Santos
GLNG

Ready Reckoner

Construction and operations activity guide for landholders

GLNG is a Santos PETRONAS Total KOGAS venture.

Santos | PETRONAS | TOTAL | KOGAS

Additional notes

Santos GLNG warrants the information provided within this document is the most current and accurate information available at the time of publishing.

Indicative disturbance, duration and personnel are always influenced by weather, geography and regulatory constraints that may vary.

As processes are improved and new technologies developed, details in this document may vary over time. Similarly, as relevant legislative requirements change, Santos GLNG will adapt to meet these requirements.

Table of contents

Introduction 2
Engagement process with new landholders for future natural gas production activities 3
Seismic surveying 10
Geotechnical investigations 14
Lease area 16
Minimal disturbance lease 18
Temporary campsites 19
Access roads 21
Natural gas wells 22
Drilling operations 25
Rig-less operations 29
Hydraulic fracturing 34
Initial completions and workover operations 36
Coil tubing clean out 39
Well maintenance operations 40
Plug and abandon 41
Modular open water storage tank 43
Flowlines 46
Powerlines 52
Gas transmission pipeline 59
Fibre optic cable 67
Laydown area 68
Water management pond 69
Communication towers 72
Water monitoring bores 74
Life in an operating gas field 79
Well lease rehabilitation and decommissioning 84
APPENDIX A: OVERVIEW OF ACTIVITIES 91
APPENDIX B: GLOSSARY 102
APPENDIX C: ACRONYMS 105

Introduction

Santos GLNG has compiled this Ready Reckoner to provide landholders in our tenure with information about gas field activities that may be carried out after negotiating a conduct and compensation agreement (CCA).

If Santos GLNG negotiates a CCA with you as a landholder, the CCA will list the activities proposed. This Ready Reckoner provides additional construction and operational details about those activities.

It also outlines the disturbance area and duration of each activity, the type of machinery you may have on your property and the number of people who might be working on site at any given time.

Photos are the most accurate way of showing you what we do so we have included a wide range of images of our construction activities to complement the descriptions.

It is important to note that while this Ready Reckoner outlines common gas field activities, it is very unlikely that all of these activities would be proposed for your land.

At Santos GLNG we believe it is important to keep you informed about potential impacts on your land and that we explain the activities involved in natural gas production and operation so you know what to expect from our team and our contractors.

Over the past few years, Santos GLNG has been asked many questions about the impact of our activities. Those questions have helped us formulate this Ready Reckoner to answer your queries.

It is important to remember that the natural gas industry, like the pastoral and agricultural industries, is undergoing continual change and improvement. That means the information contained within this Ready Reckoner is the best available at the time of publishing, but is subject to change and refinement as techniques and practices improve. Santos GLNG will undertake regular reviews of this Ready Reckoner and update it periodically.

Appendix A summarises this Ready Reckoner to give you an easy comparison of activities.

We hope you find this Ready Reckoner useful, but as always, if you have any questions please don't hesitate to call your Santos GLNG landholder liaison.

Engagement process with new landholders for future natural gas production activities

This section provides an outline of how Santos GLNG will engage with you for future natural gas production activities. The information is particularly relevant to new landholders who Santos GLNG has not yet conducted business with.

Engagement with you, as a landholder, is a vital part of our business and Santos GLNG will seek to work with you through the natural gas development phases. This section provides clarity on the following information to assist us in forming a mutually beneficial, long-lasting relationship with you:

- when we will be requesting your time
- how much of your time we may require throughout the engagement process
- how your Santos GLNG landholder liaison will engage with you.

The durations provided are to be used as a rough guide only and will be highly dependent on the level of infrastructure proposed for your property, the level of communication we have had with you in the past and the level of engagement you, as the landholder, require.

The diagram on the next page provides an outline of our engagement process.

Landholder engagement process

MEETING YOUR SANTOS GLNG LANDHOLDER LIAISON & THE TEAM

Meeting with you
- Shed meetings
- Individual meetings
- Explain natural gas development process from exploration to production
- Explain Santos GLNG compensation methodology

Keeping in contact
- Santos GLNG landholder liaison available to discuss issues
- Receive Santos GLNG project updates
- Bus tours of natural gas sites
- Our experts on hand for discussion

Property mapping
- Develop property map
- Share information
- Begin development of the rules of conduct

Preliminary discussions
- Deliver entry notice for preliminary activities
- Discuss proposed future advanced activities

NEGOTIATING AGREEMENTS

Site scout
- Landholders are encouraged to participate in the scout

Possible re-scout
- This may be necessary to confirm exact locations of infrastructure or to address any changes

Meetings to discuss preparation of conduct & compensation agreement (CCA)
- Proposed petroleum activities and map of activity locations
- Terms and conditions
- Rules of conduct which Santos GLNG and its contractors must follow
- Compensation estimates

Keeping in contact

Deliver the CCA & letter of offer
- Deliver the negotiated CCA for consideration
- Letter of offer (includes compensation)

Compensation payment
- Compensation payment made as outlined in the CCA

Agree on the CCA
- A final meeting
- Indication of likely construction start date

CONSTRUCTION

Pre-start meeting
- 10 days prior to construction commencement
- Landholders are encouraged to attend

Arrange first access
- Introduction to Santos GLNG site permit process

Site monitoring & compliance
- Rules of conduct
- Construction activities
- Weed and erosion
- Other compensation for water and gravel

Tool box meeting
- Morning of construction commencement
- All Santos GLNG supervisors and contractors
- Landholder presence is optional

Keeping in contact
- Ongoing communications regarding construction activities

Potential variations to the CCA
- Discuss variations
- Present agreement to vary (ATV) if applicable

MAINTAINING OUR RELATIONSHIP

Continued access
- Compliance with site permit process

Ongoing compensation
- Paid on time and in line with the CCA (for surface infrastructure)

Keeping in contact
- Regular consultations
- Monitoring
- Receive Santos GLNG project updates

Meeting your Santos GLNG landholder liaison and the team

Meeting with you

We believe it is important to introduce Santos GLNG to all landholders in the areas where construction activities are proposed to take place. We do this by meeting with you personally on your farm and with small groups of adjacent landholders at a place that suits the group, known as 'shed meetings'.

During these meetings we explain how our potential future activities could affect you and your land and the opportunities that become available due to natural gas infrastructure being constructed on your land.

We will also:

- introduce the Santos GLNG team who will liaise with you at every stage of the process
- explain the natural gas development process from exploration to production
- explain Santos GLNG's compensation methodology
- discuss the laws and regulations governing Santos GLNG and our behaviour.

Duration: up to two hours for initial discussions.

Personnel for shed meetings:

- up to four Santos GLNG landholder liaisons
- up to four Santos GLNG technical experts
- up to 30 invited landholders.

Personnel for individual meetings:

- up to two Santos GLNG landholder liaisons
- Santos GLNG technical experts, if required.

Property mapping

Santos GLNG wants to understand your business. In order to do this we will meet with you personally to gather information regarding your seasonal activities, such as mustering and weaning, and record whether your property has organic status or other unique characteristics.

We will map out your paddocks, tracks, fences, dams, water points, polypipes, cultivation areas, dwellings, yards, proposed no-go areas and preferred natural gas activity locations.

We can use this information to assist in minimising the impact of our activities on your land and business, where possible, and to develop a mutually beneficial coexistence.

We will collaborate with you on the development of the rules of conduct that Santos GLNG employees and contractors will follow while on your land.

Your Santos GLNG landholder liaison will visit you to deliver the completed map of your property. The map will be in A1 or A0 size so that the detail is easily readable. We can also send you the map via post and/or email.

Santos GLNG will then consider this map when planning the future proposed natural gas activities for your property.

Please note, property mapping may not always be required for smaller impact activities, such as seismic surveying and environmental impact statement (EIS) surveys.

Duration: two to five hours.

Personnel: up to three Santos GLNG landholder liaisons.

Keeping in contact

Throughout the year, you will have opportunities to attend one of the bus tours of our natural gas sites to see our activities in action. Your Santos GLNG landholder liaison will invite you to participate in these opportunities as they become available.

Santos GLNG issues a bi-monthly update which is available to everyone via the Santos GLNG website (www.santosglng.com) where you can also subscribe to our email updates.

Your Santos GLNG landholder liaison is always available if you have any follow-up questions. We are more than happy to arrange any experts required to talk you through natural gas activities in more detail.

Duration: as required.

Personnel:

- Santos GLNG landholder liaison
- Santos GLNG technical expert, as required.

Negotiating agreements

Preliminary discussions

An entry notice for preliminary activities is a notice Santos GLNG is required to supply to you prior to accessing your property for preliminary petroleum activities (primarily the site scout).

Your Santos GLNG landholder liaison will hand deliver the notice to you and, following its delivery, allow at least 10 business days to pass before entering your property to undertake the activities set out in the notice. You may waive the 10 day notice period if you wish to do so.

During this meeting, your Santos GLNG landholder liaison will discuss proposed future advanced activities for your property, which are identified on the entry notice. If possible, a map of the proposed location of activities will also be presented to you.

Your Santos GLNG landholder liaison will then arrange an appropriate time and date to return to your property to conduct the site scout.

Duration: 30 minutes to an hour.

Personnel: Santos GLNG landholder liaison.

Site scout

A site scout is a preliminary activity that involves visiting your property to survey the land and confirming with you the most appropriate locations for the proposed advanced activities. It enables us to better plan to meet the production requirements for our activities, taking into account issues such as physical access, environmental issues, cultural heritage issues and your views on any proposed activities.

Our objective is to ensure that any development on your property is carried out in a way that minimises the impact on your business and way of life. So we strongly encourage your attendance and participation at the site scout.

Duration: usually half a day, however, it may take multiple days depending on the level of infrastructure proposed for the property and the size of the property.

Personnel:

- Santos GLNG landholder liaison
- environmental adviser
- cultural heritage adviser
- civil works officer
- surveyors
- construction representatives.

Ecological and cultural heritage surveys

Ecological surveys involve the assessment of soils, vegetation flora and fauna in areas of proposed natural gas activities and surrounding areas that could be indirectly affected by the activity. Cultural heritage surveys include identifying any cultural heritage sites of significance and recommending appropriate management actions in the proposed area.

Santos GLNG is required by legislation and its approval conditions to undertake these surveys before commencing any advanced natural gas activities that involve disturbance to land.

Qualified ecologists or environmental consultants undertake the ecological surveys, while representatives of the endorsed Aboriginal parties undertake the cultural heritage surveys. Sites of cultural heritage significance may include:

- artefact scatters
- scarred trees
- habitation locations
- material source sites
- cultural areas
- rock art
- grinding grooves.

We rely on local knowledge to ensure we do not impact any significant heritage sites.

Duration of activity: approximately two days.

Machinery used during activity: light 4WD vehicles.

Personnel on site during activity: up to six personnel.

Meeting to discuss preparation of a conduct and compensation agreement

We will meet you to discuss preparation of a conduct and compensation agreement (CCA), including compensation estimates. The CCA is based on the terms negotiated with you during previous discussions and includes:

- proposed activities
- a map showing the locations of proposed activities
- terms and conditions
- compensation estimates
- the rules of conduct for Santos GLNG and its contractors to follow while on your land.

Santos GLNG's standard compensation schedule is used to calculate the compensation for each agreement, which is based on the level of infrastructure proposed.

Duration: up to three hours.

Personnel: Santos GLNG landholder liaison.

Possible re-scout

Often a second site scout may be required to gain additional detail and confirm the exact locations of infrastructure, or to address any changes that have arisen since the original site scout.

Duration: usually half a day, however, it can be multiple days depending on the level of infrastructure proposed for the property and changes required.

Personnel:

- Santos GLNG landholder liaison
- environmental adviser
- cultural heritage adviser
- civil works officer
- surveyors
- construction representatives.

Deliver the CCA and letter of offer

On completion of the site scout and before we proceed with any of the advanced activities discussed in the entry notice, we must negotiate a CCA with you. The CCA will include any compensation payable to you and the access rules agreed to. Your Santos GLNG landholder liaison will hand deliver this with an accompanying letter of offer.

Duration: up to three hours.

Personnel: Santos GLNG landholder liaison.

Keeping in contact

A follow-up meeting may be required to resolve any further issues that have arisen during negotiations.

Duration: as required.

Personnel: Santos GLNG landholder liaison.

Agree on the CCA

Once the CCA has been signed by all title holders and witnessed, your Santos GLNG landholder liaison will meet you to collect it. At this time, your Santos GLNG landholder liaison may be able to give you an indication of the likely construction start date.

The CCA will then be signed by an authorised Santos GLNG representative. A duplicate of the executed CCA will be returned to you for your records.

Duration: as required, from thirty minutes to an hour.

Personnel: Santos GLNG landholder liaison.

Construction phase

Arrange first access

We will endeavour to ensure the impact on your business and lifestyle is minimised during construction as this is the phase with the highest level of activity during natural gas development.

Access to your property is controlled through our site permit process, which ensures that only authorised equipment and personnel enter your land to conduct permitted activities.

Your Santos GLNG landholder liaison will contact you about the start of new activities authorised under the CCA at least 48 hours before they are due to commence.

This is an opportunity for you to alert your Santos GLNG landholder liaison of any unforeseen operational issues we need to be aware of.

Duration: ten minutes via phone.

Personnel: Santos GLNG landholder liaison.

Pre-start meeting

Ten days prior to commencement of construction activity, we will hold a pre-start meeting on your property. This provides you with the opportunity to point out mustering points, stock crossings and water points that may have been missed during the scout, and that are applicable to the seasonal changes in your business. The pre-start meeting also allows you to meet the construction supervisors who will be working on your property.

Duration: up to one hour.

Personnel:

- project manager
- construction supervisors
- Santos GLNG landholder liaison.

Tool box

The morning we begin construction we will hold a tool box meeting on your property. All workers are required to attend this tool box, including Santos GLNG supervisors and contractors. The focus of the tool box is to reinforce the rules of conduct and any additional site-specific information that was gained at the pre-start meeting. You are welcome to attend, but it is not mandatory.

Duration: up to one hour.

Personnel: numbers will vary greatly depending on the level of infrastructure being built.

A tool box meeting held before construction commences on a gas transmission pipeline.

Example of a much smaller tool box meeting held before construction commences on well lease areas.

Site monitoring and compliance

As construction is the phase with the highest level of activity, monitoring and compliance is as critical to its successful completion and maintaining a successful relationship with you. During the construction phase, your Santos GLNG landholder liaison will:

- monitor and enforce the rules of conduct outlined in the CCA
- ensure timely payment of the agreed compensation including other compensation (e.g. water and gravel payments)
- monitor and enforce weed and erosion control procedures in line with Santos GLNG guidelines
- monitor and enforce compliance and construction activities with works specified in the CCA.

Santos GLNG has control measures in place to regulate traffic around the Maranoa region. This includes using an in vehicle monitoring system (IVMS) in all work vehicles.

Duration: ongoing.

Personnel: your Santos GLNG landholder liaison will manage any compliance issues.

Keeping in contact

Your Santos GLNG landholder liaison is always available to answer any questions or concerns you have.

Duration: as required.

Personnel: Santos GLNG landholder liaison.

Potential variations to the CCA

Throughout the construction phase there may be times when changes or additions to the CCA will be required that were not anticipated. Some examples are:

- longer length of flowline
- change in location of an access road
- the location of smaller associated infrastructure, which was not able to be included in the initial CCA as its location was to be determined during construction
- the addition or deletion of a modular open water storage tank.

In these circumstances, your Santos GLNG landholder liaison will contact you to discuss the proposed changes. Like the CCA, the agreement to vary (ATV) will be hand delivered to you. The ATV will detail the proposed changes along with any additional compensation payable, if applicable.

Duration: one to two hours.

Personnel: Santos GLNG landholder liaison.

Maintaining our relationship

Once construction has ceased and we have transitioned into the operations phase, activities decrease significantly and consist mostly of monitoring and maintenance. During this period we focus on:

- ensuring that ongoing compensation is paid for surface infrastructure
- controlling site access to your property to ensure that only authorised personnel enter your property through our site permit system
- monitoring and enforcing compliance with legislative requirements, the rules of conduct, weed and erosion control procedures.

When a well and associated infrastructure is at the end of its life cycle and no longer operating, we begin rehabilitation of your land. We work in close contact with you throughout the rehabilitation process to ensure it meets your expectations.

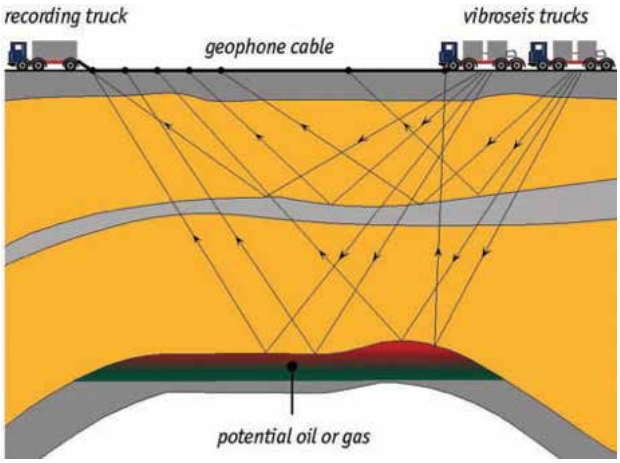
Once rehabilitation is complete, the land is returned to your control to be used for your chosen purpose. Refer to well lease rehabilitation and decommissioning on page 84 for further information.

Duration: as required, weekly to periodically throughout the year.

Personnel: Santos GLNG landholder liaison.

Seismic surveying

Seismic surveys investigate subsurface geological formations. The process involves using vibrator trucks to transmit acoustic energy into the ground along a seismic line. The acoustic energy is reflected back from the underground formations, recorded and stored electronically at the surface. The data is processed to produce subsurface images that show possible gas deposits in coal seams.



