

Environmental Value	s. 376 (1) (da) Description impacts on EVs that have / likely to occur, because of previous exercise of water rights.	s. 376 (1) (db) (i) Assessment of likely impacts on EVs that will / likely occur, because of the exercise of water rights for the next 3-year period.	s. 376 (1) (db) (ii) Assessment of likely impacts on EVs that will / likely occur, because of the exercise of water rights for the over the projected life of the resource tenure .
1. Aquifers (drawdown, sustainability)	GAB, Precipice Sndst: Around the Moonie oil field, the maximum pressure decline at the wellfield is about 120 metres, and groundwater extraction has been steadily declining at a current level of about 1,000 ML/year.	GAB, Precipice Sndst: >5 metres within three years (to end of 2021).	GAB, Precipice: Long term affects (past 2021) (>5 m decline) are predicted around the Moonie oil field, resulting from historical groundwater extraction from conventional oil / gas production. Appendix G shows areas with up to 100m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
	GAB, Hutton Sndst: NO INFO	GAB, Hutton Sndst: >5 metres within three years (to end of 2021).	GAB, Hutton Sndst: Long term affects (past 2021) (>5 m decline) are predicted. Maximum impacts at most locations in the Hutton Sandstone are minor and predicted to occur several hundred years after extraction from the Walloon Coal Measures has ceased. Appendix G shows areas with up to 100m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
	GAB, Springbok Sndst: NO INFO	GAB, Springbok Sndst: >5 metres within three years (to end of 2021).	GAB, Springbok Sndst: Impacts of more than 5 m are expected in the long term across much of the planned CSG production area. Appendix G shows areas with up to 200m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
	GAB, Walloon Coal Measures: Significant drawdown has already been observed.	GAB, Walloon Coal Measures: >5 metres within three years (to end of 2021).	GAB, Walloon Coal Measures: A substantial LTAA is predicted, as the Walloon Coal measures is the CSG target formation and has been subject to depressurisation since 2005. Appendix G shows areas with areas from 1 to >500m of predicted drawdown, at 5 th / 50 th / 95 th percentiles. [Maximum?]
	Bowen, Bandanna Fm: Significant impact has already been observed.	Bowen, Bandanna Fm: >5 metres within three years (to end of 2021).	Bowen, Bandanna Fm: A substantial LTAA is predicted (past 2021). Appendix G shows areas with 1 to >500m of predicted drawdown, at 5 th / 50 th / 95 th percentiles. [Maximum?]
	Bowen, Cattle Creek Fm: Only a small number of pilot CSG wells have been drilled to date and depressurisation of this formation is currently limited.	Bowen, Cattle Creek Fm: >5 metres within three years (to end of 2021).	Bowen, Cattle Creek Fm: Long term affects (past 2021) (>5 m decline) are predicted. Appendix G shows areas from 1 to >500m of predicted drawdown, at 5 th / 50 th / 95 th percentiles. [Maximum?]
	Alluvium, Condamine: NO INFO	Alluvium, Condamine: NO INFO	Alluvium, Condamine: There is no LTAA in the Condamine Alluvium, based on the trigger threshold of 2 m that applies to unconsolidated aquifers. The maximum impact is expected to be around 0.2 m in the north-west of the Condamine Alluvium and less than 0.05 m across the majority of the area. It is predicted that there will be a net loss of water from the Condamine Alluvium to the Walloon Coal Measures of about 735 ML/year over the next 100 years due to CSG development. Appendix G shows areas with <0.5 to >0.2m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
2. Groundwater bores (drawdown)	GAB, Gubberamunda Sndst: NO INFO	GAB, Gubberamunda Sndst: NO INFO	GAB, Gubberamunda Sndst: Appendix G shows areas with up to 5m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
	Bowen, Clematis Sndst: NO INFO	Bowen, Clematis Sndst: NO INFO	Bowen, Clematis Sndst: Appendix G shows areas with up to 500m of predicted drawdown, at 5 th / 50 th / 95 th percentiles.
	There are 222 bores that have been identified as IAA bores since 2011, with 122 identified as effective IAA bores through the UWIR 2012 / UWIR 2016 / subsequent bore record corrections.	There are 222 bores that have been identified as IAA bores since 2011, with 100 identified for the first time in this proposed UWIR.	There are 571 long-term affected bores (122 are decommissioned, leaving 449 existing).

Commented [MJ1]: Consider ML of water taken from each aquifer, vs recharge, then consequences to bores and ecosystems

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	GAB, Hutton Sndst: NO INFO	GAB, Hutton Sndst: Currently 0 IAA bores.	GAB, Hutton Sndst: 5 LTAA bores. Most of the LTAA bores are likely to experience an impact of less than 10 m and are limited to an area around Dalby where seismic data suggests that the Walloon Coal Measures and Hutton Sandstone may be in direct contact along part of the Horrane Fault.
	GAB, Springbok Sndst: Actual impacts have been observed at some locations within the formation.	GAB, Springbok Sndst: 9 new IAA in 2019 UWIR, 1 from previous UWIRs.	GAB, Springbok Sndst: 81 LTAA bores. Around half of the LTAA bores are likely to experience an impact of less than 15 m.
	Bowen, Bandanna Fm: NO INFO	Bowen, Bandanna Fm: Currently 0 IAA bores.	Bowen, Bandanna Fm: 1 LTAA bore . Bandanna Fm is not commonly used for water supply purposes.
	Bowen, Cattle Creek Fm: NO INFO	Bowen, Cattle Creek Fm: Currently 0 IAA bores.	Bowen, Cattle Creek Fm: 0 LTAA bores. This formation is not commonly used for water supply purposes; hence, there are no water bores within this formation in the LTAA.
	GAB, Walloon Coal Measures: NO INFO	GAB, Walloon Coal Measures: 91 new in 2019 UWIR.	GAB, Walloon Coal Measures: 357 LTAA bores. Around half of the affected bores are likely to experience an impact of less than 32 m. Near the centre of CSG production areas, impacts of up to 350 m are typical towards the base of the Walloon Coal Measures and around 150 m towards the upper part. Impacts develop relatively quickly within the Walloon Coal Measures before recovering slowly once local CSG extraction ceases. The time taken for groundwater levels to recover is related to the magnitude of the maximum drawdown. Groundwater levels in the Walloon Coal Measures in areas located close to the edge of the predicted LAA are expected to recover within five years. Conversely, groundwater levels within CSG production areas may take more than 1,000 years to fully recover. Predictions for the Walloon Coal Measures suggest that around 25% of impacted bores would recover to within 5 m levels in 250 years and around 75% of bores in 1,000 years.
3. Springs and groundwater connected watercourses (drawdown)	Springrock: NO INFO	Springrock: Predict at least 0.2 metres in <5 years.	Springrock: Predict 0.4–1.8 metres in 25 – 50 years.
	Lonely Eddie: NO INFO	Lonely Eddie: Predict at least 0.2 metres in <5 years.	Lonely Eddie: Predict 0.6–0.8 metres in 27–30 years.
	311: NO INFO	311: Impacts not predicted within the next three years.	311: Predict 0.4–0.7 metres in 25–27 years.
	Cockatoo: NO INFO	Cockatoo: Impacts not predicted within the next three years.	Cockatoo: Predict 0.3–0.5 metres in 29 years.

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	<p>Lucky Last: NO INFO</p> <p>Barton: NO INFO</p> <p>Horse Creek: NO INFO</p> <p>Orana: NO INFO</p> <p>Scotts Creek: NO INFO</p> <p>Abyss: NO INFO</p> <p>Eurombah: NO INFO</p> <p>Dawson River: NO INFO</p>	<p>Lucky Last: Predict at least 0.2 metres in <5 years.</p> <p>Barton: Impacts not predicted within the next three years.</p> <p>Horse Creek: Predict at least 0.2 metres in <5 years.</p> <p>Orana: Impacts not predicted within the next three years.</p> <p>Scotts Creek: Impacts not predicted within the next three years.</p> <p>Abyss: Impacts not predicted within the next three years.</p> <p>Eurombah: Impacts not predicted within the next three years.</p> <p>Dawson River: Impacts not predicted within the next three years.</p>	<p>Lucky Last: Predict 0.2–0.4 metres in 26 years.</p> <p>Barton: Predict 0.0–0.5 metres in > 100 years.</p> <p>Horse Creek: Predict 38–58 metres in 36–51 years.</p> <p>Orana: Predict 0.2–0.5 metres in > 100 years.</p> <p>Scotts Creek: Predict < 0.2 metres in TBC years (OGIA planning additional assessment).</p> <p>Abyss: Predict < 0.2 metres in TBC years (OGIA planning additional assessment).</p> <p>Eurombah: Predict < 0.2 metres in TBC years (OGIA planning additional assessment).</p> <p>Dawson River: Predict < 0.2 metres in TBC years (OGIA planning additional assessment).</p>
4. Terrestrial GDEs (drawdown)	NO INFO	NO INFO	<p>A conservative area of interest has been generated using the long-term predicted drawdown of 0.2 metres within outcropping aquifer areas.</p> <p>Therefore, surface geology against mapped GDEs is mapped, coinciding with aquifer drawdown depths and biodiversity status.</p> <p>A map (Figure 10-2) is provided, showing areas of:</p> <ul style="list-style-type: none"> No risk – long term <0.2 metres. Low risk – long term 0.2 – 1 metre. Moderate risk – long term >1 metre. High risk – ‘Endangered’ or ‘Of concern’ RE status. <p>The ability to access groundwater is conferred by the root architecture and rooting depth. A widely adopted rule of thumb is that vegetation use of groundwater is:</p> <ul style="list-style-type: none"> likely where the depth-to-water is less than 10 metres below ground level, possible at 10 to 20 metres below ground level, and unlikely at 20 metres below ground level.
5. Groundwater quality (achieving water quality objectives, drawdown resulting in movement at contaminated sites)	<p>NO INFO</p> <p>“Under the Water EPP, all Queensland waters, including groundwater, have identified EVs and WQOs.” What are these for the CMA’s aquifers?</p> <p>What is the predicted and actual movement of groundwater relative to the contaminated Linc site?</p>	NO INFO	NO INFO

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	<p>I'm not seeing a study done of WQOs against the GAB, Bowen Basin, Basalts and Alluvium for EPP Water EVs.</p> <p>I also would like to understand water movement around Linc site. I understand that there has been local-scale modelling undertaken for Arrow's SPG South, via a condensed application of the UWIR's modelling. So, what are the results? Where is the contamination going to go, based on flow direction, and by when, based on flow rates? In other words, does the UWIR include north/south/east/west predictions, and what does this mean for the conditions of the EA about not mobilising the water? The proposed UWIR doesn't seem to include any of this information. While the UWIR doesn't need to specifically provide data on the actual contaminants, it should assist with understanding the groundwater movement to inform EAs.</p>		
6. Stratigraphy compaction (land subsidence)	No info on timing of predicted subsidence. Assumed to be long term, or >3 years until observed.	NO INFO on timing of predicted subsidence. Assumed to be long term, or >3 years until observed.	<p>NO INFO on timing of predicted subsidence. Assumed to be long term, or >3 years until observed.</p> <p>Three risk classes are assigned:</p> <ul style="list-style-type: none"> • low risk, where compaction is predicted to be < 0.1 m; • moderate risk, between 0.1 to 0.2 m, and • high risk, for > 0.2 m of compaction. <p>A map (Figure 10-3) is provided, showing areas with moderate to high risk has been identified against environmental values.</p> <p>The environmental values are:</p> <ul style="list-style-type: none"> • water supply bores; • irrigation agriculture; • potential terrestrial GDEs; and • potentially gaining streams.

Public Notice Requirements – s. 382			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>1) s. 382(4)(b) states that “The responsible entity must advise the chief executive that the entity has complied with subsections (1) and (2).”</p> <p>a) DES has not identified such a statement within the “Main Report”, the “Submission Summary” or the “Letter” which formed parts of the application.</p>	<p>OGIA provided a printout of an email which had been sent from an “Acting Business Manager” of OGIA to a “Director” in DES on 1 May 2019.</p> <p>The email outlined OGIA's plans and intentions regarding the upcoming public notification of the draft UWIR for submissions. The email included attachments demonstrating the intended letters to be issued as per s. 382(1)(b) (notices to companies); the proposed notice to be published under s. 382(1)(a); and a proposed draft letter to bore owners.</p> <p>Kerynne Birch responded to this email confirming that the proposed notice to be issued under s. 382 satisfied the legal requirements under s. 382(1)(a), as well as s.382(3)(a) to (f). s.382(4)(b) is not part of those items and therefore is not addressed in this email.</p> <p>OGIA also provided a copy of a letter issued to DES' Director-General (dated 27 May 2019). In this letter, OGIA discussed the release of the consultation draft of the UWIR on 28 May 2019 and OGIA's commitment to consider submissions after the submission period closed. The letter also discussed briefings undertaken with stakeholders and peak bodies.</p> <p>It appears that OGIA misinterpret the requirement of s.382(4)(b) – rather than understand their obligation to provide a statement that they have complied with the public notice requirements in s.382(1) and (2), they seem to incorrectly interpret that approval on how they publicly notify from DES meets the requirement.</p>	<p>None of the provided response material included evidence that a statement has been made from OGIA to DES that OGIA had complied with subsections 382(1) and (2), as required by s. 382(4)(b).</p> <p>DES considers it may be helpful to clarify to OGIA that the statement to satisfy this legislative requirement could not viably have been made until <i>after</i> the notification and submission period had closed, not <i>before</i>.</p>	<p>The finding is that the proposed 2019 Surat UWIR does not meet the legislative requirement.</p> <p>This item cannot be resolved by a condition on the UWIR.</p> <p>This item could only be rectified by either:</p> <ul style="list-style-type: none"> - the modify-and-resubmit option, in which OGIA include such a statement in the resubmitted proposed UWIR; or - by OGIA providing a subsequent statement to addend to the proposed UWIR lodged on 2 August 2019.

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>2) s. 376(1)(b)(ii) requires, for each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights - an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers.</p> <p>a) DES has prepared a geological unit / aquifer list of those units / aquifers that have been identified as affected or likely to be affected by the exercise of petroleum underground water rights.</p> <p>b) Utilising this list, DES has found that there is not a comprehensive description of the movement and inter-aquifer connectivity analysis for the Clematis Sandstone – it is not clear from the report whether or not there are connecting faults, nor have details been provided on the underground water movement (such as flow characteristics).</p>	<p>OGIA responded in a meeting on 8 October 2019 that the Clematis Sandstone can, for these purposes, be regarded as the 'same' as the rest of the Bandanna Formation units as the units are difficult to distinguish at the relevant depths.</p> <p>In their response letter dated 17 October 2019, OGIA state, "A description of groundwater movement, connectivity and water level trend analysis for the Clematis Sandstone and the Bandanna Formation is not explicitly discussed in the report. This information is integrated within other relevant sections. For example, the Clematis Sandstone is described as part of the Bowen Basin (s3.2.2), with connectivity between the Clematis Sandstone and Bandanna Formation described in s3.5.6 (Permian coal measures and surrounding aquifers).</p> <p>OGIA also state, "The UWIR seeks to maintain a balance between meeting the statutory requirement under s376 of the Water Act 2000 (the Act) and general readability of the document for a broader target audience – i.e. landholders, industry, conservation groups and research organisations. Therefore, generally explicit and focused details are provided for aquifers immediately overlying and underlying the CSG target formation (e.g. Springbok Sandstone, Hutton Sandstone, Condamine Alluvium and Precipice Sandstone), or where there is a higher level of connectivity with CSG target formations in production areas compared to other formations that are well separated from CSG target formations and have low connectivity. Focus is also maintained on the Surat Basin which is part of the Great Artesian Basin and the prime target for CSG in areas where the majority of the groundwater receptors are located."</p>	<p>From the meeting, DES considers it necessary to include a sentence confirming this in the proposed UWIR to satisfy the legislative requirement, rather than silence on the unit.</p> <p>From the letter, DES interprets that OGIA agrees there is not an explicit/comprehensive description for the Clematis Sandstone in the report, but that OGIA believe that there is nevertheless sufficient information in the report to cover off on the legislative requirement. In their response, they refer to connectivity being potentially covered in s.3.5.6; however OGIA does not clarify where flow characteristics may be covered.</p> <p>DES appreciates the point of view made by OGIA in this manner. However, legislative requirements in this section of the Water Act do not allow for discretion on which sections are included and which are not included in the UWIR. Therefore, each legislative requirement must be achieved for DES to lawfully approve the UWIR.</p> <p>Similarly, DES prefers that no legislatively required items are 'censored' from the UWIR; rather, that stakeholders using the report are fully enabled to choose for themselves what information they do or do not personally wish to make use of (or consider relevant) from a legislatively complete report, for their own purposes (whatever those purposes may be).</p>	<p>In order to ensure that the legislative requirement has been achieved in the UWIR, the item may be remedied by either</p> <p>A statement (e.g. sentence) confirming the statement in the meeting (via a 'modify and resubmit' process); or</p> <p>By OGIA making statements in the other sections of the report that detail where the Clematis Sandstone is spoken to in terms of underground water movement (including flow and connectivity) (via a 'modify and resubmit' process).</p> <p>The objective being to ensure it is clear in either case where in the report the legislation is met for Clematis Sandstone.</p>
<p>3) s. 376(1)(b)(iii) requires, for each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights - an analysis of the trends in water level change for the aquifer because of the exercise of the rights mentioned in paragraph (a)(i) <i>(For the area to which the UWIR relates— (a)(i) - the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights).</i></p> <p>a) DES has prepared a geological unit / aquifer list of those units / aquifers that have been identified as affected or likely to be affected by the exercise of petroleum underground water rights.</p> <p>b) Utilising this list, DES has found that trends in groundwater level, including distinguishing petroleum from non-petroleum impacts, have not been discussed</p>	<p>OGIA state, "The UWIR seeks to maintain a balance between meeting the statutory requirement under s376 of the Water Act 2000 (the Act) and general readability of the document for a broader target audience – i.e. landholders, industry, conservation groups and research organisations. Therefore, generally explicit and focused details are provided for aquifers immediately overlying and underlying the CSG target formation (e.g. Springbok Sandstone, Hutton Sandstone, Condamine Alluvium and Precipice Sandstone), or where there is a higher level of connectivity with CSG target formations in production areas compared to other formations that are well separated from CSG target formations and have low connectivity. Focus is also maintained on the Surat Basin which is part of the Great</p>	<p>DES appreciates the point of view made by OGIA in this manner. However, legislative requirements in this section of the Water Act do not allow for discretion on which sections are included and which are not included in the UWIR. Therefore, each legislative requirement must be achieved for DES to lawfully approve the UWIR.</p> <p>Similarly, DES prefers that no legislatively required items are 'censored' from the UWIR; rather, that stakeholders using the report are fully enabled to choose for themselves what information they do or do not personally wish to make use of (or consider relevant) from a legislatively complete report, for their own purposes (whatever those purposes may be).</p>	<p>OGIA have suggested to "explicitly state that impacts from historical CSG water extraction are not noted in any other aquifers or formations."</p> <p>DES considers it reasonable that if OGIA have grounds to demonstrate an absence of trends in water level change in the Clematis Sandstone, Bandanna Fm, and the Cattle Creek Fm, because of the exercise of any previous relevant underground water rights, then this being demonstrated and stated in the UWIR could remedy this item.</p> <p>This could be achieved through a 'modify and resubmit' process.</p>

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
for all of the impacted / likely to be impacted units: Clematis Sandstone, Bandanna Fm, and the Cattle Creek Fm.	<p>Artesian Basin and the prime target for CSG in areas where the majority of the groundwater receptors are located.”</p> <p>OGIA state,</p> <ul style="list-style-type: none"> - “The Bandanna Formation is also a CSG target and has very limited groundwater use (s4.1.2) with only one impacted bore. The drawdown in the Bandanna Formation is predetermined to achieve target pressure levels for CSG production (Figure G-8). - “Predicted impacts in the Clematis Sandstone are the result of the direct take of associated water by conventional activities as described in s7.3 (Long-term impacts). - “There are inherent technical limitations in separating CSG impacts from non-CSG impacts, as detailed in s5.1 to s5.3. Therefore, impacts from historical CSG water extraction (i.e. exercise of associated water rights until now) cannot be separated at this stage, except for the CSG reservoir. Analysis of monitoring data so far has revealed that the Springbok Sandstone is the only surrounding formation where impacts may have occurred, as detailed in Chapter 5. OGIA intends to continue further research in this area. - “If required, a separate short section can be added before s5.5 as ‘trends in other formations’ to explicitly state that impacts from historical CSG water extraction are not noted in any other aquifers or formations.” 	<p>DES has had regard to Figure G-8, “Distribution of long-term impacts – Bandanna Formation” and is satisfied that this figure does NOT relate to providing information around the exercise of previous relevant underground water rights, as required by this section of the legislation. Rather, this figure is interpreted to be predicting future drawdown to be expected. Whether or not previous rights exercise has informed this figure, there is still a legislative requirement that data from previous exercise rights be presented stand-alone.</p> <p>DES has had regard to s.7.3, “Long-term impacts”. This section does not have a subsection for the Clematis Sandstone, however in its place, DES has had regard to the Bandanna Formation as this seems to be the closest potential representative unit in the geological strata. In this section, it was stated, “Significant impact has already been observed and a substantial LAA is predicted, as shown in Figure 7-2.”</p> <p>DES has had regard to Figure 7-2, however this shows the extent of the long-term affected areas and does not provide an estimate on the quantity of water produced or taken from the aquifer's area because of the exercise of any previous relevant underground water rights, as required by this section.</p> <p>DES acknowledges this point, and considers it appropriate that the legislation can be satisfied by a reasonable estimate. Given the example given in the Water Act “Example for paragraph (a)(i) – If the report is prepared by a mining tenure holder before it exercises its underground water rights, the quantity of water produced or taken from the area would be shown in the report as zero”, it may be appropriate that such an estimate could, at least, be based off data from the commencement of the CMA.</p> <p>DES considers that if OGIA have grounds to demonstrate an absence of trends in water level change in the Clematis Sandstone, Bandanna Fm, and the Cattle Creek Fm, because of the exercise of any previous relevant underground water rights, then this being demonstrated and stated in the UWIR could remedy this item.</p>	

Content of UWIR – s. 376			
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4) s. 376(1)(da) requires a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.	<p>OGIA state, "The UWIR seeks to maintain a balance between meeting the statutory requirement under s376 of the Water Act 2000 (the Act) and general readability of the document for a broader target audience – i.e. landholders, industry, conservation groups and research organisations. Therefore, generally explicit and focused details are provided for aquifers immediately overlying and underlying the CSG target formation (e.g. Springbok Sandstone, Hutton Sandstone, Condamine Alluvium and Precipice Sandstone), or where there is a higher level of connectivity with CSG target formations in production areas compared to other formations that are well separated from CSG target formations and have low connectivity. Focus is also maintained on the Surat Basin which is part of the Great Artesian Basin and the prime target for CSG in areas where the majority of the groundwater receptors are located."</p> <p>OGIA state, "Assessment of EVs is a new scope for the UWIR 2019 resulting from legislative amendments in late 2016. Therefore, DES and OGIA developed a common understanding of the scope of this assessment to be included in the UWIR following a number of discussions in 2017/18. It was acknowledged that an assessment for most of the EVs – such as water bores, groundwater aquifers, watercourses and springs – has been implicit in the scope of the UWIR that existed before 2016. An agreed position as outlined in an email dated 12 November 2018 (Attachment-1) was that as in previous UWIRs, the UWIR 2019 will include an overview of the EVs in the CMA – aquifers, human use and GDEs. For the new scope relating to terrestrial GDEs, this would include their location and current conceptual understanding about the water requirements and likely response to change in the groundwater regime. In relation to human use and water quality objectives, the UWIR would provide a summary of water chemistry by formation."</p>	<p>DES appreciates the point of view made by OGIA in this manner. However, legislative requirements in this section of the Water Act do not allow for discretion on which sections are included and which are not included in the UWIR. Therefore, each legislative requirement must be achieved for DES to lawfully approve the UWIR.</p> <p>Similarly, DES prefers that no legislatively required items are 'censored' from the UWIR; rather, that stakeholders using the report are fully enabled to choose for themselves what information they do or do not personally wish to make use of (or consider relevant) from a legislatively complete report, for their own purposes (whatever those purposes may be).</p> <p>DES has had regard to the email, dated Monday 12 November 2018, which was sent from a "Director" of OGIA to a "Director" and three "Managers" of DES, with OGIA's "Executive Director" cc'd.</p> <p>The email stated that "At this stage, the 2019 UWIR EV chapter will include an overview of the EVs in the CMA - aquifers, human use and GDEs. For aquifer and human use EVs, this chapter will point to other UWIR chapters where these EVs are addressed. For GDEs (springs, gaining streams and dependent vegetation) the EV chapter will present their location and current conceptual understanding including their water requirements and likely response to change in the groundwater regime. Impacts all EVs (aquifers, bores, GDEs) will be presented collectively in a later UWIR chapter. Noting that the Spring Impact Management Strategy (SIMS) will continue to be a stand-alone chapter, consistent with the legislative requirement."</p> <p>The email also included a table, wherein tick-marks were used to identify whether or not OGIA intended to expand upon an item in the UWIR (relative to previous UWIRs), or not. The items listed were, for human use: water bore extraction; recreational use; for aquatic ecosystems: groundwater systems; river baseflow; springs; and terrestrial GDEs. It was ticked that recreational use (e.g. waterholes) and terrestrial GDEs would be expanded upon.</p> <p>The email also stated that "Once we [OGIA] have some initial modelling results later this year/early next year, we will share the draft EV and impact assessment chapters with you [DES]." The assessing officer of the proposed UWIR is aware only of the official Draft UWIR circulated for public consultation purposes.</p>	It is unlawful for a proposed UWIR to be approved that does not meet legislative requirements. As DES is unable to 'condition' the proposed UWIR into compliance with legislative requirements, this may only be addressed through a 'modify and resubmit' process.

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
		Evidence of a response from DES was not provided by OGIA in response to this item. Nevertheless, the legislative requirements in this section of the Water Act do not allow for discretion on which sections are included and which are not included in the UWIR. Therefore, each legislative requirement must be achieved for DES to lawfully approve the UWIR, and regardless of any verbal or written agreements to the contrary.	
a) Information on pressure declinations has been provided for the GAB, Precipice Sndst and the Bowen, Cattle Creek Fm. However, the statements that 'significant drawdown / significant impact has already been observed' at the GAB, Walloon Coal Measures and Bowen, Bandanna Fm is considered insufficient in description. DES requires that these statements be elaborated and characterised / quantified.	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Response to this item is under the first and second heading of the response letter, i.e.:</p> <ul style="list-style-type: none"> • Interconnectivity, groundwater flow and trend analysis; and • Assessment of impacts on environmental values <p>"Observed impacts from past exercise of P&G water rights and non-CSG development (water users) are reflected in observed monitoring data which is used in model calibration. Also, predicted impacts from P&G in the short and long term, as presented in the UWIR, include impacts from past exercise of water rights.</p> <p>"As outlined in the third bullet point of pg 2 of the response letter, apart from CSG reservoirs – Walloon Coal Measures, Bandanna Formation and the Cattle Creek Formation, it is not possible to quantify CSG impacts in other surrounding aquifer. This is detailed in length in Chapter 5 of the UWIR, and in particular s5.2 and s5.3"</p>	<p>DES interprets the legislative requirement of "s. 376(1)(da) - a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights" to mean that a stand-alone description is required, separately and in addition to predicted upcoming impacts.</p> <p>However, in line with OGIA's concerns about the feasibility to quantify CSG impacts from non-CSG impacts – DES may be able to accept what information OGIA is able to provide on the matter for the Walloon Coal Measures, the Bandanna Formation and the Cattle Creek Formation, with an explanatory statement in the UWIR as to why the information cannot be accurately included for the other aquifers (noting that this justification may be satisfactory as already provided).</p>	The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.
b) No information has been provided on impacts from past exercise of water rights on water bores in the following units: GAB, Hutton Sndst; Bowen, Bandanna Fm; Bowen, Cattle Ck Fm; and GAB, Walloon Coal Measures. DES interprets this as a determination that no impacts have been observed, but considers it desirable to have this determination be confirmed.	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Response to this item is under the first and second heading of the response letter, i.e.:</p> <ul style="list-style-type: none"> • Interconnectivity, groundwater flow and trend analysis; and • Assessment of impacts on environmental values <p>"Observed impacts from past exercise of P&G water rights and non-CSG development (water users) are reflected in observed monitoring data which is used in model</p>	<p>DES interprets the legislative requirement of "s. 376(1)(da) - a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights" to mean that a stand-alone description is required, separately and in addition to predicted upcoming impacts.</p> <p>However, in line with OGIA's concerns about the feasibility to quantify CSG impacts from non-CSG impacts – DES may be able to accept what information OGIA is able to provide on the matter for the Walloon Coal Measures, the Bandanna Formation and the Cattle Creek Formation, with an explanatory statement in the UWIR as to why the information cannot be accurately included for the other</p>	The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.

