8.0 Review / tabulation of groundwater data across the Galilee Basin study area tenements

The surface and subsurface geology varies considerably from the steeply dipping rocks near the faulted basin margin in the north and east, to the relatively flat lying sediments in the west, to the complex stratigraphic relationships at the edge of the Maneroo Platform. The analysis of the subsurface geology, groundwater stratigraphy, groundwater levels and groundwater quality was further complicated by the pattern of tenure ownership. Specifically, the GBOF member tenements are rarely contiguous. Additionally, there was a need to process and present the data in a manner that adequately protects the GBOF members' confidentiality. Furthermore, the tenements are in different stages of development.

The subsurface geology, groundwater stratigraphy, groundwater levels and groundwater quality data are presented and discussed for each of the active tenements in the following sections.

8.1 Summary of available data for ATP 529

ATP 529 is located in the centre of the Galilee Basin study area, north-east of Longreach (Figure 1.2). The tenement is 5,940 km^2 and is drained to the south by the Thomson River. The Thomson River is formed by the confluence of Landsborough and Cornish Creeks near the northern edge of the tenure. ATP 529 is divided into two sections. A small section of ATP 529 is located 60 km north of the main tenement.

8.1.1 Surface geology for ATP 529

The central portion of ATP 529 is underlain by 4 to 7 m of alluvium associated with the Thomson River and its tributaries (Figure 3.1). The alluvium is composed of sand, silt and gravel. There are several small outcrops of the Tertiary age Glendower Formation west of the Thomson River and one just north of the Aramac Creek. In general, the sediments at the surface become older to the east.

The areas within ATP 529 east and west of the Thomson River alluvial plain are underlain by Early Cretaceous age Rolling Downs Group, specifically the Mackunda Formation and Allaru Mudstone. The older Allaru Mudstone outcrops along the eastern margin of ATP 529. The younger Mackunda Formation underlies the western two-thirds of ATP 529.

The northern section of ATP 529 is underlain by the Tertiary age Wondoola beds, which are overlain by the Quaternary alluvium in the north-east. There is a small north-east to south-west oriented outcrop of the Tertiary age Glendower Formation located in the central portion of this part of ATP 529. The Glendower Formation also outcrops in the west.

8.1.2 Exploration well drilling history for ATP 529

Thirty-four exploration wells have been advanced within ATP 529 since 4 September 1966 (Plate 1 and Table 8.1). The early wells were drilled before the current boundaries of ATP 529 were established. The early wells were drilled to explore for liquid petroleum and to define the subsurface stratigraphy. More recently, 24 wells have been drilled to explore for CSG. Ten of the exploration wells have been drilled recently, so the available data are limited to location, spud date and drill depth. An additional five CSG exploration wells have been drilled since the latest version of QPED (2011) became available. Data for these wells were limited to location, spud date and well drill depth. However, limited stratigraphic data have been made available to RPS for 13 of the recent exploration wells.

Table 8.1 Drilling summary for ATP 529

Attribute		Count
Total number of wells		34
Type of wells	Petroleum	8
	Stratigraphic	2
	Coal Seam Gas	24
Earliest spud date	04-Sep-1966	
Latest spud date	Current	
Depth shallowest well (m bKB)	1,059	
Depth deepest well (m bKB)	1,986	
Average bore depth (m bKB)	1,242	

8.1.3 Water bore drilling history for ATP 529

DERM records 68 registered water bores present within ATP 529 (Table 8.2). The first bore was drilled in 1886 (RN 103) and the most recent bore was drilled on 17 August 2010 (RN146291). The shallowest bore was drilled to approximately 650 m bGL (RN 10679) and the deepest bore was drilled to 1,786 m bGL (RN 22687). The average bore was drilled to 1,288 m bGL and is therefore likely to tap a confined aquifer. 67 bores are currently recorded to have controlled or uncontrolled artesian flow. Flow is recorded to have ceased at 1 bore and the current condition of this bores is unknown.

Table 8.2 Summary of DERM registered water bores present within ATP 529

Attribute		Count
Total number of bores		68
Type of bore	Artesian Bore--ceased to flow	1
	Artesian Bore--condition unknown	1
	Artesian Bore--controlled flow	25
	Artesian Bore--uncontrolled flow	2
	Subartesian facility	14
	Not recorded	25
Bore status	Abandoned and destroyed	16
	Abandoned but usable	1
	Existing	50
	Not recorded	1
Earliest drill date	RN 103	1886
Latest drill date	RN 146291	17/8/2010
Number of water bores in QPED		10
Depth of the shallowest bore (m bGL)	RN 10679	650
Depth of the deepest bore (m bGL)	RN 22687	1,786
Average bore depth (m bGL)		1,288

8.1.4 Subsurface geology for ATP 529

The summary of the subsurface geology of ATP 529 is based on the geological log from the Rand 1 exploration well drilled to a depth of 1,986.1 m bKB on 27 June 1969 (Table 8.3). Stratigraphy was also recorded in detail at the two stratigraphic wells present within ATP 529, GSQ Longreach 1-1B, located approximately 25 km north-east of Longreach and GSQ Muttaburra 1, which is located east of the Thomson River and 8 km from the western tenement boundary. The stratigraphy logged at these three holes intersects the major basal Jurassic unconformity between 900 and 950 m bGL and the Permian unconformity between 1,000 to 1,100 m bGL.

