



Arrow Energy

Surat development update

September 2018



- Safety moment
- About Arrow
- Operations update
- Surat Gas Project update
- What happens next?
- Water
- Arrow in the community





- Heart of Australia launched its second mobile clinic
- Custom built, 26m B-double road train
- Expansion from 13 to 18 Queensland towns
 - two additional rotations to Dalby and Moranbah
- Expansion of services to include:
 - Gynaecology
 - Gastroenterology
 - Neurology
 - Geriatric medicine
 - Endocrinology
 - as well as heart and chest.

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- An integrated coal seam gas company owned 50/50 by Shell and PetroChina
 - Produces gas equivalent to 25% of Queensland's annual demand
 - Provides gas for industrial users and electricity generation
 - tenure over two major production basins - the Surat and Bowen basins
 - about 1,450 gas wells
 - some 17,000km² of Queensland production and exploration tenements
 - Existing domestic gas operations:
 - five gas producing projects in the Surat and Bowen basins - Tipton, Daandine, Kogan, Stratheden (Surat Basin) and Moranbah Gas Project (50/50 AGL - Bowen Basin)
 - supply gas to power stations - Braemar 1, Braemar 2 (100% owned), Yabulu, Daandine, Moranbah, Swanbank
 - generation enough to power 800,000 average-sized Queensland homes.
- In 2017, Arrow announced a gas supply deal between Arrow and QCLNG to commercialise most of Arrow's gas reserves in the Surat Basin through a phased development over 27 years.
 - Arrow and QGC remain standalone companies.



- Since our last update, we've been busy:
 - Ongoing development to meet our domestic gas contracts
 - Shareholder assurance reviews, with more to follow
 - Conceptual engineering on our Surat development
 - Front-end engineering and design (FEED) for first phase (gathering networks, off-tenure pipelines and gas facilities)
 - Progressing commercial agreements with third parties
 - Delivering on our social investment partnerships.

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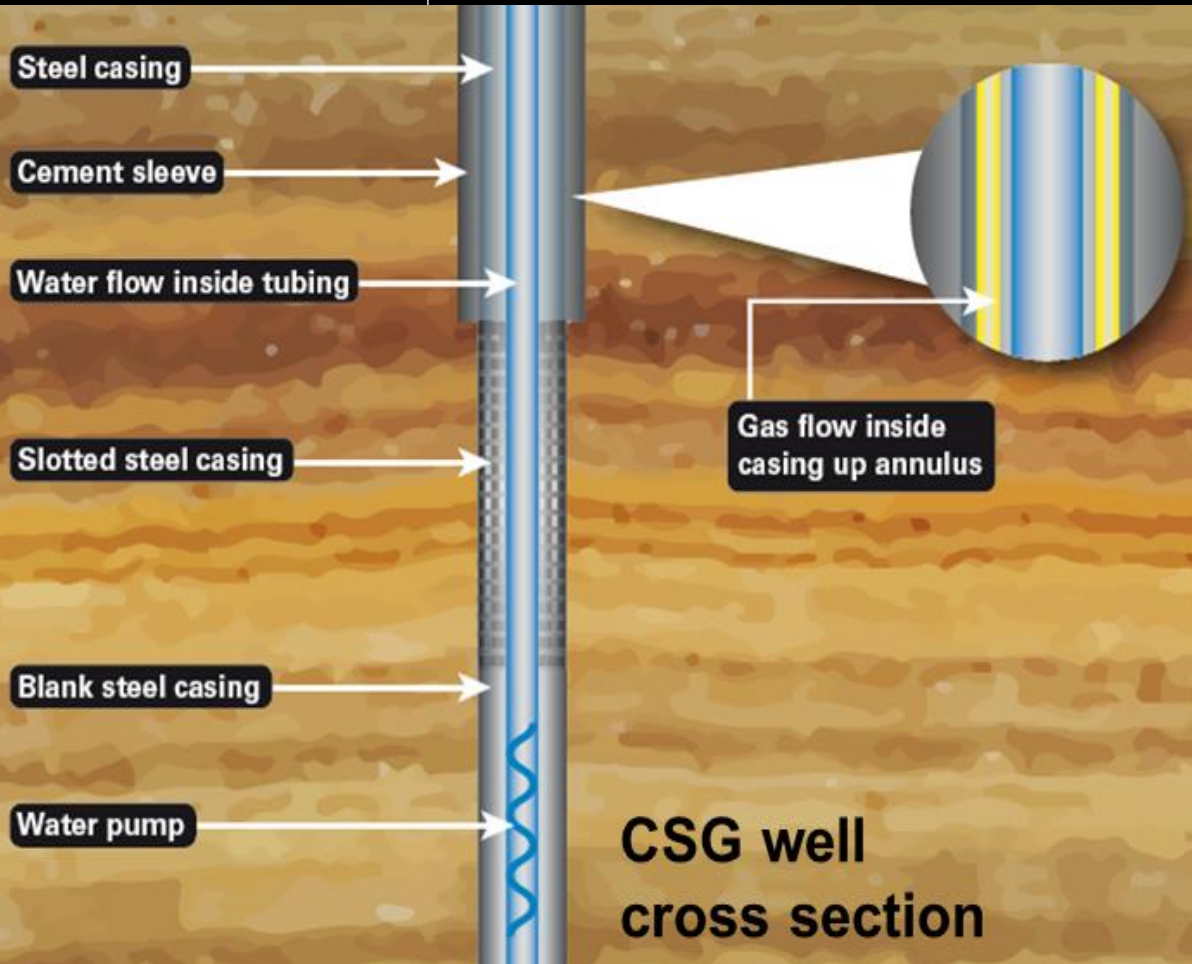
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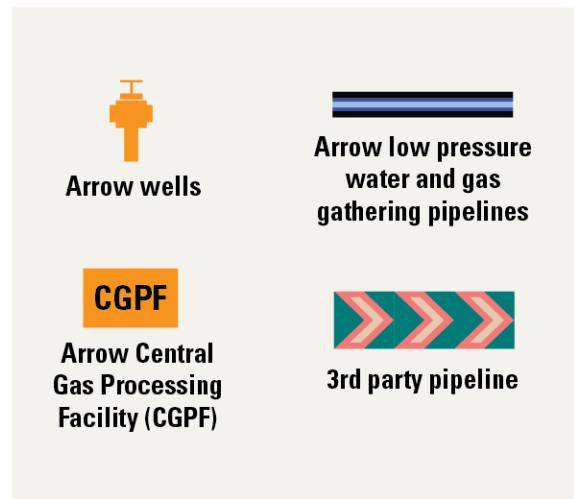
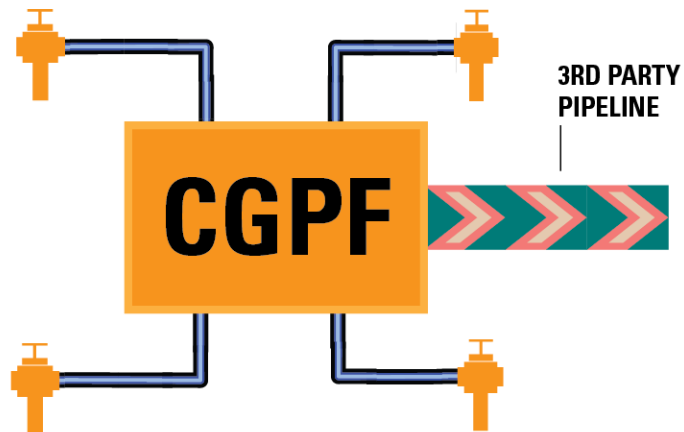
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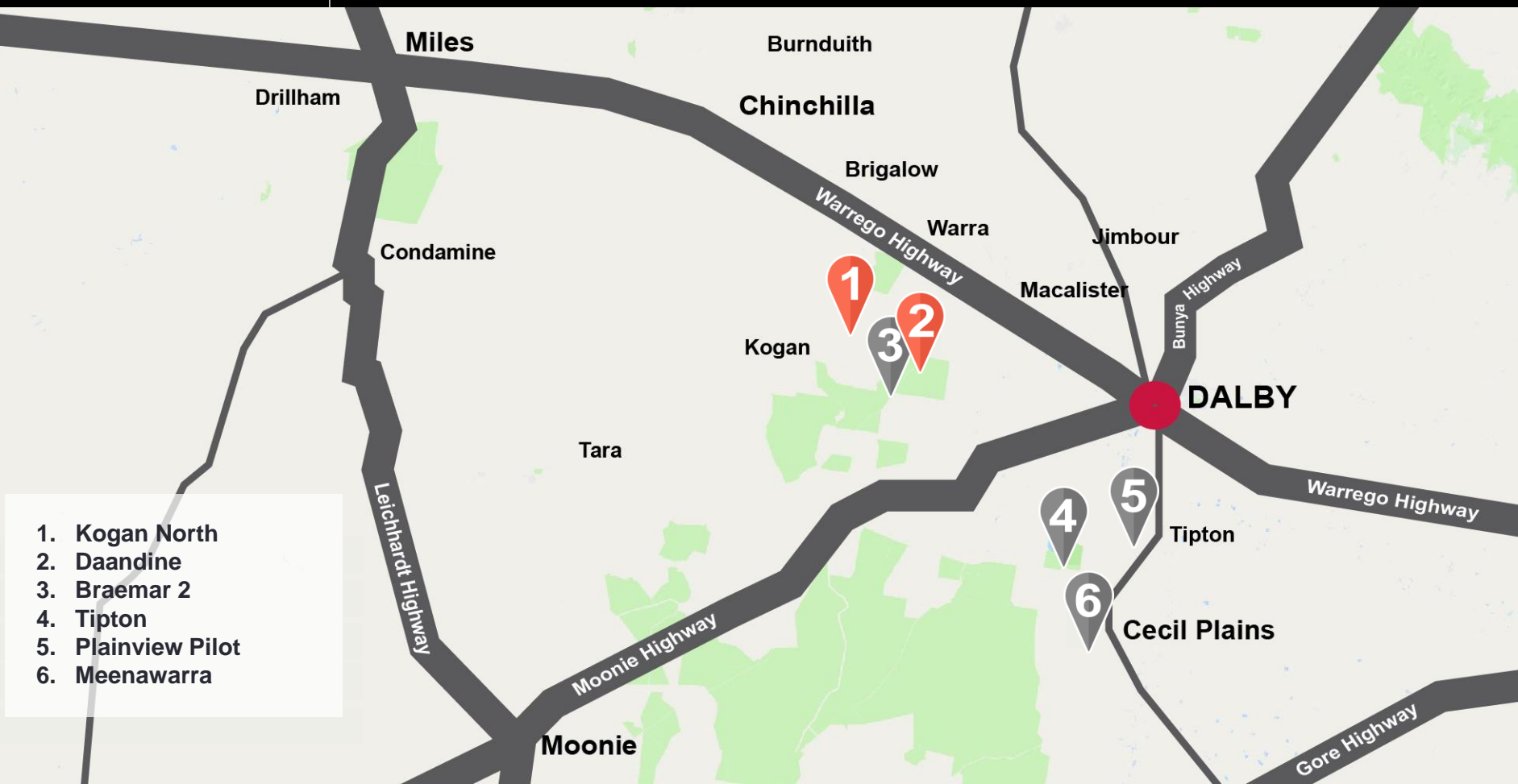




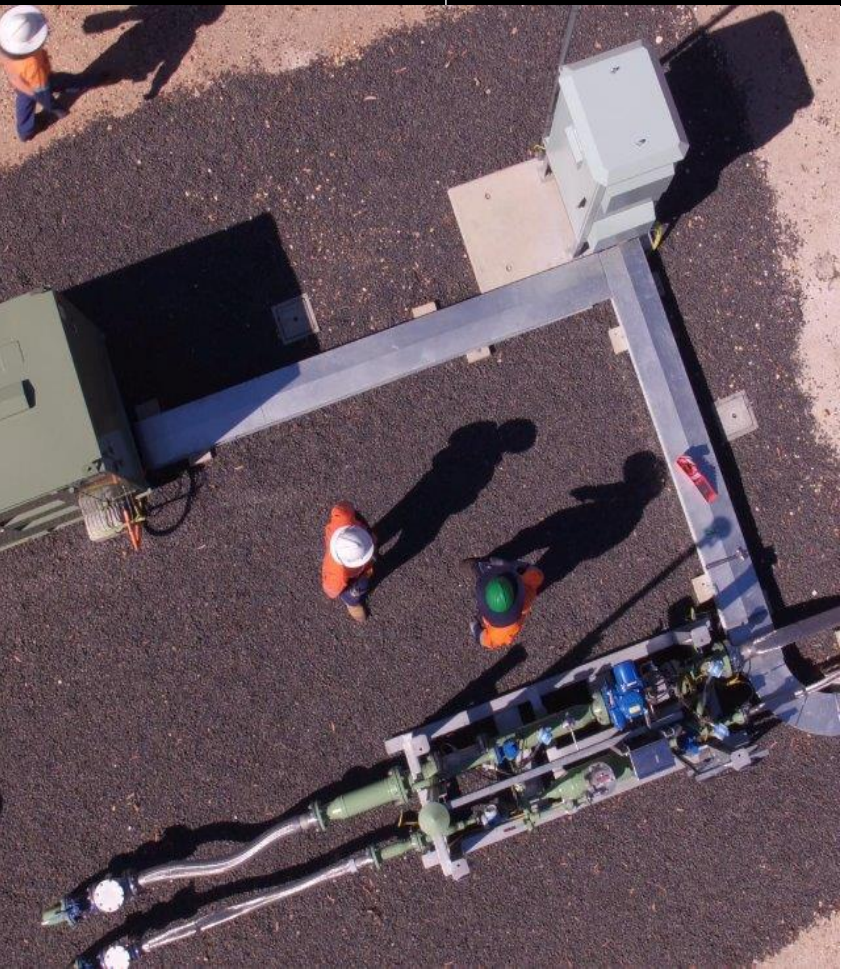
- CSG is natural gas:
 - trapped in underground coal beds
 - by water and pressure.
- To extract CSG:
 - 300-750m well to the target seam/s
 - in-seam water pumped out to release gas
 - gas and water flow separately to the surface.
- Well design isolates coal seams from groundwater aquifers.