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Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
	<p>calibration. Also, predicted impacts from P&G in the short and long term, as presented in the UWIR, include impacts from past exercise of water rights.</p> <p>"As outlined in the third bullet point of pg 2 of the response letter, apart from CSG reservoirs – Walloon Coal Measures, Bandanna Formation and the Cattle Creek Formation, it is not possible to quantify CSG impacts in other surrounding aquifer. This is detailed in length in Chapter 5 of the UWIR, and in particular s5.2 and s5.3"</p>	<p>aquifers (noting that this justification may be satisfactory as already provided).</p>	
<p>c) Insufficient information has been provided for impacts from past exercise of water rights on bores in the GAB, Springbok Sandst: "Actual impacts have been observed at some locations within the formation." DES requires that this statement be elaborated and characterised / quantified.</p>	<p>OGIA stated, "So far, the only observed impact in surrounding aquifers is in the Springbok Sandstone at three locations (detailed in s5.4.2) which does not support EVs in those areas. No impacts are currently identified in other aquifers, implying that there is no impact on associated EVs."</p> <p>DES was unsure if this response was intended to match this item, as it did not appear to address the concern. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Yes it is intended to match this item. As above, impacts from past exercise of water rights are observed impacts – to which the Chapter 5 of the UWIR is dedicated to. Observed impacts from past exercise of P&G water rights and non-CSG development (water users) are reflected in observed monitoring data which is used in model calibration. Also, predicted impacts from P&G in the short and long term, as presented in the UWIR, include impacts from past exercise of water rights.</p> <p>"The bores are impacted when aquifers are impacted. If there are no impacts observed on aquifers of the GAB then bores sourcing water from those aquifers are also not impacted. The only exception is Walloon Coal Measures and Bandanna Formation where almost all impacts are attributed to CSG (para 2, pg 67 of the Final UWIR). Practically all of the impacted bores are decommissioned or made good as part of Chapter 3 or as a proactive measure by the CSG companies. Similarly observed drawdowns in Springbok Sandstone at three locations are attributed to CSG. No other aquifers are found to be likely impacted.</p> <p>"As offered in the response letter, if required the Final UWIR could be amended to add such explicit statements."</p>	<p>From the response, DES finds the following statement to be of relevance in clarifying what actual impacts have been observed in the Springbok Sandstone as a result of past exercise of water rights:</p> <p><i>"...Observed drawdowns in Springbok Sandstone at three locations are attributed to CSG."</i></p> <p>DES interprets that the legislative requirement of "s. 376(1)(da) - a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights" to mean that "the observed drawdowns" in the Springbok Sandstone, at three locations which are understood to be attributed to CSG, to be described in the UWIR. To meet this requirement, an indication of the impact's areas, and a magnitude of the impact in values could be used. Other descriptions would also be considered, however the so-far-provided responses of 'actual impacts' and 'observed drawdowns' requires elaboration to be considered a valid description of an impact.</p> <p>DES has had regard to the proposed UWIR's s.5.4.2, with a view to identifying three locations with impacts attributed to past associated exercise of water rights. DES observes the following from s.5.4.2:</p> <ul style="list-style-type: none"> - <i>In deeper parts of the system in and around the CSG fields, impacts from CSG water extraction are most apparent in Kenya East GW4 (RN160525A, Figure 5-6), located 30 km south of Chinchilla. This monitoring site shows relatively static water levels until late 2014, after which there is a sharp change in trend, leading to an 18 m decline over the next three years. This change corresponds with the commencement of CSG production within 10 km of this site. Mapping and analysis of faults (section 3.5.1) suggest the presence of a nearby fault, where the Walloon Coal Measures is juxtaposed against the Springbok Sandstone, which may allow direct</i> 	<p>No action required.</p>

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		<p>groundwater flow between the two formations. Additionally, water chemistry for a number of CSG wells in this area indicates potential mixing of water between the two formations.</p> <p>- A similar pattern to Kenya East may also be emerging at other Springbok Sandstone monitoring points within development areas (e.g. Broadwater GW11 and Isabella 7M) although data at this early stage is somewhat inconclusive. OGIA will continue to evaluate these sites as more data becomes available.</p> <p>DES interprets that the above three bores are the three sites where impacts have been observed and attributed to past associated exercise of water rights.</p> <p>In the case of Kenya East GW4 (RN160525A), DES interprets that there has been a drawdown in the bore of 18 m due to past associated exercise of water rights.</p> <p>In the case of Broadwater GW11 and Isabella 7M, DES notes that a 'similar pattern' 'may be emerging' but is not conclusive at this point.</p> <p>DES considers that this response, of 18 m and potentially similar magnitude at two other sites, does provide a description of impact and is therefore satisfied with the response.</p>	
d) No information has been provided on whether any drawdown has occurred, or is predicted to occur, from the exercise of groundwater rights undertaken to date in the following springs: Springrock, Lonely Eddie, 311, Cockatoo, Lucky Last, Barton, Horse Creek, Orana, Scott's Creek, Abyss, Eurombah, and Dawson River.	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"As above. Similar to water bores, springs are impacted if source aquifers are impacted. As stated in the UWIR, no impacts are observed at this stage in aquifers that support springs, particularly in the area where springs are located."</p>	<p>DES interprets this as a statement from OGIA that no impacts have been observed from the exercise of groundwater rights undertaken to date, at these spring sites.</p> <p>DES is satisfied that this being stated in the UWIR would satisfy the legislative requirement.</p>	The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.
e) No information has been provided on whether any drawdown has occurred, or is predicted to occur, from the exercise of groundwater rights undertaken to date affecting terrestrial GDEs.	OGIA state, "There are limited predicted impacts in the outcrop areas of aquifers or in the aquifers immediately above and below target formations. As a result, impacts on EVs (including terrestrial GDEs) are unlikely at this stage."	DES interprets that OGIA considers it likely that no drawdown has occurred, or is likely to occur, from the exercise of groundwater rights undertaken to date affecting terrestrial GDEs.	If DES' interpretation is correct, a statement to this effect in the proposed UWIR would satisfy this legislative requirement. This can be addressed via a 'modify and resubmit' process.
f) No information has been provided on the actual water quality objectives for the pertinent aquifers of the CMA. No information has been provided on how water quality	OGIA state, "CSG depressurisation creates a pressure gradient from surrounding aquifers to CSG target formations. As a result, changes to water chemistry/quality	DES considers it appropriate for relevant water quality objectives, by aquifer, to be stated in the proposed UWIR; and that results of water quality in the CMA be tracked against these objectives over space and time in each UWIR.	This item could be rectified via a 'modify and resubmit' process after clarifying DES' understanding of the item with OGIA.

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<p>in the aquifers has changed to date, spatially or temporally, relative to these objectives.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm. 	<p>in surrounding aquifers from CSG production are unlikely. If required, this could be explicitly stated in the UWIR."</p> <p>OGIA state, "A summary of water quality compiled from all available historical data is presented in s4.1.4, with a detailed summary in Appendix D.2."</p>	<p>DES has had regard to the data in s.4.1.4 and Appendix D.2, wherein the most detailed information is in Appendix D.2, <i>Table D-2 – Water chemistry summary for the major formations in the Surat CMA</i> to determine whether all necessary aquifers are detailed. DES determined that the only unit not clearly indicated is the Cattle Creek Fm unit, which is geologically early in the Permian Bowen Basin; and is therefore taken to be incorporated into the formation in Table D-2 called "Undivided lower Bowen Basin".</p> <p>If OGIA believe that the water quality presented in Table D-2 should represent the water quality objectives of the units, DES considers that this should be stated in the UWIR and trends (increases or decreases in concentration of quality indicators) be clearly discussed in subsequent UWIRs. This should indicate if trends indicate significant change or no significant change (defined), and in what manner.</p>	
<p>g) No information has been provided on local scale water movement (e.g. flow directions, flow rates) in the pertinent aquifers of the CMA in the vicinity of the contaminated Linc site.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm. 	<p>OGIA state, "Issues relation [sic] to contamination in the vicinity of the Linc site are considered outside the scope of the UWIR. However, some background information on groundwater flow direction can be provided separately if required."</p>	<p>DES considers the OGIA groundwater modelling and actual monitoring results to be useful for a wide range of stakeholders, including DES (as the regulator of the contaminated site and the regulator of petroleum proponents operating in the vicinity of the site); landholders utilising groundwater near the site; as well as agricultural and environmental groups that may be interested in potential effects that groundwater flow rates and directional movement may have on water quality objectives in and around the contaminated site.</p> <p>As this site is within the CMA boundary, and is a known site with known environmental harm to have occurred, DES considers it within the scope of the UWIR.</p> <p>DES also considers including this information to be in the spirit of the Code of Conduct for the Queensland public service – specifically, that DES and OGIA have an ethical responsibility to act with accountability and transparency (the fourth ethics principle listed in the <i>Public Sector Ethics Act 1994</i>).</p> <p>DES believes that providing specific results of the groundwater modelling separately to DES is not considered in line with the fourth ethics principle of transparency mentioned above. DES is aware of a high level of public interest on this matter and considers that an impartial account of the results of the groundwater modelling (and monitoring results) is in line with the first principle of the Code of Conduct (integrity and impartiality); and that sharing this information with the public is in line with the</p>	<p>The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.</p>

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		<p>second principle of the Code of Conduct (promoting the public good).</p> <p>As DES considers this matter within the scope of the UWIR, DES prefers that no legislatively required items are 'censored' from the UWIR; rather, that stakeholders using the report are fully enabled to choose for themselves what information they do or do not personally wish to make use of (or consider relevant) from a legislatively complete report, for their own purposes (whatever those purposes may be).</p>	
h) No information has been provided on whether any current land subsidence is known to have occurred, or to have been investigated, from the exercise of groundwater rights undertaken to date.	OGIA state, "In relation to evidences of surface subsidence from historical CSG production, so far no larger scale surface deformations (>100 mm) have been recorded by operators. However, full extent of depressurisation will not be reached until late in field life. To date, InSAR techniques have detected some movements 50-100 mm over smaller areas with maximum rates of motion of 20 mm/yr. If required, this additional context can be added in the UWIR."	DES considers that this response addresses the legislative criteria for historic exercise of groundwater rights.	<p>This information would need to be included in the UWIR to meet the legislative requirement. It cannot be included as an approval condition.</p> <p>The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.</p>
<p>5) s. 376(1)(db)(i) requires an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights – during the period mentioned in paragraph (a)(iii) <i>(For the area to which the UWIR relates – (a)(ii) – an estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report).</i></p> <p>a) No timing information has been provided with predictions of impact to terrestrial GDEs in relation to the risk-mapped areas shown in the proposed UWIR's Figure 10-2. DES requires an assessment of likely impacts associated with these risk-mapped areas during the next three years.</p>	OGIA stated, "There are limited predicted impacts in the outcrop areas of aquifers or in the aquifers immediately above and below target formations. As a result, impacts on EVs (including terrestrial GDEs) are unlikely at this stage."	DES does not interpret that this statement clearly outlines a prediction of nil impacts in the next three years. However, if this is OGIA's perceived meaning of the statement, a clearer statement to this effect in the UWIR would satisfy this requirement.	OGIA would need to confirm whether nil impacts are predicted in the next three years, and include this in the UWIR. This can only be achieved via a 'modify and resubmit' process.
b) It is not clear if inter-aquifer connectivity is considered an identifying risk (in addition to outcropping aquifers) for the predictions associated with terrestrial GDEs and at-risk areas shown in Figure 10-2.	OGIA state, "Inter-aquifer connectivity is inherently accommodated in the assessment, and in the regional groundwater flow modelling as described throughout the document, implying that interconnectivity is also considered in all the subsequent assessments of impacts on, and risk to, EVs – as detailed in the relevant chapters and sections."	DES is satisfied with this response.	No action required. However, at the delegate's discretion , DES proposes that clarifying this item in subsequent UWIRs be discussed in a future Herbarium / DES / OGIA forum .
c) No information has been provided on the actual water quality objectives for the pertinent aquifers of the CMA. No information has been provided on	OGIA state, "CSG depressurisation creates a pressure gradient from surrounding aquifers to CSG target formations. As a result, changes to water chemistry/quality	DES considers it appropriate for relevant water quality objectives, by aquifer, to be stated in the proposed UWIR;	The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.

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<p>how water quality in the aquifers is predicted to change in the next three years, spatially or temporally, relative to these objectives.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm. 	<p>in surrounding aquifers from CSG production are unlikely. If required, this could be explicitly stated in the UWIR."</p> <p>OGIA state, "A summary of water quality compiled from all available historical data is presented in s4.1.4, with a detailed summary in Appendix D.2."</p>	<p>and that results of water quality in the CMA be tracked against these objectives over space and time in each UWIR.</p> <p>DES has had regard to the data in s.4.1.4 and Appendix D.2, wherein the most detailed information is in Appendix D.2, <i>Table D-2 – Water chemistry summary for the major formations in the Surat CMA</i>, to determine whether all necessary aquifers are detailed. DES determined that the only unit not clearly indicated is the Cattle Creek Fm unit, which is geologically early in the Permian Bowen Basin; and is therefore taken to be incorporated into the formation in Table D-2 called "Undivided lower Bowen Basin".</p> <p>If OGIA believe that the water quality presented in Table D-2 should represent the water quality objectives of the units, DES considers that this should be stated in the UWIR and trends (increases or decreases in concentration of quality indicators) be clearly discussed in subsequent UWIRs. This should indicate if trends indicate significant change or no significant change (defined), and in what manner.</p> <p>To address this legislative requirement, OGIA would also need to provide statements, for each of the pertinent aquifers, of how the quality present in Table D-2 is predicted to change in the next three years.</p>	
<p>d) No information has been provided on local scale water movement (e.g. flow directions, flow rates) in the pertinent aquifers of the CMA in the vicinity of the contaminated Linc site predicted over the next three years.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm. 	<p>OGIA state, "Issues relation [sic] to contamination in the vicinity of the Linc site are considered outside the scope of the UWIR. However, some background information on groundwater flow direction can be provided separately if required."</p>	<p>As covered above in s. 376(1)(da) – DES considers this matter within the scope of the UWIR.</p> <p>In order to satisfy this legislative requirement, OGIA would need to provide information on the modelled flow direction(s) and flow rate(s) in the vicinity of the site, to the effect that it could be inferred where contamination may migrate in the next three years.</p>	<p>The matter may be remedied by requesting it to be addressed via a modify and resubmit process.</p>
<p>e) Although a map has been generated with low / moderate / high risk categories for land subsidence</p>	<p>OGIA state, "In relation to evidences of surface subsidence from historical CSG production, so far no larger scale</p>	<p>DES considers that this response does not addresses the legislative criteria for describing predicted likely impacts</p>	<p>The matter may be remedied by requesting it to be addressed via a modify and resubmit process.</p>

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due to stratigraphic compaction, the timing of the predicted impacts has not been included relative to the next three years.	surface deformations (>100 mm) have been recorded by operators. However, full extent of depressurisation will not be reached until late in field life. To date, InSAR techniques have detected some movements 50-100 mm over smaller areas with maximum rates of motion of 20 mm/yr. If required, this additional context can be added in the UWIR."	anticipated in the next three years, as would be required to meet this legislative requirement.	
<p>6) s. 376(1)(db)(ii) requires an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights – over the projected life of the resource tenure.</p> <p>a) The maximum long-term predicted aquifer drawdown levels associated with the figures in Appendix G have not been provided for the Walloons, Bandanna Fm, or the Cattle Creek Fm.</p>	OGIA state, "For bores predicted to be impacted in the long term, the prediction of long-term impact at each bore location is provided in the 'Bore Search Tool' available on OGIA's website and referenced in the UWIR. Similar predictions at spring sites are provided in Table I-3."	DES does not presently have the resources to check each individual bore via the online 'Bore Search Tool' to ascertain if maximum values are provided rather than an open-ended ">value" drawdown level.	The matter may be remedied by requesting it to be addressed via a modify and resubmit process.
<p>b) Counts of LTAA water bores have been provided for the GAB, Hutton Sndst and the GAB, Springbok Sndst with an indication of bores predicted to have "less-than-x" metres of impact. However, the predicted maximum impacts are for these bores has not been provided.</p>	OGIA state, "For bores predicted to be impacted in the long term, the prediction of long-term impact at each bore location is provided in the 'Bore Search Tool' available on OGIA's website and referenced in the UWIR. Similar predictions at spring sites are provided in Table I-3."	<p>DES notes that Appendix G.2 <i>Drawdown pattern for long-term impacts in key formations</i> contains Figures G-1 to G-9 (a total of nine figures). Of these nine figures, six have maximum long-term predicted aquifer drawdown levels indicated in the legend "Drawdown (m)", and three of the figures have open-ended ">value" levels.</p> <p>DES considers the most efficient way to portray the information of the maximum predicted drawdown levels be included, in a manner deemed fit-for-purpose by OGIA, in these three figures (Figures G-2, G-8 and G-9).</p> <p>DES requires that the predicted likely maximum impacts for these bores are included in the UWIR, as values, which can therefore be interpreted by readers (rather than the data omitted and only OGIA's interpretation of unknown values provided).</p> <p>DES has had regard to the proposed UWIR's s.7.3 (summaries of the predicted long-term impacts in key formations).</p> <p>Hutton Sndst – the proposed UWIR states,</p> <p><i>"The number of water bores likely to be affected in the long term has therefore reduced from 35 to seven.</i></p> <p><i>"Most of the LAA bores are likely to experience an impact of less than 10 m and are limited to an area</i></p>	The matter may be remedied by requesting it to be addressed via a modify and resubmit process.

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		<p><i>around Dalby where seismic data suggests that the Walloon Coal Measures and Hutton Sandstone may be in direct contact along part of the Horrane Fault.</i></p> <p><i>"Maximum impacts at most other locations in the Hutton Sandstone are minor and predicted to occur several hundred years after extraction from the Walloon Coal Measures has ceased. Recovery may take hundreds of years."</i></p> <p>DES interprets that:</p> <ul style="list-style-type: none"> - the population of the data set is seven bores; and - that for some number of these bores, the likely maximum impact is less than 10 m; and - for some other of these bores, the likely maximum impact is "minor" (which is an interpretation / opinion rather than a number); and - that for some other of these bores, the maximum impact is not stated. <p>DES requires that the full dataset population is described with a likely maximum impact, expressed by values, and that no bore in the dataset is omitted from being described in this manner.</p> <p>Springbok Sndst – the proposed UWIR states,</p> <p><i>"Impacts of more than 5 m are expected in the long term across much of the planned CSG production area. While the number of water bores likely to be affected in the long term has also increased, around half of the LAA bores are likely to experience an impact of less than 15 m."</i></p> <p>DES is uncertain from this excerpt what the population of this dataset is. This should be remedied in the UWIR to remove doubt.</p> <p>DES interprets that:</p> <ul style="list-style-type: none"> - for some number of bores comprising the total dataset population, the likely maximum impact is less than 5 m; 	

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		<ul style="list-style-type: none"> - for some number of bores comprising the total dataset population, around 50% of these bores' likely maximum impact is less than 15 m; - for some number of bores comprising the total dataset population, neither of the above statements is applicable, and for these bores the likely maximum impact is not stated. <p>DES requires that the full dataset population is described with a likely maximum impact, expressed by values, and that no bore in the dataset is omitted from being described in this manner.</p>	
c) Information has been provided that there is one LTAA water bore targeting the Bowen, Bandanna Fm; however the predicted magnitude of the impact has not been included.	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"The bore number is RN22182. Bore search tool provides long term impact as 312.5m and year of max impact as 2030."</p>	<p>DES originally had regard to the proposed UWIR's s.7.3.6 "Bandanna Formation" where it is stated:</p> <p><i>"Significant impact has already been observed and a substantial LAA is predicted, as shown in Figure 7-2; however, this formation is not commonly used for water supply purposes. There is only one water bore that sources water from this formation in the LAA."</i></p> <p>DES requires that this bore is described with a likely maximum impact, expressed by a value.</p> <p>Following OGIA's response on 21 October 2019, DES is satisfied that this information being included in the UWIR will address the legislative requirement, in that the affected bore represents the overall effects for the aquifer.</p>	The matter may be remedied by requesting it to be addressed via a modify and resubmit process.
d) It is not clear if inter-aquifer connectivity is considered an identifying risk (in addition to outcropping aquifers) for the predictions associated with terrestrial GDEs and at-risk areas shown in Figure 10-2.	OGIA state, "Inter-aquifer connectivity is inherently accommodated in the assessment, and in the regional groundwater flow modelling as described throughout the document, implying that interconnectivity is also considered in all the subsequent assessments of impacts on, and risk to, EVs – as detailed in the relevant chapters and sections."	DES is satisfied with this response.	No action required. However, at the delegate's discretion , DES proposes that clarifying this item in subsequent UWIRs be discussed in a future Herbarium / DES / OGIA forum .
<p>e) No information has been provided on the actual water quality objectives for the pertinent aquifers of the CMA. No information has been provided on how water quality in the aquifers is predicted to change after the next three years, spatially or temporally, relative to these objectives.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok 	<p>OGIA state, "CSG depressurisation creates a pressure gradient from surrounding aquifers to CSG target formations. As a result, changes to water chemistry/quality in surrounding aquifers from CSG production are unlikely. If required, this could be explicitly stated in the UWIR."</p> <p>OGIA state, "A summary of water quality compiled from all available historical data is presented in s4.1.4, with a detailed summary in Appendix D.2."</p>	<p>DES considers it appropriate for relevant water quality objectives, by aquifer, to be stated in the proposed UWIR; and that results of water quality in the CMA be tracked against these objectives over space and time in each UWIR.</p> <p>DES has had regard to the data in s.4.1.4 and Appendix D.2, wherein the most detailed information is in Appendix D.2, <i>Table D-2 – Water chemistry summary for the major formations in the Surat CMA</i>, to determine whether all necessary aquifers are detailed. DES determined that the</p>	The matter may be remedied by requesting it to be addressed via a modify and resubmit process.

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm.</p>		<p>only unit not clearly indicated is the Cattle Creek Fm unit, which is geologically early in the Permian Bowen Basin; and is therefore taken to be incorporated into the formation in Table D-2 called "Undivided lower Bowen Basin".</p> <p>If OGIA believe that the water quality presented in Table D-2 should represent the water quality objectives of the units as a starting point, DES considers that this should be stated in the UWIR and trends (increases or decreases in concentration of quality indicators) be clearly discussed in subsequent UWIRs. This should indicate if trends indicate significant change or no significant change (defined), and in what manner (including values).</p> <p>To address this legislative requirement, OGIA would also need to provide statements, for each of the pertinent aquifers, of how the quality present in Table D-2 is predicted to change after the next three years to the end of tenure.</p>	
<p>f) No information has been provided on local scale water movement (e.g. flow directions, flow rates) in the pertinent aquifers of the CMA in the vicinity of the contaminated Linc site predicted after the next three years.</p> <ul style="list-style-type: none"> The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm. 	<p>OGIA state, "Issues relation [sic] to contamination in the vicinity of the Linc site are considered outside the scope of the UWIR. However, some background information on groundwater flow direction can be provided separately if required."</p>	<p>As covered above in s. 376(1)(da) – DES considers this matter within the scope of the UWIR.</p> <p>In order to satisfy this legislative requirement, OGIA would need to provide information on the modelled flow direction(s) and flow rate(s) in the vicinity of the site, to the effect that it could be inferred where contamination may migrate in the next three years.</p>	<p>The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.</p>
<p>g) Although a map has been generated with low / moderate / high risk categories for land subsidence due to stratigraphic compaction, the timing of the predicted impacts has not been included relative to effects after the next three years to the end of the life of tenure.</p>	<p>OGIA state, "In relation to evidences of surface subsidence from historical CSG production, so far no larger scale surface deformations (>100 mm) have been recorded by operators. However, full extent of depressurisation will not be reached until late in field life. To date, InSAR techniques have detected some movements 50-100 mm over smaller areas with maximum rates of motion of 20 mm/yr. If required, this additional context can be added in the UWIR."</p>	<p>DES appreciates the likely challenge of predicting long term impacts for this environmental value. However, DES does not consider that this response adequately provides values and locations predicted to be likely to occur from the exercise of relevant underground water rights from after the next three years until the end of tenure, as is required by legislation.</p>	<p>This information would need to be included in the UWIR to meet the legislative requirement. It cannot be included as an approval condition.</p> <p>The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.</p>

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>7) s. 378(1)(a)(ii) requires a strategy for monitoring changes in the water level of, and the quality of water in, aquifers in the area because of the exercise of the rights. s. 378(2)(c) requires that the strategy include the frequency of the measurements.</p> <p>a) DES requires that the UWIR included a timeframe due date for the one-off chemistry sample monitoring point collection for "Suite B" for bores in the Hutton, Springbok and Precipice sandstones.</p>	OGIA have stated that, "A strontium sample will be collected within 12 months of the finalisation of the UWIR. This will be stated in the published report."	OGIA have clarified that the expectation is that the appropriate timeframe is 12 months from the date the UWIR is approved.	<p>OGIA's response indicates acceptance that a modification of the originally submitted report on 2 August 2019 would need to occur to include this requirement in the UWIR.</p> <p>This item could be rectified though a DES condition on the approval of the UWIR, but would add convolution to the already intricate UWIR.</p> <p>Therefore, this item should be rectified through a 'modify and resubmit' process.</p>
<p>8) s. 378(2)(a) requires the water monitoring strategy to include the parameters to be measured.</p> <p>a) DES notes there a discrepancy between the number of monitoring points for pressure in the proposed UWIR text (622) as opposed to the actual count within the Excel spreadsheet (627). DES requires the number to be confirmed.</p>	OGIA state: "The difference is because of the changes between the draft and final UWIR that will be updated on the web version once the UWIR is approved. In the meantime, the final list is provided to DES."	DES considers the reasoning valid, although the number has not been confirmed in the response. Nevertheless, this can be checked after the modification and resubmission.	This item can be rectified through a 'modify and resubmit' process.
<p>9) s. 378(3) requires that the strategy must include a program to undertake baseline assessments for water bores that are outside the area of the resource tenure.</p> <p>a) DES requires that the areas shown in Figure 8-6 indicating where baseline assessments are due within 12 months from the approval date of the proposed UWIR, be tabulated into table form, individually identifying the bores and responsible tenure holders.</p>	OGIA state: "The bores located on tenure are prepared by tenure holders and included in their Baseline Assessment Plans (BAP) that they submit to DES. To assist the process, OGIA has prepared a list of bores yet to be baselined, has assigned an RTH and is providing the assignment to RTHs."	<p>On-tenure bores are not the subject of the item to be addressed.</p> <p>The item has not been addressed.</p>	The item can be rectified through clarifying the requirement to OGIA and obtaining the information through a 'modify and resubmit' process.
<p>10) s. 379(1)(a) requires that a responsible entity's spring impact management strategy must include each of the following for each spring of interest in the area to which the entity's underground water impact report relates – the details of the spring, including its location.</p> <p>a) DES notes there is a discrepancy between the number of springs of interest (spring vents) in the report compared to those in the corresponding Excel spreadsheet. The report lists 212 and the spreadsheet lists 216 (difference of four spring vents). DES requires the number to be confirmed.</p>	OGIA state: "The difference is because of the changes between the draft and final UWIR that will be updated on the web version once the UWIR is approved. In the meantime, the final list is provided to DES."	DES considers the reasoning valid, although the number has not been confirmed in the response. Nevertheless, this can be checked after the modification and resubmission.	This item can be rectified through a 'modify and resubmit' process.

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>11) s. 379(1)(d) requires that the Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, —a strategy, including the actions to be taken, for preventing or mitigating the predicted impacts on the spring; or, if a strategy for preventing or mitigating the predicted impacts on the spring is not included, the reason for not including the strategy.</p> <p>a) DES is not satisfied with the proposed SIMS component 1 of 4 – the Monitoring Report.</p> <ul style="list-style-type: none"> DES requires that the rationality for not monitoring at W216 (in addition to W217) to be included in the UWIR (for example, the site's suitability for monitoring, cost of monitoring, etc.) for assessment. 	<p>OGIA state, "Watercourse W216 has been identified as potentially impacted (Table 9-4) but no instream monitoring has been prescribed in the UWIR 2019. This is because new groundwater monitoring has been specified in the source aquifer between this reach and the impact propagation pathway. Separately, Santos continues to undertake an annual manual gauging of these reaches, which is also periodically reported to OGIA."</p>	<p>DES recalls that in a meeting held on 8 October 2019, OGIA also stated verbally that access was an issue at W216.</p> <p>DES is satisfied with the response.</p>	<p>No further action is required.</p>
<p>b) DES is not satisfied with the proposed SIMS component 2 of 4 – the Watercourse Spring Investigation Report.</p> <ul style="list-style-type: none"> DES note the requirement written in the proposed UWIR: "A watercourse spring investigation report is also required to be submitted to OGIA within 12 months of the approval of the UWIR for sites identified in Appendix I.2. The investigation must include the chemistry suite specified in Appendix I.2." There is no chemistry suite in Appendix I.2. 	<p>OGIA state, "The reference table for both the watercourse reaches requiring validation and the recommended chemistry suite have been incorrectly stated. This will be corrected in the published version of the report."</p>	<p>A reference to the correct chemistry suite is required for this obligation to be clear and enforceable.</p>	<p>A correction to the location of the chemistry suite to be used in the investigation obligation would remedy the item.</p> <p>OGIA have proposed to modify the original proposed UWIR lodged on 2 August 2019. This can occur through a 'modify and resubmit' process.</p>
<p>c) DES has concerns regarding the accountability of responsible tenure holders to complete field investigations / validations within any specified time frame. While the requirement indicates which sites require validation, and a report within 12 months, there is only a requirement to report on desktop studies / any field investigations which have been carried out (leaving it voluntary / proactive for the responsible tenure holder).</p>	<p>OGIA state, "Where field investigations are required, it is stated that a dry season longitudinal survey is completed within 12 months of the approval of the UWIR. This is supported by the text in s9.5.1 and s9.7."</p>	<p>During original assessment, DES noted that the proposed UWIR states that some watercourse springs have been identified on the basis of a desktop assessment. Only watercourse springs where field verification has been completed are included in the mitigation groups.</p> <p>DES noted that field verification is required to be undertaken, in the manner described by OGIA in the proposed UWIR, by responsible tenure holders for unverified watercourse springs identified as a high risk.</p> <p>DES has had regard to s.9.5.1, where it is stated "Where an unverified watercourse spring is identified as a high risk, field verification by tenure holders is necessary (see section 9.7). This should include a dry season longitudinal survey of the reaches to assess where groundwater is discharging to stream and to identify the source aquifer. The field methods must include surface water chemistry</p>	<p>DES is satisfied that there is no clear demarcation of 'high risk' requiring field verification within 12 months of the date the UWIR is approved.</p> <p>Rather, years before impact (0-3) has been utilised.</p> <p>DES considers it necessary that due dates for field verification to have been completed on or by, to be clearly indicated in the proposed UWIR (e.g. as an additional column in Table I-4, or clearly stated in the "Watercourse Spring Investigation Report" obligation section of the text of the proposed UWIR (s.9.7).</p> <p>DES considers it necessary that the sites where there are 0 years remaining before >0.2 m drawdown impact, the full 12 months may actually be longer than due diligence should allow – and this should be suitably reduced.</p>

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
		<p>(recommended chemistry suites are provided in Appendix I, Table I-8), stream gauging, and the measurement of water levels and chemistry in nearby shallow water bores. These sites are shown in Figure 9-2 and listed in Appendix I.3.”</p> <p>DES notes that while this excerpt from s.9.5.1 discusses field verification, this is stated within s.9.5 “Spring impact mitigation strategy” rather than the “Watercourse Spring Investigation Report” component of the SIMS. DES has interpreted that this s.9.5.1 discusses field verification for the purposes of mitigation, not watercourse spring investigation.</p> <p>DES observed that Figure 9-2 includes amber-coloured polylines referred to in the legend as “Mitigation site (unverified)”. DES also deduced that Appendix I.3 was not correct, and that OGIA stated “Only watercourse springs where field verification has been completed are included in the mitigation groups” in the proposed UWIR.</p> <p>DES has had regard to s.9.7 “Tenure holder obligations” where it is stated, “A watercourse spring investigation report is also required to be submitted to OGIA within 12 months of the approval of the UWIR for sites identified in Appendix I.2. The investigation must include the chemistry suite specified in Appendix I.2. The report must include:</p> <ul style="list-style-type: none"> - “details of the desktop investigations of the identified watercourse spring - “details of any field investigations of the identified watercourse spring - “findings on the groundwater-surface water connectivity of the identified reach - “identification of an ongoing monitoring program where the reach is identified as connected.” <p>DES has had regard to Table I-4 “Watercourse springs – predicted impacts and risk assessment results” in Appendix I.2 “Spring risk assessment” to determine if all sites within this appendix match those ‘unverified watercourse springs identified as a high risk’ referred to in the Mitigation Strategy component – if so, then the item is addressed; if not, it is not.</p> <p>There are 15 watercourse spring sites that require validation.</p> <p>Of these 15 sites, seven have asterisks beside them, linking to the corresponding footnote “The need for validation at</p>	<p>This can be discussed with OGIA or determined by DES as the delegate deems appropriate. In either case, to include the due dates in Table I-4, a ‘modify and resubmit’ process is necessary.</p> <p>DES considers that affecting this item via an approval condition would add convolution to the UWIR and tenure holder obligations; and it appears that OGIA have two intentions about when the field verifications may need to be undertaken (some within 12 months of the date of the UWIR’s approval, and some at a date to be determined later based on <i>consideration of the industry development scenario</i>).</p>

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
		<p>these locations in the current UWIR cycle will be reviewed at the Annual Report in consideration of the industry development scenario.”</p> <p>DES interprets that “ Validation* ” means that validation is not due until at least after the next Annual Report, as it is stated that “The need for validation at these locations in the current UWIR cycle will be reviewed at the Annual Report in consideration of the industry development scenario.” Therefore, these seven watercourse springs are not included in those due within 12 months of the approval of the UWIR; in spite of their ‘total risk criterion scores’ ranging from 3 to 5 on a scale of 1 to 5.</p> <p>The eight watercourse springs with the “validation” action requirement remaining have ‘total risk criterion scores’ ranging from 4 to 5 on a scale of 1 to 5.</p> <p>DES found that the seven sites with asterisks were associated with “Years before >0.2 m” impact were at least four years, whereas the eight sites without asterisks had 0 – 3 years before the predicted impact. From this, DES deduces that the risk scoring was not utilised; rather the criteria of 0 – 3 or >3 years was utilised.</p> <p>Within s.9.7 of the proposed UWIR, DES interprets that the Watercourse Spring Investigation Report only requires details of field investigations which have been carried out, without consequence should no investigation have been undertaken.</p> <p>Therefore, DES is satisfied that there is no clear demarcation of ‘high risk’ requiring field verification within 12 months of the date the UWIR is approved. Rather, years before impact (0-3) has been utilised. DES considers it necessary that due dates for field verification to have been completed on or by, to be clearly indicated in the proposed UWIR (e.g. as an additional column in Table I-4, or clearly stated in the “Watercourse Spring Investigation Report” obligation section of the text of the proposed UWIR (s.9.7).</p> <p>DES considers it necessary that the sites where there are 0 years remaining before >0.2 m drawdown impact, the full 12 months may actually be longer than due diligence should allow – and this should be suitably reduced. This can be discussed with OGIA or determined by DES as the delegate deems appropriate. In either case, to include the due dates in Table I-4, a ‘modify and resubmit’ process is necessary.</p>	
	OGIA state,		

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
d) DES requires that provisions are incorporated into this component to ensure OGIA / DES approves the nominated monitoring program, with or without changes, with or without the responsible tenure holder's agreement, within reasonable timeframes.	<ul style="list-style-type: none"> - "Where a monitoring program is submitted as part of a watercourse spring validation report or a SIMS mitigation plan, OGIA will assess the technical validity of the proposed plan and endorse or require a revised program to be submitted for DES consideration." 	<p>DES notes that this response refers to the "Watercourse Spring <u>Validation</u> Report" rather than the "Watercourse Spring <u>Investigation</u> Report", however DES interprets that OGIA is referring to the "Watercourse Spring <u>Investigation</u> Report".</p> <p>DES interprets that, once a monitoring program is submitted pursuant to the requirements under the Watercourse Spring Investigation Report component of the SIMS, that, either:</p> <ul style="list-style-type: none"> - OGIA will assess the technical validity of the proposed plan and endorse it; or - OGIA will require a revised program to be submitted for DES consideration. <p>DES interprets this to mean that OGIA will determine if OGIA is satisfied with the proposal; however, if OGIA is not satisfied, OGIA will oblige the proponent to revise their monitoring program and submit it to DES for endorsement.</p> <p>DES is unclear why a resubmitted monitoring program would be sent to DES for endorsement rather than to OGIA, where OGIA have first considered the original proposal, and consider themselves otherwise capable of endorsing proposals.</p> <p>DES prefers this to be clarified from OGIA. DES suspects that OGIA's intention was to have the authority to endorse or require a modification and resubmission of any monitoring program for a Watercourse Spring Investigation Report; and that DES will have the authority to endorse or require a modification and resubmission of any monitoring program for a SIMS Mitigation Plan.</p>	<p>DES prefers that OGIA clarify their proposed endorsement methodology; and once this is achieved, that the endorsement process is clearly laid out in the proposed UWIR so that it is known by the proponents and enforceable.</p> <p>That the process is clearly laid out in the proposed UWIR so that it is known by the proponents and enforceable is required in any case.</p> <p>This can be achieved through:</p> <ul style="list-style-type: none"> - further correspondence with OGIA, then a 'modify and resubmit' process; or - by an 'executive decision' made by DES and requested in a 'modify and resubmit' process, or - by an 'executive decision' made by DES generated as a condition of approval for the UWIR. <p>DES considers it ideal that it is addressed via a 'modify and resubmit' process rather than as an approval condition, to avoid convolution in the UWIR.</p>
e) DES is not satisfied with the proposed SIMS component 3 of 4 – the Mitigation Plan.	OGIA state, "Where a SIMS mitigation plan is required, all four options must be considered and evaluated as part of the plan. If required this can be amended as proposed by replacing the word 'or' with 'and'."	DES is satisfied with this response.	The replacement of the 'or' for 'and' can be achieved through a 'modify and resubmit' process.
f) DES requires that provisions are incorporated into this component to ensure it is clear that DES may approve the nominated monitoring program, with or without changes, with or without the responsible tenure holder's agreement, or may require the	OGIA state, "Where a monitoring program is submitted as part of a watercourse spring validation report or a SIMS mitigation plan, OGIA will assess the technical validity of the proposed plan and endorse or require a revised program to be submitted for DES consideration."	Same as two items above.	Same as two items above (clarify endorsement process; lay out process in UWIR; via a 'modify and resubmit' process).