Seismic survey method.

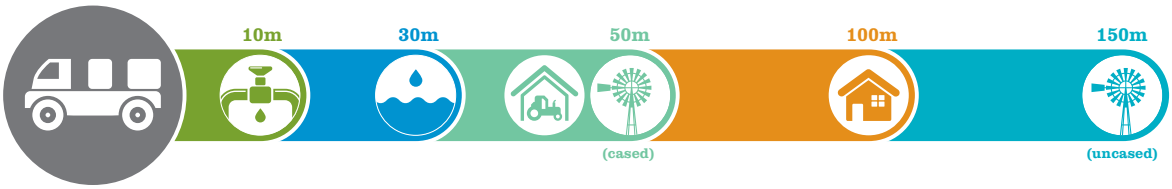
Before a seismic survey begins, geophysicists position seismic lines so their locations will optimise the imaging of the subsurface formations.

The line locations are also determined by the existing infrastructure on the landholder's property.

Santos GLNG's vibrator trucks will not generally come within the following exclusion zones:

- 10 metres from high density polyethylene (HDPE) water lines
- 30 metres from a dam
- 50 metres from an outhouse
- 50 metres from a cased water bore
- 100 metres from a dwelling
- 150 metres from an uncased water bore.

A complete seismic survey can require several weeks of line preparation and recording work.



Santos GLNG's vibrator trucks will not generally come within the above exclusion zones.

Seismic trucks travelling along a seismic line.

Disturbance area

Each site will require different lengths of seismic investigation. This will be detailed in your CCA.

Santos has adopted low-impact methods to reduce land disturbance and farming operations. Where possible seismic lines are adjusted to run along existing tracks, helicopters are used to deliver or pick up geophones to minimise the traffic on site and ATV's are used in place of light 4WD vehicles.

The typical width of the seismic corridor is four metres.

Example of a seismic line running alongside a property boundary fence.

Activities during seismic surveying

Seismic line preparation

Depending upon the terrain of your land, line preparation may be limited to stick raking and moving any large rocks on the seismic lines. Other line preparation may include slashing of light vegetation and stick raking along seismic lines. If dense strands of vegetation block the seismic line, they will be detoured to minimise environmental and farming impacts.

Surveyors then mark and survey the prepared line to be ready for the arrival of the vibrator trucks a few days later.

Duration of activity: up to two months for entire projects, however, this will vary greatly between sites.

Machinery used during activity:

- slasher
- grader
- mulcher
- bulldozer
- stick rake
- light 4WD vehicles
- helicopter.

Personnel on site during activity:
up to six personnel.

Example of a prepared seismic line through blade plough country. Seismic line has weaved around natural features to reduce clearing.

Seismic recording

Acoustic energy is generated by specially-designed vibrator trucks that operate alone or in tandem. The trucks have metal base plates connected to a vibration mechanism. When these base plates are hydraulically lowered to the ground they transmit acoustic energy into the ground for four to six seconds over a range of frequencies. This process is repeated at regular intervals of approximately 15 metres along the seismic line.

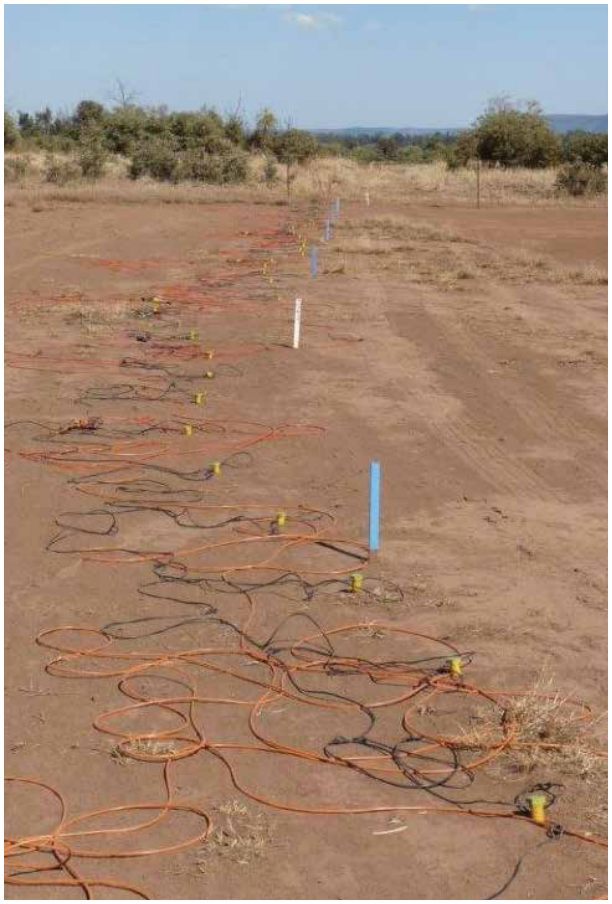
Several hundred of these recordings can be done in one day, resulting in daily progress of up to 10 kilometres.

The acoustic energy returning from the subsurface formations is picked up by small and very sensitive detectors called geophones that are mounted on lightweight wireless data acquisition units. They are inserted a few centimetres into the ground along the seismic line. In the instance that wireless units are not available, lightweight cables are connected to these geophones and carry the signals picked up by the geophones to a recording truck. The recording truck contains instrumentation that organises and stores this data. This stored data is then sent to an off-site processing centre that produces images of the subsurface geological structures lying beneath the seismic lines. Data processing can take several months to complete.

Battery packs and geopohones.

Wireless geophone and battery pack.

Wireless geophone installed in the ground, only the battery pack is visible.



Geophones and lightweight cables along a seismic line.

Communications, recording truck and all-terrain vehicle.

During seismic surveys, a Santos GLNG landholder liaison is on site to keep landholders fully informed of where the crew is and when the trucks are expected to arrive on their property.

Duration of activity: approximately one day for every 10 kilometres of seismic line.

Machinery used during activity:

- vibrator trucks
- vibrator service truck
- recording truck
- all-terrain vehicle
- light 4WD vehicles
- helicopter(s).

Personnel on site during activity:

- Santos GLNG field representative
- Santos GLNG landholder liaison
- up to 40 personnel.

Pack up

When the seismic survey is completed all seismic line equipment and survey markers are picked up and removed by crew members.

Duration of activity: one to two days.

Machinery used during activity:

- ATV, helicopter or light 4WD vechicles.

Personnel on site during activity:

- Santos GLNG landholder liaison
- up to 20 personnel.

The crew packing up cables and geophones.

Rehabilitation

Rehabilitation of the seismic line will involve, where required, repair to fence lines, touching up access roads with a grader, creating erosion banks with a bulldozer and tidying up any wheel ruts that may have been generated.

Duration of activity: generally no more than four days.

Machinery used during activity:

- light 4WD vehicles
- grader
- bulldozer.

Personnel on site during activity:

- Santos GLNG landholder liaison
- two to three personnel.

Seismic line two months following project with limited rain fall (Scotia Oct 2014).

Geotechnical investigations

Geotechnical investigations are sometimes performed for the purpose of obtaining specific information on the soil and/or rock where construction is proposed. This information assists in the engineering design of infrastructure such as the well lease area, pipelines, flowlines, roads, water management ponds, camps and laydown areas.

Soil samples are taken in one of two ways – by excavating test pits or drilling bore holes – and sent to a laboratory for analysis.

Disturbance area

The disturbance area will vary from site to site depending on the type of investigation that is being undertaken. The type of soil sampling and the disturbance area will be detailed in your CCA.

Activities during geotechnical investigations

Bore holes

Bore holes can be drilled using a truck-mounted drilling rig that is much smaller than a regular natural gas drilling rig.

However, smaller bore holes – up to one metre in depth – are excavated using a hand auger. If a hand auger is used, no CCA is required because it is categorised as a preliminary activity authorised under the issuance of the entry notice.

When performing geotechnical investigations along a pipeline route, current standard practice is to drill one bore hole every 500 metres to an average depth of two metres.

During geotechnical investigations for a facility, such as a water management pond or well lease area, Santos GLNG usually drills several bore holes at the proposed location. The number of bore holes drilled will depend on the size of the proposed facility. This will be detailed in your CCA.

Core samples will be taken at several intervals throughout the drill and retained for analysis to determine the soil and rock types we are likely to encounter when construction begins. The average depth of a bore hole is 15 metres with a diameter of 25 centimetres.

A typical core sample from a geotechnical bore hole can take up to three hours to drill, depending on depth and ground conditions. Most site visits for geotechnical work are completed within a day with the site and bore hole backfilled and rehabilitated before we leave.

A hand auger is used to drill small bore holes during geotechnical investigations.

Typical truck-mounted drilling rig used to drill bore holes during geotechnical investigations.

Duration of activity: one day or multiple days depending on the proposed activity.

Machinery used during activity:

- truck-mounted drilling rig or hand auger
- light 4WD vehicles.

Personnel on site during activity: up to six personnel.

Test pits

Test pits are relatively small excavation areas that require a tractor fitted with a backhoe or an excavator. They are excavated to obtain information on the soil and/or rock to assist the engineering design of infrastructure. Test pits are commonly used where the use of truck-mounted drilling rig is not practicable, such as in limited access or sensitive areas.

When performing geotechnical investigations along a pipeline route, current standard practice is to excavate one test pit every five kilometres with an average depth of two to three metres. The size of a test pit varies from one to two metres wide and three to five metres long.

Similar to a bore hole, Santos GLNG usually excavates several test pits for a facility within the proposed location. The number of test pits will again depend on the size of the proposed facility and will be detailed in your CCA.

The site and test pit is then backfilled and rehabilitated when we finish.

Duration of activity: up to three days.

Machinery used during activity:

- tractor fitted with a backhoe
- excavator
- light 4WD vehicles.

Personnel on site during activity: up to six personnel.

Soil samples taken from a bore hole.

Backfill of test pit.

Lease area

Lease areas refer to the pads and associated pits where drilling rigs sit during well drilling activities. They consist of a level pad and associated pits that carry the weight of the rig and store drill fluids and drill cuttings.

Disturbance area

The disturbance area varies significantly depending on the number of wells proposed for the pad. Typically, a one-well pad will have a disturbance area of 100 metres by 100 metres (one hectare) while a 10-well pad may be up to 100 metres by 300 metres (three hectares) in size. The number of proposed wells will be detailed in your CCA.

Construction of a lease area for a one-well pad (approximately one hectare).

Construction of a lease area for a 10-well pad (approximately three hectares).

A three hectare lease area is quite a large disturbance area, but it can accommodate between eight and 10 wells. It has a much lower disturbance area than building the same number of single well lease areas. The area of disturbance for associated linear infrastructure such as access roads, flowlines and powerlines for a multi-well pad is also significantly less than if the 10 wells were all on separate pads.

A 10-well pad requires a disturbance area of 0.3 hectares per well, compared to a single well pad with an area of one hectare per well.

Activities on and around the lease area

Surveying and pegging

This is the process of identifying and clearly marking the lease pad and pit area. The reasons for doing this are to:

1. provide detail of topography to engineers designing the infrastructure
2. provide a basis for identifying the area for ecological and cultural heritage surveys.

The resulting construction disturbance may occur up to 10 metres outside the initial pegged area depending on the slope of the land. The pegs are usually painted wooden stakes. Sometimes there will be felt pen writing at the top of the peg.

Duration of activity: approximately three days.

Machinery used during activity:
light 4WD vehicles.

Personnel on site during activity:
up to three personnel.

Ecological and cultural heritage surveys

Ecological surveys involve the assessment of soils, flora and fauna in areas of proposed natural gas activities and surrounding areas that could be indirectly affected by the activities.

Cultural heritage surveys involve identifying any cultural heritage sites of significance and recommending appropriate management actions in the proposed area.

Santos GLNG is required by legislation and its approval conditions to undertake these surveys before commencing any advanced activities that involve disturbance to land.

Qualified ecologists or environmental consultants undertake the ecological surveys, while representatives of the endorsed Aboriginal parties undertake the cultural heritage surveys. Sites of cultural heritage significance may include:

- artefact scatters
- scarred trees
- habitation locations
- material source sites
- cultural areas
- rock art
- grinding grooves.

We rely on local knowledge to ensure we do not impact any significant heritage sites.

Duration of activity: approximately two days.

Machinery used during activity:
light 4WD vehicles.

Personnel on site during activity:
up to six personnel.

Construction civil works

Lease pads can be built with inground sumps to store water produced from coal seams and drilling mud, however, Santos GLNG is transitioning to aboveground storage whenever possible.

The pad may also include a flare pit. The flare pit is an excavation area with the excavated material being stockpiled to the outside to form a heat and flare barrier. It is designed to safely exhaust any gas that may be produced during the drilling process.

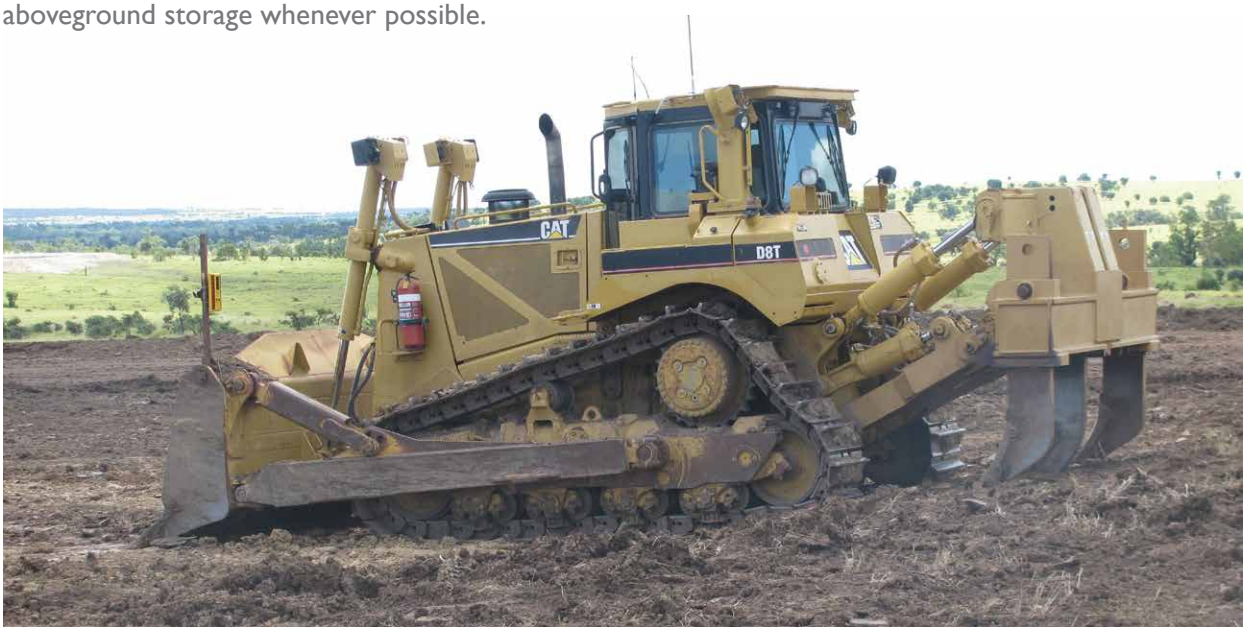
After the pad is constructed, the site will be fenced to stock-proof condition. Any topsoil from the pad will be stockpiled within the fenced area for use during rehabilitation of the site.

Duration of activity: approximately 30 to 60 days.

Machinery used during activity:

- bulldozers
- tippers
- water truck
- excavator
- loader
- grader
- rollers
- fencing equipment
- conductor installing drilling rig
- light 4WD vehicles.

Personnel on site during activity: up to six personnel.



Example of a bulldozer on site.

Minimal disturbance lease

Minimal disturbance leases (MDLs) area designed to remove the need for any cut and fill excavation activities. A grader will prepare the lease area for drilling, removing any rocks, sticks or heavily grassed areas from the site without removing the grass root system. Where possible, some sites may only need to be slashed.

Only certain drilling rigs are able to operate on MDLs and only certain topography is suitable. The maximum grade for an MDL is approximately four per cent. Anything over this will require full civil works preparation. An MDL will generally use a mud tank in place of a mud pit and cuttings skip in place of a cuttings pit.

Rig matting is placed over the high load bearing areas of the MDL pad to support the drilling rig and protect the soil structure.

Santos GLNG is exploring opportunities to expand the use of MDL drilling from single-well pads (currently used) to multi-well pads.

Disturbance area

MDLs usually have a fenced area of between 0.6 to 0.7 hectares.

Activities on and around the minimal disturbance lease

Construction civil works

A grader is used to prepare the MDL area for drilling without stripping the topsoil and root system. After the pad is constructed, the site will be fenced to a stock-proof condition. The mud tank and cuttings skid will remain on site until the drilling rig has finished drilling the next well. At this time it will return to remove the mud tank and cuttings skid from the site.

Duration of activity: approximately seven days.

Machinery used during activity:

- grader
- slasher
- front-end loader
- backhoe or excavator
- conductor installing drilling rig
- fencing equipment
- light 4WD vehicles.

Personnel on site during activity:
up to six personnel.

Minimal disturbance lease with a mud pit for the workover rig.

Minimal disturbance lease with rig matting and flowlines installed.

Minimal disturbance lease three months after rig work has been completed.

Temporary campsites

Temporary campsites are established to accommodate drilling and completion rig crews and ancillary staff. Temporary campsites consist of a series of prefabricated buildings that are transported to site on road trains and include kitchen and laundry facilities.

Disturbance area

Temporary campsites are generally 50 metres by 50 metres (0.5 hectares), however, they may be up to 100 metres by 100 metres (one hectare) in size, depending on requirements.

