

Appendix K

DERM database preliminary assessment



FILE NOTE

SUBJECT: DERM GROUNDWATER MONITORING DATABASE ANALYSIS **DATE:** MARCH 2012

AUTHOR: NICOLE CARUSO **PROJECT:** GROUNDWATER

Introduction

QGC aims to undertake an analysis of the latest data extraction of the DERM groundwater bore monitoring database, to inform its own regional understanding of baseline groundwater potentiometric surface levels and to aid in identification of potential sources of impacts to these levels. Additionally, water level data sourced from the DERM database will provide calibration data for QGC's GEN3 dual phase numerical groundwater model development, which will then be utilised for undertaking future scenario predictions. Any vertical hydraulic gradient information that can be gleaned from the DERM data will also be assessed by QGC in terms of ongoing regional aquifer connectivity studies.

Methodology

DERM's groundwater database is not categorised by bore type and purpose. Therefore, to assess long-term monitoring data, the entire database must be queried for multiple water level records. During 2012, QGC intends to process and analyse the DERM groundwater database water level records. The data for bores within the Surat Basin and nearby surrounds will primarily be categorised by source aquifer. The data will then be further queried to establish bores with more than one groundwater level record, in order to produce hydrographs and analyse groundwater trends. For bores that are identified as having a significant temporal record or identified as dedicated monitoring bores, spatial locations and screen depths will be assessed within QGC's 3D geological model to confirm the contributing aquifer(s) for each bore.

Hydrograph trends will be assessed in relation to local stratigraphy and rainfall trends. A detailed review of regional groundwater extraction entitlement data and compiled knowledge of basin-wide extractions will also be completed. This review will provide a source for comparison of potentiometric surface trends with nearby groundwater use before, during and after CSG development, as the data is continually updated and analysed.

Progress to Date

Preliminary analysis of the DERM groundwater database indicates that there are very sparse records of ongoing regular groundwater level monitoring across the Surat Basin. Where regular groundwater monitoring is undertaken, these sparse records are geographically spread widely across the basin. An exception to this is in the Condamine River Alluvium region, east of QCLNG tenements in a relatively small area northwest and south of Dalby. In this area there are 100 groundwater bores that have greater than 100 groundwater level records between 1965 and 2011. A sampling of these bores is depicted in Figure 1 to illustrate the geographical spread of these bores and their contributing aquifer(s). The locations of dedicated DERM groundwater monitoring bores or DERM database bores with significant (i.e. ten or more and relative to QGC tenements) length of water level records are also identified in Figure 1.

There are only three DERM monitoring bores equipped with data loggers recording daily water level measurements located within the Surat Basin. These bores are all located in the northern Surat Basin (refer to Figure 1):

- RN 42220061, screened shallow from 9.8 m to 30.8 m depth within the Mooga Sandstone and Orallo Formation with groundwater level records from 1993 through 2011, located 93 km west of QCLNG's Northern Development Area tenements.
- RN 42220058, screened shallow from 20 m to 53 m depth within the Gubberamunda Sandstone and Westbourne Formations with groundwater level records from 1900 through 2011, located 108 km west of QCLNG's Northern Development Area tenements.
- RN 13030613, screened from 69 m to 129 m depth within the Hutton Sandstone with groundwater level records from 1993 through 2011, located 120 km west/northwest of the QCLNG Northern Development Area tenements.

The only bores within the DERM groundwater database with multiple groundwater level records that are located within QCLNG tenements are RN 13030808 (Lawton block) and RN 13030809 (Paradise Downs block). These two bores have sporadic records (10 and 11 in number respectively) since 2003; construction records indicate they are shallow and are screened between 9 m and 39 m depth in the Westbourne Formation and Springbok Sandstone.

In the south-central Surat there are six bores with limited records (13 to 24 records between 1915 and 1969). These are deep bores, screened between 800 m and 1200 m depth in the Mooga Sandstone, Orallo Formation and Gubberamunda Sandstone. Finally, in the north-eastern Surat, there are eleven bores in the Alluvium/Hutton Sandstone and Evergreen Formation/Precipice Sandstone with between 25 and 40 records between 2006 and 2011.

Examples of water level hydrographs compared to cumulative residual rainfall curves from nearby BOM rainfall recording stations (located within the same rainfall districts) are provided below in Figures 2 and 3. RN 42220058 shows a steady decline of 0.17 m/yr in the Gubberamunda Sandstone and Westbourne Formation. The other graph shows groundwater levels from bores screened in the Walloon Coal Measures between 11 m and 51 m depth, located near the Condamine River Alluvium region in the eastern Surat, 15 km north of the QCLNG Southern Development Area: RN 42230204, RN 42230205 and RN 42230208. Generally, groundwater levels in RN 42230205 and RN 42230208 increase with rainfall in 1970, flattening out in 1976. Hydrographs reflect rainfall peaks in 1984, 1989 and 1998/1999. RN 42230204 appears to possibly have some pumping influences early in its record through to 1990, following a period of recovery through 1993 at which point its hydrograph begins to mimic rainfall patterns.

