



Surat Gas Project

SPRINGVALE & GRASSDALE
Area-wide planning

26 AUGUST 2021



Safe Work. Strong Business.



Why are we here today

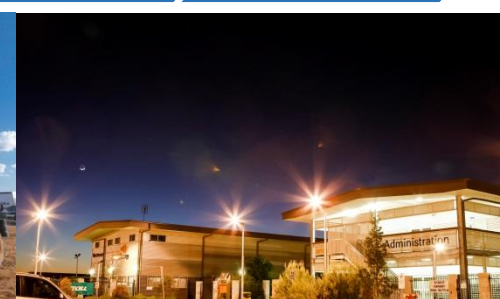
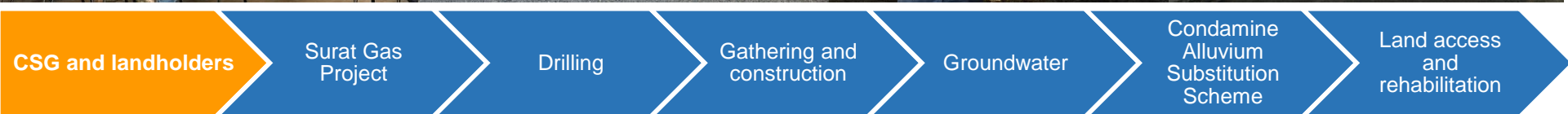
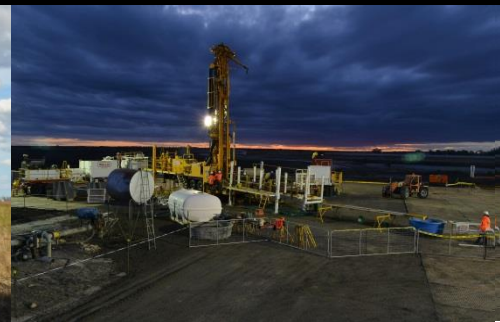


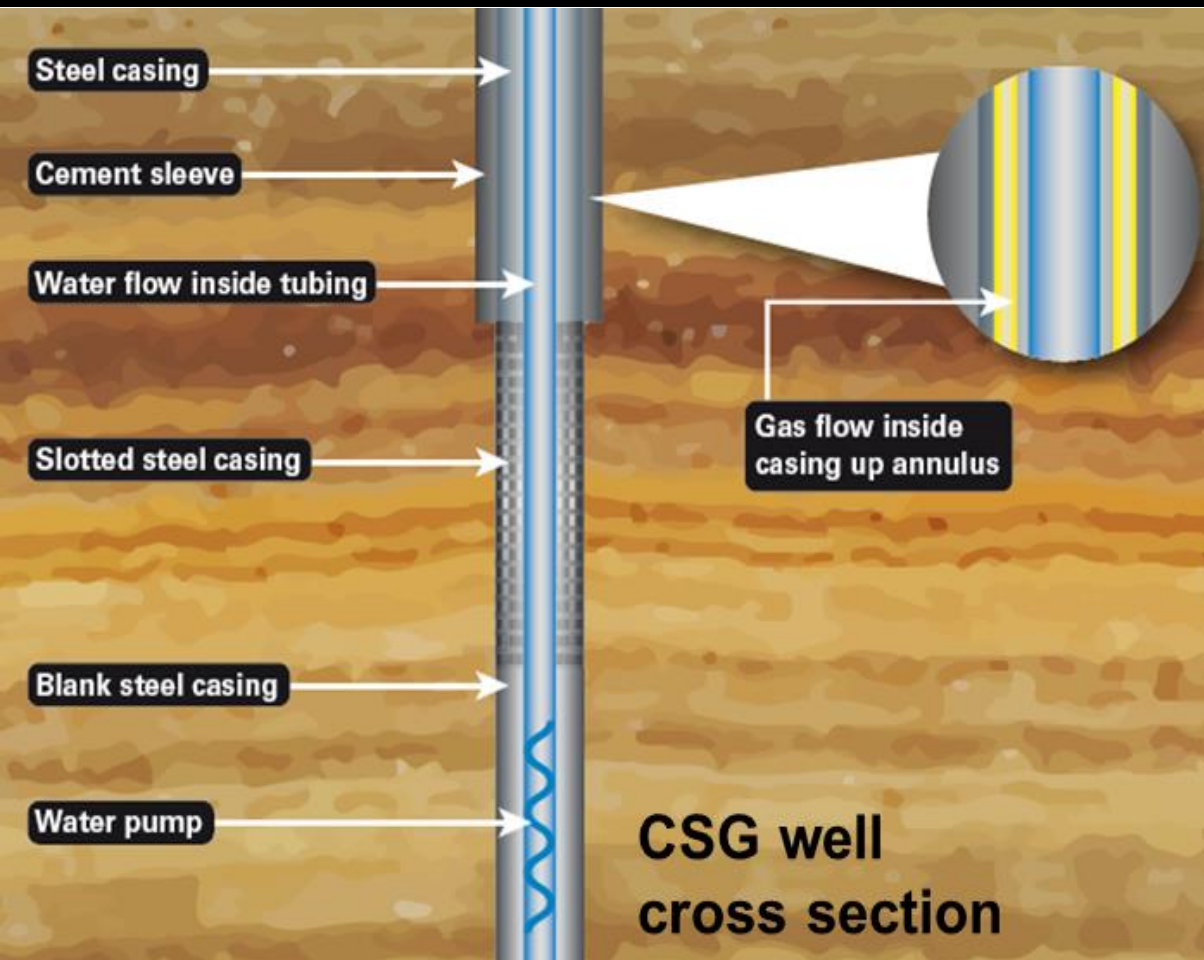
Arrow's Surat Gas Project (SGP) is underpinned by the largest gas sales agreement on the east coast of Australia, with the Shell-QGC joint venture:

- In April 2020, positive Financial Investment Decision (FID) for phase 1 of the 27-year project
- Construction commenced in late 2020
- Peak construction to occur between 2021-2025
- First gas in 2021

Today we will introduce Arrow's proposed plans for this area.

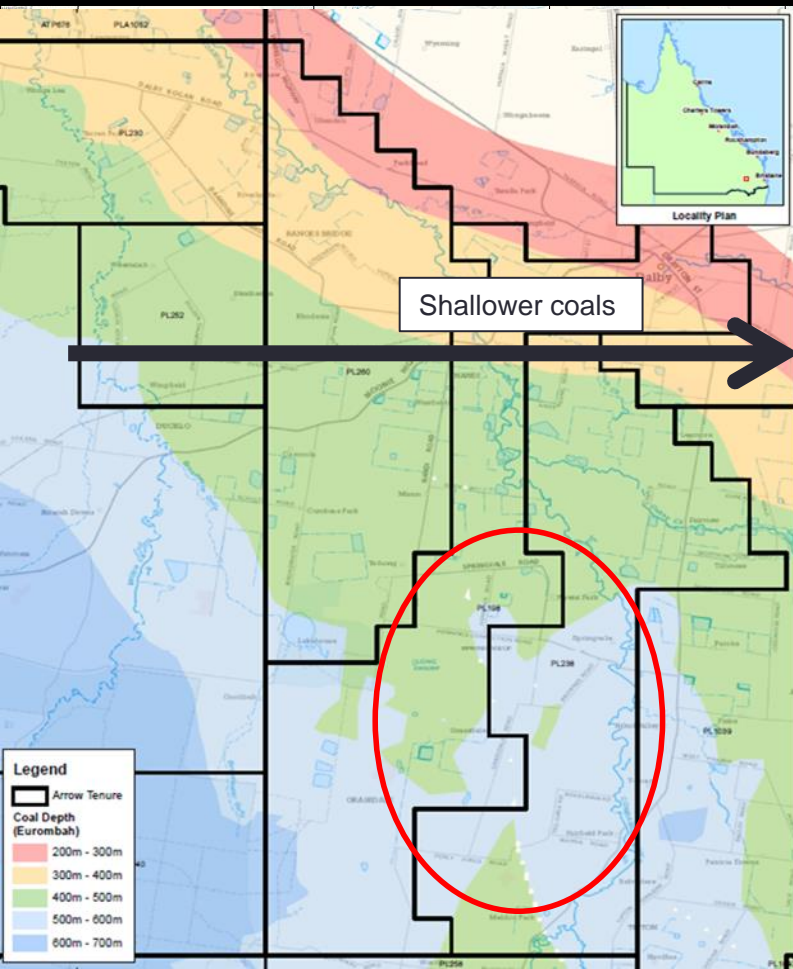
- Our objectives are to:
 - share information on our proposed development
 - explain next steps, and how we would like to involve you in the process
 - seek your feedback on our plans
 - encourage you to consider where infrastructure could be located on your property