Typical temporary campsite.

Activities on and around the temporary campsite

Construction civil works

A temporary campsite is usually given a light grade to remove any grass or other combustible material. The grading is stockpiled to the side of the pad and used to rehabilitate the site at a later date. If a suitable flat area cannot be located cut and fill construction may be required (see Appendix B). If a temporary campsite is going to be used for an extended period of time it may be gravel capped. The site is then fenced to exclude any farming livestock.

Duration of activity: approximately 30 to 60 days, concurrent with the lease area civil works.

Machinery used during activity:

- bulldozers
- tippers
- water truck
- excavator
- loader
- grader
- rollers
- light 4WD vehicles.

Personnel on site during activity:
up to six personnel.

Set up

The temporary campsite buildings are transported to site on trucks.

Duration of activity: approximately two days.

Machinery and buildings on site during activity:

- road trains
- cranes
- accommodation dongas
- kitchen donga
- laundry donga
- cold room donga
- generator and water skid
- auxiliary water tank
- dry store and rec skid
- sewage processing unit.

Personnel on site during activity:
up to 14 personnel.

Operations

Some temporary campsites will be kept for use by workover rig crews at a later date. This will be detailed in your CCA.

Sewage produced in the temporary campsite is treated on site in aboveground units. The treated sewage effluent is then discharged in a fenced off 'discharge area' located at least 100 metres from any potable water or stock drinking supply and at least 50 metres from any watercourse. While this is standard practice for Santos GLNG, the specific legislative requirements will vary in each tenement.

Santos GLNG conducts monthly tests of its sewage processing units to ensure they meet the manufacturer's design specifications in accordance with Santos GLNG's environmental approval conditions.

Duration of activity: ongoing, up to 52 weeks.

Machinery used during activity: rig change vehicles (light 4WD vehicles and mini bus).

Personnel on site during activity:

- two crews of 12 people each
- operators for each service vehicle
- Santos GLNG operating company representative
- up to three visiting drilling specialists per day.

Sewage processing unit.

Access roads

Access roads are constructed to provide a route for the drilling rigs and other vehicles to access the site.

Disturbance area

Each site requires its own access, so the disturbance area will differ from site to site. This will be detailed in your CCA.

The maximum width of the access road construction corridor is 18 metres, which reduces to around eight metres during the operational phase.

Activities on and around access roads

Construction civil works

Some of the drilling rigs are heavier than standard heavy transport gross vehicle mass (GVM). To ensure the transport vehicles do not break through the surface, access roads will either be gravelled or have matting laid in areas of risk.

Water courses, turning radiuses of trucks and equipment and the location of existing infrastructure will be taken into consideration when choosing access road alignments. It is standard practice for Santos GLNG to install grid and gate assemblies where access roads intersect existing fence lines. The location and configuration of the grid and gate assemblies is subject to discussion with landholders.

Duration of activity: approximately 30 to 60 days, concurrent with the lease area civil works.

Machinery used during activity:

- tippers
- water truck
- loader
- grader
- roller
- light 4WD vehicles.

Personnel on site during activity:
up to six personnel.

Operations and maintenance

Santos GLNG will maintain the condition of its access roads to allow continued safe access for operators and minimise any land degradation.

We welcome input and advice from landholders who identify maintenance problems as they may arise.

Duration of activity:

- ongoing, throughout the life of the well
- up to eight trips per day during intense activity
- workover rig traffic as required to maintain the well
- once every three weeks during normal operations.

Machinery used during activity:

- grader
- light 4WD vehicles.

Personnel on site during activity:
up to two operators per vehicle.

Example of a Santos GLNG access road.

Example of a Santos GLNG access road with gate and grid.

Natural gas wells

Santos GLNG's drilling and completions team is responsible for the construction, maintenance and decommissioning of all wells. Within our authority to prospect (ATP) tenure, the Santos GLNG drilling and completions team may drill coreholes and/or appraisal wells to assess the economic viability of the coal seam and location of the natural gas reserves. Within our petroleum lease (PL) tenure, production wells for the commercial production of natural gas may be drilled.

Disturbance area

Wells and associated infrastructure are drilled in the defined lease area. No additional disturbance area is required.

Activities carried out during natural gas drilling operations

Corehole

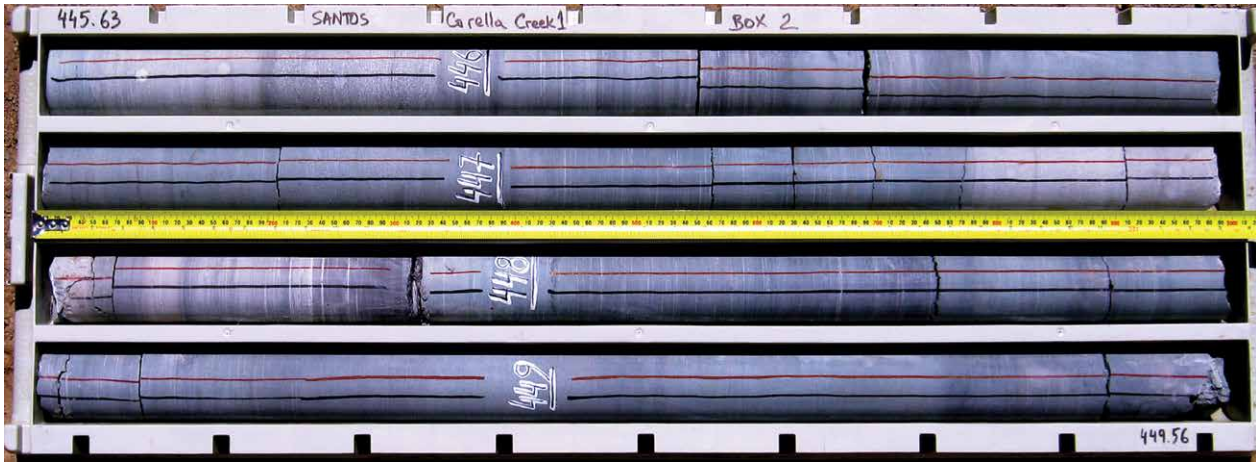
A corehole is a well from which cylindrical samples are extracted from the full depth of the well to enable evaluation and testing of a reservoir. Due to the nature of coring, the drilling can take longer than typical appraisal and production wells (up to 28 days).

A core sample is taken from the coal seam and stored in an airtight cylinder under pressure (refer to image below) before being sent to a laboratory, where technicians determine how much gas the core can produce. Other information gathered includes:

- how much water is produced
- the quality of the water
- how porous the coal is
- the alignment of the cleats (natural cracks) within the coal seam.

This information is used to assess the economic viability of the coal seam and its location. It is later used in the design stage for further drilling of corehole, appraisal or production wells.

Coreholes may be either plugged and abandoned (and later decommissioned) after the sample has been taken, or cased and suspended for possible future production.



Core samples.

Airtight cylinders holding core samples.

Appraisal well

An appraisal well is drilled to produce gas for a short period of time and allow Santos GLNG to evaluate the volume of gas production at a given location. Appraisal wells are not used for commercial production, instead giving a strong indication of potential gas reserves within a greater field development.

Information gathered from an appraisal includes:

- the volume of water produced from the coal seam
- the quality of water produced from the coal seam
- the porosity of the coal seam
- an estimate of the length of time during which the well will keep producing water from the coal seam.

An appraisal well is used for information gathering so it is not connected to a flowline network. The well will usually be equipped with a modular open water storage tank (MOWST) to store water produced from the coal seam and a flare pit to safely flare any gas produced from the well. Refer to modular open water storage tank on page 43 for more information.

Production well

If a field is deemed economically viable for gas production, Santos GLNG will proceed with drilling production wells.

Production wells are drilled and completed for the commercial production of natural gas and can only be drilled within a petroleum lease tenure.

A transmission network consisting of high voltage overhead powerlines and buried water and gas flowlines is typically associated with these wells.

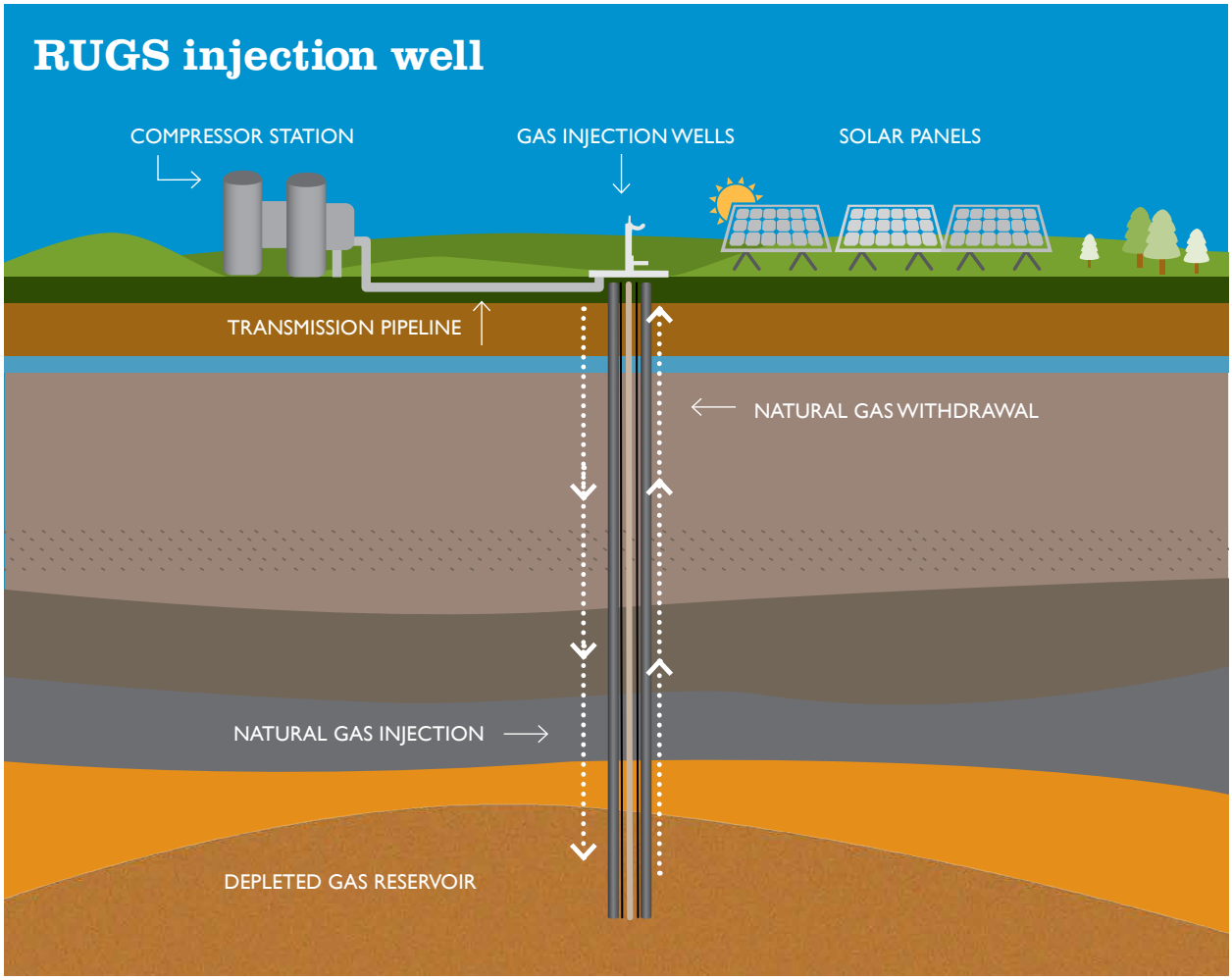
The scope of disturbance for the above works, including infrastructure (power, water and gas transmission) and well pad construction (access roads, lease areas and campsites) is documented and agreed with the landholder in the CCA.

RUGS injection well

Roma underground gas storage (RUGS) injection wells are depleted gas reservoirs located in the Roma region that are used for storing natural gas produced from operating wells. The geological structures of these reservoirs have been determined as safe and well suited to the ongoing storage of natural gas.

Transmission pipelines are used to transport natural gas from the compressor station to the RUGS injection well pad, where it is then fed into the RUGS injection well. The gas remains within the RUGS reservoir until it is required, at which time the gas injection process will be reversed, and gas transported through the gas transmission pipeline back to the compressor station for use by Santos GLNG.

Solar panels provide power to the RUGS injection wells. Powerlines are not required.

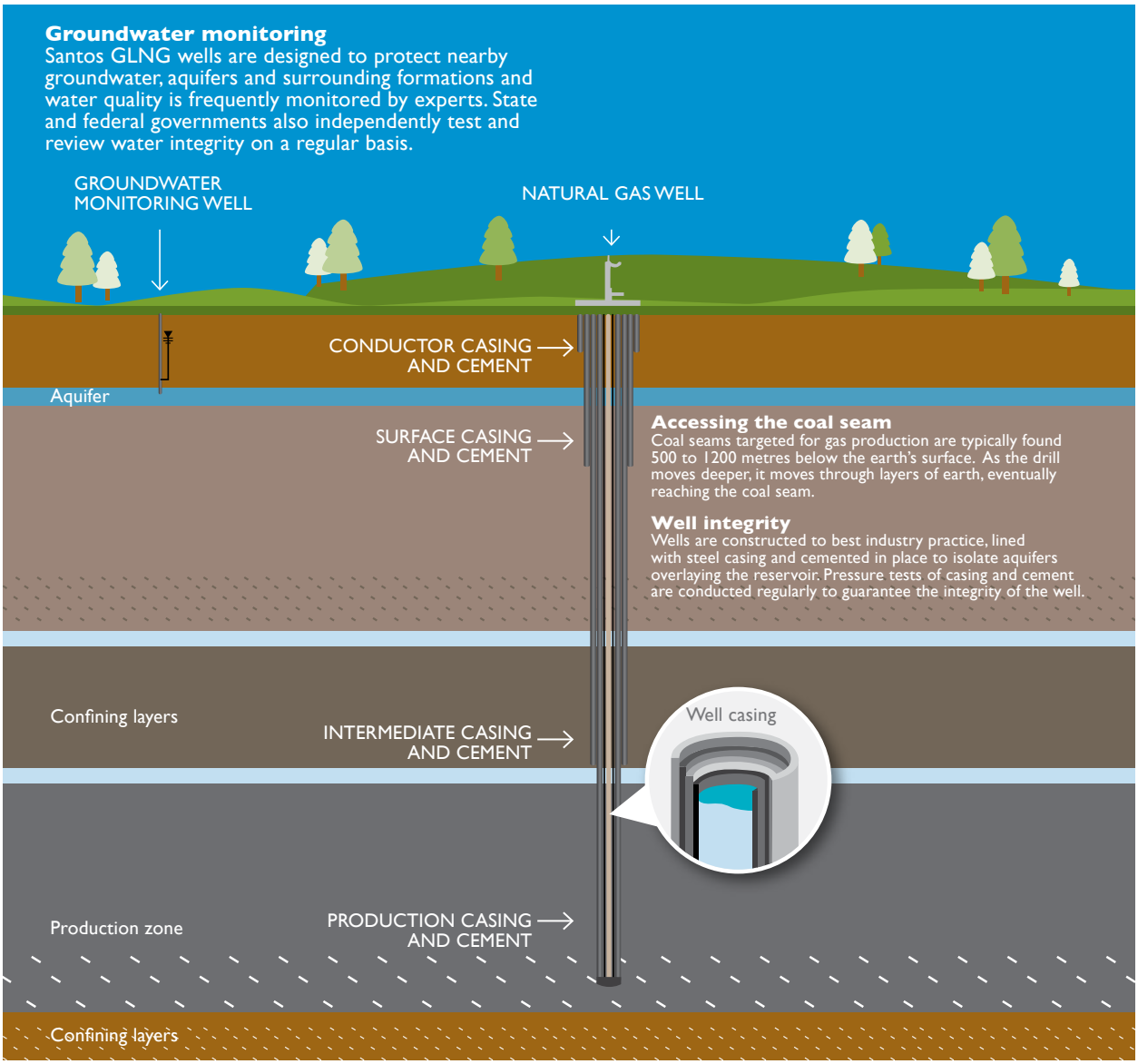


Representation of the injection into and withdrawal of natural gas from a depleted gas reservoir. **not to scale*

Operational RUGS injection wells.

Drilling operations

Drilling is the first phase of the well construction process where the wellbore is created, cased and cemented. Santos GLNG's wells are designed to protect groundwater, aquifers and surrounding formations. All wells have layers of steel casing and cement which form a continuous and solid barrier. Well integrity is frequently monitored by water experts and regular reports are submitted to state and federal governments.



*not to scale

The drilling rig will drill into the coal seam in one of two ways – underbalanced (utilising air) or overbalanced (utilising mud), see page 26 and 27. This is done to install either blank casing (a steel closed cylinder used to support the wellbore) for the hydraulic fracturing process (refer to page 34) or a slotted liner (a steel closed cylinder with pre-perforated holes to allow the transmission of gas from the formation). A completions rig and 'frac' spread, if required, are then used to stimulate the well and install tubing within the casing to allow production to occur.

Santos GLNG currently drills a number of different production wells each requiring different equipment, personnel, materials, durations and trajectories (i.e. vertical, horizontal or deviated) to achieve predetermined objectives.

All natural gas wells are drilled on a continuous 24-hour basis to minimise the time the wellbore is exposed (unsupported by casing and cement) during the drilling process. This in turn assists data gathering from downhole logging tools and the overall safety of the drilling operation.

Disturbance area

Drilling of natural gas wells is carried out inside the boundaries of the lease area. All equipment, vehicles and materials are stored on the lease.