EXISTING SURAT OPERATIONS





- 1. Kogan North
- 2. Daandine
- 3. Braemar 2
- 4. Tipton
- 5. Plainview Pilot
- 6. Meenawarra

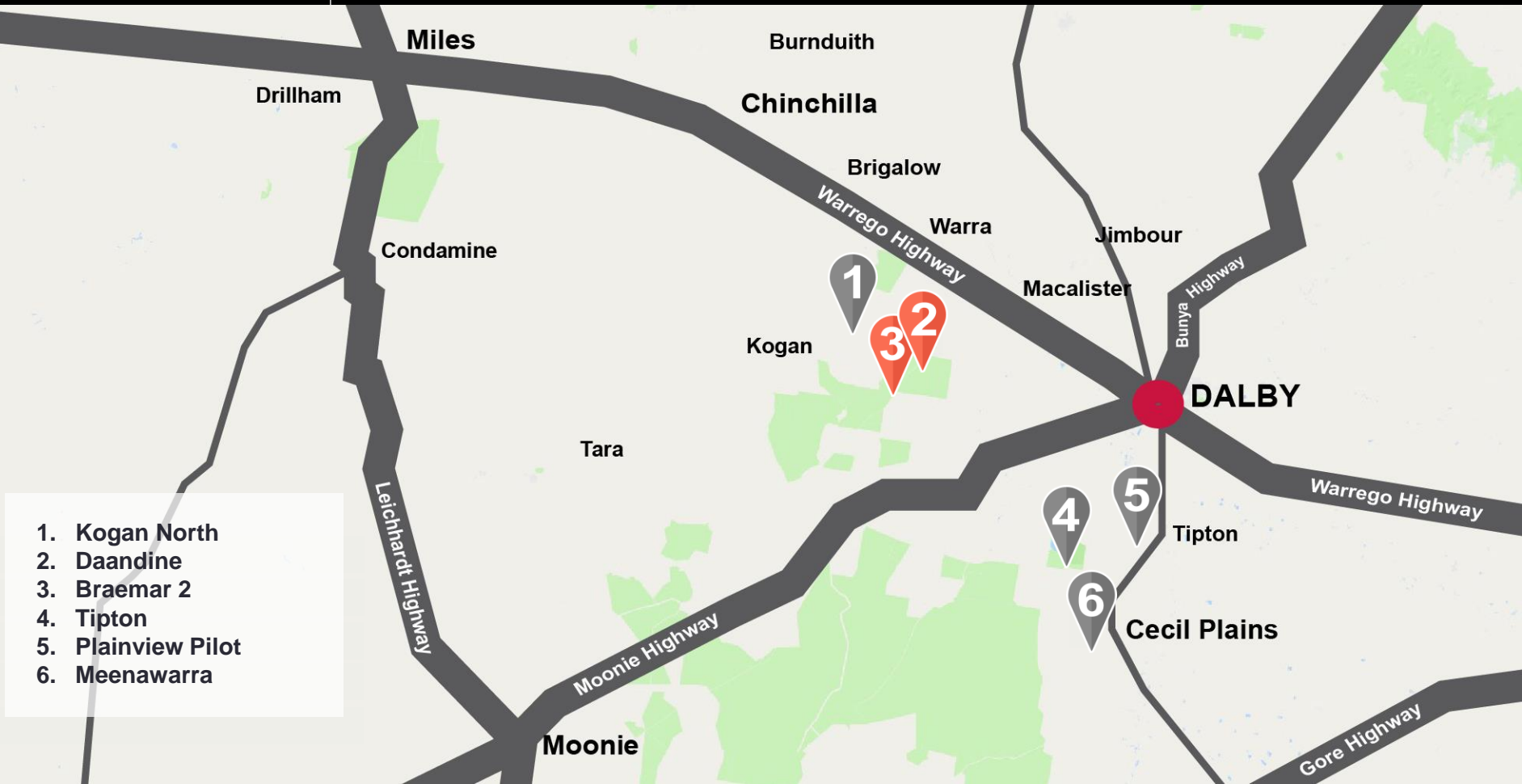


Kogan North

- Three new wells are now online.

Daandine

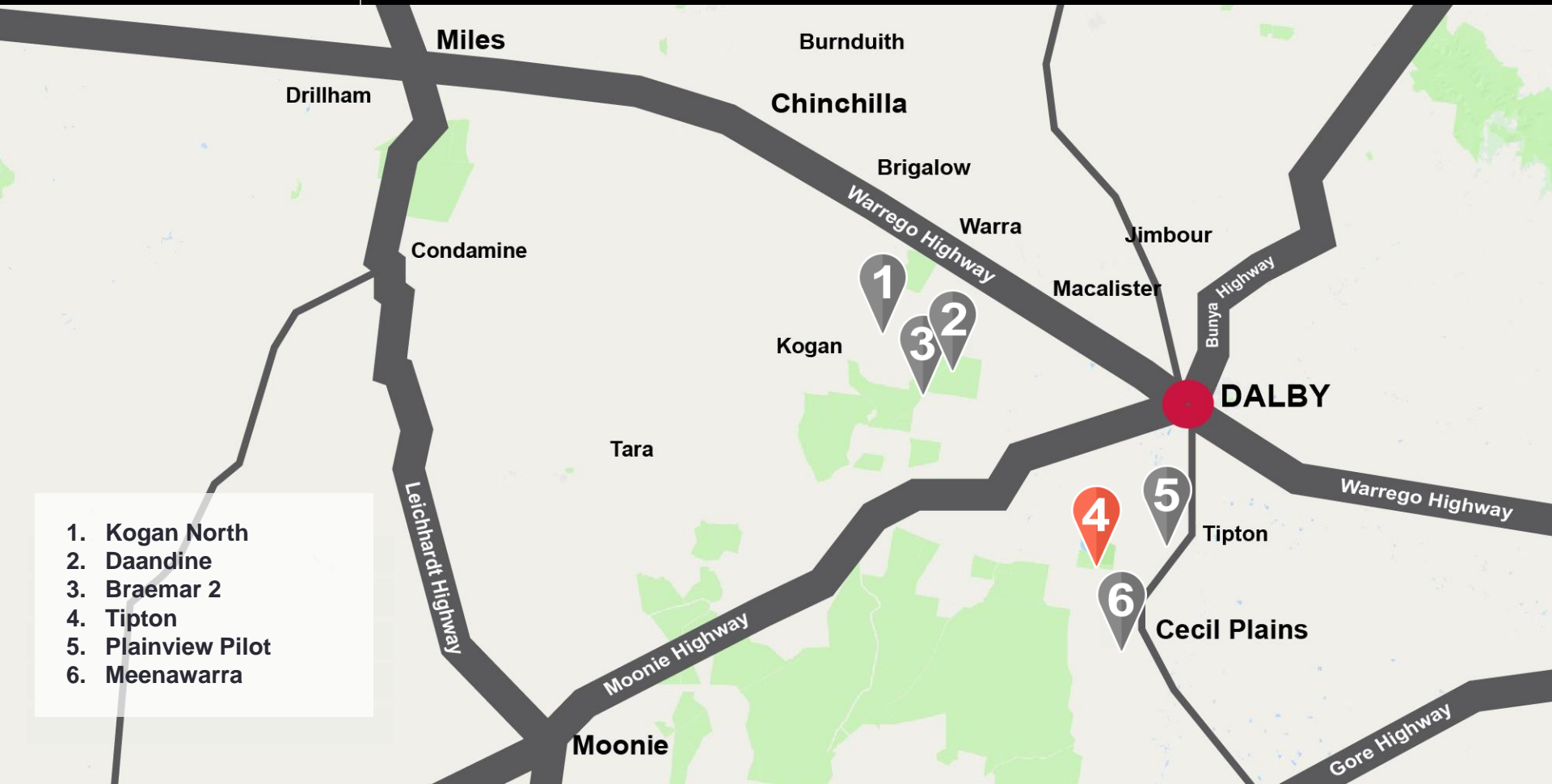
- Additional new wells are being developed to demonstrate coexistence on intensively farmed land:
 - 21 new wells on six multi-well pads on intensively farmed land at Theten
 - construction includes well pad facilities and 20km of gathering systems.
- Expansion of existing field in 2019/20 will include:
 - up to 15 new wells and gathering
 - Area Wide Planning (AWP) for this area is complete.



- 1. Kogan North
- 2. Daandine
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- Maintenance activities at the Central Gas Processing Facility (CGPF) and Braemar 2 Power Station from 18 September for ~2 days.
- Flaring will be required during this time:
 - the size and appearance of the flare will vary – up to 30m high
 - flaring will be minimised as much as possible
 - flaring is regulated by Queensland Department of Environment & Science through the *Queensland Environmental Protection Act*.

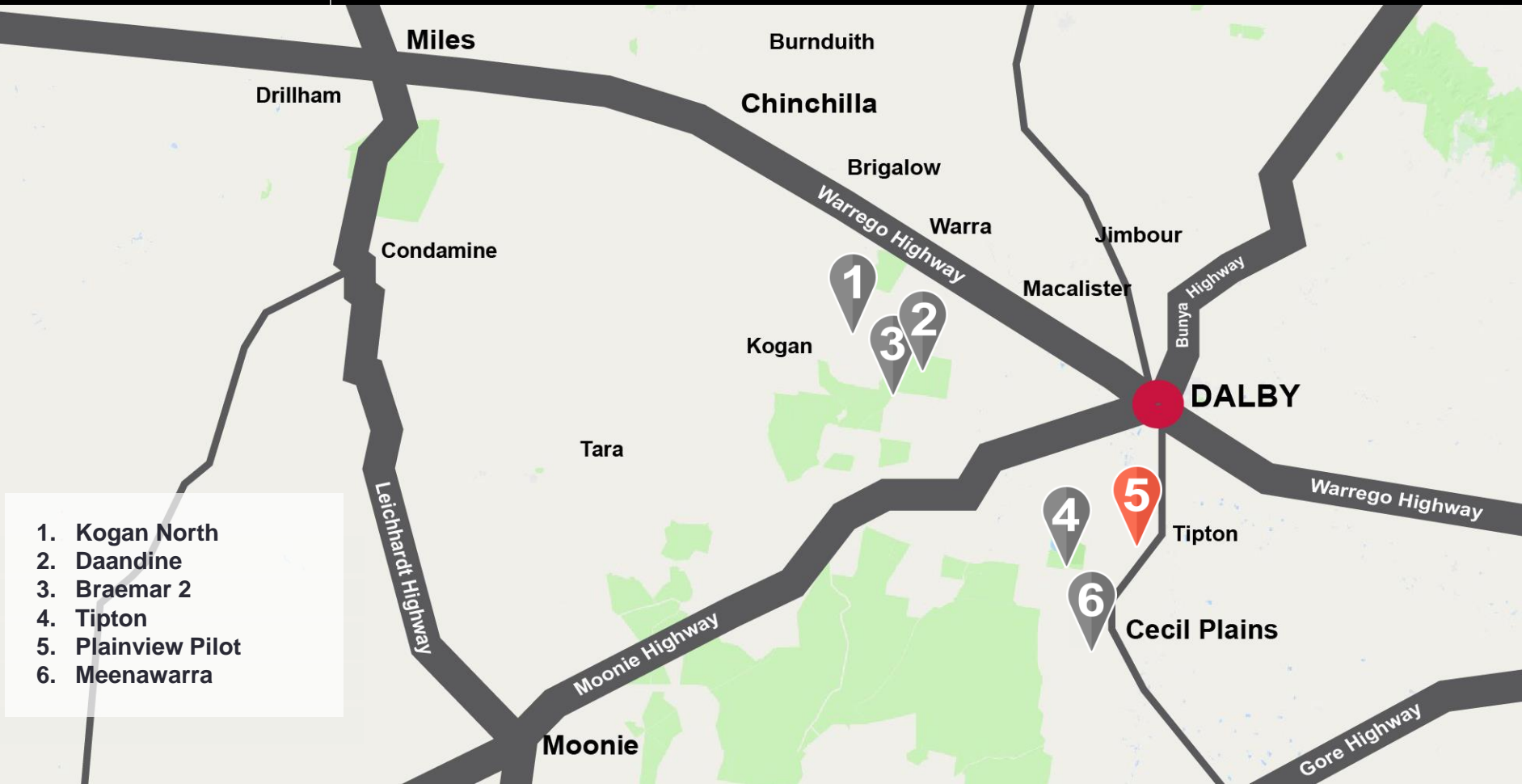


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Tipton

- Annual CGPF maintenance shutdown scheduled for 4 September.
- Construction planned from late 2018 to expand the existing Tipton field and facility:
 - ~80 new wells over four years
 - four new compressors at the Tipton CGPF
 - the existing gas vent replaced with a vertical flare for safety during maintenance and unplanned facility shutdowns
 - CGPF construction teams (50 - 70 people) onsite from early 2019 for ~15 months
 - access via Broadwater Road under approved Traffic Management Plans
 - community notifications will be provided throughout construction (subscribe via the Arrow website).



