on standard computer equipment.

Fig. 2 provides a general description of the operations of the ADP system. Fig. 3 shows, in a simplified way, the location, elements and connexion of the groundwater data in the whole watercycle and their relation to the other components, such as surface water and meteorology.

Note that the GAB-ADP system only applies to well information (coded 4), but it can be expanded to other information in the watercycle.

1.3 Organization of the Great Artesian Basin Automatic Data Processing System

1.3.1 Characteristics

The GAB-ADP system has the following characteristics:

- basic data, which are abbreviated or coded on the transfer sheets, filled in a fixed format form. A given topic of information is described and will be coded or abbreviated, as indicated in the enclosed manual for transcription of data.
- transfer sheets, containing 80 columns, from which the transcribed data can be directly punched on to 80 column punch cards, after checking and reviewing by the data-collection team and the geologist in charge. These sheets record information about:

  A Master information

  B Well casing and screen

  C Lithostratigraphy

  D Aquifer description

  E Well discharge

  F Well production

  G Head and temperature

GAB ADP SYSTEM OPERATIONS FLOW CHART

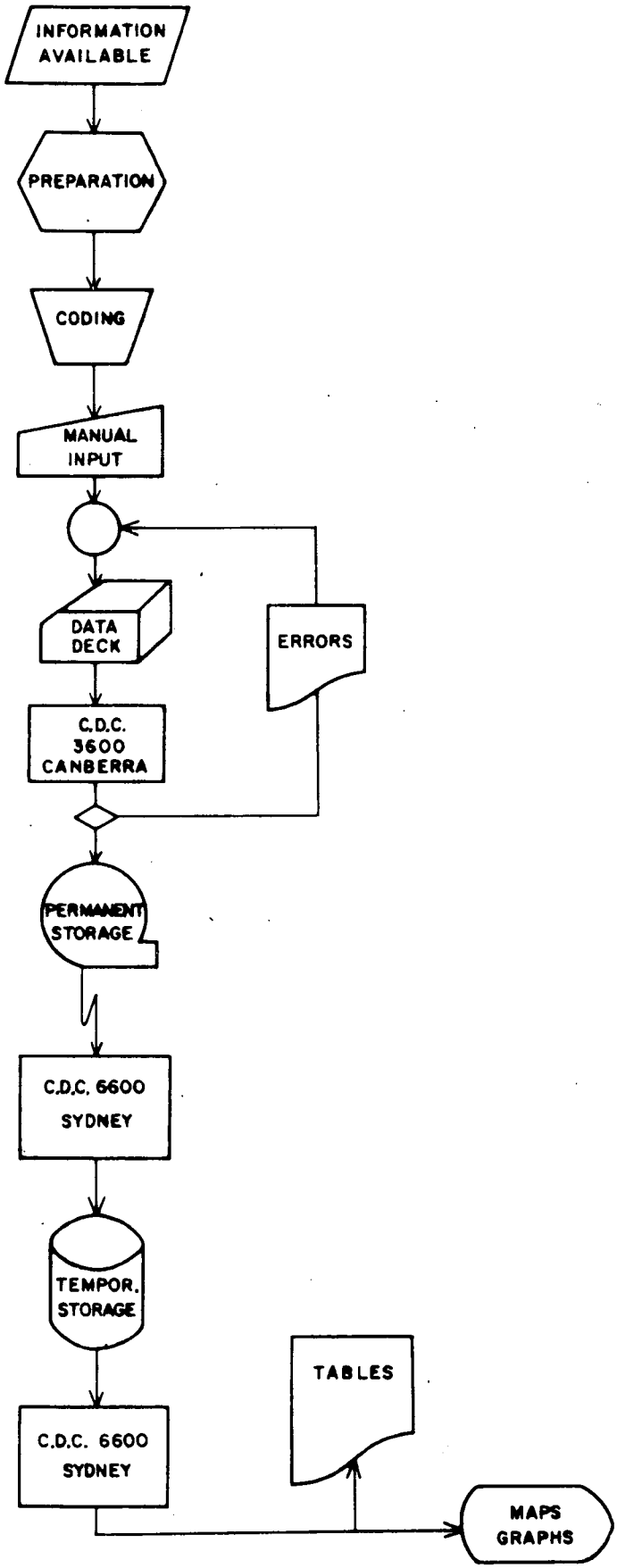


FIG. 4

H Well hydrodynamics

I Pumping and flowing test

J Well characteristic curve

K Total dissolved solids

L Water chemistry-1

M Water chemistry-2

Items A, B, C and part of D refer to fixed information, while E to M deal with types of information which vary with time.

- first computer data input which is the cards, punched directly from the transfer sheets, filled with transcribed data. This basic computer input is used to generate magnetic tapes, which are loaded sequentially with data from the card deck (Fig. 4). These magnetic tapes are used for the final support of data or input to the computer. Temporary storage during computer processing is by magnetic discs, allowing fast selective access to information.
- the loading, checking, updating and processing software package (GABADP) to be used for this ADP system, will be a program written in FORTRAN IV. The GABADP package and listing will be described (Krebs, in prep.).
- major operations involved in the GAB-ADP system are summarized in the flow-chart of Fig. 4. The components of the GAB-ADP system or main items of information are shown in Fig. 5.

1.3.2 Code explanation

The major code, which defines the transfer sheets and data cards, consist of two characters. The first, shown in column 1, is a numeral referring to a component of the water cycle (Fig. 3); for the present transfer sheets and data cards it is the numeral 4, which refers to wells. The second character, an alphabetic character, refers to the specific information item such as those listed in 1.3.1 and shown in Fig. 5.

GAB ADP SYSTEM DATA BANK ORGANIZATION

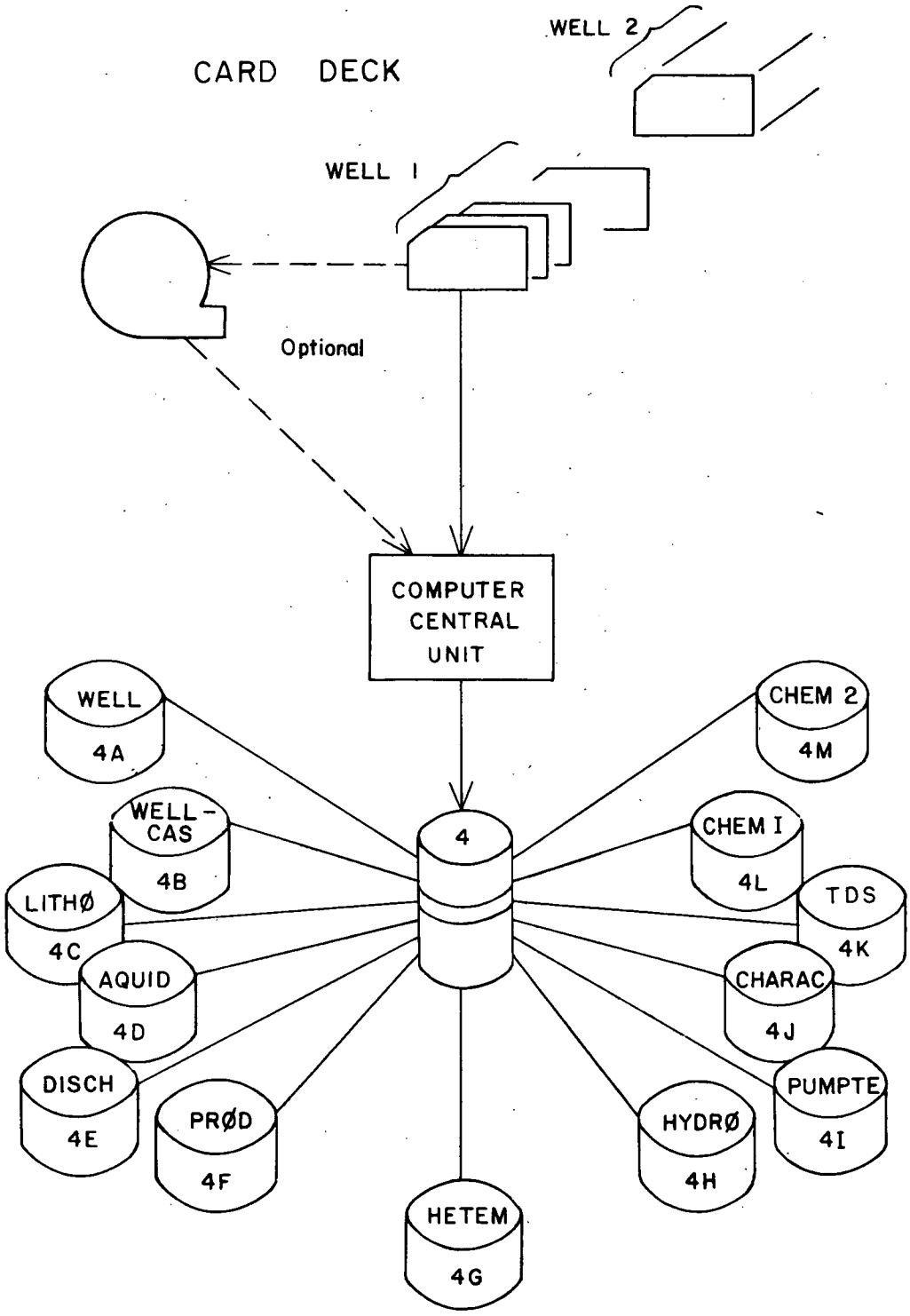


FIG. 5 'EXPLOSION' OF THE BANK

1.3.3 Identification

On all transfer sheets and data cards, the same identification section is shown. This provides an unique identification of the well about which data are recorded, and specifies its geographical position.

The first column of the identification section, column 3, is filled with a numeric character, indicating the State in which the well is located (see explanation of the Master sheet for code). Column 4 is filled with the second letter of the 1:1 000 000 topographical map sheet identification (the first letter S, being common to all Australia, is omitted). Columns 5 to 8 refer to the numeric index of the 1:250 000 map sheet on which the well is located (Fig. 6).

Column 9 is used to indicate whether there are subsequent cards with more data for the same well.

Column 10 is used to indicate whether the well has been deepened during its existence.

Column 11-15 deal with the well number, to be filled in from the Registration Number (which are exclusive and sequential in each State), used by the issuing authority, e.g. IWSC-Qld, WCIC-NSW, etc. Note that the identification section is the same for an individual well on all cards, with the exception of column 9, which contains information unique to each card.

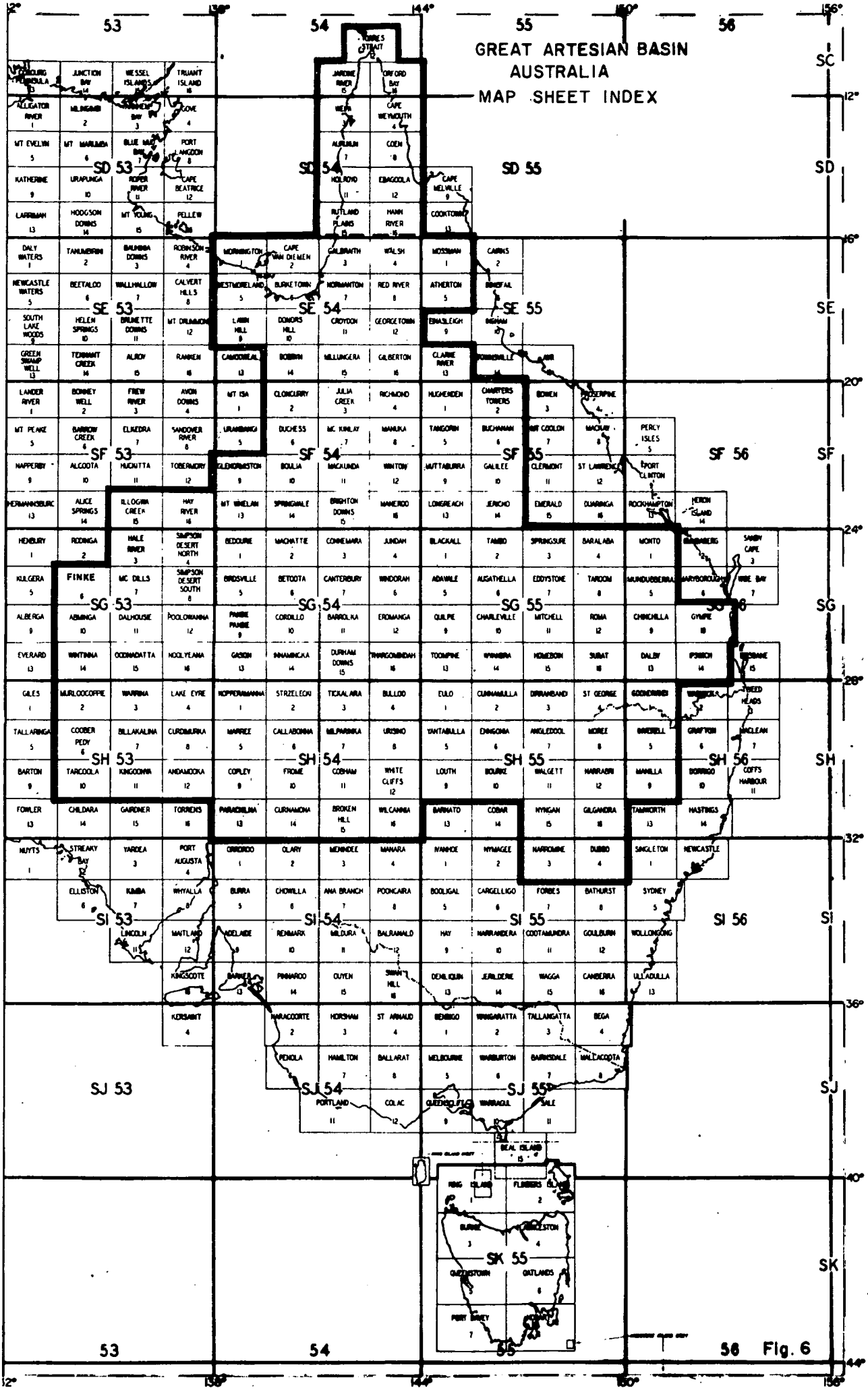

GREAT ARTESIAN BASIN
AUSTRALIA
MAP SHEET INDEX
53
54
55
56
SC
SD
SE
SF
SG
SH
SI
SJ
SK
SD 53
SD 54
SD 55
SE 53
SE 54
SE 55
SF 53
SF 54
SF 55
SF 56
FINKE
SG 53
SG 54
SG 55
SG 56
SH 53
SH 54
SH 55
SH 56
SI 53
SI 54
SI 55
SI 56
SJ 53
SJ 54
SJ 55
SK 55
12°
16°
20°
24°
28°
32°
36°
40°
44°
128°
132°
136°
140°
144°
148°
152°
156°
160°

Fig. 6

2. TRANSFER SHEET AND DATA CARD PRESENTATION

This chapter on the Automatic Data Processing system for use in the Great Artesian Basin hydrogeological project, is designed as an operator's manual for the transcription of well information on to transfer sheets. It provides the data collection team with the guidelines needed for this operation.