Activities during drilling operations

Selection criteria for overbalanced versus underbalanced drilling

The major considerations when choosing whether to drill a natural gas well overbalanced or underbalanced are safety and well control. As with all Santos GLNG operations, our first priority is the safety of our employees, the community and environment. Maintaining good well control is essential to safe drilling and completions activities.

Well control is generally maintained by holding an overbalance on the well, whereby the drilling fluids in the wellbore have a higher pressure than the formation. In certain situations, however, it is not always possible to maintain an overbalance in the well and that is when underbalanced drilling is selected.

In underbalanced drilling, well control is essentially maintained by bleeding the pressure from the formation through the blooie line (see page 27), which means the well is essentially producing gas while drilling occurs.

Overbalanced drilling operations

Overbalanced drilling is the most common drilling method used on wells drilled by Santos GLNG. It refers to the use of mud for drilling the well. Drilling mud is typically used to increase the density and viscosity of the drilling fluid and prevent the wellbore from swelling and collapsing. Please note that wells drilled underbalanced will also require overbalanced drilling to occur in the shallower sections of the well.

Duration of activity: drilling can take anywhere from two days for a shallow vertical well to up to 30 days for a deeper directional or horizontal well.

Machinery and equipment permanently on site:

- drilling rig trailer mounted carrier
- two mud pumps
- two mud tanks
- up to eight shacks (offices and sleepers) for crew and third parties on site
- doghouse attached to either a water tank skid or hydraulic power unit. 'Doghouse' refers to the control room from which a driller operates the rig equipment
- two generator skids
- chemical skid (designed for safe storage and containment of any chemicals used on site)
- two 'junk' skids (used for storage of miscellaneous equipment)
- diesel fuel tank
- settling tank with mounted centrifuge
- up to three skips for storing dry well cuttings
- drill pipe handler or 'catwalk' (both used for transferring pipe from storage bins to rig floor)
- three drill pipe storage tubs
- two sets of casing storage racks
- forklift/telehandler.

Personnel on site during activity:

- two rig contractor crews typically with six to eight members working in 12-hour shifts
- four Santos GLNG operating company representatives
- six rig contractor supervisors and tradesmen
- up to six drilling specialists depending on well type and drilling phase.

Third-party activity

During drilling operations, a number of third-party contractors will access the site to provide support and specialist assistance. These activities will be included in your CCA as 'ancillary activities' and can include:

- rigid truck, semi-trailers and road trains for delivering supplies such as casing, equipment, chemicals, water and diesel and removing waste fluid, drilling fluid and solid waste from site
- cement trucks and pumping units used to cement the well to ensure integrity. This includes pumping units and one to three cement 'bulker' trailers
- wireline trucks which are used to lower tools downhole to service and evaluate the formations.

Duration of activity: concurrent with drilling operations.

Additional machinery and equipment used during activity:

- rigid truck, semi-trailers and road trains
- cement trucks
- wireline trucks
- water trucks
- vacuum trucks
- light 4WD vehicles.

Underbalanced drilling operations

Underbalanced drilling refers to the use of air in lieu of mud as the drilling fluid. Using air to drill means that fluids will flow from the formation into the wellbore and up to surface. So the well is actually producing gas while drilling occurs.

The use of air requires compressors and boosters that are not used during overbalanced drilling. A mist pump may also be installed so that a small amount of mud/agent can be added to the stream of air, aiding in the drilling process. Because the wellbore is essentially flowing during drilling, extra pressure control equipment is required on the surface to ensure the integrity of the wellbore and the safety of the operations.

Underbalanced drilling is performed primarily in producing coal seams, but can also be used in other formations. In the majority of natural gas wells, underbalanced drilling will be used after the well is 'top set' (when the shallower stages of the hole have been drilled) using drilling mud.

One distinguishing feature of underbalanced drilling is the 'blooie line' which is essentially a line of pipe connected to the surface equipment that allows cuttings from the wellbore to flow into storage pits on site. While drilling through gas-bearing zones, the end of the blooie line may be lit and a flare will be seen. The flare ensures that all gas coming to the surface is burnt off, mitigating a potential fire hazard. The blooie line can also act as a pressure relief line during drilling, characterised by a large gush coming from the end of the line. This gush only occurs occasionally during drilling and materials leaving the line are either air or cuttings from drilling.

Blooie line during underbalanced drilling.

Blooie line during underbalanced drilling.

Underbalanced drilling may also allow the drilling rig to install the initial completion (as described in a later section). As the well may be flowing (gas and water) during air drilling, transportation of fluid off site will require an increased number of water trucks.

Duration of activity: drilling can take anywhere from two days for a shallow vertical well to up to 30 days for a deeper directional or horizontal well.

Additional machinery and equipment used during activity:

- two compressors
- two boosters
- mist pump
- surface pressure control equipment
- blooie line
- extra tanks for water storage
- extra water trucks.

Additional personnel on site during activity:

- depending on the rig contractor, a specialist may be required to operate the air equipment.

Flaring during underbalanced drilling

Flaring of any gas produced during underbalanced drilling operations only occurs to ensure safety of the activity. Flaring usually happens during a small percentage of the operation when the coal seam is being drilled. Lease pads and rig equipment are custom designed to handle flaring and controls are in place to ensure the flare does not harm people or the environment.

Directional and horizontal drilling

Natural gas wells can be drilled either with a vertical profile, where the reservoir target is vertically below the well location, or directional profile (including horizontal), where anywhere from two to 11 wells (multiple wells) can be drilled from a single lease location to hit multiple subsurface targets.

The only difference between drilling a regular vertical well and a directional well is the profile. The same surface equipment is used, but due to the increased length of directional wells, larger drilling rigs are usually required.

Operationally, the main difference is the equipment that goes downhole is what essentially allows the drill bit to be steered in the desired direction. During directional operations, sensitive measuring devices and a motor are included in the drill string, allowing specialist directional drillers to determine the inclination and direction of the wellbore and follow a predetermined path.

The main benefit of directional drilling is that it allows multiple wells to be drilled from a single lease location which reduces Santos GLNG's overall disturbance area (lease, access road, powerline and flowline network). Directional drilling does increase the complexity, cost and duration of drilling operations.

Duration of activity: up to 30 days.

Additional machinery and equipment used during activity:

- on site office for directional drillers
- light 4WD vehicles
- downhole tools for directional drilling
- increased size and capability of equipment on the surface (currently all drilling rigs in the Santos GLNG fleet are capable of drilling directional wells from 1500 metres to 3000 metres long).

Additional personnel on site during activity: four directional personnel (two each working back to back 12-hour shifts). Directional personnel will only be on site for the drilling phase of the well.

Under-reaming

Under-reaming involves the use of a particular type of drill bit to enlarge a section of the hole in the interval of the coal seam. It is no longer common practice, but it may still be used occasionally in specific areas where it is considered beneficial to production.

Duration of activity: this activity occurs consecutively with the drilling phase and can usually extend the drilling duration by five to 10 days.

Rig-less operations

Although the majority of drilling and completions operations are performed by or with a rig on location, a number of activities can be performed without a rig. These activities are included in your CCA as 'ancillary activities' and are commonly referred to as 'rig-less operations'.

Rig-less operations can offer a cost-effective and efficient solution for the following reasons:

- minimal equipment and personnel on site
- rigs can be utilised on other locations
- wireline activities can often be performed more quickly than those done using a rig, as explained later.

Two common rig-less operations are wellhead installation and wireline activities.

Wellhead installation, logging and perforating operations usually occur post-drill only (see explanation further below). The exact timing is varied and dependent on how long it takes for the well to be completed or connected. It may also rely on contractor equipment and personnel availability.

Flushby, wireline and workover operations are required over the lifespan of the well from post-drill until decommissioning (see explanation further below). It is difficult to ascertain how often an individual well will be visited until the well has begun production and even then uncertainty remains.

Disturbance area

Rig-less operations are undertaken inside the boundaries of the lease area. All equipment, vehicles and materials are stored on the lease.

Activities during rig-less operations

Wellhead installation

The primary purpose of the wellhead is to seal the well at the surface and control the flow of fluids out of the well through valves. The wellhead also provides a means of connecting the various pipes (casing) in the well to a common point at surface.

The type of wellhead and wellhead components may vary depending on the well. However, generally the wellhead is installed in three parts at different stages of drilling and completions operations. At each stage, the wellhead components are tested before and after installation by specialised technicians. The testing procedures confirm that the wellhead seal is effective.

Wellhead components

The wellhead is typically made up of a base with additional segments mounted on top. These different sections are useful as they have valves for production, well monitoring and well access.

The first section of the wellhead is the casing head (A-section). The A-section is connected to the top of the surface casing immediately after it is installed and cemented by the rig. Typically the A-section is installed in the well cellar with its top flange at or just below ground level, therefore it is not usually able to be seen above-ground.

When the drilling of the well has progressed further, the B-section is installed on the top of the A-section. The B-section typically has two valves (one on each side) for well access on natural gas wells. The main function of the B-section is to provide a place for installation of secondary seals for a subsequent inner cemented casing string (if run) and also to allow the fitting of the seals for the un-cemented, innermost, production tubing string.

On some particular types of wellhead, the A-section and B-section functions are combined into a single wellhead component known as a compact wellhead.

The third section for all wellheads is the production tree (or Christmas tree because of its shape) and this is installed on top of the B-section of the wellhead. The Christmas tree contains the well's production valves. For some well types, the Christmas tree can be installed in rig-less operations after the drilling rig has left the site.

Where no pump is installed, the installation of the Christmas tree completes the wellhead.

For other wells that require removal of water to initiate and sustain gas flow, a fourth section known as the pump drive head is installed on top of the Christmas tree. This comprises an electric motor which drives a pump shaft (connected to a pump located on the bottom end of the production tubing string) and a gland (known as a stuffing box) which seals where the pump drive rod goes into the wellhead. Typically the installation of a pump would only be required for part of the well's life span, and subsequently when the pump is no longer required, it is removed and the wellhead re-configured.

Completed wellhead with a Christmas tree (no pump required).

Completed wellhead with a pump installed.

Wellhead Installation

In rig-less operations for wellhead installation, the wellhead section is lifted by a crane and mounted on top of existing sections. It is screwed into or bolted onto the top of the existing wellhead.

Duration of activity: less than four hours.

Machinery and equipment used during activity:

- small rigid crane truck
- light 4WD vehicles.

Personnel on site during activity:

- two representatives from wireline contractor
- Santos GLNG representative.

Wireline activities

Wireline operations involve feeding equipment or measuring tools into the well via a cable. Various activities can be performed on wireline, such as:

- gathering wellbore data for surveys and logs
- perforating operations to penetrate casing and cement to connect formations to the wellbore
- installing and retrieving equipment from the well
- manipulating existing equipment in the well
- identifying clearances and obstructions in the well.

Various wireline operations may be performed throughout the life of the well. For example, logging activities may take place during the drilling phase, perforating operations during the completions phase and equipment installed on wireline for the decommissioning phase.

Wireline operations can be completed with or without a rig on site. Ultimately, a rig may only be required for pre and/or post operations around the wireline activity. Even if there is a rig on site capable of performing the activity, it is typically quicker and more efficient to use a wireline unit. This is because the speed of running a cable into the well is faster than connecting lengths of pipe together and inserting them into the well.

Wireline unit

Wireline equipment is housed in a self-contained unit on a small rigid truck. Depending on the configuration of the unit, the truck may hold one or two spools of wire as well as numerous logging tools.

There are two different types of wire used in wireline operations, namely slickline and electric line (e-line). Slickline is a solid, mechanical line used to insert and retrieve tools from the well. E-line uses electrical cable to transmit signals for instant data gathering and advanced tool operation.

The wireline operator manages and monitors activities from a control room located within the truck.

Wireline unit.

Wireline set up and operation

Wireline operators assemble ancillary running equipment at the surface which is suspended on top of the well by a crane or a winch on the rig. Some wireline operators may have a crane mounted on the wireline unit.

Once set up, pulleys (known as 'sheaves') guide the wire from the truck into the wellbore. The wire is held taut by the weight of the tool on the end of the wire.

When the wire enters the well, it is unwound from the spool. Usually, the weight of the tool on the end of the wire allows the wire to be gravity-fed into the well. Some wells may require a tractor tool to be added to the end of the wire to push the tool down the well. Once the target depth has been reached and the task performed, a motor spins the drum to pull the wire and retrieve the tool from the well.

Duration of activity: the duration is largely dependent on the scope of the activity and target depth down the well for the tool. Typically, wireline operations will take less than eight hours. On rare occasions, it may take several days to undertake particularly complex data gathering processes for wellbore evaluation.

Machinery and equipment used during activity:

- small rigid wireline truck
- crane (for rig-less operations only, wireline contractor dependent)
- light 4WD vehicles.

Personnel on site during activity:

- up to four representatives from the wireline contractor
- Santos GLNG representative.

Perforating

Perforation activities involve punching a series of small holes – each less than a few centimetres in diameter – through the casing and cement sheath. This enables the formations behind the casing to be accessed. Perforations are only made over target intervals to ensure that interconnectivity does not occur with non-target formations.

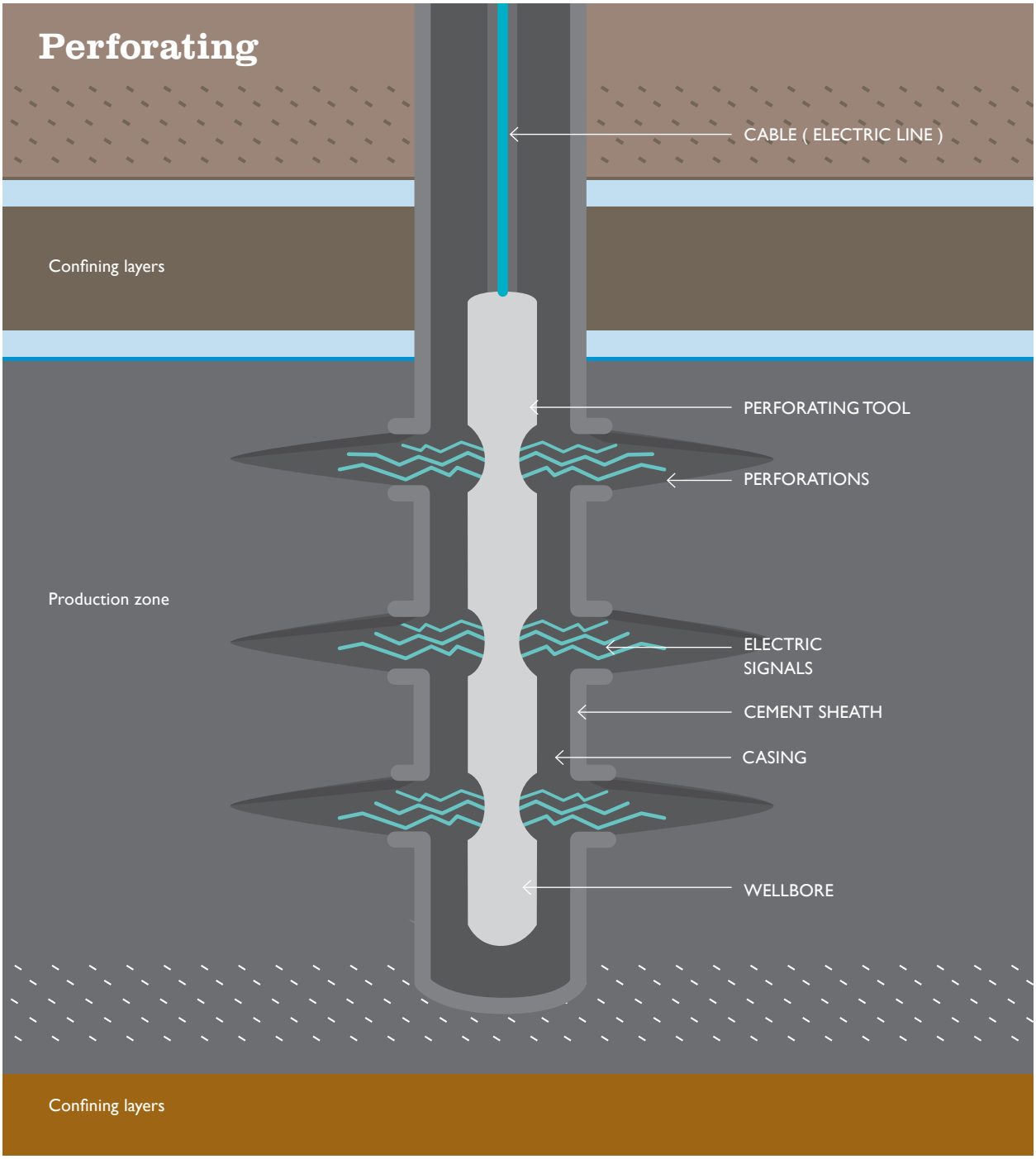
Perforating is commonly used to:

- connect zones to the wellbore for production
- allow for cementing operations behind casing.

Perforating tools may be inserted into the well on a small pipe, but are most commonly inserted via a cable (electric line). The perforating tools are attached to the end of the cable and lowered into the wellbore to a specific target depth.

Electric signals are transmitted down the wire to activate the tools and puncture holes through the casing. This allows fluids trapped in the formation to flow into the well.

Using this set up, tool length can vary significantly depending on the type and number of tools attached to the end of the wire. Perforating tools typically measure one to five metres in length, and allow for holes to be punctured across this interval at the same time.



Graphical representation of perforating downhole.

Perforating may be carried out at one depth in the wellbore in what's known as a single stage, or it may be activated at several different depths in the wellbore in multiple stages.

Duration of activity: dependent on target depths and the number of intervals to be perforated in the well. Single stage perforating usually takes less than four hours.