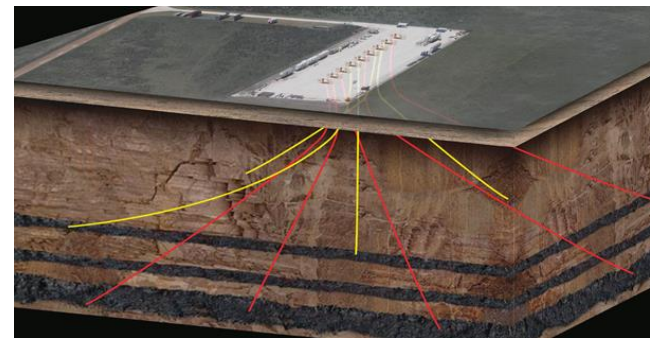
Unconventional gas versus conventional gas

- Thousands of phased on-shore, low pressure wells
- Trapped in coal, not sandstone, by large volumes of water that must be released first, and treated
- More flexible – some non-technical risks can be technically designed out
- Mix of shallow (300m) and deep (1.5km+) vertical, deviated and horizontal wells and well pads
- Gas and water flow up the well to the surface separately
- Wells are constructed to isolate coal seams from groundwater aquifers
- Different drilling techniques between the Surat and Bowen Basins



- Coal seam depths are shallower to the east.
- Shallower coals have lower gas content but greater permeability, so the gas flows better.
- Coal depth determines well type:
 - shallower coals – single vertical wells
 - deeper coal seams – deviated wells from multi-well pads of up to eight wells.
- Average surface spacing between well sites ranges:
 - ~800m (single vertical wells)
 - up to 2km (for multi-well pads).

- Coexistence commitments on Intensively Farmed Land (IFL) includes:
 - multi-well pads on IFL, where geology allows (unless negotiated) results in 50-75% smaller footprint
 - average well site surface spacing not less than 800m
 - pads located in paddock boundaries and less productive areas
 - gathering lines buried deep enough for future land use.
- Typically, Multi-well pads on IFL area where coal depth is greater than 400m
- Arrow's deviated drilling practices have been shaped by engagement with stakeholders over the last 8 years
- Deviated wells are a fundamental part of Arrow's ability to coexist with the agricultural industry, reducing surface footprint and providing greater flexibility to accommodate farming systems
- The majority of wells in this area are deviated wells on multi-well pads.

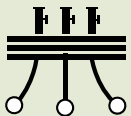




Arrow's commitments to Surat Basin landholders

(current as of 13/8/21)

IN ACTION



Historical Deviated wells

- All landholders notified
- Detailed maps with as-built diagrams, location, depth, and trajectory of wells
- Wells logged in Dial Before You Dig and communications fixed



Insurance Deed Poll

- Protects farm insurance cover by indemnifying landowners for public liability associated with deviated wells as per CCAs



Improved Area Wide Planning (AWP)

- Early and ongoing transparent engagement about potential location of deviated wells



Subsidence Baseline Pack

- Property-specific baseline data
- Provides transparency on any gradient changes (subsidence) over time
- To be provided to all with deviated wells (and more broadly in the future)
- Bi-annual LiDAR data acquisition for monitoring will be shared



Entry Notices

- Provided for all historical deviated wells beneath properties
- Includes maps, Deed Poll, Subsidence Baseline Pack, Notice of Intention to Drill and Code of Practice for construction and abandonment of bores in Queensland
- To be provided where landholders agreements are not in place

IN DEVELOPMENT



Enhanced Water Monitoring and Management Plan (WMMP)

- Enhanced commitments on: monitoring, impact identification and how subsidence would be addressed
- Feedback to be sought from Arrow's Community Committees
- Re-submission of WMMP to Commonwealth Government for approval



Commitment to Surat Basin landholders on future compensable impacts

- Details include how Arrow will work respectfully and transparently with landholders, how any impacts will be addressed (including subsidence)



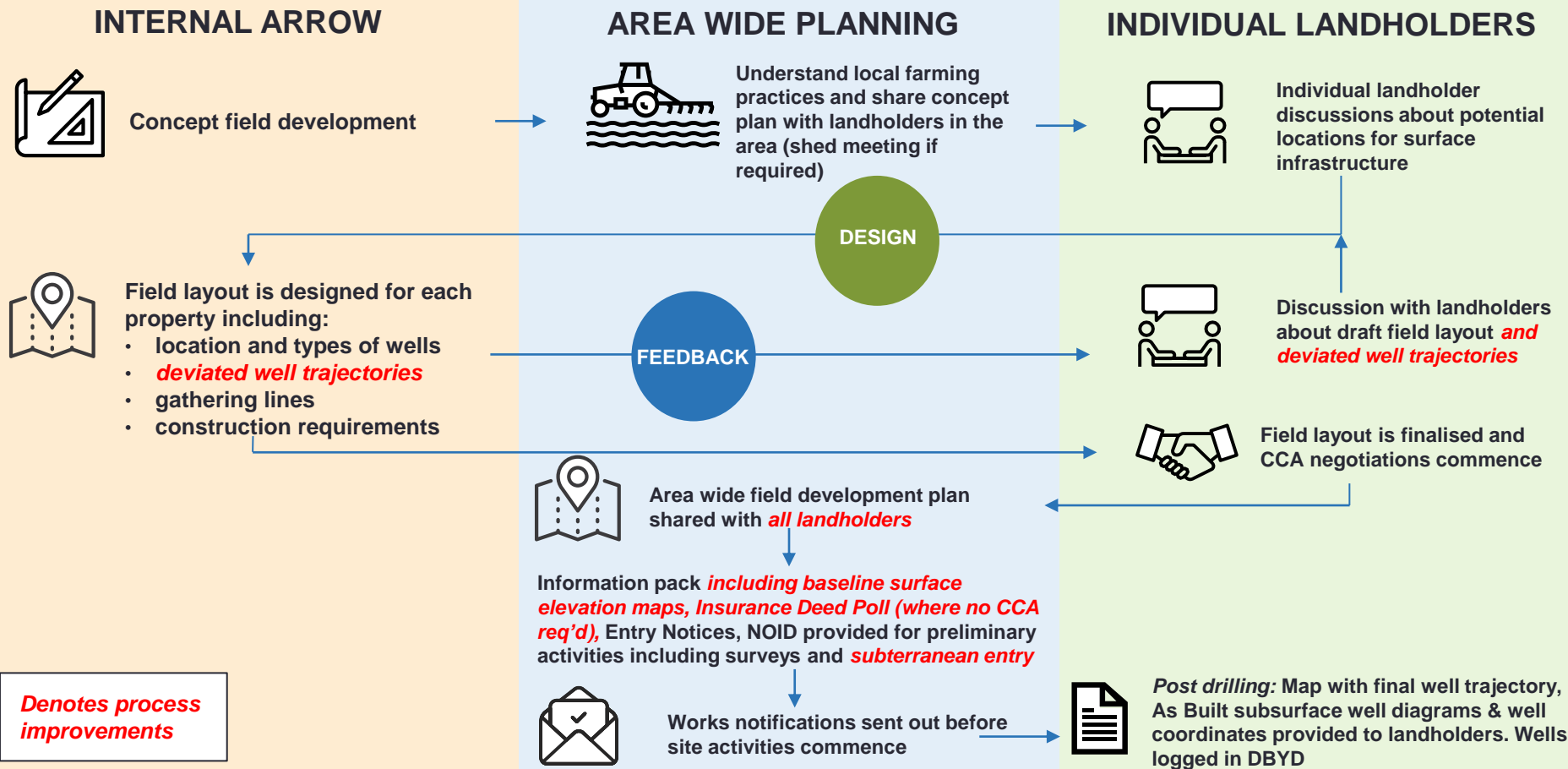
Working with GasFields Commission, AgForce, Queensland Farmers Federation, APPEA, Community Committees and the regulator to fully understand, and address landholder concerns

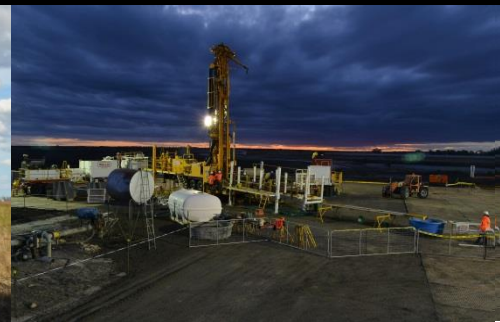


A template for a *Voluntary Deviated Wells Agreement* with landholder (for consultation with peak bodies)