The summary data presented in Table 8.3 are presented as they have been recorded in Rand 1 well completion report. Note that several formations that are documented elsewhere are not presented in the stratigraphic details contained in Table 8.3.

The younger and shallower Eromanga basin aquifers, the undifferentiated Injune Creek Group, and the Hooray Sandstone, are separated from the underlying Jurassic age Measures by the low permeability Birkhead (~84 m thick) and Westbourne Formations (~33 m thick). The Hutton Sandstone, which stratigraphically underlies the Birkhead Formation, is separated from the Permian coal measures by the regionally significant aquitard, the Rewan Formation.

Table 8.3 Type stratigraphy for ATP 529—LOL Rand 1

Depth to formation top (m bKB)	Depth to formation bottom (m bKB)	Basin	Formation name		Age
4		Eromanga Basin sequence	Rolling Downs Group	Winton Formation	Late Cretaceous
	204			Mackunda Formation	Cretaceous
204	448			Allaru Mudstone	Cretaceous
448	455			Toolebuc Formation	Early Cretaceous
455	616			Wallumbilla Formation	Early Cretaceous
616	719			Hooray Sandstone	Late Jurassic to Early Cretaceous
719	752		Injune Creek Group	Westbourne Formation	Jurassic
752	765			Adori Sandstone	Jurassic
765	849			Birkhead Formation	Jurassic
849	942			Hutton Sandstone	Middle Jurassic
942	954	Galilee Basin sequence		Rewan Formation	Middle Triassic
954	1,122			Betts Creek beds	Late Permian
1,122	1,264		Joe Joe Group	Aramac Coal Measures	Late Carboniferous to Early Permian
1,264	1,786			Jericho Formation	
1,786				Jochmus Formation	

8.1.5 Aquifers within ATP 529

Bores within the noted aquifers and water bearing sediments are taken from water quality, pump test and water level tables found in the DERM GWDB (2010). These data are not tabulated in this report, thus, bore quantities presented in this report will not necessarily be reflected in the summary text. The following Eromanga basin aquifers and water-bearing sediments may be present within ATP 529 (Appendix Table D.1 and Table E.1):

- Winton Formation (no bores identified);
- Mackunda Formation (4 identified);
- Wallumbilla Formation (1identified);
- Hooray Sandstone (7 bores);
- Adori Sandstone (no bores identified);
- Injune Creek Group (1 bore); and
- Hutton Sandstone (13 bores).

The following potential Galilee basin aquifers and water-bearing sediments are present within ATP 529:

- Clematis Sandstone (1 bore);
- Betts Creek beds (2 bores);
- Aramac Coal Measures (no bores identified);
- Jericho Formation (no bores identified); and
- Jochmus Formation (no bores identified).

Note that the Galilee basin aquifers and water-bearing sediments occur stratigraphically below the Rewan Formation, which is found at a significant depth within ATP 529.

8.1.6 Groundwater level summary for ATP 529

Groundwater level data are available for four formations present within ATP 529. Sixteen groundwater level measurements have been recorded that can be attributed to a specific formation (Table 8.4). An additional 29 aquifer pressure observations have been recorded for the Permian age sediments from exploration well DSTs (Table 7.3).

All of the groundwater level measurements have been made in the Eromanga basin sediment aquifers. The groundwater level measurements range from the earliest reported date of 9 December 1955 to the last recorded data of 1 January 2006. There are too few groundwater level measurements to support robust conclusions. However the groundwater level data suggest upward groundwater flow gradient in the Hutton Sandstone aquifer. The DST pressure data for the aquifers and water bearing sediments in the underlying Permian sediments also suggests upward pressure gradient, especially where the Galilee basin sequence meets and pinches out under the Eromanga basin sediments.

Table 8.4 Summary of groundwater levels from water bores within ATP 529

Basin	Formation name	Measurement period		Count	Depth to groundwater (m bGL)				
		Start	End		Ave	Max	Min	Range	Median
Eromanga Basin sequence	Mackunda Formation	09-Dec-1955	10-Jun-1958	4	-38.5	-27.4	-60.7	33.2	-32.9
	Wallumbilla Formation	11-July-1967		1	-10.64				
	Hooray Sandstone	3-Sept-1935		1	-6.1				
	Hutton Sandstone	1-Jan-1906	17-Oct-1974	10	-8.68	17.8	-103.6	121.41	-5.7

There are 29 DST final shut-in pressure measurements from six exploration wells drilled into ATP 529. The shut in pressures were measured in:

- Betts Creek beds;
- Aramac Coal Measures;
- The Joe Joe Group; and the
- Drummond Basin sequence.