Machinery and equipment used during activity: refer to wireline activities on page 30.

Personnel on site during activity: refer to wireline activities on page 30.

Logging

Logging activities allow wellbore data to be gathered and analysed.

A series of tools are joined together and are typically inserted into the well on a wireline. As the tools are lowered, they repeatedly send signals into the wellbore to record wellbore properties. The results are processed and graphed by the wireline operator. This graph paints a picture of the well from top to bottom and is known as a log.

Information on the geology in the wellbore, as well as casing and cement properties, can be gathered using this technology. Once analysed, this data can be used to:

- indicate production characteristics
- confirm subsequent drilling and completions operations
- provide detailed records of well information for future reference.

Logging activities can be performed as early as the drilling phase, even before the well is lined with casing. This is known as 'open-hole logging'. Once casing is installed, further logging activities may be performed in 'cased-hole logging'.

Logging is not limited to rig-less operations as some logging tools can be added to the tools used during drilling with the rig (logging while drilling) and removed from the well once drilling is complete.

Duration of activity: dependent on the type of logging to be performed and the target depths. This usually takes approximately eight hours although logging activities may continue for up to two days.

Machinery and equipment used during activity: refer to wireline activities on page 30.

Personnel on site during activity: refer to wireline activities on page 30.

Hydraulic fracturing

Hydraulic fracturing, or 'fraccing', is a process used to improve the productivity of natural gas wells. It increases the overall permeability of gas-bearing formations in the area around the well. Fraccing is a proven and accepted technology.

A specific well design is used for fraccing to ensure accurate placement of the fracture stimulation. To protect fresh water aquifers, the surface hole is also cased, cemented and pressure tested.

Casing used within the coal seam is perforated. When fraccing fluid is pumped into the well and through these perforations at high pressure, it forms tiny fractures in the coal seam that increase permeability and allow more gas to be released. These fractures are typically only millimetres in height and extend no more than a few hundred metres into the coal seam.

Without fraccing more production wells would need to be drilled, resulting in a much larger operational footprint.

Fracture stimulation is strictly regulated in natural gas operations. As a part of this regulation, all landholders are issued with a notice of intention to stimulate along with a completion notice once the operations have been completed.

Fraccing fluid contains mostly water and sand (around 99 per cent) and small quantities of chemicals found in common household products. These chemicals used are not hazardous or specific to the oil and gas industry and are commonly found in swimming pools, toothpaste, baked goods, ice cream, detergents and soap.

The overall concentration of additives within the fraccing fluid is very small and heavily diluted in the complete mixture. A list of chemicals typically used can be viewed on the Queensland Government website at: www.ehp.qld.gov.au/management/non-mining/fraccing-chemicals.

Disturbance area

Fracture stimulation usually uses the same size area a drill rig would use to setup the operating equipment. An additional sump or portable water tank may also be required for fluid storage.

Lease layout during hydraulic fracture activities, commonly known as a 'frac spread'.

Activities during hydraulic fracturing

Fracture stimulation

Duration of activity: fracture stimulation operations usually take between two and five days per well.

Contractor equipment used during activity:

- up to five high pressure pumps
- up to eight prime movers
- sand storage facility
- chemical blender
- hydration unit
- data acquisition van
- mechanical workshop
- fuel truck
- iron package and trailer
- two forklifts
- two temporary shacks.

Machinery used during activity:

- rigid truck, semi-trailers and road trains
- water trucks
- vacuum trucks
- light 4WD vehicles.

Personnel on site during activity:

- up to 24 personnel
- Santos GLNG operating company representative.

Third-party/support activity

During stimulation activity a range of third-party and support activity is required on site.

These can include:

- rigid truck, semi-trailers and road trains for delivering supplies such as wellhead equipment, chemicals, water and diesel and removing rubbish and waste fluid
- two to six water trucks travelling to and from location to deliver water to site. This may be performed prior to the fracture stimulation operation commencing on site
- wireline trucks that are used to lower tools downhole to evaluate formations and perforate casing
- coil tubing units that can be used as an alternative to wireline for the evaluation of formations and perforating of casing.

Initial completions and workover operations

Completion and workover operations are carried out to run and change the conduits for fluid flow, such as production tubing and associated components, within the wellbore. In a production well, tubing provides a pathway for the fluid entering the wellbore to flow to the surface. While in an injection well, tubing allows a pathway for fluid to flow to the formation.

Initial completions are generally run after the well has been drilled or fracture stimulated and are usually:

- free-flow installation (can also be run by the drilling rig)
- pump installation (can also be run by the drilling rig).

Workover rig lease and carrier.

Coal seams are often water saturated reservoirs. The gas within coal is absorbed into the coal matrix and generally requires reservoir pressure to be artificially lowered so gas can desorb and flow freely.

It is common to run a pump, such as a progressive cavity pump (PCP), to remove enough formation fluid from the reservoir to depressurise it and allow gas to flow. PCPs are powered by a surface motor connected to the pump rotors by a long tube called 'sucker rods'.

Workover operations occur from time-to-time when pumps fail or require maintenance, or coal fines (small particles of coal material) restrict the flow of gas into the well. Pumps may also be changed for a more optimal sized pump, or converted to a free-flow string if a pump is no longer required. This requires a workover which is usually one of the following:

- pump repair
- pump replacement
- free flow conversion.

In some cases, prior to pump installation, the well will require an underbalanced cleanout using a specific underbalanced workover rig. Note the terms 'completion' rig and 'workover' rig are used interchangeably.

Workover rig pipe rack.

Disturbance area

Completion/workover operations will occur on the existing well/s inside the original boundary of the preexisting lease area. All equipment and transport vehicles are contained within the lease area.

Activities during initial completions and workover

Overbalanced initial completions and workovers

Completion/workover rigs are usually smaller and more mobile than drilling rigs, and can run on either 24-hour operations, or 12-hour operations during daylight hours.

Duration of activity: approximately two to three days per well.

Frequency of activity: once on first completion, then as required, averaging five visits over the life of the well.

Machinery and equipment used during activity:

- workover rig (truck-mounted)
- pipe handler
- mud pump and water tank (trailer-mounted)
- two water tanks (skid-mounted)
- two shacks/offices (trailer-mounted)
- fuel and generator skid
- flare tank
- telehandler
- semi-tanker water truck
- in some cases, a truck-mounted continuous-rod unit may also be used
- light 4WD vehicles.

Personnel on site during activity:

- one crew (six people), or two crews (12 people) for 24-hour operations
- operators for each service vehicle
- one or two Santos GLNG operating company representatives
- up to three visiting specialists per day.

Underbalanced workovers/cleanouts

In some cases, completions or workovers are carried out using an underbalanced workover rig (see page 27), which is slightly larger than a conventional overbalanced workover rig. An underbalanced cleanout involves the circulation of air/mist into the wellbore to clean it and help improve production. A pump will normally be installed or replaced using the same rig following the cleanout.

Underbalanced clean out.

Duration of activity: Approximately three to 14 days per well.

Machinery and equipment used during activity:

- workover rig (truck-mounted)
- pipe handler (trailer-mounted)
- mud pump (trailer-mounted)
- two water tanks (trailer-mounted)
- two air compressors
- one booster compressor
- generator and control unit
- three shacks/offices (trailer-mounted)
- telehandler
- semi-tanker water truck
- in some cases, a truck-mounted continuous-rod unit may also be used
- light 4WD vehicles.

Personnel on site during activity:

- two crews of 12 people for 24-hour operations
- operators for each service vehicle
- two Santos GLNG operating company representatives for 24-hour operations
- up to three visiting specialists per day.

Flaring during underbalanced completions

Flaring of gas from the wellbore occurs during underbalanced completions to ensure the safety of the operation. Most, if not all, underbalanced completions will have some component of flaring. See page 28.

Coil tubing clean out

Movement of sand and accumulated debris within a well can considerably impact the gas and water flow. Sediment in a river can change and/or block its own flow in a similar way to sand and mobile solids impairing or stopping the flow of hydrocarbons from a well. The only way to resolve this is to clean the blocking material out of the wellbore. This is usually done via the use of coil tubing.

Coil tubing is a versatile tool used in many workover (well servicing) operations. The ability to pump fluids continuously while running in and out of a well provides fast trip times and excellent control of the well. Coil tubing is a cost- and time-effective method of undertaking well servicing operations. Coil tubing is a continuous length of composite material or steel wound onto a large reel on a coil tubing unit. The coil tubing unit consists of the coil tubing reel with tubing, an injector, control console, power supply and a well control stack (or blow out preventer [BOP]).

The BOP provides the ability to cut or seal around the coil tubing pipe isolating the wellbore. This coil tubing is injected into a pre-existing wellbore to undertake the required well intervention activities.

Coil tubing is a relatively simple and quick process as the individual pieces of tubing do not need to be screwed together as would be required for a workover rig. The other added benefit of coil tubing is that through use of a closed injector, the well can remain in production during the well intervention process.

Disturbance area

The disturbance area required for coil tubing operations is usually accommodated within the original boundary of the pre-existing lease area. This is due to the relatively small footprint of the coil tubing unit and its associated support equipment.

Activities during coil tubing clean out

Coil tubing clean out

Duration of activity: the duration of coil tubing clean out operations can vary depending on the depth, complexity, path and number of wells. Operations may take from a couple of days to a couple of weeks.

Machinery and equipment used during activity: various service vehicles supplement the operations to transport water, fuel, chemicals, equipment and personnel to site. Typically this will consist of:

- coil tubing rig (truck-mounted self-propelled)
- water tank (trailer-mounted)
- two shacks/offices (trailer-mounted)
- fuel and generator skid
- telehandler
- semi-tanker water truck
- light 4WD vehicles.

Personnel on site during activity:

- the wellbore cleanout is usually completed by a crew of around 12 people (including Santos GLNG site representatives) working 24 hours a day in shifts of 12 hours.
- Up to four operators of service vehicles can be expected per day to support the operations (supplies, equipment and services).

Coil tubing rig.

Well maintenance operations

Flushby and continuous rod (co-rod) units are pieces of oilfield equipment designed specifically for handling 'rods' or the 'continuous rod string' used in a PCP operation.

The rod string is necessary to provide the transfer of torque supplied by the motor – which is usually installed on the wellhead – to the rotor at the bottom of the well. The rod string consists of either a series of steel rods joined together via a coupling and thread or one long continuous steel length of string supplied by the co-rod unit. The flushby can remove and install conventional rod strings by itself while it needs the assistance of a co-rod unit for the running and retrieval of a continuous rod string. The units are designed to require minimal equipment and personnel so the operation can move efficiently between wells.

Flushby and co-rod units are used for the following operations:

- pump repairs due to rotor or rod issues
- flushing or cleaning of PCP pumps
- landing rotors on new wells.

Disturbance area

These activities are undertaken within the confines and boundaries of the lease area. All equipment, vehicles and materials are stored on the lease.

Activities during well maintenance operations

Flushby operations (Tubing flush)

Duration of activity: flushby operations usually require less than 12 hours per well visit.

Machinery and equipment permanently on site:

- drilling rig trailer-mounted carrier
- catwalk trailer
- prime movers
- supervision shack
- crib room
- water tanker.

Personnel on site during activity:

- three to four contractors working a 12-hour shift
- Santos GLNG operating company representative.

Annular flush

Annular flush is a maintenance activity conducted solely by a water truck. Regular annular flushes will help reduce the amount of tubing flush operations and therefore possibly reduce visits by rigs in the future.

Duration of activity: on site for approximately half a day. Once per well per quarter, up to monthly for a short period of time in rare cases.

Machinery and equipment used during activity:

- water truck
- light 4WD vehicle.

Personnel on site during activity:
operators for each vehicle.

Co-rod operations

Machinery and equipment permanently on site:

- co-rod support and handling truck
- co-rod reel.

Personnel on site during activity:

- two to three members working a 12-hour shift
- Santos GLNG operating company representative.

Third-party activity

Flushby and co-rod activity may require additional support from third parties for the delivery of supplies such as rod and wellhead equipment.

Duration of activity: ongoing throughout operations.

Machinery and equipment used during activity:

- rigid truck, semi-trailers and road trains
- water trucks
- vacuum trucks
- light 4WD vehicles.

Personnel on site during activity:
contractors, as required.

Plug and abandon

Plugging and abandoning (P&A) means permanently 'closing in' a well to restore its geological formation to its original state.

P&A may be done for a number of reasons including:

- the well is a corehole and was drilled for exploration purposes only
- the well may now be depleted (producing no gas or water)
- the gas from the well may now be uneconomical to produce
- the well may have been dry when it was drilled
- materials in the well may be nearing the end of their life cycle
- the well may be becoming susceptible to leaking
- the pressures found in the well are higher than that of the well design.

The overall aim of a P&A is to decommission the well safely, while maintaining the highest environmental standards and meeting all required regulations. The various hydrocarbon bearing zones are isolated from other geological formations and water bearing zones, ensuring that no gas or other forms of contaminant will be able to migrate into water tables.

Legislation for what is required during this process varies from state to state. In Queensland, legislation requires all zones to be isolated from one another, whereas in New South Wales, isolation is required to surface.

Once the well is plugged and abandoned, there should be no immediate, visible evidence that there was a well previously on site.

Disturbance area

When a corehole needs to be drilled, then plugged and abandoned immediately, the activities will take place within the constructed lease area. If the P&A is part of rehabilitation and decommissioning operations for an existing well, the current lease area may need to be re-established to accommodate a service rig.

Activities during a plug and abandon

P&A process

The P&A process involves using barriers of different methods to isolate various zones beneath the surface. There are two main types of barriers implemented during this process – cement and mechanical.

Cement is the main material used as it forms a strong, impermeable seal that is resistant to corrosion. It is also able to withstand high-pressure differences downhole. Mechanical plugs are also used to support the cement plug, and to prevent any migration of gas between zones and the surface during cementing.

This operation is generally performed by a smaller drilling or workover rig. The rig will first set up over the hole, and start removing any salvageable equipment from the well such as pumps, tubing etc. Once the equipment has been removed, a wireline unit will run a perforating tool downhole to create holes in the casing. Cement and mechanical plugs will then be set inside the well at varying depths, dependent on the location of the geological formations. The perforations allow for the cement to be squeezed behind the casing to isolate the formations. If mechanical plugs are used, cement is usually set on top of these plugs too.

The plugs are tested by running a drill string to locate the top of the plug to ensure it has been set in the correct location. It is then pressure tested to ensure its integrity.

Duration of activity: approximately seven to 28 rig activity days per well depending on the size and complexity of the well and the number of different zones that require isolation.

Machinery and equipment used during activity:

- workover rig or small drilling rig
- carrier
- mud pump
- storage water tanks
- approximately eight skid loads (highly variable)
- air compressors
- booster
- dongas to accommodate the current activities
- third-party cement unit and bulker
- third-party wireline unit for perforation tool and mechanical plug setting.

Personnel on site during activity:

- two crews of 12 people each
- operators for each service vehicle
- Santos GLNG operating company representative
- approximately three visiting drilling specialists per day, dependent on daily operations.

Ongoing monitoring

Immediately following the rig operation, a regular monitoring program will be set up to ensure that the abandonment operation was successful and there are no unwanted effects.

Following the main monitoring process, the area will be remediated, the wellhead removed and a cap placed over the hole. The area is then generally signposted with minor details about the well, such as the date it was drilled, abandoned and the size of the well.

Refer to well lease rehabilitation and decommissioning on page 84 for further information.

Modular open water storage tank

Modular open water storage tanks (MOWSTs) are predominantly used to store water produced from the coal seam during the appraisal of wells and fluid for water processing facilities.

There are several standard sizes of MOWSTs, most with a capacity of 1.8, 3.6 or 7 megalitres. The two latter-sized MOWSTs are generally constructed outside the standard lease area.

Disturbance area

1.8 megalitre MOWSTs will generally be located within the existing lease area.

3.6 megalitre and 7 megalitre MOWSTs may be constructed on a separate lease pad up to one hectare in size, or alternatively the drilling lease pad may be extended to accommodate it.

Activities on and around the MOWST

Construction civil works

Civil works for a 3.6 or 7 megalitre MOWST may be conducted concurrently with the lease area civil works.

Duration of civil works: up to 10 days.

Machinery used during civil works:

- grader
- roller
- water truck
- backhoe/excavator
- light 4WD vehicles.

Personnel on site during civil works: up to six personnel.

Construction civil works for a 3.6 megalitre MOWST.

MOWST construction

MOWSTs are predominantly concrete and steel structures designed to be relocated after works are completed. They have no concrete footings. Precast concrete slabs are positioned vertically and linked together with steel posts in a circular formation. The slabs and posts are then tensioned with several bands of steel cable to form a structure able to withstand the pressure of water inside the tank.

Two liners are then installed – a leak detection liner connected to a leak detection system to alert Santos GLNG personnel if leaks occur and a primary liner. MOWSTs are connected to the wellhead by HDPE or steel pipes. The complete construction process may take several weeks.

Duration: up to 12 days.

Machinery on site:

- telescopic handler
- generator
- liner welding equipment
- light 4WD vehicles.

Personnel on site: up to six personnel.

Connections, testing and clean up

Duration of activity: up to three days.

Machinery used during activity:

- grader
- rollers.

Personnel on site during activity:
up to six personnel.

Operations

During the appraisal of a well, the MOWST will be monitored for capacity and water transport trucks made available to remove the water produced from the coal seam, if required.

If the water is suitable, it will be used for dust suppression or construction of other lease pads and access roads. If it does not meet regulatory requirements for dust suppression or construction purposes, it will be trucked to a water treatment facility.

The number of truck movements will vary for each site, as it is highly dependent on the volume of water produced and the capacity of the MOWST.

Duration of activity: six to 18 months for appraisal and longer for water treatment facilities.