- Including commitments on any future compensable impacts

Arrow's field development process





CSG & landholders

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Drilling

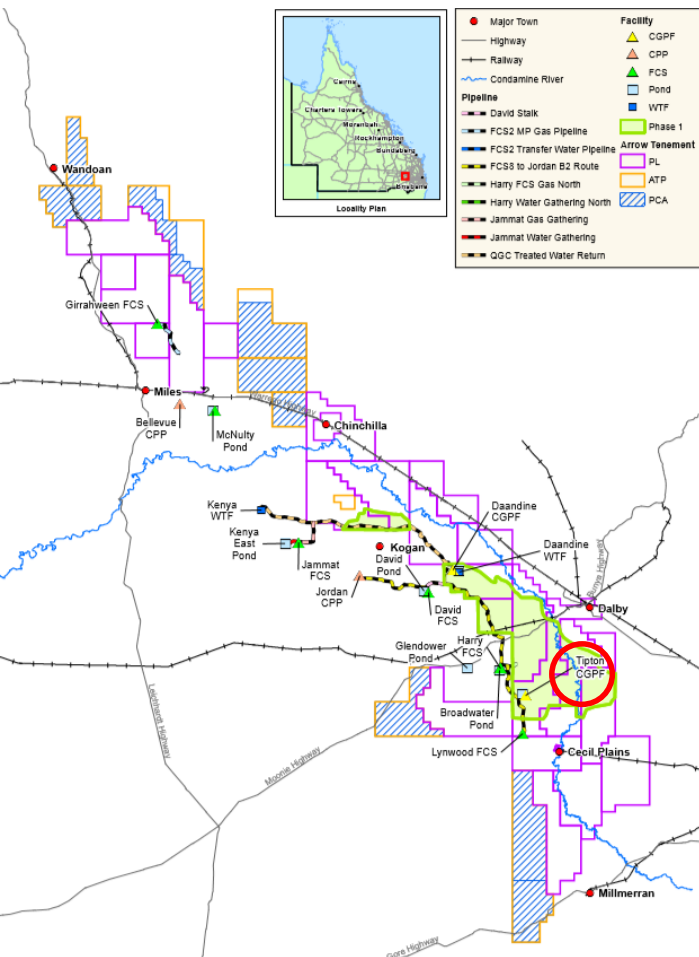
Gathering and
construction

Groundwater

Condamine
Alluvium
Substitution
Scheme

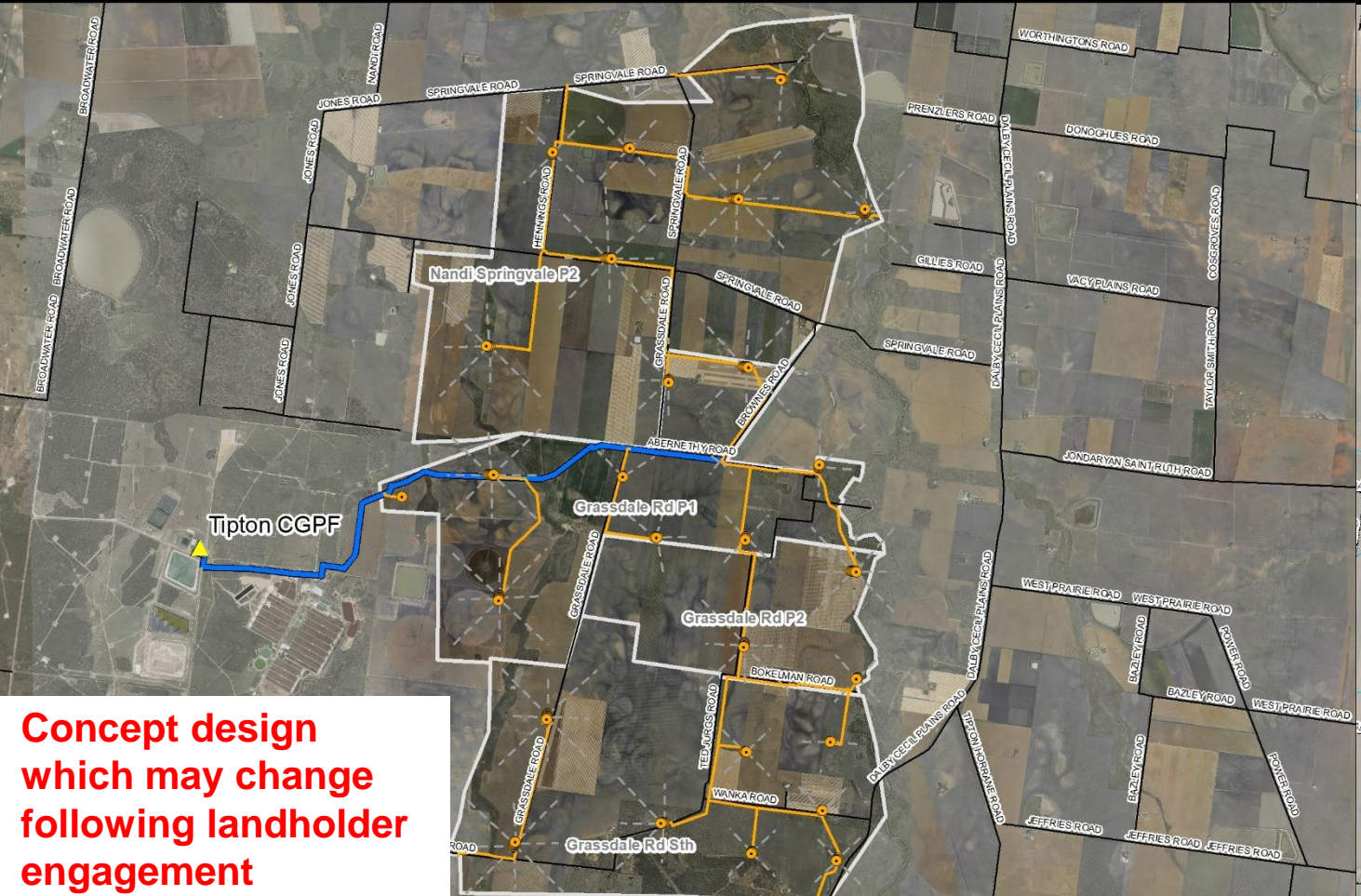
Land access
and
rehabilitation





- Expansion north of current operations at Daandine, to Tipton:
 - Drilling of 600+ wells and construction of associated gathering and infrastructure commenced in late 2020
 - Arrow will continue using Daandine and Tipton compression facilities; upgrade at Tipton to extend its operating life
- New on and off-tenure gas/water pipelines to Shell-QGC facilities
- Upgrades to Arrow's water treatment facilities
- A beneficial use network to substitute Condamine Alluvium groundwater allocations (in Arrow's area of greatest predicted drawdown)

Springvale and Grassdale development areas



Indicative 1 st disturbance dates	
<div></div>	Nandi Springvale 2 Q2 2022
<div></div>	Grassdale Road Q4 2022
<div></div>	Grassdale Road Sth Q4 2022

**Concept design
which may change
following landholder
engagement**



**Concept design
which may change
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engagement**

Wells & gathering

- Approximately 44 wells over 7 multi-well pads
- Approximately 19km of water and gas gathering pipelines

Workforce

- Construction crews to stay in existing accommodation facilities in Dalby
- short-term (mobile) drilling camp at Tipton CGPF