The DST final shut-in pressures were measured at Crossmore 1 and 2; Rand 1; Rodney Creek 1, Rodney Creek 2 and Thunderbolt 1.

The equivalent groundwater elevation (i.e. piezometric head) for the Permian coal measures was calculated to be 30 to 60 m bGL across all measurements. One final shut-in pressure from Crossmore 1 attributed to the Betts Creek beds yielded an equivalent groundwater elevation of 5 m aGL (above ground level). One final shut-in pressure from Crossmore 2 attributed to the Betts Creek beds yielded an equivalent groundwater elevation of 44 m aGL. The final shut-in pressures attributed to the Joe Joe Group yielded equivalent groundwater elevation significantly above ground level (Table 7.3).

The groundwater flow direction assessment for the aquifers present within ATP 529 is based on the groundwater contours presented on Figure 6.20 and Figure 6.21. Groundwater flow in the Rolling Downs Group aquifers, Cadna-owie / Hooray Sandstone aquifers and the Hutton Sandstone aquifer is generally to the south-southwest, paralleling the Thomson River under ATP 529. There is a notable high in the groundwater contours for the Rolling Downs Group aquifers.

8.1.7 Summary of DERM GWDB flow and pumping test data for ATP 529

Pumping test data was received for 45 water bores in DERM GWDB (2010) for ATP 529 (Figure 6.23). The formation could be identified for 20 of these bores. These bores have been identified as tapping the following aquifers and water bearing sediments:

- Wallumbilla Formation;
- Hooray Sandstone;
- Injune Creek Group;
- Clematis Sandstone; and
- Hutton Sandstone.

The first flow test was conducted on 19 May 1890 and the most recent was conducted on 30 January 2006 (DERM GWDB, 2010). Fewer observations have been recorded after 1972.

The changes in aquifer pressure and depth to groundwater over time were assessed by plotting the discharge upon arrival at the bore (Figure 8.1), changes in the static groundwater level (Figure 8.2) and changes in the calculated static groundwater level (Figure 8.3).

The peak groundwater discharge for the observations at bores drilled in the Wallumbilla Formation decline non-linearly from a high of approximately 30 L/s per bore in the early 1900s to approximately 5 L/s per bore in 2004 (Figure 8.1). Peak groundwater discharge is observed to decline from approximately 25 to 15 L/s in the bores drilled in the Hutton Sandstone. The peak groundwater discharge declines from 35 to 25 L/s per bore that have not been assigned to an aquifer. However, the discharge observations remain relatively stable at bore RN 65 between 1938 and 1971.

Static groundwater levels appear to remain relatively consistent for all aquifers between 1900 and 2010 (Figure 8.2). However, there is a noticeable 20 m upward shift in the observations around 1980. The static groundwater level data are dominated by subartesian values prior to 1980 and artesian values after 2000. It is unknown if this is an artefact of the bores sampled or if this is due to a change in aquifer pressure.

The calculated static groundwater levels appear to remain relatively constant from the early 1980s through to 2010 (Figure 8.3). If there is any trend, the calculated static groundwater levels appear to have increased slightly since 1980.

The water bores drilled within ATP 529 generally target the shallower aquifers with groundwater occurring typically above the Injune Creek Group sediments. However, the Hutton and Clematis Sandstone aquifers are tapped locally. This is important because the regionally significant confining units, those that separate the base of the Hutton Sandstone from the top of the Permian coal measures are thin or even absent under sections of ATP 529 (Figure 3.3, Figure 3.4 and Figure 3.10).

Figure 8.1 Bore discharge (L/s) at arrival for ATP 529 water bores with data, 1900 to 2010