2.1 Preliminary remarks

The transfer sheets for all cards contain eighty columns on one line, and deal with several headings and subheadings. These columns (headings and their detailed content) have to be filled either in coded or non-coded form, as indicated in the following explanatory notes.

One line with eighty columns on a transfer sheet correspond with one standard IBM punch card containing eighty columns. Information recorded on the fixed format transfer sheets will be punched onto IBM punch cards.

All alpha-numeric data are to be framed on the left hand side of the space allowed for the set of digits of the record, i.e. left justification,

example: ALLANDALE 1

| A | L | L | A | N | D | A | L | E | | 1 | | | | right

| | | A | L | L | A | N | D | A | L | E | 1 | | | wrong

All numerical data are to be framed on the right hand side of the space allowed for the set of digits of the record, unless the contrary is stated in the explanatory note, i.e. right justification,

example: 530

| | | | | | 5 | 3 | 0 | right

| | | | 5 | 3 | 0 | | | wrong

| 5 | 3 | 0 | | | | | | wrong

Filling of the reliability items will be done after consultation with the geologist in charge of the data collection operation; reference should also be made to him if any doubts occur when filling the transfer sheets.

Date items have to be filled in 2 or 3 columns, depending on the type of transfer sheet. For the date in years, these 2 or 3 spaces refer to the 2 or 3 last numbers of the year (see note on the filling of numerical data), example: 1892

yields either | 8 | 9 | 2 |

or | | 9 | 2 |

Months, coded from 1 to 12 and days, 1 to 31, have to be filled in accordance with the note on the framing of numerical data (right justification).

A blank character (quoted b in the explanatory notes) is equivalent to zero in numerical format.

The following alphabetic and numerical characters are to be used during the filling of the transfer sheets:

0 - zero	Ø - alphabetic O
1 - one	I - alphabetic I
2 - two	Z - alphabetic Z

If these symbols are not used during the data collection stage, errors may occur in the punching stage, subsequently causing expensive or time-consuming errors in the processing stage.

All depths, heights and elevations are to be scheduled in feet or feet and tenths of feet (and not in inches). Inches (and fractions of inches) are only used for diameter measurements on the Well screen and casing sheet.

All depths or heights are taken from a reference level, which is ground level unless stated otherwise. Provision is made on the transfer sheets for measurements taken from other reference points.

Aquifer numbering and filling of the Lithostratigraphy sheet and parts of the Aquifer description, Well hydrodynamics and Pumping and flowing test sheet will be done by the geologist in the data collection team, or under his guidance.

2.2 Master card

The master card deals with the main constant information about a well, with regard to identification (registration number, name), geographical location, ground elevation, total depth and completion date. Other information on this card refer to the type and use of the well, the availability of geological and geophysical logs and the existence of other data cards with information about the well. The master card does not give information about the amount and reliability of the information on other data cards.

B M R – G A B Groundwater project

MASTER SHEET

G A B – ADP System transfer sheet

CODE	IDENTIFICATION: State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number	WELL NAME	WELL LOCATION: Longitude Deg.	Min.	Sec.	Latitude Deg.	Min.	Sec.	Accuracy	GROUND ELEVATION: Feet	O.I feet	Accuracy	TOTAL DEPTH DRILLED (feet)	DATE COMPL.: Year	Mth.	TYPE AND USE	GEOL. LOG AVAIL.	GEOPH. LOG AVAIL.	CARD AVAILABILITY: Bore casing and screen	Lithostrat.	Aquif. desc.	Discharge data	Well production	Head and temperature	Hydrodyn.	Pump and Flow	Well charact.	T.D.S.	Chem. 1	Chem. 2	D.S.T.-M.C.
4,A																																				
4,A																																				
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WELL MASTER INFORMATION CARD EXPLANATORY NOTE

MASTER TRANSFER SHEET

Topic	Total	Column Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card; see Introduction, 1.3.2.	Master card 4 A
IDENTIFICATION	13	3	15	Columns 3 to 15 refer to the identification of the well, i.e. the general geographic location and well number.	
State	1	3	3	Column 3 refers to the state where the well is located to be coded as: A.C.T. 1 N.S.W. 2 N.T. 3 Qld. 4 S.A. 5 Tasm. 6 Vict. 7 W.A. 8 P.N.G. 9	Queensland Qld. 4
Map identification	5	4	8	Columns 4 to 8 refer to the map on which the well is located.	
Letter	1	4	4	Column 4 refers to the second letter which characterizes 1:1 000 000 and 1:250 000 topographic and geological map sheets. (Omit the first letter S of the map reference)	Charleville SG 55 G

Master transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Map number	4	5	8	Columns 5 to 8 refer to the map sheet number Columns 5 and 6 refer to the index number of the 1:1 000 000 topographic and geological map sheets. Columns 7 and 8 refer to the number of the 1:250 000 topographic and geological map sheets that follows the number in columns 5 and 6. These numbers in columns 7 and 8 (1 to 16) are the subdivisions of the 1:1 000 000 map sheet (in columns 5 and 6). Note: Figure 6 shows the distribution of map names and numbers.	SG 55 |5|5| Tambo SG 55 - 2 |2| Roma SG 55 - 12 |G|5|5|1|2|
Card continuation	1	9	9	Column 9 refers to card continuation. Fill column 9 with 0, if after the present card (which corresponds to one horizontal line on the transfer sheet) no other card follows with information about the specific well. Fill Column 9 with 1, if another card follows with records about the well. Note: Column 9 will be unique for each transfer sheet. Continue filling column 9 with 1 until the last but one card, and insert 0 on the last card (or line in case of the transfer sheet).	

Master transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Deepening	1	10	10	Column 10 indicates whether the well has been deepened during its existence. Insert 1 in column 10 if the well is deepened once, 2 if its deepened for the second time, 3 for the third time, etc. If there was no deepening after the initial drilling, fill column 10 with 0.	not deepened |0| deepened |1| 3rd deepening |3|
Well number	5	11	15	Columns 11 to 15 include the well number. Fill columns 11 to 15 with	
				Queensland: bore registration number of IWSC (Irrigation and Water Supply Commission).	Qld: RN 7348 |7|3|4|8|
				New South Wales: bore registration number of WCIC (Water Conservation and Irrigation Commission).	N.S.W.: 2685 |2|6|8|5|
				South Australia: bore registration number of Dept. of Mines, which consist of nine figures and has to be reduced to five figures as follows: Omit the first figure (grid squares areas S.A.: 052 to 125 → 52 to 25), and use the 2nd and 3rd figures (52 to 25), omit the 4th, 5th and 6th figures (county numbers: 000); use the 7th, 8th and 9th figures representing the S.A. bore number.	S.A.: 064000128 |6|4|1|2|8|
				Northern Territory: System to be determined.	
				Note: Fill last number in column 15 i.e. right justification of numeric data.	| |6|7|8|4| right |6|7|8|4| | wrong

Master transfer sheet

Topic	Total	Column Start	End	Explanation	Example
				Note: Columns 3 to 15 include the main identification of the well and are repeated on all transfer sheets/cards, except for column 9, which depends on the amount of information for a well, and whether this information can be inserted on one or more cards/lines on transfer sheets. Column 9 will therefore be different for all transfer sheets/cards, while columns 3 to 8 and 10 to 15 contain the same information on all transfer sheets/cards for one well.	
WELL NAME	10	16	25	Columns 16 to 25 refer to the well name. If no name exists, leave columns blank. When the name exceeds 10 characters, stop at the 10th character. If a number follows the name, the last columns must be used for the number, and a dash placed before the number. In some cases mnemonic abbreviations should be used (see example). For further explanation on abbreviations refer to Preliminary remarks. Note: Left justification for alphabetic data	Alton |A|L|T|O|N| | | | | | Cunnamulla |C|U|N|N|A|M|U|L|L|A| Thargomindah |T|H|A|R|G|O|M|I|N|D| Cunnamulla No. 3 |C|U|N|N|A|M|U|L|-|3| Lightning Ridge |L|I|G|H|T|R|I|D|G|E|
WELL LOCATION	14	26	39	Columns 26 to 39 refer to the well location in longitude and latitude.	
Longitude	7	26	32	Columns 26 to 32 refer to the longitude of the well location, in degrees (columns 26 to 28), minutes (columns 29 and 30), and seconds (columns 31 and 32).	$136^{\circ}42'09''$ |1|3|6|4|2|0|9|
Latitude	6	33	38	Columns 33 to 38 refer to the latitude of the well location in, degrees (columns 33 and 34) minutes (columns 35 and 36), and seconds (columns 37 and 38).	$24^{\circ}07'12''$ |2|4|0|7|1|2|

Master transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Accuracy	1	39	39	Column 39 designates the accuracy of the well location, as inserted in columns 26 to 38, and is to be coded as: unknown 0 surveyed by instrument 1 not surveyed by instrument 2 (If a well is plotted on a map, this does not necessarily mean that it has been surveyed).	not surveyed |2|
GROUND ELEVATION	6	40	45	Columns 40 to 44 refer to the ground elevation of the well in feet. Fill columns 40 to 43 with the integer part of this figure (with the last figure in column 43), and column 44 with the decimal part. Note: If the ground elevation is below sea level, fill column 40 with -.	954.3 | |9|5|4|3|
Accuracy	1	45	45	Column 45 refers to the accuracy of the ground elevation recorded columns 40 to 44, coded as: unknown 0 elevation surveyed (instrument) 1 elevation not surveyed (instrument) 2	330.0 not surveyed | |3|3|0|0|2|
TOTAL DEPTH DRILLED	5	46	50	Columns 46 to 50 refer to the total depth drilled in feet, with an accuracy of 1 foot; ignore decimal parts. Last figure in column 50. (right justification).	3027 | |3|0|2|7| 13465.8 |1|3|4|6|5| 6854.2 | |6|8|5|4|

Topic	Total	Column Start	End	Explanation	Example
DATE COMPLETED	5	51	55	Columns 51 to 55 refer to the date of completion of the well.	13 May 1887 |8|8|7|0|5|
Year	3	51	53	Columns 51 to 53 refer to the three last figures of the year of completion	
Month	2	54	55	Columns 54 and 55 refer to the month during which the well was completed. Code the months from 1 to 12. If the year of completion is unknown, leave columns 51 to 55 blank; if the month is unknown, leave columns 54 and 55 blank.	1928 |9|2|8| 7 July 1955 |9|5|5|0|7|
TYPE AND USE OF WELL	1	56	56	Columns 56 refers to the type and use of the well, i.e. the purpose of drilling the well and the present principal use of the well, coded as:	

type and use unknown	A
type unknown, use - water supply	B
water well, use - water supply (not specified)	C
" " " - town water supply	D
" " " - domestic water supply	E
" " " - irrigation water supply	F
" " " - stockwater supply	G
" " " - industrial water supply	H
" " " - dewatering	I
" " " - test and observation	J
" " " - abandoned	K
stratigraphic hole, use - stratigraphy and abandoned	L
" " " - water supply (not specified)	M
" " " - town water supply	N
" " " - domestic water supply	Ø
" " " - irrigation water supply	P
" " " - stock water supply	Q
" " " - industrial water supply	R
" " " - test and observation	S

Topic	Total	Column Start	End	Explanation	Example
				petroleum well, use - petroleum production well	T
				" " " - abandoned	U
				" " " - water supply (not specified)	V
				" " " - town water supply	W
				" " " - domestic water supply	X
				" " " - irrigation water supply	Y
				" " " - stock water supply	Z
				" " " - industrial water supply.	1
				" " " - test and observation	2
				" " " - (water) recharge/injection	3
				mining exploration, use - mining exploration and abandoned	4
				" " " - water supply (not specified)	5
				" " " - water observation	6
				waste disposal	7
				miscellaneous	8
				others	9
				others	0
AVAILABILITY OF GEOLOGICAL LOGGING	1	57	57	Column 57 refers to the availability of geological well logging, to be coded as: unknown 0 geological log available 1 no geological log available 2 Note: This does not refer to a driller's log	geological log [1]
AVAILABLE GEOPHYSICAL LOG (S)	1	58	58	Column 58 refer to the availability of geophysical logs, whether electrical (spontaneous-potential, resistivity, conductivity), gamma-ray, neutron, caliper, casing, temperature or acoustic log. Code this information as: unknown 0 geophysical log (s) 1 no geophysical log (s) 2	gamma-ray log [1]

Master transfer sheet

Topic	Total	Column Start	End	Explanation	Example
CARD AVAILABILITY	22	59	80	Columns 59 to 80 refer to the availability of cards with specific information. Insert in these columns the highest folio number of specific data cards for a given well; if no card is present fill in 0. (Each data card corresponds with one line on the corresponding transfer sheet). Note that the amount and reliability of the information on the data cards (or transfer sheets) is not defined in the columns of the Master card; records in columns 59 to 80 refer only to the availability of other data cards, and the total number of these cards.	

Columns 59 and 60 Well casing and screen card (4 B)
Columns 61 and 62 Lithostratigraphy card (4 C)
Column 63 Aquifer description card (4 D)
Columns 64 and 65 Well discharge data card (4 E)
Columns 66 and 67 Well production card (4 F)
Columns 68 and 69 Head and temperature card (4 G)
Column 70 Well hydrodynamics cards (4 H)
Columns 71 and 72 Pumping and flowing test card (4 I)
Column 73 Well characteristic curve card (4 J)
Column 74 Total dissolved solids card (4 K)
Columns 75 and 76 Water chemistry - 1 card (4 L)
Columns 77 and 78 Water chemistry - 2 card (4 M)
Columns 79 and 80 are left open for optional further information cards.

2.3 Well casing and screen card

The well casing and screen card deals with the down-hole equipment of the well, and gives details of the casing, cementation, screens (including perforated or slotted casing), and open hole.

This provides reliable data on the aquifers tapped by the bore; it is especially important if there are no lithostratigraphic and permeability data.

