

MEMORANDUM



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From: Jason Harley (Bradlees)

cc: Samantha Buchanan (RPS)

EDQ Development Application for Installation of Flowing and Non-Flowing Water Bores within Flagstone PDA

1. This memo describes the proposal to drill and construct water bores within the Flagstone PDA. As advised by EDQ on 13Oct17, Peet Flagstone City Pty Ltd is required submit a development application to support any proposal to conduct exploratory and operational groundwater extraction works and operations within MEDQ administered land. This is based on EDQ's interpretation that the Development Scheme does not provide an exemption for operational works for taking or interfering with water (bore).

2. The purpose of this memorandum is to explain the staged process for conducting water bore works within the Flagstone PDA to support the development application.

Background and Preliminary Assessment

3. Whilst the Flagstone PDA is located within the Logan Basin, in hydrogeological terms, it is located outside of the Great Artesian Basin area (see Figure 1). Consequently, the proposed bore works needs to comply with the *Minimum Construction Requirements for Water Bores in Australia*.

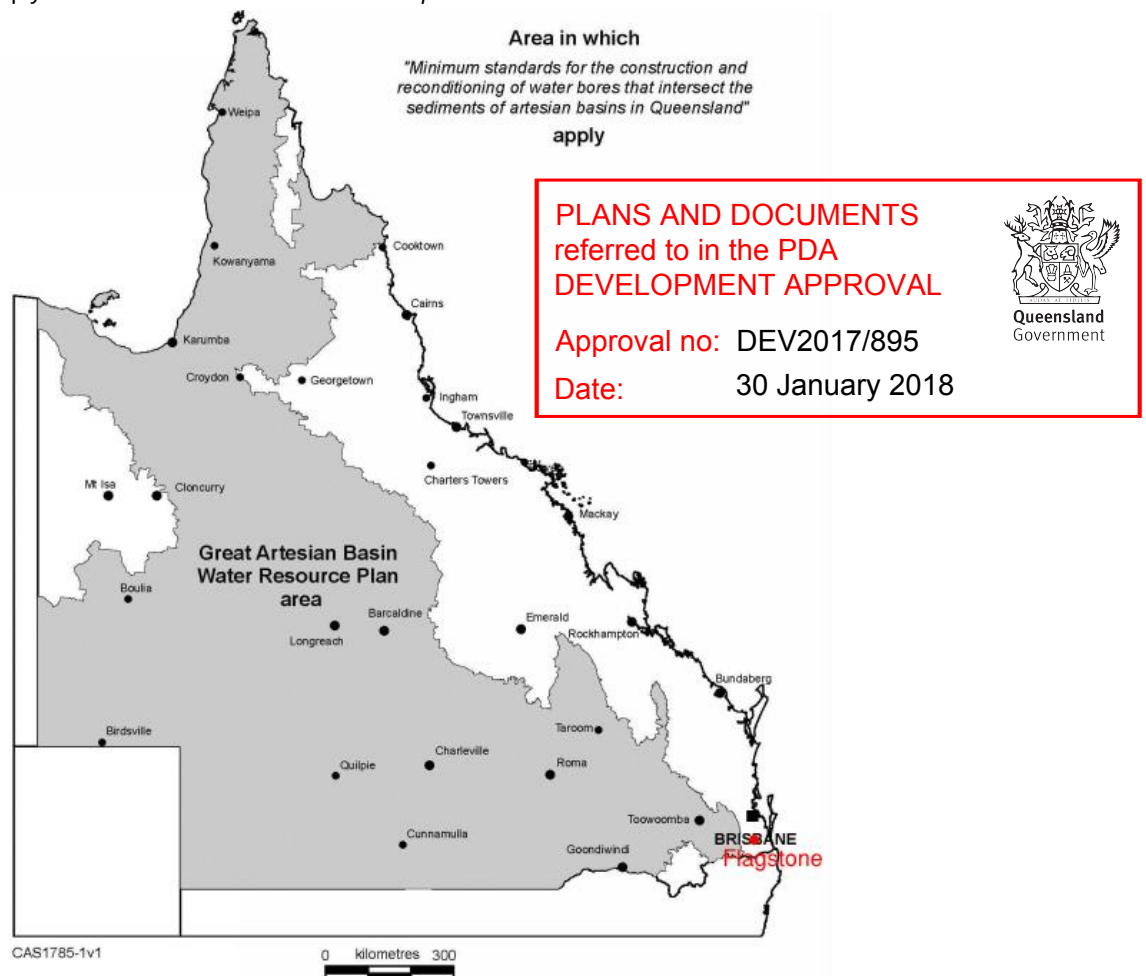


Figure 1 – Water Resource Plan Area - Queensland (Source: Reference 5)

4. According to the *Flagstone PDA Feasibility – Aquifer Disposal Desktop Study* (Reference 1), there are three main aquifer formations surrounding the PDA study area:

- Quaternary Alluvium - local unconfined unconsolidated aquifer. The alluviums are distributed along the Logan River and its tributaries. The system is bounded by the basement rocks, the Bundamba group for most of the study area and the Walloon Coal Measures on the south part of the project. From the geological logs available surrounding the area, the alluvium are an alternation of silty clay, sandy silt and sand and gravels. The minimum thickness of the unconfined aquifer is 4 m to a maximum of 30 m. The water is brackish. There are only two registered bores in the area, and only one bore has data (yield of 1.3 L/s and EC of 2614 uS/cm)
- Marburg Formation (Gatton Sandstone) - Regional to local unconfined consolidated sediment aquifer. It is the main formation in the study area and composed of sandstone with sparse shales of 1 to 2 m thick. Some fractured zones have been identified in the surrounding registered boreholes, generally 0.5 to 2 m interval and some water is flowing through the shale as well. The maximum depth explored in the study area was 168 m below the ground surface with a thickness of 160 m. This specific bore is located between blocks Greenbank and North Maclean. The formation is covered by a silty soil or the alluvium of 4m to 30m thick and is classified as unconfined. The water is brackish. There are ten registered bores in the area. Yield data ranges from 0.13 L/s to 2 L/s. Water Quality ranges from 300 – 4000 uS/cm
- Woogaroo Formation (Ripley Road Sandstone) – Regional to local unconfined consolidated sediment aquifer. This formation appears on the north part of the Flagstone area and the west part of the Greenbank area. It is majority of sandstone (grey, brown and white) with some large water entry (interval of 5 to >20m) from coarse sandy/sandstone bed and fractured zone with minor shale. The maximum exploration depth in the area is 160 m below ground surface. The formation is covered by a thin layer of clay and silty soil from 0.5 m to a maximum of 16 m thick. It is categorized as unconfined. The groundwater is fresh to brackish. Yield data ranges from 0.17 L/s to 2.56 L/s. There is no quantitative water quality data