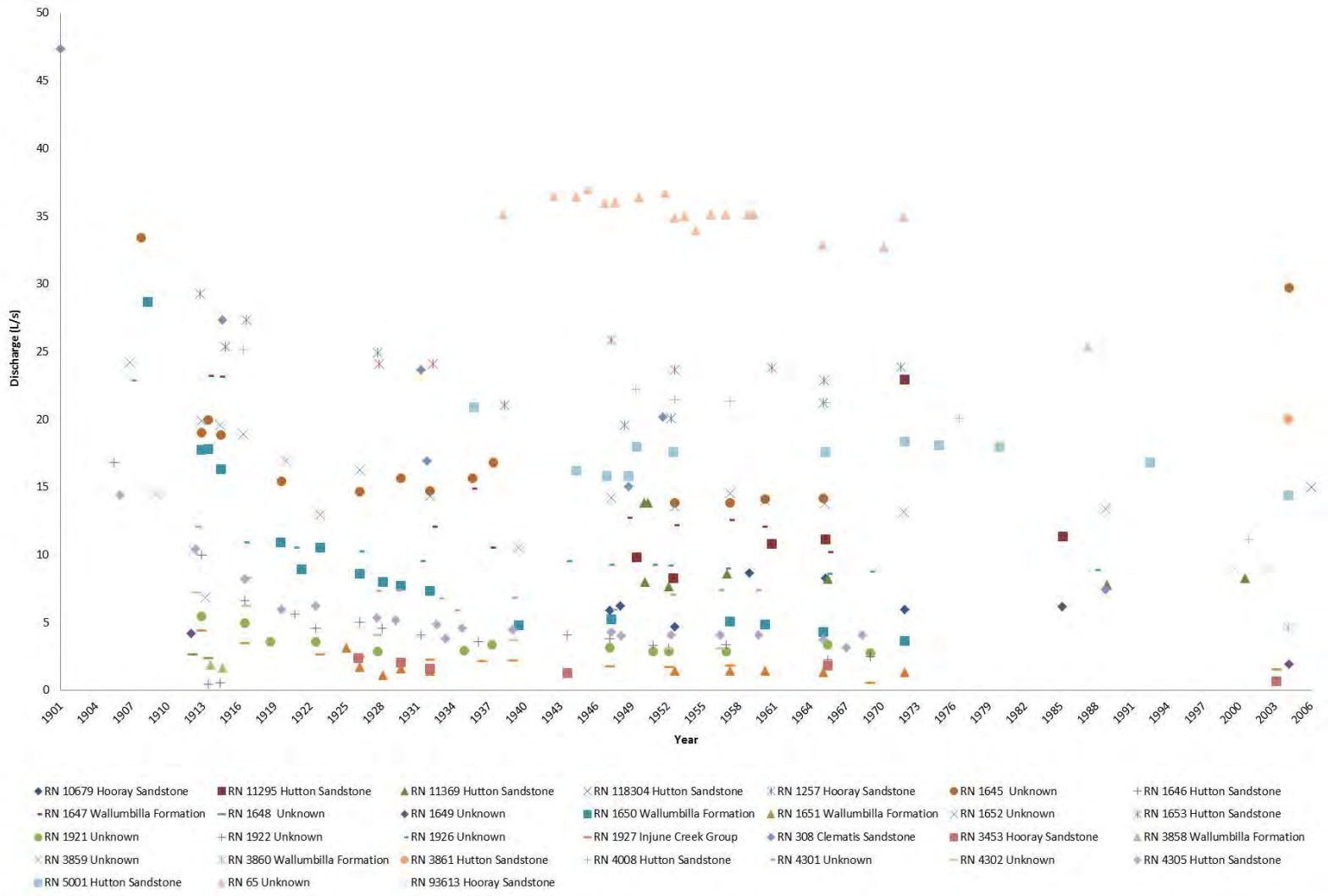


Figure 8.2 Static groundwater levels for ATP 529 water bores with data, 1900 to 2010