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Stringing of pipeline ready for welding



Pipeline welding



Soil gas monitoring

Plainview Pilot

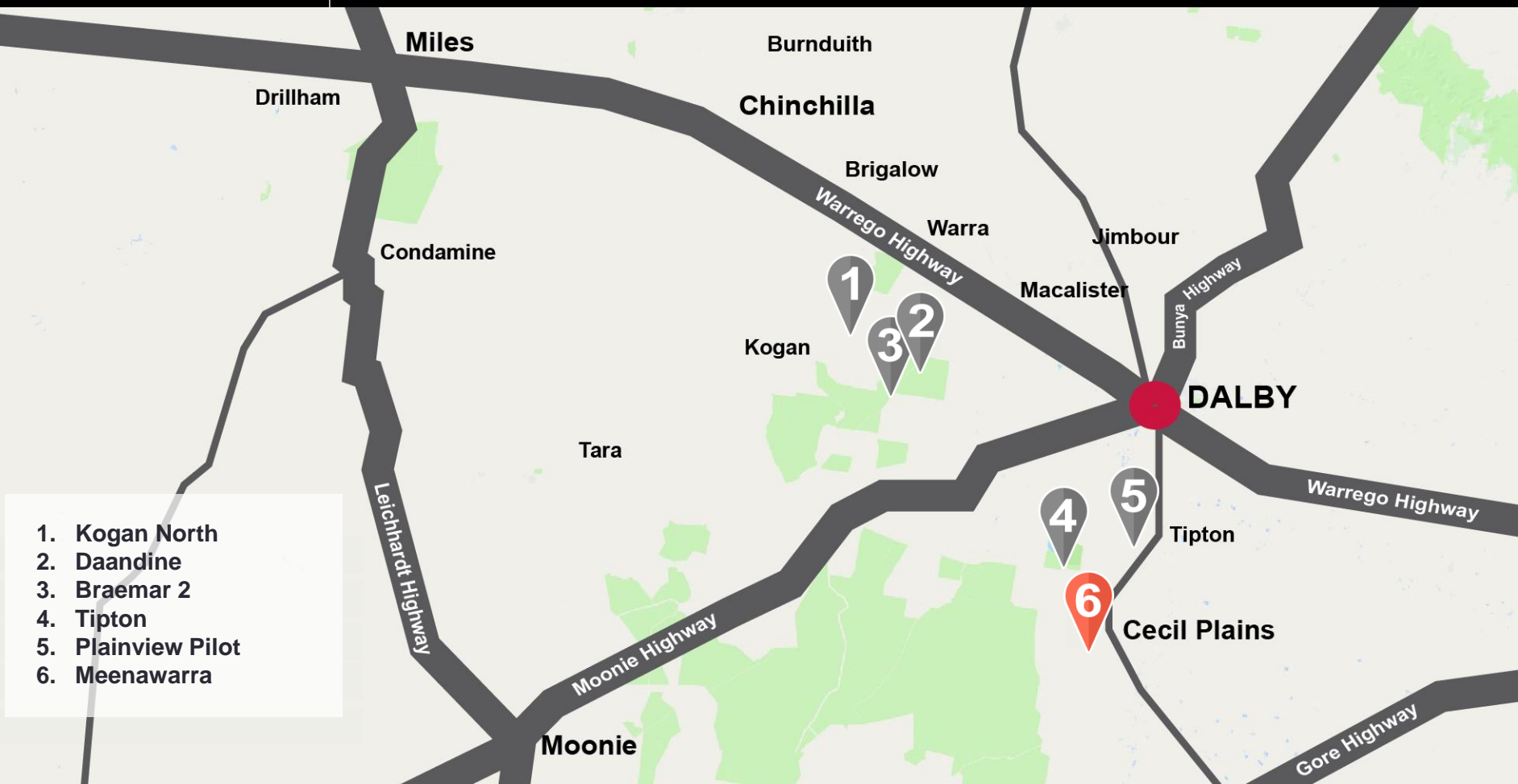
- Gathering construction underway to connect to the Tipton CGPF
 - ~11km of gas and water pipelines.
- Drilling of groundwater monitoring bore complete
- Drilling of 5 production wells underway
- 12-hour overnight road closures for pipeline commissioning
 - 6pm Friday 21 September to 6am Saturday 22 September
- Wells online ~November 2018
- Regular community email notifications (subscribe via the Arrow website).

Soil Gas Monitoring Project

- 23 soil gas monitoring points
- First data has been collected to establish baseline before Plainview Pilot begins production.

Future Pilot activity

- In 2019 Arrow will replicate this pilot nearby, a site has not been identified
- Community will be updated as planning progresses.



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- Four new vertical wells to be drilled north of the existing Meenawarra wells
- ~2km gas and water gathering pipelines
- Drilling and construction from ~November 2018.



- Arrow is completing seismic survey series across the Surat Basin
- The next seismic campaign: September to October 2018:
 - ~20km north-east of Miles
 - ~90km of seismic acquisition on private property and gazetted roads.
- Directly impacted landholders already contacted
- Seismic surveys gather images below the earth's surface:
 - Truck-mounted vibrating pad creates seismic waves
 - Waves travel below surface and reflect off underground rock layers
 - Strings of geophones (small microphones) 'hear' reflected waves
 - Geophone signals recorded for analysis
 - Geologists – and high-powered computing – turn raw data into a picture.

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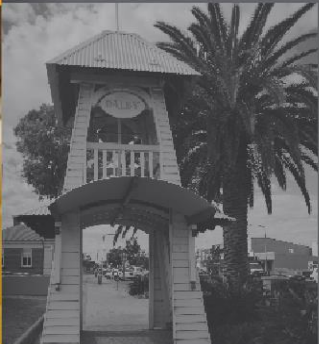
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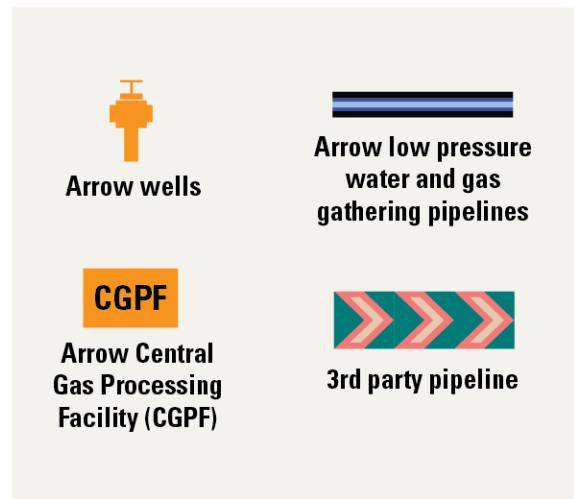
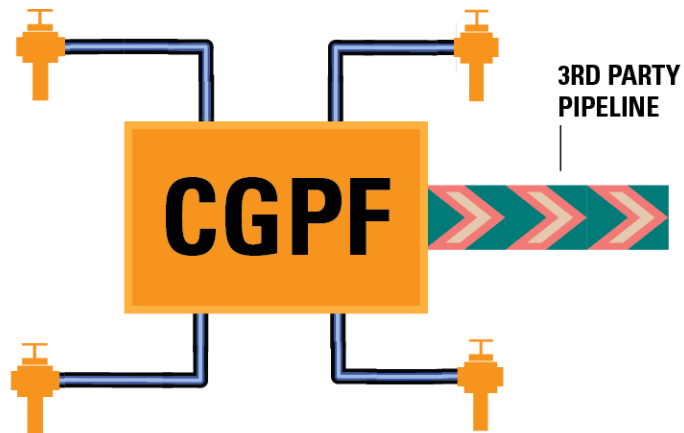
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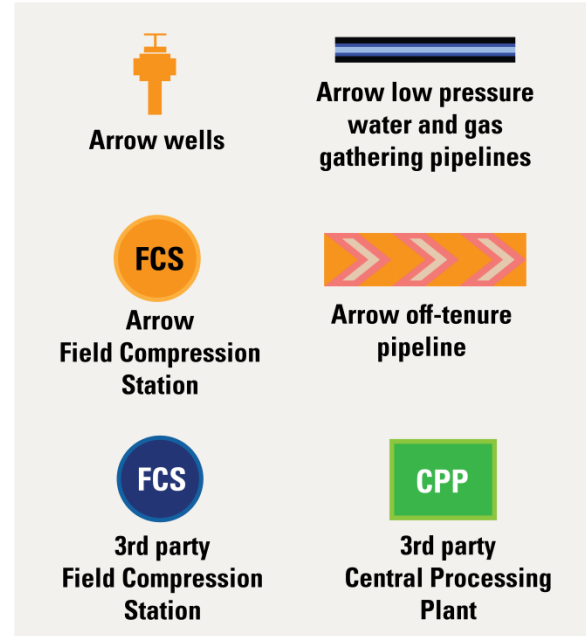
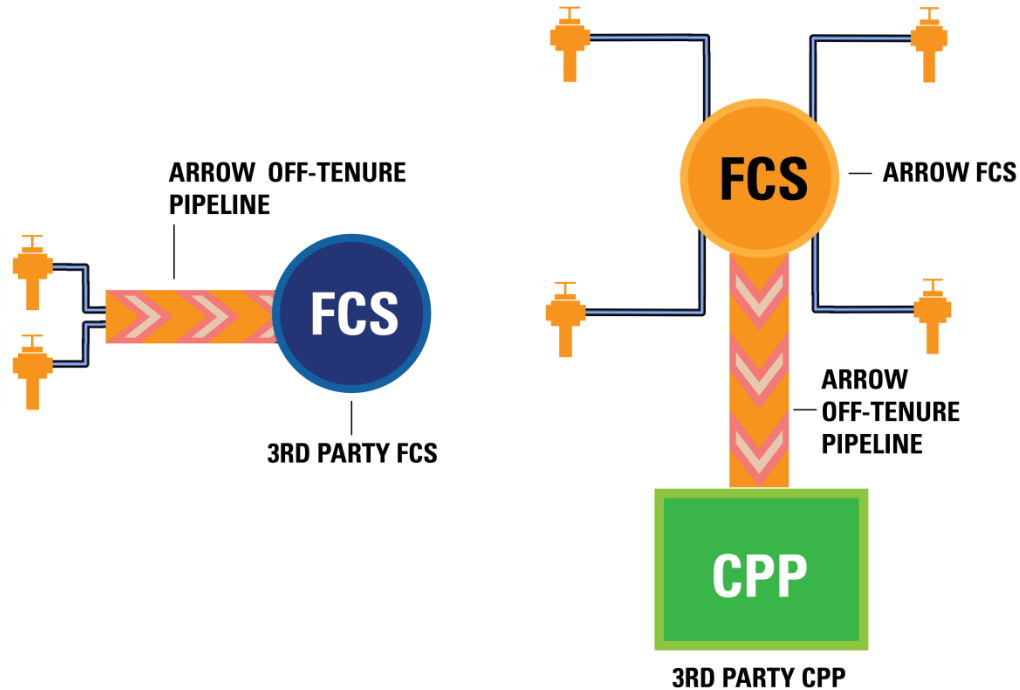
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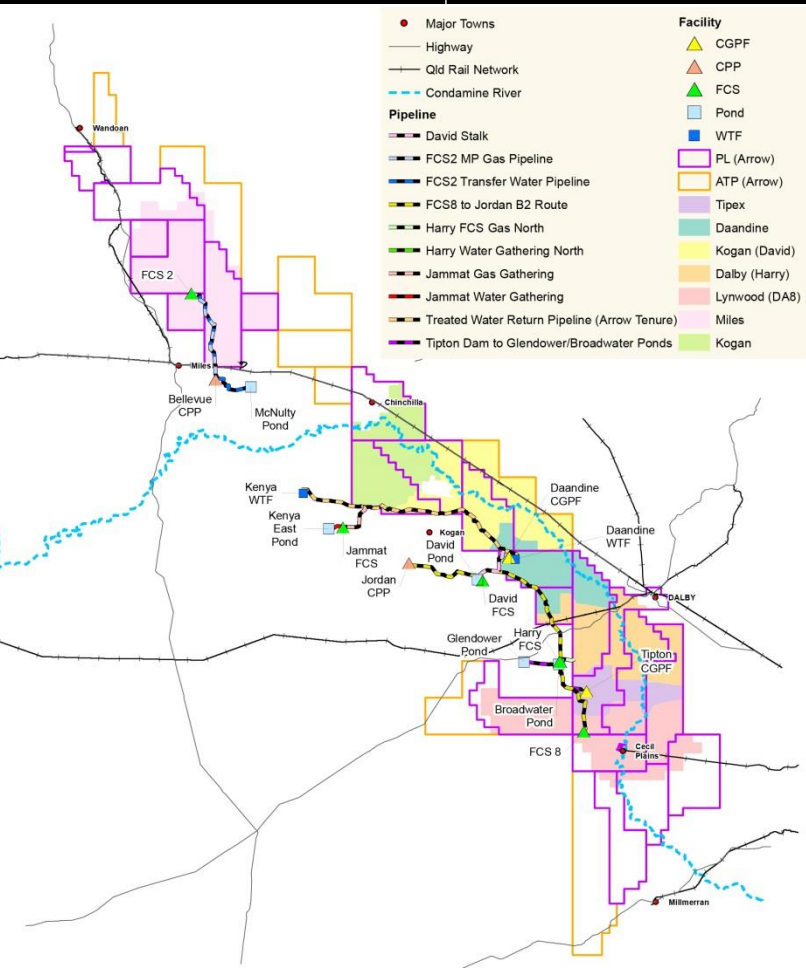