Discussion

There appears to be only two DERM groundwater monitoring bores with medium to long term records within QCLNG tenements (RN 13030808 and RN 13030809) which may be suitable for QGC's ongoing groundwater monitoring program. The condition, ownership and purpose of these bores are unknown, and will be further investigated to assess their monitoring capacity and appropriateness. Additionally, there are many (100+) bores that are located north and east of QCLNG's Southern Development Area and are, according to the DERM database, screened at least in part within the Condamine River Alluvium. QGC's initial investigation indicates that many of these bores in the Condamine Alluvium area may be screened through the deeper Walloons or outcrop edges of the Westbourne Formation or Springbok Sandstone. Details of these bores are being investigated further by QGC as to their monitoring capacity and appropriateness. Although the complete DERM database is yet to be interrogated by QGC, the analysis undertaken to date indicates that longer term groundwater level trends may correlate with long term rainfall trends.

Preliminary Conclusions

The paucity of long term regional groundwater level monitoring data that is relevant to QGC's tenements is highlighted by the review of the DERM data. This emphasises the need for QGC to collect accurate groundwater level data on QGC tenements.

Further detailed assessment of possible suitable DERM monitoring bores will be undertaken over the next year. This may require discussions with DERM concerning monitoring frequency and methods.

QGC will also discuss with our Industry Collaborators the availability and suitability of other long term groundwater level data which may be useful for both regional trend analysis and to assist the calibration of the GEN 3 model.