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
responsible tenure holder to modify and resubmit for approval within DES' nominated timeframe.			
<p>g) DES requires that the UWIR also explicitly state that, once approved, the plan must then be implemented.</p> <p>h) DES considers it necessary and desirable that the UWIR have a condition stating that all plans / programs / etc. must be implemented.</p>	OGIA state, "It is implied that once the UWIR is approved, all plans and actions for responsible tenure holders become statutory obligations and must be complied."	DES agrees, and notes that there are frequently conditions made (e.g. in environmental authorities) clarifying this point to make it clearly enforceable.	<p>DES considers it preferable that the UWIR include the requirement that all plans, procedures, programs, reports and methodologies required under this UWIR must be written, approved (where required) and implemented.</p> <p>This can either be achieved as an approval condition of the UWIR or as a statement in the proposed UWIR s.9.7 "Tenure holder obligations" through a 'modify and resubmit' process.</p> <p>DES considers it preferable that the requirement be included in the body of the UWIR for the sake of simplification for proponents.</p>
<p>i) DES is not satisfied with the proposed SIMS component 4 of 4 – Field Verification for Mitigation.</p> <ul style="list-style-type: none"> DES considers it likely that an error has been made in the proposed UWIR, whereby the sites referred to in Appendix I.3 are NOT the sites requiring field validation. Instead, the sites requiring field validation are those 15 sites listed in Appendix I.2, Table I-4. This requires verification from OGIA. 	OGIA state, "The reference table for both the watercourse reaches requiring validation and the recommended chemistry suite have been incorrectly stated. This will be corrected in the published version of the report."	DES appreciates this statement, although it does not clarify which the correct reference table is.	The correct reference table / appendix must be included in the UWIR. As the response did not clarify the correct table, this information is still required from OGIA and therefore could not at this point be included as an approval condition of the UWIR, but could be obtained through a 'modify and resubmit' process.
j) DES considers it necessary that additional spring vents may also be included following field validation, rather than only watercourse springs.	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Unlike watercourse springs, the spring complexes are reasonably well mapped in the Surat CMA, particularly in and around the CSG production areas. Position of spring vents within a complex tends to be dynamic and may</p>	DES is satisfied with this response.	No further action required.

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Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
	change over time in response to hydrogeological conditions applicable to the complex. Therefore, impact assessment, risk assessment, and corresponding mitigation and monitoring strategies are also primarily focused on spring complex level (and sometime at spring group level). Additional vents outside existing complexes are less likely to be found in field verification processes. However, if such additional vents are found, then they will be reported through the Annual Report process and included in the subsequent UWIR assessment."		
k) DES requires that timeframes be incorporated into the field verification obligations, determining due dates for field verifications to have been completed. DES considers the 'years before predicted impact' should be utilised to inform which sites should be prioritised.	<p>OGIA state, "In Table I-4, watercourse springs requiring validation have been prioritised based on prediction of the number of years before 0.2 metres of impact. Therefore, not all sites are identified for verification during this UWIR cycle. The need for validation at the remaining sites is proposed to be reviewed in the next UWIR."</p> <p>OGIA state, "Where field investigations are required, it is stated that a dry season longitudinal survey is completed within 12 months of the approval of the UWIR. This is supported by the text in s9.5.1 and s9.7."</p>	<p>DES is not clear which responses from OGIA necessarily link to each item from DES, as OGIA grouped their responses and DES has attempted to correctly separate.</p> <p>From the proposed UWIR, DES noted that there are 15 sites in Table I-4 (Watercourse springs – predicted impacts and risk assessment results) which are listed as requiring "Validation".</p> <p>Of these 15 sites, seven have asterisks beside them, linking to the corresponding footnote "The need for validation at these locations in the current UWIR cycle will be reviewed at the Annual Report in consideration of the industry development scenario." Therefore, DES interprets that there is no imminent due date for these to be verified in the field.</p> <p>DES found that the seven sites with asterisks were associated with "Years before >0.2 m" impact were at least four years, whereas the eight sites without asterisks had 0 – 3 years before the predicted impact.</p> <p>DES considers it necessary that the time frame by which the eight sights without asterisks (with 0 – 3 years before an impact of >0.2 m drawdown) to have had their field verification completed by, be included in Table I-4.</p> <p>DES interprets that as it currently stands, there is no clear due date for these sites. DES now interprets that it may be that they should be undertaken within 12 months of the date the UWIR is approved, given OGIA's response of "Where field investigations are required, it is stated that a dry season longitudinal survey is completed within 12 months of the approval of the UWIR. This is supported by the text in s9.5.1 and s9.7."</p> <p>DES considers that for the sites where there are 0 years remaining before impact, the full 12 months may actually be longer than due diligence should allow.</p>	<p>To remove any doubt, DES requires that Table I-4 be modified to include due dates for the field verifications.</p> <p>DES considers it necessary that the sites where there are 0 years remaining before >0.2 m drawdown impact, the full 12 months may actually be longer than due diligence should allow – and this should be suitably reduced. This can be discussed with OGIA or determined by DES as the delegate deems appropriate. In either case, to include the due dates in Table I-4, a 'modify and resubmit' process is necessary.</p>

Content of UWIR – s. 376			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>l) With regard to field methods for undertaking field validation, DES requires that 'nearby' and 'shallow' be described, to remove as much doubt as practicable regarding which water bores would be suitable to meet this requirement.</p>	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Watercourses are generally connected to outcropping formations or shallow alluviums over which they flow. Therefore 'shallow' bores are bores that are likely to be in formations that may be connected to watercourses and may provide information about water pressure and chemistry for such connectivity assessment. The distance (i.e. how nearby) and depth (i.e. how shallow) of these bores would depend on local hydrogeological conditions. If required, a statement to this effect could be added in the final UWIR."</p>	<p>DES considers it appropriate for the obligation to undertake field validation to include an obligation whereby the responsible tenure holder is to assess which bores they deem to be 'nearby' and 'shallow' and include this, with justification, for endorsement with OGIA prior to undertaking the validation. This will allow for transparency for all parties that relevant and appropriate bores have been considered in line with the intention of the original obligation.</p>	<p>The matter may be remedied by requesting it to be addressed via a 'modify and resubmit' process.</p> <p>It could also be remedied via an approval condition, however DES prefers that the UWIR be as stand-alone as possible for ease of use for all parties.</p>
<p>m) With regard to the 'recommended' suite of parameters for surface water chemistry, DES requires that the 'recommendation' be clarified / modified to determine what the minimum surface water chemistry requirements are per site.</p>	<p>OGIA state, "In many cases, monitoring of watercourse springs water quality relies on sampling of water supply bores in the outcrop of aquifers that support those watercourse springs. This, however, is opportunistic because nearby water supply bores are not always present and may not be available for sampling. Similarly, the appropriateness of the water chemistry suite may vary depending on the source aquifer. As a result, such monitoring is included as a recommendation only. OGIA will continue to assess and review this approach and report to DES through Annual Reports."</p>	<p>DES interprets that the recommended suite of parameters is free to be either disregarded, followed, or amended by proponents as they see fit without such decisions being verified by either OGIA or DES.</p> <p>DES considers it necessary and desirable that an obligation exist where, should a proponent think it necessary to not follow the recommended suite, that this be presented to OGIA for endorsement (either before or after the sampling is / has been undertaken). Should OGIA have reasonable grounds to disagree with the proponent's justification, OGIA should be entitled to request additional parameters that OGIA deems suitable.</p>	<p>DES considers it preferable that OGIA be contacted to provide a response to DES' preferred obligation, which could then be remedied via a 'modify and resubmit' process or through an approval condition on the UWIR. DES considers that including the obligation in the UWIR is preferable for the sake of simplicity.</p>
<p>12) s. 379(1)(e) requires that the Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, —a timetable for implementing the strategy.</p> <p>a) DES requires that timeframes for undertaking field investigations / validation studies of unverified watercourse or vent spring sites be included in the plan. This should determine due dates for field verifications to have been completed by the responsible tenure holder. DES considers the 'years before predicted impact' should be utilised to inform which sites should be prioritised.</p>	<p>OGIA state, "Where field investigations are required, it is stated that a dry season longitudinal survey is completed within 12 months of the approval of the UWIR. This is supported by the text in s9.5.1 and s9.7."</p>	<p>As stated above in relation to this matter.</p>	<p>As stated above in relation to this matter – i.e. to remove any doubt, DES requires that Table I-4 be modified to include due dates for the field verifications.</p> <p>DES considers it necessary that the sites where there are 0 years remaining before >0.2 m drawdown impact, the full 12 months may actually be longer than due diligence should allow – and this should be suitably reduced. This can be discussed with OGIA or determined by DES as the delegate deems appropriate. In either case, to include the due dates in Table I-4, a 'modify and resubmit' process is necessary.</p>

Miscellaneous			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
13) Note – in the UWIR's Table 4-1, as well as Appendix D, Table D-1, the Moolayember Formation has been tallied with the GAB, when it is listed in the UWIR as being currently recognised as a unit of the Bowen basin.	OGIA state, "This will be corrected in the published version of the report. The formation is not an aquifer and relatively very small water use is assigned to it."	DES is satisfied with this response.	OGIA have proposed to modify the original proposed UWIR lodged on 2 August 2019. This can occur through a 'modify and resubmit' process.
14) Note – no actual value, or table of values, was provided for 376(1)(a)(i) - <i>the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights.</i> <ul style="list-style-type: none"> While it is possible to state that the legislative requirement has been met due to the provision of the graph in Figure 4-4, an appendix with the hard values utilised to generate this information (including by unit by year) would be preferred to supplement the graph. 	OGIA state, "Further details on underlying data in Figure 4-4 and Figure 7-3 can be provided on request."	OGIA can be said to have technically met the legislative requirement. It is unclear why including the data as values in the report is considered non-ideal by OGIA.	The item does not technically need to be remedied. The delegate should consider discretion on whether it is in the public interest to include data as values as well as data in graph form. Should data be required in values, this could either be done outside of the UWIR process, or through a 'modify and resubmit' process.
15) Note – no actual values were provided for 376(1)(a)(iii) - <i>an estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report.</i> <ul style="list-style-type: none"> While it is possible to state that the legislative requirement has been met due to the provision of the graph in Figure 7-3, an appendix with the hard values utilised to generate this information (including by unit by year) would be preferred to supplement the graph. 			
16) Note – five bores were identified in the LTAA which are reported to access the Westbourne Fm aquitard. DES will require that these bores be investigated to determine if they do target the Westbourne Fm or not. However, bore details have not been provided (RN, location etc.) to identify them.	OGIA state, "OGIA acknowledges the issue and plans to investigate this as part of its future work program."	DES would prefer that the identifying details of these bores be disclosed. DES currently has confidence that OGIA will investigate (albeit DES does not know by when).	DES considers it appropriate that the identifying details of these bores be included in the UWIR. This could be achieved through a 'modify and resubmit' process. Ongoing correspondence with the progress of the proposed investigations can occur between OGIA and DES subsequently.

Miscellaneous			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>17) Note – for terrestrial GDEs, the Herbarium had feedback with regard to the risk classification. Rather than the current risk classification (0.2 to 1 metre, etc.), the preference is to consider:</p> <ul style="list-style-type: none"> the likelihood of groundwater dependence (confidence), the level of predicted impact and biodiversity status (consequence). 	<p>OGIA state, "Queensland Herbarium was involved with the development and review of the method for assessing impacts to terrestrial GDEs and provided feedback on the technical report. The level of impact and biodiversity status has been included in the assessment. The confidence assigned to each GDE was not used. Confidence in the GDE dataset represents the level of data used to identify the GDE, rather than confidence in the polygon being a GDE."</p>	<p>DES considers that the Herbarium's input be sought on this item and response.</p>	<p>This item does not need to be remedied immediately. DES proposes that potential improvements suggested by the Herbarium be discussed in a forum where the Herbarium, OGIA and DES are represented, and outcomes determined for future action (such as an amended process for the next UWIR cycle).</p>
<p>18) Note – for terrestrial GDEs, it is not clear if inter-aquifer connectivity is considered an identifying risk (in addition to outcropping aquifers).</p>	<p>In a meeting on 8 October 2019, OGIA stated that inter-aquifer connectivity was inherently considered for items relating to terrestrial GDEs.</p> <p>In their letter dated 17 October 2019, OGIA state "Inter-aquifer connectivity is inherently accommodated in the assessment, and in the regional groundwater flow modelling as described throughout the document, implying that interconnectivity is also considered in all the subsequent assessments of impacts on, and risk to, EVs – as detailed in the relevant chapters and sections."</p>	<p>DES is satisfied with this response.</p>	<p>DES proposes that clarifying this item in subsequent UWIRs be discussed in the abovementioned forum.</p>
<p>19) Note – for identifying source aquifers of springs of impact, the actual assessment is not included in the proposed UWIR. Rather, it is stated that "The source aquifer for each spring complex was assessed as part of detailed conceptualisation work in 2015 (OGIA 2015, <i>Wetland Conceptualisation: A summary report on the conceptualisation of springs in the Surat Cumulative Management Area. Version 2.0</i>, OGIA, Department of Natural Resources and Mines, Brisbane)." DES notes this report is not available on the OGIA website. DES prefers the proposed UWIR to include details on this assessment process, at least as a summary; and prefers that the reports referenced in the UWIR are provided on the website (and / or as hyperlinks in the proposed UWIR).</p>	<p>DES was originally unable to find a response from OGIA in reference to this item. OGIA were asked to comment, and subsequently in response on 21 October 2019, OGIA stated:</p> <p>"Report is available on OGIA's website at the location below. It was originally made available in 2016.</p> <p>https://www.dnrm.qld.gov.au/data/assets/pdf_file/0009/1394298/springs-in-the-surat-cma.pdf"</p>	<p>DES appreciates that the report exists as a technical supplementary report to the 2016 UWIR. DES considers it appropriate for a succinct summary of this supplementary report to be included in the UWIR.</p>	<p>The delegate should consider a preference for this item, which could be subsequently actioned via a 'modify and resubmit' process.</p>

Miscellaneous			
Original Finding (Put to OGIA for Response)	OGIA's response	DES comments on response	Recommendation for Proceedings
<p>20) Note – DES is concerned about the use of the OGIA website for supplementary information to the proposed UWIR, in relation to the possibility of the supplementary items to be changed post-approval. This includes:</p> <ul style="list-style-type: none"> List of current petroleum and gas tenure holders in the Surat CMA (PDF) List of all monitoring points in the water monitoring strategy (Excel) List of springs in the Surat CMA (Excel) <p>DES notes that it is stated in the proposed UWIR that <i>"Additional watercourse springs may be included following field validation."</i></p> <p>DES appreciates that these documents might be kept on the website due to a higher-frequency rate of potential change, such as changes to tenure holders, updates on monitoring points, and updates on springs; however, for the purpose of assessing a proposed UWIR, it is necessary that this information be 'locked' to the time of assessment (such as in an appendix) and subsequent changes to the documents be addressed via amendments to the UWIR as required.</p>	<p>OGIA state, "The proposed approach is to manage ongoing changes without affecting the UWIR readability and report length. OGIA agrees to locking-in the document with UWIR approval but proposes to work with DES to find an effective and appropriate mechanism to deal with ongoing changes and updates."</p>	<p>DES considers this response adequate.</p>	<p>To remedy the issue, all components of the UWIR (including those stored on the website rather than submitted with the UWIR package on 2 August 2019) are required to be included in an assessed UWIR package. This allows a clear record of what informed the assessment, and is transparent to all stakeholders. The inclusion of the additional items as appendices of the original UWIR may occur via a 'modify and resubmit' option.</p>
<p>21) Note – If OGIA's model (s) have been independently reviewed, it was not stated in the proposed UWIR. DES suggests that if the model (s) used in the predictions made in the UWIR have been through an independent review process, this be spoken to in the report.</p>	<p>OGIA state, "The outcome of the model review is provided in the Submission Report (s4.5, pg 13 of the Submission Summary Report)."</p>	<p>DES has had regard to the Submission Summary, which states: "All model development work undertaken by OGIA is subject to review by independent technical experts. A professional peer review of the final calibrated model, using standard review techniques, concluded that the model is fit for purpose as a quantitative tool and exceeds national standards for a regional groundwater flow model."</p>	<p>While specific or technical details around the peer review (for example, who the review was undertaken by, and their qualifications and experience) are not included, DES accepts that more information was included in the Submission Summary than DES originally discovered. The delegate should consider if additional information around the independent review process should be included either in this or subsequent UWIRs, in line with concerns raised by stakeholders about the accuracy of the model.</p>

Notice

Water Act 2000

Notice of approval of underground water impact report

This statutory notice is issued by the chief executive¹ pursuant to section 385(4) of the Water Act 2000 to advise you of the decision to approve your underground water impact report.

Office of Groundwater Impact Assessment
1 William Street
BRISBANE CITY QLD 4000

Your reference: Underground Water Impact Report for the Surat Cumulative Management Area
Our reference: 101 /00308656

Attention: Sanjeev Pandey

Dear Sanjeev Pandey,

Re: Notice of approval of underground water impact report

The chief executive received an underground water impact report described below.

1. Report details

Date underground water impact report received: 2 August 2019

In relation to: the Surat Cumulative Management Area (CMA)

2. Decision

The chief executive has approved the underground water impact report with conditions. Please find attached the conditions of approval (Attachment A). The approved report takes effect on 16 December 2019.

3. Public notice

As per section 386 of the *Water Act 2000*, within 10 business days after receiving this notice of approval, you must

- publish a notice about the approval that states that copies of the approved report may be obtained from you and how the copies may be obtained; and
- give a copy of this notice of approval to each bore owner of a water bore within the area to which the report relates.

¹ The Department of Environment and Science is the chief executive for Chapter 3 of the *Water Act 2000*.

Notice of approval of underground water impact report

Within 15 business days after receiving this notice of approval, you must advise the chief executive that you have complied with the requirements outlined above.

4. Penalties

Under section 386(1) of the *Water Act 2000*, failure to comply with this direction notice is an offence.

- A maximum penalty for an individual is 50 penalty units, totalling \$6,672.50
- A maximum penalty for a corporation is 250 penalty units, totalling \$33,362.50.

If you have any questions regarding this notice please contact the Department of Environment and Science on the telephone number listed below.

Yours sincerely

C

sch4p4(6) Personal information

12 November 2019

Signature

Date

Clancy Mackaway
Manager
Department of Environment and Science
Delegate of the chief executive
Water Act 2000

Enquiries:

Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Attachments

Attachment A - Conditions of approval

Attachment A - Conditions of approval

1. The **responsible entity** must submit to the **chief executive** by 31 January 2020 a separate analysis of groundwater movement for each aquifer listed below pursuant to s.376(1)(b)(ii) of the *Water Act 2000*:
 - a. **GAB** - Springbok Sandstone;
 - b. **GAB** - Walloon Coal Measures;
 - c. **GAB** - Hutton Sandstone;
 - d. **GAB** - Precipice Sandstone;
 - e. Bowen Basin - Clematis Sandstone;
 - f. Bowen Basin - Bandanna Formation; and
 - g. Bowen Basin - Cattle Creek Formation.
2. The **responsible entity** must submit to the **chief executive** by 31 January 2020 a separate analysis of the trends in water level change for each aquifer listed below due to the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights pursuant to s.376(1)(b)(iii) of the *Water Act 2000*:
 - a. Bowen Basin - Clematis Sandstone;
 - b. Bowen Basin - Bandanna Formation; and
 - c. Bowen Basin - Cattle Creek Formation.

Should the **responsible entity** determine that there is insufficient data to establish trends, this determination and its grounds must be included in the UWIR in lieu of the trend analysis.

3. The **responsible entity** must submit an environmental values assessment with the first annual review that updates the assessment of impacts presented in the approved UWIR on the following environmental values:
 - a. Terrestrial Groundwater Dependent Ecosystems;
 - b. Changes in water quality of each aquifer (including water quality objectives, groundwater flow direction, rate, and movement); and
 - c. Irrigation land.

In addition to the information presented in the approved UWIR, the environmental values assessment must specifically differentiate between the impacts over the following time periods:

- Impacts that have occurred or are likely to occur because of any previous exercise of underground water rights pursuant to s.376(1)(da) of the *Water Act 2000*;
- Impacts that will occur or are likely to occur because of the exercise of underground water rights during the three (3) year period starting on the consultation day of the report pursuant to s.376(1)(db)(i) of the *Water Act 2000*; and
- Impacts that will occur or are likely to occur because of the exercise of underground water rights over the projected life of the resource tenures pursuant to s.376(1)(db)(ii) of the *Water Act 2000*.

4. The **responsible entity** must submit to the **chief executive** by 31 January 2020, further details on the program for **responsible tenure holders** under the UWIR to undertake a baseline assessment of bores located in the areas detailed in s.378(3)(a) and s.378(3)(b) of the *Water Act 2000*. The program must include the following and made available on the responsible entity's website:

Notice of approval of underground water impact report

- a Bore identification details e.g. unique identifying number or GPS coordinates; and
 - b Identification of the responsible tenure holder for each bore.
5. The **responsible entity** must submit to the **chief executive** a summary of the annual review required under section 376(e)(ii) of the *Water Act 2000*, within 20 business days after each **anniversary day**, or another date agreed to in writing by the chief executive. The annual review must provide an analysis and a statement of whether there has been a material change in the information or predictions used to determine the IAA.

DEFINITIONS

Anniversary day means each anniversary of the day the first UWIR took effect - 16 December 2019.

Chief executive means the Director-General of the department responsible for administering Chapter 3 of the *Water Act 2000* or the persons delegated the powers of the chief executive as stated in the Water Act (EHP-Chief Executive) Delegation (No. 1) 2017 or subsequent versions.

GAB means the Great Artesian Basin.

Responsible entity means the Office of Groundwater Impact Assessment in accordance with s.368 of the *Water Act 2000*.

Responsible tenure holder means the resource tenure holder identified in the underground water impact report in accordance with s.369 of the *Water Act 2000*.

UWIR means the underground water impact report prepared by the Office of Groundwater Impact Assessment for the Surat Cumulative Management Area dated July 2019.

Assessment report

Water Act 2000

Underground water impact report

This assessment report is to assist officers to recommend a decision under section 385 of the Water Act 2000 (Water Act) about an underground water impact report (UWIR).

Organisation name:	Office of Groundwater Impact Assessment
Registered business address:	1 William Street, Brisbane; PO Box 15216 City East 4002
Tenure number(s):	Surat CMA
File number:	101/0030857
Date UWIR received:	2 August 2019
Date UWIR approved (if applicable):	NIA
Decision due date: Note the statutory timeframe for a decision to be made on a UWIR is 60 business days.	29 October 2019

1 Background

The previous Surat UWIR (2016 - 2018) was approved on 6 September and took effect on 19 September 2016.

2 Submission requirements-section 370 of the Water Act

The UWIR was NOT submitted within the timeframes outlined in section 370.

The current Surat UWIR (2019-2021) was due on 31 July 2019 and was submitted on 2 August 2019 (two business days overdue).

Pursuant to section 370(2)(c) of the *Water Act 2000* (Water Act), a revised UWIR must be given to the Department of Environment and Science (the Department, or DES) within 10 business days after each third anniversary of the day the first UWIR took effect. Therefore, the current UWIR was originally due on 17 December 2018. However, the Office of Groundwater Impact Assessment (OGIA) requested an extension to the due date to 31 July 2019 in a letter to the Department dated 12 June 2018. In a letter dated 19 July 2018, the Department agreed to extend the submission date of the UWIR to 31 July 2019 (eDOCS# 6687610). The UWIR was submitted two business days after the submission due date, which was communicated to, and acknowledged by, OGIA without enforcement action.

3 Public notice requirements-section 382 of the Water Act

The responsible entity undertook public consultation. However, the consultation did not meet the requirements of section 382 of the Water Act.

- OGIA released the draft UWIR for public consultation on 28 May 2019, prior to the submission due date of 31 May 2019.
- Public consultation closed on 8 July 2019.
- The consultation process consisted of the following:
 - o A notice was published in 11 newspapers circulated within the Surat CMA;
 - o A copy of the notice was mailed to all bore owners and petroleum tenure holders in the Surat CMA;
 - o Five public information sessions were held in regional centres (Toowoomba, Dalby, Roma, Wandoan and Chinchilla) for community members to attend and ask questions;
 - o OGIA's website hosted the draft UWIR, the submission form, and details regarding the consultation process; and
 - o OGIA's website provided a bore search tool for bore owners to access information regarding predicted impacts to water levels by bore.
- DES checked the notice against the requirements of s. 382 (3) (what the notice must state) and found it satisfactory.
- s. 382(4)(b) states that "The responsible entity must advise the chief executive that the entity has complied with subsections (1) and (2)."
 - o DES has not identified such a statement within the "Main Report", the "Submission Summary" or the "Letter" which formed parts of the application.

4 Submission summary-sections 370(2)(d) and 383 of the Water Act

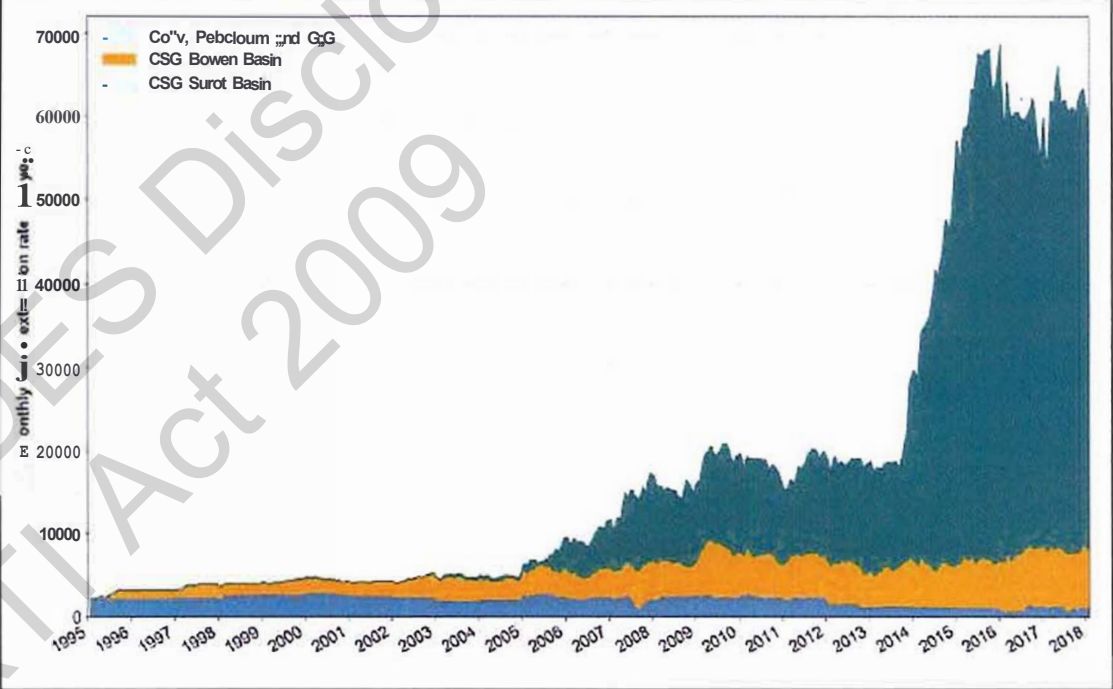
The UWIR was accompanied by a submission summary that meets the requirements of section 383 of the Water Act.