B M R – G A B Groundwater project

WELL CASING AND SCREEN SHEET

G A B — ADP System transfer sheet

CODE	IDENTIFICATION						RECORDS																						YEAR COMPLETED	FOLIO NUMBER
							N° 1											N° 2												
	State	Letter	1:250 000 Map Number	Card cont.	Deepening	Well Number	Equip. diam.	Nature	Material	Depth from	Depth to	Drilling diam.	Method	Cemented from	Cemented to	Corroded		Equip. diam.	Nature	Material	Depth from	Depth to	Drilling diam.	Method	Cemented from	Cemented to	Corroded			
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16 17 18 19	20	21	22 23 24 25	26 27 28 29	30 31 32 33	34	35 36 37 38	39 40 41 42	43	44 45	46 47 48 49	50	51	52 53 54 55	56 57 58 59	60 61 62 63	64	65 66 67 68	69 70 71 72	73	74 75	76 77	78 79 80
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Well casing and screen transfer sheet

Topic	Column Total	Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Well casing and screen card | 4 | B |
IDENTIFICATION	13	3	15	For filling columns 3 to 15, refer to Master Card explanatory note, from which the identification is to be repeated.	
				Note column 9, see Introduction, 1.3.3. Column 10 refers to the deepening of the well; first deepening, fill in 1, second deepening: 2, 3rd, 4th and 5th: 3, 4 and 5. First reconditioning of the well, fill in 6, 2nd recond.: 7 etc.	
RECORDS	30	16	45	Two record sequences are allocated to each line of the Well casing and screen transfer sheet (which corresponds to one data card); record 1 from columns 16 to 45, record 2 from columns 46-75.	
Equipment diameter	4	16	19	Columns 16 to 19 refer to the diameter of the equipment (casing, screen, open hole) in inches.	
				Columns 16 and 17 to be used for the integer part, columns 18 and 19 for the fractional part.	9'5/8 | | 9 | 5 | 8 |

Well casing and screen transfer sheet

Topic	Column Total	Start	End	Explanation	Example
Nature	1	20	20	Column 20 refers to the nature of the equipment, to be coded as indicated below: unknown 0 open hole 1 cased 2 perforated casing 3 screened 4 5 6 7 8 9	cased well | 2 |
Material	1	21	21	Column 21 refers to the type of material of the downhole equipment: unknown 0 metal 1 plastic 2 timber 3 4 5 6 7 8 other 9	metal | 1 |
Depth	8	22	29	Columns 22 to 29 refer to the depth interval in feet (ignore decimal parts) for which equipment is present in the bore-hole. Last numbers in columns 25 and 29, i.e. right justification	to 931.5 | | 9 | 3 | 1 | from 450.3 | | 4 | 5 | 0 |

Well casing and screen transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Drilling diameter	4	30	33	Columns 30 to 33 refer to the diameter of the <u>drilled</u> hole in inches. Columns 30 and 31 to be used for the integer part, columns 32 and 33 for the fractional part.	12' 7/8 |1|2|7|8|
Method	1	34	34	Column 34 refers to the method of drilling, to be coded as indicated below: cable tool 1 rotary 2 jetted 3 down hole hammer 4 dug well 5 6 7 8 9	
Cemented	8	35	42	Columns 35 to 42 refer to the depth interval from top to bottom in feet (ignore decimal parts) for which the bore-hole has been cemented. Last numbers to be filled in columns 38 and 42, i.e. right justification.	from 250.8 | |2|5|0| to 0.0 | | | |0|
Corroded	1	43	43	Column 43 refers to the condition of the well-casing. A corroded section of the casing is coded as 1, a non-corroded section as 2. If unknown, fill column 43 with 0. Information about corrosion will mostly come from geophysical logging, i.e. the casing collar locator log.	corrosion |1|

Well casing and screen transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Miscellaneous	2	44	45	Columns 44 and 45 are left open for optional further information eventually required for the Well casing and screen card.	

The record sequence is to be repeated in the columns 46 to 75 of the Well casing and screen transfer sheet/card.

YEAR COMPLETED	2	76	77	Columns 76 and 77 refer to the date of completion of the well; the last two numbers of the year to be filled in, see note in 2.1.	1927 | 2 | 7 |
FOLIO NUMBER	3	78	80	Columns 78 to 80 are for the folio numbering of the Well casing and screen card. This folio number refers to one well, i.e. the sequence of cards (which corresponds to lines on a transfer sheet) to be used for one well. The folio number is framed to the right, see note in 2.1.	9th record is on 5th line (= 5th card) | | | 5 |

2.4 Lithostratigraphy card

The lithostratigraphy card deals with the information about the lithostratigraphy of the well versus depth.

The lithostratigraphy is expressed as far as possible in formations, for which names are abbreviated to two, three, or (maximal) four-digit alphabetic symbols, similar to the ones used on BMR geological maps.

The alphabetic symbols, representing formation names, are recorded versus the depth at which this specific formation or lithostratigraphic unit is first encountered in the well, i.e. the top of the formation is stated (in feet).

BMR – GAB Groundwater project

LITHOSTRATIGRAPHY SHEET

GAB — ADP System transfer sheet

CODE	IDENTIFICATION						LITHOSTRATIGRAPHY RECORDS														FOLIO NUMBER
	State	Letter	1:250000 Map Number	Card Cont.	Deepening	Well Number	1		2		3		4		5		6		7		
							Depth	Lithost.	Depth	Lithost.	Depth	Lithost.	Depth	Lithost.	Depth	Lithost.	Depth	Lithost.	Depth	Lithost.	
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29	30 31 32 33	34 35 36 37 38	39 40 41 42	43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60	61 62 63 64 65	66 67 68 69	70 71 72 73 74	75 76 77 78	79 80
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Lithostratigraphy Transfer Sheet

Topic	Column Total	Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card; see Introduction, 1.3.2.	Lithostratigraphy card 4 | C
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the bore; this information is to be repeated from the master card; for filling of these columns, refer to the master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
LITHO-STRATIGRAPHY/ DEPTH RECORDS	63	16	78	Seven litho-stratigraphy/depth records are allocated to each line of the litho-stratigraphy transfer sheet (which corresponds to one data card).	
DEPTH	5	16	20	Columns 16 to 20 refer to the depth of the top of the formation in feet (ignore decimal parts). The depth is to be recorded as a depth in feet of the formation top measured from the ground elevation as datum. In case measurements of formation tops are made from the kelly bushing or other part of the drilling rig, the depths have to be recalculated from groundlevel.	368.5' | | 3 | 6 | 8 | 12375' 1 | 2 | 3 | 7 | 5 |

Lithostratigraphy Transfer Sheet

Topic	Column Total	Start	End	Explanation	Example
Litho-stratigraphy	4	21	24	Columns 21 to 24 refer to the lithostratigraphy of the bore-hole or well. The lithostratigraphy is expressed in formations, the names of which are abbreviated to two, three or (maximal) four digit alphabetic symbols, similar to the ones used on BMR geological maps; the symbols are listed in the appendix. Fill the first letter in column 21. ie. left justification, as para 2.1.	
				A total of seven records can be filled in columns 16 to 24, 25 to 33, 34 to 42, 43 to 51, 52 to 60, 61 to 69 and 70 to 78	Top of Hooray Sandstone at 348 ft | | |3|4|8|J|K|H| |
FOLIO NUMBER	2	79	80	Columns 79 and 80 refer to the folio number of the lithostratigraphy card. This folio number refers to one well i.e. the set of cards (or lines on a transfer sheet) used for one well.	18th formation, on 3rd line (= card No. 3) | |3|

2.5 Aquifer description card

The aquifer description card records all reliable information on the aquifers or waterbearing pervious layers which is available in well logs. This information includes the depth of the aquifer(s), lithostratigraphy, qualitative permeability description, depth of water struck, records showing the artesian or subartesian character of the well, the pressure head or depth of standing water level recorded and the flowrate in case of an artesian bore.

B M R – G A B Groundwater project

AQUIFER DESCRIPTION SHEET

G A B – ADP System transfer sheet

CODE	State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number	No.1 Aquifer Number Main	No.1 Aquifer Number Sub layer	No.1 Top Depth	No.1 Bottom Depth	No.1 Lithostr.	No.1 Perm. Cls.	No.1 Perm. Sce.	No.1 Perm. Rel.	No.1 Depth Tested	No.1 Pressure or Depth Sign	No.1 Pressure or Depth	No.1 Flow Rate When Flowing (100 g.p.d)	No. 2 Aquifer Number Main	No. 2 Aquifer Number Sub layer	No. 2 Top Depth	No. 2 Bottom Depth	No. 2 Lithostr.	No. 2 Perm. Cls.	No. 2 Perm. Sce.	No. 2 Perm. Rel.	No. 2 Depth Tested	No. 2 Pressure or Depth Sign	No. 2 Pressure or Depth	No. 2 Flow Rate When Flowing (100 g.p.d)	FOLIO NUMBER
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17 18	19 20 21 22	23 24 25 26	27 28 29 30	31	32	33	34 35 36 37	38	39 40 41 42	43 44 45 46 47	48	49 50	51 52 53 54	55 56 57 58	59 60 61 62	63	64	65	66 67 68 69	70	71 72 73 74	75 76 77 78 79	80
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Aquifer description transfer sheet

Topic	Total	Column Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Aquifer description card | 4 | D |
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the Master card; for filling of these columns, refer to the Master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
AQUIFER DESCRIPTION RECORDS	32	16	47	Two record sequences are allocated to each line of the Aquifer description transfer sheet (which corresponds to one data card).	
Aquifer number	3	16	18	Columns 16 to 18 refer to the aquifer number, i.e. the numerical position of the aquifer in the stratigraphic sequence, started from the top of the well.	
				Column 16 refers to the main water-producing rock layer as follows:	
				Water table 1	
				Hooray Sandstone and Adori Sandstone aquifers, and correlates 2	Hooray Sandstone | 2 |
				Hutton Sandstone, Evergreen Fm. and Precipice Sandstone aquifer 3	Hutton Sandstone | 3 |
				Triassic, Permian and stratigraphically deeper aquifers 4	several main aquifers tapped | 9 |
				Note: If several Main Aquifers are tapped, fill column 16 with 9; if unknown which aquifer is tapped, fill with 0.	unknown | 0 |

Topic	Total	Column Start	End	Explanation	Example
				Columns 17 and 18 refer to the numbers of the sub-layers, or individual aquifers, within the well. This numbering starts from the top and is solely a serial number system in each well referring only to single layers in that well.	
Top depth	4	19	22	Columns 19 to 22 deal with the depth, in feet (ignore decimal parts), of the top of the intersected pervious water-producing interval (right justification).	2031'6" | 2 | 0 | 3 | 1 |
Bottom depth	4	23	26	Columns 23 to 26 deal with the depth in feet (ignore decimal parts), of the bottom of the intersected pervious water-producing interval (right justification).	4245'6" | 4 | 2 | 4 | 5 |
				Note: If the depths are greater than 10 000 feet, delete the first number. The computer will automatically check the right value.	
Lithostratigraphy	4	27	30	Columns 27 to 30 refer to the lithostratigraphic coding of the corresponding aquifer; see explanatory note Lithostratigraphy transfer sheet (left justification).	Precipice Sandstone | J | L | P | |
Permeability description	3	31	33	Columns 31 to 33 refer to the Permeability description of the aquifer.	
Permeability class	1	31	31	Column 31 is the Permeability class, coded as: unknown 0; Less than 10^{1} Md:poor 1	

Aquifer description transfer sheet

Topic	Total	Column Start	End	Explanation		Example
				10^1-10^2 Md: medium	2	80 Md
				10^2-10^3 Md: good	3	medium permeability
				10^3-10^4 Md: high	4	|2|
				greater than 10^4 Md: very high	5	
Permeability determination	1	32	32	Column 32 refers to the source of permeability determination, coded as follows:		
				unknown	0	laboratory analysis
				field description	1	|3|
				sample description	2	
				laboratory analysis	3	
					4	
					5	
					6	
Reliability of permeability information	1	33	33	Column 33 refers to the reliability of information about permeability, coded:		
				unknown	0	good
				good	1	|1|
				medium	2	
				poor	3	
Depth tested	4	34	37	Column 34 to 37 refer to the Depth at which water was met during drilling (normally expressed in drillers' logs as "Water struck"). Record depth in feet; ignore decimal parts; right justification.		water struck 941.6 | |9|4|1|

Topic	Total	Column Start	End	Explanation	Example
Pressure or depth	5	38	42	Columns 38 to 42 refer to the pressure or depth of the water in the well, and whether the well is artesian or sub-artesian.	
				Column 38 shows whether the well was flowing (artesian) or non-flowing (sub-artesian) at the time of completion. Fill column 38 with + in case of an artesian bore, i.e. when the "water level" is expressed as a positive pressure in feet (above the ground surface or pressure plug), and fill with - when the standing water level is expressed as a (negative) depth below the ground surface.	pressure above ground surface | + | standing water level | - |
				Columns 39 to 42 deal with the level to which water rose in relation to ground level, (right justification).	12 feet | | | 1 | 2 |
Flowrate	5	43	47	Columns 43 to 47 deal with the cumulative flowrate recorded when the aquifer (sub-aquifer) met is artesian and the well free-flowing. The flowrate is expressed in 100 g.p.d. Last number in column 47, 2.1, right justification.	27500 gpd | | | 2 | 7 | 5 |
				Note: When column 38 is filled with + and the flowrate is unknown, the columns 43 to 47 must be filled with UNKNW	| U | N | K | N | W |
				A second set of records is to be filled in columns 48 to 79.	
4 FOLIO NUMBER	1	80	80	Column 80 include the Folio number of the Aquifer description card. This folio number refers to one well, i.e. the sequence of cards (and lines on a transfer sheet) to be used for one well.	5 records on 3 lines (= 3rd card) | 3 |

2.6 Well discharge data card

The well discharge data card contains all reliable information on the rate of discharge of wells throughout their histories. Information includes date of discharge measurement, dynamic level or back pressure, type of flow, data about the outlet of the well and whether it is a single well or a group of wells, a single aquifer or group of aquifers tapped.

BMR – GAB Groundwater project

WELL DISCHARGE DATA SHEET

GAB – ADP System transfer sheet

CODE	IDENTIFICATION State	Letter	1:250000 Map Number	Card cont.	Deepening	Well Number	MAIN AQUIFER	RELIABILITY	SINGLE WELL	DISCHARGE RECORDS No.1 Date Year	Month	Discharge Rate 10^3 gpd	Reliability	Sign	Dynamic Level Back Pressure	O.I	Unit	Type of Flow	Outlet	Comments	No.2 Date Year	Month	Discharge Rate 10^3 gpd	Reliability	Sign	Dynamic Level Back Pressure	O.I	Unit	Type of Flow	Outlet	Comments	No.3 Date Year	Month	Discharge Rate 10^3 gpd	Reliability	Sign	Dynamic Level Back Pressure	O.I	Unit	Type of Flow	Outlet	Comments	FOLIO NUMBER
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18	19 20	21 22	23 24 25 26	27	28	29 30 31	32	33	34 35	36	37 38	39 40	41 42	43 44 45 46	47	48	49 50 51	52	53	54 55	56	57 58	59 60	61 62	63 64 65 66	67	68	69 70 71	72	73	74 75	76	77 78	79 80
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Well discharge data transfer sheet

Topic	Total	Column Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card; see Introduction, 1.3.2.	Well discharge data card 4 E
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the Master card; for filling of these columns, refer to the Master transfer sheet explanation. Note column 9, see Introduction 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described for the Aquifer description card:	
				Unknown 0	
				Watertable 1	
				Hooray Sandstone and Adori Sandstone aquifer, plus correlates 2	Hooray Sandstone 2
				Hutton Sandstone, Evergreen Fm. and Precipice Sandstone aquifer 3	
				Triassic, Permian and stratigraphically deeper aquifers 4	
				If several main aquifers are tapped: 9	

Well discharge data transfer sheet

Topic	Total	Column Start	End	Explanation	Example
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about aquifers tapped, coded as: unknown 0 good 1 medium 2 poor 3	good | 1 |
SINGLE WELL	1	18	18	Column 18 deals with information whether the well scheduled is a single well or a group of wells. If the well scheduled with regard to its discharge history is to be considered as a single well, column 18 has to be filled with 1; if it is considered as the representative well in the centre of a group of wells, fill in 2; if unknown, fill in 0.	single well | 1 | representative well | 2 | unknown | 0 |
DISCHARGE RECORDS	20	19	38	Three discharge record sets are allocated to each line of the well discharge data transfer sheet (which corresponds to one data card).	
Date	4	19	22	Columns 19 to 22 refer to the date of the well discharge measurement.	
Year	2	19	20	Columns 19 and 20 to be used for the last two numbers of the year, see 2.1.	
Month	2	21	22	Columns 21 and 22 for the month of the data collection (see 2.1), coded 1 to 12. If year and/or month are not known, don't fill the columns.	
Discharge rate	4	23	26	Columns 23 to 26 refer to the discharge rate recorded, expressed in 1000 gpd. Last number in column 26, i.e. right justified.	225000 | | 2 | 2 | 5 |

Well discharge data transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Reliability	1	27	27	Column 27 refers to the reliability of information about the well discharge rate, coded according to the method of measurement:	
				unknown — 0 orifice meter, orifice bucket, container - good — 1 types of weirs or flumes - medium — 2 jet stream measurements, other estimates - poor — 3	Container [1] V - weir [2]
Dynamic level	6	28	33	Columns 28 to 33 deal with the dynamic level or "back pressure" of the well.	
				Column 28 deals with the sign for the dynamic level or back pressure of the well (if given in feet) expressed as + for a flowing well, or well with a level or pressure (in feet) above groundsurface, and - for a well with a level or pressure (in feet) below groundsurface.	
				Columns 29 to 31 refer to the dynamic level or back pressure value for the integer part, fill last whole number in column 31 , the decimal part to be filled in column 32.	
				Column 33 refers to the unit in which the dynamic level or back pressure is expressed, coded as: pressure, elevation or depth in feet — 1 pressure in pounds per square inch - (p.s.i.) — 2 pressure in inches mercury — 3	
				Note: The back pressure is the pressure measured in the well when it is free flowing or partially closed by a valve.	