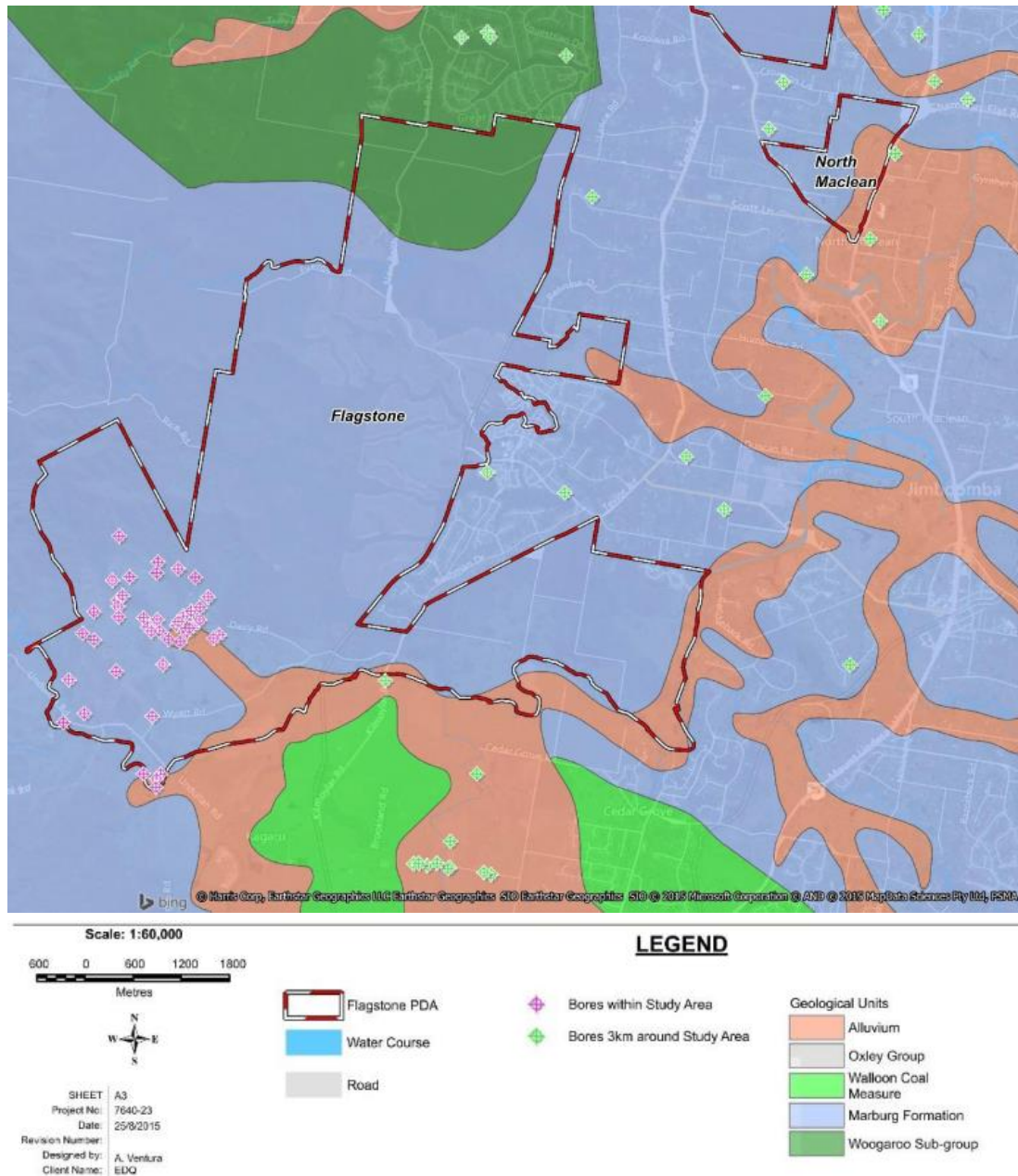


Figure 2 – Flagstone Hydrogeological Map (Source: Reference 1)

5. Due to the remoteness of the Woogaroo Formation and broader mapped Quarternary Alluvium Formations, from land owned by Peet, exploratory bores will initially target Marburg Formations and localised Alluvium sources along drainage features.

Staged Implementation

6. The staged implementation of water bore works is as follows:

- Stage 1 – Conduct of exploratory water bore works
- Stage 2 – Design, construction and operation of temporary/permanent water bore works and water extraction operations

Stage 1 Works

7. The Scope of Works for the Stage 1 is as follows:
- Conduct of underground services search
 - Preparation of Construction Management Plan and Environment Management Plan
 - Drilling, casing and temporary capping of minimum of four (4) water bore as per Figure SK012
 - Water quality and yield testing of bores, including temporary works
 - Temporary fencing of bore heads
8. The following guidelines will be applied:
- Stage 1 works will be conducted in accordance with “*Minimum Construction Requirements for Water Bores in Australia*”.
 - Apart from the conduct of yield tests, all bores will be managed as non-flowing bores during Stage 1.
 - All works will be conducted by licensed water bore driller.
 - Bores are located above the Q100 floodline
 - Bores are located at least 100m from adjacent properties
 - Final bore locations may change during drilling to suit local circumstances
 - Bores depths may range between 6m to 200m deep
 - Minimum casing size shall be 100mm diameter
 - If PVC-U material is used for casings, the minimum class shall be PN12
 - The following water constituents analysis will be conducted for each bore should water be found:
 - Conductivity (uS/cm)
 - pH
 - Total Ions (mg/L)
 - Hardness
 - Na
 - K
 - Ca
 - Mg
 - Mn
 - HCO₃
 - Fe
 - CO₃
 - Cl
9. Subject to the outcome of Stage 1 testing, the proposed future usage of each bore is as follows;

Table 1 – Proposed Water Bore Use

Bore No.	Intended Future Use
1	Construction water (short term) + landscape irrigation water (long term)
2	Construction water (short term)
3	Construction water (short term) + landscape irrigation water and constructed lake top-up (long term)
4	Stock watering (short term)

Stage 2 Works

10. The precise nature of Stage 2 Works will be determined upon review of test results from Stage 1 and assessment of the financial and environmental aspects of water bore operations. Consequently, bores will be either: 1) decommissioned, 2) classified flowing (and may be subject to future water head

works and water extraction operations), and 3) classified as non-flowing (and may be converted into monitoring bores).

11. For long term use, it is possible that ownership and operational management of water bore headworks and associated may be transferred to the Local Authority at a later date. The likely Scope of Works for the Stage 2 is as follows:

- Decommissioning of water bore(s) (if bore characteristics prove unsuitable for future intended use)
- Preliminary Design of Water Bore Headworks, power, water pipelines and storage facilities
- Design, construction of water bore headworks and associated infrastructure
- Short and long-term operation management of water bore headworks and associated infrastructure

References

1. Cardno 2 Sep 2015, *Flagstone PDA Feasibility – Aquifer Disposal Desktop Study*, Report no. 7640-23,
2. Communications with DNRM 2017
3. National Uniform Drillers Licensing Committee 2012, *Minimum construction requirements for water bores in Australia*, 3rd edition, National Water Commission, Canberra, Australia.
4. Department of Natural Resources and Mines 2013, *Water bore drillers' licensing handbook*, State of Queensland, Brisbane, Australia.
5. Department of Natural Resources and Mines 2016, *Minimum Standards for the construction and reconditioning of water bores that intersect the sediments of artesian basins in Queensland* WSS/2016/3189 Version 1.01 25/10/2016 State of Queensland, Brisbane, Australia.