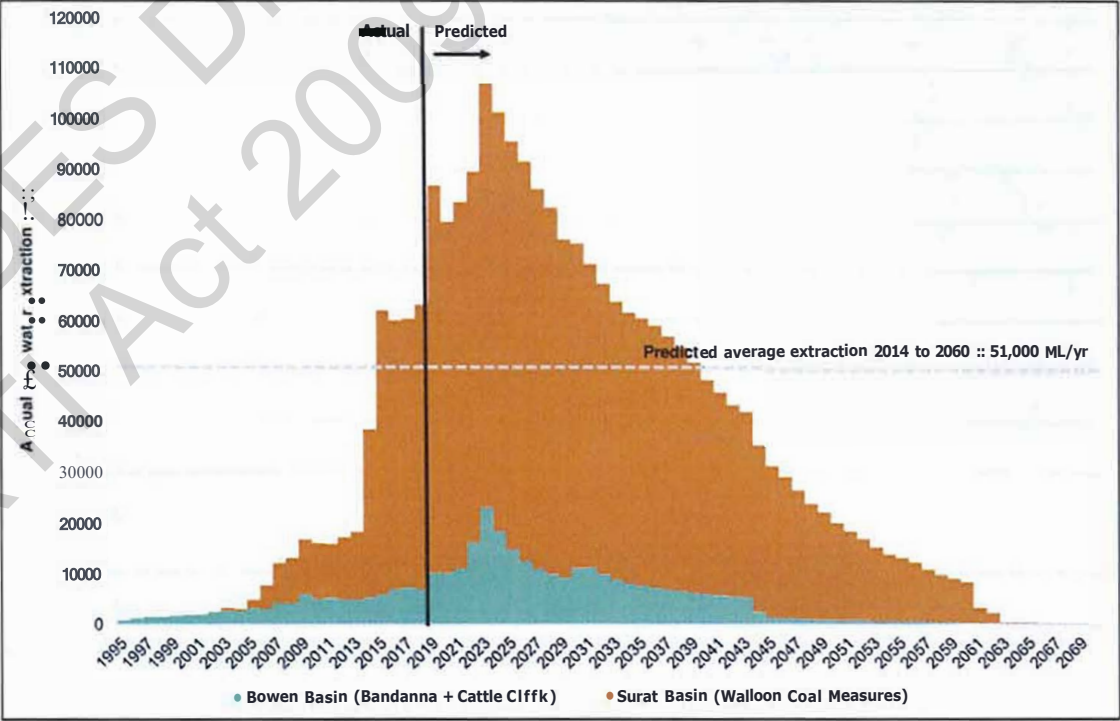
- s.383(1)(a) - OGIA must consider each properly made submission about the report; and*
- s.383(1)(b) - prepare a summary of the submissions.*
- s.383(2)(a) - The summary must summarise the properly made submissions about the report; and*
- s.383(2)(b)- how OGIA addressed the submissions; and*
- s.383(2)(c) - any changes OGIA made to the report because of the submissions.*
- A total of 23 submissions were received by OGIA, from:
 - o 8 landholders/ landholder based groups;
 - the effect of both coal seam gas (CSG) and non-CSG groundwater take on the sustainability of the GAB, particularly in the Hutton Sandstone;
 - the effect of climate change;
 - the impact of migrating gas in water bores;
 - delays in finalising make-good arrangements;
 - the indirect impact of make-good bores in the Hutton Sandstone;

- overall impacts of CSG development;
 - construction of CSG wells;
 - the effect of modelling scale on predicting impacts in water supply bores; and
 - the inherent limitation associated with the modelling of impacts;
 - o 6 industry/ industry based groups;
 - financial implications of monitoring;
 - the lack of scientific rationale provided to support new monitoring points;
 - the practicality of implementing monitoring obligations off tenure and away from production areas;
 - the lack of clarity around the spring and watercourse risk assessment and its implication on monitoring obligations;
 - changes to the responsible tenure holder rules; and
 - the lack of more detailed engagement on the issues raised prior to the release of draft UWIR;
 - o 4 general community members;
 - *See landholder groups;*
 - o 4 environmental groups;
 - impacts on springs;
 - the lack of firm actions on mitigation of impacts; and
 - the lack of reconciliation of the impacts identified in the UWIR and tenure holders' approvals under the various authorities and approval conditions; and
 - o 1 agency.
- The UWIR was accompanied by a submissions summary, which covered:
 - o The context of the submissions;
 - o How the submissions had been addressed in the finalised report;
 - o A description of any changes made to the UWIR in response to the issues raised;
 - o Where submission context was not addressed in the report, the submission summary provided an explanation as to why it was not addressed (e.g. outside the scope of the UWIR).

5 UWIR requirements-sections 376, 378 and 379 of the Water Act

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
376(1)(a)- For the area to which the UWIR relates-		
(i) the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights.	YES	<ul style="list-style-type: none"> • Section 4.2.1 states that there are currently -6,800 CSG wells and 70 conventional production wells in the Surat CMA <ul style="list-style-type: none"> o Associated water extraction has increased since 2014 to the current level of about 60,000 MU/year, however this rate seems currently stable. o The majority (50,000 MU/year) of extracted water is associated with CSG production in the Surat Basin. o CSG water extraction in the Bowen Basin has remained relatively stable in recent years at around 9,000 MU/year. o Conventional oil / gas associated water extraction has declined since 2011 to the current level of around 1,000 ML/year. o Total water production from CSG and conventional wells, in volumes as ML/year, is shown in Figure 4-4 (reproduced overleaf). • Section 4.2.2 states that QGC, Origin and Santos have reported non-associated water extraction (for consumption in exploration camps, etc.) - the total volume of extraction is currently around 500 ML/year.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		 <p>Figure 4-4 Historical groundwater extraction by the P&G industry in the Surat CMA</p>
<p>376(1)(a)- For the area to which the UWIR relates- (ii) an estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report</p>	<p>YES</p>	<ul style="list-style-type: none"> OGIA have predicted average extraction around 51,000 MU/year over the life of the industry (to 2060). UWIR Figure 7-3 (reproduced overleaf) demonstrates actual CSG water extraction by calendar year against predicted extraction to 2060.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none">Deduced from UWIT Figure 7-3, the predicted water extractions for the next three calendar years are around:<ul style="list-style-type: none">2019: 86,000 ML/year2020: 80,000 ML/year2021: 83,000 ML/year2022: 89,000 ML/year.  <p>Figure 7-3 Predicted CSG water extraction</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> Conventional associated water is not included in this prediction, however OGIA state that most conventional petroleum fields within the Surat CMA are towards the end of their productive life and that there has been a steady decline in conventional petroleum production since 1995. OGIA state that the current level of water extraction (conventional) is around 1,000 MUyear and appears steady (as shown in Figure 4-4, section above).
376(1)(b)-For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights-		
(i) a description of the aquifer	YES	<p>DES considers it necessary to have a coherent list of geological units which have been identified as affected, or likely to be affected, by the exercise of petroleum underground water rights. This list can then be referred to for each subsequent section of the legislation in this assessment report, to ensure the units are all spoken to in the proposed UWIR as required.</p> <p>OGIA did not provide such a list. Therefore, to develop this list, DES has considered the geological information and discussions provided in the proposed UWIR, and has identified which units show impacts, predicted impacts, or likely impacts.</p> <p>13 units were thus identified. 10 of which have (or likely will/have) impacts, while three of which DES opts to 'keep an eye on in spite of a lack of predicted impacts. The justification for DES' selection of these units is below. These units are best visually represented within the proposed UWIR Figure 3-6.</p> <p>Alluvium - Condamine: NO IMPACTS predicted in the short or long term, so only being kept-an-eye-on. Selected because irrigation, stock and domestic (S&D) and town water supplies have been developed in the CMA, with the most significant and hiahlv developed system associated with the Condamine River, used for</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>irrigation and town water supply with minor use for domestic and other purposes. Around 13,800 water bores access the shallow alluvium and tertiary basalts.</p> <p>Basalts - NO IMPACTS predicted in the short or long term, so only being kept-an-eye-on. Selected because the Tertiary basalts of the Main Range Volcanics contain significant aquifers used for irrigation, S&D and town water supplies. As stated above, around 13,800 water bores access the overlying shallow alluvium and tertiary basalts.</p> <p>Gubberamunda Sandstone - NO IMPACTS predicted in the short or long term, so only being kept-an-eye-on. Selected because the proposed UWIR indicates that the Gubberamunda and Precipice sandstones are the most permeable consolidated formations in the Surat CMA. Non-associated water extracted by petroleum tenure holders for consumptive purposes is largely extracted from the Precipice and Gubberamunda sandstones. In addition, Santos have authority to treat associated water to an appropriate standard and then reinject it into the aquifer system, targeting the Gubberamunda Sandstone at the Roma gas field. The proposed UWIR also states that the Gubberamunda Sandstone is one of the key aquifers which feed springs in the Surat CMA.</p> <p>Springbok Sandstone - Selected because OGIA have found that groundwater level monitoring data for the Springbok Sandstone, which overlies the Walloon Coal Measures, shows evidence of CSG impacts in at least three of the monitoring points within the CSG production area. Also, OGIA state that emerging data from CSG well completions has revealed that around 16% of CSG wells may be partially completed into the overlying Springbok Sandstone, which has the potential to induce direct connectivity with the underlying Walloon Coal Measures. The Springbok Sandstone is also one of two formations where IAA bores are identified.</p> <p>Walloon Coal Measures - Selected because it is one of the two primary target formations for CSG production in the Surat CMA. It is also one of two formations where IAA bores are identified.</p>

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		<p>Hutton Sandstone- Selected because OGIA state that the groundwater level trends in the Hutton Sandstone are of particular interest as it is a major water supply aquifer in the GAB and declines of up to 1.5 to 2 metres per year have been observed recently at some locations. OGIA's analysis indicates that at this stage, there is no evidence to suggest that these declines are due to CSG water extraction from the overlying Walloon Coal Measures; and that non-CSG groundwater extraction from the Hutton Sandstone aquifer itself is likely to be the primary cause of the declining trends. However, in relation to the connectivity between the Walloon Coal Measures with the underlying Hutton Sandstone, two locations have been identified where faults have sufficient displacement to bring the two formations into contact.</p> <p>Precipice Sandstone- Selected because OGIA indicates that the Gubberamunda and Precipice sandstones are the most permeable consolidated formations in the Surat CMA. There is also an LTM for the Precipice Sandstone around the Moonie oil field. Non-associated water extracted by petroleum tenure holders for consumptive purposes, such as camp supplies and construction, is extracted largely from the Precipice and Gubberamunda sandstones. The Precipice Sandstone is also one of the key aquifers which feed springs in the Surat CMA.</p> <p>Clematis Sandstone - Selected because the sandstone aquifers of the Clematis Group are the main aquifers used for water supply purposes in the Bowen Basin. It is also one of the key aquifers which feed springs in the Surat CMA, and there is an LTAA for the Clematis Sandstone. While the majority of conventional associated water extraction is from the Precipice Sandstone in the Moonie oil field, there is also some minor extraction from the Evergreen Formation and the Clematis Sandstone.</p> <p>Bandanna Fm - Selected as it is one of the two primary target formations for CSG production in the Surat CMA, and the primary target in the Bowen Basin. It is also noted that the Hutton-Wallumbilla Fault in the Bowen Basin has allowed</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>direct contact with the Precipice Sandstone and the Bandanna and Cattle Creek formations. An LTAA is predicted for the Bandanna Formation.</p> <p>Cattle Creek Fm - Selected as it is one of the relevant coal sequences for CSG production in the Surat CMA. As above, the Hutton-Wallumbilla Fault in the Bowen Basin has allowed direct contact with the Precipice Sandstone and the Bandanna and Cattle Creek formations. LTAA's associated with CSG extraction are predicted for the Cattle Creek Fm.</p> <p>DES also considered, but decided against, including the GAB's Westbourne Formation (Fm). This formation could have been selected because impacts of more than 5 m are predicted in five existing water bores that are currently assessed as accessing the Westbourne Formation aquitard. However, DES notes that the Westbourne Fm is stated by OGIA to not contain aquifer material. OGIA state that details about these bores will need to be clarified to confirm that they are in fact accessing these (Westbourne Fm) units. While the bores are, in the meantime, included as bores that are likely to be impacted, DES is currently satisfied that the Westbourne Fm, as a tight aquitard, is not reasonably understood to be impacted by petroleum activities. This is discussed further in this assessment report below, for s.376(1)(b)(v).</p> <p>Summarily, for this item (376(1)(b)(i)), the following units (among others) have been described:</p> <ul style="list-style-type: none"> 181Alluvium -Condamine (aquifer) (optional) 181Basalts (surface aquifer) (optional) 181GAB - Gubberamunda Sandstone (regional aquifer) {optional} 181GAB - Springbok Sandstone (tight aquifer) 181GAB - Walloon Coal Measures (coal seam; interbedded aquitard) 181GAB - Hutton Sandstone (partial to tight aquifer) 181GAB - Precipice Sandstone (regional aquifer) 181Bowen Basin - Clematis Sandstone (regional aquifer) 181Bowen Basin - Bandanna Fm (coal seam; interbedded aquitard)

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>igj Bowen Basin - Cattle Creek Fm (coal seam; deep, not well understood)</p> <p>DES is satisfied with the provided aquifer descriptions, which are given below. While the Springbok Sandstone is not specifically spoken to by name, it is understood to be a tight aquifer overlying the Walloon Coal Measures and its description fits within the overall GAB description, which has been provided.</p> <p>Section 3.2 of the report addresses groundwater systems of the CMA, and states the following.</p> <p>The aquifers affected / likely to be affected are comprised within four primary groundwater systems in the CMA:</p> <ul style="list-style-type: none"> • Great Artesian Basin (GAB) <ul style="list-style-type: none"> o a <i>Jurassic to Cretaceous age hydrogeological basin comprising alternating aquifers and aquitards of various geologic formations of Surat Basin sediments and their equivalents.</i> o The main GAB aquifers are: <ul style="list-style-type: none"> • Precipice Sandstone • Hutton Sandstone • Gubberamunda Sandstone • Mooga Sandstone • Bungil Formation and their equivalents. o These aquifers are generally laterally continuous, have significant water storage and permeability and are extensively developed for groundwater use. Aquifers are recharged by infiltration of rainfall and leakage from streams into outcropping sandstone, mainly on the eastern margins of the basin, close to the Great Dividing Range.

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		<ul style="list-style-type: none"> ○ The Surat Basin and the Clarence-Moreton Basin form geological sub-basins of the GAB and are considered a single connected hydrogeological system. ○ The Walloon Coal Measures occur in this groundwater system. ○ The Westbourne Formation - this formation contains the highest proportion of mudstone (relative to other formations in the CMA), which OGIA state reaffirms its status as one of the major aquitards. • Bowen Basin <ul style="list-style-type: none"> ○ <i>Permian to Triassic aquifers and aquitards of the Bowen Basin formations underlying the Surat Basin.</i> ○ The main Bowen Basin aquifers are: <ul style="list-style-type: none"> • Bandanna Formation • Cattle Creek Formation <ul style="list-style-type: none"> • both these formations are fine-grained, well cemented, and have little permeability. • Clematis Group (mainly, Clematis Sandstone) • Moolayember Formation <ul style="list-style-type: none"> • fine-grained siltstone and mudstone formation which generally hydraulically separates the Bowen Basin sediments from the Surat Basin sediments above. • Basalt <ul style="list-style-type: none"> ○ <i>Cenozoic consolidated surficial aquifer that mainly caps the Clarence-Moreton Basin along the Great Dividing Range.</i> • Alluvium <ul style="list-style-type: none"> ○ <i>Quaternary unconsolidated surficial aquifers; mainly the Condamine and St George alluviums.</i> ○ The significant aquifers are:

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		<ul style="list-style-type: none"> • Condamine Alluvium <ul style="list-style-type: none"> • comprises gravels and fine to coarse-grained channel sands interbedded with clays. The productive part of the alluvium comprises individual channel sand and gravel units that are typically less than 20 m thick. A thick, clayey sequence of sheetwash deposits overlies the productive granular alluvium in the east, causing the aquifer to be semi-confined in nature. • Primarily recharged from infiltration through the bed of the Condamine River. Minor recharge occurs laterally from the surrounding bedrock and alluvium of the tributaries of the Condamine River. The consistent layer of low-permeability black soil over most of the Condamine Alluvium (up to 10 m thick) restricts direct rainfall recharge. • St. George Alluvium <ul style="list-style-type: none"> • an unconsolidated to semi-consolidated formation occurring west of St. George, extending over 25,000 km² with a maximum thickness of over 200 m. The deeper parts of the aquifer consist of unconsolidated coarse sand with gravel layers covered by silt, clay, siltstone and mudstone layers. The upper part is more laterally extensive and consists of unconsolidated fine to very coarse sand beds, up to 4 m thick.
<p>376(1)(b)-For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights-</p> <p>(ii) an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers</p>	NO	<p>Section 3.4.1 of the report addresses groundwater recharge. Section 3.4.3 addresses groundwater flow in the coal measures. Section 3.5 addresses inter-aquifer connectivity. Directions of groundwater flow are also discussed in section 3.2 (e.g. Figure 3-5) and Chapter 5.</p> <p>The geological units in this section have been discussed by OGIA largely relative to their connectivity to the coal units (the Walloons, Bandanna Fm and Cattle Creek Fm), as these are</p>

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		<p>the units targeted for petroleum extraction. DES considers it necessary that each of the 'key' geological units of the checklist described above, should include the underground water movement analysis.</p> <p>The geological units identified as affected/ likely to be affected by petroleum water extraction and discussed in the proposed UWIR are:</p> <ul style="list-style-type: none"> Alluvium - Condamine (aquifer) (optional) D Basalts (surficial aquifer) (optional) D GAB - Gubberamunda Sandstone (regional aquifer) (optional) GAB - Springbok Sandstone (tight aquifer) GAB - Walloon Coal Measures (coal seam; interbedded aquitard) GAB - Hutton Sandstone (partial to tight aquifer) GAB - Precipice Sandstone (regional aquifer) D Bowen Basin - Clematis Sandstone (regional aquifer) Bowen Basin - Bandanna Fm (coal seam; interbedded aquitard) Bowen Basin - Cattle Creek Fm (coal seam: deep, not well understood) <p>Descriptions around the Basalts and Gubberamunda Sandstone are not required, as impacts/ likely impacts have not been observed or predicted.</p> <p>A description around the Clematis underground water movement and inter-aquifer interaction was lacking in the report, with the only description being <i>"Across most of the Bowen Basin, the Clematis Sandstone aquifer is separated from the Bandanna Formation by a thick sequence of fine-grained, low-permeability siltstones and mudstones of the Rewan Group"</i>. However, DES had regard to the proposed UWIR Figures 3-6 and 6-1, which both demonstrate that the Clematis Sandstone is situated below the Moolayember Fm (tight aquitard) and above the Rewan Fm (tight aquitard). While this supports a lack of likely movement from the coal seams, it</p>

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		<p>is not clear from the report whether or not there are connecting faults, nor details on the underground water movement (such as flow characteristics). Subsequently, DES considers the proposed UWIR to be lacking the necessary (full) description of groundwater movement for the Clematis Sandstone.</p> <p>The underground water movement analysis by OGIA is discussed below.</p> <p><u>Groundwater Recharge</u></p> <p>OGIA state that there are three dominant recharge mechanisms in the Surat CMA:</p> <ul style="list-style-type: none"> - Localised recharge <ul style="list-style-type: none"> • occurs beneath drainage features including rivers and free-draining unconsolidated sedimentary cover such as alluvium. - Preferential pathway flow <ul style="list-style-type: none"> • occurs where zones of increased permeability - such as fractures and permeable beds - allow rapid inflow to a deeper aquifer. This is understood to be the dominant recharge mechanism in the GAB. - Diffuse recharge <ul style="list-style-type: none"> • occurs via high intensity and volume rainfall events to provide sufficient saturation of the surficial sediments. <p>In terms of groundwater flow, OGIA refer to two key hydraulic parameters: permeability and storativity. Permeability refers to the ease for water to flow through the medium, while storativity refers to the capacity of the medium to store water that can be released when depressurised or desaturated.</p>

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		<p><u>Groundwater Flow (Coal Measures)</u></p> <p>OGIA state that the Walloon Coal Measures, the Bandanna Formation and the Cattle Creek Formation are the relevant coal sequences for CSG production in the Surat CMA.</p> <ol style="list-style-type: none"> 1. The Walloon Coal Measures comprise siltstone, mudstone, fine to medium-grained lithic sandstone and coal. <ul style="list-style-type: none"> • The coal seams are generally the more permeable units, sitting within a sequence of mudstones, siltstones or fine-grained sandstones with lower permeabilities. • Permeability also decreases with depth due to overburden pressure closing cleats and fractures: for every 300m of depth, OGIA expect a one order of magnitude permeability declination. • Tapping CSG wells in the coal measures will initially draw water primarily from high-permeability coal seams, creating a pressure difference with the surrounding interburden. <ul style="list-style-type: none"> ○ The pressure difference will also contribute a small amount of water inflow to the well, particularly over the long term. ○ This implies that during the initial stages of well development, the groundwater pressure in the coal seams will drop while in the interburden the pressure may remain largely unaffected. ○ As extraction continues, the pressures of the high-permeability coal seams and the surrounding interburden (interbedded mudstones / siltstones / fine-grained sandstones) will gradually equilibrate over the lifetime of the well until they are the same.

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		<ul style="list-style-type: none"> ○ For CSG wells in the Surat CMA, this process is expected to take around 20 to 25 years to complete. • Groundwater flow is also affected by the release of gas in response to depressurisation. As the coal seams are depressurised, both gas and water are released, causing dual phase flow within the coal seam. <ul style="list-style-type: none"> ○ The presence of gas within the coal seam provides additional resistance to the flow of water and effectively reduces the water permeability (relative to if water alone were present in the coal seam). ○ As a result, the effective permeability also tends to reduce over time as depressurisation continues and more gas flows with the water. This contributes to the reduction in associated groundwater extraction over time. ○ During the latter stages of development, coal seams may become completely depressurised, such that the only source of water entering the well is a small amount of inflow from the surrounding interburden and slow recharge from outside the wellfield. ○ Once dewatered, it is anticipated that the coal seams will be particularly prone to compression, which could cause minor compaction and subsidence. ○ Where this does occur, re-wetting of the coal seams is likely to occur more slowly than did the initial desaturation. <p>2 OGIA state that the groundwater flow characteristics of the Bandanna Formation are similar to those of the Walloon Coal Measures, with the thickness and distribution of coal being different.</p>

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		<ul style="list-style-type: none"> Ten individual coal seams can be identified in the Bandanna Formation, which are typically thicker and more continuous than those in the Walloons. <p>3. OGIA state that the Cattle Creek Formation is present 500m below the base of the Bandanna Formation, at depths up to 1,800m below ground. Consequently, there are only a few CSG exploration wells into this formation.</p> <p><u>Inter-aquifer Connectivity</u></p> <p>1. Faults</p> <ul style="list-style-type: none"> Faults have the potential to affect aquifer connectivity and groundwater flow. Therefore, an understanding of their location, impact on groundwater flow and the way they are represented in the groundwater flow model are important considerations. Seismic survey data, supplemented with knowledge about the formation materials from well log data, provides a useful insight into the location and displacement of faults at a local and regional scale. OGIA have 32 major mappable faults incorporated into the geological model, 22 of which were explicitly represented in the groundwater flow model for this UWIR. OGIA represent faults in a way that account for the juxtaposition of the formations based on their estimated displacement, and variations in permeability along the fault plane due to clay smearing. Smaller faults which cannot be incorporated into the regional groundwater flow model had their potential to increase connectivity analysed by OGIA. <p>2. Well Construction and Abandonment</p>

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		<ul style="list-style-type: none"> • CSG well construction and physical integrity have the potential to influence the transmission of groundwater impacts from CSG reservoirs to surrounding aquifers. <ul style="list-style-type: none"> ○ This may occur in two ways: <ul style="list-style-type: none"> • through the direct extraction of water, where CSG wells are open to adjacent formations; and • through induced connectivity across formations, in the event that well integrity is compromised. • OGIA compared water production profiles and water chemistry changes of wells that are exclusively completed into the Walloon Coal Measures, with wells completed both into the Walloon Coal Measures and partially into the Springbok Sandstone. <ul style="list-style-type: none"> ○ Partial completion of wells into the Springbok Sandstone is accounted for - in the groundwater flow model construction, calibration and predictions - by allowing such wells to extract water directly from the screened portions of the Springbok Sandstone. • Coal exploration holes drilled prior to 2002 may not have been abandoned properly and have the potential to affect connectivity. <ul style="list-style-type: none"> ○ OGIA has further explored the potential effects of coal exploration holes, P&G wells and water bores on aquifer interconnectivity. ○ OGIA retain their understanding that older exploration holes are likely to have partially collapsed over time and may not induce connectivity. <p>3. Walloon Coal Measures and the Condamine Alluvium</p> <ul style="list-style-type: none"> • OGIA has led a research project into the connectivity between the two formations, which included: reinterpreting geology with a particular focus on the contact between the two

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		<p>systems; mapping regional groundwater level differences between the two systems; analysing the hydrochemistry of the two systems; drilling, coring and running pumping tests at representative sites; and numerically analysing the test data.</p> <ul style="list-style-type: none"> o It was conceptualised that vertical flow and interaction between the Condamine Alluvium and the upper parts of the Walloon Coal Measures is impeded by a combination of the undifferentiated clay transition zone at the base of the alluvium and the firm mudstone/siltstone interburden of the Walloon Coal Measures, in which its coal seams are embedded. The degree to which flow is impeded therefore depends upon the combined thickness and vertical hydraulic conductivity of these two units. o In summary, the project concluded that there is a low level of connectivity between the formations (section 3.5.3). <p>4. Walloon Coal Measures and the Springbok Sandstone</p> <ul style="list-style-type: none"> • OGIA reviewed a number of additional datasets and information to improve understanding of the connectivity between the Walloon Coal Measures and the Springbok Sandstone. It is considered that interconnectivity between the two units is likely to be low. • However, the contact between the two formations is erosional, and therefore there are areas where the Springbok is in contact with the productive coal seams, and a higher degree of interconnectivity is likely in these places. <p>5. Walloon Coal Measures and the Hutton Sandstone</p> <ul style="list-style-type: none"> • The Hutton Sandstone is physically separated from the Walloon Coal Measures by the Durabilla Formation, a unit commonly regarded as a major aquitard of the GAB.

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		<ul style="list-style-type: none"> OGIA's evaluation of CSG well intake and down-hole wireline logs suggested that of the thousands of CSG production wells, only one may be partially screened into the Hutton Sandstone. OGIA understand that fault-induced lateral connectivity between the two formations is very low. Overall, OGIA considers that the overall interconnectivity between the Walloon Coal Measures and the underlying Hutton Sandstone is low. <p>6. Permian Coal Measures and Surrounding Aquifers</p> <ul style="list-style-type: none"> The Bandanna Formation is the main productive CSG formation within the Bowen Basin. The deeper Permian formations underlying the Bandanna Formation have extremely low permeability. OGIA state that it is therefore unlikely that depressurisation of the Bandanna Formation will affect the underlying formations. However, there is potential for the coal formation of the Bowen Basin to come in contact with the Precipice Sandstone due to fault displacement. OGIA are aware of two areas where the Bandanna Formation is in contact with the Precipice Sandstone that have received a substantial increase in the available volume of seismic survey and drilling data to investigate. <ul style="list-style-type: none"> At the western contact zone - an area immediately east of Injune near the Fairview and Spring Gully fields, in the vicinity of the Hutton-Wallumbilla Fault - there is potential for a high degree of interaction between both of these coal bearing formations and the Precipice Sandstone. At the eastern contact zone - an area five km south of the Peat gas field, near the Burunga Fault - there is a much smaller area of potential connectivity

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		compared to the western contact zone, but insufficient data to assess the degree of connectivity. OGIA require further monitoring data to understand the potential for impacts at this location.
<p>376(1)(b)-For each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights-</p> <p>(iii) an analysis of the trends in water level change for the aquifer because of the exercise of the rights mentioned in paragraph (a)(i):</p> <p><i>376(1)(a)- For the area to which the UWIR relates- (a)(i) - the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights.</i></p>	NO	<p>Chapter 5 of the report speaks to trends in groundwater level, including distinguishing CSG from non-CSG impacts. DES notes the following units have been addressed:</p> <ul style="list-style-type: none"> Alluvium - Condamine (aquifer) (optional) D Basalts (surficial aquifer) (optional) D GAB - Gubberamunda Sandstone (regional aquifer) (optional) GAB - Springbok Sandstone (tight aquifer) GAB - Walloon Coal Measures (coal seam: interbedded aquitard) GAB - Hutton Sandstone (partial to tight aquifer) GAB - Precipice Sandstone (regional aquifer) D Bowen Basin - Clematis Sandstone (regional aquifer) D Bowen Basin - Bandanna Fm (coal seam: interbedded aquitard) D Bowen Basin - Cattle Creek Fm (coal seam: deep. not well understood) <p>The Basalts and Gubberamunda Sandstone are not required as impacts/ likely impacts have not been observed or predicted.</p> <p>DES considers that the analyses of trends in groundwater level, including distinguishing petroleum from non-petroleum impacts, needs to be carried out and discussed in the proposed UWIR for the Clematis Sandstone, the Bandanna Fm and the Cattle Creek Fm to meet the legislative requirement.</p>

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		<p>1. Walloon Coal Measures</p> <ul style="list-style-type: none"> • Groundwater trends in the Walloons are discussed in detail in section 5.4.1 . • Across the development area, there are broadly consistent trends in groundwater level response to CSG development. The magnitude of drawdown within each of the sub-units within the Walloon Coal Measures generally increases with depth. • In the lower part of the Walloon Coal Measures - the Taroom Coal Measures - declines tend to be greater, up to 250 m • In comparison, in the shallower Upper Juandah Coal Measures, the observed declines are typically 100 m or less. <ul style="list-style-type: none"> ◦ In part, this reflects the disconnected nature of the coal seams due to the intervening low permeability interburden. • A comparison of observed groundwater level decline in all monitoring points in the Walloon Coal Measures, with distance to nearest active CSG well, assesses how far these impacts have propagated to date. <ul style="list-style-type: none"> ◦ This analysis indicates declines of more than 10 m are limited to areas within 10 km of CSG production wells. ◦ OGIA state this also suggests that although declines of 200-300 m are observed closer to CSG wells, the cone of groundwater level decline (or impact) around the CSG field is steep and generally confined to within 10-15 km. <ul style="list-style-type: none"> • DES' interpretation of this statement is that all drawdown is observed (generally) no further than 15km away from the boundary of the CSG field.

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		<ul style="list-style-type: none"> ○ Although not conclusive, there is also an indication of a flatter cone of depression in the lower part of the Walloon Coal Measures. <ul style="list-style-type: none"> • DES' interpretation of this statement is that the geographic lateral extent of this impact is further out-reaching, but with relatively lower draw-down depths. • From this information, DES is satisfied that an analysis of groundwater trends in the Walloon Coal Measures has been undertaken, reflecting previous exercise of groundwater rights. <p>2 Springbok Sandstone</p> <ul style="list-style-type: none"> • Trends observed in the Springbok Sandstone are discussed in section 5.4.2 of the UWIR. • OGIA observe that, given the scale of the proposed CSG development area and the magnitude of observed drawdown in the Walloon Coal Measures, there is the potential for significant drawdown in both overlying and underlying aquifers. • The Springbok Sandstone immediately overlies the Walloon Coal Measures in the Surat Basin. The formation is considered a tight aquifer and has a very low estimated water use and permeability compared to other aquifers. • Monitoring points show highly variable trends with an even representation of rising, falling and flat trends. • In deeper parts of the system in and around the CSG fields, impacts from CSG water extraction are most apparent in Kenya East (bore number RN160525A), located 30 km south of Chinchilla.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> ○ This monitoring site shows relatively static water levels until late 2014, after which there is a sharp change in trend, leading to an 18 m decline over the next three years. ○ This change corresponds with the commencement of CSG production within 10 km of this site. ○ Mapping and analysis of faults as well as water chemistry analysis suggest the presence of a nearby fault, where the Walloon Coal Measures is juxtaposed against the Springbok Sandstone, which may allow direct groundwater flow between the two formations. • A similar pattern to Kenya East may also be emerging at other Springbok Sandstone monitoring points within development areas (e.g. Broadwater GW11 and Isabella 7M) although data at this early stage is somewhat inconclusive. OGIA will continue to evaluate these sites as more data becomes available. • In addition to declining water level trends, rising trends are also observed at a number of locations following CSG commencement. <ul style="list-style-type: none"> ○ At the Ross 6M monitoring points (RN160904) completed into the lower Springbok Sandstone, observations indicate a rising trend during a period when rainfall has, for the most part, been below average. ○ The cause has not yet been established but may include the presence of gas or gradual equilibration in water level due to low permeability. • Overall, there are variable trends in the Springbok Sandstone. • There is evidence of CSG impacts at some locations, particularly where connectivity may be enhanced due to local geological features such as faults.