Turnouts

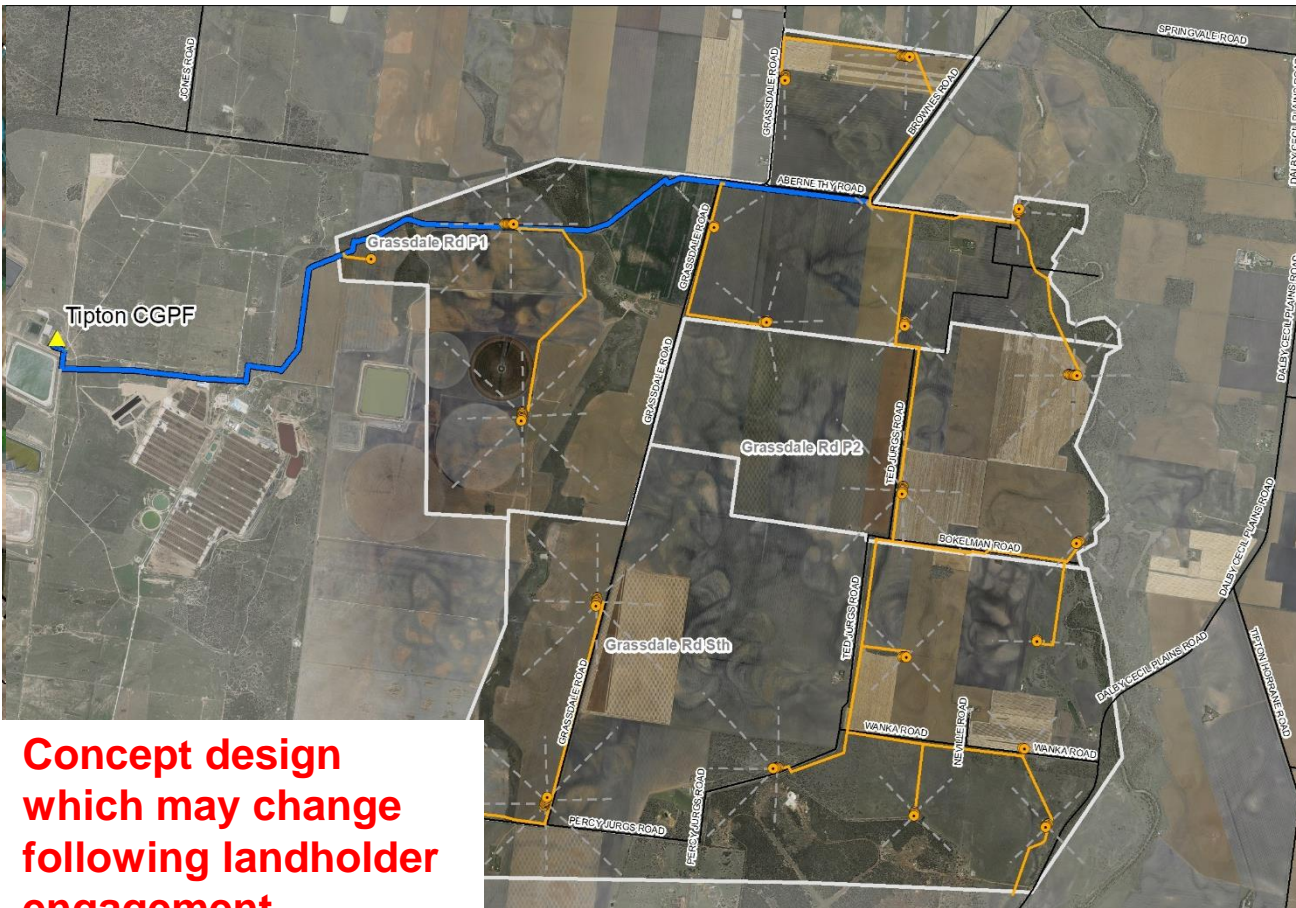
- Locations to be determined, likely Springvale Road and Hennings Road (pending approvals)

Water

- Construction water sourced from Tipton Dam or offtake at Plainview Pilot on Abernethy Road

Gravel

- Gravel to be sourced from existing quarry on private property



**Concept design
which may change
following landholder
engagement**

Wells

- Approximately 110 wells over 21 multi-well pads with locations still to be determined

Workforce

- Construction crews to stay in existing accommodation facilities in Dalby
- short-term (mobile) drilling camp at Tipton CGPF

Turnouts (roads)

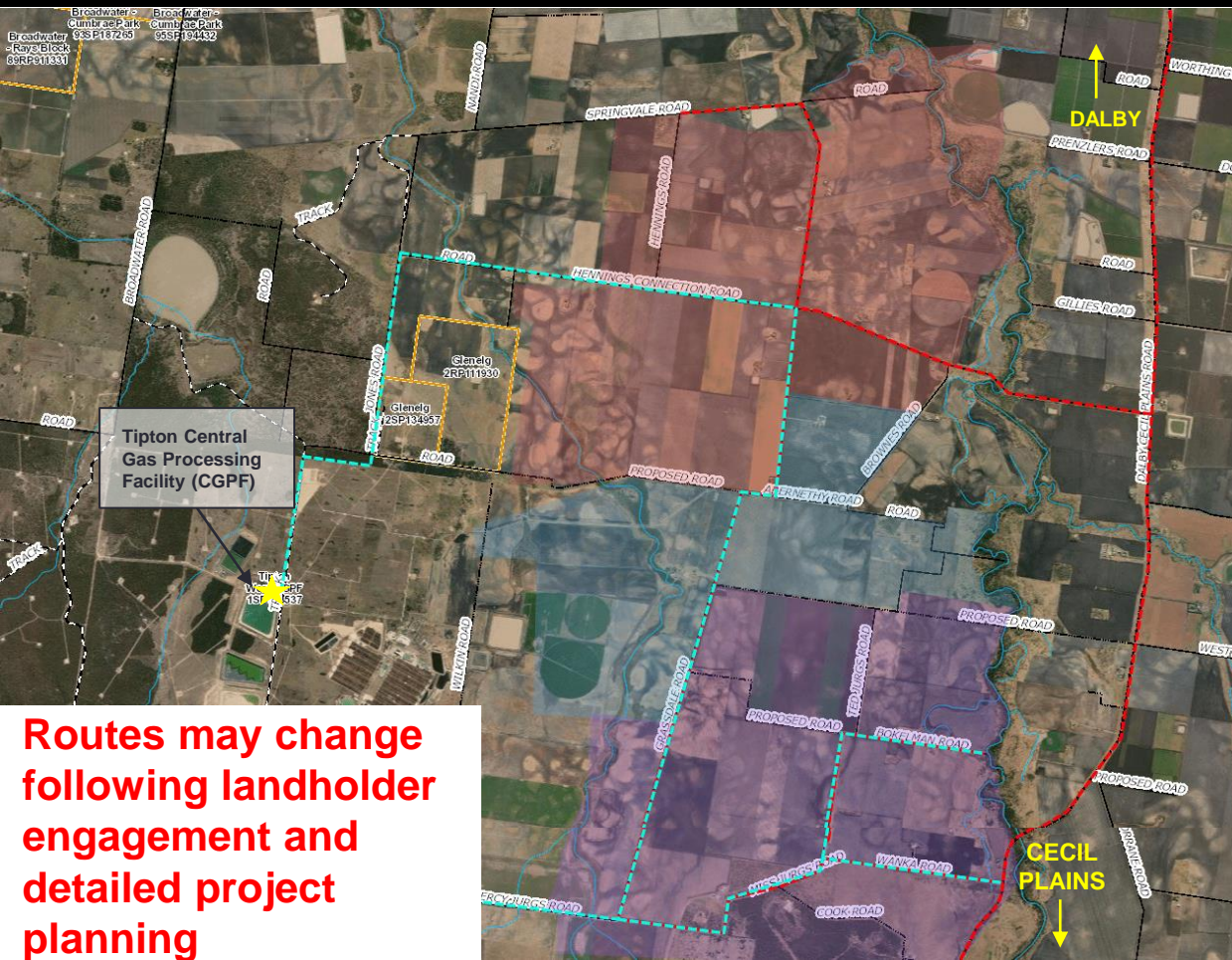
- Locations to be determined, likely to include Grassdale Rd, Ted Jurgs Rd, Wanka Road and other local roads

Water

- Construction water sourced from Tipton Dam or offtake at Plainview Pilot on Abernathy Road

Gravel

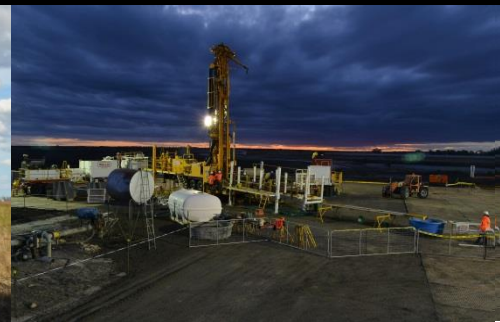
- Gravel to be sourced from quarry on Arrow's Lynwood property or existing quarry on private property



- Drill rigs and associated HV's routes
- Water / Gravel HV route

- Arrow undertake Traffic Impact Assessments to identify potential road safety issues caused by our increased traffic
- Any road upgrades or maintenance require approval from the road owner
- Transport routes are subject to approval by Department of Transport and Main Roads (DTMR) and Councils
- Road Use Management Plans are developed directly prior to construction and tailored to specific areas and conditions