EXISTING SURAT OPERATIONS

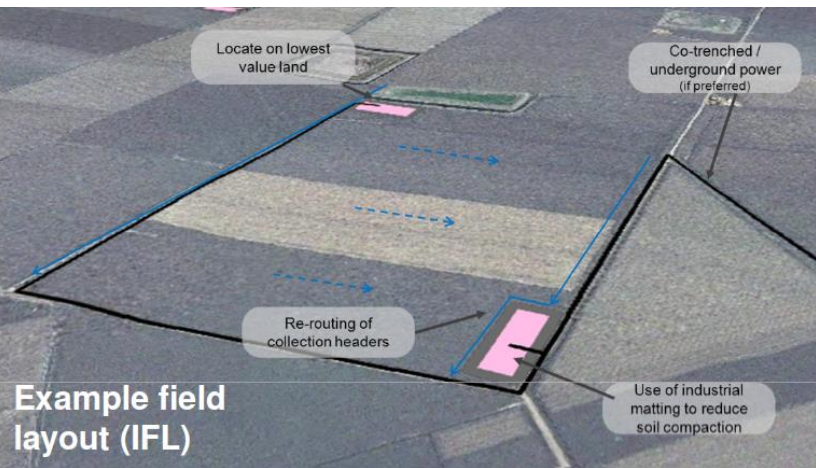


SURAT GAS PROJECT



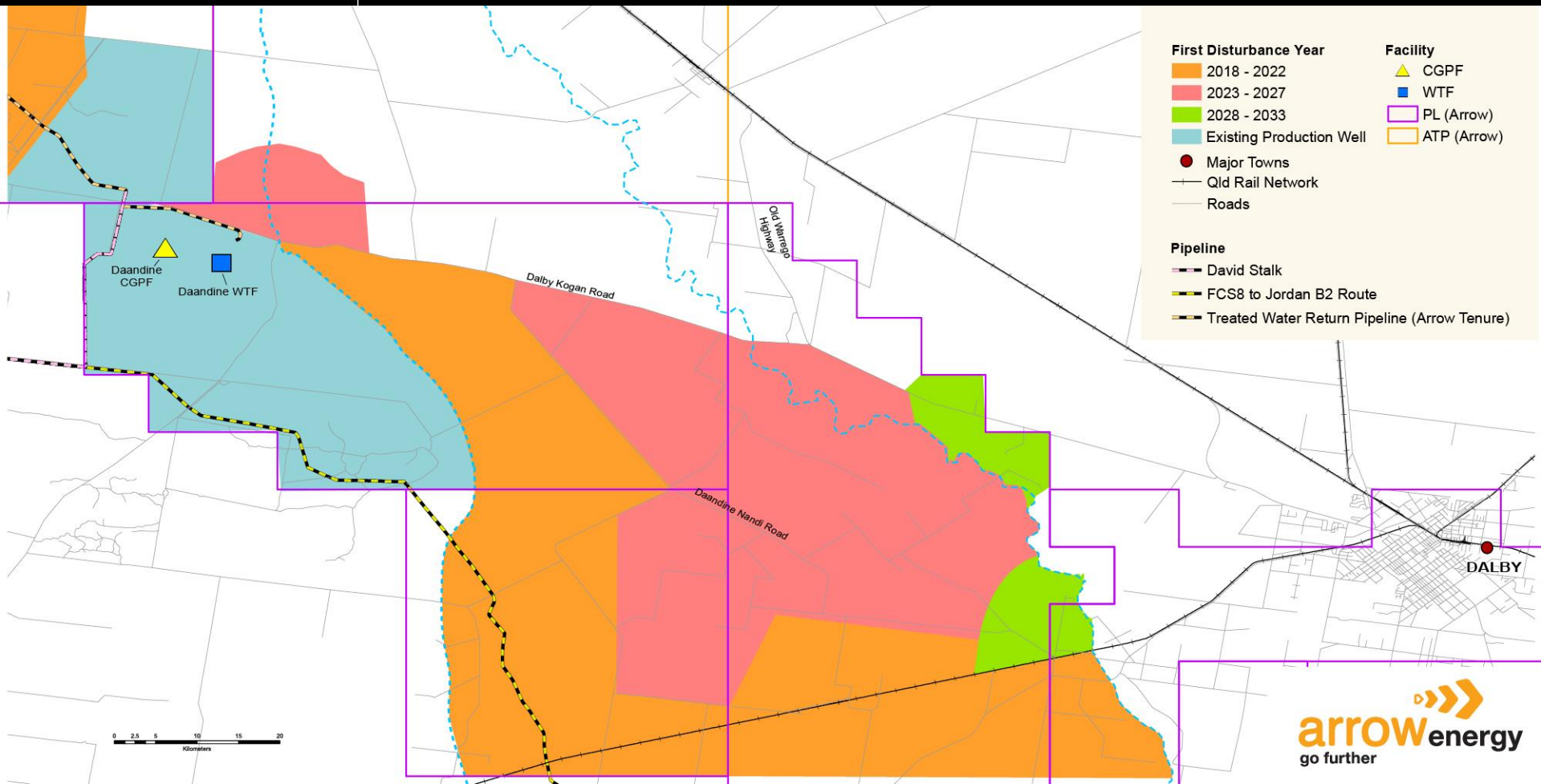


- Development planning is underway
- Overarching project principles unchanged including Arrow's coexistence commitments
- Arrow is operator and developer:
 - phased development over 27 years
 - two new gas facilities (near Miles and Tipton/Cecil Plains)
 - 2,500 wells
 - well pad life ~20 years
 - onsite generators to self-power wells, where possible
 - surface infrastructure on gathering lines:
 - low point drains
 - high point vents
 - some water pumping equipment
 - some off tenure pipelines are required
 - the Arrow Surat Pipeline is not required.
- Arrow will offset any impact on the Condamine Alluvium and will maximise beneficial use of treated coal seam water.



Arrow uses *area wide planning* (AWP):

- incorporates landholder and local knowledge into development plans
- gathers landholders' constraints and overland flow patterns
- arrives at the best layout for both landholders, and Arrow
- Arrow's development plans are not defined until after AWP
- Output examples include:
 - locating well sites for least impact on land
 - routing low pressure gas, water and underground power lines to follow existing tracks, where possible
 - defining depth-of-cover suitable for ongoing land use
 - defining access priorities for different farming and project activities.



First Disturbance Year

- 2018 - 2022
- 2023 - 2027
- 2028 - 2033
- Existing Production Well

Facility

- CGPF
- WTF
- PL (Arrow)
- ATP (Arrow)

Major Towns

- Major Towns

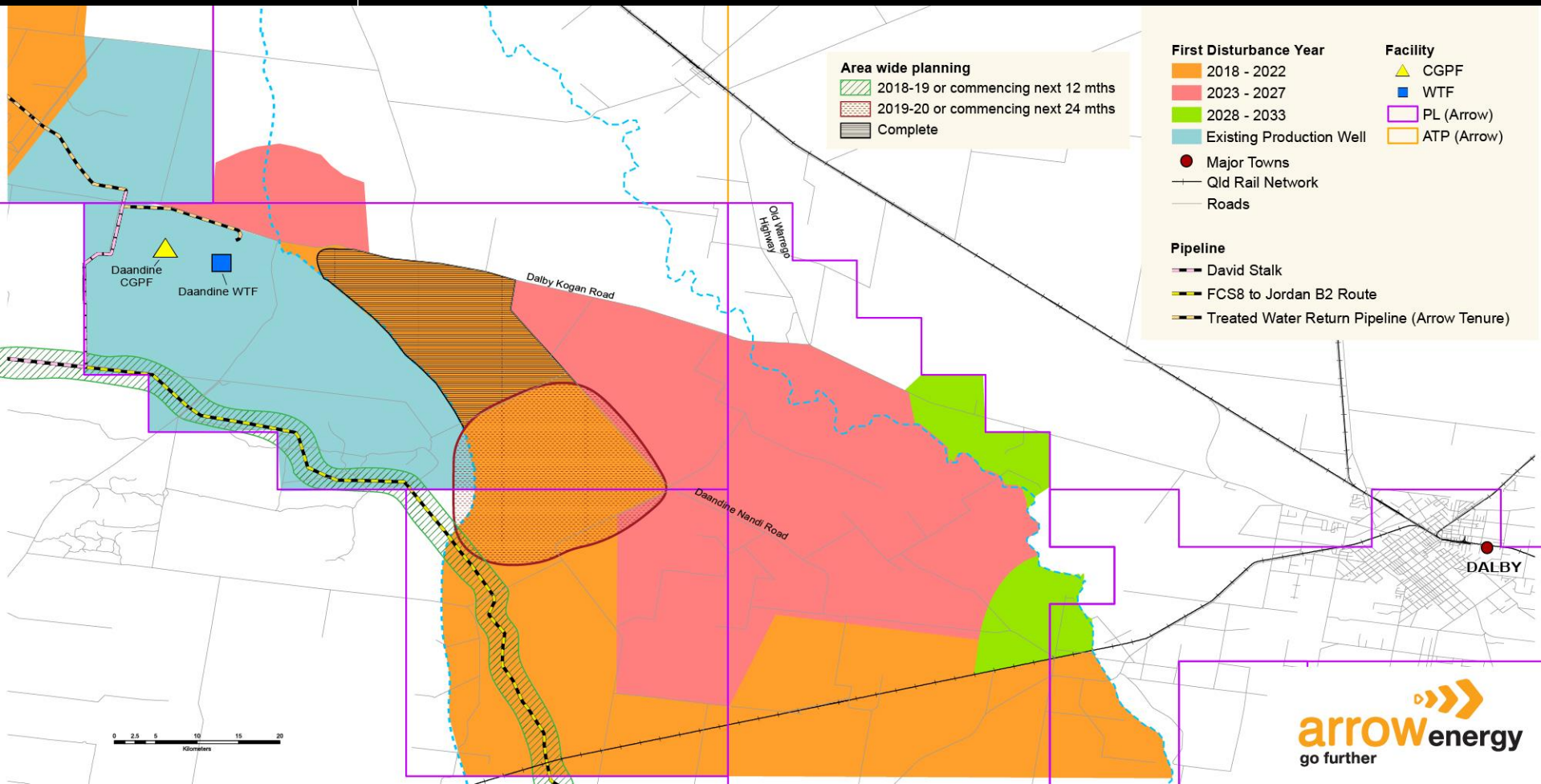
Qld Rail Network

- Qld Rail Network
- Roads

Pipeline

- David Stalk
- FCS8 to Jordan B2 Route
- Treated Water Return Pipeline (Arrow Tenure)