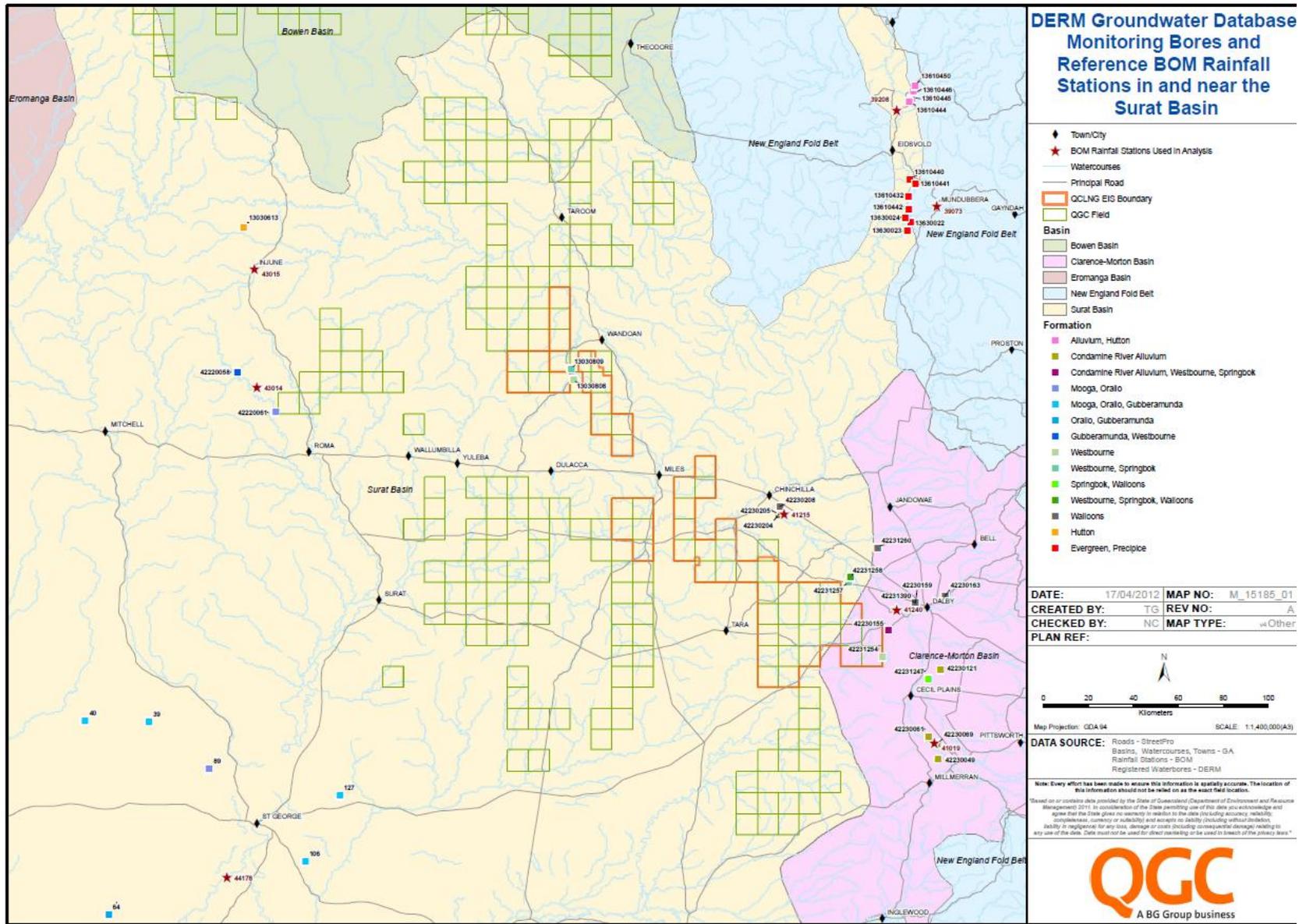


Figure 1 Location of selected DERM database bores

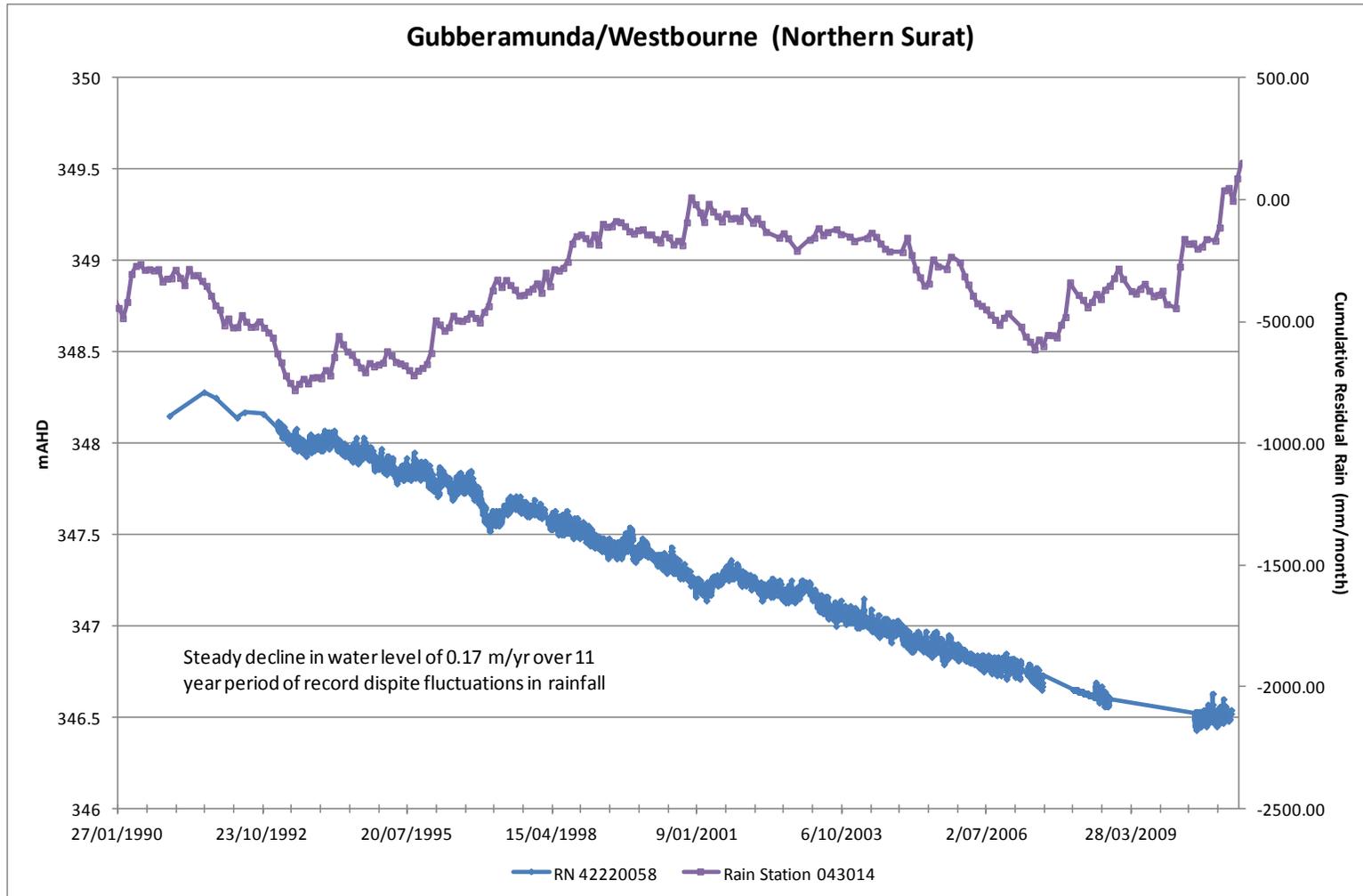


Figure 2 RN 42220058 