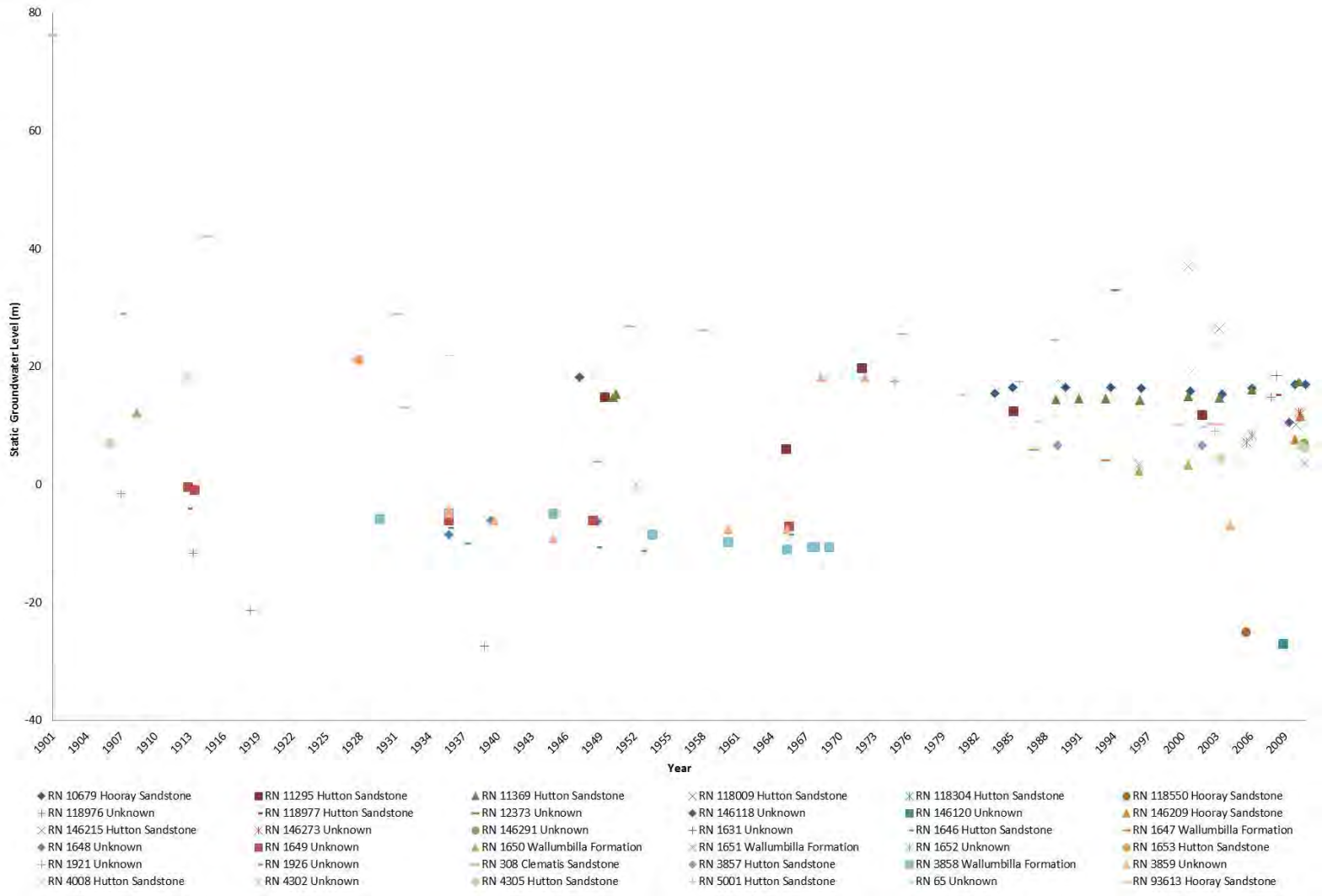
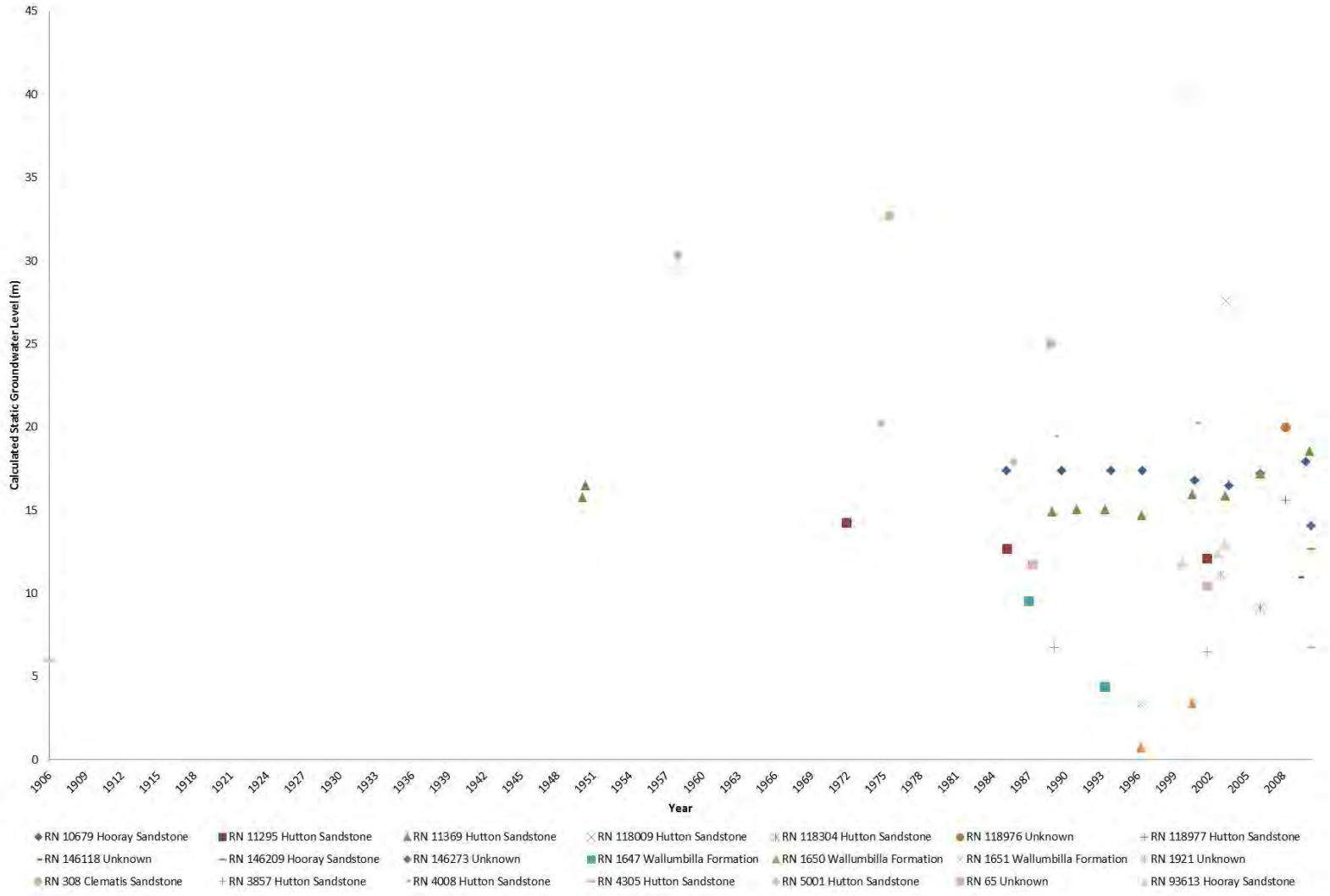