Routes may change following landholder engagement and detailed project planning



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Deviated drilling





Multi-well pad layout



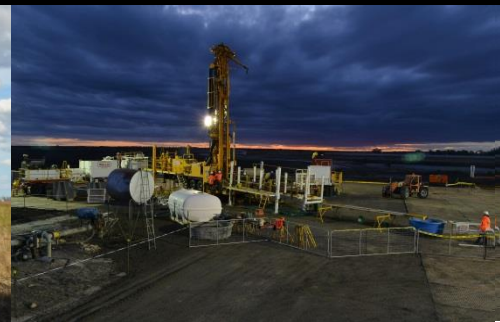
> Phases of wellsite construction

Well pad cleared and levelled	4-8 days	☀
Drilling	4-7 days	☀🌙
Installation of well surface facilities	30-90 days	☀
Installation of water pump	5 days per well	☀🌙
Well maintenance (workovers)	3-6 days per well	☀🌙



- Typical construction workforce numbers per site:
 - site prep: ~8 workers
 - drilling: ~ 15 workers
 - surface facility construction: ~10 workers
- Contractors will orientate lighting to minimise light spill
- Noise during drilling and construction is managed by:
 - Use of noise attenuation on plant and machinery
 - Scheduling of work activities
 - Short term alternative arrangement agreements

Please speak to your Land Liaison Officer if you have any concerns about noise during the planning, construction, drilling or operational phase.



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> Phases of pipeline construction

- ~80 gathering construction workers on site at any one time
- Construction timeframes vary, however typically daytime hours (6am-6pm)
- Construction workforce housed in Dalby in existing accommodation

Right of way cleared and levelled, topsoil stockpiled



Pipeline is laid out and welded in a continuous string



The trench is excavated to at least 750mm to top of pipe, the pipe is lowered into the trench



Above ground infrastructure (high-point vents, low point drains) are constructed



The pipeline is pressure tested (road closures may be necessary)



The right of way is rehabilitated



During operations, maintenance will be required from time to time





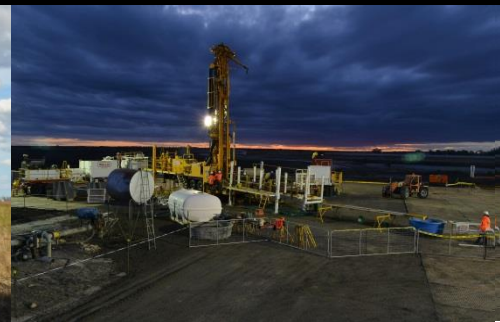
BREAK





Drilling timelapse





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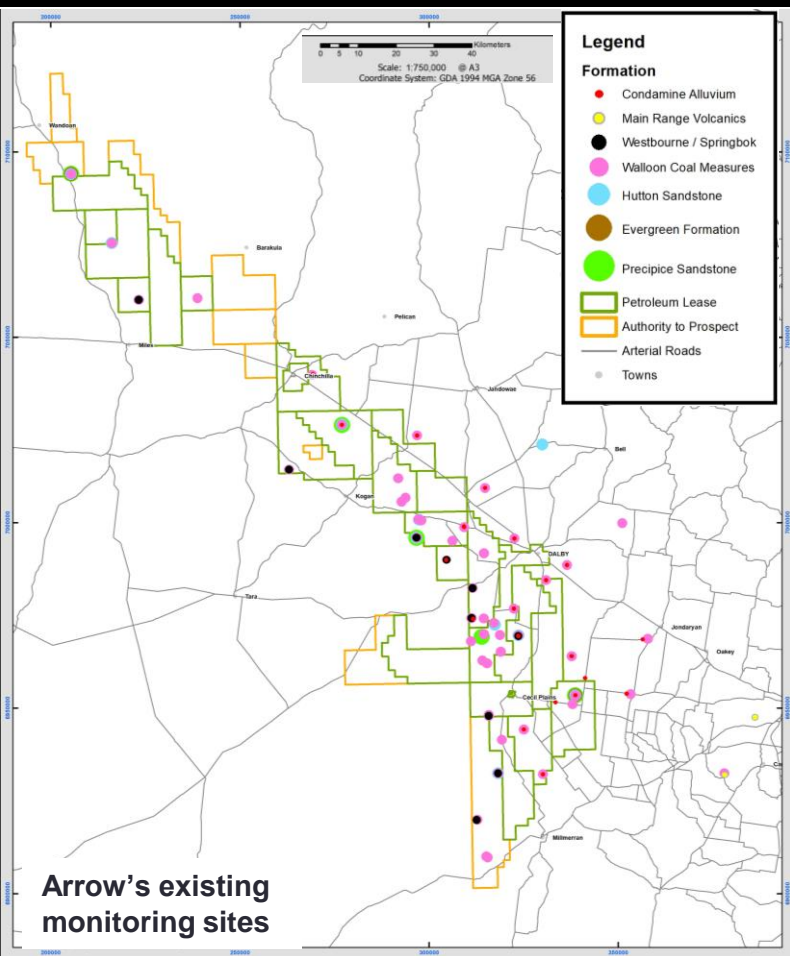




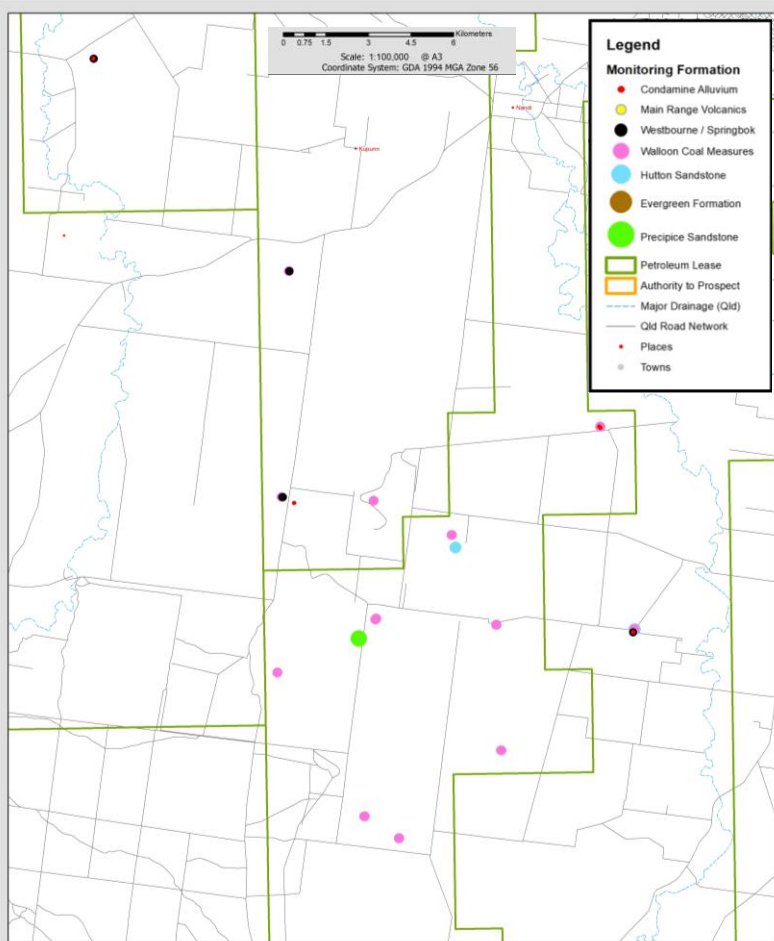
- The Queensland Office of Groundwater Impact Assessment (OGIA) prepares the UWIR which includes modelling of industry-wide CSG impacts to groundwater resources.
- The groundwater model is informed by groundwater monitoring across the area.
- The third Surat Cumulative Area UWIR was released in July 2019 (following 2012 and 2016 versions) and found:
 - less impacts are predicted to the Hutton Sandstone and Condamine Alluvium.
 - greater impacts are predicted to the Walloon Coal Measures and Springbok Sandstone.