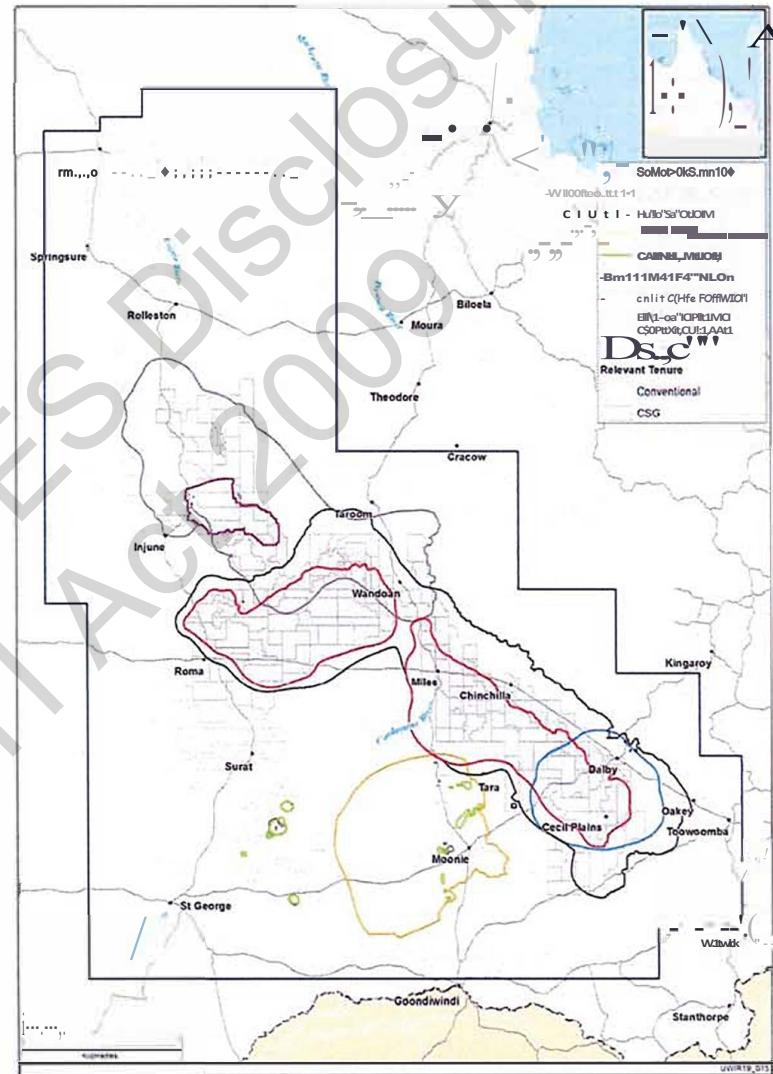
Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • There is also limited non-CSG water use from the formation, although this may still be sufficient to cause localised groundwater level declines, particularly outside of CSG production areas. • Rising groundwater level trends in CSG production areas could be related to low permeabilities or other non-groundwater-related factors. • From this information, DES is satisfied that an analysis of groundwater trends in the Springbok Sandstone has been undertaken, reflecting previous exercise of groundwater rights. <p>3. Hutton Sandstone</p> <ul style="list-style-type: none"> • This unit is discussed in the UWIR section 5.4.3. • The Hutton Sandstone underlies the Walloon Coal Measures in the Surat Basin, with the Durabilla Formation aquitard separating the aquifer from the CSG reservoir. • Water level trends in the Hutton Sandstone are of particular interest because it is a major water supply source in the Surat Basin and recent reported declining trends have caused concerns for water users. • Spatially, declining trends are observed in areas where there is significant localised non-CSG water use, indicating potential correlation. • In relation to correlation with CSG water extraction, there is no discernible change in the rate of groundwater level decline corresponding to the onset of CSG water extraction, although the predevelopment data is limited. • The widespread declining trends in available data correlate well with rainfall patterns, particularly in outcrop areas, and with non-CSG related groundwater use in the aquifer, both inside and outside CSG production areas.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • There are no discernible changes in the rate of decline that could correlate with CSG water extraction. There is a reasonably thick aquitard separating the aquifer from the CSG reservoir and connectivity is unlikely to be significantly influenced by geological faults or poorly constructed bores and wells. • OGIA summarise that there is no evidence to suggest that declining trends in the Hutton Sandstone are due to CSG water extraction in the overlying Walloon Coal Measures. • OGIA understand that non-CSG water extraction for the aquifer itself is likely to be the primary cause of the declining trends. • From this information, DES is satisfied that an analysis of groundwater trends in the Hutton Sandstone has been undertaken, reflecting previous exercise of groundwater rights. <p>4. Condamine Alluvium</p> <ul style="list-style-type: none"> • The Condamine Alluvium water trends are discussed in section 5.4.4 of the UWIR. • OGIA state that groundwater use for irrigation purposes has lowered the groundwater level in the more developed parts of the Condamine Alluvium by up to 26 m over the past 60 years, significantly altering the flow pattern in the formation. • The groundwater levels in the Walloon Coal Measures have not materially changed until recently, resulting in a difference of 5-20 m between the formations across much of the central part of the Condamine Alluvium. • OGIA has updated mapping of groundwater level difference along the western flank, where CSG development has occurred and the Walloon Coal Measures is depressurised.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> ○ The pattern of groundwater level differences suggests overall low connectivity between the two formations. • Consistent with previously reported findings, OGIA considers it unlikely that the trends in the Condamine Alluvium are influenced by CSG water extraction in the Walloon Coal Measures. • From this information, DES is satisfied that an analysis of groundwater trends in the Condamine Alluvium has been undertaken, reflecting previous exercise of groundwater rights. <p>5. Precipice Sandstone</p> <ul style="list-style-type: none"> • The Precipice Sandstone is discussed in section 5.4.5 of the UWIR. • The Precipice Sandstone is a regional aquifer, with the highest horizontal permeability of all aquifers in the Surat Basin. Changes in water levels in response to recharge or extraction are consequently generally smaller in magnitude and more laterally extensive, compared to other units. • The Bandanna Formation is generally isolated from overlying aquifers by the Rewan Formation, limiting any impact propagation from CSG development. <ul style="list-style-type: none"> ○ There are two locations where the Precipice Sandstone is interpreted to be in direct contact with the Bandanna Formation; in the western and eastern contact zones. ○ These two zones are in close proximity to existing CSG production fields and represent areas of potential connectivity.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • There is also conventional oil production from the Moonie field in the southern part of the CMA, in which some extraction of associated water has been directly from the Precipice Sandstone since 1963. <ul style="list-style-type: none"> ○ At this location, oil has formed within a structural trap within the Precipice Sandstone and Evergreen Formation. • OGIA note that since the commencement of water reinjection into the Precipice Sandstone in 2015, significant pressure responses have been observed across large parts of the Surat Basin. <ul style="list-style-type: none"> ○ At the Reedy Creek reinjection facility, initial short-term water level responses of up to 50 m have been observed. ○ Regionally, pressure responses are observed more than 80 km from the reinjection site, demonstrating the high permeability of this unit. • OGIA interpret that at this stage, there is no evidence of CSG impacts at the two contact zones. Reinjection provides the dominant effect on water levels in these areas. • Further south within the CMA, it is likely that pressures in the Precipice Sandstone have been affected by extraction from the Moonie oil field, although there is no long-term groundwater level data to confirm this. • From this information, DES is satisfied that an analysis of groundwater trends in the Precipice Sandstone has been undertaken, reflecting previous exercise of groundwater rights.

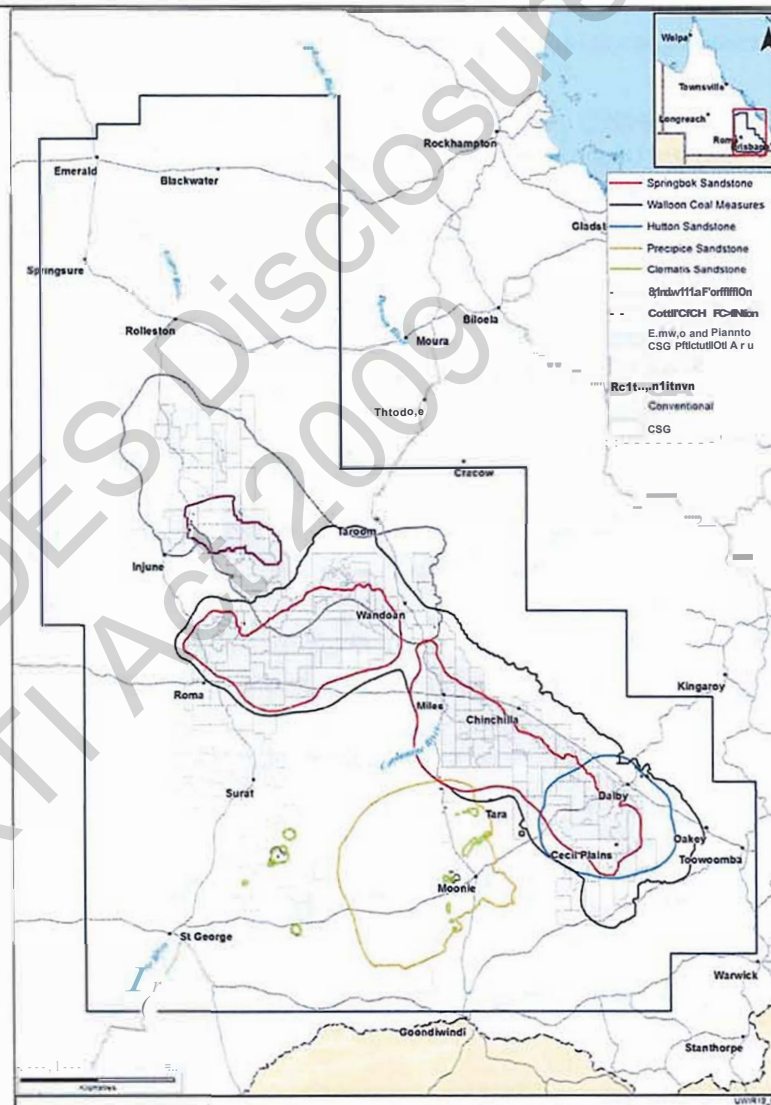
Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
<p>Include, for each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights -</p> <p>(iv) a map showing the area of the aquifer where the water level is predicted to decline, because of the taking of the quantities of water mentioned in paragraph (a), by more than the bore trigger threshold within 3 years after the consultation day for the report (an immediately affected area (IAA)).</p>	YES	<p>OGIA discuss the short-term impacts/ IAAs in section 7.2 of the UWIR.</p> <p>DES notes that IAAs are predicted for the following units:</p> <ul style="list-style-type: none"> D Alluvium - Condamine (aquifer) (optional) D Basalts (surficial aquifer) (optional) D GAB - Gubberamunda Sandstone (regional aquifer) (optional) GAB - Springbok Sandstone (tight aquifer) GAB - Walloon Coal Measures (coal seam; interbedded aquitard) GAB - Hutton Sandstone (partial to tight aquifer) GAB - Precipice Sandstone (regional aquifer) ☒ Bowen Basin - Clematis Sandstone (regional aquifer) Bowen Basin - Bandanna Fm (coal seam; imerbedded aquitard) Bowen Basin - Cattle Creek Fm (coal seam; deep, not well undersoodl <p>... and IAAs are not predicted in the Condamine Alluvium, Basalts, or the Gubberamunda Sandstone at this time. DES is satisfied, therefore, that the proposed UWIR satisfies this requirement, as all the IAAs are present in the map. Further comments are below.</p> <ul style="list-style-type: none"> • The UWIR's Figure 7-1 (provided overleaf) shows the IAAs for each aquifer. <ul style="list-style-type: none"> o In these IAAs, impacts from petroleum development are predicted to be more than five metres with in three years (to the end of 2021).



UWIR Figure 7-1: Extent of Immediately Affected Areas (IMs)

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
<p>(v) a map showing the area of the aquifer where the water level is predicted to decline, because of the exercise of underground water rights, by more than the bore trigger threshold at any time (a long-term affected area (LTAA)).</p>	<p>YES</p>	<p>OGIA discuss the long-term affected areas LTAA's in section 7.3 of the UWIR.</p> <p>DES notes that LTAA's are predicted for the following units:</p> <ul style="list-style-type: none"> 0 Alluvium - Condamine {aquifer} (optional) D Basalts (surficial aquifer) (optional) D GAB - Gubberamunda Sandstone (regional aquifer) (optional) 0 GAB - Springbok Sandstone (tight aquifer) 0 GAB - Walloon Coal Measures (coal seam; interbedded aquitard) 0 GAB - Hutton Sandstone {partial to tight aquifer} GAB - Precipice Sandstone {regional aquifer} 181 Bowen Basin - Clematis Sandstone (regional aquifer) 0 Bowen Basin - Bandanna Fm (coal seam; interbedded aquitard) 0 Bowen Basin - Cattle Creek Fm (coal seam; deep, not well understood) <p>... and LTAA's are not predicted in the Condamine Alluvium, Basalts or the Gubberamunda Sandstone at this time.</p> <p>The proposed UWIR reports that there are five S&D bores which have predicted a more-than-5-m impact, currently understood to access the Westbourne Formation aquitard. This is cause for perplexity, as the Westbourne Fm does not contain aquifer material. OGIA state that details about these bores will need to be clarified to confirm that they are in fact accessing the Westbourne Fm units, and OGIA have included these bores as 'likely to be impacted.' However, a corresponding LTAA has not been mapped for this formation. DES supposes this might be because there is no 'bore trigger threshold' for 'tight aquitards', and 5 m refers to the bore trigger threshold for consolidated aquifers (2 m applies to unconsolidated aquifers).</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>In determining whether or not the legislative requirement is satisfied, DES has had regard to the following:</p> <ul style="list-style-type: none"> • The Westbourne Fm is understood to be a tight aquitard (not an aquifer). • The impacts are predicted, not measured (in other words, predicted by a computer model rather than being measured or otherwise observed in reality). • OGIA indicate that the information indicating the five bores are accessing the Westbourne Fm units might be inaccurate, and should be confirmed. <p>Therefore, DES is satisfied that it is sufficiently unlikely that the Westbourne Fm aquitard be required to be included in the LTAA mapping at this time, however confirming whether or not these bores are targeting the Fm and verifying the likelihood of petroleum related impacts should be carried out.</p> <p>DES is satisfied, therefore, that the proposed UWIR satisfies this requirement. Further comments are below.</p> <ul style="list-style-type: none"> • The UWIR's Figure 7-2 (provided overleaf) shows the LTAAs for each aquifer. <ul style="list-style-type: none"> o LTAAs associated with CSG extraction are predicted for the Walloon Coal Measures, Bandanna Formation, Cattle Creek Formation, Springbok Sandstone and Hutton Sandstone. o There is also an LTA A for the Precipice Sandstone around the Moonie oil field and the Clematis Sandstone as a result of historical groundwater extraction from conventional oil and gas production in the area. • LTAAs are predicted to experience more than five metres of impact in the long term.



UWIR Figure 7-2: Extent of Long-Term Affected Areas (LTAA)

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
376(1)(c)-A description of methods and techniques used to obtain the information and predications under paragraph (b)	YES	Chapter six of the UWIR discusses how OGIA undertakes modelling impacts. This chapter includes methods and techniques used in modelling the predicted impacts; construction of the geological model; conceptual framework for the groundwater flow model; data availability; and the groundwater model construction and calibration. DES is satisfied with OGIA's capability to adequately model and assess impacts to the CMA.
376(1)(d)-A summary of information about all water bores located within the IAA, including the number of bores, and the location and authorised use or purpose of each bore.	YES	<p>UWIR section 7.2.2 speaks to IAA bores.</p> <ul style="list-style-type: none"> • There are 100 water bores that have been categorised as IAA bores for the first time in this proposed 2019 UWIR as a result of progressive changes over time since the 2012 and 2016 UWIRs. • The summarised information about IAA water bores are located in the UWIR's Appendix G as described below: <ul style="list-style-type: none"> o Table G-1 lists 100 bores that have been identified in this 2019 UWIR. o Table G-2 lists all bores identified in previous UWIRs with information on their current status. <p>DES has reviewed Table G-1 and Table G-2 and is satisfied that the number of bores, their locations (latitude and longitude) and authorised use/ purpose have been addressed.</p>
376(1)(da)-A description of the impacts on environmental values (EVs) that have occurred, or are likely to occur, because of any previous exercise of underground water rights.	NO	<p>Environmental values (EVs) (and impact descriptions) addressed in this UWIR are:</p> <ol style="list-style-type: none"> 1. Aquifers (drawdown, sustainability) (UWIR Ch. 7) 2. Groundwater bores (drawdown) (UWIR Ch. 7) 3. Springs and groundwater connected watercourses (drawdown) (UWIR Ch. 9) 4. Terrestrial groundwater-dependent ecosystems (drawdown) (UWIR Ch. 10)

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>5. Groundwater quality (achieving water quality objectives, drawdown resulting in movement around contaminated sites (i.e. Linc) (UWIR Ch. 10)</p> <p>6. Stratigraphy compaction (land subsidence) (UWIR Ch. 10)</p> <p>Environmental values contemplated by DES are:</p> <p>7. Wetlands - covered by springs, as OGIA's spring typology assessment included utilising characteristics relating to how a wetland has formed and how it is likely to respond to a change in the groundwater regime. Therefore, this seventh EV is not addressed further.</p> <p>A table summarising the six environmental values, against the requirements of s.376(1)(da) / (db)(i) / and (db)(ii), was produced as part of this assessment: Assessment Report Supplementary Document 1 - s.376(1)(da)(db) Environmental Values Table. As the summary table split each of the six EVs against the impacts from past exercise, predicted impacts in the next three years, and predicted impacts for the life of tenure, the gaps in information were more readily identified.</p> <p>DES considers that these information gaps, outlined below, must be addressed to meet this legislative requirement.</p> <p>In summary:</p> <p>1. Aquifers (drawdown) - previous: <i>Information on pressure declinations has been provided for the GAB, Precipice Sndst and the Bowen, Cattle Creek Fm. However, the statements that 'significant drawdown' I 'significant impact has already been observed' at the GAB, Walloons and Bowen, Bandanna Fm is considered insufficient in description. DES requires that these statements be elaborated and characterised I quantified.</i></p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>Aquifers - next three years: <i>Information has been provided that >5m of drawdown is predicted in the next three years for the GAB, Precipice Sndst; GAB, Hutton Sndst; GAB, Springbok Sndst; GAB, Walloon Coal Measures; Bowen, Bandanna Fm; and the Bowen, Cattle Ck Fm.</i></p> <p>Aquifers - end of tenure: <i>Information has been provided (particularly from Appendix G) regarding the locations and geographic extent of drawdown for the Condamine Alluvium; GAB, Gubberamunda Sndst; GAB, Precipice Sndst; GAB, Hutton Sndst; GAB, Springbok Sndst; GAB, Walfoons; Bowen, Clematis Sndst; Bowen, Bandanna Fm; and the Bowen, Cattle Ck Fm. However, maximum predicted drawdown levels have not been provided for the Walfoons, Bandanna Fm, or the Cattle Creek Fm.</i></p> <p>2 Groundwater bores - previous: <i>No information has been provided on impacts from past exercise of water rights on bores in the following units: GAB, Hutton Sndst; Bowen, Bandanna Fm; Bowen, Cattle Ck Fm; and GAB, Walloon Coal Measures. DES interprets this as a determination that no impacts have been observed, but considers it desirable to have this confirmed. Insufficient information was provided for the GAB, Springbok Sndst: "Actual impacts have been observed at some locations within the formation." DES requires that this statement be elaborated and characterised I quanUfied.</i></p> <p>Groundwater bores - next three years: <i>Information has been provided on the bores which are predicted to be impacted by more than the trigger thresholds in the next three years.</i></p> <p>Groundwater bores - end of tenure: <i>Information has been provided for the Bowen, Cattle Ck Fm and the GAB, Walloon Coal Measures. Counts of LTAA bores have been provided for the GAB, Hutton Sndst and the GAB, Springbok Sndst with an indication of bores predicted to have "less-than-x" metres of impact, however no information on the</i></p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p><i>predicted maximum impacts are for these units. For the Bowen, Bandanna Fm - information has been provided that there is one LTAA bore, but no information on the predicted magnitude of the impact.</i></p> <p>3. Springs - previous: <i>No information has been provided on metres of drawdown known to have occurred, or to have been investigated, to date. The sites are: Springrock, Lonely Eddie, 311, Cockatoo, Lucky Last, Barton, Horse Creek, Orana, Scott's Creek, Abyss, Eurombah, and Dawson River.</i></p> <p><i>Springs - next three years: Metres-within-years of drawdown have been included at all sites.</i></p> <p><i>Springs - end of tenure: Metres-within-years of drawdown have been included at all sites.</i></p> <p>4. Terrestrial GDEs - previous: <i>No information has been provided on how petroleum activities to date have, or may have, affected terrestrial GDEs. No information has been provided summarising investigations and findings undertaken to date.</i></p> <p>Terrestrial GDEs - next three years: <i>No information has been provided on predictions of how petroleum activities may affected terrestrial GDEs in the next three years, in relation to the risk-mapped areas referred to below (end of tenure).</i></p> <p><i>Terrestrial GDEs - end of tenure: An area of interest has been generated using the "long-term" predicted drawdown of 0.2 metres within outcropping aquifer areas. Surface geology was mapped against known GDEs, coinciding with aquifer drawdown depths and biodiversity status. This yielded a map (UWIR Figure 10-2) showing areas of differing</i></p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p><i>risk. DES understands that "long-term" in this context refers to predicted impacts after the next three years.</i></p> <p>5 Groundwater quality - previous: <i>No information has been provided on the actual WQOs, or alternative objectives, for the aquifers. No information has been provided on how water quality in the aquifers has changed to date, spatially or temporally, relative to these objectives. No information has been provided on local scale water movement in the vicinity of the contaminated Linc site. The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm.</i></p> <p>Groundwater quality - next three years: <i>No information has been provided on the actual WQOs, or alternative objectives, for the aquifers. No information has been provided on how water quality in the aquifers is predicted to change in the next three years, spatially or temporally, relative to these objectives. No information has been provided on local-scale predicted water movement in the vicinity of the contaminated Linc site over the next three years. The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm.</i></p> <p>Groundwater quality - end of tenure: <i>No information has been provided on the actual WQOs, or alternative objectives, for the aquifers. No information has been provided on how water quality in the aquifers is predicted to change after the next three years, spatially or temporally, relative to these objectives. No information has been provided on local scale predicted water movement in the vicinity of the contaminated Linc site after</i></p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p><i>the next three years. The aquifers DES considers necessary to be spoken to are the Condamine Alluvium, Basalts, GAB's Gubberamunda Sndst; Springbok Sndst; Walloon Coal Measures; Hutton Sndst; Precipice Sndst; and the Bowen's Clematis Sndst; Bandanna Fm and Cattle Ck Fm.</i></p> <p>6. Stratigraphic compaction - previous: <i>No information has been provided on whether any current land subsidence is known to have occurred, or to have been investigated, to date.</i></p> <p>Stratigraphic compaction - next three years: <i>No information has been provided on the timing of predicted impacts, i.e. predictions in the next three years or after three years, though a map has been generated with low / moderate / high risk categories for subsidence.</i></p> <p>Stratigraphic compaction - end of tenure: <i>No information has been provided on the timing of predicted impacts, i.e. predictions in the next three years or after three years, though a map has been generated with low / moderate / high risk categories for subsidence.</i></p> <p>Details from the proposed UWIR which informed the Assessment Report Supplementary Document 1 - s.376(1)(da)(db) Environmental Values Table are given below.</p> <p>Details from the proposed UWIR which informed the sustainability component of aquifers are addressed separately, as this information was more difficult to extract.</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>Detailed responses from the proposed UWIR which informed the Assessment Report Supplementary Document 1- s.376(1)(da)(db) Environmental Values Table:</p> <ol style="list-style-type: none"> Aquifers (drawdown) <ul style="list-style-type: none"> GAB: <ul style="list-style-type: none"> Precipice Sandstone <p>Impacts are predicted to be more than five metres within three years (to the end of 2021)</p> <p>Long term affects (past 2021) are predicted around the Moonie oil field, resulting from historical groundwater extraction from conventional oil / gas production.</p> <p>Around the Moonie oil field, the maximum pressure decline at the wellfield is about 120 metres. Unlike CSG production, conventional production is nearing end of life (expected to cease entirely by 2030) and groundwater extraction has been steadily declining at a current level of about 1,000 ML/year. As a result, groundwater pressure is predicted to continue to recover for this area in the Precipice Sandstone.</p> <p>Minor impacts are also predicted in the Precipice Sandstone towards the north of the CMA, associated with CSG extraction from the Bandanna Formation close to two areas where the coal reservoir is in direct contact with the Precipice Sandstone. These impacts are</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>characterised by a shallower but more extensive area of impact, predominantly associated with the western contact zone.</p> <ul style="list-style-type: none"> • Hutton Sandstone <p>The Hutton Sandstone underlies the Walloon Coal Measures but is separated from the productive coal seams by the Durabilla Formation. It is now believed that there is lower vertical permeability in the Durabilla Formation than previously understood, and that there is less interaction with the overlying Walloon Coal Measures than previously estimated.</p> <p>Impacts are predicted to be more than <i>five</i> metres within three years (to the end of 2021).</p> <p>Long term affects (past 2021) are also predicted.</p> <p>Maximum impacts at most other locations in the Hutton Sandstone are minor and predicted to occur several hundred years after extraction from the Walloon Coal Measures has ceased. Recovery may take hundreds of years. Groundwater level monitoring data has confirmed that the Durabilla Formation is a highly effective aquitard that limits the propagation of CSG impacts into the Hutton Sandstone across most of the area.</p> <ul style="list-style-type: none"> • Gubberamunda Sandstone

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>The Gubberamunda Sandstone is not well connected to any coal formations, since it is separated from the Walloon Coal Measures by the intervening Westbourne Formation aquitard and the Springbok Sandstone.</p> <p>There is no LTAA for this aquifer.</p> <ul style="list-style-type: none"> • Springbok Sandstone <p>Impacts are predicted to be more than five metres within three years (to the end of 2021).</p> <p>Long term affects (past 2021) are also predicted.</p> <p>Impacts of more than 5 m are expected in the long term across much of the planned CSG production area.</p> <p>Impacts tend to develop more slowly in the Springbok Sandstone than in the underlying upper Walloon Coal Measures. Groundwater levels will therefore recover more slowly than in the Walloon Coal Measures.</p> <ul style="list-style-type: none"> • Walloon Coal Measures - <p>Impacts are predicted to be more than five metres within three years (to the end of 2021).</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>Long term affects (past 2021) are also predicted. Significant drawdown has already been observed and a substantial LTAA is predicted, as the Walloon Coal Measures is the CSG target formation and has been subject to depressurisation since 2005.</p> <p>Bowen Basin:</p> <ul style="list-style-type: none"> Bandanna Formation <p>The Bandanna Formation is the main CSG target formation in the Bowen Basin and has been subject to depressurisation since 1995 in some places.</p> <p>Impacts are predicted to be more than five metres within three years (to the end of 2021).</p> <p>Significant impact has already been observed and a substantial LTAA is predicted (past 2021)</p> <ul style="list-style-type: none"> Cattle Creek Formation - <p>The Cattle Creek Formation is a secondary CSG target formation in the Bowen Basin, located several hundred metres below the Bandanna Formation.</p> <p>Development of the Cattle Creek Formation is currently only proposed within the Fairview CSG field. Only a small number of pilot</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>CSG wells have been drilled to date and depressurisation of this formation is currently limited.</p> <p>Impacts are predicted to be more than five metres within three years (to the end of 2021)</p> <p>Long term affects (past 2021) are also predicted.</p> <p>Alluvium:</p> <ul style="list-style-type: none"> • Condamine Alluvium - <p>There is no L T M in the Condamine Alluvium, based on the trigger threshold of 2 m that applies to unconsolidated aquifers.</p> <p>The maximum impact is expected to be around 0.2 m in the north-west of the Condamine Alluvium and less than 0.05 m across the majority of the area.</p> <p>It is predicted that there will be a net loss of water from the Condamine Alluvium to the Walloon Coal Measures of about 735 MUyear over the next 100 years due to CSG development.</p> <p>2 Groundwater bores (drawdown)</p> <ul style="list-style-type: none"> o I M bores are those expected to experience water level drawdown of more than the trigger threshold (five metres) by the end of 2021.