Well discharge data transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Type of flow	2	34	35	Columns 34 and 35 deal with the type of flow encountered in the well. A well can be: free flowing FF controlled CF pumped PF ceased to flow CD non-flowing NL	Free flowing bore F F
Outlet	1	36	36	Columns 36 refers to the history of the outlet of the well. Changes (lowering) of the outlet are recorded in the following way: 1st lowering of outlet 1 2nd lowering of outlet 2 3rd lowering of outlet 3 Note: record an unknown number of lowerings as 9. If the outlet has been raised instead of lowered, fill column 36 with : H	1st lowering 1
Miscellaneous/ Comments	2	37	38	Columns 37 and 38 are left for optional further information eventually required for the Well discharge rate card. Fill columns 37 and 38 with AD for an abandoned well and with LK for a well in which leakage occurs. Second and third sets of records are to be filled in columns 39 to 58 and 59 to 78.	
7 FOLIO NUMBER	2	79	80	Columns 79 and 80 are for the folio number of the well discharge data card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) to be used for one well.	15th card 1 5

2.7 Well production card

The well production card deals with the production (flow or discharge) history of a well or group of wells.

The discharge rate is recorded in relation to production periods, which may be hours per day, days per week, or months. The total production of a well in a year and the type of flow are also recorded.

B M R – G A B Groundwater project

WELL PRODUCTION SHEET

G A B – ADP System transfer sheet

CODE	IDENTIFICATION						MAIN AQUIFER	RELIABILITY	PRODUCTION RECORDS No.1									No.2									No.3										FOLIO NUMBER
											Production Period									Production Period									Production Period							
	State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number			Year	Discharge Rate 10^3 gpd	Month	To Month	Days/W	Hours Per Day	Reliability	Total Yearly Prod. 10^6g	Type of Flow	Year	Discharge Rate 10^3 gpd	Month	To Month	Days/W	Hours Per Day	Reliability	Total Yearly Prod. 10^6g	Type of Flow	Year	Discharge Rate 10^3 gpd	Month	To Month	Days/W	Hours Per Day	Reliability	Total Yearly Prod. 10^6g	Type of Flow		
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18 19	20 21 22 23	24 25	26 27	28	29 30	31	32 33 34 35	36 37	38 39	40 41 42 43	44 45	46 47	48	49 50	51	52 53 54 55	56 57	58 59	60 61 62 63	64 65	66 67	68	69 70	71	72 73 74 75	76 77	78	79 80
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Well production transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Well production card. | 4 | F |
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the Master card; for filling of these columns, refer to the Master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described in the aquifer description card:	
				Unknown 0 Watertable 1 Hooray Sandstone and Adori Sandstone aquifer plus correlates 2 Hutton Sandstone, Evergreen Fm, and Precipice Sandstone aquifer 3 Triassic, Permian and stratigraphically deeper aquifers 4	Hooray Sandstone | 2 |
				If several main aquifers are tapped: 9	Hooray Sandstone and Hutton Sandstone | 9 |

Well production transfer sheet

Topic	Total	Column Start	End	Explanation	Example
RELIABILITY	1	17	17	Column 17 refers to the reliability of information on the aquifers tapped, coded as: unknown 0 good 1 medium 2 poor 3	medium | 2 |
PRODUCTION RECORDS	20	18	37	Three production records are allocated to each line of the Well production transfer sheet (which corresponds to one data card).	
Year	2	18	19	Columns 18 and 19 refer to the year for which the total annual production is given and/or the year for which a detailed production period is given in the following columns. Fill columns 18 and 19 with the last two numbers of the year, see 2.1.	production year 1928 | 2 | 8 |
Discharge rate	4	20	23	Columns 20 to 23 refer to the discharge rate in 1000 gpd. This figure represents the average daily discharge rate during the year, expressed in 1000 gpd.	5 250 000 gpd | 5 | 2 | 5 | 0 |
Production period	7	24	30	Columns 24 to 30 refer to the production period. The period during which the well is producing water (i.e. is pumping) can be expressed in months, days per week, or hours per day.	
				Columns 24 to 27 refer to a pumping sequence of months within the year (eg. for a seasonal cycle); the months to be coded from 1 to 12 (see 2.1). Month started columns 24 and 25, month ended columns 26 and 27.	August to November | | 8 | 1 | 1 |

Well production transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
				Note: If a pumping season extends from one year into the other, eg. October 1965 to May 1966, the record has to be filled as:	October 1965 to May 1966
				Columns 18 and 19: Year 65, columns 24 to 27: Months 10 to 12, and in the next record: columns 38 and 39: Year 66, columns 44 to 47: Months 1 to 5	|6|5| |1|0|1|2| |6|6| |\ |1| |5|
				Column 28 refers to the production period expressed in days per week, in case of a weekly pumping cycle.	3 days per week |3|
				Columns 29 and 30 deal with the production period expressed in hours per day for a daily cycle.	10 hours per day |1|0|
Reliability	1	31	31	Column 31 refers to the reliability of the production period information, coded as:	
				unknown 0 good: accurate records 1 e.g. continuously flowing well or recorded pumping medium: suspect records, 2 e.g. irregularly controlled flowing well poor: unreliable records, 3 e.g. wind pumped well	poor |3|
Total year's production	4	32	35	Columns 32 to 35 refer to the total production of the well in the year stated in columns 18 and 19 in millions of gallons.	550 000 000 g. |\ |5|5|0|

Well production transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Type of flow	2	36	37	Columns 36 and 37 refer to the type of flow encountered in the well, coded as: free flowing — FF controlled flow — CF pumped — PF ceased flowing — CD non-flowing — NL Second and third sets of records are to be filled in columns 38 to 57 and 58 to 77.	pumped P | F
MISCELLANEOUS	1	78	78	Column 78 is available for other information eventually required for the well production card.	
FOLIO NUMBER	2	79	80	Columns 79 and 80 are for the folio number of the well production card. This refers to one well, i.e. the set of cards (and lines on a transfer sheet) to be used for one well.	6th card | 6 |

2.8 Head and temperature card

The head and temperature card deals with the head (water level) and temperature records of a well or group of wells.

The pressure head, depth or elevation with date of measurement are recorded for a given aquifer, together with the reference level or distance from the ground surface and the temperature of the water discharging from the well.

BMR — GAB Groundwater project

HEAD AND TEMPERATURE SHEET

GAB — ADP System transfer sheet

CODE	IDENTIFICATION						AQUIFER No.	RELIABILITY	HEAD AND TEMPERATURE RECORDS No. 1											No. 2											No. 3											FOLIO NUMBER
	State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number			Date		Build-up	Sign	Pressure Depth Elevation	O.I	Unit	Ref. Lev./ Ground Surface	Temperature	°C — °F	Reliability	Date		Build-up	Sign	Pressure Depth Elevation	O.I	Unit	Ref. Lev./ Ground Surface	Temperature	°C — °F	Reliability	Date		Build-up	Sign	Pressure Depth Elevation	O.I	Unit	Ref. Lev./ Ground Surface	Temperature	°C — °F	Reliability	
									Year	Month										Year	Month										Year	Month										
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18 19	20 21	22	23	24 25 26 27	28	29	30 31 32	33 34 35	36	37	38 39	40 41	42	43	44 45 46 47	48	49	50 51 52	53 54 55	56	57	58 59	60 61	62	63	64 65 66 67	68	69	70 71 72	73 74 75	76	77	78 79 80
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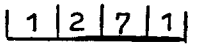
Head and temperature transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Head and temperature card | 4 | G |
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the Master card; for filling of these columns, refer to the Master transfer sheet explanation. Note column 9, see Introduction 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells) as described by the aquifer description card:	
				Unknown 0 Watertable 1 Hooray Sandstone and Adori Sandstone aquifer plus correlates 2 Hutton Sandstone, Evergreen Fm. and Precipice Sandstone aquifer 3 Triassic, Permian, stratigraphically deeper aquifers 4	Hooray Sandstone | 2 |
				If several main aquifers are tapped 9	Hooray Sandstone and Hutton Sandstone | 9 |
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about the aquifers tapped, coded as:	
				unknown 0 good 1 medium 2 poor 3	medium | 2 |

Topic	Total	Column Start	End	Explanation	Example
HEAD AND TEMPERATURE RECORDS	20	18	37	Three head and temperature records are allocated to each line of the transfer sheet (which corresponds to one data card).	
Date	4	18	21	Columns 18 to 21 refer to the date of the head and/or temperature measurement	1956
Year	2	18	19	Columns 18 and 19 refer to the last two numbers of the year, see 2.1.	5 6
Month	2	20	21	Columns 20 and 21 refer to the month of the head and/or temperature measurement; months to be coded 1 to 12, see 2.1.	August 8
Build-up	1	22	22	Column 22 refers to the build-up of the pressure or waterlevel (recovery): unknown 0 build-up occurs 1 no build-up occurs 2	pressure or water level build-up 1
Pressure - Depth - Elevation	7	23	29	Column 23 to 29 deal with the head, i.e. the pressure, depth or elevation of the waterlevel of the well according to the unit of measurement. Column 23 refers to the sign, expressed as the position of the waterlevel in feet below (-) or above (+) the measurement datum. A standing water level (SWL) is to be indicated as a "depth", sign - .	

Head and temperature transfer sheet

Topic	Total	Column Start	End	Explanation	Example
				A pressure head will be indicated by the sign +.	
				Column 24 to 27 refer to the pressure, depth or elevation value, for the integer part.	
				Column 28 contains the decimal part of the pressure, depth or elevation.	- 23.5 ft. elevation | - | | | 2 | 3 | 5 | 3 |
				Column 29 refers to the unit in which the pressure, depth or elevation is expressed, and this can be either pounds per square inch (psi) or feet, coded as: pressure or depth in feet 1 pressure in psi 2 elevation (related to reference level) in feet, either with sign + or - 3	+ 178.5 ft. elevation | + | | 1 | 7 | 8 | 5 | 3 | + 12.8 ft. pressure | + | | 1 | 2 | 8 | 5 | 2 | - 486.1 ft. depth | - | | 4 | 8 | 6 | 1 | 1 |
Reference level/ Ground surface	3	30	32	Columns 30 to 32 refer to the reference level, i.e. the distance in feet (integer part in columns 30 and 31, decimal part in column 32), from the reference level to the ground surface. The reference level can be the place of the pressure plug for a pressure measurement, or the top of the casing for SWL measurement. The groundsurface elevation is given on the master card (columns 40 to 44)	reference level 12.6 ft. above ground surface | 1 | 2 | 6 |

Topic	Total	Column Start	End	Explanation	Example
Temperature	4	33	36	Columns 33 to 35 refer to the temperature of the water at the outlet of the well when it has been flowing or pumped for some time. Ignore decimal parts. Fill last number in column 35 i.e., right justification. (This measurement will be used with T.D.S. data - card 4K - to correct all head values for the water density values) Column 36 refers to the unit in which the temperature is expressed, coded as: degrees Fahrenheit 1 degrees Celsius 2	127 Fahrenheit 
Reliability	1	37	37	Column 37 deals with the reliability of the pressure, depth or elevation measurements coded as: unknown 0 good 1 medium 2 poor 3 Second and third sets of records are to be filled in columns 38 to 57 and 58 to 77.	good 
FOLIO NUMBER	3	78	80	Columns 78 to 80 refer to the folio number of the head and temperature card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) to be used for one well.	

2.9 Well Hydrodynamics card

The well hydrodynamics card deals with information about hydrodynamic tests (pumping or flowing), the test characteristics, and the test results.

Test characteristics include starting and finishing dates of tests, duration of recovery, elevation, depth of screens, screen length, distance to pumping or flowing well and the interpretation method used (steady or unsteady state).

Test results include transmissivity values of the main confined aquifer tapped, both from the lowering and recovery interpretation, the specific capacity of the well and the storage coefficient. Test results for the confining bed include the thickness, vertical permeability and storage coefficient.