- Arrow has completed research to assess interconnectivity & identify if there will be any impact to the Condamine Alluvium.
- Tests provided scientific evidence to address stakeholder concerns about the potential for such impact
- Completion of both tests (Daleglade and Lone Pine) increased Arrow's ability to demonstrate co-existence with existing, laser-levelled, irrigated cropped land.
- Data collected from the tests:
 - Verified that there is only a low level of hydraulic connection between the Condamine Alluvium and the underlying Walloon Coal Measures
 - Is integrated with other research by OGIA on geology, groundwater levels and groundwater chemistry across the Condamine Alluvium (OGIA, 2016)
 - Supported earlier OGIA modelling that predicted CSG operations would have a minimal effect on the Condamine Alluvium (OGIA, 2019)



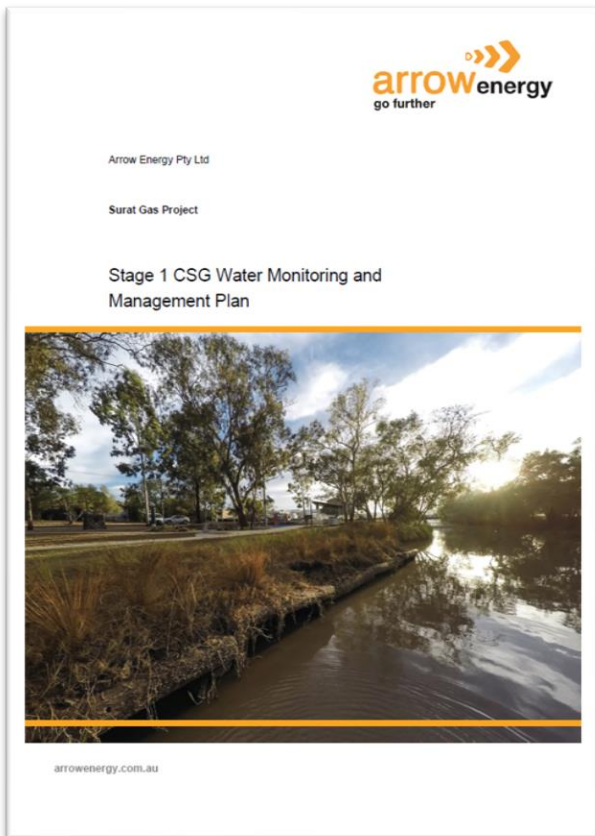
- Across the CSG industry at late 2020, the UWIR monitoring network comprised ~780 monitoring points in the Surat Basin.
- Arrow's own monitoring network includes:
 - 197 groundwater bores in the Surat Basin (additional bores in the Bowen Basin)
 - UWIR monitoring obligations:
 - 137 points for water level and pressure
 - 29 points for water quality
 - telemetry for 'real time view' of data collected every hour
 - data contributes to the understanding of groundwater impacts in the Surat Basin and OGIA's Annual Review.
- Data is available to download via Queensland Globe on Google Earth™: <https://qldglobe.information.qld.gov.au>



- Arrow's current points:
 - 137 points for water level and pressure
 - 29 points for water quality
 - 3 points for ground movement monitoring
- Arrow's future additional points:
 - 19 points for water level and pressure
 - 2 points for water quality
 - 8 points for ground movement monitoring



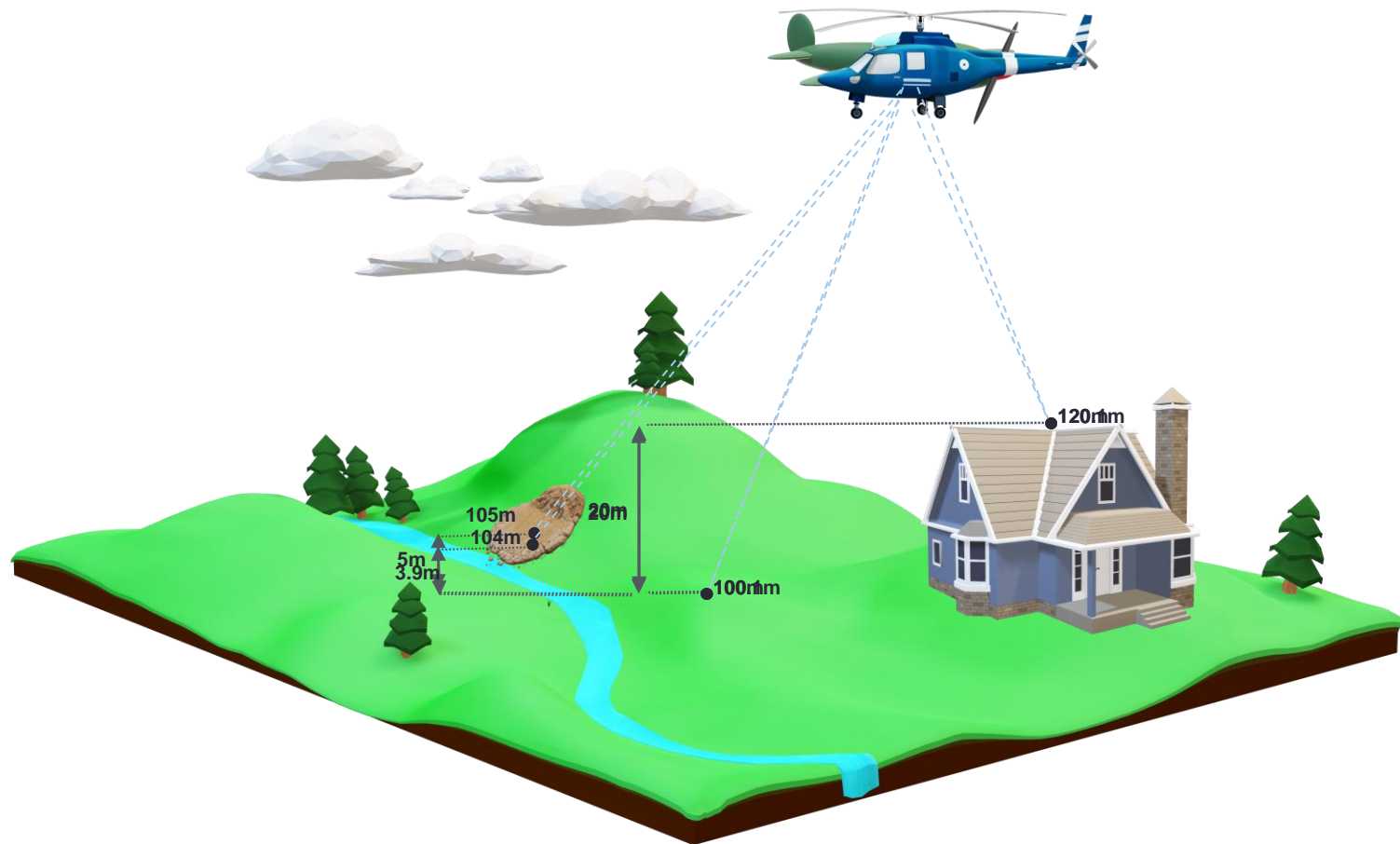
- If your bore is identified in the UWIR:
- Arrow will contact you to conduct a bore assessment
- If found to be impacted, Arrow will provide make good measures including payment of compensation or monitoring (depending on how imminent and likely the impact is).
- To date, Arrow has entered into 41 made good agreements for bores in the Surat Basin.
- Please contact Arrow through your Land Liaison Officer, if you think bore is experiencing impacts
- Arrow will not make good bores which cannot make water.



- Subsidence and ground movement due to groundwater use and soil wetting/drying cycles predates CSG activity
- Arrow has strict EPBC Act compliance obligations in it's WMMP* which was approved by Federal Dept of Agriculture Water & Environment (DAWE) after assessment by it and an independent water expert
- Must report results to DAWE by January 2022, annually thereafter
- DAWE conducted compliance inspection in May 2021
- We use the most accurate techniques available i.e. relative change in elevation and change in gradient, noting:
 - Subsidence impacts due to CSG are less than natural variation
 - Arrow is not aware of any technique which has absolute accuracy high enough to identify CSG impacts instead we use techniques which measure relative change



How we monitor

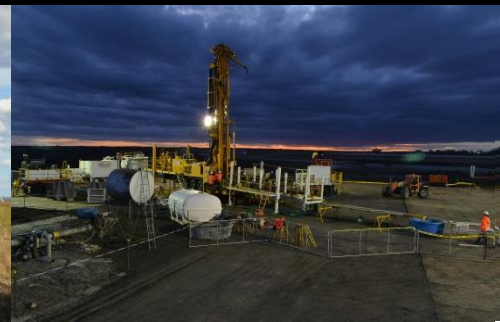




Summary

- Analysis of historical observations indicates CSG-induced subsidence is unlikely to be perceptible at property scale and small compared to natural variability (such as from such as from soil wetting/drying)
- Consistent with previously presented modelling indicating a minor impact compared to existing slopes
- We have installed 3 out of 4 ground-truthing monitoring points, ahead of any possible SGP subsidence
- We are obliged, by the Commonwealth, to address impacts regardless of whether CCA is in place