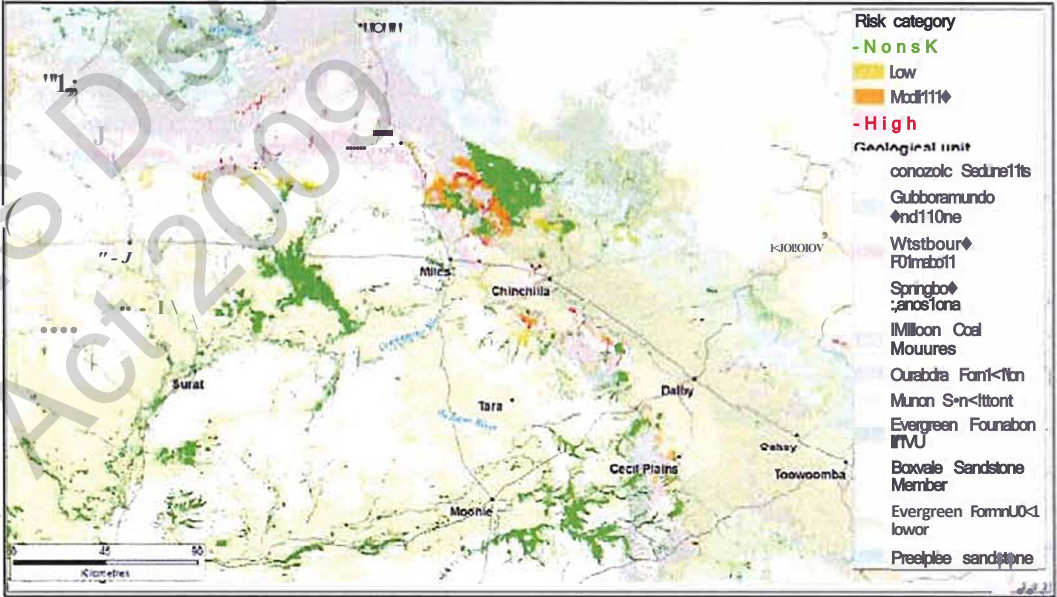
Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>There are 222 bores that have been identified as IAA bores since 2011, with 100 identified for the first time in this proposed UWIR, and 122 identified as effective IAA bores through the UWIR 2012 / UWIR 2016 / or due to subsequent bore record corrections.</p> <p>The new 100 IAA bores access either the Springbok Sandstone or Walloon Coal Measures, and have uses which are either agricultural (6), industrial (1), town water supply (1), or stock and domestic (92).</p> <ul style="list-style-type: none"> o LTAA bores are those predicted to be affected in the long term because they access water from a relevant aquifer within the aquifer's long-term affected area. <p>There are 571 long-term affected bores (though 122 are decommissioned, leaving 449 existing). Of these, 34 are agricultural, 4 are industrial, 3 are town water supply, and 408 are stock and domestic.</p> <p>The number of water bores in the Hutton Sandstone likely to be affected in the long term has reduced from 35 to seven. Most of the LTAA bores are likely to experience an impact of less than 10 m and are limited to an area around Dalby where seismic data suggests that the Walloon Coal Measures and Hutton Sandstone may be in direct contact along part of the Horrane Fault.</p> <p>While the number of water bores likely to be affected in the long term within the Springbok Sandstone has increased, around half of the LTAA bores are likely to</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>experience an impact of less than 15 m. Actual impacts have been observed at some locations within the formation.</p> <p>The Bandanna Formation is not commonly used for water supply purposes, and there is only one water bore that sources water from this formation in the LTM.</p> <p>The Cattle Creek Formation is not commonly used for water supply purposes; hence, there are no water bores within this formation in the LTAA.</p> <ul style="list-style-type: none"> o Walloon Coal Measures <p>Around half of the affected bores are likely to experience an impact of less than 32 m</p> <p>Near the centre of CSG production areas, impacts of up to 350 m are typical towards the base of the Walloon Coal Measures and around 150 m towards the upper part.</p> <p>Impacts develop relatively quickly within the Walloon Coal Measures before recovering slowly once local CSG extraction ceases.</p> <p>The time taken for groundwater levels to recover is related to the magnitude of the maximum drawdown. Groundwater levels in the Walloon Coal Measures in areas located close to the edge of the predicted LAA are expected to recover within five years. Conversely, groundwater levels within CSG production areas may take more than 1,000 years to fully recover.</p>

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		<p>Predictions for the Walloon Coal Measures suggest that around 25% of impacted bores would recover to within 5 m levels in 250 years and around 75% of bores in 1,000 years.</p> <p>3. Springs and groundwater connected watercourses (drawdown)</p> <p>There are eight spring groups where impacts of more than 0.2 metres are predicted in the springs' source aquifers. At the majority of these springs, predicted impacts are less than one metre.</p> <p>4. Terrestrial groundwater-dependent ecosystems (drawdown)</p> <p>GDEs require access to groundwater permanently or intermittently to maintain ecological assemblages, processes and ecosystem services. The ecological water requirement of terrestrial vegetation may not only be volumetric, but importantly may have a timing component. Access to groundwater during dry periods may have a crucial role in the maintenance of aspects of plant life cycles, such as sapling establishment and growth.</p> <p>Three types of GDEs are broadly recognised:</p> <ul style="list-style-type: none"> ○ ecosystems dependent on the surface expression of groundwater: associated with wetlands, lakes, seeps, springs and river baseflow ○ ecosystems dependent on the sub-surface presence of groundwater: associated with terrestrial vegetation accessing the water table below ground ○ cave and aquifer ecosystems: located within the pore or void spaces of caves and aquifers.

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		<p>Terrestrial GDEs occur where vegetation requires access to groundwater either intermittently or permanently to maintain ecological composition and function. In contrast to springs, which are usually relatively localised features, terrestrial GDEs may be extensive and may intergrade with non-GOE vegetation communities, depending on variations in surface geology, landform and soil. A vegetation community may access groundwater in one location, or many locations. This makes understanding dependency and impact more difficult.</p> <p>The ability to access groundwater is conferred by the root architecture and rooting depth. A widely adopted rule of thumb is that vegetation use of groundwater is:</p> <ul style="list-style-type: none"> • <i>likely</i> where the depth-to-water is less than 10 metres below ground level, • <i>possible</i> at 10 to 20 metres below ground level, and • <i>unlikely</i> at 20 metres below ground level. <p>DES notes that the QLD Herbarium adds a qualifier to this rule of thumb, which is: the rule-of-thumb does not consider species and their differing root architecture and rooting depth. For example, specific Eucalypt species may more than 'possible' access groundwater at 10 to 20 metres below ground level.</p> <p>For the purpose of the UWIR 2019, OGIA has completed a desktop assessment (OGIA 2019e) to:</p> <ul style="list-style-type: none"> • integrate existing mapping of potential terrestrial GDEs with areas of predicted drawdown in the regional groundwater model; • develop conceptual understanding of groundwater dependency and response to drawdown; and

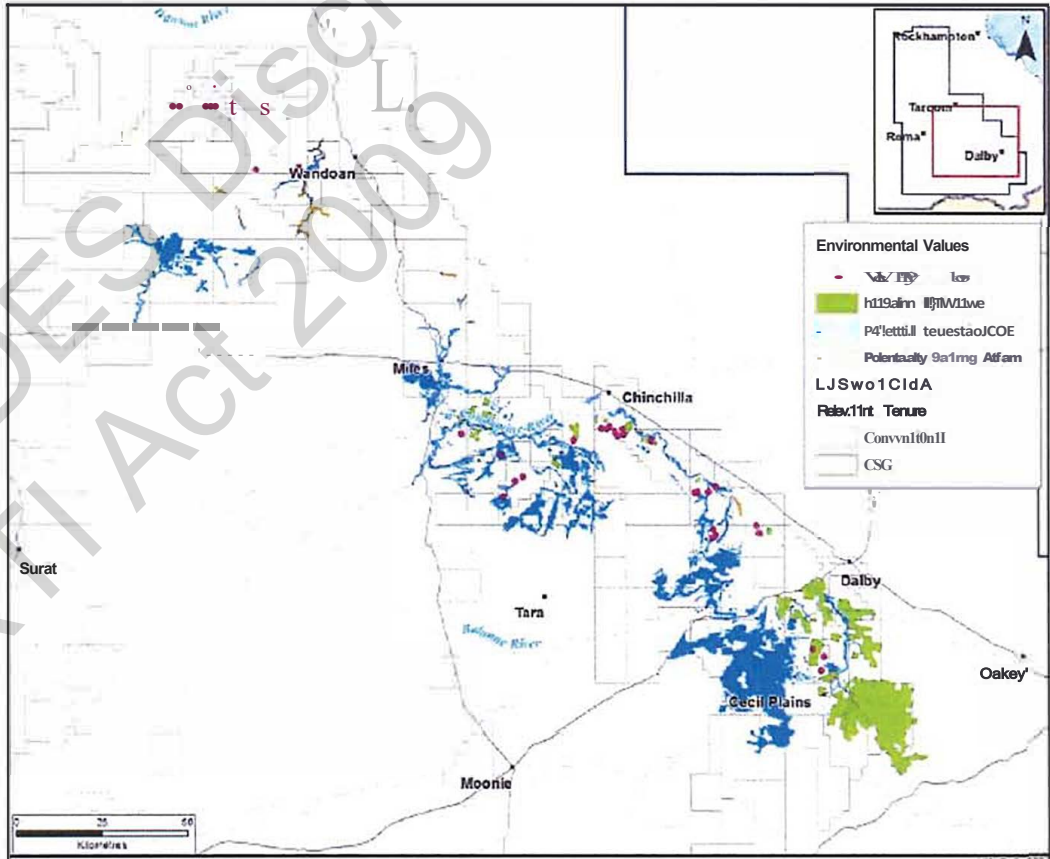
Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • identify areas for improvement of knowledge. In most cases, additional field verification will be required to confirm groundwater dependence. <p>Consistent with OGIA (2019d), the approach integrates outcomes from the regional groundwater flow model, the geological model and mapped potential terrestrial GDEs.</p> <p>A conservative area of interest is generated using the long-term predicted drawdown of 0.2 metres. Since GDEs occur in outcrop areas, the areas of mapped potential GDEs are identified where impacts are predicted within the outcropping aquifers.</p> <p>Areas where an impact of more than 0.2 m but less than one metre is predicted are identified as low risk. Areas where an impact of more than one metre is predicted are assigned a moderate risk. Areas of potential terrestrial GDEs associated with REs with an 'Endangered' or 'Of concern' biodiversity status are assigned a high risk.</p> <p>The risk mapping identifies areas of drawdown associated with potential terrestrial GDEs. It should not be used to infer likely ecological responses to predicted impact. The risk mapping should be used, in combination with the RE biodiversity status, to prioritise further investigation of potential GDEs to verify groundwater use and to inform future monitoring locations to test hypotheses about ecological responses.</p>

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		<p>Areas of high risk are primarily associated with the outcrop of the Walloon Coal Measures south-east of Wandoan. This is shown in the UWIR's Figure 10-2 below.</p>  <p>DES comments:</p> <ul style="list-style-type: none"> A more appropriate classification of risk (rather than 0.2m to 1 metre ...) should consider likelihood of groundwater dependence (confidence), level of predicted impact, and consequence (biodiversity status).

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		<ul style="list-style-type: none"> • There is no discussion on characterising non-human-use EVs of groundwater aquifers despite its mention in list of aquatic ecosystem EVs. • It is not clear if inter-aquifer connectivity is considered in identifying risk - in addition to outcropping aquifers. <p>5. Groundwater quality (achieving water quality objectives, drawdown resulting in movement around contaminated sites (i.e. Linc)</p> <p>The Environmental Protection (Water) Policy 2009 (Water EPP) identifies specific EVs that are to be protected with corresponding water quality objectives (WQOs). Under the Water EPP, all Queensland waters, including groundwater, have identified EVs and WQOs. In relation to groundwater, EVs in the Surat CMA include:</p> <ul style="list-style-type: none"> • aquatic ecosystem: groundwater aquifers, GDEs such as groundwater inflows to rivers (baseflow) and springs, and terrestrial GDEs • human use: consumption or use of groundwater for a range of purposes including aquaculture, recreation (e.g. waterholes), industrial, cultural and spiritual values. <p>Within the Surat CMA, groundwater in aquifers supports a range of EVs. There are four primary groundwater systems in the Surat CMA: the GAB, Bowen Basin, Basalts and Alluvium.</p> <p>The regional groundwater flow model has been redeveloped to assess the impacts on water levels from current and proposed P&G development activities. Available water chemistry data from all formations is assessed to understand the long-term movement of water through the groundwater system. At this stage, other than in isolated areas of the</p>

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		<p>Walloon Coal Measures, no significant changes in water chemistry are observed that could be related to CSG groundwater extraction.</p> <p>In Queensland, the GAB groundwater movement is very slow, estimated at about 1-5 metres per year. As discussed in Chapter 3, recharge occurs predominantly by direct infiltration of rainfall in the outcrop areas, or indirectly by leakage from streams and/or overlying aquifers. Flow directions are generally towards the south-west with discharge into the remainder of the GAB to the south. However, north of the Great Dividing Range, groundwater flow in a number of aquifers is towards the north-east into the Dawson River catchment. Detailed analysis previously undertaken by OGIA, further confirmed by observations, shows that CSG production leads to the development of pressure gradients within the target reservoirs. This demonstrates that impacts do not propagate evenly within the reservoirs.</p> <p>To account for this variance, a minimum of three model layers are used to represent each of the coal formations. A total of six model layers have been used for the Walloon Coal Measures, which allows for a more accurate representation of the geometry of the contact zone with the Condamine Alluvium.</p> <p>6. Stratigraphy compaction (land subsidence)</p> <p>Depressurisation associated with CSG water extraction may result in reservoir compaction, which has the potential to cause subsidence at the land surface. This may have implications for human-use (e.g. agricultural land and water bores) and aquatic ecosystems, such as watercourse springs and terrestrial GDEs.</p>

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		<p>For the UWIR 2019, an assessment of the risk of subsidence to EVs has been undertaken. The approach incorporates an assessment of the likelihood of subsidence occurring and a description of the EVs located within those areas.</p> <p>The likelihood of subsidence occurring was assessed using two risk factors: an estimate of compaction within the Walloon Coal Measures, using the predictions of water level change; and the presence or absence of overlying consolidated sandstone formations to attenuate any potential impacts to the surface.</p> <p>Three risk classes are assigned:</p> <ul style="list-style-type: none"> • areas of low risk, where compaction is predicted to be less than 0.1 metres; • moderate risk between 0.1 to 0.2 metres, and • high risk for greater than 0.2 metres of compaction.

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		<p>In areas where there are consolidated formations overlying the reservoirs, the assigned level of risk is reduced to a lower level.</p> <p>A map is provided (UWIR Figure 10-3, reproduced below) showing EVs where a moderate to high risk is identified.</p> <p>OGIA state that with the exception of Woleebee Creek near Wandoan, all remaining EVs are subject to moderate risk of subsidence. This includes an area of irrigated cropping land, near the Condamine Alluvium and between Chinchilla and Miles, and potentially gaining streams in this area including Bottle Tree Creek, the Condamine River, Horse Creek (East Branch), Kangaroo Creek, L Tree Creek, Punch Bowl Creek, Wilkie Creek and Yuleba Creek.</p> <p>OGIA state that at this stage, there is insufficient data and understanding to assess the resilience or susceptibility of these features to subsidence, i.e. to assess the consequence of the predicted subsidence impacts. Future monitoring and evaluation of subsidence and EVs will provide data to inform this understanding.</p> <p>Details from the proposed UWIR which informed the sustainability component of aquifers are addressed below.</p> <p>1. Aquifers (sustainability) -</p> <p>OGIA state (PDF p. 125/180, UWIR p. 103) the following:</p> <p><i>"The model output ... suggests that over a long period of time most of the CSG extracted water will be from the storage in the Walloon Coal Measures and only about 8% will be through cross-formational flow from the surrounding aquifers, including 3% from the Hutton Sandstone and 5% from the Springbok Sandstone and Condamine Alluvium."</i></p>

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		<p>"Timing and volumes of predicted water extraction may vary in future, as they are highly dependent on the planned sequencing of new production areas and infilling of existing areas (section 2.4.3). Uncertainty analysis results suggest that the average extraction may be 13% higher than the predictions presented in Figure 7-3, based on the current development profile.</p> <p>"There is no direct relationship between the volume of water extracted and the magnitude of groundwater level impacts.</p> <p>This is because CSG fields are operated to maintain a close-to-constant water level (or pressure) in the gas field."</p> <p>Nevertheless, OGIA state (PDF 115/180, UWIR p.93) that "Outputs from the model identify the spatial and temporal distribution of impacts from P&G development in terms of water level decline in each of the aquifers."</p> <p>DES has utilised the IAA and LTAA maps in the proposed UWIR and those in Appendix D, to identify which of the pertinent aquifers in the CMA show long-term sustainability as an issue, as well as determining which of the affected areas geographically align or lie geographically discrete from the others. Note that the areas were only 'eyeballed' from the maps. The findings are (colouring in unit names indicates geographic impact alignment):</p> <table><tr><th>Basin</th><th>Unit</th><th>Type</th><th>Area (km)</th><th>Drawdown (m)</th></tr><tr><td>1 GAB</td><td>Springbok - tight aquifer</td><td>CSG, -5%</td><td>400 x 200</td><td>20-200</td></tr><tr><td>2 GAB</td><td>Walloon - interbedded aquitard</td><td>CSG, 92%</td><td>400 x 200</td><td>20 to >500</td></tr><tr><td>3 GAB</td><td>Hutton - partial to tight aquifer</td><td>CSG, 3%</td><td>80 x 80</td><td>20-100</td></tr><tr><td>4 GAB</td><td>Precipice - regional aquifer</td><td>Conventional, majority</td><td>80 x 80</td><td>20 - 100</td></tr><tr><td>5 Bowen</td><td>Clematis - regional aquifer</td><td>Conventional, minor</td><td>10 x 10</td><td>50 - 500</td></tr><tr><td>6 Bowen</td><td>Bandanna - interbedded aquitard</td><td>CSG</td><td>100 x 100</td><td>50 to >500</td></tr><tr><td>7 Bowen</td><td>Cattle Ck - not well understood</td><td>CSG</td><td>40 x 40</td><td>50 to >500</td></tr></table>	Basin	Unit	Type	Area (km)	Drawdown (m)	1 GAB	Springbok - tight aquifer	CSG, -5%	400 x 200	20-200	2 GAB	Walloon - interbedded aquitard	CSG, 92%	400 x 200	20 to >500	3 GAB	Hutton - partial to tight aquifer	CSG, 3%	80 x 80	20-100	4 GAB	Precipice - regional aquifer	Conventional, majority	80 x 80	20 - 100	5 Bowen	Clematis - regional aquifer	Conventional, minor	10 x 10	50 - 500	6 Bowen	Bandanna - interbedded aquitard	CSG	100 x 100	50 to >500	7 Bowen	Cattle Ck - not well understood	CSG	40 x 40	50 to >500
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		<p>Noting that the following statements from the proposed UWIR were utilised:</p> <p>Conventional - <i>"The majority of conventional associated water extraction is from the Precipice Sandstone in the Moonie oil field. There is also some minor extraction from the Evergreen Formation and the Clematis Sandstone."</i></p> <p>CSG - <i>"...most of the CSG extracted water will be from the storage in the Walloon Coal Measures ... about 8% will be through cross-formational flow from the surrounding aquifers, including 3% from the Hutton Sandstone and 5% from the Springbok Sandstone and Condamine Alluvium."</i></p> <p>DES notes that 'sustainable management' of Qld's water resources, by managing impacts on underground water caused by exercise of underground water rights by the resource sector, is one of the purposes of the Water Act.</p> <p>Sustainable management means - incorporation of ecologically sustainable development, allow for use of water for economic, physical and social wellbeing of Qlders within limits that can be sustained indefinitely; sustain health of ecosystems, water quality, ecology, biological diversity related to natural water systems; promote efficient use of water.</p> <p>Ecologically sustainable development means - protect Qld environment while allowing for development that improves the total quality of life, now and in the future, in a way that maintains the ecological processes on which life depends.</p> <p>Efficient use of water means - incorporation of water demand and conservation, or consideration of quality and quantity of water required in circumstances including releases to the environment.</p>

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		In consideration of the above definitions, DES is satisfied that the management of 'aquifer sustainability' is to be most practicably achieved through the related environmental values - namely, ecosystem health and water quality.
376(1)(db)-an assessment of the likely impacts on EVs that will occur, or are likely to occur, because of the exercise of underground water rights-		
(i) for a 3-year period starting on the consultation day for the report.	NO	Discussed above.
(ii) over the projected life of the resource tenure.	NO	Discussed above.
376(1)(e)-Include a program for -		
(i) conducting an annual review of the accuracy of each map prepared under paragraph (b)(iv) (IAA) and (v) (LTAA)	YES	<p>Tracking changes to IAA bores is discussed in the UWIR's section 7.2.3. Periodic reporting and review is discussed in the UWIR's Chapter 12.</p> <ul style="list-style-type: none"> • Together with the maps showing the IAAs for aquifers, the UWIR identifies and lists existing water bores understood to access water from an aquifer within the IAA for the aquifer. • Information about the bores comes initially from the GWDB and is further refined with baseline assessment, bore assessment and project specific data. • OGIA plan to prepare annual reports to provide an update on changes to circumstances that would impact on the predictions reported in the UWIR, and to provide updates on the implementation of management strategies specified in the UWIR. • OGIA will continue to provide annual reports to DES for the current UWIR. These reports will be published on the OGIA website.

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		<ul style="list-style-type: none"> In addition to changes, the future annual reports will also include a revised list of IAA bores resulting from ongoing verification of bore status, authorisation and aquifer attribution for bores referred to in Appendix G. <p>DES is satisfied that this plan satisfies the requirements of the legislation for reviewing the accuracy of the maps for IAAs and LTAAAs.</p>
(ii) giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps.	YES	OGIA refer to their commitment to continue providing annual reports to DES on the Surat UWIR, in section 12.1 of the UWIR.
376(1)(f)-A water monitoring strategy (WMS) (Insert WMS details in WMS section below).	YES	The UWIR's Chapter 8 speaks to the Water Monitoring Strategy- its components, the monitoring network, parameters to monitor, reporting obligations, tenure holder obligations, and baseline assessment.
376(1)(g)-A spring impact management strategy (SIMS) {Insert Spring info details in SIMS section below}.	YES	The UWIR's Chapter 9 speaks to the Spring Impact Management Strategy- its components, the nature of the springs, predicted impacts, mitigation strategy, the spring monitoring program and tenure holder obligations.
376(1)(h)-If the UWIR has been prepared by the Office of Groundwater Impact Assessment (OGIA) -		
(i) a proposed responsible tenure holder for each report obligation mentioned in the UWIR	YES	<p>Responsible tenure holders are mapped by geographic distribution in the UWIR's Figure 2-6.</p> <p>OGIA assign individual responsible tenure holders through rules specified in the UWIR. The rules were established initially in the first UWIR in 2012 and are refined to provide increased clarity for both tenure holders and affected landholders.</p> <p>The rules are designed such that responsible tenure holders can change with the change of ownership of a tenure.</p> <p>Obligations in the UWIR are designated as follows:</p>

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		<ul style="list-style-type: none"> ○ Rule 1: The authorised tenure holder over land identified as a relevant tenure in Figure 2-6 is the responsible tenure holder for make good obligations in relation to a bore on the land. ○ Rule 2: For a bore to which Rule 1 does not apply, the authorised tenure holder over land identified as a relevant tenure in Figure 2-6 that is closest to the bore is the responsible tenure holder for make good obligations in relation to the bore. ○ Rule 3: The authorised tenure holder over land identified as P&G tenure in Figure 2-5 is the responsible tenure holder for carrying out the baseline assessment program identified in section 8.7.2 in relation to a bore on the land. ○ Rule 4: For a bore to which the baseline assessment program in section 8.7.2 applies, but the bore is outside the land identified as P&G tenure in Figure 2-5, the responsible tenure holder is the authorised tenure holder over land identified as P&G tenure in Figure 2-5 that is closest to the bore. ○ Rule 5: The authorised tenure holder over land identified as a relevant tenure in Figure 2-6 is the responsible tenure holder for obligations identified in Chapter 8 [Water Monitoring Strategies (WMS)] and Chapter 9 [Spring Impact Management Strategies (SIMS)]. ○ Rule 6: For WMS and SIMS obligations, other than baseline assessment, to be carried out outside the area to which Rule 5 applies, the responsible tenure holder is the authorised tenure holder over the land identified as relevant tenure in Figure 2-6 that is closest to the bore.

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		<ul style="list-style-type: none"> o Rule 7: A tenure holder with an obligation under application of Rules 1 to 6 may transfer to another tenure holder the obligation to carry out future activities required under the obligation, if the transfer is approved by OGIA. o Rule 8: Regardless of the Rules 1 to 6 above, a tenure holder's obligation from the previous UWIR arising from applicable assignment rules from those UWIRs will continue unless the tenure holder transfers the obligation to another tenure holder and the transfer is approved by OGIA. <p>DES understands that these rules have been in place for some years now, and no issues have been identified. DES is satisfied with this system.</p>
(ii) for each immediately affected area-the proposed responsible tenure holder or holders who must comply with any make good obligations for water bores within the immediately affected area.	YES	As above.
Water Monitoring Strategy (WMS) requirements		
378(1) - The WMS must include the following for each immediately affected area (IAA) and long-term affected area (LTAA) identified in the UWIR -		
378(1)(a) - a strategy for monitoring -		
(i) the quantity of water produced or taken from the area because of the exercise of relevant underground water rights	YES	<p>The Water Monitoring Strategy (WMS) is covered in the UWIR's Chapter 8. The WMS includes a regional network of monitoring points used to assess water pressure trends.</p> <p>The network -</p> <ul style="list-style-type: none"> • Includes groundwater pressure, groundwater chemistry and production well chemistry monitoring points.

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		<ul style="list-style-type: none"> • Assigns a status to each monitoring point; 'Maintain', 'Repair', 'Replace', 'Integrate', 'Proposed' and 'Remove'. • Existing and new groundwater monitoring points in the 2019 WMS network is available at OGIA's website as an Excel file (at time of assessment, located here as this file). <ul style="list-style-type: none"> ◦ This file includes unique identification numbers for the monitoring points, their location coordinates, status, applicable component (e.g. groundwater chemistry, groundwater pressure, or production well chemistry), target geological formation and the tenure holder. • Summary information by tenure holder and geological formation and bore status is provided in Appendix H.1, Tables H-1 to H-3. This summary data does not specify the monitoring points (bore names, location coordinates). <p>The data-</p> <ul style="list-style-type: none"> • The WMS requires tenure holders to provide, every six months, monthly associated water extraction volumes for each well. • The WMS requires annual monitoring of water chemistry from 157 production wells. • Major ions, dissolved metals and field parameters (suite A) are required every six months from all existing and new monitoring points until at least five complete samples have been received by OGIA. • For isotopes (suite B), a strontium sample is required once only for all existing and new monitoring points in the Hutton, Springbok and Precipice sandstones. A strontium sample is required annually for monitoring points in the CSG reservoir and production wells.

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		<ul style="list-style-type: none"> Responsible tenure holders must provide OGIA, by 1 April and 1 October of each year, with the data collected for each monitoring location including groundwater pressure, water chemistry, associated water volumes (and reinjection volumes where applicable). <p>Because there is significant non-petroleum use in aquifers adjacent to the target reservoirs, and an absence of metering data, OGIA developed a method for estimating non-petroleum water use in 2012 which is continuously refined as additional data and information becomes available (details are discussed in UWIR Chapter 4).</p> <p>Limited metering data means that there is increased uncertainty in the estimated use. The data gap affects OGIA's ability to accurately separate petroleum from non-petroleum impacts, and each UWIR contains updates to the predictions and uncertainty analyses.</p> <p>The monitoring network spans the CMA, so the Department has had regard specifically to the identified IAAs and LTAAAs.</p> <ul style="list-style-type: none"> IAAs <ul style="list-style-type: none"> Chapter 8 of the proposed UWIR does not speak specifically to the IAAs. However, the IAA bores have been identified and it is stated in Chapter 11 of the proposed UWIR that water bores within the IAA for a formation require bore assessment. LTAAAs <ul style="list-style-type: none"> OGIA state that in many parts of the LTAAAs, impacts on water level or water pressure will not occur for some time, and that they believe baseline assessments are most effective when they are undertaken immediately before the impacts are expected to occur.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>o Therefore, OGIA has decided that the baseline assessment area for an aquifer, is the area where a water pressure fall of more than one metre is expected within three years. Responsible tenure holders must carry out baseline assessments for bores that tap an aquifer within the baseline assessment area for that aquifer. Each time the UWIR is reviewed, new baseline assessment areas are established until the baseline assessment areas for an aquifer coincide with the entire LTAA for the aquifer.</p> <p>DES is satisfied that this addresses the means for monitoring the quantity of water produced or taken from the area because of the exercise of relevant underground water rights.</p>
(ii) changes in the water level of, and the quality of water in, aquifers in the area because of the exercise of the rights.	YES	<p>Details are above.</p> <p>DES is satisfied that this addresses the means for monitoring the changes in the water level / quality of water in aquifers because of the exercise of relevant underground water rights.</p>
378(1)(b) the rationale for the WMS strategy.	YES	<p>The existing strategy is ongoing from previous iterations of the UWIR since its commencement in 2012.</p> <p>The strategy aims to:</p> <ul style="list-style-type: none"> • Identify groundwater impacts from petroleum development that may have occurred; • Improve knowledge about the groundwater systems and ability to predict impacts; • Support the evaluation of UWIR impact management strategies. <p>The WMS is designed to achieve these outcomes by the specification of a groundwater monitoring network. The network across the CMA has been built progressively over the life of</p>

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		<p>the CMA (since 2012). The design of the network is geared towards achieving the following objectives:</p> <ul style="list-style-type: none"> • Develop an understanding in background trends in groundwater pressure, due to climatic variability and extraction by non-CSG uses. • Identify pressure changes near areas of petroleum development, including the propagation of impacts from CSG reservoirs to over- and underlying geological formations. • Develop an understanding of how groundwater flows near connectivity features, where there is high potential for connectivity between CSG reservoirs and other aquifers. • Develop an understanding of how groundwater flows near high value assets, such as springs and water bores. • Improve conceptual understanding and future groundwater flow modelling, to assist in future validation and model predictions. <p>Considerations made towards designing the network include:</p> <ul style="list-style-type: none"> • Monitoring points should reasonably represent water pressure and water chemistry at the formation or sub-formation scale. • A higher density of monitoring points is required inside / near existing / proposed CSG development areas, relative to more distant areas (where background monitoring is required). • The use of suitable existing tenure holder monitoring points is maximised so that the drilling of new dedicated monitoring bores can be focussed in areas of greatest need.