B M R – G A B Groundwater project

WELL HYDRODYNAMICS SHEET

G A B – ADP System transfer sheet

CODE	IDENTIFICATION						AQUIFER No.	WELL NUMBER	TEST CHARACTERISTICS													TEST RESULTS							RELIABILITY	SURVEYED BY	TEST NUMBER
									Date Started			Date Ended								Interp. Method		Main Aquifer				Confining Bed					
	State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number			Year	Month	Day	Year	Month	Day	Recovery Last (Hours)	Elevation Datum 0.1	Depth Of Screen	Screen Length	Distance To Pumping (Flowing) Well	Steady St.	Non Steady State	Transm. Low. 10^n	Transm. Rec. 10^n	Spec. Cap. 10^n	Stor. Coeff. 10^{-n}	Thickness	K' z 10^n	S' 10^{-n}			
1					10					20					30		40		50				60			70					80
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18 19	20 21	22 23	24 25	26 27	28 29	30 31 32	33 34 35 36 37	38 39 40 41 42	43 44 45 46	47 48 49 50 51	52	53 54	55 56 57	58 59 60	61 62 63	64 65 66	67 68 69 70	71 72 73	74 75 76	77	78	79 80
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Well hydrodynamics transfer sheet

Topic	Column Total	Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the code of the card, see Introduction, 1.3.2.	Well hydrodynamics card | 4 | H |
IDENTIFICATION	13	3	15	Column 3 to 15 deal with the identification of the well; this information is to be repeated from the Master card; for filling of these columns, refer to the Master transfer sheet explanation. Note column 9, see Introduction 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described by the Aquifer description card:	
				Unknown 0 Watertable 1 Hooray Sandstone and Adori Sandstone aquifer, plus correlates 2	Hooray Sandstone | 2 |
				Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer 3 Triassic, Permian, and stratigraphically deeper aquifers 4	
				If several main aquifers are tapped 9	Hooray + Hutton Sandstone | 9 |

Well hydrodynamics transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
WELL NUMBER	1	17	17	Column 17 refers to the well number, i.e. the number of the well (or observation well) while the field test was processed. Nine numbers, 1 to 9 are allowed. If the well scheduled is the pumping or flowing well: Fill column 17 with P for a pumped, with F for a flowing bore.	Observation well No. 3 | 3 |
TEST CHARACTERISTICS	37	18	54	Columns 18 to 54 refer to the test characteristics of the pumping or flowing tests.	
Date started	6	18	23	Columns 18 to 23 refer to the date on which the test started.	7 May 1943 | 4 | 3 | | 5 | | 7 |
Year	2	18	19	Columns 18 and 19 to be filled in with the last two numbers of the year (see 2.1)	1943 | 4 | 3 |
Month	2	20	21	Columns 20 and 21 to be filled in with the month, numbered from 1 to 12, (see 2.1)	May | | 5 |
Day	2	22	23	Columns 22 and 23 to be filled in with the day on which the test started.	7 | | 7 |
Date ended	6	24	29	Columns 24 to 29 refer to the date on which the test ended; these columns to be filled in the same way as for date started.	
Recovery period	3	30	32	Columns 30 to 32 refer to the recovery period, the time in hours since the recovery started (since pumping stopped or flow was closed off). Last number to be filled in column 32, i.e. right justification.	18 hours | | 1 | 8 | 247 hours | 2 | 4 | 7 |

Well hydrodynamics transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Elevation datum	5	33	37	Columns 33 to 37 refer to the elevation datum, i.e. the well datum or reference level in feet above (or below) mean sea level. This well datum or reference level may be the ground-surface, the top of the well casing, or anywhere else. The elevation of this datum needs, therefore, to be carefully copied from the test report. It is expressed in feet, to be filled in columns 33 to 36, with the decimal part in column 37 (right justification).	1425.3 ft. | 1 | 4 | 2 | 5 | 3 |
				Note: Fill column 33 with - if the well datum is below sea level.	28.5 ft. | - | | 2 | 8 | 5 |
Depth of screen	5	38	42	Columns 38 to 42 deal with the depth of the bottom of the screen, or bottom of the slotted or perforated part of the casing. In case of open hole, the bottom of the hole should be taken if it is in a pervious layer, otherwise the bottom of the pervious layer must be taken. This depth is to be recorded in feet (as the depth from the well datum to the screen bottom), and no decimal part is required. Last number in column 42, i.e., right justification.	3238.6 ft. | | 3 | 2 | 3 | 8 |
Screen length	4	43	46	Columns 43 to 46 refer to the screen length, perforated or slotted part of the casing, or the open-hole length. The length of this interval to be stated in feet (no decimal part required); if there are several intervals, add the actual screened, slotted or perforated lengths (if facing the same main aquifer).	138 feet | | 1 | 3 | 8 |

Well hydrodynamics transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Distance to pumping or flowing well	5	47	51	Columns 47 to 51 refer to the distance from the well scheduled (if an observation well during the test), to the pumping or flowing well, expressed in feet (no decimal part required), right justified. Note: If the well scheduled is the pumping or flowing well during the test, fill columns 47 to 50 with TEST, and column 51 with P for a pumping well and F for a flowing well.	324 ft. | | | 3 | 2 | 4 | | T | E | S | T | P |
Interpretation method	3	52	54	Columns 52 to 54 refer to the interpretation method used to evaluate the pumping or flowing (hydrodynamic) test (see Kruseman and De Ridder, 1970, tables 15 and 17). Column 52 to be used for steady-state interpretation methods, coded as: Thiem, 1906 — 1 De Glee, 1930; Hantush-Jacob, 1955; Ernst mod-Thiem — 2 Thiem-Dupuit, 1906 — 3 Dietz, 1943 — 4 Culmination point — 5 Huisman, corr. 1 — 6 Huisman, corr. 2 — 6 Jacob corr., 1963 — 6 Huisman, corr. 1 and 2 — 6 Hantush corr. 1964 — 6 Huisman-Kemperman 1951 — 7 Bruggeman, 1966 — 7 Logan, 1964; Gosselin, 1951; Logan, 1964; Zangar, 1953 — 8 9 0	

Well hydrodynamics transfer sheet

Topic	Total	Column Start	End	Explanation	Example
				Columns 53 and 54 refer to the unsteady-state method of analysis, coded as:	
				Theis (Jacob), 1940 1	Hantush (confined) 1964 15
				Chow, 1952 2	Hantush (unconfined, 1964 16
				Jacob (Cooper and Jacob), 1946 3	Cooper-Jacob, 1946 17
				Theis recovery, 1935 4	Aron-Scott, 1965 18
				Walton, 1962 5	Sternberg, 1968 19
				Hantush 1, 1956 6	Sternberg recovery, 1967 20
				Hantush 2, 1956 7	Hantush, 1962 21
				Hantush 3, 1956 8	Theis, mod. Hantush, 1962 22
				Boulton, 1963 9	Jacob, mod. Hantush, 1962 23
				Stallman (Ferris et al,) 1962 10	Papadopulos-Cooper, 1967 24
				Hantush image, 1959 11	Hurr, confined, 1966 25
				Hantush (confined-unconfined) 1966 12	Hurr, unconfined, 1966 26
				Hantush-Thomas, 1966 13	Jacob-Lohman, 1952 27
				Hantush (semi-confined), 1966 14	
TEST RESULTS	22	55	76	Columns 55 to 76 refer to the results of the pumping and flowing tests.	
Main aquifer	12	55	66	Columns 55 to 66 refer to the test results for the main aquifer and include:	
Transmissivity (lowering)	3	55	57	Columns 55 to 57 refer to the transmissivity values deduced from the lowering period or from a drawdown test. Transmissivity or transmissibility is the product of the average hydraulic conductivity (or permeability) and the thickness of the aquifer . Transmissivities are expressed in gpd/ft; insert in columns 55 and 56 the first two numbers of this value, and in column 57 the number indicating the value to the power of 10.	22 000 gpd/ft. | 2 | 2 | 3 | 1 590 000 gpd/ft | 1 | 5 | 5 |

Well hydrodynamics transfer sheet

Topic	Column Total	Start	End	Explanation	Example
Transmissivity (recovery)	3	58	60	Columns 58 to 60 refer to the transmissivity values deduced from the recovery period test. Transmissivities are expressed in gpd/ft; insert in columns 58 and 59 the first two numbers of this value, and in column 60 the number of the power of 10.	210 000 gpd/ft | 2 | 1 | 4 | 4 410 000 | 4 | 4 | 5 |
Specific capacity	3	61	63	Columns 61 to 63 refer to the specific capacity or the measure of the effectiveness of well (which is a function of the discharge - drawdown ratio and time). Specific capacity values are expressed in gpm/ft; insert in column 61 and 62 the first two numbers of this value, and in column 63 the number indicating the power of the nearest value of 10.	2 560 000 000 gpm/ft | 2 | 5 | 8 |
Storage coefficient	3	64	66	Columns 64 to 66 refer to the storage coefficient of the main aquifer, as deduced from the test results. (The storage coefficient refers to the volume of water released or stored per unit surface area of the aquifer per unit change in the component of head normal to that surface; it refers to the confined parts of an aquifer and depends on the elasticity of the aquifer material and fluid). Storage coefficients are dimensionless and expressed as 10^{-4}, 10^{-6}, etc.; insert in columns 64 and 65 the first two numbers of this value, and in column 66 the negative power value of 10	15×10^{-5} | 1 | 5 | 5 | 10^{-6} | | 1 | 6 |
Confining bed	10	67	76	Columns 67 to 76 deal with the test results for the confining bed, and include:	

Well hydrodynamics transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Thickness confining bed	4	67	70	Columns 67 to 70 refer to the thickness of the confining bed in feet; no decimal part is required. Fill the last number in column 70, i.e. right justification.	845.5 ft | | 8 | 4 | 5 | 1234 ft | 1 | 2 | 3 | 4 |
Vertical permeability	3	71	73	Columns 71 to 73 refer to the vertical permeability of the confining bed. The vertical permeability is expressed in gpd/ft. Fill in columns 71 and 72 the first two numbers of this figure, and in column 73 the power value of 10.	
Storage coefficient	3	74	76	Columns 74 to 76 refer to the storage coefficient or specific yield of the confining bed. Storage coefficient and specific yield are dimensionless. Fill in columns 74 and 75 the first two numbers of this value, and in column 76 the negative power of 10.	25×10^{-4} | 2 | 5 | 4 | 10^{-3} | | 1 | 3 |
RELIABILITY	1	77	77	Column 77 refers to the reliability of the test characteristics and test data, coded as: unknown 0 good 1 medium 2 poor 3	medium | 2 |

Well hydrodynamics transfer sheet

Topic	Column Total	Start	End	Explanation		Example
SURVEYED BY	1	78	78	Column 78 refers to the surveying authority, to be coded as:		
				unknown	0	
				Bureau of Mineral Resources and its contractors	1	
				State water authorities:		
				Queensland	2	
				New South Wales	3	
				South Australia	4	
				Northern Territory	5	
				State geological surveys	6	
				Water consultants and industry	7	
				Universities and research organizations	8	
				Local authorities, drillers and owners	9	
TEST NUMBER	2	79	80	Columns 79 and 80 refer to the number of the test (flowing or pumping) in the series scheduled for one well		3rd test [3]

2.10 Pumping and flowing test card

The pumping and flowing test card deals with the test history in terms of measuring conditions, together with the actual measurements.

Information about the measuring conditions include the well number, type of test, reliability of pressure and gauging equipment, and the authority which carried out the test. Basic test data consist of the date the test was completed, the flow rate, static head, standing water level or back pressure at the start of the test, and container capacity if a container was used for measuring the discharge.

Records of time-dependant test measurements include the time in hours and minutes, head or depth, and discharge.

B M R – G A B Groundwater project

PUMPING AND FLOWING TEST SHEET

G A B – ADP System transfer sheet

CODE	IDENTIFICATION						AQUIFER No.	RELIABILITY	WELL NUMBER	TYPE OF TEST	PRESSURE EQ. REL.	GAUGE EQUIP. REL.	COMPLETED BY	DATE COMPLETED			FLOW RATE BEFORE TEST STARTS	Unit	Type Of Flow	STATIC HEAD STAND. WATER LEVEL or BACK PRESS. FEET or PSI.				CONTAINER CAPACITY	RECORDS																FOLIO NUMBER
																									No.1								No.2								
	State	Letter	1:250 000 Map Number	Card Cont.	Deepening	Well Number								Year	Month	Day				Sign		O.I	Unit		Time Since Test Started Hours	Min.	Sign	Head Depth Feet or Psi.	O.I	Unit	Discharge 1,000 g.p.d. or Seconds	Unit	Time Since Test Started Hours	Min.	Sign	Head Depth Feet or Psi.	O.I	Unit	Discharge 1,000 g.p.d or Seconds	Unit	
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18	19	20	21	22 23	24 25	26 27	28 29	30 31 32 33	34	35	36	37 38 39	40	41	42 43 44	45 46 47 48	49 50	51	52 53 54	55	56	57 58 59 60	61	62 63 64 65	66 67	68	69 70 71	72	73	74 75 76 77	78	79 80
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Pumping and flowing test transfer sheet

Topic	Column Total	Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Pumping and flowing test card: 4 | I
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the master card; for filling of these columns, refer to the master card transfer sheet explanation. Note column 9, see Introduction 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described by the aquifer description card:	Hooray Sst: 2

Unknown	0
Watertable	1
Hooray Sandstone and Adori Sandstone aquifer plus correlates	2
Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer	3
Triassic, Permian and stratigraphically deeper aquifers	4
If several main aquifers are tapped	9

Pumping and flowing test transfer sheet

Topic	Total	Column Start	End	Explanation	Example
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about the aquifers tapped, coded as: unknown 0 good 1 medium 2 poor 3	good [1]
WELL NUMBER	1	18	18	Column 18 refers to the number of the well during the test, if the well is an observation well. If the well is the flowing or pumping well tested, fill column 18 with F for a flowing well, and with P for a pumped well. Observation wells can be numbered from 1 to 9.	flowing well [F] 2nd observation well [2]
TYPE OF TEST	1	19	19	Column 19 refers to the type of test performed, to be coded as: static test 1 dynamic test - opening 2 dynamic test - closing 3 recession test 4 5 6 7 8 9	recession test [4]

Pumping and flowing test transfer sheet

Topic	Total	Column Start	End	Explanation	Example
PRESSURE EQUIPMENT RELIABILITY	1	20	20	Column 20 refers to the reliability of the equipment used to measure the Pressure of the well, coded as: unknown 0 mercury manometer, water tube - good 1 .....- medium 2 pressure gauge - poor 3	mercury manometer |1|
GAUGE EQUIPMENT RELIABILITY	1	21	21	Column 21 refers to the reliability of the equipment used to measure the levels of the well, coded as: unknown 0 automatic level recorders, electric probe tape, air line 1 floating tape (hand operated) 2 measuring tape (hand-operated), wetted tape 3	floating tape |2|
COMPLETED BY	2	22	23	Columns 22 and 23 refer to the authority which carried out the test scheduled, to be coded as: Unknown 00 BMR 01 BMR contractors 02 - 09 State water authorities 10 - 19 " " " Qld 11 " " " NSW 12 " " " SA 13 " " " NT 14	BMR |0|1| Irrigation and Water Supply Commission, Brisbane |1|1|

Topic	Column Total	Start	End	Explanation	Example
				State geological surveys 20-29 " " " Qld 21 " " " NSW 22 " " " SA 23 " " " NT 24 Water consultants 30 - 39 Universities and research organisations 40 - 49 Industrial, petroleum, & mining companies 50 - 59 Local authorities 60 - 69 Drillers 70 - 79 Owners 80 - 89 Others 90 - 99	Flinders Shire Council |6|0|
DATE COMPLETED	6	24	29	Columns 24 to 29 deal with the date on which the test was completed	28 May 1956 |5|6| |5|2|8|
Year	2	24	25	Columns 24 and 25 refer to the year in which the test was carried out; fill in with last two numbers of the year (see 2.1.)	1956 |5|6|
Month	2	26	27	Columns 26 and 27 refer to the month in which the test was carried out; code months from 1 to 12, right justified.	May | |5|
Day	2	28	29	Columns 28 and 29 refer to the day on which the test was carried out.	28 |2|8|