Machinery used during activity: water trucks.

Personnel on site during activity:
up to two operators per vehicle.

3.6 megalitre MOWST construction.

3.6 megalitre MOWST construction.

Liner installed in a MOWST.

Completed 3.6 megalitre MOWST. The white triangle is a new water ballast system designed to maintain the integrity of the outer ring.

Completed 3.6 megalitre MOWST.

Completed 7.04 megalitre MOWST.

Flowlines

In the production phase of a natural gas well it is necessary to connect the well to the flowline network. This allows the produced gas to go to a compressor station and the produced water to go to a water treatment facility.

The diameter of the flowlines is dependent on the volume of gas or water produced. The flowlines are usually made from HDPE.

The water and gas will pass through the wellhead separator, but there is always some gas dissolved in the water. Likewise, the gas lines may also have water condensate inside the flowline. To prevent potential flowline blockages, it is necessary to install high point vents in water lines to release the gas and low point drains in gas lines to release the water because flowlines are laid with the undulation of the ground.

Disturbance area

Each site will require different lengths of flowline. This will be detailed in your CCA. The maximum width of the flowline corridor ranges from 12 to 20 metres during construction.

To minimise disturbances to existing vegetation or agricultural land, gas and water flowline gathering systems and powerline corridors will be located parallel to access roads and fence lines or natural landscape features, wherever practicable. Multiple flowlines along a common alignment may require an increased construction width.

Santos GLNG trenches are excavated to ensure the flowline is adequately covered. No farming activities can take place on the disturbed area during construction, but may continue as normal to a depth of 0.6 metres once flowlines are operational. Please refer to the construction details in your CCA before conducting any farming activities over a flowline.

Activities on and around flowlines

Clear and grade

Clear and grade is the removal of trees, shrubs and around 0.15 metres of topsoil and seed stock from the construction corridor. The topsoil and seek stock is stockpiled on the side of the corridor and graded back over the corridor during the post construction reinstatement period.

The site is then levelled in preparation for excavation before erosion control measures are installed.

Duration of activity: up to two days for every 500 metres of flowline.

Machinery used during activity:

- grader
- bulldozer
- light 4WD vehicles.

Personnel on site during activity:

- cultural heritage personnel
- environmental adviser and associated contractors
- construction supervisor
- up to 20 personnel.

Clear and grade in preparation for flowline construction.

String, weld, trench, lay and bury

HDPE flowlines come in lengths from 12 to 20 metres or coils of 100 to 300 metres, depending on the diameter. After a corridor has been cleared, the flowline lengths will be laid out end-to-end along the construction corridor, known as 'stringing', in a formation ready for welding.

After the flowline is strung out, it is joined using a thermal poly-welding process.

The trench is then excavated using a trenching machine with assistance from a hydraulic excavator as required. The trench is excavated to a depth that ensures the flowline is covered with soil. A trace wire is laid on the bottom of the trench prior to the flowline being installed.

The flowline is then lowered into the trench, partially backfilled with the stockpiled soil and compacted. An orange mesh is laid on top of the soil. More soil is added and compacted to within 0.3 metres of the surface, where a green/yellow marker tape is installed and the backfilling completed, leaving a slight crown to minimise subsidence.

Flowline trenches are backfilled as the flowline is laid and only a small work section will be left open at the end of each day. Any open bell holes (widened areas where welders work) are fenced off with panel fencing. An inspection is carried out at the start of each day to ensure no animals have been trapped.

Duration of activity: between two and four days for every 500 metres of flowline.

Machinery used during activity:

- excavators
- line tamer
- trenching machine
- grader
- prime mover and extendable trailer
- crane
- HDPE fast fusion machine
- water trucks
- air compressor
- light 4WD vehicles.

Personnel on site during activity: up to 20 personnel.

Water flowline stringing and welding. The machine in the foreground is a 'fast fusion' machine.

Water flowline stringing and welding once complete.

Flowline trenching and laying.

Single water flowline in trench.

Three water flowlines in one trench.

High point vents

High point vents (HPVs) are installed in water flowlines at the top of a rise in the topography to allow any gas that remains dissolved in the water after separation to vent.

The HPVs are fenced to exclude livestock.

Duration of activity: concurrent with flowline – string, weld, trench, lay and bury.

Machinery and personnel: no additional machinery or personnel required.

Example of a HPV

Low point drains

Low point drains (LPDs) are installed at the bottom of topography undulations. Valves installed in the gas flowline allow condensed water that has collected in the bottom of the flowline to be removed.

Traditionally, 1,000 litre tanks were installed adjacent to LPDs to collect condensed water. Santos GLNG has undertaken extensive testing of condensed water from LPDs and the sampling results show water quality is typically equal to or better than rainwater.

In response to the water quality monitoring to date, Santos GLNG will no longer be locating 1,000 litre tanks adjacent to LPDs. The condensed water will instead be released to ground via a flexible hose into a small rock lined discharge point (refer to the second image below).

All LPDs are fenced to exclude livestock.

Duration of activity: up to 14 days.

Machinery used during activity:

- crane
- excavator
- delivery truck
- light 4WD vehicles.

Personnel on site during activity: up to four personnel.

Example of an older style LPD with tank.

Example of the new style of LPD without tank.

Manifolds/tie-ins/take-off stations

Manifolds and tie-ins are areas where the flowlines are connected to the existing network. These are either HDPE or steel pipes typically 0.1 to 0.3 metres in diameter. They can occupy an area between 25 and 100 square metres (including fencing).

Their purpose is to allow for the future connection of new flowlines to the network to facilitate maintenance without having to shut the entire network down.

Duration of activity: up to 10 days.

Machinery used during activity:

- light 4WD vehicles
- crane
- excavator
- delivery truck.

Personnel on site during activity: up to four personnel.

Construction of an underground HDPE manifold.

Testing of flowlines

Before use, flowlines are tested using either water or air to prove their integrity. Exclusion areas are required around manifolds, HPVs and LPDs during testing.

Duration of activity: one to seven days depending on the size and length of the flowline.

Machinery used during activity:

- light 4WD vehicles
- water truck
- fill/hydro-test pump.

Personnel on site during activity: up to two operators per vehicle.

Post construction reinstatement

Following construction, the disturbed areas will be reinstated to allow revegetation of pre-existing species to take place and stabilise.

Stabilisation methods will be used and natural regeneration will be promoted. Activities include grading the topsoil back over the construction corridor and respreading seed stock, where required. Any timber removed during the clear and grade may be respread over the construction corridor, while still maintaining access over the flow line for maintenance purposes.

Duration of activity: approximately three days.

Machinery used during activity:

- grader
- excavator
- mulcher
- light 4WD vehicles.

Personnel on site during activity: three construction personnel and one site supervisor.

Reinstated flowline post-construction. The reinstatement is not yet complete.

Example of a flowline 83 days after reinstatement when the reinstatement is complete.

Operations and maintenance

As part of the well maintenance program, operators will periodically inspect flowlines to ensure HPVs and LPDs are operating properly and there are no flowline integrity problems, such as land subsidence and erosion.

The condensate in the LPDs with tanks will be removed and transported off site as required. Operators will also check the rehabilitation and maintenance of the construction corridor has been effective.

Flowlines are marked by safety signage at intervals to ensure landholder and public safety in the event of anyone excavating in the area.

Details of other operations and maintenance activities include:

- draining of LPDs
- general HPV maintenance including whipper snippering
- weed maintenance
- erosion repairs
- monthly integrity inspections
- twice monthly HPV compliance inspection
- annual water sampling
- annual facilities inspection
- annual construction corridor survey
- annual cathodic protection checks by contractor.

Frequency of activity: as required.

Machinery used during activity:

- earthmoving equipment (required only during erosion repairs)
- light 4WD vehicles.

Personnel on site during activity:

- up to two operators and contractors during the annual contractor cathodic protection check
- more operators will be required during any erosion repairs.

Powerlines

Electricity is required for the operation of a well.

Disturbance area

Each site will require different lengths of powerline. The maximum width of the powerline ROW ranges from 12 to 20 metres during construction. The height of aboveground powerlines ranges from 6.5 to 20 metres.

Activities on and around powerlines

Buried powerlines – clear and grade

Clear and grade is the removal of the topsoil from the construction ROW, which is then stockpiled on the side of the ROW. The topsoil will be graded back over the ROW during the rehabilitation phase post construction.

Duration of activity: up to two days for every 500 metres of buried powerline.

Machinery used during activity:

- grader
- bulldozer
- light 4WD vehicles.

Personnel on site during activity:
up to six personnel.

Buried powerlines – trench, lay and bury

After the clear and grade, buried powerlines will usually be buried directly into the soil. The trench is excavated to a depth that ensures the powerline is covered with a minimum of 1.2 metres of soil. No farming activities can take place on the disturbed area during construction, but can continue as normal to a depth of 0.6 metres once the powerlines are operational. Please refer to the construction details in your CCA before conducting farming activities over a powerline.

Duration of activity: up to two days for every 500 metres of buried powerline.

Machinery used during activity:

- excavator
- trenching machine grader
- crane
- tippers
- water trucks
- air compressor
- light 4WD vehicles.

Personnel on site during activity:
up to 40 personnel.

Buried powerlines – reinstatement

Once the trench is fully backfilled, the construction ROW will be rehabilitated and restored as close as possible to its original contours by re-establishing surface drainage patterns and installing permanent erosion mitigation.

The phase first involves spreading any excess trench material evenly over the construction ROW, then re-spreading the original topsoil. If the soil is significantly compacted the surface layer will be ripped. Finally, vegetation is spread over the ROW – leaving a track for light 4WD vehicles – to assist seed spreading and erosion control. All materials will be removed from site and disposed of appropriately.

Buried powerlines – aboveground infrastructure / electrical enclosures – RMUs

To access the buried power for isolation and possible future connection it is necessary to install Ring Main Units (RMUs). These RMUs provide similar functionality to a manifold for a buried pipeline in that they allow power to be split off in multiple directions.

Typically these RMU's are located in the ROW, and in certain instances these may be located on the wellpad lease. Effectively it is an electrical switching point designed for safe high voltage applications.

Duration of construction:

Typically performed in two parts:

- site is levelled during ROW works
- RMU pre-mounted on concrete plinth is delivered to site, dropped on ground and cables are connected

2-4 days of work total

Machinery used during activity:

- grader to level site
- crane truck or truck and franna combo for unloading/placement of enclosure
- light 4WD vehicles

Personnel on site during activity:

maximum of four at any one time

Buried powerlines – aboveground infrastructure / electrical enclosures – pad mount transformer kiosk

At each wellpad it is required that the high voltage supply (11kV) be transformed into a low voltage (400V) for use on the well lease. With aboveground power lines we use pole mounted transformers. With underground cable installations, these transformers are mounted on the ground in specially designed metal enclosures or kiosks. There are numerous designs, yet these kiosks typically contain an area for high voltage equipment such as a RMU if required, the transformer itself, and also a low voltage equipment area. All of these pad mount transformer kiosks utilise biodegradable vegetable oil and/or bunding for spill containment.

Duration of construction:

Typically performed in two parts:

- site is levelled during lease pad works
- transformer kiosk pre-mounted on concrete plinth is delivered to site, dropped on ground and cables are connected

2-4 days of work total

Machinery used during activity:

- grader to level site
- crane truck or truck and franna combo for unloading/placement of enclosure
- light 4WD vehicles

Personnel on site during activity:

maximum of four at any one time.

Example of an RMU

Example of an RMU

Example of a pole mounted transformer

Example of pad mount tranformer kiosk

Buried powerlines – aboveground infrastructure – 'two-pole' design

The functionality of a pad mount transformer kiosk with integral RMU can also be achieved by using two aboveground power poles fitted with the appropriate high voltage (HV) switchgear and a pole mount transformer. This solution is cheaper than the typical pad mount kiosk design and is accomplished by running the buried HV cable up one pole fitted with HV switchgear and onto a second pole a very short span away. The second pole is fitted with a pole mount transformer similar to the picture on the previous page.

The two power poles are erected within the existing boundaries of the well pad and do not add to the footprint of the well lease pad. This option enables Santos GLNG to provide buried electrical supply to the well lease. All pole mount transformers utilise bio-degradable vegetable oil.

Construction involves pole foundations, pole assembly and erection.

Duration of activity:

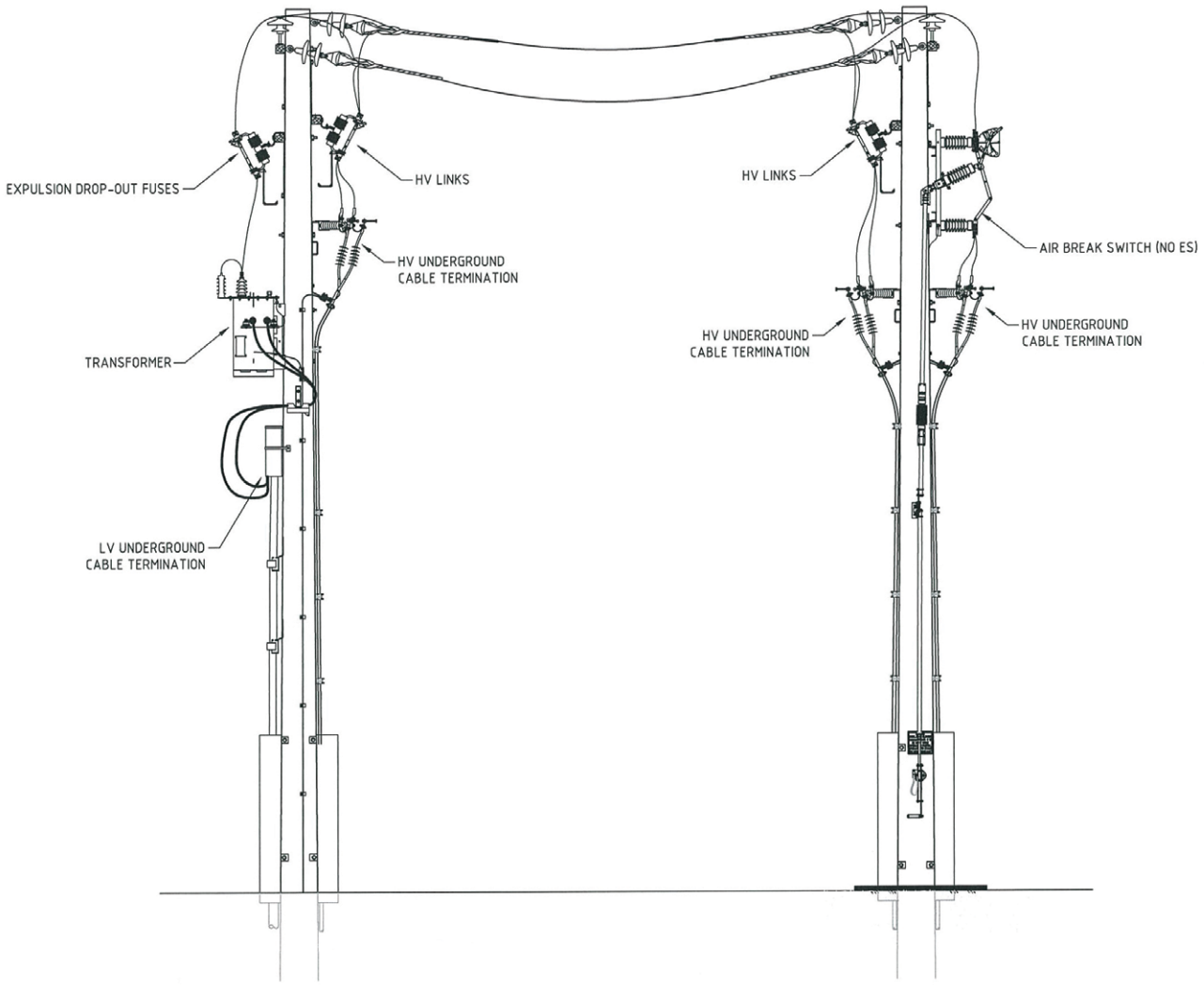
2-4 days.

Machinery used during activity:

- concrete truck
- lifter borer
- pole transporter
- bucket truck
- light 4WD vehicles.

Personnel on site during activity:

up to seven personnel.



Aboveground powerlines – clear and grade

To prepare the construction ROW for safe works and transportation of materials, vegetation along the ROW is cleared where necessary, followed by stripping approximately 0.15 metres of topsoil and seed stock, which is then stockpiled along the side of the ROW. Large log sections kept for fauna habitat are placed adjacent to the ROW and smaller shrubs are mulched.

Duration of activity:
up to 0.25 kilometres per day.

Machinery used during activity:

- grader
- bulldozer
- dump truck
- crew truck
- light 4WD vehicles.

Personnel on site during activity:
up to 20 personnel.

Aboveground powerlines – pole foundations

Foundation construction begins with surveying and pegging of required areas. Excavation for the foundation is performed by a boring machine then reinforced and concreted in place. Foundation bolts are placed within the concrete and emerge from the top of the foundation to allow pole erection.

Duration of activity:
up to 0.5 kilometres per day.

Machinery used during activity:

- concrete truck
- boring machine
- light 4WD vehicles.

Personnel on site during activity:
up to seven personnel.

Aboveground powerlines – pole assembly and erection

Poles can be assembled either vertically or horizontally. The vertical method involves attaching the base of the pole to the foundation bolts, then attaching additional sections. The horizontal method involves assembling the entire pole horizontally on the ground. Once completed, the pole is erected using a rough terrain crane.

Duration of activity:
up to 0.5 kilometres per day.

Machinery used during activity:

- 80-tonne crane
- guide crane
- pole transporter
- light 4WD vehicles.

Personnel on site during activity:
up to 11 personnel.