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		<ul style="list-style-type: none"> As far as practicable, an integrated single monitoring network is established over time that meets the requirements of UWIR and other State and Commonwealth approval conditions. <p>OGIA have spoken specifically to the rationale for changes made to the existing monitoring network, which are:</p> <ul style="list-style-type: none"> Locations where tenure holders have recently constructed/ or plan to construct monitoring points (for specific purposes relating to ongoing investigation or to meet project approval conditions) align with the WMS network objectives, these locations have been integrated into the network. New monitoring points are added to specific locations where gaps in coverage are identified or where improvement is required in knowledge about groundwater flow or impact propagation in and around connectivity features. <ul style="list-style-type: none"> Example: four new monitoring nests have been added along the Hutton-Wallumbilla Fault, and one adjacent to the Horrane Fault, to investigate connections between reservoirs and adjacent aquifers. In recognising the heterogeneity of the Hutton and Springbok sandstone, new sub-formation-scale monitoring is specified within production areas, targeting the part of the formation closest to the reservoir. In shallower parts of the groundwater system, new monitoring is specified to provide better control on groundwater flow boundaries and the ability to assess impacts on environmental values such as terrestrial GDEs. At some of the older monitoring locations, the target formation is screened over a long interval or the equipment is beginning to fail, particularly those monitoring points that are installed with VWPs.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> o In locations where data continues to be required, monitoring points are to be replaced or repaired. o Where appropriate, the location is also rationalised in consideration of the other available data around that area; such as around Roma, where seven VWP nests are merged into four. • Some monitoring points are removed from the network due to infrastructure or equipment failure, or because of lack of saturation of the aquifer to measure the water level. • Some points are removed if there is sufficient data coverage from other points in the area. <p>Increased water chemistry parameters sought by OGIA, to include both major ions and isotopes, has been introduced into the WMS to enhance OGIA's ability to detect impacts from petroleum development in the CMA.</p> <p>DES is satisfied that the rationale for the WMS strategy is sound.</p>
378(1)(c) a timetable for implementing the WMS strategy.	YES	<p>It is understood that the WMS strategy is already under implementation, and is ongoing since 2012.</p> <p>For all new constructions, the responsible tenure holders are required to provide a summary of the planned design of monitoring points to OGIA for endorsement, prior to completion due dates discussed below. OGIA will subsequently respond within 10 business days of receipt of the information.</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>Following completion of the construction of a monitoring point, a monitoring bore completion diagram must be provided to OGIA within six months.</p> <p>On 1 April and 1 October of each year, the RTH must provide a WMS water monitoring report, in which, where a new monitoring point is required under the WMS, the RTH must provide:</p> <ul style="list-style-type: none"> the planned design of monitoring points prior to construction for endorsement by OGIA, and; upon completion, a monitoring bore completion diagram for endorsement by OGIA. <p>To ascertain 'due dates' for the completion of new/ replaced / repaired/ integrated monitoring points in the network, DES has reviewed the "List of all monitoring points in the water monitoring strategy" Excel spreadsheet (which forms supplementary information to the proposed UWIR on OGIA's website).</p> <ul style="list-style-type: none"> It is noted that the 'Proposed', 'Repair', 'Integrate' and 'Replace' monitoring points in this spreadsheet have corresponding dates under the header "UWIR Required". The description for this field is the 'Completion Due by (Year)', which is listed as a year such as 2019 or 2021, or is listed as 'Upon commencement of production testing or production on the associated block (UCP)'. It is taken that the year listed in this field is the year during or by which, the new monitoring point must have been installed and implemented. This would need to have consideration by the responsible tenure holder to ensure that enough preparation time had been allocated such that the necessary endorsements by OGIA had been completed in time.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		DES is satisfied that this timetable outlines the requirements for when responsible tenure holders must complete new / replaced / repaired / integrated monitoring point actions.
378(1)(d) a program for reporting to OGIA about the implementation of the WMS strategy.	YES	As above.
378(3)-The WMS must include a program for the responsible tenure holder(s) to undertake a baseline assessment for each water bore that is outside the area of a resource tenure, but within the predicted LTAA.	YES	<p>As covered in the section of this assessment report 376(1)(h)(i), there are 'rules' established by OGIA which determine responsible tenure holders for water bores outside of tenure boundaries:</p> <p><i>Rule 4: For a bore to which the baseline assessment program in section 8 7. 2 applies, but the bore is outside the land identified as P&G tenure in Figure 2-5, the responsible tenure holder is the authorised tenure holder over land identified as P&G tenure in Figure 2-5 that is closest to the bore.</i></p> <p>The actual timeframes for baseline assessments to be undertaken by the holder is discussed above, in the 378(1)(a)(i) section of this assessment report under "LTAAs" (reproduced below).</p> <p><i>OGIA has decided that the baseline assessment area for an aquifer, is the area where a water pressure fall of more than one metre is expected within three years.</i></p> <p><i>Responsible tenure holders must carry out baseline assessments for bores that tap an aquifer within the baseline assessment area for that aquifer. Each time the UWIR is reviewed, new baseline assessment areas are established until the baseline assessment areas for an aquifer coincide with the entire LAA for the aquifer.</i></p> <p>DES is satisfied this program establishes a timetable for when baseline assessments for bores outside of resource tenure but within LTAAs are to be undertaken.</p>
Spring Impact Management Strategy (SIMS) requirements		
379(1) - The SIMS must include each of the following for each spring of interest in the area to which the UWIR relates-		

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379(1)(a)-the details of the spring, including its location	YES	<p>The proposed UWIR's Chapter 9 addresses springs.</p> <p>"Spring of interest" means springs that overlie an aquifer with a predicted impact of more than 0.2 metres drawdown at any time. In other words, springs of interest are those that overlie an aquifer where the long-term predicted reduction in water pressure exceeds 0.2 metres.</p> <p>OGIA has used predictions from the regional groundwater flow model to identify springs of interest. The source aquifer (the aquifer providing the greatest contribution to groundwater discharge), the spring type, and discharge mechanism are provided in the proposed UWIR's Appendix I.I.</p> <p>A detailed list of each spring of interest including location coordinates is available on OGIA's website.</p> <ul style="list-style-type: none"> At the time of assessment, that website location was here, in this Excel spreadsheet. <p>Appendix I.1 states that in most cases, aquifers predicted to be affected by a drawdown impact of more than 0.2 metres do not actually feed the identified spring overlying the aquifer.</p> <p>That said, OGIA reports that there are 212 spring vents and 119 watercourse springs identified as springs of interest. The Excel file contains 216 spring vents and 119 watercourse springs.</p> <p>DES is satisfied with the approach to define 'springs of interest' as those whose source aquifers have a predicted impact of more than 0.2 metres of drawdown. DES is also satisfied that the information on the springs (including locations) are provided in the Excel spreadsheet on the website and that this forms part of the UWIR.</p>
379(1)(b)-an assessment of the connectivity between the spring and the aquifer over which the spring is located.	YES	<p>A connectivity assessment between springs and underlying aquifers has not been included in Chapter 9 nor in Appendix I of the proposed UWIR. However, results from such an assessment</p>

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		<p>undertaken previously by OGIA are included in the Excel spreadsheet on springs (referred to in the section above).</p> <p>The Excel spreadsheet on springs includes 216 spring vents and 119 watercourse springs (for a total of 335 springs). OGIA state that there are 212 spring vents and 119 watercourse springs as of interest (total of 331 springs). The discrepancy in the number of spring vents is not explained; however, given that the spreadsheet contains more springs rather than fewer, DES considers that all springs of interest are present within the spreadsheet, and, to be conservative, considers all 335 to be springs of interest.</p> <p>The spreadsheet lists the 'source aquifer' and 'geological control' against each spring. It does not list the underlying aquifer.</p> <p>For example:</p> <table><tr><th colspan="5">Location</th><th colspan="4">Hydrogeology</th></tr><tr><th>Complex</th><th>Name</th><th>Vent</th><th>Latitude</th><th>Longitude</th><th>Source aquifer</th><th>Geological control</th><th>Typology</th><th>Confidence</th></tr><tr><td>362</td><td>Cockatoo</td><td>321.7</td><td>-25.728932</td><td>150.250114</td><td>Precipice Sandstone</td><td>Outcrop</td><td>2</td><td>High</td></tr><tr><td>362</td><td>Cockatoo</td><td>321.8</td><td>-25.728712</td><td>150.250240</td><td>Precipice Sandstone</td><td>Outcrop</td><td>2</td><td>Hiah</td></tr><tr><td>370</td><td>Starlina</td><td>44</td><td>-25.458634</td><td>150.047581</td><td>Precipice Sandstone</td><td>Fault</td><td>1b</td><td>Hiah</td></tr><tr><td>371</td><td>Sprocket</td><td>37</td><td>-25.460890</td><td>150.080470</td><td>Precipice Sandstone</td><td>Fault</td><td>1a</td><td>Hiah</td></tr><tr><td>371</td><td>Sprocket</td><td>37.1</td><td>-25.460838</td><td>150.079812</td><td>Precipice Sandstone</td><td>Fault</td><td>1a</td><td>High</td></tr><tr><td>383</td><td>Onkaparinga</td><td>1231</td><td>-25.394000</td><td>150.146000</td><td>Precipice Sandstone</td><td>OutcroP</td><td>3</td><td>Low</td></tr><tr><td>437</td><td>Horror</td><td>682</td><td>-25.808097</td><td>148.734199</td><td>Hutton Sandstone</td><td>Outcrop</td><td>2</td><td>Low</td></tr></table>	Location					Hydrogeology				Complex	Name	Vent	Latitude	Longitude	Source aquifer	Geological control	Typology	Confidence	362	Cockatoo	321.7	-25.728932	150.250114	Precipice Sandstone	Outcrop	2	High	362	Cockatoo	321.8	-25.728712	150.250240	Precipice Sandstone	Outcrop	2	Hiah	370	Starlina	44	-25.458634	150.047581	Precipice Sandstone	Fault	1b	Hiah	371	Sprocket	37	-25.460890	150.080470	Precipice Sandstone	Fault	1a	Hiah	371	Sprocket	37.1	-25.460838	150.079812	Precipice Sandstone	Fault	1a	High	383	Onkaparinga	1231	-25.394000	150.146000	Precipice Sandstone	OutcroP	3	Low	437	Horror	682	-25.808097	148.734199	Hutton Sandstone	Outcrop	2	Low
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		<p>The assessment whereby source aquifers are identified for each spring is not included in the proposed UWIR. Rather, it is stated in the proposed UWIR that "The source aquifer for each spring complex was assessed as part of detailed conceptualisation work in 2015 (OGIA 2015, wetland Conceptualisation: A summary report on the conceptualisation of springs in the Surat Cumulative Management Area. Version 2.0, OGIA, Department of Natural Resources and Mines, Brisbane)." OGIA state that this assessment (the 2015 Wetland Report) incorporated secondary information about the springs, local and regional scale geology, hydrogeology, hydrochemistry and monitoring data."</p> <p>A copy of this report has been found online, here.</p> <p>It is considered self-evident that an assessment of the springs of interest and their connectivity to underlying aquifers was completed in order to produce the Excel spreadsheet on springs.</p> <p>Nevertheless, the 2015 Wetland Report has been considered by DES with regard to further determining whether OGIA has completed an assessment of the connectivity between each spring of interest and the aquifer over which the spring is located, and understanding the nature of this assessment.</p> <p>Findings include:</p> <ul style="list-style-type: none"> • In the 2015 Wetland Report, the term 'wetland' includes springs and watercourse springs used in Queensland legislative framework. • The scope of the 2015 Wetland Report was to develop revised conceptual models for 17 wetland complexes; and for these models to establish understanding on the interactions with the underlying hydrogeology, surrounding landscapes, and broad ecological water requirements of the wetland.

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		<ul style="list-style-type: none"> • The scope also included classifying the complexes, and using these classifications to identify wetlands that have formed through similar processes and are likely to respond to changes in the water regime in a similar fashion. • The 2015 Wetland Report concluded that: <ul style="list-style-type: none"> ◦ The dominant control on groundwater flow to the wetlands is groundwater flow along geological structures, or contacts between geological units. ◦ Many wetlands receive groundwater inflows from both regional (e.g. the Precipice Sandstone aquifer) and local groundwater systems. Local groundwater flows were found to often be a significant contributor of discharge. ◦ OGIA state that "at a number of wetlands, attributions of source aquifer have been revised in consideration of the new information." ◦ Not all wetlands are permanent features of the landscape, with many only having a seasonal/ ephemeral connection to the groundwater system. • The 2015 Wetland Report methodology included the detailed study of key element relating to the hydrogeology and ecological assemblages in the wetlands, such as the hydrogeological setting, geological structures, hydrology, geomorphology, hydrochemistry, wetland geometry, wetland dynamics, wetland flora and wetland macroinvertebrates. • Underlying aquifers for the wetlands of study were discussed in the wetland site summaries. <p>Therefore, although the process is not detailed within the proposed UWIR, the connectivity assessment (Wetland Conceptualisation, OGIA 2015) has been considered by DES; and, for the purposes of this assessment report, DES is satisfied that the assessment of the connectivity</p>

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		between springs and underlying aquifers has been carried out by OGIA. This assessment has resulted in the listing of each source aquifer against each spring of interest.
379(1)(c)-the predicted risk to, and likely impact on, the ecosystem and cultural and spiritual values of the spring because of a decline in water level of the aquifer over which the spring is located.	YES	<p>In assessing this legislative requirement, DES has considered the 'source aquifer' as identified by OGIA (rather than the underlying aquifer) as this is believed to be the relevant consideration in the spirit of the legislation.</p> <p>Therefore, the <i>risk I likely impacts</i> to ecosystems, <i>cultural I spiritual values</i> of 335 springs of interest are considered in relation to their assessed source aquifer, as identified by OGIA and described above.</p> <p><u>Ecological values of springs</u></p> <p>OGIA have found that a number of spring complexes support species and ecosystems recognised under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) and the Queensland <i>Nature Conservation Act 1992</i> (NC Act). OGIA understand that watercourse springs may also play an important role in maintaining stream ecosystem functions and processes, particularly during dry periods. OGIA have used information on the conservation significance of springs in assessing the risks to springs.</p> <ul style="list-style-type: none"> • To sustain ecological assemblages and functions, springs and watercourses have an ecological water requirement. Essentially, this is the water regime necessary to sustain the values of water-dependent ecosystems at a low level of risk. • Springs and watercourses require discharge above ground level to sustain wetlands. Available pressure at each spring varies and depends on a range of factors including the source aquifer and the elevation of the spring within the landscape. • In the Surat CMA, available pressure at springs varies from more than 20 to less than one metre above ground surface.

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		<ul style="list-style-type: none"> The water requirements of some spring wetlands are also met from local inflows, such as groundwater in shallow alluvium, surface water flows, rainfall and overland flow. At some locations, springs expand and contract in response to the presence of these additional inflows and changes in evapotranspiration, resulting in distinct seasonality in wetland extent and floristic composition. <p><u>Cultural/ Spiritual values of springs</u></p> <p>OGIA has considered a project undertaken by the Queensland Government where engagement was undertaken with Aboriginal people in the Murray-Darling Basin to further understand cultural values and uses of surface and groundwater.</p> <ul style="list-style-type: none"> The project highlighted the holistic and interconnected relationship between Aboriginal people and water - one connected system with spiritual, cultural, social, economic and environmental values. Water is vital for many aspects of Aboriginal life, such as fishing, hunting, swimming, storytelling, family gatherings, ceremonies and other sacred activities. Springs, in many cases, are permanent sources of water in semi-arid environments and are often associated with cultural values. <p>In addition to this recent project, a number of previous studies highlight the connection between cultural values and springs in the Surat CMA, which OGIA considered in the proposed UWIR. These values align with the following categories:</p> <ul style="list-style-type: none"> Mythological association: <i>the linkage between a spring and its water, and mythological events and/or creator beings or other beings.</i> Ritual and ceremonial association: <i>the role that a spring and its water play in the conduct of ceremonies. This may also be linked to the mythological associations.</i>

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		<ul style="list-style-type: none"> Economic and subsistence association: <i>the role that a spring, or group of springs, and the water available from them, play in the patterns of seasonal, economic and subsistence activities of particular Aboriginal groups.</i> Major or personal historical event: <i>events such as births, massacres, and long-term camping and habitation.</i> <p><u>Predicted impacts on springs</u></p> <p>OGIA carried out a risk assessment for all springs of interest to ensure management strategies could be commensurate with risk. The assessment:</p> <ul style="list-style-type: none"> identified springs for which responsible tenure holders are required to develop and implement mitigation actions; and identified locations where monitoring is required. <p>The risk assessment criteria related to:</p> <ul style="list-style-type: none"> the likelihood and timing of a drop in pressure in a source aquifer due to petroleum water extraction; the uncertainty associated with the predicted drop in pressure at the spring; and the consequence for the spring, should the pressure drop. <p>The likelihood was assessed using the regional groundwater flow model. The consequence was evaluated using a combination of factors, including the estimated magnitude of pressure in the spring's source aquifer and the conservation significance of the spring.</p> <p>Using this risk assessment, OGIA determined that there are eight spring groups where impacts of more than 0.2 metres are predicted in the springs' source aquifers due to petroleum activities (excluding the recharge impacts from reinjection to the Precipice/ Boxvale Sandstones).</p>

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		<div><div><ul style="list-style-type: none">The eight spring groups are marked in red in the summary table overleaf.The spring identifier is in parentheses in the 'Spring complex/ watercourse spring' field.</div><div>Out of the 335 springs of interest, 14 have predicted impacts (>0.2 m source aquifer decline). Of these 14 springs, 10 predict a maximum impact of less than one metre of drawdown. From the remaining four springs with greater than one metre of drawdown in the source aquifer, the Springrock Group predicts a maximum impact of 0.4 - 1.8 metres. The Department notes that this impacted may be influenced (risk reduced) by reinjection of water into the Precipice Sandstone. By contrast, Horse Creek predicts a maximum impact of 38 - 58 metres.</div></div> <table><tr><th>Spring Group</th><th>Spring complex/ watercourse spring</th><th>Source Aquifer</th><th>Max. Impact (m)</th><th>Years until 0.2m impact</th><th>2019 Risk Score</th></tr><tr><td rowspan="3">Spring rock</td><td>Springrock Creek (561)</td><td rowspan="7">Precipice Sandstone</td><td rowspan="3">0.4-1.8</td><td rowspan="3"><5</td><td>5</td></tr><tr><td>Hutton Creek (W216)</td><td>5</td></tr><tr><td>Hutton Creek (W217)</td><td>5</td></tr><tr><td>Lonely Eddie</td><td>Lonely Eddie (339)</td><td>0.6-0.8</td><td><5</td><td>4</td></tr><tr><td rowspan="3">311</td><td>Dawson River (W40)</td><td rowspan="3">0.4-0.7</td><td rowspan="3"><10</td><td>4</td></tr><tr><td>Hutton Creek (W81)</td><td>5</td></tr><tr><td>311 (311), Yebna 2 (591)</td><td>5</td></tr></table>	Spring Group	Spring complex/ watercourse spring	Source Aquifer	Max. Impact (m)	Years until 0.2m impact	2019 Risk Score	Spring rock	Springrock Creek (561)	Precipice Sandstone	0.4-1.8	<5	5	Hutton Creek (W216)	5	Hutton Creek (W217)	5	Lonely Eddie	Lonely Eddie (339)	0.6-0.8	<5	4	311	Dawson River (W40)	0.4-0.7	<10	4	Hutton Creek (W81)	5	311 (311), Yebna 2 (591)	5
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311	Dawson River (W40)		0.4-0.7	<10	4																											
	Hutton Creek (W81)				5																											
	311 (311), Yebna 2 (591)				5																											

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.					
		Cockatoo	Cockatoo Creek (W28)		0.3-0.5	8 - 12	4
			Cockatoo (362)				4
		Lucky Last	Lucky Last (230)	Boxvale Sandstone	0.2-0.4	<5	5
		Barton	Barton (283)	Gubberamunda Sandstone	0.0-0.5	>100	2
		Spring Group	Spring complex / watercourse spring	Source Aquifer	Max. Impact (m)	Years until 0.2m impact	2019 Risk Score
		Horse Creek	Horse Creek (W215)	Alluvium, Springbok Sandstone	38-58	<5	5
		Orana	Or (765)	Cenozoic	0.2-0.5	>100	3
		Scotts Creek	Scotts Creek (260)	Hutton Sandstone	< 0.2	N/A	3
		Abyss	Abyss (592)				3
		Eurombah	Eurombah Creek (W59)				3
		Dawson River	Dawson River 8 (8)				2

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		DES is satisfied that OGIA has sufficiently predicted the risk to, and likely impact on, the ecosystem and cultural and spiritual values of the spring because of a decline in water level of the aquifer sourced by the springs of interest.
379(1)(d)-a strategy, including the actions to be taken, for preventing or mitigating the predicted impacts on the spring or, if a strategy for preventing or mitigating the predicted impacts on the spring is not included, the reason for not including the strategy.	NO	<p>Out of 335 springs of interest, 14 have predicted impacts (>0.2 m source aquifer decline).</p> <p>Of these 14 springs, 12 are included in the six groups of springs that OGIA have identified as requiring mitigation actions, shown in the table overleaf (with ongoing assigned actions, and comments).</p> <p>The two springs not included are those with >100 years until the impacts are predicted (the Orana and Barton complexes).</p> <p>The prevention/ mitigation strategy to address s.379(1)(d) includes the obligations that responsible tenure holders must submit:</p> <ul style="list-style-type: none"> • A SIMS Monitoring Report to OGIA by 1 April and 1 October each year, for the sites listed in Appendix I.3 (which includes 11 of the 12 springs, but not "Hutton Creek W216"). The report must include the current status of the spring monitoring activities, the monitoring data collected, conclusions from the monitoring data and emerging implementation issues. • A Watercourse Spring Investigation Report to OGIA for the sites listed in Appendix I.2 (which includes all 12 springs of interest) within 12 months of the approval of the UWIR. The investigation must include the chemistry suite specified in Appendix I.2, and the report must include details of desktop investigations of the identified springs; details of field investigations of the springs; findings on groundwater-surface water connectivity of

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.											
		<p>the identified reach; and the identification of an ongoing monitoring program where the reach is identified as connected.</p> <ul style="list-style-type: none">A SIMS mitigation plan (and updates of previous plans) to DES for approval within six months of the approval of the UWIR, for mitigation sites identified in Appendix I.2 (which includes all 12 springs of interest). The plan must include a summary of the hydrogeological conceptualisation for the mitigation site; an evaluation of the options for prevention, minimisation, mitigation or offset of the predicted impacts, with specification of the preferred mitigation option; and a plan, including ongoing monitoring, mitigation actions, triggers and timeframes, for the implementation of activities. <p>OGIA note that some watercourse springs have been identified on the basis of a desktop assessment, but only those watercourse springs where field verification has been completed are included in the mitigation groups for mitigation strategies. Of particular note, there remains some uncertainty at Horse Creek, where additional site-specific field assessments are currently being undertaken by the responsible tenure holder (QGC). The requirement for a mitigation plan at Horse Creek will be reviewed by OGIA, following the outcomes of these investigations.</p> <table><tr><th>Group</th><th>Complex/ Watercourse</th><th>Actions</th><th>Residual Risk</th><th>RTH</th></tr><tr><td rowspan="2">Spring-rock</td><td>Springrock Creek (561)</td><td rowspan="2"><i>Ongoing:</i> Baseline survey, monitoring and local scale conceptualisation completed by the RTH. Nearby monitoring bores have been commissioned in the source aquifer.</td><td rowspan="2">High</td><td rowspan="2">Santos</td></tr><tr><td>Hutton Creek (W216)</td></tr></table>	Group	Complex/ Watercourse	Actions	Residual Risk	RTH	Spring-rock	Springrock Creek (561)	<i>Ongoing:</i> Baseline survey, monitoring and local scale conceptualisation completed by the RTH. Nearby monitoring bores have been commissioned in the source aquifer.	High	Santos	Hutton Creek (W216)
Group	Complex/ Watercourse	Actions	Residual Risk	RTH									
Spring-rock	Springrock Creek (561)	<i>Ongoing:</i> Baseline survey, monitoring and local scale conceptualisation completed by the RTH. Nearby monitoring bores have been commissioned in the source aquifer.	High	Santos									
	Hutton Creek (W216)												

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.				
			Hutton Creek 0,N217)	At this stage, no mitigation actions have been implemented.		
		311	Dawson River (0-46)	Ongoing: Baseline survey, monitoring and local scale conceptualisation completed by the RTH. Monitoring bores have been commissioned in the source aquifer.	Med	Santos
			Hutton Creek 0N81)			
			311(311), Yebna 2 (591)	At this stage, no mitigation actions have been implemented. Pressure responses from reinjection activities are predicted to delay impacts at this location.		
		Lonely Eddie	Lonely Eddie (339)	Site not previously identified. Actions to be specified by RTH in the SIMS mitigation plan.	High	Santos
		Lucky Last	Lucky Last (230)	Site not identified in the UWIR 2016. Actions to be specified by the RTH in the SIMS mitigation plan. No mitigation actions currently implemented. Pressure responses from reinjection activities are predicted to delay impacts at this location.	Med	Santos
		Horse Creek	Horse Creek 0Af215)	Site not previously identified. At this location, there is some uncertainty to the degree of connectivity between groundwater and surface water.	Mod	QGC

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.				
				The RTH is currently undertaking investigations. The need for ongoing monitoring or a mitigation plan will be reviewed following the outcomes of the RTH investigations.		
		Cocka- too	Cockatoo Creek NV28)	Site not previously identified.	Med	TBC*
			Cockatoo (362)	Pressure responses from reinjection activities will delay predicted impacts at this location. *Actions and the assignment of a RTH will be determined following initial assessments to be conducted by OGIA at this location.		
<p>* OGIA intend to undertake further assessments to improve understanding of impact propagation at this spring site, before assigning a responsible tenure holder, because predicted impacts are small and not predicted to occur for another -25 years.</p> <p>Where an unverified watercourse spring is identified as a high risk, field verification by tenure holders is necessary. The sites where this is required are listed in Table I-5 (Spring vents - sites and methods) and Table 16 (Watercourse springs - sites and methods) of Appendix 1.3, alongside the responsible tenure holder.</p> <p>For field verification, OGIA have determined:</p> <ul style="list-style-type: none">• This should include a dry season longitudinal survey of the reaches, to:<ul style="list-style-type: none">o assess where groundwater is discharging to stream; ando to identify the source aquifer;• The field methods must include:						

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> ○ surface water chemistry (recommended chemistry suites are provided in Appendix I, Table I-8), ○ stream gauging, and ○ the measurement of water levels and chemistry in nearby shallow water bores. <p>Where a watercourse spring is verified through these activities, OGIA will specify monitoring and mitigation actions where appropriate. OGIA state that their annual report will provide an update on the progress and outcomes from these activities.</p> <p>DES is satisfied with the selection of the 12 springs identified for mitigation actions, and the nomination by OGIA to postpone the SIMS in this proposed UWIR for the Orana and Barton complexes since it is predicted to be more than 100 years before predicted impact.</p> <p>DES is not satisfied with the proposed SIMS component 1 of 4 - the Monitoring Report.</p> <ul style="list-style-type: none"> • The spring "W216" is not listed as a monitoring point in Appendix I.3, Table I-6. Therefore, this site will not be monitored and included as per the SIMS Monitoring Report requirements reported to OGIA every six months. • DES notes that OGIA have provided the following justification: <i>"Nine spring complexes and six watercourse springs are identified for ongoing monitoring (Appendix 1.3, Table I-5 and Table 1-6). Springs vary considerably in terms of their ecological values, physical condition and suitability for monitoring. Site suitability in conjunction with the outcomes from the risk assessment have been used to guide site selection. Additional watercourse springs may be included following field validation. Appendix 1.3 specifies</i>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p><i>monitoring methods for each location, monitoring attributes and the responsible tenure holders."</i></p> <ul style="list-style-type: none"> • DES notes that W216 is one of two vent locations for the Hutton Creek watercourse spring in the Springrock group. The other 'at risk' vent associated with Hutton Creek, W217, is being monitored. While the particulars for suitability for monitoring are unknown by DES, it is understood that Hutton Creek is being monitored at one location. • DES requires that the rationality for not monitoring at W216 (in addition to W217) to be included in the UWIR (for example, the site's suitability for monitoring, cost of monitoring, etc.) for assessment. <p>DES is not satisfied with the proposed SIMS component 2 of 4 - the Watercourse Spring Investigation Report.</p> <ul style="list-style-type: none"> • DES notes that this component addresses all 12 of the springs in Appendix 12. • DES notes that the responsible tenure holder is to <i>identify an ongoing monitoring program where the reach [watercourse spring] is identified as connected.</i> • DES notes the strategy component requirement of being submitted to OGIA within 12 months from the UWIR's approval. • DES notes that there is not a provision within the proposed UWIR for the nominated monitoring programs to be approved by OGIA / DES, and to allow OGIA / DES to request further work by the responsible tenure holder, or to otherwise make changes to the proposed monitoring program, within specified timeframes.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • DES requires that provisions are incorporated into this component to ensure OGIA / DES approves the nominated monitoring program, with or without changes, with or without the responsible tenure holder's agreement, within reasonable timeframes. <p>DES is not satisfied with the proposed SIMS component 3 of 4 - the Mitigation Plan.</p> <ul style="list-style-type: none"> • DES notes that this plan is due to DES for approval within six months of the approval of the UWIR, and that all 12 springs of interest are included as per Appendix 12 • SIMS mitigation plans require the <i>evaluation of the options for prevention, minimisation, mitigation or offset of the predicted impacts, with specification of the preferred mitigation option.</i> <ul style="list-style-type: none"> ○ DES requires that the word "and" replaces the word "or" within this requirement, to clarify that all four options must be considered in the option evaluation. • SIMS mitigation plans require a <i>plan, including ongoing monitoring, mitigation actions, triggers and timeframes, for the implementation of activities.</i> <ul style="list-style-type: none"> ○ DES requires that provisions are incorporated into this component to ensure it is clear that DES may approve the nominated monitoring program, with or without changes, with or without the responsible tenure holder's agreement, or may require the responsible tenure holder to modify and resubmit for approval within DES' nominated timeframe. ○ DES requires that the UWIR also explicitly state that, once approved, the plan must then be implemented. ○ DES considers it necessary and desirable that the UWIR have a condition stating that <i>all plans/ programs / etc. must be implemented.</i>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>DES is not satisfied with the proposed SIMS component 4 of 4 - Field Verification for Mitigation.</p> <ul style="list-style-type: none"> • DES notes that the proposed UWIR explains that, in contrast to spring complexes, there has been less research into watercourse springs. • The proposed UWIR states that <i>some watercourse springs have been identified on the basis of a desktop assessment. Only watercourse springs where field verification has been completed are included in the mitigation groups.</i> • DES notes that field verification is required to be undertaken, in the manner described by OGIA in the proposed UWIR, by responsible tenure holders for unverified watercourse springs identified as a high risk. • The proposed UWIR states that: <i>Where an unverified watercourse spring is identified as a high risk, field verification by tenure holders is necessary. ... These sites are shown in Figure 9-2 and listed in Appendix 13</i> • DES observes that Figure 9-2 includes amber-coloured polylines referred to in the legend as "Mitigation site (unverified)". • DES observes that Appendix 13 includes: <ul style="list-style-type: none"> ◦ Tables 15 (<i>Spring vents - sites and methods</i>); ◦ Table 16 (<i>Watercourse springs- sites and methods</i>); ◦ Table 17 (<i>Attributes and methods</i>); ◦ Table 18 (<i>Water chemistry suite</i>); and ◦ Table 19 (<i>Target species list</i>); • From the above list of tables, DES deduces that Table 16 (<i>Watercourse springs - sites and methods</i>) would include the list of unverified watercourse springs to be investigated

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>by responsible tenure holders. Table 15 (<i>Spring vents- sites and methods</i>) would include spring vents (not watercourse springs) which require field verification.</p> <ul style="list-style-type: none"> • DES notes that the proposed UWIR also states <i>"Nine spring complexes and six watercourse springs are identified for ongoing monitoring (Appendix 13, Table 15 and Table 1-6). ... Additional watercourse springs may be included following field validation. Appendix 13 specifies monitoring methods for each location, monitoring attributes and the responsible tenure holders."</i> • DES considers it necessary that additional spring vents may also be included following field validation, rather than only watercourse springs. • Therefore, DES deduces that the springs requiring field verification are those in the five spring groups listed in Tables 15 and 16 which state <i>"Monitoring locations, methods and frequency to be proposed in RTH mitigation plan"</i>. <ul style="list-style-type: none"> o By that deduction, the five spring groups identified for field verification are: <ul style="list-style-type: none"> • Lonely Eddie (vent, complex 339); • Cockatoo (vent, complex 362); • Cockatoo Creek (watercourse, site W28); • Daswon River (watercourse, site W42); and • Horse Creek (watercourse, site W215). • DES notes that there is no timeframe listed for undertaking field investigations. • In searching the proposed UWIR for timeframes associated with undertaking field investigations for the five spring groups nominated, DES observes that <i>'details of any field investigations of the identified watercourse spring'</i> are required in the Watercourse

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>Spring Investigation Report required under SIMS component 2 of 4. This is required within 12 months of the UWIR's approval.</p> <ul style="list-style-type: none"> ○ However, this statement refers to sites listed in Appendix 12, whereas the five spring groups for field verification were listed in Appendix 13. • Consequently, DES referred to Appendix 1.2's Table 13 (<i>Spring complexes- predicted impacts and risk assessment results</i>) and Table 14 (<i>Watercourse springs- predicted impacts and risk assessment results</i>) to investigate whether the same five spring groups were captured. • From Table 13 (<i>Spring complexes- predicted impacts and risk assessment results</i>), DES found that: <ul style="list-style-type: none"> • Lonely Eddie (vent, complex 339) is listed as requiring a Mitigation Plan; and • Cockatoo (vent, complex 362) is listed as requiring a Mitigation Plan. • From Table 14 (<i>Watercourse springs- predicted impacts and risk assessment results</i>), DES found that: <ul style="list-style-type: none"> • Cockatoo Creek (W28) is listed as requiring a Mitigation Plan; • Dawson River (W42) is listed as requiring a Mitigation Plan; and • Horse Creek (W215) is listed as requiring a Mitigation Plan. • Therefore, all five groups identified from Appendix 13 as requiring field verification, are listed in Appendix 12 as requiring a Mitigation Plan.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> • DES notes that OGIA stated "<i>Only watercourse springs where field verification has been completed are included in the mitigation groups</i>" in the proposed UWIR. • Meanwhile, there are a further 15 sites in Table 14 (<i>Watercourse springs - predicted impacts and risk assessment results</i>) which are listed as requiring "Validation". • Of these 15 sites, seven have asterisks beside them, linking to the corresponding footnote "<i>The need for validation at these locations in the current UWIR cycle will be reviewed at the Annual Report in consideration of the industry development scenario.</i>" • DES found that the seven sites with asterisks were associated with "Years before >0.2 m" impact were at least four years, whereas the eight sites without asterisks had 0- 3 years before the predicted impact. • DES considers it likely that an error has been made in the proposed UWIR, whereby the sites referred to in Appendix 13 are NOT the sites requiring field validation. Instead, the sites requiring field validation are those 15 sites listed in Appendix 12, Table 14. • This requires verification from OGIA <p>o The Watercourse Spring Investigation Report only requires details of field investigations which have been carried out, without consequence should no investigation have been undertaken.</p>

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<ul style="list-style-type: none"> ○ DES requires that timeframes be incorporated into the field verification obligations, determining due dates for field verifications to have been completed. DES considers the 'years before predicted impact' should be utilised to inform which sites should be prioritised. • DES notes that for field verification, OGIA have determined that field methods must include the measurement of water levels and chemistry in nearby shallow water bores. ○ DES requires that 'nearby' and 'shallow' be described, to remove as much doubt as practicable regarding which water bores would be suitable to meet this requirement.
379(1)(e)-a timetable for implementing the strategy.	NO	DES is satisfied with the timetable for implementing the proposed strategy, apart from the absence of a clear timetable for undertaking field investigations / validation studies as discussed above.
379(1)(f)-a program for reporting to the OGIA about the implementation of the strategy.	YES	<p>As discussed above, the SIMS includes obligations that responsible tenure holders must submit:</p> <ul style="list-style-type: none"> • A SIMS Monitoring Report to OGIA by 1 April and 1 October each year, for the sites listed in Appendix 1.3. The report must include the current status of the spring monitoring activities, the monitoring data collected, conclusions from the monitoring data and emerging implementation issues. • A Watercourse Spring Investigation Report to OGIA for the sites listed in Appendix 1.2 within 12 months of the approval of the UWIR. The investigation must include the chemistry suite specified in Appendix 1.2, and the report must include details of desktop investigations of the identified springs; details of field investigations of the springs; findings on groundwater-surface water connectivity of the identified reach; and the identification of an ongoing monitoring program where the reach is identified as connected.