Pumping and flowing test transfer sheet

Topic	Total	Column Start	End	Explanation	Example
FLOW RATE BEFORE TEST STARTS	6	30	35	Columns 30 to 35 refer to the flow rate before the test started. If the actual amount of water is measured, the measurement of the flowrate is expressed in 1000 gpd in columns 30 to 33. If the measurement is in gallons per hour, multiply by 24 before filling the columns. If the flowrate is measured by the time needed to fill a water container of known capacity, columns 30 to 33 are to be filled with the time in minutes or seconds. Insert last number in column 33, see 2.1.	256000 gpd | | 2 | 5 | 6 | 18 minutes | | | 1 | 8 |
Unit	1	34	34	Column 34 deals with the unit in which the flowrate measurement of columns 30 to 33 is expressed, i.e. whether these figures express gpd or minutes gpd - gallons per day 1 minutes 2 seconds 3	gpd | 1 |
Type of flow	1	35	35	Column 35 refers to the type of flow in the well before the start of the test, coded as: free flowing 1 controlled flow 2 pumped 3 ceased to flow 4 flow nil 5 (flow stopped by closed valve etc.)	pumped | 3 |

Pumping and flowing test transfer sheet

Topic	Total	Column Start	End	Explanation	Example
STATIC HEAD, STANDING WATER LEVEL OR BACK PRESSURE	6	36	41	Columns 36 to 41 refer to the static head, standing water level or back pressure of the bore immediately before the start of the test.	
Sign	1	36	36	Column 36 refers to the sign for the head or waterlevel above (sign +) or below (sign -) the measurement datum level.	
Static head, standing water level or back pressure	4	37	40	Columns 37 to 39 refer to the static head, standing water level or back pressure, expressed in feet or pounds per square inch. Fill in columns 37 to 39 the integer part only, with last number in column 39, i.e., right justified.	+ 28.4 ft | + | | 2 | 8 | 4 | 1 |
				Column 40 refers to the decimal part of the static head, standing water level or back pressure record.	- 356.8 ft | - | 3 | 5 | 6 | 8 | 1 |
Unit	1	41	41	Column 41 refers to the unit in which the static head, standing water level or back pressure are expressed in columns 37 to 40, coded as: pressure, head or level in feet 1 pressure in psi 2 pressure in inches of mercury 3	38 psi | 3 | 8 | | 2 |
CONTAINER CAPACITY	3	42	44	Columns 42 to 44 refer to the capacity of the container in gallons if such a device is used to measure the flow rate. Fill last number in column 44, i.e. right justified.	20 gallon | | 2 | 0 |

Pumping and flowing test transfer sheet

Topic	Column Total	Start	End	Explanation	Example
PUMPING AND FLOWING TEST RECORDS	17	45	61	Two pumping and flowing test records are allocated to each line of the pumping and flowing test transfer sheet, which corresponds to one data card.	
Time since test started	6	45	50	Columns 45 to 50 refer to the time since the test started, expressed in hours in columns 45 to 48, and in minutes in columns 49 and 50. Fill last numbers in columns 48 and 50 respectively; i.e., right justification.	4 h. 12 min. | | | |4|1|2|
Head or depth	6	51	56	Columns 51 to 56 refer to the head or depth measured at the time recorded in columns 45 to 50.	
				Column 51 refers to the sign for the head or waterlevel above (+) or below (-) the measurement datum level.	- 256.8 ft |-|2|5|6|8|1|
				Columns 52 to 55 deal with the integer part of the actual head or depth measurements, to be filled with the last number in column 54, see 2.1.	
				Column 55 refers to the decimal part of the head or depth figures.	
				Column 56 refers to the unit in which the head or depth is expressed in columns 52 to 55, coded as: head or level in feet 1 in psi 2 pressure in inches of mercury 3	

Pumping and flowing test transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
Discharge in 1000 gpd or time	5	57	61	Columns 57 to 61 refer to the discharge rate measured at the time recorded in columns 45 to 50. The discharge rate is expressed in 1000 gpd to be filled in columns 57 to 60, with last number in column 60, i.e. right justification. If the flowrate is measured by the time needed to fill a water-container of known capacity (filled in columns 42 to 44), columns 57 to 60 are filled with this time in minutes or seconds. Insert last number in column 60, i.e. right justification.	35000 gpd | | |3|5|1| 25 minutes | | |2|5|2|
				Column 61 refers to the unit in which the discharge rate measurement in columns 57 to 60 is expressed coded as: gpd 1 minutes 2 seconds 3	minutes |2|
				A second set of records is to be filled in columns 62 to 78.	
FOLIO NUMBER	2	79	80	Columns 79 and 80 refer to the folio number of the pumping and flowing test card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) used for one well.	3rd card |3|

2.11 Well characteristic curve card

The well characteristic curve card deals with the information about stepwise steady state tests, i.e. tests with a varying discharge.

Information about these types of tests include the date on which they were carried out, head measurements at the start of tests, discharge rates, and pressure or waterlevel of the well.

BMR – GAB Groundwater project

WELL CHARACTERISTIC CURVE SHEET

GAB – ADP System transfer sheet

CODE	IDENTIFICATION: State	IDENTIFICATION: Letter	IDENTIFICATION: 1:250 000 Map Number	IDENTIFICATION: Card Cont.	IDENTIFICATION: Deepening	IDENTIFICATION: Well Number	AQUIFER No.	RELIABILITY	TEST NUMBER	DATE COMPLETED: Year	DATE COMPLETED: Month	DATE COMPLETED: Day	STARTING HEAD: Build-up	STARTING HEAD: Sign	STARTING HEAD: Measurement	RECORDS No.1: Discharge Rate (1,000 g.p.d)	RECORDS No.1: Pressure Or Depth	RECORDS No.2: Discharge Rate (1,000 g.p.d)	RECORDS No.2: Pressure Or Depth	RECORDS No.3: Discharge Rate (1,000 g.p.d)	RECORDS No.3: Pressure Or Depth	RECORDS No.4: Discharge Rate (1,000 g.p.d)	RECORDS No.4: Pressure Or Depth	RECORDS No.5: Discharge Rate (1,000 g.p.d)	RECORDS No.5: Pressure Or Depth	UNITS	COMPLETED BY	RELIABILITY	FOLIO NUMBER
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18	19 20	21 22	23 24	25	26	27 28 29 30 31	32 33 34 35	36 37 38 39 40	41 42 43 44	45 46 47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62	63 64 65 66 67	68 69 70 71	72 73 74 75 76	77	78	79	80
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Well characteristic curve transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the code of the card, see Introduction, 1.3.2.	Well characteristic curve card |4|J|
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the master card; for filling of these columns, refer to the master transfer sheet explanation. Note column 9, see Introduction 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described by the Aquifer description card:	
				Unknown 0	
				Watertable 1	
				Hooray Sandstone and Adori Sandstone aquifers, plus correlates 2	Hooray Sst |2|
				Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer 3	
				Triassic, Permian and stratigraphically deeper aquifers 4	Cambrian |4|
				If several main aquifers are tapped 9	

Well characteristic curve transfer sheet

Topic	Total	Column Start	End	Explanation	Example
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about the aquifers tapped, coded as: unknown 0 good 1 medium 2 poor 3	Poor | 3 |
TEST NUMBER	1	18	18	Column 18 refers to the test number, i.e. the chronological number of the test performed on the date recorded in columns 19 to 24.	2nd test | 2 |
DATE COMPLETED	6	19	24	Columns 19 to 24 deal with the date on which the test was carried out.	
Year	2	19	20	Columns 19 and 20 refer to the year in which the test was carried out; fill with the last two numbers of the year, see 2.1.	1964 | 6 | 4 |
Month	2	21	22	Columns 21 and 22 refer to the month in which the test was carried out; fill in with the months coded from 1 to 12, see 2.1.	June | | 6 |
Day	2	23	24	Columns 23 and 24 refer to the day on which the test was carried out.	14 | 1 | 4 |
STARTING HEAD	7	25	31	Columns 25 to 31 refer to the head measurement before the test started.	

Well characteristic curve transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Build up	1	25	25	Column 25 refers to the build-up of the pressure or water-level (recovery), to be filled according to the occurrence of a build up: unknown 0 build up occurs 1 no build up occurs 2	pressure or water level build up | 1 |
Sign	1	26	26	Column 26 refers to the sign for the head or water level below (-) or above (+) the measurement datum level. A standing water level is to be indicated as a depth with sign -, a pressure with sign +.	| + |
Measurement	5	27	31	Columns 27 to 31 refer to the head measurement at the time the test started Columns 27 to 30 contain the integer part of the pressure, depth, or elevation, and Column 31 contains the decimal part. Note: The unit in which the head measurement is expressed is shown in column 77	+ 23.6 ft | + | | 2 | 3 | 6 |
DISCHARGE AND PRESSURE OR DEPTH RECORDS	9	32	40	Five discharge and pressure or depth records are allocated to each line on a well characteristic curve transfer sheet (which corresponds to one data card).	
Discharge Rate	4	32	35	Columns 32 to 35 refer to the discharge rate during a test or specific test interval, characterized by the test number in column 18. If the actual amount of water is measured the discharge rate is expressed in 1000 gpd shown in this way in columns 32 to 35. If the measurement is in gallons per hour, multiply by 24 before filling the columns. If the discharge rate is measured by the time required to fill a water container of known capacity, insert the time in minutes or seconds in columns 32 to 35. The unit of discharge rate measurement is shown in column 77. Insert last number in column 35, i.e. right justification.	125000 gpd | | 1 | 2 | 5 | 12 min | | | 1 | 2 |

Well characteristic curve transfer sheet

Topic	Total	Column Start	End	Explanation	Example
Pressure or depth	5	36	40	Columns 36 to 40 refer to the pressure, head or depth during a test or specific test interval, characterized by the test number in column 18. Column 36 refers to the sign for the head or water level below (-) or above (+) the measurement datum level. A standing water level is to be indicated as a depth with sign -, a pressure with sign +. Columns 37 to 39 contain the integer part of the pressure, depth or elevation, and Column 40 contains the decimal part. Note: The unit in which the pressure or depth is expressed is shown in column 77. Second, third, fourth and fifth sets of record can be filled in columns 41 to 49, 50 to 58, 59 to 67 and 68 to 76.	
UNITS	1	77	77	Column 77 refers to the units in which the discharge rate, pressure, head and depth are expressed, coded as: gpd - pressure/depth in ft 1 gpd - pressure in psi 2 gpd - elevation, either with sign + or -, in ft (insert the sign in column 36) 3 gpd - pressure in inches mercury 4 min - pressure/depth in ft 5 min - pressure in psi 6 min - elevation, either with sign + or -, in ft (insert sign in column 36) 7 min - pressure in inches mercury 8 sec - pressure/depth in ft 9 sec - pressure in psi 0 sec - elevation, either with sign + or -, in ft (insert sign in column 36) A	

Well characteristic curve transfer sheet

Topic	Total	Column Start	End	Explanation	Example
				sec - pressure in inches mercury B	
COMPLETED BY	1	78	78	Column 78 refers to the authority which carried out the test, coded as: Unknown 0 Bureau of Mineral Resources and its contractors 1 State water authorities: Queensland 2 New South Wales 3 South Australia 4 Northern Territory 5 State geological surveys 6 Water consultants and industry 7 Universities and research organisations 8 Local authorities, drillers, owners 9	WCIC - NSW [3]
RELIABILITY	1	79	79	Column 79 refers to the reliability of the discharge rate and pressure or depth measurements, coded as: unknown 0 good 1 medium 2 poor 3	medium [2]
FOLIO NUMBER	1	80	80	Column 80 refers to the folio number of the well characteristic curve card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) used for one well.	2nd card [2]

2.12 Total dissolved solids card

The total dissolved solids card deals with measurements of the total amount of dissolved solids in the water of the well. This information will be used for corrections of the head or water level measurements.

Information recorded includes the year of measurement, the unit in which the total dissolved solids measurement is expressed, and the actual measurement.

BMR – GAB Groundwater project

TOTAL DISSOLVED SOLIDS SHEET

GAB — ADP System transfer sheet

CODE	IDENTIFICATION						MAIN AQUIFER	TOTAL DISSOLVED SOLIDS RECORDS																					FOLIO NUMBER
								1			2			3			4			5			6			7			
	State	Letter	1:250000 Map Number	Card Cont	Deepening	Well Number		Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	Year	Unit	Total Dissolved Solids Measurement	
1 1 2	3	4	5 6 7 8	9	10 10	11 12 13 14 15	16	17 18 19	20 20	21 22 23 24 25	26 27 28	29	30 30 31 32 33 34	35 36 37	38	40 39 40 41 42 43	44 45 46	47	50 48 49 50 51 52	53 54 55	56	60 57 58 59 60 61	62 63 64	65	70 66 67 68 69 70	71 72 73	74	75 76 77 78 79	80 80
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Total dissolved solids transfer sheet

Topic	Total	Column Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the Code of the card, see Introduction, 1.3.2.	Total dissolved solids card | 4 | K |
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the master card; for filling of these columns, refer to the master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described by the aquifer description card;	
				Unknown 0	
				Watertable 1	
				Hooray Sandstone and Adori Sandstone aquifer, plus correlates 2	
				Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer 3	Hutton Sandstone | 3 |
				Triassic, Permian and stratigraphically deeper aquifers 4	Hooray Sandstone +
				If several main aquifers are tapped 9	Hutton Sandstone | 9 |

Total dissolved solids transfer sheet

Topic	Total	Column Start	End	Explanation	Example
TOTAL DISSOLVED SOLID RECORDS	9	17	25	Seven total dissolved solids records are allocated to each line of the total dissolved solids transfer sheet (which corresponds to one data card)	
Year	3	17	19	Columns 17 to 19 refer to the year of measurement, i.e. the year in which the water of the well was sampled and analyzed for the amount of total dissolved solids. Fill columns 17 to 19 with the last three numbers of the year, see 2.1.	1955 | 9 | 5 | 5 |
Unit	1	20	20	Column 20 refers to the unit in which the total dissolved solids measurement is expressed, coded: parts per million (ppm) 1 grains per gallon 2 ounces per gallon 3	ppm | 1 |
TDS Measurement	5	21	25	Columns 21 to 25 refer to the total dissolved solids measurement of the water, i.e. the value of the analysis result in figures. Fill the last number of this figure in column 25, see 2.1, right justification.	5 000 ppm | | 5 | 0 | 0 | 0 |
				A total of seven sets of records can be filled in columns 17 to 25, 26 to 34, 35 to 43, 44 to 52, 53 to 61, 62 to 70 and 71 to 79.	

Total dissolved solids transfer sheet

Topic	Total	Column Start	End	Explanation	Example
FOLIO NUMBER	1	80	80	Column 80 refers to the folio number of the total dissolved solids card. This folio number refers to one well, i.e. the set of cards (and lines on the transfer sheet) used for one well.	

2.13 Water chemistry - 1 card.

The water chemistry -1 card deals with the basic physical and chemical characteristics of a water sample.

Information recorded on this card includes the authority which took the water sample, the date of sampling and analysis, the laboratory which performed the analysis, field determination data and basic laboratory determinations, and availability of further information on the sample.