Area wide planning

- 2018-19 or commencing next 12 mths
- 2019-20 or commencing next 24 mths
- Complete

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- 2028 - 2033
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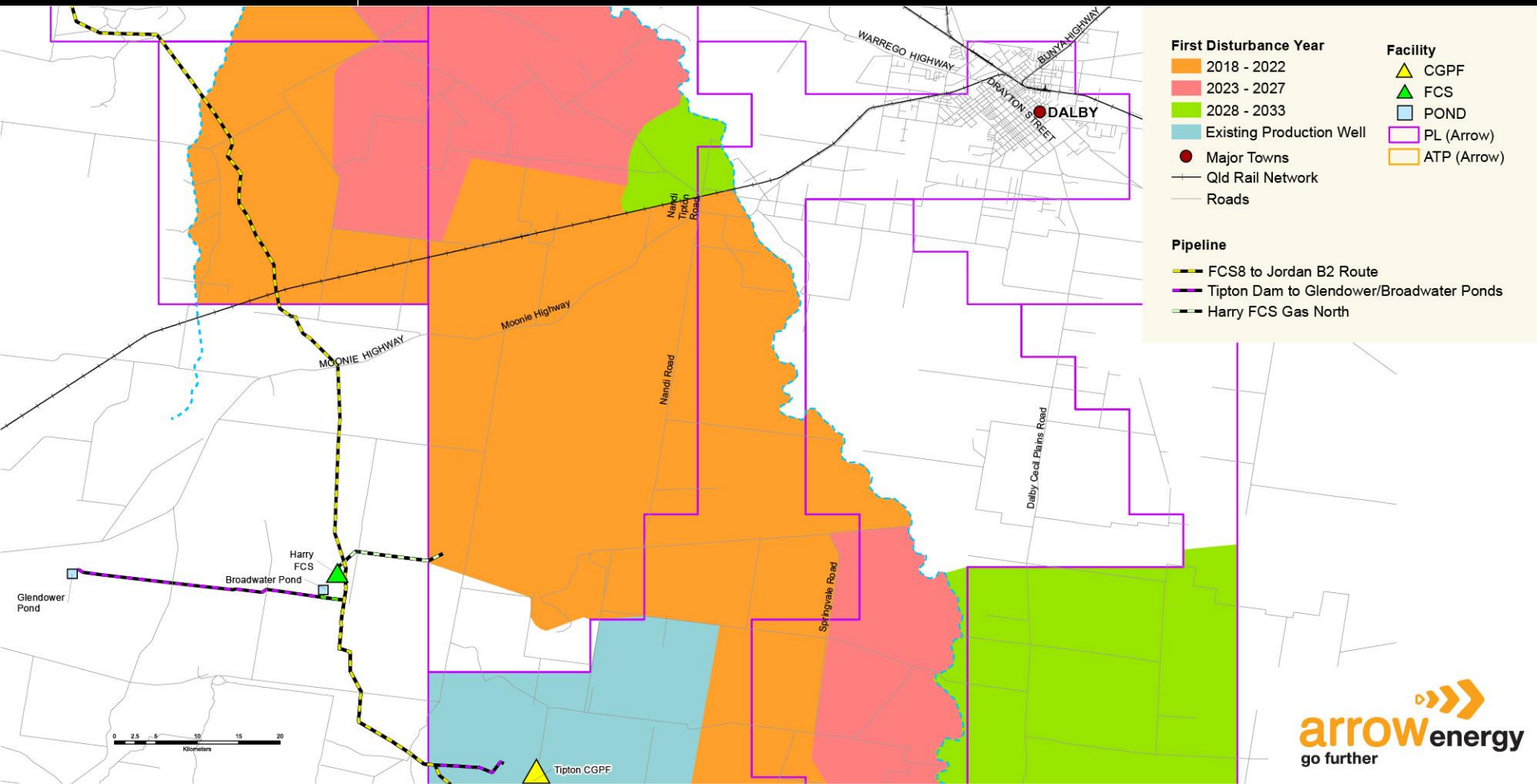
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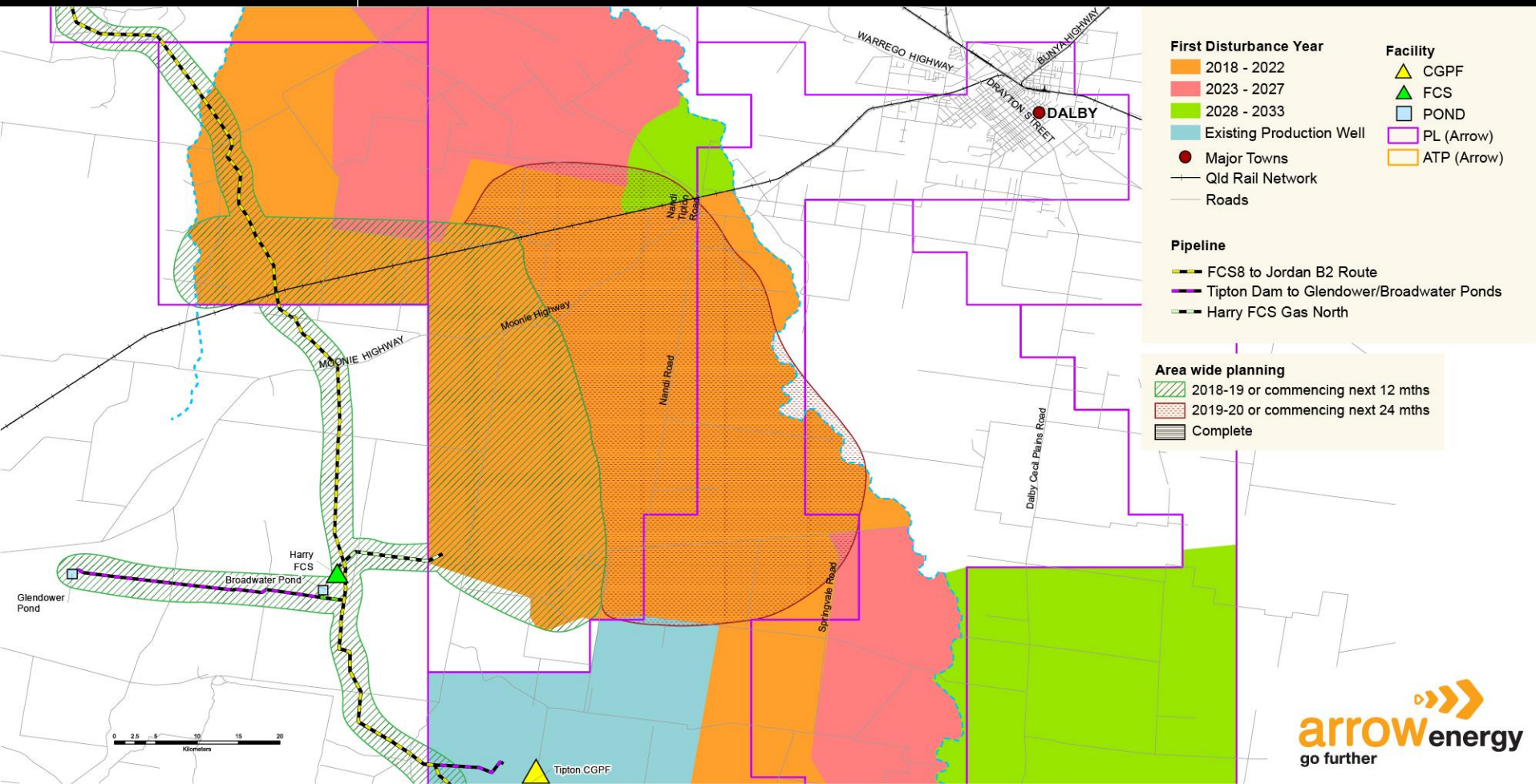
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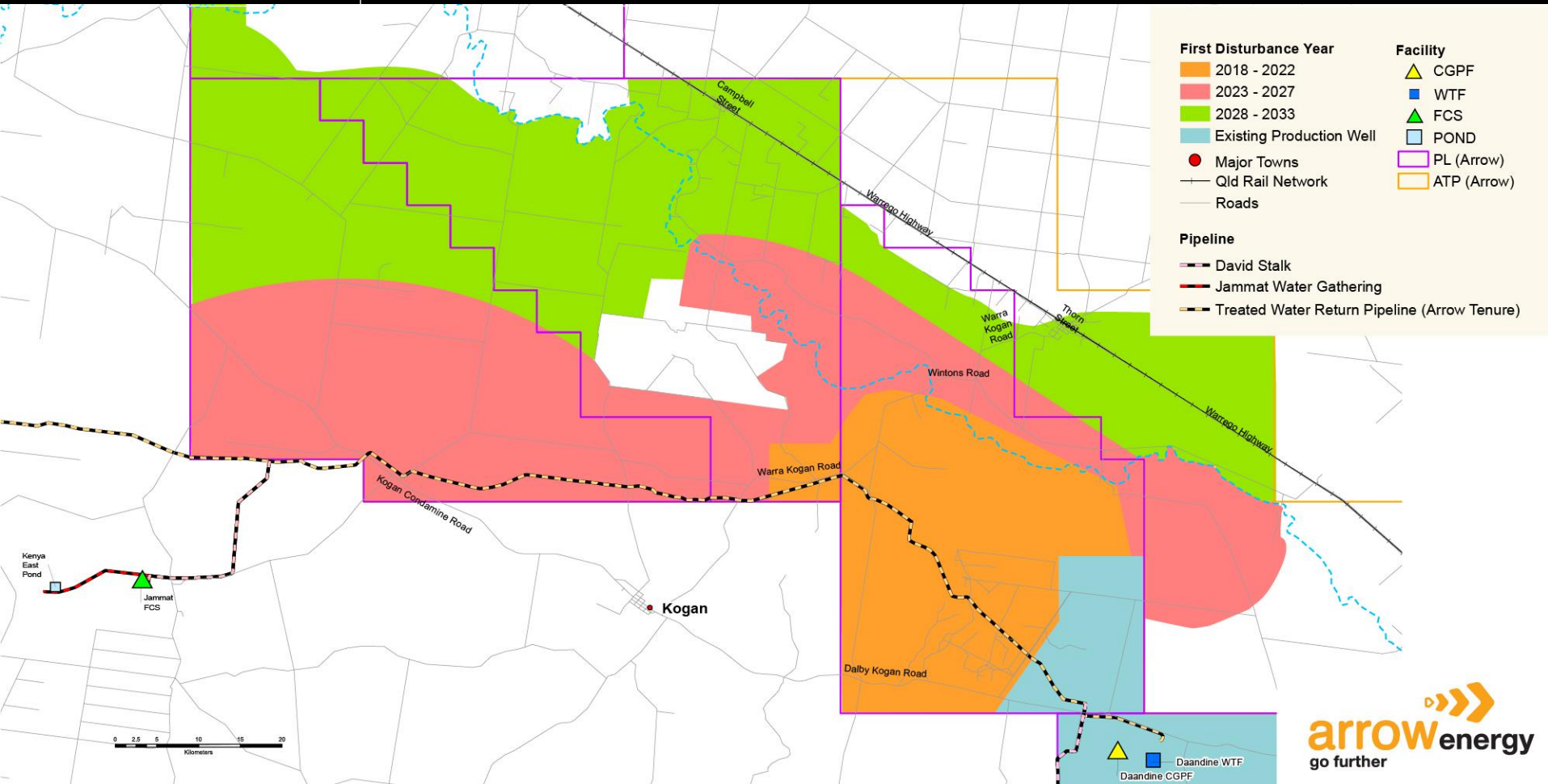
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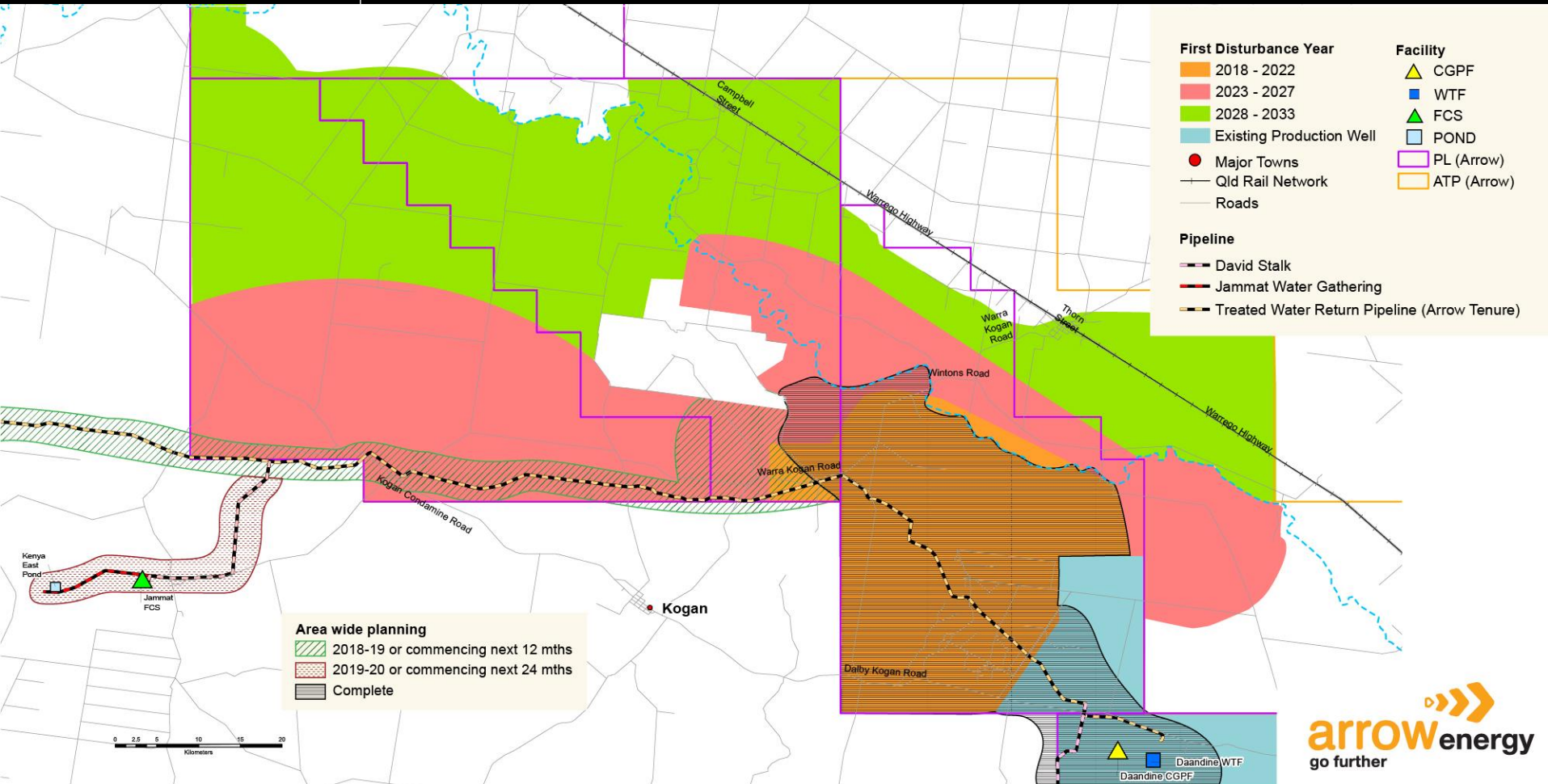
- Major Towns
- Qld Rail Network
- Roads