Aboveground powerlines – conductor stringing

The conductor wire is strung along the poles with the use of stringing sheaves and drum pullers. The wire is tensioned to the manufacturer's specification, allowing for heat expansion and cold weather contraction.

Duration of activity:
up to 0.6 kilometres per day.

Machinery used during activity:

- drum pullers
- winch truck
- brake truck
- water truck
- light 4WD vehicles.

Personnel on site during activity:
up to 11 personnel.

Aboveground powerlines – reinstatement

The topsoil and seed stock will be graded back over the ROW during the rehabilitation phase post construction. Environmental controls will be installed such as berms (raised barriers) and contour banks. Additionally, appropriate signage on the catenaries (curves) of overhead powerlines will also be installed.

Operations and maintenance

Operators will perform ongoing monitoring and call in maintenance experts, as required.

Frequency of activity:
quarterly checks, as required.

Machinery used during activity:
light 4WD vehicles.

Personnel on site during activity:
up to two operators per vehicle.

Aboveground powerline pre-construction.

Aboveground powerline construction.

Completed aboveground powerline.

Gas transmission pipeline

A network of buried transmission pipelines is required for Santos GLNG's production phase to transport the natural gas to market. Underground gas transmission pipelines, which differ considerably from HDPE flowlines, are designed to transport gas over large distances between processing hubs and from hubs to the liquefied natural gas (LNG) plant and port at Gladstone.

Easements

Gas transmission pipelines are generally constructed, operated and maintained within an easement. Easements provide a legal means by which two or more parties can share use of an area of land. Individual easement agreements between landholders and Santos GLNG outline the rights and limitations of both parties to ensure the ongoing safe operation of the pipeline.

Copies of registered easement agreements can be sourced from the Titles Registry of the Queensland Department of Natural Resources and Mines.

Right of ways (ROWs)

In the instance that Santos GLNG has not exercised the option to register an easement over a freehold parcel of land, a CCA will be negotiated with individual landholders. The CCA will specify an operational ROW to enable Santos GLNG to establish, operate and maintain the pipeline.

The ROW constitutes the area of land along the route of the pipeline and includes five metres either side of the as built (surveyed) alignment.

Limitations

If you are planning any activity within 15 metres of the gas transmission pipeline, Santos GLNG requires the details to be communicated to the Santos GLNG EQ Pipelines Group for assessment prior to any works commencing. Contact the group by phoning our free community information line: 1800 761 113.

Activities such as excavation, ripping, moving heavy equipment, building drains, changing land profiles, trenching, boring, blasting or building structures are all assessed on a risk basis, and any authority issued by Santos GLNG is conditional on maintaining the integrity of the pipeline, and safety of the general public, environment and pipeline personnel.

A site visit can be arranged to discuss the intended activity and to explain the process of obtaining any written approval.

Gas transmission pipeline

The pipe used is much larger in diameter and operates at a higher pressure than the network of flowlines utilised to gather gas and water from the wells.

The pipe is made from high tensile carbon steel and is pre-coated with a fusion bonded epoxy coating to protect the steel from corrosion and accommodate any future deep penetration agricultural activities. It can range in diameter from 10 to 60 inches depending on the volume of gas and distance it is to be transported.

The minimum depth a gas pipeline is required to be buried is 0.75 metres. During the construction phase of a pipeline, short-term 'laydown' areas are prepared at strategic locations along the pipeline route in order to stockpile lengths of pipe and other construction equipment. Refer to laydown areas on page 68 for further information.

Following installation, signs will be placed along the length of the pipeline as a safety measure. The location and spacing of the signs is subject to location assessment and visibility, but they are typically spaced no more than 500 metres apart in rural areas and considerably closer in areas with a larger population or assessed increased activity.

Disturbance area

Each location will have various degrees of disturbance during construction, dependent on the terrain, length of pipeline to be constructed and location the pipeline crosses the landholder's property.

The construction ROW is generally 25 metres wide, however, in some cases additional area will be required for construction equipment to manoeuvre and for storage.

For the operational and maintenance phase, disturbance will nominally be limited to access to the pipeline easement or operational ROW.

Activities on and around the pipeline route

Survey

Refer to lease area – surveying and pegging on page 16.

Prepare access roads and temporary facilities

Refer to access roads and laydown areas on page 21 and 68.

Clear and grade

To prepare the construction ROW for safe works and transportation of materials, any vegetation along the ROW is cleared and approximately 0.15 metres of topsoil and seed stock is stripped and stockpiled along the side of the ROW. Temporary erosion measures, fences and gates are installed.

The topsoil and seed stock will be graded back over the ROW during the rehabilitation phase post construction.

The site is then graded in preparation for trenching.

Duration of activity: up to two days for every 500 metres of pipeline.

Machinery used during activity:

- grader
- bulldozer
- light 4WD vehicles.

Personnel on site during activity: up to 20 personnel.

Clear and grade – topsoil on the left and sub-soil on the right with temporary fencing.

Delivery of pipe, string and weld

Pipe is delivered to the site from laydown areas and laid adjacent to the trench on wooden 'skids'. Specialised trailers are used to string the pipe joints end-to-end in preparation for welding. Prefabricated pipe bends are used to accommodate sharp changes in direction or grade, although pipe bending equipment is used where allowance is required to accommodate changes in terrain. The pipe joints are then welded together either manually or by using automated welding machines.

Each weld is inspected using ultrasonic or radiographic techniques and checked for flaws before being coated to prevent corrosion.

Duration of activity: up to two days for every 500 metres of pipeline, but generally one kilometre each day.

Machinery used during activity:

- prime movers and extendable trailers
- cranes
- hydraulic bending machine
- automated welding machines
- air compressor
- light 4WD vehicles
- radiographic X-ray machines
- ultrasonic testing equipment.

Personnel on site during activity: up to 20 personnel.

Stringing of pipeline complete.

Trenching

The trench is excavated using either a bucket-wheel trenching machine, rocksaw, or in difficult areas, a hydraulic excavator. The trench is excavated to a depth that ensures the pipeline is covered to meet the minimum statutory requirement although Santos GLNG generally exceeds this limit.

Pipe delivered to site and strung along the pipeline ROW.

A bucket-wheel trenching machine..

Trenching complete, ready for pipe to be laid.

Open trenches are fenced off to prevent cattle and other animals from becoming trapped. As a result, access across the ROW is restricted.

Every endeavour is made to ensure all trenches are backfilled as soon as practicable. The walls and bottom of the trench are inspected for rocks and other debris that may cause damage to the pipe or its coating.

Duration of activity: approximately two kilometres per day.

Machinery used during activity:

- excavators
- automated trenching machines
- grader
- water trucks
- light 4WD vehicles.

Personnel on site during activity: up to six personnel.

Lay, tie-in and bury

The welded pipeline is then lowered into the trench and tie-in welds are conducted to join sections of welded pipe together.

A cathodic protection (CP) system is installed to help protect the pipeline from corrosion, cables are attached to the pipe and above-ground test points installed to facilitate monitoring of the CP.

The initial backfill of the trench is usually carried out with a padding machine. This piece of equipment sifts soil taken from the trench and places it on the pipeline. The sifting of soil ensures the coating is not damaged. The rest of the backfill is usually carried out with a rubber-tyred grader.

A fibre optic cable (FOC) is laid in one side of the trench after initial backfilling of the pipeline.

For larger diameter pipelines, a compactor is used in the trench or mounted on an excavator boom. It is important that the backfill is compacted so both erosion and subsidence are minimised. On steep grades, trench breakers are installed to prevent scouring of the trench during heavy rainfall.

Duration of activity: the welding rate of the pipeline determines the rate of progress for the following activities. The rate of backfilling is determined by the rate of welding.

Machinery used during activity:

- pipelayer tractors
- padding machine
- rubber-tyred grader
- compactor
- bulldozers
- excavators
- light 4WD vehicles.

Personnel on site during activity: up to six personnel.

Pipe being laid into the trench.

Tie-in welds are being used to join a section of welded pipe together.

Example of a ROW after pipe has been buried.

Creek crossings

When encountering a creek, all trees and scrubs will be cleared from the embankment, dewatering will occur, where required, a trench line excavated through the creek, bedding installed, and pipe strung and welded on the creek bank before being lowered into the trench. The backfill will then be completed and the creek reinstated to its original condition with revegetation occurring in line with seasonal constraints.

Duration of activity: 14 days on average per creek crossing, depending on the size.

Machinery used during activity:

- side booms
- excavators
- tippers
- welding equipment
- light 4WD vehicles.

Personnel on site during activity: up to 15 personnel.

Road crossings

When encountering a road, a trench will be opened across part of the road and traffic diverted to the other side, under traffic control.

A temporary crossing will be put in place on the excavated side while the second half of the road is trenched. The pipe will then be laid into the trench.

The trench on the closed side of the road will then be backfilled. Traffic will be diverted to the completed side of the road when the second half is being backfilled.

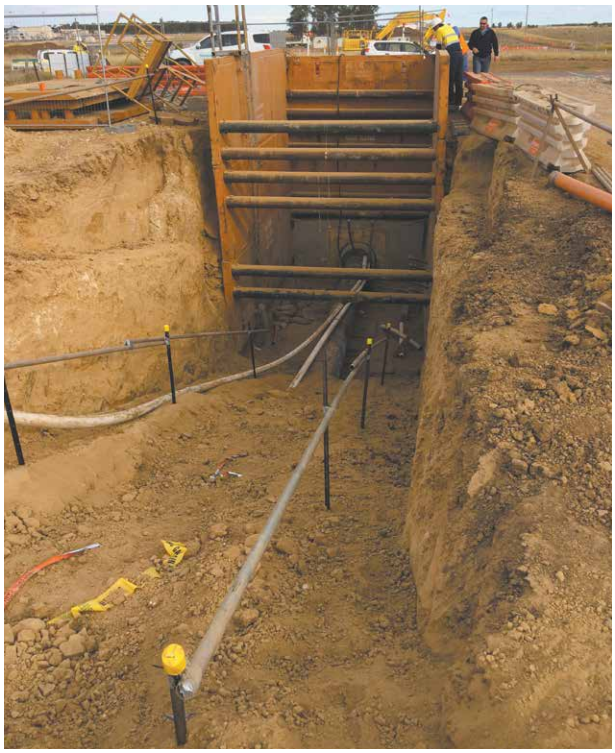
On completion of construction, traffic controls and plant will be removed and the site tidied.

Duration of activity: approximately one day per road crossing.

Machinery used during activity:

- excavators
- tippers
- welding equipment
- static roller
- cranes
- light 4WD vehicles.

Personnel on site during activity: up to 13 personnel.



Example of a pipeline road crossing under a highway.

Example of a pipeline road crossing under a highway.

Hydro-testing

Hydro-testing is carried out to confirm the integrity of the pipeline and welded joints.

To do this, the pipeline is filled with water and pressurised to exceed its designed operating pressure (up to 20,000 kilopascals) for 24 hours to ensure there are no leaks. If the section of pipeline being tested does not hold pressure, an inspection is carried out to identify, excavate and repair the leak.

Once hydro-testing is successfully completed, water is removed from the pipeline and stored in either a dam or a temporary tank for use on the next section of the pipeline.

The pipeline is cleaned and dried using a pipeline inspection gadget (known as a 'pig') that is propelled by compressed air. It may then be filled with nitrogen to keep it dry and inert until it is commissioned.

Pipeline hydro-testing data collection.

Duration of activity: one to seven days depending on the size and length of the section of pipeline.

Machinery used during activity:

- water truck
- compressor
- water pumps
- water tanks
- light 4WD vehicles.

Personnel on site during activity: Up to six personnel.

Rehabilitation and clean up

Once the trench is fully backfilled, the construction ROW, temporary tracks and laydown areas will be rehabilitated and restored as close as possible to their original contours. This is done by re-establishing surface drainage patterns and installing permanent erosion mitigation.

This phase involves spreading any excess trench material evenly over the construction ROW then respreading the original topsoil. If the soil has been significantly compacted the surface layer will be ripped. Finally, vegetation is spread over the ROW – leaving a track for light 4WD vehicles – to assist with seed spread and erosion control.

Clean up of the site is relatively quick as there is a very little waste material produced during construction. All materials and pipe cut-offs will be removed from site and disposed of appropriately.

Duration of activity: up to three days. Restoration will take place progressively as work is completed in each paddock or property.

Machinery used during activity:

- bulldozer
- grader
- tractor and harrows
- seeding equipment
- light 4WD vehicles.

Personnel on site during activity: up to eight personnel.

Operations and maintenance

Routine and regular pipeline patrols are a necessary part of the ongoing safe operation of a pipeline, including the management of erosion, encroachments and external activities within its vicinity.

Santos GLNG makes every effort to contact landholders whenever undertaking planned activities. We appreciate the cooperation of landholders and residents in providing unhindered access to the pipeline for these purposes.

Operations and maintenance activities include:

- twice monthly CP checks, requiring access to test-points

- monthly integrity inspections
- monthly compound maintenance (weed management) of main-line valve (MLV) and tie-in stations
- quarterly pigging (using in-line pipeline inspection gauges/'pigs')
- quarterly coating survey (requiring walking the entire pipeline)
- six monthly survey of the operational ROW/ easement and aboveground pipework visual inspection
- annual CP survey with contractor
- annual or as required, gas leak test survey
- 'in-line intelligent' (ILI) pigging every five to 10 years, measuring wall-thickness and welds
- excavation programs, as required (following the coating surveys and ILI pigging)
- erosion repairs following heavy rain
- activity checks (identifying and supervising third-party activity around the pipelines).

Frequency of activity: as required.

Machinery used during activity:

- light 4WD vehicles
- other small machinery when required.

Personnel on site during activity:

- two operators
- two contractors.

Fibre optic cable

To reduce personnel and vehicle movements in the field, Santos GLNG installs fibre optic cable (FOC) along some of its pipelines and flowlines. The FOC network is utilised to transmit field data to the Brisbane operations control centre allowing for continuous remote operation of the field. This initiative reduces the volume of vehicle traffic and maintenance visits to wellheads.

Disturbance area

Each property will require different FOC lengths.

The cable is run in conjunction with flowlines, gas transmission lines or powerlines. The maximum width of the FOC corridor ranges from 12 to 20 metres during construction.

No farming activities can take place on the disturbed area during construction, but may continue as normal once the FOC is operational.

Landholder activities involving excavation or deep-ripping should be raised with Santos GLNG first to ensure any potential threat to the cable and network is adequately managed.

Activities on and around the fibre optic cable

Clear and grade

Refer to flowlines – clear and grade on page 46

String, trench, lay and bury

After the corridor has been cleared, the FOC will be laid out along the corridor construction zone (stringing). The construction zone will be a limited length of the corridor, usually one to two kilometres at a time.

The trench is dug using an automated trenching machine with assistance from a hydraulic excavator as required. The trench is excavated to a depth that ensures the FOC is covered with soil. The FOC is then laid into the trench and backfilled with soil. The backfill is compacted to minimise subsidence post-construction.

Duration of activity: approximately two days for every 500 metres of FOC.

Machinery used during activity:

- excavators
- trenching machine
- graders
- stringing trucks
- cranes
- light 4WD vehicles.

Personnel on site during activity: up to 20 personnel.

Fibre optic cable (right) lying alongside a gas transmission pipeline.

Operations and maintenance

As part of the well maintenance program, operators will periodically inspect the FOC to check for integrity, potential subsidence and erosion. Operators will also look to ensure the rehabilitation of the construction corridor has been effective.

The FOC is marked by signage at intervals to advise landholders of its location and ensure public safety in the event of any future excavations in the area.

Laydown area

A laydown area is an area used to temporarily stockpile construction materials such as pipes, power poles and machinery.

It will usually be a large flat area suitable for unloading trucks.

Disturbance area

The size of the laydown area will vary depending on Santos GLNG's requirements. It may range from one to 25 hectares and will be detailed in your CCA.

No farming activities can take place on the disturbed area.

Activities in and around the laydown area

Clear and grade

The preparation of a laydown area usually requires a light grading to remove grass and timber and fencing of the area. Gravel capping of the laydown area may be required in some areas.

Duration of activity: up to seven days.

Machinery used during activity:

- bulldozer
- roller
- grader.

Personnel on site during activity: up to six personnel.

Operations

The operations phase involves the delivery of the material to be stockpiled and machinery used to load and unload the delivery trucks.

Duration of activity: as required (this will be detailed in your CCA).

Machinery used during activity:

- trucks
- forklifts
- cranes.

Personnel on site during activity: up to two operators per vehicle.

Water management pond

Water management ponds (WMPs) are large ring tanks made from earth, similar in size and construction to irrigation ring tanks.

WMPs are most commonly used during the appraisal stage of a well.

After the appraisal period, engineers can determine the necessary piping and long-term water management strategy required to produce from the wells.

Disturbance area

The typical size of a WMP is 200 megalitres, but may vary from 140 megalitres to 250 megalitres.

The disturbance area is approximately 20 hectares during construction, including the campsite, laydown area, stockpile area, spoil pile and contractor equipment storage area.

This disturbance area will reduce to approximately eight hectares when construction is complete. This will be detailed in your CCA.

WMP under construction.

Activities in and around the WMP

Clear and grade

Clear and grade is the removal and stockpiling of the top soil and levelling of the site. Top soil will be reused in the site rehabilitation phase post construction.

Duration of activity: approximately seven to 14 days.

Machinery used during activity:

- bulldozers
- loaders
- graders
- rollers
- scrapers
- excavators
- light 4WD vehicles.

Personnel on site during activity: up to 20 personnel.

Construction

To store water produced from coal seams, the government requires Santos GLNG to install a leak detection system in the dam. The system comprises a compacted clay lining, sand filter and two millimetre thick HDPE lining.