Statutory requirement	Is the statutory requirement met?	Provide details of how the UWIR does or does not meet the statutory requirements, or why the requirement is not relevant to the UWIR.
		<p>In addition to reporting the above to OGIA, there is an obligation that a SIMS mitigation plan (and updates of previous plans) be submitted to DES for approval within six months of the approval of the UWIR, for mitigation sites identified in Appendix I.2. The plan must include a summary of the hydrogeological conceptualisation for the mitigation site; an evaluation of the options for prevention, minimisation, mitigation or offset of the predicted impacts, with specification of the preferred mitigation option; and a plan, including ongoing monitoring, mitigation actions, triggers and timeframes, for the implementation of activities.</p> <p>DES is satisfied that there is a program in place for reporting to OGIA (and DES) about the SIMS' implementation.</p>

6 Actual and proposed consultation (provide for natural justice)

A letter from DES to OGIA, dated 26 September 2019, informed OGIA that "Initial assessment of the proposed UWIR has been completed, with the identification of several areas which require potential modification before the proposed UWIR can be recommended for approval."

OGIA was asked to provide a response on or before 11 October 2019, as to whether the information had been overlooked; or if OGIA would need to gather information and/or otherwise modify the proposed UWIR to address the item(s).

OGIA requested a meeting to better understand the items and DES' request for a response. This meeting was held on 8 October 2019.

OGIA provided their response to DES via a letter on 17 October 2019.

The items to be addressed, OGIA's responses, DES' consideration of the response, and DES' recommendation for how to proceed pursuant to legislative requirements, was produced as part of this assessment, as:

[*Assessment Report Supplementary Document 2 - Consultation with OGIA on the Proposed UWIR.*](#)

7 Advice from the Office of Groundwater Impact Assessment-section 385(3) of the Water Act

N/A- The UWIR was submitted by the Office of Groundwater Impact Assessment.

8 Recommendation

It is recommended that the responsible entity should be directed to modify and resubmit the UWIR under section 384 of the Water Act. DES has had consideration to which items are considered those which MUST be done, SHOULD be done and would be NICE to do. Only those which are considered MUST be done will be included in the direction notice. Other items will be discussed with OGIA where appropriate for potential inclusion and continuous improvement of the proposed UWIR.

It is recommended that the following modifications should be made to the UWIR:

The report must be modified as follows:

Section (Water Act 2000)	Legislative Requirement	Modification Requirement
376(1)(b)(ii)	An underground water impact report must include, for each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights- an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers.	It is appropriate that each likely / affected aquifer's analysis is distinctly included, and described, in the proposed UWIR. A description of groundwater movement, connectivity and water level trend analysis for the Clematis Sandstone aquifer is not explicitly discussed in the proposed UWIR.
376(1)(b)(iii)	An underground water impact report must include, for each aquifer affected, or likely to be affected, by the exercise of the	It is appropriate that each likely/ affected aquifer's analysis is distinctly included, and described, in the proposed UWIR; and that

Assessment report
Underground water impact report

Section (Water Act 2000)	Legislative Requirement	Modification Requirement
	<p>relevant underground water rights- an analysis of the trends in water level change for the aquifer because of the exercise of the rights mentioned in paragraph (a)(i).</p> <p>Note: the exercise of the rights mentioned in paragraph (a)(i) is - <i>for the area to which the report relates- the quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights.</i></p>	<p>such an analysis is included discretely for each time period (in this instance, relating to previous exercise discretely from predicted impacts due to exercise in the next three years, and discretely from predicted impacts due to exercise until the end of the life of tenure).</p> <p>An analysis and discussion of the trends in water level change for the Clematis Sandstone, the Bandanna Formation and the Cattle Creek Formation because of previous exercise of relevant underground water rights - distinct from any impacts which may occur from current, upcoming or longer term future exercise - are included in the proposed UWIR.</p>
376(1)(da)	<p>An underground water impact report must include a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.</p>	<p>It is appropriate that each environmental value that has been, or could yet be, impacted from any previous exercise of underground water rights is described; and that the description be discrete from any other description of impacts on environmental values that will or are likely to occur because of any future exercise.</p> <p>It is appropriate that, as a minimum, the following environmental values are described across the CMA:</p> <ul style="list-style-type: none"> - Aquifer pressure (water level; groundwater flow direction and flow rate); - Water bores (water level); - Spring vents and groundwater connected watercourses (water level); - Terrestrial groundwater dependent ecosystems (GDEs) (water level); - Groundwater quality (water quality objectives; groundwater flow direction and flow rate; movement (flow direction and rate) of underground water within /from/ towards sites of existing harmed groundwater environments); and - Stratigraphic compaction (land subsidence).

Assessment report
Underground water impact report

Section (Water Act 2000)	Legislative Requirement	Modification Requirement
		<p>A description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights, is not explicitly discussed in the proposed UWIR for the minimum set of environmental values described above.</p>
376(1)(db)(i)	<p>An underground water impact report must include an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights- during the period mentioned in paragraph (a)(ii).</p> <p>Note: the period mentioned in (a)(ii) is - a 3-year period starting on the consultation day for the report.</p>	<p>It is appropriate that an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights during the three year period starting on the consultation day for the report is included in the proposed UWIR - and that the exercise during the three year period is described discretely from other time periods (though it may be appropriate to include compounded impacts from past exercise).</p> <p>It is appropriate that, as a minimum, the following environmental values are described across the CMA:</p> <ul style="list-style-type: none"> - Aquifer pressure (water level; groundwater flow direction and flow rate); - Water bores (water level); - Spring vents and groundwater connected watercourses (water level); - Terrestrial groundwater dependent ecosystems (GDEs) (water level); - Groundwater quality (water quality objectives; groundwater flow direction and flow rate; movement (flow direction and rate) of underground water within / from / towards sites of existing harmed groundwater environments); and - Stratigraphic compaction (land subsidence). <p>An assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights during the three year period starting on the consultation day for the report, is not explicitly discussed in the proposed UWIR for the minimum set of environmental values described above.</p>

Assessment report
Underground water impact report

Section (Water Act 2000)	Legislative Requirement	Modification Requirement
376(1)(db)(ii)	An underground water impact report must include an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights- over the projected life of the resource tenure.	<p>It is appropriate that an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights over the projected life of the resource tenure is included in the proposed UWIR - and that the exercise over the projected life of the resource tenure is described discretely from other time periods (though it may be appropriate to include compounded impacts from past and the upcoming three year period's exercise of underground water rights).</p> <p>It is appropriate that, as a minimum, the following environmental values are described across the CMA:</p> <ul style="list-style-type: none"> - Aquifer pressure (water level; groundwater flow direction and flow rate); - Water bores (water level); - Spring vents and groundwater connected watercourses (water level); - Terrestrial groundwater dependent ecosystems (GDEs) (water level); - Groundwater quality (water quality objectives; groundwater flow direction and flow rate; movement (flow direction and rate) of underground water within / from / towards sites of existing harmed groundwater environments); and - Stratigraphic compaction (land subsidence). <p>An assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights over the projected life of the resource tenure, is not explicitly discussed in the proposed UWIR for the minimum set of environmental values described above.</p>
378(3)	A responsible entity's water monitoring strategy must include, for each immediately affected area and long-term affected area identified in its underground water impact report- a program for the responsible	It is appropriate that there be a program for responsible tenure holders to be identified for bores requiring baseline assessments, where bores are not within the boundary of petroleum tenure; and that this program include (as a minimum):

Section (Water Act 2000)	Legislative Requirement	Modification Requirement
	<p>tenure holder or holders under the report to undertake a baseline assessment for each water bore that is - (a) outside the area of a resource tenure; but (b) within the area shown on the map prepared under section 376(b)(v).</p> <p>Note - the area shown on the map prepared under section 376(b)(v) is - <i>for each aquifer affected, or likely to be affected, by the exercise of the relevant underground water rights - the area of the aquifer where the water level is predicted to decline, because of the exercise of relevant underground water rights, by more than the bore trigger threshold at any time.</i></p>	<ul style="list-style-type: none"> - Identifying details of the bore (such as a unique identifying number, location coordinates, etc.); - Identifying the responsible tenure holder for each bore; and - Identifying a timeframe for the baseline assessment to be completed by. <p>The proposed UWIR does not include all of the minimum details listed above.</p>
382(4)(b)	<p>The responsible entity must advise the chief executive that the entity has complied with subsections (1) and (2).</p> <p>Note: subsections (1) and (2) are -</p> <p>(1) <i>The responsible entity must -</i></p> <ul style="list-style-type: none"> a. <i>publish a notice about the proposed underground water impact report or final report in the way required by the chief executive; and</i> b. <i>give a copy of the notice to each owner of a water bore within the area to which the report relates.</i> <p>(2) <i>The responsible entity for a cumulative management area must also give a copy of the notice to each holder of a CMA tenure within the area, other than the holder of a closing CMA tenure.</i></p>	<p>Note: Ensuring that the notice in subsection (1)(a) (as drafted by OGIA) has been approved in a way required by the chief executive prior to the notice being issued, does not in itself satisfy the requirement for the statement of compliance with subsections 382(1) and (2).</p> <p>A statement of compliance with subsections 382(1) and (2) is not provided in the proposed UWIR.</p>

Assessment report Underground water impact report

Note: DES considers that the report SHOULD be modified for (see [Assessment Report Supplementary Document 2 - Consultation with OG/A on the Proposed UWIR](#) for references):

Finding Item D	Legislation	Item Description
7(a)	378(1)(a)(ii) and 378(2)(c)	OGIA must include a strategy for monitoring changes in the water level of, and the quality of water in, aquifers in the area because of the exercise of the rights. s. 378(2)(c) requires that the strategy include the frequency of the measurements.
8(a)	378(2)(a)	OGIA must include a water monitoring strategy which includes the parameters to be measured.
10(a)	379(1)(a)	OGIA's spring impact management strategy must include each of the following for each spring of interest in the area to which the entity's underground water impact report relates - the details of the spring, including its location.
11 (b)	379(1)(d)	As above.
11 (c)	379(1)(d)	As above.
11 (d)	379(1)(d)	As above.
11 (e)	379(1)(d)	As above.
11 (f)	379(1)(d)	As above.
11 (g)(h)	379(1)(d)	As above.
11 (i)	379(1)(d)	As above.
11 (k)	379(1)(d)	As above.
11 (l)	379(1)(d)	As above.
11(m)	379(1)(d)	As above.
12(a)	379(1)(e)	OGIA's Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, - a timetable for implementing the strategy.
13	376(1)(a)(i) and (ii)	OGIA have tallied one geological unit in the incorrect geological basin.
19	379(1)(b)	The spring impact management strategy must include, for each spring of interest in the area to which the UWIR relates, an assessment of the connectivity between the spring and the aquifer over which the spring is located.
20	370(1)(a)	The proposed UWIR should be presented and assessed as a single, static proposal with all supporting records / reports / etc. locked in at the time of assessment for the purpose of assessment. Dynamic records / reports / etc. should not be used to form part of the proposed UWIR.

Assessment report
Underground water impact report

Note: DES considers that the report COULD (would be NICE to) be modified for (see [Assessment Report Supplementary Document 2 - Consultation with OGIA on the Proposed UW/R](#) for references):

Finding Item ID	Legislation	Item Description
11 (a)	379(1)(d)	OGIA's Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, - a strategy, including the actions to be taken, for preventing or mitigating the predicted impacts on the spring; or, if a strategy for preventing or mitigating the predicted impacts on the spring is not included, the reason for not including the strategy.
14	376(1)(a)(i)	The quantity of water produced or taken from the area because of the exercise of any previous relevant underground water rights must be provided - OGIA have provided the data only as a graph (not as values)
15	376(1)(a)(ii)	An estimate of the quantity of water to be produced or taken because of the exercise of the relevant underground water rights for a 3-year period starting on the consultation day for the report must be included - OGIA have provided the data only as a graph (not values).
17	376(1)(da), (db)(i) and (db)(ii)	Risk classification scheme used for terrestrial GDEs - to be considered for modification between DES/ Herbarium / OGIA for subsequent UWIRs.
21	370(1)(a)	OGIA may provide details around the professional peer review of the final calibrated underground water model.

Assessing officer	
Signature:	Date: 29 October 2019
Name: Julia Miller	Position: Principal Environmental Officer

9 Approval

In reviewing the above assessment considerations, and the details of the *Water Act 2000* relevant to the decisions required to be made on the UWIR, I make a decision to approve the UWIR subject to conditions, in accordance with s.385(1)(a).

In making this decision, I have considered the details subject to this assessment report and identified areas of the legislation where the UWIR has not included or described with sufficient detail, as described by the assessing officer, the content requirements relevant to s.376 of the *Water Act 2000*.

In considering the assessment report, I am also aware that the *Water Act 2000*, provides that the chief executive must within 60 business days after receiving the report, decide to approve the report, with or without conditions; or to require the responsible entity to modify the report under s.384.

In accordance with s.384 if the chief executive considers the report is inadequate in a material particular, the chief executive **may** give the responsible entity for the report a notice requiring the UWIR to be modified and resubmitted in a particular way. There is no requirement under the *Water Act 2000*, that the chief executive **must** require the report to be modified to address inadequacies in material particular.

It is my opinion that an appropriate strategy and method to manage the identified insufficiencies in the UWIR would be to require further assessment and necessary action to address those insufficiencies, with conditions. I recommend that conditions are imposed under section 385(1)(a) as a more appropriate method to achieve the outcomes required of the UWIR.

The imposed conditions would form part of the approved report, and enable the chief executive a clear legislative pathway to ensure measures and programs are in place to respond to impacts on underground

Assessment report
Underground water impact report

Assessing officer	
Signature: sch4p4(6) Personal information	Date: 28 October 2019
Name: Julia Mfller	Position: Principal Environmental Officer

9 Approval

The recommendation is approved.

--

Signature

28 Oct 2019

Date

Clancy Mackaway
Manager
Delegate of the chief executive
Chapter 3 of the *Water Act 2000*
Department of Environment and Science

Assessment report
Underground water impact report

water, while allowing for further considered assessment on issues (covered by the conditions, based on the above assessment findings) to be undertaken in a manner determined appropriate by the chief executive.

The decision to approve the report, and impose conditions further enables the adaptive management regime of impacts to groundwater through the *Environmental Protection Act 1994*, by ensuring that there is sufficient monitoring, collection and review of information for ongoing adaptive management of groundwater.

The recommendation is to approve the report with conditions, subject to s.385(1)(a) of the *Water Act 2000*.

sch4p4(6) Personal information

Signature

29 October 2019

Date

Clancy Mackaway
Manager
Delegate of the chief executive
Chapter 3 of the *Water Act 2000*
Department of Environment and Science

From: [PANDEY Sanjeev](#)
To: [MILLER Julia](#)
Cc: [MARSHALL Hugh](#); [MACKAWAY Clancy](#); [BIRCH Kerynne](#); [SuratUWIR](#)
Subject: RE: Proposed 2019 Surat CMA UWIR - Initial Assessment
Date: Monday, 21 October 2019 10:49:52 AM
Attachments: [image004.png](#)
[image006.png](#)
[image009.png](#)
[image003.png](#)
[image005.png](#)

Hi Julia

I have completed the matching table below with additional comments that you asked for in the email, following our further conversation this morning.

As stated in my response letter, combined responses were provided and mapped to each of the items number from DES's assessment. The corresponding items are mapped in brackets at the end of each heading in the response letter. We took this approach because of the common context that applies to many of the items.

Hope this helps.

Regards

Sanjeev

Content of UWIR – s. 376	
Original Finding (Put to OGIA for Response)	OGIA's Response
<p>4) s. 376(1)(da) requires a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.</p> <p>a) Information on pressure declinations has been provided for the GAB, Precipice Sndst and the Bowen, Cattle Creek Fm. However, the statements that 'significant</p>	<p>Response to this item is under the first and second heading of the response letter, i.e.:</p> <ul style="list-style-type: none"> <i>Interconnectivity, groundwater flow and trend analysis; and</i> <i>Assessment of impacts on environmental values</i> <p>Observed impacts from past exercise of P&G water rights and non-CSG development (water users) are reflected in observed monitoring data which is used in model calibration. Also, predicted impacts from P&G in the short and long term, as presented in the UWIR, include impacts from past exercise of water rights.</p> <p>As outlined in the third bullet point of pg 2 of the response letter, apart from CSG reservoirs – Walloon Coal Measures, Bandanna Formation and the Cattle Creek Formation, it is not possible to quantify CSG impacts in other surrounding aquifer. This is detailed in length in Chapter 5 of the UWIR, and in particular s5.2 and s5.3</p>

<p>drawdown / significant impact has already been observed' at the GAB, Walloon Coal Measures and Bowen, Bandanna Fm is considered insufficient in description. DES requires that these statements be elaborated and characterised / quantified.</p>	
<p>b) No information has been provided on impacts from past exercise of water rights on water bores in the following units: GAB, Hutton Sndst; Bowen, Bandanna Fm; Bowen, Cattle Ck Fm; and GAB, Walloon Coal Measures. DES interprets this as a determination that no impacts have been observed, but considers it desirable to have this determination be confirmed.</p>	<p>As above</p>
<p>c) Insufficient information has been provided for impacts from past exercise of water rights on</p>	<p>OGIA stated, "So far, the only observed impact in surrounding aquifers is in the Springbok Sandstone at three locations (detailed in s5.4.2) which does not support EVs in those areas. No impacts are currently identified in other aquifers, implying that there is no impact on associated EVs."</p> <p>Yes it is intended to match this item. As above, impacts from past exercise of water rights are observed impacts – to which the Chapter 5 of the UWIR is</p>

<p>bores in the GAB, Springbok Sndst: "Actual impacts have been observed at some locations within the formation." DES requires that this statement be elaborated and characterised / quantified.</p>	<p>dedicated to. Observed impacts from past exercise of P&G water rights and non-CSG development (water users) are reflected in observed monitoring data which is used in model calibration. Also, predicted impacts from P&G in the short and long term, as presented in the UWIR, include impacts from past exercise of water rights.</p> <p>The bores are impacted when aquifers are impacted. If there are no impacts observed on aquifers of the GAB then bores sourcing water from those aquifers are also not impacted. The only exception is Walloon Coal Measures and Bandanna Formation where almost all impacts are attributed to CSG (para 2, pg 67 of the Final UWIR). Practically all of the impacted bores are decommissioned or made good as part of Chapter 3 or as a proactive measure by the CSG companies. Similarly observed drawdowns in Springbok Sandstone at three locations are attributed to CSG. No other aquifers are found to be likely impacted.</p> <p>As offered in the response letter, if required the Final UWIR could be amended to add such explicit statements.</p>
<p>d) No information has been provided on whether any drawdown has occurred, or is predicted to occur, from the exercise of groundwater rights undertaken to date in the following springs: Springrock, Lonely Eddie, 311, Cockatoo, Lucky Last, Barton, Horse Creek, Orana, Scott's Creek, Abyss, Eurombah, and Dawson River.</p>	<p>As above. Similar to water bores, springs are impacted if source aquifers are impacted. As stated in the UWIR, no impacts are observed at this stage in aquifers that support springs, particularly in the area where springs are located.</p>
<p>6) s. 376(1)(db)(ii) requires an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of</p>	<p>DES has had regard to the proposed UWIR's s.7.3.6 "Bandanna Formation" where it is stated:</p> <p><i>"Significant impact has already been observed and a substantial LAA is predicted, as shown in Figure 7-2; however, this formation is not commonly used for water supply purposes. There is only one water bore that sources water from this formation in the LAA."</i></p> <p>DES requires that this bore is described with a likely maximum impact, expressed by a</p>

<p>the exercise of underground water rights – over the projected life of the resource tenure.</p> <p>c) Information has been provided that there is one LTAA water bore targeting the Bowen, Bandanna Fm; however the predicted magnitude of the impact has not been included.</p>	<p>value.</p> <p>The bore number is RN22182. Bore search tool provides long term impact as 312.5m and year of max impact as 2030.</p>
<p>7) s. 379(1)(d) requires that the Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, — a strategy, including the actions to be taken, for preventing or mitigating the predicted impacts on the spring; or, if a strategy for preventing or mitigating the predicted impacts on the spring is not included, the reason for not including the strategy.</p> <p>j) DES considers it necessary that additional spring vents may also be included following field validation,</p>	<p>Unlike watercourse springs, the spring complexes are reasonably well mapped in the Surat CMA, particularly in and around the CSG production areas. Position of spring vents within a complex tends to be dynamic and may change over time in response to hydrogeological conditions applicable to the complex. Therefore, impact assessment, risk assessment, and corresponding mitigation and monitoring strategies are also primarily focused on spring complex level (and sometime at spring group level). Additional vents outside existing complexes are less likely to be found in field verification processes. However, if such additional vents are found, then they will be reported through the Annual Report process and included in the subsequent UWIR assessment.</p>

rather than only watercourse springs.	
<p>l) With regard to field methods for undertaking field validation, DES requires that 'nearby' and 'shallow' be described, to remove as much doubt as practicable regarding which water bores would be suitable to meet this requirement.</p>	<p>Watercourses are generally connected to outcropping formations or shallow alluviums over which they flow. Therefore 'shallow' bores are bores that are likely to be in formations that may be connected to watercourses and may provide information about water pressure and chemistry for such connectivity assessment. The distance (i.e. how nearby) and depth (i.e. how shallow) of these bores would depend on local hydrogeological conditions. If required, a statement to this effect could be added in the final UWIR.</p>
<p>19) Note – for identifying source aquifers of springs of impact, the actual assessment is not included in the proposed UWIR. Rather, it is stated that "The source aquifer for each spring complex was assessed as part of detailed conceptualisation work in 2015 (OGIA 2015, Wetland Conceptualisation: A summary report on the conceptualisation of springs in the Surat Cumulative Management Area. Version 2.0, OGIA, Department of Natural Resources and Mines, Brisbane)." DES notes this report is not available on the OGIA website. DES prefers the proposed UWIR to include details on this assessment process, at least as a summary; and prefers that the reports referenced</p>	<p>Report is available on OGIA's website at the location below. It was originally made available in 2016.</p> <p>https://www.dnrm.qld.gov.au/_data/assets/pdf_file/0009/1394298/springs-in-the-surat-cma.pdf</p>

in the UWIR are provided on the website (and / or as hyperlinks in the proposed UWIR).



Sanjeev Pandey

Executive Director

Office of Groundwater Impact Assessment

Department of Natural Resources, Mines and Energy

P: 07 3199 7316 **M:** 04 (6) Personal inform

E: sanjeev.pandey@dnrm.qld.gov.au **W:**

<https://www.dnrm.qld.gov.au/ogia>

From: MILLER Julia <Julia.Miller@des.qld.gov.au>

Sent: Monday, 21 October 2019 7:56 AM

To: SuratUWIR

Cc: PANDEY Sanjeev; MARSHALL Hugh; MACKAWAY Clancy; BIRCH Kerynne

Subject: RE: Proposed 2019 Surat CMA UWIR – Initial Assessment

Hi Sanjeev *et al.*,

Thank you for your response dated 17 October.

I've done my best to match the responses to each item – however there are a few that I could not find answers for; or where I was unsure if the response I had matched, was the response intended for that item.

Could you please:

- assist with matching responses to the items, or
- providing a response, or
- confirming that OGIA are satisfied with not providing any additional response to the item (e.g. perhaps in deference to overarching paragraphs previously provided for the section, in the original letter)?

As I am in the finalisation stages of the assessment, please provide your response by the end of today (Monday, 21 October) for consideration.

The items are tabulated below. The original item number is retained, with new letters (a, b, c...) to help distinguish components of each item.

I am satisfied I've found responses for all other items.

Please write your response (perhaps in a distinguishing font colour) into the "OGIA's Response" column, below what is already written.

Content of UWIR – s. 376	
Original Finding (Put to OGIA for Response)	OGIA's Response
<p>4) s. 376(1)(da) requires a description of the impacts on environmental values that have occurred, or are likely to occur, because of any previous exercise of underground water rights.</p> <p>a) Information on pressure declinations has been provided for the GAB, Precipice Sndst and the Bowen, Cattle Creek Fm. However, the statements that 'significant drawdown / significant impact has already been observed' at the GAB, Walloon Coal Measures and Bowen, Bandanna Fm is considered insufficient in description. DES requires that these statements be elaborated and characterised / quantified.</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>
<p>b) No information has been provided on impacts from past exercise of water rights on water bores in the following units: GAB, Hutton Sndst; Bowen, Bandanna Fm; Bowen, Cattle Ck Fm; and GAB, Walloon Coal Measures. DES interprets this as a determination that no impacts have been observed, but considers it desirable to have this determination be confirmed.</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>
<p>c) Insufficient information has been provided for impacts from past exercise of water rights on bores in the GAB, Springbok Sndst: "Actual impacts have been observed at some locations within the formation." DES requires that this statement be elaborated and characterised / quantified.</p>	<p>OGIA stated, "So far, the only observed impact in surrounding aquifers is in the Springbok Sandstone at three locations (detailed in s5.4.2) which does not support EVs in those areas. No impacts are currently identified in other aquifers, implying that there is no impact on associated EVs."</p> <p>DES is unsure if this response is intended to match this item. The item does not appear to have been addressed.</p>
<p>d) No information has been provided on whether any drawdown has occurred, or is predicted to occur, from the exercise of groundwater rights undertaken to date in the following springs: Springrock, Lonely Eddie, 311, Cockatoo, Lucky Last, Barton, Horse Creek, Orana, Scott's Creek,</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>

<p>Abyss, Eurombah, and Dawson River.</p>	
<p>6) s. 376(1)(db)(ii) requires an assessment of the likely impacts on environmental values that will occur, or are likely to occur, because of the exercise of underground water rights – over the projected life of the resource tenure.</p> <p>c) Information has been provided that there is one LTAA water bore targeting the Bowen, Bandanna Fm; however the predicted magnitude of the impact has not been included.</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p> <p>DES has had regard to the proposed UWIR's s.7.3.6 "Bandanna Formation" where it is stated:</p> <p><i>"Significant impact has already been observed and a substantial LAA is predicted, as shown in Figure 7-2; however, this formation is not commonly used for water supply purposes. There is only one water bore that sources water from this formation in the LAA."</i></p> <p>DES requires that this bore is described with a likely maximum impact, expressed by a value.</p>
<p>6) s. 379(1)(d) requires that the Spring Impact Management Strategy (SIMS) must include, for each spring of interest in the area to which the UWIR relates, —a strategy, including the actions to be taken, for preventing or mitigating the predicted impacts on the spring; or, if a strategy for preventing or mitigating the predicted impacts on the spring is not included, the reason for not including the strategy.</p> <p>j) DES considers it necessary that additional spring vents may also be included following field validation, rather than only watercourse springs.</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>
<p>l) With regard to field methods for undertaking field validation, DES requires that 'nearby' and 'shallow' be described, to remove as much doubt as practicable regarding which water bores would be suitable to meet this requirement.</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>
<p>19) Note – for identifying source aquifers of springs of impact, the actual assessment is not included in the proposed UWIR. Rather, it is stated that "The source aquifer for each spring complex was assessed as part of detailed conceptualisation work in 2015 (OGIA 2015, <i>Wetland Conceptualisation: A summary report on the conceptualisation of springs in the Surat Cumulative Management Area. Version 2.0</i>, OGIA, Department of Natural Resources and Mines, Brisbane)." DES notes this report is not available on the OGIA website. DES prefers the proposed UWIR to include details on this assessment process, at least as a summary; and prefers that the reports referenced in the UWIR are provided on the website</p>	<p>DES is unable to find a response from OGIA in reference to this item.</p>

(and / or as hyperlinks in the proposed UWIR).

Many thanks,

Julia Miller

Principal Environmental Officer

Energy and Extractive Resources | Brisbane

Energy, Extractive and South West Queensland Compliance

Environmental Services and Regulation

Department of Environment and Science

P 07 3330 5620 | E julia.miller@des.qld.gov.au

Level 7, 400 George Street, Brisbane

GPO Box 2454, BRISBANE QLD 4001



From: SuratUWIR <SuratUWIR@dnrme.qld.gov.au>

Sent: Thursday, 17 October 2019 12:20 PM

To: MILLER Julia

Cc: MACKAWAY Clancy; COPP Rachel; BIRCH Kerynne; PANDEY Sanjeev

Subject: RE: Proposed 2019 Surat CMA UWIR - Initial Assessment

Julia,

Please find attached a letter from OGIA to DES, including attachments, in response to the letter from Rachel Copp dated 26 September.

Cheers,

-Hugh



Hugh Marshall

Project Officer

Office of Groundwater Impact Assessment

Department of Natural Resources, Mines and Energy

[07 3199 7317](tel:0731997317) | hugh.marshall@dnrme.qld.gov.au

Level 5, 1 William St, Brisbane QLD 4000

PO Box 15216, City East QLD 4002

From: MILLER Julia <Julia.Miller@des.qld.gov.au>

Sent: Thursday, 26 September 2019 2:32 PM

To: PANDEY Sanjeev; SuratUWIR

Cc: COPP Rachel; MACKAWAY Clancy

Subject: Proposed 2019 Surat CMA UWIR - Initial Assessment

Good afternoon Sanjeev,

Please see the attached letter with regard to the proposed 2019 Surat CMA UWIR.

Do not hesitate to get in touch with me if you would like to meet and discuss any of the items raised for

OGIA's review and response.

Kind regards,

Julia Miller

Principal Environmental Officer

Energy and Extractive Resources | Brisbane

Energy, Extractive and South West Queensland Compliance

Environmental Services and Regulation

Department of Environment and Science

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