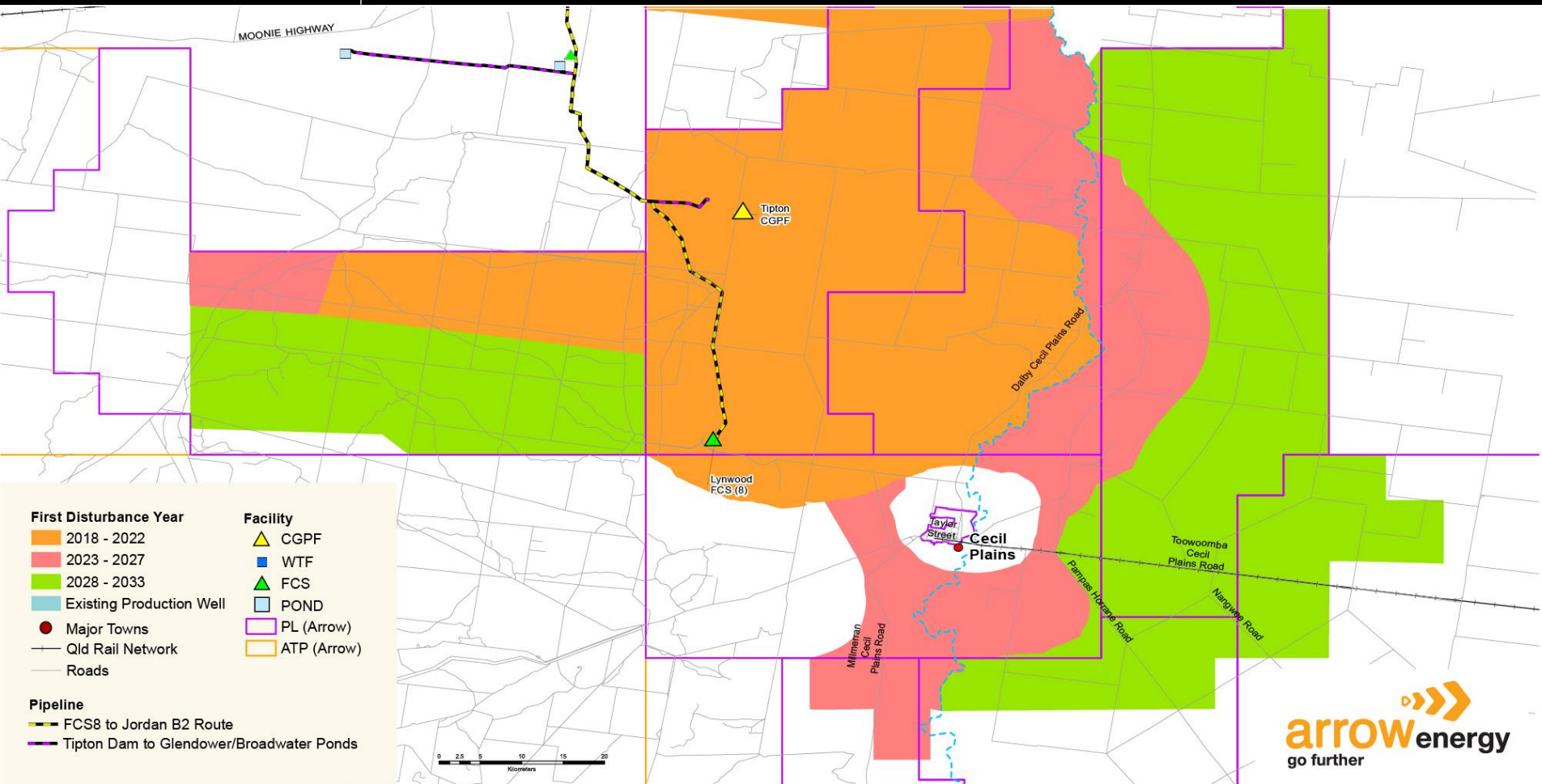


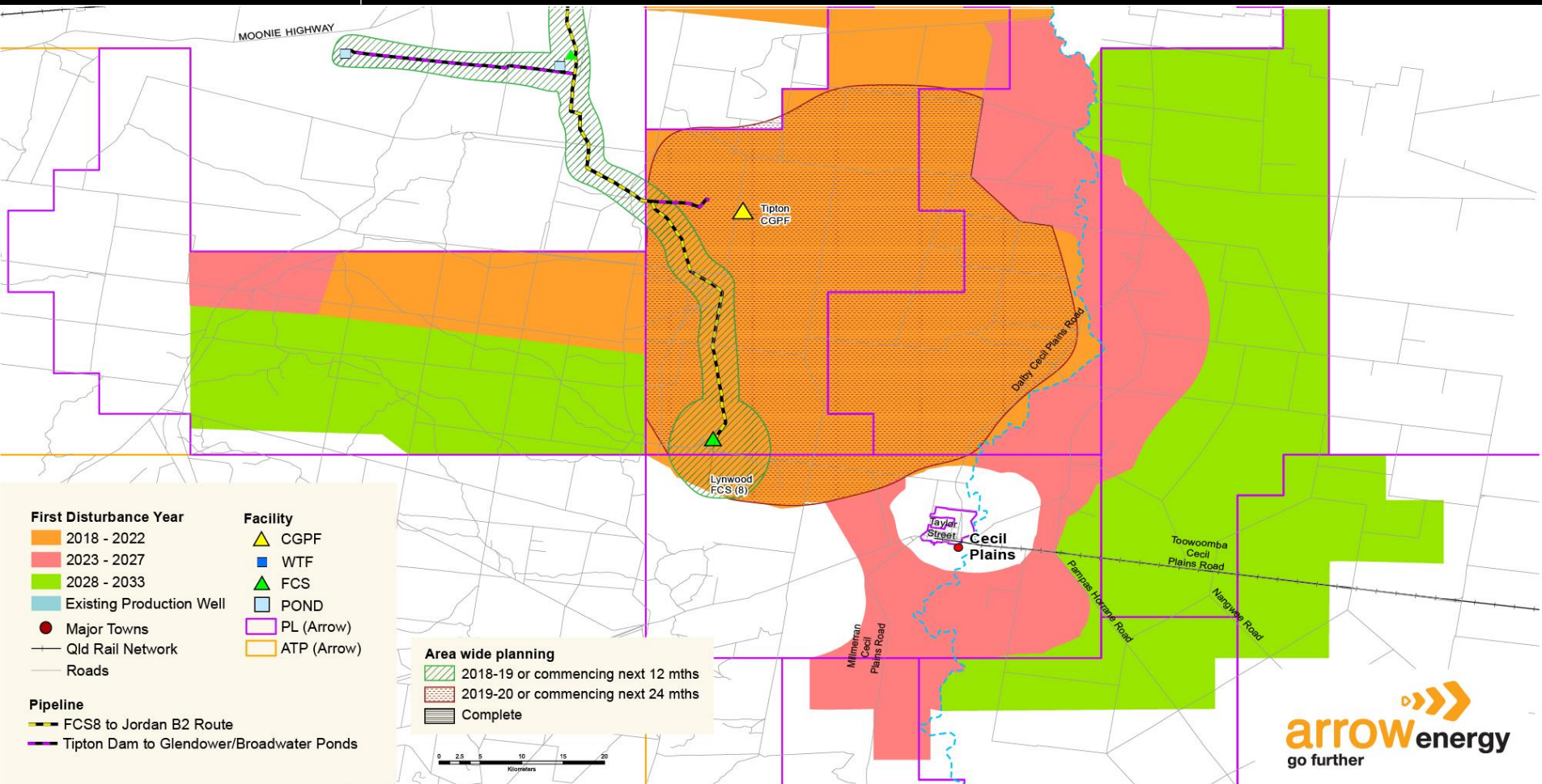


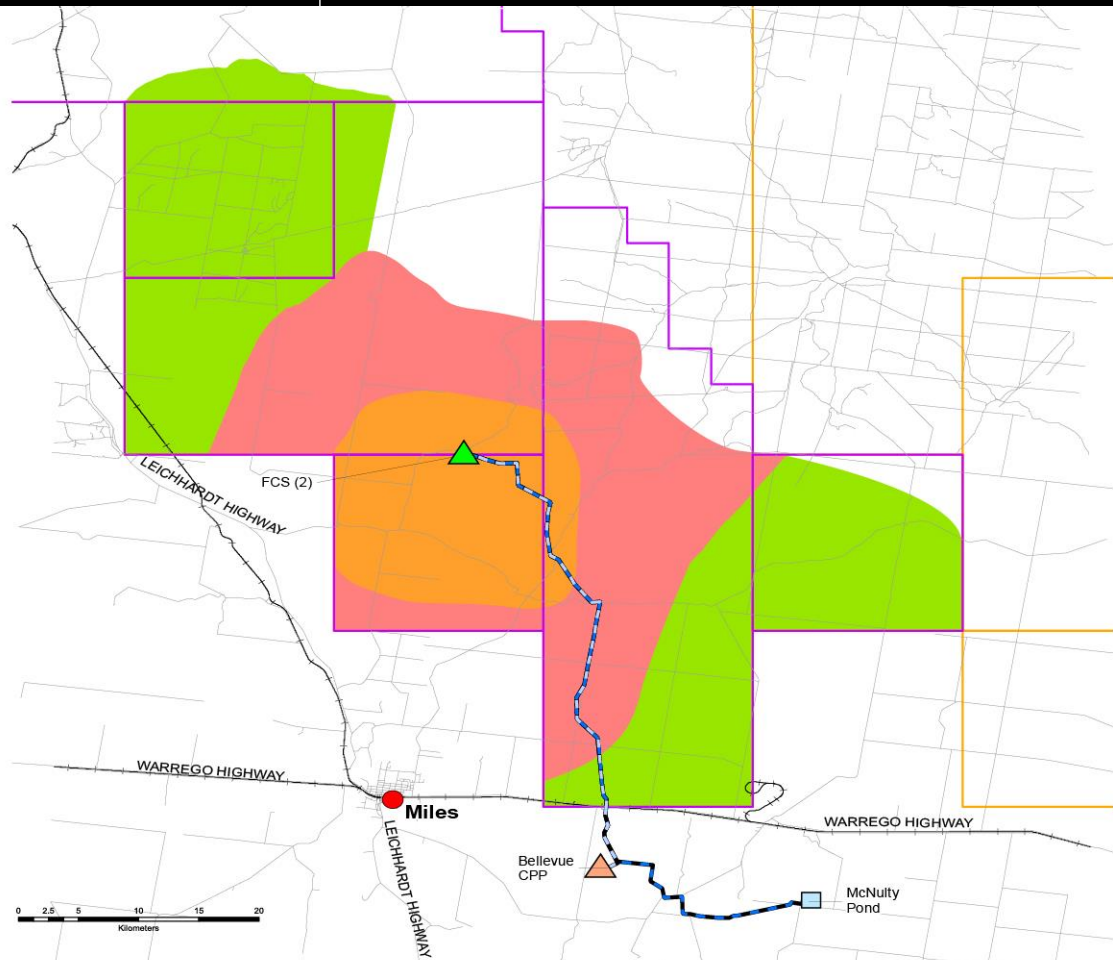












First Disturbance Year

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- Existing Production Well

Facility

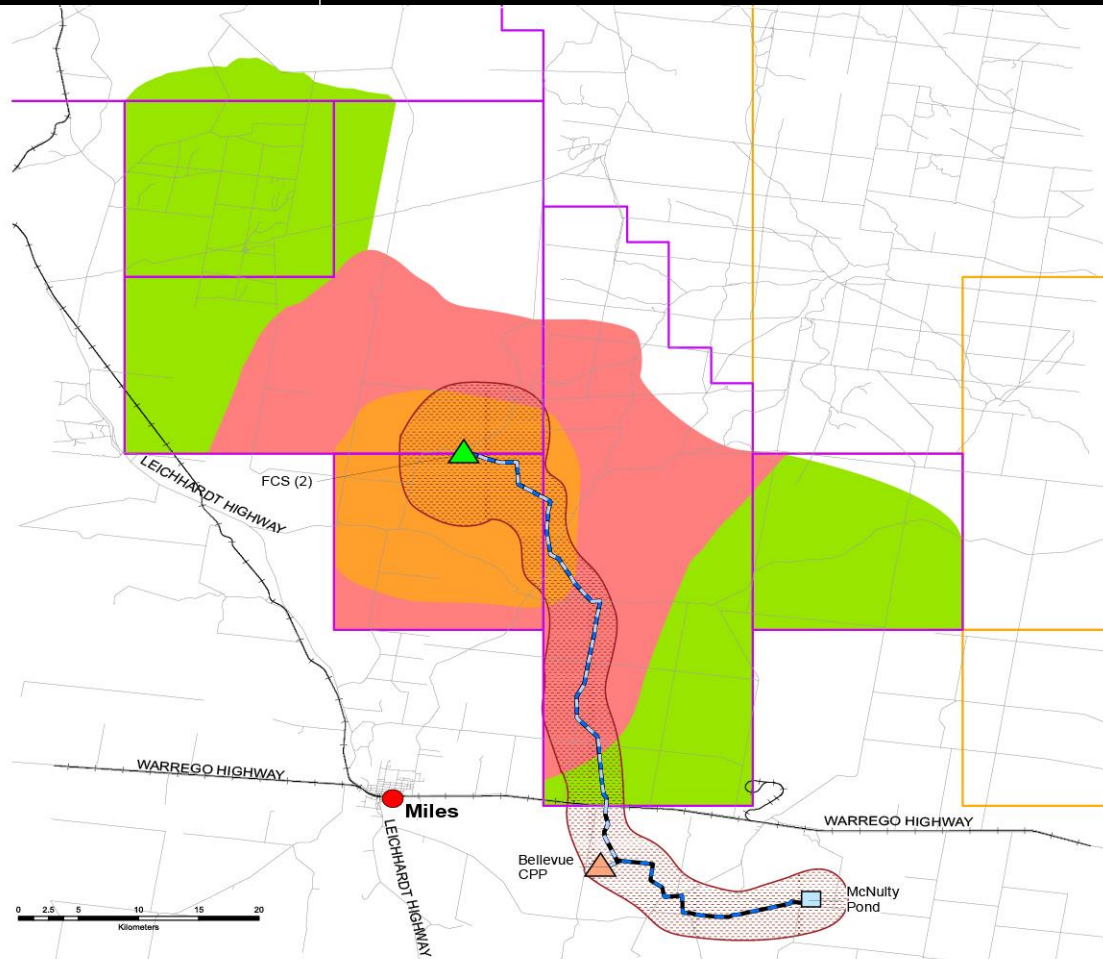
- CGPF
- FCS
- POND
- PL (Arrow)
- ATP (Arrow)

Pipeline

- FCS2 MP Gas Pipeline
- FCS2 Transfer Water Pipeline

Other Symbols:

- Major Towns
- Qld Rail Network
- Roads


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- Existing Production Well

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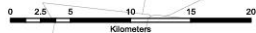
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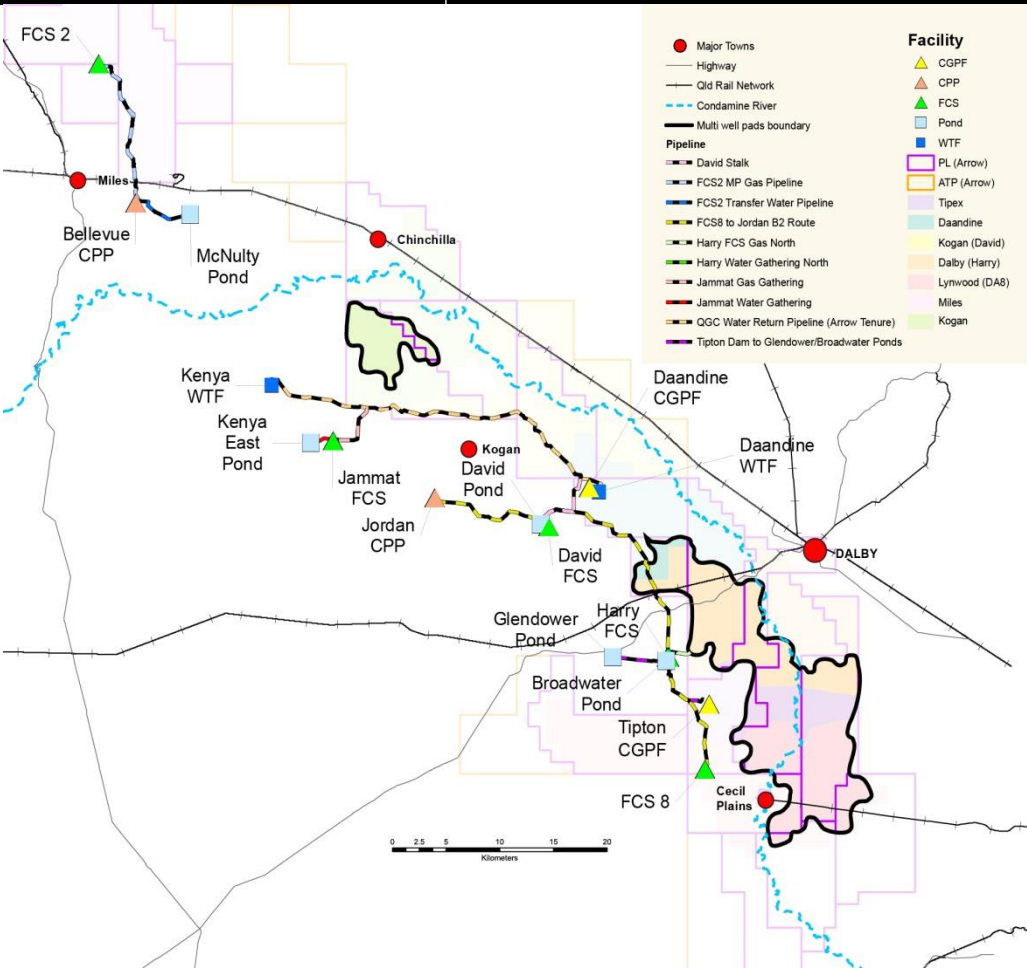
Area wide planning

- 2018-19 or commencing next 12 mths
- 2019-20 or commencing next 24 mths
- Complete





- Arrow has 12 coexistence commitments for intensively farmed land, to ensure:
 - minimised impact
 - no permanent damage to productivity of the land or the Great Artesian Basin
 - landholders are fairly compensated for possible impacts from our activities.
- We will demonstrate coexistence, in collaboration with our landholders, through:
 - pre-development design work to minimise our footprint
 - best practice construction management to minimise our impact on landholder operations
 - best practice operational management to minimise our impact on farm productivity.



Practically, Arrow's coexistence means:

- Multi-well pads as standard on intensively farmed land, where coal depth allows, unless negotiated
- Gathering lines deep enough for future land use
- Power: reticulated underground to well sites or generated on-site, unless otherwise agreed
- Well site surface spacing will average not less than 800m on intensively farmed land