CSG & landholders

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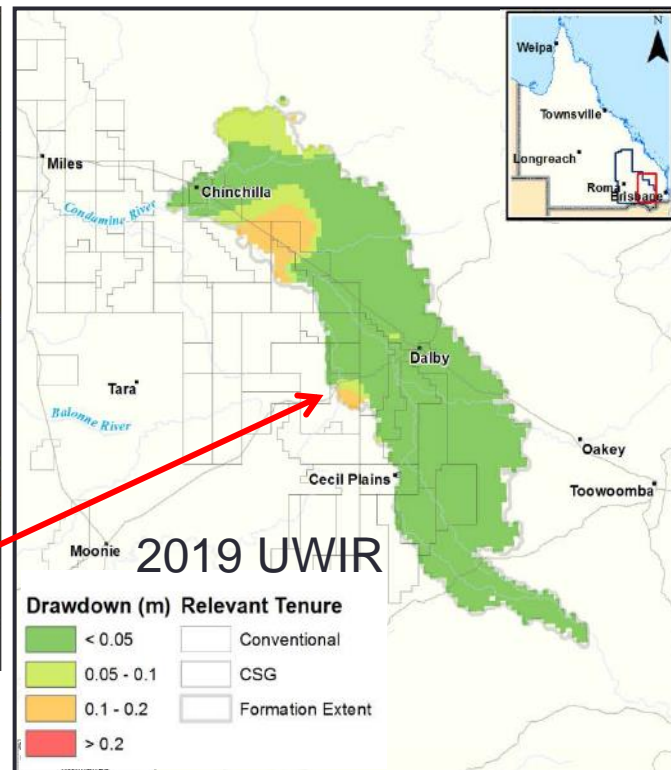
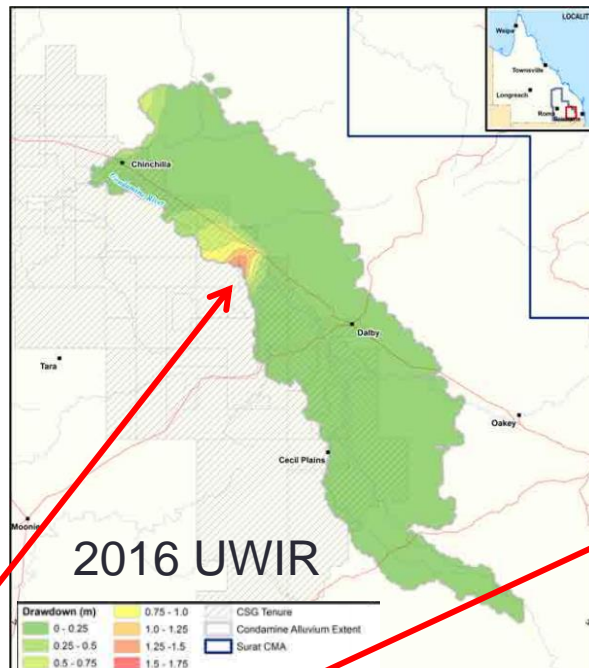
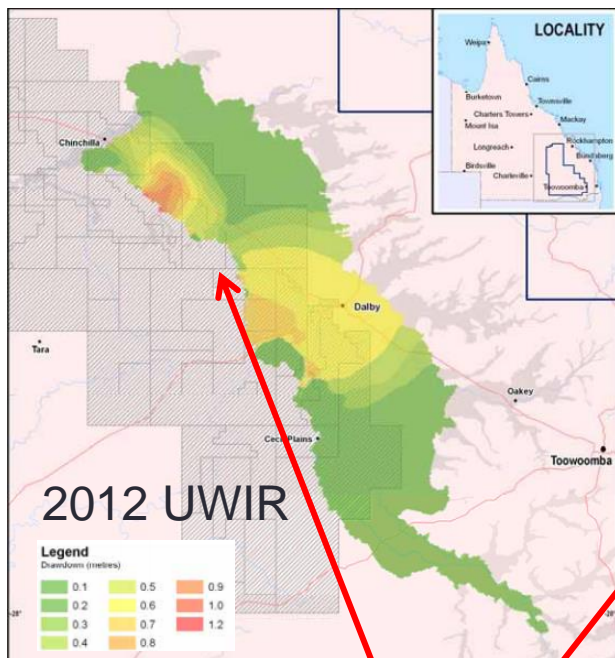
Land access &
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- Connectivity between the Condamine Alluvium and Walloon Coal Measures is low (measured through Arrow/OGIA interconnectivity research)
- The predicted impact to the Condamine Alluvium from Arrow's proposed activity is 58 GL over 100 years
- Arrow has committed to bring water back to substitute Arrow's impacts to the Condamine Alluvium:
 1. Maximise beneficial use of produced water
 2. Where practical, return water to the region from which it is produced
 3. Offset our impact on the Condamine Alluvium in the area of greatest predicted Arrow drawdown.



What is Arrow's impact on the Condamine Alluvium?



- Area of greatest impact is predicted to occur on the western boundary
- **Maximum** predicted drawdown has reduced from ~1m to <0.2m
- Average predicted drawdown is now less than 5cm



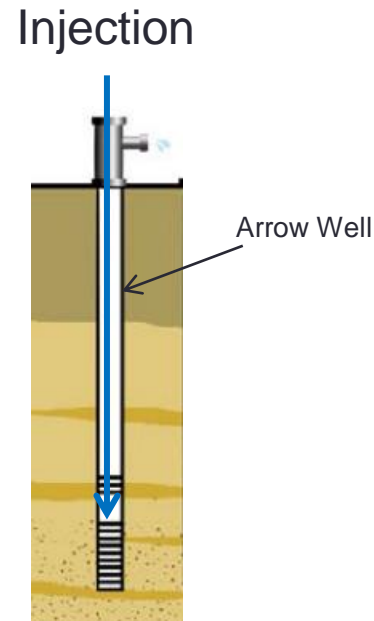
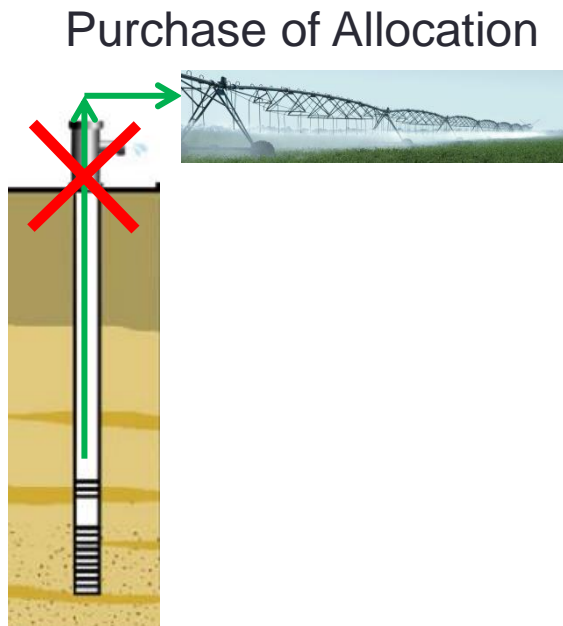
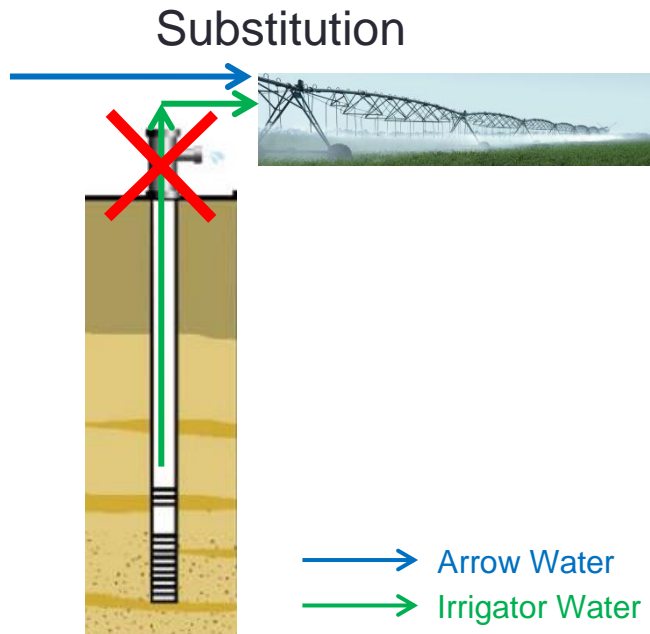
What is Arrow's impact on the Condamine Alluvium?