Field determination data include the actual temperature of the water at the time of sampling, pH and Eh and resistivity or conductivity values, and the temperature during resistivity or conductivity measurements.

Laboratory determinations include the resistivity or conductivity value determined in the laboratory analysis, pH, total hardness, total alkalinity, total dissolved solids, and the amount of free carbon dioxide.

Further information about the sample may include data about hydrocarbons, trace elements, pesticides, insecticides, radioactive material, and other components.

BMR – GAB Groundwater project

WATER CHEMISTRY – I SHEET

GAB – ADP System transfer sheet

CODE	IDENTIFICATION: State	IDENTIFICATION: Letter	IDENTIFICATION: 1:250000 Map Number	IDENTIFICATION: Card Cont.	IDENTIFICATION: Deepening	IDENTIFICATION: Well Number	AQUIFER No.	RELIABILITY	SAMPLING AUTHORITY	RELIABILITY	DATE SAMPLED: Year	DATE SAMPLED: Month	DATE SAMPLED: Day	DATE ANALYZED: Year	DATE ANALYZED: Month	DATE ANALYZED: Day	Analyzing Laboratory	FIELD DETERMINATION: Temperature of Resistivity	FIELD DETERMINATION: °C or °F	FIELD DETERMINATION: Temperature of Sample	FIELD DETERMINATION: °C or °F	FIELD DETERMINATION: pH	FIELD DETERMINATION: Eh	FIELD DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm: Code	FIELD DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm	FIELD DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm: 10^n	LABORATORY DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm: Code	LABORATORY DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm	LABORATORY DETERMINATION: Resistivity ohm / m Conductivity µmhos/cm: 10^n	LABORATORY DETERMINATION: pH	LABORATORY DETERMINATION: Total Hardness: Method	LABORATORY DETERMINATION: Total Hardness	LABORATORY DETERMINATION: Total Hardness: 10^n	LABORATORY DETERMINATION: Total Alkalinity: Method	LABORATORY DETERMINATION: Total Alkalinity ppm	LABORATORY DETERMINATION: Total Alkalinity: 10^n	LABORATORY DETERMINATION: Total Dissolved Solids: Method	LABORATORY DETERMINATION: Total Dissolved Solids ppm	LABORATORY DETERMINATION: Total Dissolved Solids: 10^n	LABORATORY DETERMINATION: Free CO_2 ppm	LABORATORY DETERMINATION: Free CO_2: 10^n	FURTHER INFORMATION AVAILABLE: Hydro-Carbon	FURTHER INFORMATION AVAILABLE: Trace Elem.	FURTHER INFORMATION AVAILABLE: Pesticides	FURTHER INFORMATION AVAILABLE: Insecticides	FURTHER INFORMATION AVAILABLE: Radioactive	FURTHER INFORMATION AVAILABLE: Other		FOLIO NUMBER
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18 19	20	21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36 37	38	39 40 41	42	43 44	45 46 47	48	49 50	51	52	53 54	55	56 57	58	59 60	61	62	63 64	65	66	67	68	69 70	71	72	73	74	75	76	77	78	79 80
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Water chemistry - 1 transfer sheet

Topic	Total	Column Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the code of the card, see Introduction, 1.3.2.	Water chemistry - 1 card |4|L|
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the master card; for filling of these columns, refer to the master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells), as described by the aquifer description card: Unknown 0 Watertable 1 Hooray Sandstone and Adori Sandstone aquifer, plus correlates 2 Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer 3 Triassic, Permian and stratigraphically deeper aquifers 4 If several main aquifers are tapped 9	Hooray Sst |2|
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about the aquifers tapped, coded: unknown 0 good 1 medium 2 poor 3	good |1|

Topic	Column Total	Start	End	Explanation	Example
SAMPLING AUTHORITY	1	18	19	Columns 18 and 19 refer to the authority which took the sample of water from the well.	
				Unknown 00 Bureau of Mineral Resources 01 BMR and its contractors 02-09 State Water Authorities " " " Qld. 11 " " " NSW 12 " " " SA 13 " " " NT 14 State Geological Surveys " " " Qld. 21 " " " NSW 22 " " " SA 23 " " " NT 24 Water consultants 30-39 Universities & research organizations 40-49 Industrial, petroleum, and mining companies 50-59 Local authorities 60-69 Drillers 70-79 Owners 80-89 Others 90-99	BMR |0|1| Owner |8|0|
RELIABILITY	1	20	20	Column 20 refers to the reliability of the sampling method used by the sampling authority, coded as: unknown 0 good 1 medium 2 poor 3	medium |2|

Water chemistry - 1 transfer sheet

Topic	Total	Column Start	Column End	Explanation	Example
DATE SAMPLED	6	21	26	Columns 21 to 26 refer to the date on which the sample of water was taken.	3 July 1961 6 1 7 3
Year	2	21	22	Columns 21 and 22 refer to the year in which the water sample was taken; fill the last two numbers of the year in columns 21 and 22 (see 2.1.)	1961 6 1
Month	2	23	24	Columns 23 and 24 refer to the month in which the water sample was taken; code the months from 1 to 12, see 2.1.	July 7
Day	2	25	26	Columns 25 and 26 refer to the day on which the water sample was taken.	3rd 3
DATE ANALYZED	6	27	32	Columns 27 to 32 refer to the date on which the water sample was analyzed in the laboratory; these columns are to be filled in the same method described for date sampled.	8 Aug. 1961 6 1 8 8
ANALYZING LABORATORY	2	33	34	Columns 33 to 34 refer to the laboratory which performed the analysis of the water sample, coded as:	

Unknown		00
Bureau of Mineral Resources		01
BMR and its contractors		02-09
State chemical laboratories		
" " "	Qld	11
" " "	NSW	12
" " "	SA	13
" " "	NT	14
Universities and Research organizations		20-29
AMDEL		30
		31-39
		40-49
		50-59
		60-69
		70-79
		80-89
		90-99

Topic	Column Total	Start	End	Explanation	Example
FIELD DETERMINATION	17	35	51	Columns 35 to 51 refer to the field determinations of some characteristics of the water sampled.	
Temperature of resistivity	4	35	38	Columns 35 to 38 refer to a temperature measurement of a water sample, taken at the time the resistivity or conductivity measurement was made in the field. Fill columns 35 to 37 with integer part of the temperature value measured, (no decimal is required). Fill columns 38 with the unit in which the temperature in columns 35 to 37 is expressed, i.e. Fahrenheit or Celsius, coded: Fahrenheit F, Celsius C	85.6 C | | 8 | 5 | C | 123.4 F | 1 | 2 | 3 | F |
Temperature of sample	4	39	42	Columns 39 to 42 refer to the temperature measurement of the water from the well, taken at the time of sampling at the sample point. Fill columns 39 to 41 with the integer part (no decimal required), and column 42 with either F or C, depending whether the temperature is expressed in Fahrenheit or Celsius.	

Water Chemistry - 1 transfer sheet

Topic	Column Total	Start	End	Explanation	Example
pH	2	43	44	Columns 43 and 44 refer to the field pH measurement of the water from the well, i.e. the value used to designate the logarithm (base 10) of the reciprocal of the hydrogen-ion concentration. Column 43 to be used for the integer part of the pH value, column 44 for the decimal part.	7.8 | 7 | 8 |
Eh	3	45	47	Columns 45 to 47 refer to the field Eh measurement of the water from the well; i.e. the value used to designate the energy needed to remove electrons from ions in a given chemical environment, the redox potential or oxidation-reduction potential. Column 45 to be used for the positive (+) or negative (-) sign of the Eh value. Column 46 to be used for the integer part of the Eh value, column 47 for the decimal part.	+ 0.2 | + | 0 | 2 | - 0.3 | - | 0 | 3 |
Resistivity or Conductivity	4	48	51	Columns 48 to 51 refer to the resistivity (in ohms-m) or Conductivity micromhos per centimeter measurement, performed on the water from the well in the field; i.e. the electrical resistivity or resistance and its reciprocal the electrical conductivity or ability to conduct an electrical current	Conductivity 1600 micromhos/cm 16 X 10^2. | C | 1 | 6 | 2 |

Topic	Column Total	Start	End	Explanation	Example
				Column 48 to be filled with: R-in case of a resistivity value, and C-in case of a conductivity value. Columns 49 and 51 contain the actual measured value, i.e. fill column 49 and 50 with the first two numbers of this figure, and in column 51 the nearest power value of 10.	Conductivity 150 micromhos/cm 15 x 10. | C | 1 | 5 | 1 |
LABORATORY DETERMINATIONS	20	52	71	Columns 52 to 71 refer to the Laboratory determinations of some physical and chemical characteristics of the water sampled.	
Resistivity or Conductivity	4	52	55	Columns 52 to 55 refer to the resistivity (in ohms-cm) or conductivity (micromhos/cm^{-1}) measurement, performed on the water sample in the laboratory. Fill columns 52 to 55 in the same way as described for the field measurement in columns 48 to 51.	
pH	2	56	57	Columns 56 to 57 refer to the pH (laboratory) measurement of water sampled. Fill column 56 with the integer part of the pH value, column 57 with the decimal part.	8.2 | 8 | 2 |
Total hardness	4	58	61	Columns 58 to 61 refer to the total hardness of the water sample; i.e. the measure of the calcium and magnesium content of the water, either expressed as the equivalent of calcium carbonate in ppm or in degrees.	

Topic	Column Total	Start	End	Explanation	Example
				Column 58: The unit of total hardness filled in	
				$CaCO_3$ in ppm 1 Clarke degrees 2 German degrees 3 1^oD, equiv.10 mg CaO per litre English degrees 4 $1^oE = 0.80\ ^oD$ French degrees $1^oF = 0.56\ ^oD$ 5	25 ppm $CaCO_3$ |1|2|5|0|
				Columns 59 and 60 to be filled with the first two numbers of the figure.	300 ppm $CaCO_3$
				Column 61 with the power value of 10 (if necessary).	|1|3|0|1|
Total alkalinity	4	62	65	Columns 62 to 65 refer to the total alkalinity of the water sample, i.e. the measure of an amount of a standard concentration of sulfuric acid which is needed to titrate a water sample to an endpoint of pH 4.5. Alkalinity is produced almost exclusively by bicarbonate and carbonate ions. Fill columns 62 to 65 with the value for the total alkalinity as calcium carbonate in ppm; column 62 with the method of analysis, coded as: unknown 0 titration 1 2	
				Fill column 63 and 64 with the first two numbers of the ppm value, and column 65 with the power of 10.	3000 ppm 30.10^{-2} |1|3|0|2|

Topic	Column Total	Start	End	Explanation	Example
Total dissolved solids	3	66	68	Columns 66 to 68 refer to the amount of total dissolved solids (TDS) in the water sample, as determined in the laboratory analysis. The total dissolved solids in a water sample includes all solid material in solution, whether ionized or not, and does not include suspended sediments, colloids or dissolved gases. Column 66 refers to the method by which the TDS is determined, coded as: unknown 0 evaporation at 110°C 1 evaporation at 180°C 2 numerical sum of all dissolved solids, which are determined by chemical tests 3 electrical conductivity 4 Column 67 refers to the first number of ppm value, and Column 68 to the power of 10.	evaporation at 180°C 3600 ppm 3×10^3 |2|3|3|
Free CO_2	3	69	71	Columns 69 to 71 refer to the amount of free carbon dioxide in the water sample, determined in the laboratory, expressed in ppm. Fill columns 69 and 70 with the first two numbers of this value, and column 71 with the power of 10.	60 ppm 60×10^0 |6|0|0| or 6×10^1 | |6|1|

Water chemistry - 1 transfer sheet

Topic	Column Total	Start	End	Explanation	Example
FURTHER INFORMATION AVAILABLE	62	72	77	Columns 72 to 77 refer to further information available on the results of the laboratory analysis of the water sample, coded: unknown 0 available 1 not available 2	
Hydrocarbons	1	72	72	Column 72 refers to hydrocarbons.	
Trace elements	1	73	73	Column 73 refers to trace elements.	
Pesticides	1	74	74	Column 74 refers to pesticides.	
Insecticides	1	75	75	Column 75 refers to insecticides.	
Radioacitivity	1	76	76	Column 76 refers to radioactive materials	
Other	1	77	77	Column 77 refers to other information available on the results of the water analysis, which is not expressed in one of the previous columns.	
MISCELLANEOUS	1	78	78	Column 78 is left open for optional further information eventually required for the water chemistry - 1 card.	
FOLIO NUMBER	2	79	80	Columns 79 and 80 refer to the folio number of the water chemistry - 1 card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) used for one well.	4th card 4

2.14 Water chemistry - 2 card

The water chemistry - 2 card deals with the information about the actual chemical determinations of water sampled from a well.

Information recorded on this card includes the laboratory determinations of all anions and cations present in the water as well as the amount of hydrocarbons. The dates of sampling and analyzing the water are also recorded.

Recording on the card is in parts per million (ppm). An intermediate, temporary, transfer sheet and card will be used for determinations in other units and these will be converted by computer.