- Area wide planning to identify infrastructure locations
- Arrow's compensation framework considers the value of prime farming land, including:
 - value of the land
 - level of disturbance
 - intensity of development.



- Project strategies are informed through our approved Environmental Impact Statement and Social Impact Management Plan
- Our philosophy:
 - support local
 - maximum opportunity for local participation
 - mitigate impacts.
- Project strategies under development include:
 - road impact assessments
 - road use management plans
 - workforce and accommodation plans
 - contracting and procurement strategies
 - training and capacity building.
- More information in early 2019.





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Search for the right suppliers or project partners here.

Keywords e.g. electrician, glass etc

Choose state ▼

Choose region ▼

FIND SUPPLIERS

Looking for work?

Search for projects and new business opportunities here.

Keywords e.g. fabrication, steel etc

Choose state ▼

Choose region ▼

FIND WORK

- Economic benefits through employment, contracting and procurement
- Job opportunities:
 - Arrow strongly supports local employment
 - 800 jobs in construction – peak in 2022
 - 200 jobs in on-going operations
 - vacancies will be advertised.
- Local content:
 - Arrow and its contractors will provide full, fair and reasonable opportunities for capable and competitive local industry participation
 - Arrow will publish a Supplier Information Guide on the Arrow Energy website and www.arrow.icn.org.au
 - Work with local supplier advocates, regional development bodies, chambers of commerce and local councils to promote supply opportunities
 - Support for local suppliers to develop their businesses in prequalifying or tendering with workshops in 2019.