Figure 8.3 Calculated static groundwater levels for ATP 529 water bores with data, 1900 to 2010



8.1.8 Groundwater quality within ATP 529

Chemical analysis for groundwater samples are available from bores tapping nine aquifer systems or water-bearing sediments ranging from the Wallumbilla Formation to the undifferentiated Carboniferous; including the water-bearing units within Permian coal measures (Table 8.5a). Groundwater quality samples from the Permian coal measures were available for analysis from petroleum exploration drilling (Table 8.5b and Appendix Table E-1), but excluded from the discussion below.

Groundwater quality samples were obtained from between 24 m bGL and 921 m bGL for bore RN 1647 that taps the Wallumbilla Formation and 1,877 m bGL for bore RN 22687 that taps the undifferentiated Carboniferous strata (DERM GWDB 2010)

- Groundwater pH varied between 6.8 to 9.5;
- Total dissolved solids ranged from 18.5 to 6,840 mg/L indicating dominantly fresh to slightly brackish groundwater;
- Electrical conductivity data ranged from 410 to 4,400 μS/cm, excluding data obtained from drill stem tests which may be tainted by drilling fluid;
- Sodium ranged from 7.1 to 754 mg/L;
- Calcium ranged from 0.4 to 480 mg/L;
- Chlorine ranged from 2.4 to 1500 mg/L;
- Fluoride ranged from 0.1 to 5.4 mg/L;
- Bicarbonate ranged from 176 to 1,002 mg/L.

Groundwater quality data from the DERM registered bores and groundwater quality data from QPED (2011) are presented in the Figure 8.4 Piper diagram. Not all of the analytical results have been included on the Piper diagram because the full 11 parameter analytical suite required to develop an ion balance has only been completed for a subset of the groundwater samples collected. The groundwater chemistry data indicated generally sodium / chloride and sodium / bicarbonate type waters. The shallower groundwater tends to plot as sodium / bicarbonate type water and the groundwater associated with the Permian age sediments and coal measures tend to plot as sodium / chloride type water. The high chloride values presented on Figure 8.4 all come from Permian age and older sediments. Many of the samples obtained from the Permian age and older aquifers and water-bearing strata were obtained as DST samples and therefore may contain drilling fluids.

Figure 8.4 Piper diagram of the summary groundwater quality results from aquifers present within ATP 529