- Groundwater modelling using OGIA's models predicted 58 GL less water in the Condamine Alluvium over 100 years, as a result of low level of interconnectivity (due to Arrow's project)
- To mitigate this, Arrow has committed to:
 1. Maximise beneficial use of produced water
 2. Where practical, return water to the region from which it is produced
 3. Offset our impact on the Condamine Alluvium in the area of greatest predicted Arrow drawdown
- Following previous community feedback, Arrow committed to achieving this through substitution of allocation



What is substitution?

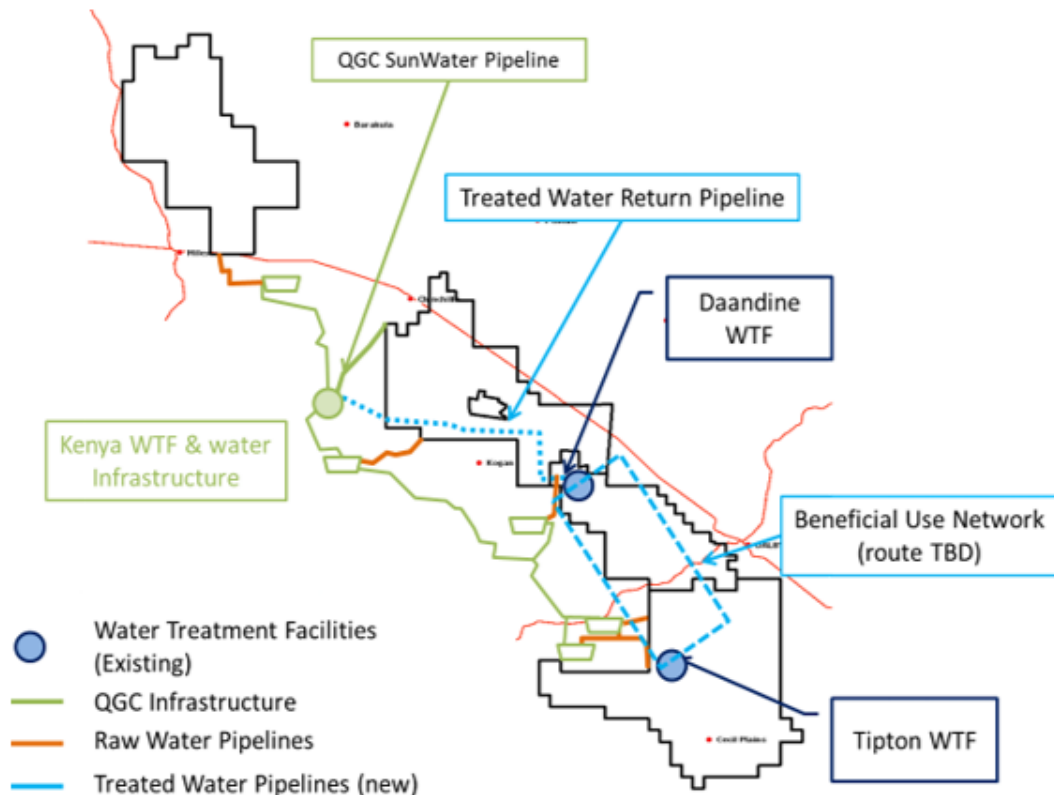


Treatment

- Existing Arrow water infrastructure (Tipton & Daandine)
- Existing QGC water infrastructure (Kenya).







End use

- Existing QGC/SunWater pipeline
- New pipeline back to Condamine Alluvium region
- New Condamine Alluvium Substitution scheme

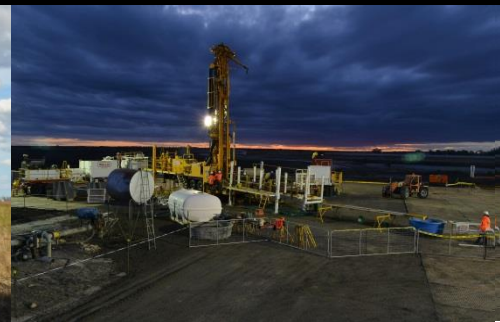


> Next step - expressions of interest

- Arrow is seeking Expressions of Interest (EOI) to participate in the Substitution Scheme
- The EOI process will identify eligible landholders within the target area, who may wish to participate in Arrow's proposed Substitution Scheme
- The EOI is not binding
- If there is a lack of interest, Arrow reserves the right to re-assess its approach

					
Call for EOI	EOI closes	Selection process commences	Scheme selection process closes	Landholders advised	Commencement of supply
23 August	10 September	1 November*	12 November*	29 November*	2024*

* Dates are indicative only and may be subject to change



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- Meet with landholders in the area to look at placement of infrastructure and to understand local area
- Work directly with landholders to map areas their property that may be appropriate to host Arrow infrastructure
- Understand landholder sub-surface requirements
- Use this information to develop a 'Concept' layout
- Present the 'Concept' layer, including indicative deviated well paths, to landholders to obtain feedback and refine the layout
- Scout the proposed layout with a surveyor, construction representative and landholder if they are available. Information from scouting is used to update the 'Concept' layout.
- This is a reiterative process that benefits from landholder involvement

Landholder operations

- Arrow will understand your farming operation, including:
 - types of equipment and machinery
 - farming system
 - future plans
 - constraints, i.e. water
 - landholder conditions

Site assessment

- The proposed layout is walked and assessed by a qualified team of professionals including:
 - an ecologist
 - archaeologist
 - traditional owners
 - surveyor
 - Land Liaison Officer
 - Survey Lead
- Survey map provided to landholder to confirm assessment areas and inform the Conduct and Compensation Agreement (CCA)
- Landholder involvement throughout the process is encouraged





Valuation

- Arrow engage a registered valuer to do an onsite valuation of the property

Conduct and Compensation Agreement (CCA)

- Once all those steps are complete, Arrow will draft a CCA detailing all proposed activities, including a compensation offer
- Landholder can review the CCA and seek professional advice to negotiate CCA in good faith

Arrow may offer other agreements where applicable.



12 Land Access Rules



01

Only enter a property with the approval of your supervisor who has cleared access with the Access Department.



07

Do not interfere with the landholder's property, equipment or operations. Use approved tracks and laydown areas. Drive at less than 10kph within 200m of buildings. Leave gates as signed or found.



02

Only conduct activities that are approved within the access conditions.



08

Do not take firearms, weapons, animals, illicit drugs or alcohol onto the property.



03

Follow directions of Landholders. Report any directions that are not within the access conditions.



09

Do not light fires unless authorised. Smoking is only permitted in the designated locations.



04

Report landholder discussions, complaints or incidents to your supervisor or Land Liaison Officer.



10

Do not enter a site during or after wet weather without consent of the Land Liaison Officer (who has cleared access with the landholder) except in the case of a declared emergency.



05

Carry personal and vehicle identification showing that you are an employee or contractor of Arrow.



11

Only Land Liaison Officers are permitted to discuss activities and access conditions with the landholder.



06

Keep sites tidy, ensure all rubbish is removed from site.



12

Do not threaten or pressure landholders or other people on the property.

- We have 12 mandatory Land Access Rules that govern how all staff and contractors behave on your property.
- Failure to comply may result in disciplinary action, dismissal or termination of contract.
- Property-specific rules and requirements are captured in the Landholder Conditions.
- Landholder Conditions are formulated with the LLO to assist Arrow to plan around farming operations and conduct on your farm.

- Rehabilitation is highly regulated through the Environmental Authority (EA) granted by the State Government
- Arrow's rehabilitation requirements are underpinned by a Financial Provisioning Scheme, proportional to the construction and operational footprint

Operational rehabilitation

- Construction work is undertaken and completed. The site is reduced to its operating size, with the area required during construction, able to be reused by the landholder

Final rehabilitation

- At the end of life of the above-ground infrastructure, it is cleared from the site, the landform reinstated and, in un-farmed areas, seeded
- The rehabilitated area is monitored until it meets its EA
- To demonstrate the conditions have been met:
 - Arrow seeks landholder input into the success of rehabilitation
 - Arrow must lodge a final rehabilitation report with the Department of Environment and Science (DES), who must agree that final rehabilitation is complete

Only once these steps have been achieved, the EA is surrendered and the tenure is relinquished



> Recap: why are we here today



- Our objectives are to:
 - share information on our proposed development
 - explain next steps, and how we would like to involve you in the process
 - seek your feedback on our plans
 - encourage you to consider where infrastructure could be located on your property
- Next steps:
 - Land Liaison Officers will be in contact to seek your feedback on development plans

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