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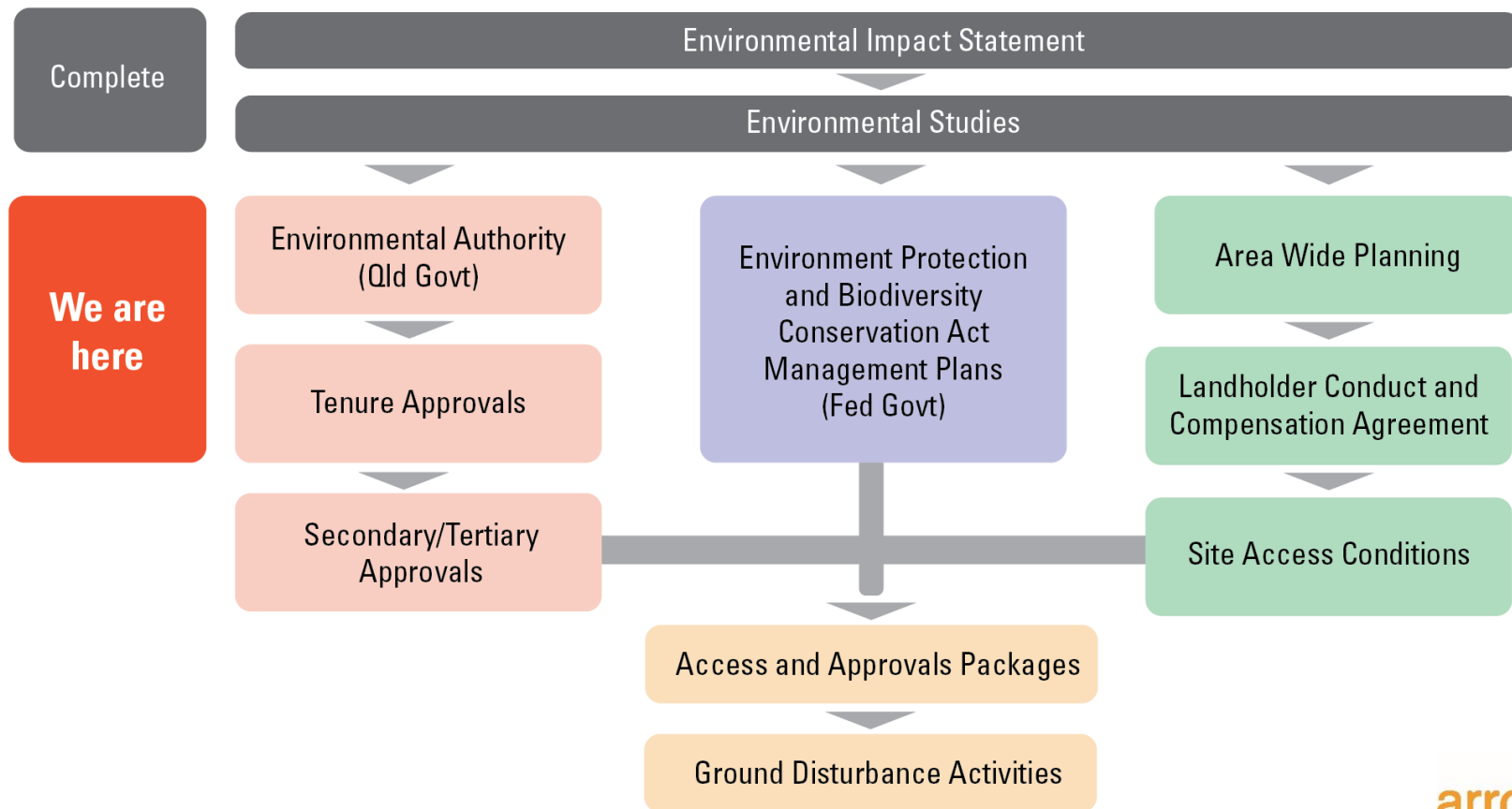
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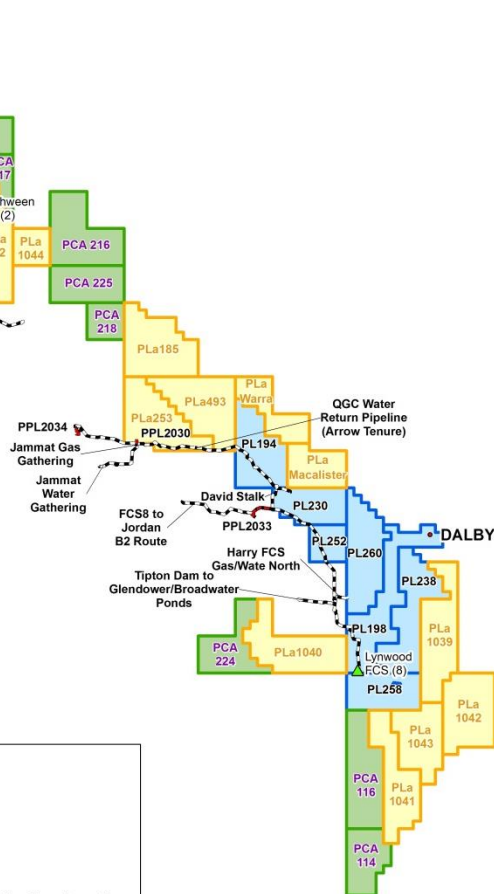
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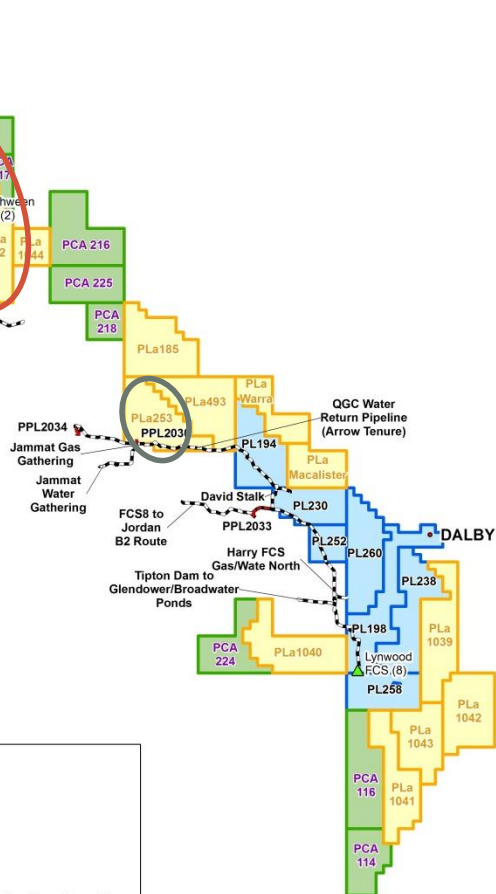
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- Resource activities, including coal seam gas, require:
 - tenure (petroleum licences) *and*
 - environmental authority (EA) before production.
- Arrow's SGP will require both on-tenure and off-tenure approvals
- On-tenure approvals include:
 - Regional Interest Development Approvals (RIDA)
 - 16 petroleum leases and associated environmental authorities
 - 2 petroleum facility licences (field compression stations) and EAs.
- Off-tenure pipelines and activities will require:
 - New federal (Environment Protection and Biodiversity Conservation Act) approval – lodged May 2018
 - 8 petroleum pipeline licences (PPLs) and associated EAs – phased lodgement from 2018 to 2022.



- The SGP North EA (red) covers ~78,000ha from Miles north to Guluguba:
 - 588 new gas production wells
 - 650km of gathering pipelines to be installed over ~20 years.
- This EA has no effect until six corresponding petroleum leases are granted by the State Government.
- The Hopeland pilot and pipeline EAs (grey) cover a small area ~25km south-west of Chinchilla:
 - Arrow to collect gas from an existing 6-well pilot, and bring it to market
 - install up to 14 additional water monitoring bores.
- Tipton Expansion approvals, including:
 - an amendment to the EA for Arrow's existing domestic gas operations (7 blue PLs), to expand the existing Tipton CGPF
 - Tipton CGPF expansion RIDA, for activity on Arrow-owned cropping land.

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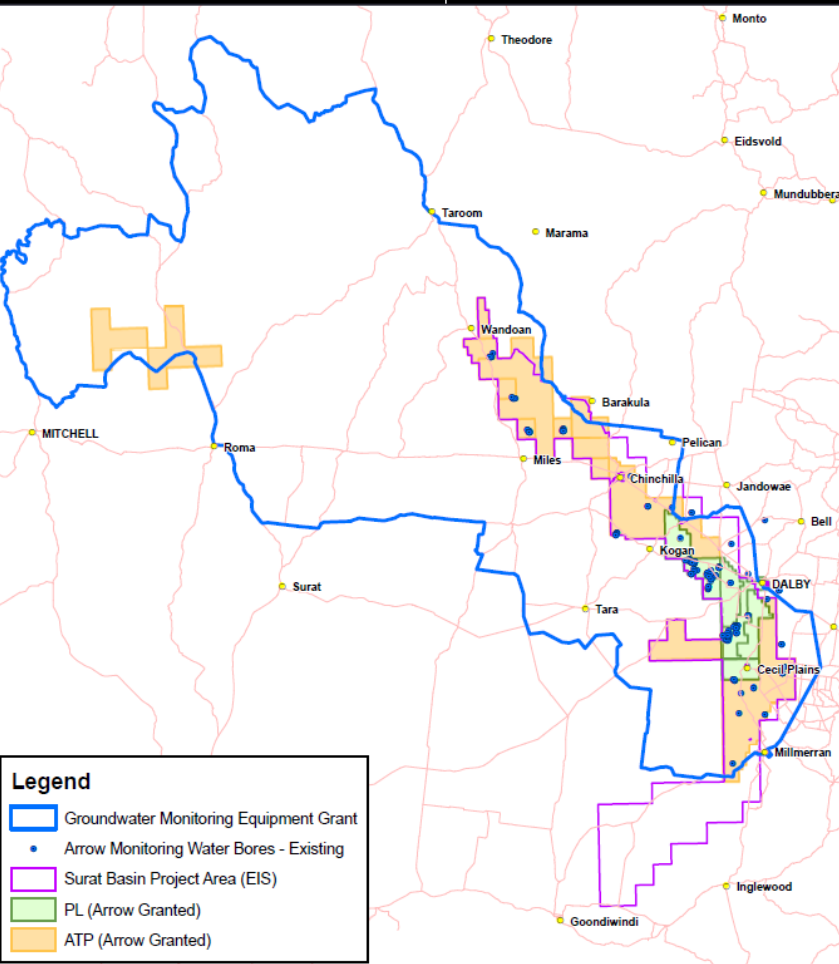




- Arrow anticipates less drawdown than predicted in environmental impact statements.
- Arrow will continue to update drawdown predictions by using OGIA's most appropriate groundwater model.

Arrow's groundwater activities

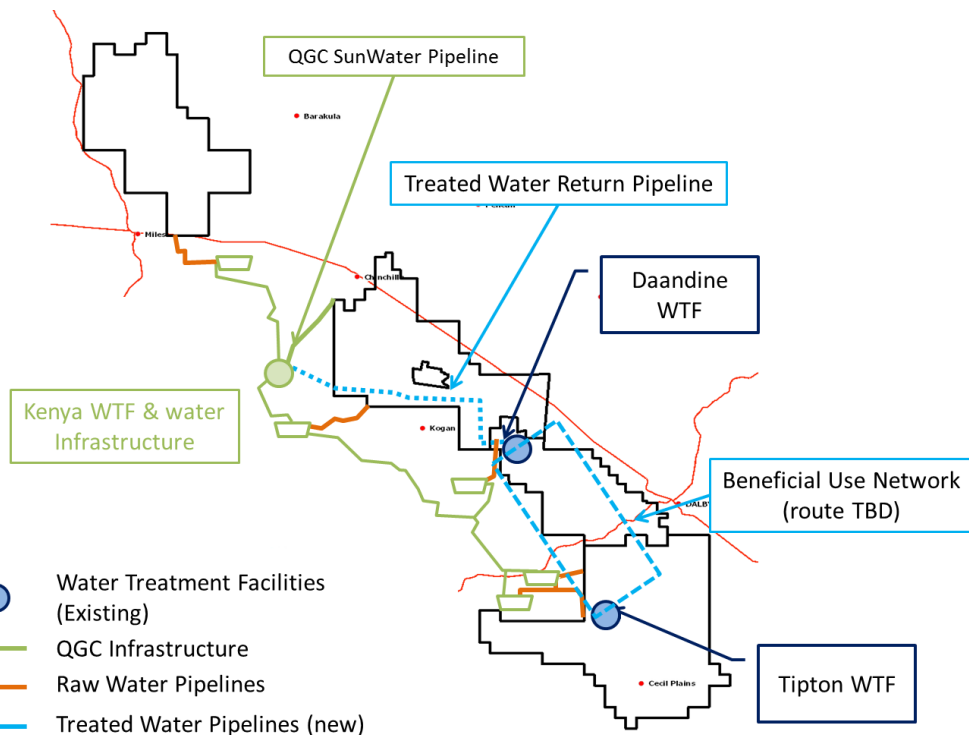
- ✓ Surat Cumulative Area Underground Water Impact Report (UWIR)
- ✓ Arrow's Surat groundwater monitoring network >200 bores
- ✓ Surat Groundwater Dependent Ecosystem investigations completed (15 bores installed)
- ✓ Stage 1 Water Monitoring and Management Plan submitted to Federal Government
- ✓ Voluntarily undertaking pro-active negotiations for make good agreements
- ✓ Early planning for water beneficial use network



- Arrow’s Surat groundwater monitoring network (>200 Surat bores) contributes to regional understanding of groundwater levels
- Groundwater Net’s community groundwater monitoring program also works to expand knowledge of the groundwater resource
- Grants cover up to 75% of costs to install monitoring equipment on registered bores in the Surat Basin
- Groundwater Net, through the Department of Natural Resources, Mines and Energy coordinate the collection of groundwater levels
- Information is published online via the Queensland Globe.



- Arrow is committed to offset our impact on the Condamine Alluvium.
- Our end use strategy aims to balance known stakeholder concerns, as far as possible, considering volumes are comparatively small.
- There is insufficient water to support ‘new’ users – this will inevitably lead to stranded investment and poor outcomes for users.
- Following community feedback, we’ve committed to substitution of allocation.



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 beneficial use network.

Milestone dates

- 2019 – engage with Condamine Alluvium Allocation holders
- 2023 – target date for beneficial use network.

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