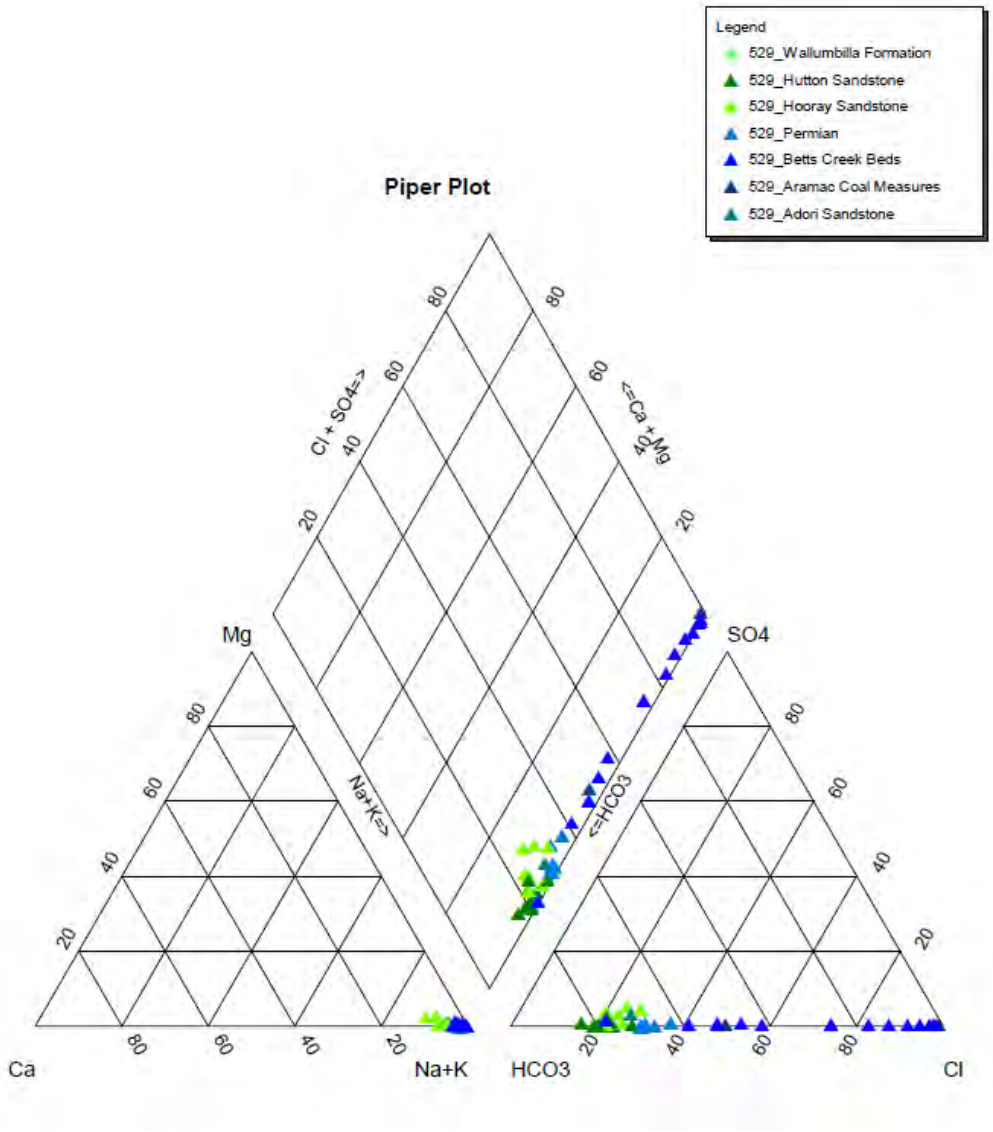


Table 8.5a Groundwater quality data summary for ATP 529

Basin	Identified aquifer or water bearing sediment	Statistic	Depth of Sample m bGL)	Conductivity (uS/cm)	pH	Hardness (mg/L Ca)	Alkalinity (mg/L)	Total Dissolved Solids (MG/l)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulphate (mg/L)	Zinc (mg/L)
Eromanga Basin sequence	Wallumbilla Formation	Total Number	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
		Number of Tests	8	14	17	6	17	16	17	11	17	10	8	8	14	16	17	17	3	10	0
		Average	699	924	8.2	136	367	535	192	5.5	3.4	17.6	0.04	0.02	447	36.2	86	1.74	3.7	3	--
		Maximum	921	1,450	9	717	650	898	364	10	9	170	0.09	0.04	787	219	135	5	4	14	--
		Minimum	24	425	8	12	188	280	29	1	0.6	0.1	0.01	0.01	200	1	34.1	0.1	3	0.5	--
	Hooray Sandstone	Total Number	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
		Number of Tests	10	12	12	10	12	11	12	10	12	11	8	7	12	10	12	12	3	8	1
		Average	552	799	8.1	19.7	325	503	184	5.1	5.7	0.77	0.49	0.03	383	7.7	66	1.45	2.0	10	0.02
		Maximum	841	1,762	9	34	862	1,122	449	8	10	2.6	3.5	0.05	1,002	24	145	5.4	4	20	0.02
		Minimum	452	455	7	11	190	290	96	2	1.5	0.1	0.01	0.01	230	1	35	0.3	1	4	0.02
	Injune Creek Group	Total Number	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Number of Tests	2	3	4	2	4	3	4	1	4	4	1	0	3	3	4	4	0	2	0
		Average	763	1,628	8.3	13	731	976	420	3.0	2.5	1.10	0.01	--	768	207	135	3.28	--	8	--
		Maximum	763	1,645	9	14	881	1,024	475	3	4	1.9	0.01	--	883	528	152	4.4	--	14	--
		Minimum	762	1,600	8	12	628	916	381	3	1.4	0.1	0.01	--	610	16	117	0.9	--	1.4	--
	Hutton Sandstone	Total Number	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
		Number of Tests	11	34	36	19	39	37	39	23	39	23	16	18	36	30	39	35	0	18	2
		Average	781	625	8.1	15.8	264	404	149	6.5	3.9	0.4	0.10	0.03	314	21	52	1.1	--	6	0.02
		Maximum	932	1080	9	25	615	1150	338	18	10	1.2	0.49	0.07	750	266	102	3.4	--	18	0.03
		Minimum	598	410	8	10	13	18.52	7.1	4	0.4	0.1	0.01	0.01	193	1	2.4	0.2	--	0.3	0.01
Galilee Basin sequence	Clematis Sandstone	Total Number	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Number of Tests	1	5	5	1	5	5	5	4	5	5	2	3	5	4	5	5	0	3	0
		Average	825	482	8	26	197	290	104	12.0	3.2	0.60	0.04	0.06	232	5.5	37	0.35	--	1	--
		Maximum	825	570	8	26	223	309	120	16	7	2	0.06	0.06	255	14	46	0.5	--	2	--
		Minimum	825	420	8	26	183	277	92	8	2.2	0.1	0.01	0.06	220	2	33	0.2	--	0.4	--
	Jochmus Formation	Total Number	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Number of Tests	4	1	4	3	3	3	3	0	3	3	0	0	3	0	4	0	0	3	0
		Average	1,461	1,800	8.3	70	257	843	293	--	10	11	--	--	313	--	253.75	--	--	82	--
		Maximum	1,727	1,800	9.5	120	350	900	300	--	12	22	--	--	427	--	300	--	--	112	--
		Minimum	1,364	1,800	7.7	40	200	809	280	--	8	5	--	--	244	--	225	--	--	60	--
	Jericho Formation	Total Number	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Number of Tests	2	2	2	2	1	2	1	0	2	2	0	0	1	1	2	0	0	2	0
		Average	1,588	4,100	8.35	1,075	160	4,600	754	--	307	75	--	--	176	10	1,360	--	--	82	--
		Maximum	1,588	4,400	8.4	1,800	160	6,840	754	--	480	146	--	--	176	10	1,500	--	--	104	--
		Minimum	1,588	3,800	8.3	350	160	2,360	754	--	134	4	--	--	176	10	1,220	--	--	60	--
	undifferentiated Joe Joe Group	Total Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Number of Tests	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0
		Value	1,529	--	7.7	--	270	1,300	235	--	--	--	--	--	330	--	140	--	--	44	--
Basement sequence	undifferentiated Carboniferous	Total Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Number of Tests	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
		Value	1877	--	8.1	--	--	--	--	--	--	--	--	--	--	--	340	--	--	--	--