comparison against residual rainfall

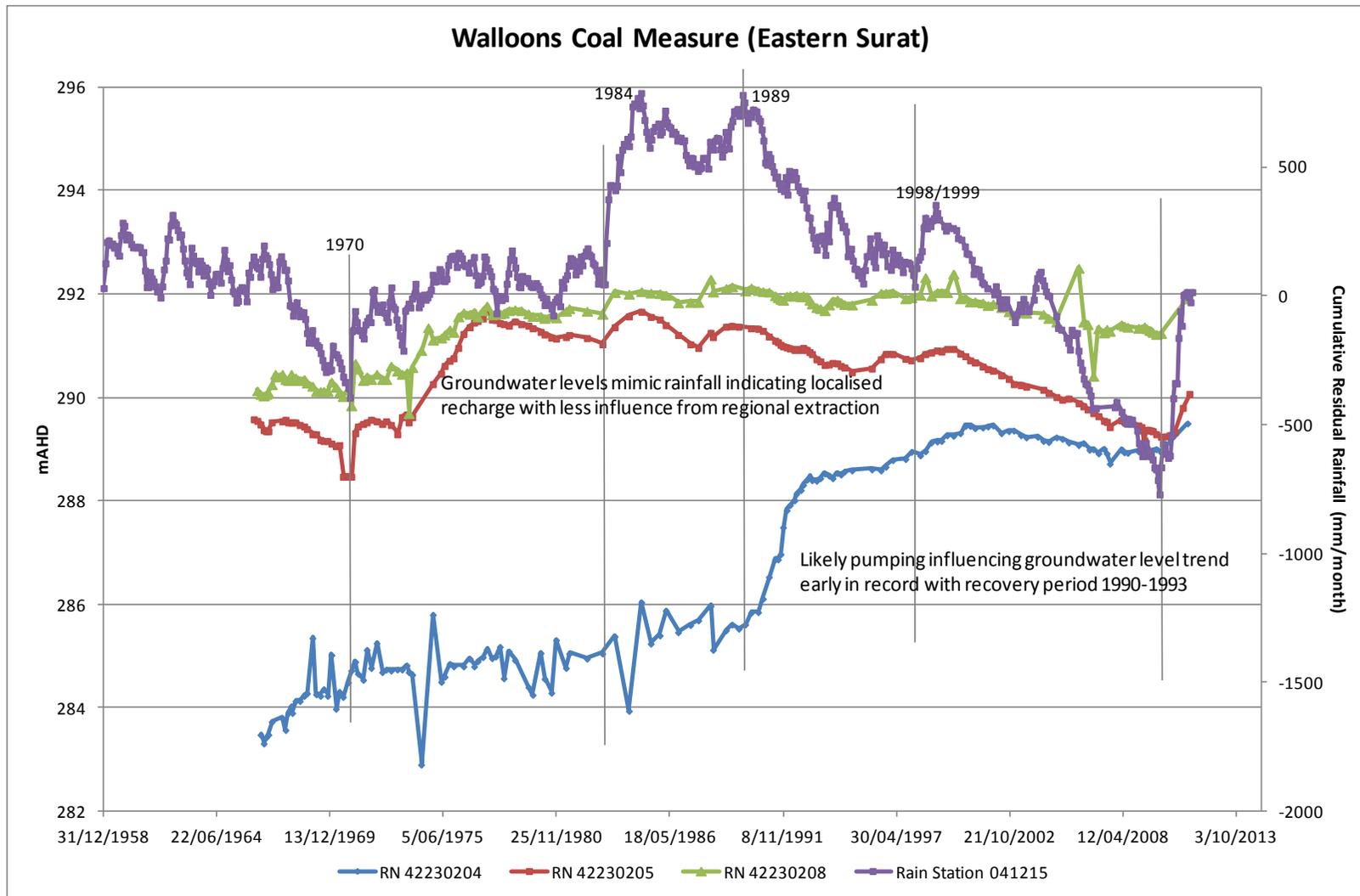


Figure 3 RN 42230204, RN 42230205 and RN 42230208 comparison against residual rainfall