BMR – GAB Groundwater project

WATER CHEMISTRY – 2 SHEET

GAB – ADP System transfer sheet

CODE	IDENTIFICATION						AQUIFER No.	RELIABILITY	LABORATORY DETERMINATION																	DATE SAMPLED			DATE ANALYZED			FOLIO NUMBER
									Anions								Cations							Hydrocarbons								
	State	Letter	1:250000 Map Number	Card Cont.	Deepening	Well Number			Cl^- ppm (10^n)	SO_4^{2-} ppm (10^n)	HCO_3^- ppm (10^n)	CO_3^{2-} ppm (10^n)	NO_3^- ppm (10^n)	PO_4^{3-} ppm (10^n)	F^- ppm (0.1)	Br^- ppm (0.1)	Ca^{2+} ppm (10^n)	Mg^{2+} ppm (10^n)	Na^+ ppm (10^n)	K^+ ppm (10^n)	Fe^{2+} ppm (0.1)	Mn^{2+} ppm (0.1)	Si^{4+} ppm (0.1)	CH_4 ppm	Other	Year	Month	Day	Year	Month	Day	
1 2	3	4	5 6 7 8	9	10	11 12 13 14 15	16	17	18 19 20	21 22 23	24 25 26	27 28 29	30 31 32	33 34 35	36 37 38	39 40 41	42 43 44	45 46 47	48 49 50	51 52 53	54 55 56	57 58 59	60 61 62	63 64 65	66	67 68	69 70	71 72	73 74	75 76	77 78	79 80
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Water Chemistry - 2 transfer sheet

Topic	Column Total	Start	End	Explanation	Example
CODE	2	1	2	Columns 1 and 2 are pre-printed and refer to the code of the card, see Introduction, 1.3.2.	Water chemistry - 2 card |4|M|
IDENTIFICATION	13	3	15	Columns 3 to 15 deal with the identification of the well; this information is to be repeated from the master card; for filling of these columns, refer to the master transfer sheet explanation. Note column 9, see Introduction, 1.3.3.	
MAIN AQUIFER TAPPED	1	16	16	Column 16 deals with the main aquifer tapped by the well (or representative well in the centre of a group of wells) as described by the aquifer description card:	
				Unknown 0	
				Watertable 1	
				Hooray Sandstone and Adori Sandstone aquifers, plus correlates 2	Hooray Sandstone + Adori Sandstone |2|
				Hutton Sandstone, Evergreen Fm and Precipice Sandstone aquifer 3	
				Triassic, Permian and stratigraphically deeper aquifers 4	Clematis Sandstone |4|
				If several main aquifers are tapped: 9	

Topic	Total	Column Start	End	Explanation	Example
RELIABILITY	1	17	17	Column 17 refers to the reliability of information about the aquifers tapped, coded: unknown 0 good 1 medium 2 poor 3	poor | 3 |
LABORATORY DETERMINATIONS	49	18	66	Columns 18 to 66 refer to the laboratory determinations of anions and cations in the water sample, and hydro-carbons, if present.	
Anions	24	18	41	Columns 18 to 41 refer to the amount of anions determined to be present by the laboratory analysis of the water sample, expressed in ppm (parts per million). Fill the first two columns of each anion record with the first two numbers of the ppm - figure determined, and fill the third column of each anion record with the power of 10 (except for fluoride and bromide, where the third column is to be filled with the decimal part of the ppm - value).	605 ppm 60 x 10^1 | 6 | 0 | 1 | 56 ppm 56 x 10^0 | 5 | 6 | 0 |

Water Chemistry - 2 transfer sheet

Topic	Total	Column Start	End	Explanation	Example
				The following anion determinations can be recorded:	
Chloride	3	18	20	Columns 18 to 20 refer to chloride, Cl^- expressed in ppm.	
Sulphate	3	21	23	Columns 21 to 23 refer to sulphate, SO_4^{2-} in ppm.	
Bicarbonate	3	24	26	Columns 24 to 26 refer to bicarbonate, HCO_3^- in ppm.	
Carbonate	3	27	29	Columns 27 to 29 refer to carbonate, CO_3^{2-} in ppm	
Nitrate	3	30	32	Columns 30 to 32 refer to nitrate, NO_3^-, in ppm.	
Phosphate	3	33	35	Columns 33 to 35 refer to phosphate, PO_4^{3-}, in ppm.	
Fluoride	3	36	38	Columns 36 to 38 refer to fluoride, F^-, in ppm. Note: Fill the decimal in part in column 38.	
Bromide	3	39	41	Columns 39 to 41 refer to bromide, Br^-, in ppm. Note: Fill the decimal part in column 41.	
Cations	21	42	62	Columns 42 to 62 refer to the amount of cations determined to be present by the laboratory analysis of the water sample, expressed in ppm (parts per million). Fill the first two columns of each cation record with the first two numbers of the ppm figure and fill the third column of the cation record with the power of 10 (except for iron, manganese and silicon where the third column is to be filled with the decimal part of the ppm value instead of the power of 10).	

Topic	Total	Column Start	End	Explanation	Example
				The following cation determinations can be recorded:	
Calcium	3	42	44	Columns 42 to 44 refer to calcium, Ca^{2+}, expressed in ppm.	
Magnesium	3	45	47	Columns 45 to 47 refer to magnesium, Mg^{2+} expressed in ppm.	
Sodium	3	48	50	Columns 48 to 50 refer to sodium, Na^{+} expressed in ppm.	
Potassium	3	51	53	Columns 51 to 53 refer to potassium, K^{+} expressed in ppm.	
Iron	3	54	56	Columns 54 to 56 refer to iron, Fe^{2+} expressed in ppm. Note: Fill the decimal part in column 56.	
Manganese	3	57	59	Columns 57 to 59 refer to manganese, Mn^{2+} expressed in ppm. Note the decimal part in column 59.	
Silicium	3	60	62	Columns 60 to 62 refer to silica, Si^{4+} expressed in ppm. Note the decimal part in column 62.	
Hydrocarbons	4	63	66	Columns 63 to 66 refer to the presence of hydrocarbons. The amount of methane, CH_4, determined by the laboratory analysis of the water sample, expressed in ppm, is recorded in columns 63 to 65. Column 66 is used to indicate whether other hydrocarbons are present, by use of the code: unknown 0 no other hydrocarbons 1 other hydrocarbons 2	

Water Chemistry - 2 transfer sheet

Topic	Total	Column Start	End	Explanation	Example
DATE SAMPLED	6	67	72	Columns 67 to 72 refer to the date on which the water sample was taken.	
Year	2	67	68	Columns 67 and 68 refer to the year in which the water sample was taken; fill in columns 67 and 68 the last two numbers of the year, see 2.1.	1972 | 7 | 2 |
Month	2	69	70	Columns 69 to 70 refer to the month in which the water sample was taken. Code the months from 1 to 12, see 2.1.	November | 1 | 1 |
Day	2	71	72	Columns 71 and 72 refer to the day on which the sample was taken.	22 | 2 | 2 |
DATE ANALYZED	2	73	78	Columns 73 to 78 refer to the date on which the water sample was analyzed in the laboratory; fill these columns in the same way as for date sampled.	23 November, 1972 | 7 | 2 | 1 | 1 | 2 | 3 |
FOLIO NUMBER	2	79	80	Columns 79 and 80 refer to the folio number of the water chemistry - 2 card. This folio number refers to one well, i.e. the set of cards (and lines on a transfer sheet) used for one well.	2nd card | 2 |

3. REFERENCES

Krebs, G., - The Great Artesian Basin automatic data processing system (GABADP). Computer program documentation. Bur. Miner. Resour. Aust. Rec. (in prep.).

Kruseman, G.P., de Ridder, N.A., 1970 - Analysis and evaluation of pumping test data. Intern. Instit. Land Reclam. Improv., Bull. 11.

Ungemach, P., - The Great Artesian Basin simulation model (GABSIM). Description of a digital simulation model for groundwater flow. Bur. Miner. Resour. Aust. Rec. (in prep.).

4. Appendix - Lithostratigraphic Symbols For Rock Units

4.1. Stratigraphic List

Quaternary, undivided	Q
Tertiary, undivided	TE
Cainozoic, undivided	CZ
Mesozoic, undivided	M
Cretaceous, undivided	K
Upper Cretaceous, undivided	KU
Lower Cretaceous, undivided	KL
Pre-Cretaceous, undivided	XK
Rolling Downs Group	KR
Manuka Sub-group	KM
Wilgunya Sub-group	KLW
Winton Formation	KW
Mackunda Formation	KLM
Allaru Mudstone	KLA
Toolebuc Limestone	KLØ
Wallumbilla Formation	KLU
Coreena Member	KLC
Ranmoor Member	KLQ
Jones Valley Member	KLJ
Doncaster Member	KLD
Griman Creek Formation	KLGG
Surat Siltstone	KLS
Rumbalara Shale	KLR
Oodnadatta Formation	KLØD
Mt Alexander Sandstone Member	KLAS
Wooldridge Limestone Member	KLWL
Coorikiana Member	KLCØ
Bulldog Shale	KLB
Bungil Formation	KLY
Minmi Member	KLI
Nullawurt Sandstone Member	KLN
Kingull Member	KLK
Claravale Sandstone Member	KLX
Mooga Sandstone (Surat Basin only)	KLMØ
Gilbert River Formation	KLG

Cadna-Owie Formation	KCØ
Mt Anna Sandstone Member	KLMA
Gum Vale Beds	KLV
Crooble Beds	KLCR
Jurassic to Cretaceous, undivided	JK
Hooray Sandstone	JKH
Upper Hooray Sandstone	JKHU
Lower Hooray Sandstone	JKHL
Pre-Jurassic	XJ
Kumbarilla Beds	JKK
Ronlow Beds	JKR
Longsight Sandstone	JKL
De Souza Sandstone	JKD
Southlands Formation	JKS
Jurassic, undivided	J
Upper Jurassic, undivided	JU
Middle Jurassic, undivided	JM
Lower Jurassic, undivided	JL
Westbourne Formation	JUW
Adori Sandstone	JA
Birkhead Formation	JMB
Injune Creek Group	JI
Hutton Sandstone	JLH
Evergreen Formation	JLE
Boxvale Sandstone Member	JLB
Oolite Member	JLØ
Westgrove Ironstone Member	JLW
Precipice Sandstone	JLP
Orallo Formation	JUØ
Gubberamunda Sandstone	JUG
Springbok Sandstone	JS
Walloon Coal Measures	JMW
Eurombah Formation	JME
Marburg Sandstone	JLM
Helidon Sandstone	JLL
Blantyre Beds	JUB
Loth Formation	JUL
Hampstead Sandstone	JH
Algebuckina Sandstone	JUA
Pilliga Sandstone	JP
Purlawaugh Beds	JPU
Warialda Sandstone	JPW

Garrawilla Volcanics	JG
Gragin Conglomerate Member	JGC
Triassic, undivided	T
Pre-Triassic	XT
Moolayember Formation	TM
Clematis Sandstone	TRE
Dunda Beds	TLD
Rewan Formation	TLR
Brumby Sandstone Member	TB
Warang Sandstone	TLW
Showgrounds Sandstone	TS
Wandoan Formation	TW
Narrabeen Group	TN
Nappamerrie Formation	TP
Palaeozoic, undivided	PZ
Permian, undivided	P
Upper Permian	PU
Lower to Upper Permian	PLU
Lower Permian	PL
Pre-Permian	XP
Blackwater Group	PUW
"Bandanna" Formation	PUA
Black Alley Shale	PUC
Peawaddy Formation	PUP
Colinlea Sandstone	PLØ
Ingelara Formation	PLI
Cattle Creek Formation	PLK
Aldebaran Sandstone	PLL
Back Creek Group	PB
Reids Dome Beds	PLJ
Betts Creek Beds	PUB
Boonderoo Beds	PLB
Crown Point Formation	PC
Gidgealpa Group	PG
Toolachee Formation	PUT
Fly Lake Member	PUF
Roseneath Shale	PLR
Daralingie Member	PLD
Epsilon Formation	PLE
Murteree Shale	PLM
Tirrawarra Sandstone	PLT
Merrimelia Formation	PM
Barra Beds	PUBB
Werrie Formation	PLW
Carboniferous to Permian, undivided	CP
Joe Joe Formation	CPJ

Carboniferous, undivided	C
Drummond Group	CD
Devonian, undivided	D
Adavale Group	DA
Silurian, undivided	S
Ordovician, undivided	Ø
Cambrian to Ordovician, undivided	EØ
Cambrian, undivided	E
Precambrian to Palaeozoic, undivided	XEPZ
Precambrian	XE
"Basement"	BAS

4.2 Alphabetic List

Adavale Group	DA
Adori Sandstone	JA
Aldebaran Sandstone	PLL
Algebuckina Sandstone	JUA
Allaru Mudstone	KLA
Back Creek Group	PB
"Bandanna" Formation	PUA
Barra Beds	PUBB
Basement	BAS
Betts Creek Beds	PUB
Birkhead Formation	JHB
Black Alley Shale	PUC
Blackwater Group	PUW
Blantyre Beds	JUB
Boonderoo Beds	PLB
Boxvale Sandstone Member	JLB
Brumby Sandstone Member	TB
Bulldog Shale	KLB
Bungil Formation	KLY
Cadna-Owie Formation	KCØ
Cainozoic, undivided	CZ
Cambrian, undivided	E
Cambrian to Ordovician, undiv.	EØ
Carboniferous, undivided	C
Carboniferous to Permian, undivided	CP
Cattle Creek Formation	PLK
Claravale Sandstone Member	KLX
Clematis Sandstone	TRE
Colinlea Sandstone	PLØ
Coorikiana Member	KLCØ
Coreena Member	KLC
Cretaceous, undivided	K
Crooble Beds	KLCR
Crown Point Formation	PC
Daralingie Member	PLD
De Souza Sandstone	JKD
Devonian, undivided	D
Doncaster Member	KLD
Drummond Group	CD
Dunda Beds	TLD

Epsilon Formation	PLE
Eurombah Formation	JHE
Evergreen Formation	JLE
Fly Lake Member	PUF
Garrawilla Volcanics	JG
Gidgealpa Group	PG
Gilbert River Formation	KLG
Gragin Conglomerate Member	JGC
Griman Creek Formation	KLGG
Gubberamunda Sandstone	JUG
Gum Vale Beds	KLV
Hampstead Sandstone	JH
Helidon Sandstone	JLL
Hooray Sandstone	JKH
Hutton Sandstone	JLH
Ingelara Formation	PLI
Injune Creek Group	JI
Joe Joe Formation	CPJ
Jones Valley Member	KLJ
Jurassic to Cretaceous, undivided	JK
Jurassic, undivided	J
Kingull Member	KLK
Kumbarilla Beds	JKK
Longsight Sandstone	JKL
Loth Formation	JUL
Lower Cretaceous, undivided	KL
Lower Hooray Sandstone	JKHL
Lower Jurassic, undivided	JL
Lower Permian, undivided	PL
Lower to Upper Permian, undivided	PLU
Mackunda Formation	KLM
Manuka Sub-Group	KM
Marburg Sandstone	JLM
Merrimelia Formation	PM
Mesozoic, undivided	M
Middle Jurassic, undivided	JM
Minmi Member	KLI
Mooga Sandstone (Surat Basin only)	KLMØ

Moolayember Formation	TM
Mt. Alexander Sandstone Member	KLAS
Mt. Anna Sandstone Member	KLMA
Murteree Shale	PLM
Nappamerrie Formation	TP
Narrabeen Group	TN
Nullawurt Sandstone Member	KLN
Oodnadatta Formation	KLØD
Oolite Member	JLØ
Orallo Formation	JUØ
Ordovician, undivided	Ø
Palaeozoic, undivided	PZ
Peawaddy Formation	PUP
Permian, undivided	P
Pilliga Sandstone	JP
Precambrian, undivided	XE
Precambrian to Paleozoic, undivided	XEPZ
Pre-Cretaceous, undivided	XK
Pre-Jurassic, undivided	XJ
Pre-Permian, undivided	XP
Pre-Triassic, undivided	XT
Precipice Sandstone	JLP
Purlawaugh Beds	JPU

Quaternary, undivided	Q
Ranmoor Member	KLQ
Reids Dome Beds	PLJ
Rewan Formation	TLR
Rolling Downs Group	KR
Ronlow Beds	JKR
Roseneath Shale	PLR
Rumbalara Shale	KLR
Showgrounds Sandstone	TS
Silurian, undivided	S
Southlands Formation	JKS
Springbok Sandstone	JS
Surat Siltstone	KLS
Tertiary, undivided	TE
Tirrawarra Sandstone	PLT
Toolachee Formation	PUT
Toolebuc Limestone	KLØ
Triassic, undivided	T

Upper Cretaceous, undivided	KU
Upper Hooray Sandstone	JKHU
Upper Jurassic, undivided	JU
Upper Permian, undivided	PU
Walloon Coal Measures	JMW
Wallumbilla Formation	KLU
Wandoan Formation	TW
Warang Sandstone	TLW
Warialda Sandstone	JPW
Werrie Formation	PLW
Westbourne Formation	JUW
Westgrove Ironstone Member	JLW
Wilgunya Sub-Group	KLW
Winton Formation	KW
Wooldridge Limestone Member	KLWL