Table 8.5b Drill stem test groundwater quality data summary for ATP 529

Basin	Identified aquifer or water bearing sediment	Statistic	Depth of Sample m bGL)	Conductivity (uS/cm)	pH	Hardness (mg/L Ca)	Alkalinity (mg/L)	Total Dissolved Solids (MG/l)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Nitrate (mg/L)	Sulphate (mg/L)	Zinc (mg/L)
Eromanga Basin sequence	Hooray Sandstone	Total Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Number of Tests	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
		Value	766	1,650	9	42	670	1,000	340	5	14	2	1	0.1	690	64	165	7	--	37	2
	Hutton Sandstone	Total Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Number of Tests	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0
		Value	916	1,500	9	9	650	960	380	4	4	0.1	1	0.03	670	61	150	6	--	2	--
Galilee Basin sequence	Bandanna Formation	Total Number	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Number of Tests	4	4	4	4	4	4	4	4	4	4	0	0	4	0	4	0	0	4	0
		Average	841	1,915	8	60	811	1,112	435	16	13	7	--	--	1,013	--	122	--	--	12	--
		Maximum	873	2,150	8	107	833	1,151	459	17	16	20	--	--	1,041	--	192	--	--	18	--
		Minimum	820	1,820	8	39	795	1,088	387	14	10	2	--	--	995	--	93	--	--	3	--
	undifferentiated Betts Creek beds	Total Number	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
		Number of Tests	16	18	15	15	17	18	18	18	18	18	7	7	18	2	18	2	5	17	5
		Value	1,011	17,410	8	95	771	11,129	4,238	153	30	3	8	0	912	105	6,186	7	0	42	0
		Maximum	1,055	90,100	9	362	1,256	57,664	23,550	1,492	145	7	35	2	1,177	182	37,935	8	1	164	1
		Minimum	942	1,560	7	23	532	963	384	4	8	0	0.36	0.02	609	28	129	6	0.08	3	0.02
	undifferentiated Permian	Total Number	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Number of Tests	0	0	0	0	0	5	5	5	5	5	0	0	5	5	5	0	0	5	0
		Value	--	--	--	--	--	7,228	788	4,771	23	12	--	--	1,050	224	3,453	--	--	154	--
		Maximum	--	--	--	--	--	24,060	2,167	20,000	60	47	--	--	2,300	810	13,000	--	--	540	--
		Minimum	--	--	--	--	--	1,400	384	17	8	0	--	--	609	1	205	--	--	1	--
	Aramac Coal Measures	Total Number	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Number of Tests	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	1	0
		Value	1,083	77,800	7	615	467	49,792	19,650	70	225	13	--	--	571	--	31,350	--	--	113	--

8.1.9 Summary for ATP 529

The drilling history for ATP 529 has been dominated by completion of water supply bores tapping generally fresh groundwater.

The water bores drilled within ATP 529 generally target the shallower aquifers with groundwater occurring typically above the Injune Creek Group sediments. However, the Hutton and Clematis Sandstone aquifers are tapped locally. This is important because the regionally significant confining units, those that separate the base of the Hutton Sandstone from the top of the Permian coal measures are thin or potentially absent under sections of ATP 529 (Figure 3.3, Figure 3.4 and Figure 3.10).