During construction of the WMPs, some soil not suitable for use in the pond wall may be excavated and stored in a mound that is covered with a layer of topsoil post construction to establish stabilised vegetation.

Duration of activity: between four and six months.

Machinery used during activity will vary as required, but will include:

- D10 bulldozer
- tippers
- scrapers
- compactors
- water trucks
- excavators
- loader
- graders
- roller
- light 4WD vehicles.

Personnel on site during activity: up to 31 personnel.

Machinery used during construction of a WMP.

Operations and maintenance

During the operating phase of a WMP, Santos GLNG operators will check on the pond to ensure its integrity and safety. From time to time soil samples may be taken near the perimeter of the pond to determine the integrity of the WMP.

Specific activities include:

- minor maintenance and troubleshooting
- vegetation management
- monthly operator inspections
- annual operator inspections.

In addition to these activities, the WMP will be inspected annually by a third party. For safety reasons, the WMP will also be fenced.

Frequency of activity: as required.

Machinery used during activity: light 4WD vehicles.

Personnel on site during activity:

- two operators during normal inspections
- two contractors during the annual third-party inspection.

Drainage on the side walls of this WMP is designed to catch any leakage that may occur through the HDPE membrane.

A HDPE membrane lining being laid into a WMP.

Spillway around the outside of the WMP walls.

Completed WMP.

Communication towers

Communication towers are used to relay radio transmissions around our natural gas fields.

These include:

1. UHF radio used by Santos GLNG field personnel and contractors
2. IVMS data
3. telemetry signals from wellheads and operating plants
4. office connectivity to smaller facilities where Santos GLNG field personnel need to work.

Some communication towers are shared with telecommunication companies and operators.

Tower heights range from 30 to 160 metres.

Disturbance area

The total disturbance area is up to 100 by 200 metres (two hectares) and will be detailed in your CCA.

The fenced area for the tower is generally around 0.25 hectares with additional access requirements.

Activities in and around communication towers

Construction

Communication towers are constructed from steel and are similar to telco towers seen near townships. They can be freestanding or stayed using guy wires.

A small hut is generally placed next to the tower to house telecommunications equipment. The hut is situated inside the fenced area.

Some essential services such as power may need to be extended to the tower through narrow underground trenches or overhead wires.

Duration of activity: approximately seven to 30 days.

Machinery used during activity:

- concrete trucks
- auger
- trencher
- digger
- rockbreaker
- crane
- light 4WD vehicles.

Personnel on site during activity: one operator per machine.

Maintenance

Ongoing maintenance visits will occur several times a year post construction.

There may also be a need for emergency access in the event of a site failure.

Frequency of activity: quarterly checks, or as required.

Machinery used during activity: light 4WD vehicles.

Personnel on site during activity: up to two operators per vehicle.

60 metre high communications tower.

30 metre high communications tower.

Guy wires used to stay a communications tower.

Water monitoring bores

Water monitoring bores provide ongoing quality and pressure monitoring of the various water aquifers above and below the coal seam, including those used for stock and domestic use within the natural gas fields.

When existing bores are available in a suitable condition, such as those drilled for or by landholders or previous users, the Santos GLNG water monitoring team will use these.

When there is no suitable existing bore, a new bore will need to be drilled to ensure the aquifers can be adequately monitored. Depending on the depth and bore design, a truck-mounted drilling rig will move on site to complete the drilling and development work.

Active drilling of water bores typically takes between five and 25 days with the duration of site activities being dependent on the depth of the target aquifers. A Santos GLNG landholder liaison will discuss the anticipated drilling time with landholders during the negotiation process. Development of a groundwater bore following drilling generally takes between two and four days.

For more information on Santos GLNG groundwater monitoring programs, please visit the Santos Water Portal at:
www.santoswaterportal.com.au

Disturbance area

The lease area generally measures approximately 70 by 70 metres. In some circumstances the lease area may be closer to 100 by 100 metres (one hectare). A water monitoring bore lease area typically does not require the same amount of preparation needed for a natural gas well.

For 24-hour drilling operations, a camp is often required to accommodate drilling personnel for the duration of the operations. The campsite will consist of a number of small temporary structures, similar to portable offices, including cooking and dining facilities, ablution facilities and sleeping blocks.

Much like the drilling site itself, the campsite occupies a minimum disturbance pad, but the area occupied is much smaller (typically 40 by 40 metres). Refer to temporary campsites on page 19 for further information.

Activities on and around water monitoring bores

Construction civil works

Construction will be similar to that of a minimal disturbance lease, with a smaller lease area of approximately 70 by 70 metres. Most CCAs allow for a maximum of four groundwater monitoring bores to be installed within a lease area of this size.

In areas where Santos GLNG is drilling into deeper aquifers, a larger rig is sometimes required. In these situations, a lease area of 100 by 100 metres (one hectare) will be required.

All lease areas will have temporary electric fences constructed around them to ensure that cattle cannot access the site. On some occasions, new access gates to the property and lease area will be installed. Due to the size of the machinery accessing the lease area and Santos GLNG's commitment to minimise environmental impacts, a new access point onto the property, by way of a gate, may be required. Shortening the access route will reduce the impact of heavy machinery on the access roads while also reducing the amount of dust generated by traffic.

Temporary storage pits will be excavated within the lease area to house drill cuttings and used drilling muds during site operations. The dimensions will vary depending on the depth of the bore to be drilled.

The material will be housed in the storage pit and collected for disposal every two to three days using a vacuum truck. Storage pits are constructed to accommodate 0.3 metres of 'freeboard' above the highest anticipated level within the storage pit. Prior to the commencement of drilling, the outside of storage pits is built up to form an additional barrier and provide extra capacity.

Typical site set-up – there are no flare pits and it occupies a much smaller disturbance area than gas production well lease.

Drilling

Duration of activity: approximately five to 25 days depending on the design and depth of the bore.

Deeper water monitoring bore leases may take longer to set up, extending the duration by up to two days before drilling commences and another two days for pack down on completion of the bore.

Water monitoring bores may be drilled on a 12-hour or 24-hour basis depending on the depth of the bore. Similar to natural gas wells, continuous drilling operations ensure that strata (rock formations) in the bore, where not yet protected by casing, continue to be supported by the pressure of the drilling mud. This is important for maintaining the correct diameter and integrity of the bore.

This in turn assists data gathering from downhole logging tools and also the overall safety of the drilling operation.

In addition, 24-hour operations allow the bore to be completed in a shorter timeframe so the rig can move off sooner, lessening the duration of disturbance at that location. Sometimes drilling will only take one day when undertaken continuously over 24 hours.

Generally, 12-hour operations are undertaken when the target aquifer is shallow and the risk of caving into the bore is low. A campsite is seldom required during 12-hour operations, unless the drilling site is remote and travelling to and from site is impractical.

Machinery and equipment on site during drilling:

- truck-mounted drilling rig
- drilling support vehicles (rod carriers)
- gas blow-off preventers (when drilling into aquifers below coal seams)
- mud pumps
- mud tanks
- mud shaker
- telehander and forklift
- drilling rod loader
- equipment storage and shipping containers
- site offices.

Service vehicles visiting site:

- cementing truck
- geophysics logging vehicle
- waste removal trucks
- water supply trucks.

Personnel on site during activity:

- pre-drilling contractors to:
  - slash the drilling and camp areas
  - erect fences and install gates
  - install well cellars and conductor casing.
- a crew of three to 12 drilling and support personnel (operating in two shifts for 24-hour drilling)
- up to four visiting drilling support service contractors per day.

Delivery of equipment to site.

Rig with mud tanks and pumps.

Installing conductor casing.

Post-drilling activities

Following drilling, aquifer testing may be undertaken on the newly drilled water monitoring bore to ascertain aquifer characteristics. Aquifer testing usually lasts between 24 and 72 hours.

Aquifer testing typically generates a large volume of water that can be directed into landholder dams, where available, and when the water quality is suitable for stock watering. When the water is not disposed into a dam, it is often used for dust suppression to minimise dust during site activities.

Duration of activity: 24 to 72 hours.

Machinery used during activity:

- groundwater pump
- generator power supply and fuel cell
- lay-flat hosing to dispose of water
- water truck (if no dam is available to receive the water)
- light 4WD vehicles.

Personnel on site during activity: up to two operators per vehicle.

Drilling lease and campsite rehabilitation

Due to the large size of machinery and number of vehicle movements over the site, the lease area and access roads will often require rehabilitation

to return them to their pre-existing condition. This work will be undertaken following the departure of all machinery and personnel from the site.

Santos GLNG may conduct the site rehabilitation activities or engage external contractors who have the resources to undertake the work on our behalf.

The extent and timing of rehabilitation works to be undertaken will be discussed between landholders and their Santos GLNG landholder liaison. Work will typically require multiple site visits to promote grass growth. Refer to well lease rehabilitation and decommissioning on page 84 for more information.

Duration of activity: half a day per month or as required.

Machinery used during activity:

- grader
- excavator.

Personnel on site during activity:

- one operator per vehicle
- rehabilitation personnel.

Telemetry station installation

A telemetry station records water level data from the bore and transmits it to a website (www.envault.com.au) which the landholder can directly access. The components that make up the station include:

1. solar power system
2. small mast (approximately four metres including aerial) to house the aerial and control box
3. control box to house the compressor, batteries and data logger.

Duration of activity: approximately two days.

Machinery used during activity: light 4WD vehicles.

Personnel on site during activity: up to two operators per vehicle for several hours.

Telemetry station to the right of an existing landholder water bore.

Downhole installation

Downhole installation is carried out in one of two ways:

a) Bubble line

The bubble line uses an internal air compressor at ground level to force a metered amount of air through a bubble line submerged in the flow channel. By measuring the pressure needed to force air bubbles out of the line, the level of the water in the well is accurately determined.

b) Pressure transducer

In the event that a well is not suitable for a bubble line system, a pressure transducer ('diver', 'logger') will be installed. Depending on the pump installed in the bore, the transducer will be secured to pipe work or cables, or simply installed down the side of the well, away from the pump to ensure that it does not become entangled in the pump works.

Duration of activity: installation will usually take less than one day and will remain in place for the life of the equipment.

Machinery used during activity:

- crane truck
- light 4WD vehicles.

Personnel on site during activity: up to two operators per vehicle.

Flow meter

A flow meter will be installed at ground level on wellhead works. This meter will be installed on pipework leading away from the head works providing valuable data to Santos GLNG and landholders (relating to pumping volumes and duration).

Installation occurs concurrently with downhole installation.

Water quality sampling port

Where one is not already available, an inline tap will be installed on the pump-head works or piping leading away from the well, to allow Santos GLNG environmental monitoring officers to collect water quality samples at various times throughout the year. The tap will be similar to a ball valve or a brass garden tap.

Installation occurs concurrently with downhole installation.

Maintenance

Frequency of activity:
quarterly checks, as required.

Machinery used during activity:
light 4WD vehicles.

Personnel on site during activity:
up to two operators per vehicle

Operations and maintenance

Duration of activity: quarterly checks, as required.

Machinery used during activity: light 4WD vehicles.

Personnel on site during activity: up to two operators per vehicle.

Life in an operating gas field

Once construction has ceased and we have transitioned to the operations phase, activities decrease significantly and consist mostly of monitoring and maintenance. Some Roma field assets that were in production for many years will be shutdown and decommissioned.

Until these Roma field assets are fully decommissioned, Santos GLNG's statutory requirements apply and our assets must continue to be monitored and maintained.

The table below outlines the activities that need to be carried out until Santos GLNG field assets are decommissioned.

Example of an old Roma operating natural gas well.

Example of a more recent operating natural gas well.

Asset name	Activity name	Requirement for activity	Description of activity	Frequency	Personnel and machinery
Natural gas wells and associated infrastructure	Well reads	Collection of data and monitoring and maintenance of equipment	Recording of data including: • pressure readings (well and equipment) • sonolog reads • fluid levels • operating conditions • condition of equipment.	Twice per week. RUGS (Roma underground gas storage) – once per week	1 operator 1 light 4WD vehicle
	Inspections	Hazard identification and rectification	Review of lease area and equipment to identify hazards that may be present and correct if possible or record to allow appropriate action to be taken to ensure the situation is safe.	Completed with well reads (as above)	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
	Well shutdown/startup	Change in operating requirements or restart well for operation	Attendance to site by operator to shutdown the well for maintenance activities or due to change in operating requirements that may not require the well to be on line. Or restart of the well after planned/unplanned shutdown to allow continued production. Changes may also need to be made to the operating conditions (e.g. speed up or slow down of pump speeds).	As required	Up to 2 operators Up to 2 light 4WD vehicles
	Vegetation management	Maintain a safe operating environment	Vegetation management consists of the following activities: • mowing • slashing • whipper-snippering • weed spraying (if approved).	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
	Separator cleans	Maintain reliability and the continued operation of equipment	Well site is shutdown in a planned manner and the separator vessel is isolated. Vessel flanges are opened to allow connection of the vacuum unit to remove all material from vessel. Vessel flanges are reinstated and the well site is de-isolated and restarted.	As required	Up to 2 operators Up to 2 light 4WD vehicles
	Fuel delivery	Continued operation	Refuelling of equipment (with either diesel/LPG) for continued generator operation.	Weekly/as required	1 operator 1 light 4WD vehicle 1 delivery truck (LPG/diesel)
	Breakdowns/repairs	Continued operation and to maintain the reliability of equipment	To maintain the reliability and return equipment to service, fault finding and associated repairs are conducted by operational, mechanical, instrumentation and electrical personnel.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
	Water quality sampling	Environmental analysis/monitoring	To monitor and analyse the quality of water produced from the wells, a sample of water is taken from the wellhead or separator for analysis off site.	Monthly (start of month)	1 operator 1 light 4WD vehicle

Asset name	Activity name	Requirement for activity	Description of activity	Frequency	Personnel and machinery
Natural gas wells and associated infrastructure	Gas sampling	Analysis/monitoring	Gas samples are taken from the wellhead by operators connecting a canister to the equipment, obtaining a sample and the gas sample is then analysed off site.	As required	Up to 6
	Generator servicing	Reliability and operation	Servicing of equipment is completed as per technical instructions derived from equipment Operating & Maintenance Manual.	Every 5 weeks	Up to 2 operators Up to 2 service trucks
	Critical function testing	Reliability and operation	Testing is conducted on equipment to verify the correct functionality and operation. It must be completed on all lease equipment including electrical and instrumentation components.	Annually	Up to 2 operators Up to 2 light 4WD vehicles
	Statutory internal vessel inspection	Maintain equipment integrity	Internal vessel inspections are conducted by a third-party contractor to gather information about the condition of internal surfaces and verify the integrity of the vessel. This is done to ensure it is fit for service without defects. This inspection is completed in accordance with AS/NZS3788.	2 yearly	1 operator 1 contractor 2 light 4WD vehicles
	Statutory external vessel inspection	Maintain equipment integrity	External vessel inspections are conducted by a third-party contractor to gather information about the condition of external surfaces, to inspect additional equipment associated with the pressure vessel, and verify the integrity of the vessel. This is done to ensure it is fit for service without defects. This inspection is completed in accordance with AS/NZS3788.	4 yearly	1 operator 1 contractor 2 light 4WD vehicles
	Pressure relief device testing	Maintain equipment integrity	Pressure relief device testing is conducted by a third-party contractor to test and if required overhaul the valve to ensure that it is fit for service without defects. This testing is completed in accordance with AS/NZS3788.	5 yearly	1 operator 1 contractor 2 light 4WD vehicles
	As required maintenance	Maintain a safe operating environment	Additional maintenance that is required to be undertaken may include: • erosion repairs • installation or repairs to fencing • rehabilitation activities • warranty work/certification of equipment • modifications/changes to existing infrastructure.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
	Well lease leak survey	Monitor and maintain equipment integrity	A third-party contractor is engaged to conduct a survey of 20 per cent of well leases to verify the absence of leaks and ensure compliance with government regulations.	Annually	1 operator 1 light 4WD vehicle
High point vents (HPV)	HPV inspections	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a basic inspection of the HPV for leaks or damage. This is to ensure all connections are maintained and that panels are still in place around the asset.	Bi-monthly	1 operator 1 light 4WD vehicle

Asset name	Activity name	Requirement for activity	Description of activity	Frequency	Personnel and machinery
High point vents (HPV)	Facility inspection	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all assets to ensure there is no external interference (from weather, external construction/maintenance activities).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Repairs/maintenance	Continued operation and to maintain the reliability of equipment	Additional repairs or maintenance may be required to rectify issues identified during inspections and may include: • HPV repairs • HPV replacement • removal of water from containment tank.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
Low point drains (LPD)	Water removal and drainage	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a basic inspection of the LPD to drain any water present, take a sample of the water for analysis and inspect it for leaks or damage. This is to ensure all connections are maintained and that panels are still in place around the asset.	Bi-monthly	1 operator 1 light 4WD vehicle
	Facility inspection	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all assets to ensure there is no external interference (from weather, external construction/maintenance activities).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Repairs/maintenance	Continued operation and to maintain the reliability of equipment	Additional repairs or maintenance may be required to rectify issues identified during inspections and may include: • LPD repairs • LPD replacement.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
Manifolds	Facility inspection	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all assets to ensure there is no external interference (from weather, external construction/maintenance activities).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Repairs/maintenance	Continued operation and to maintain the reliability of equipment	Additional repairs or maintenance may be required to rectify issues identified during inspections and may include: • manifold repairs • manifold upgrades.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
Risers	Water removal and drainage	Maintain and monitor integrity (statutory requirement)	A riser is a piece of aboveground pipe – usually at the end of an underground pipeline. As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a basic inspection of the LPD to drain any water present, take a sample of the water for analysis and inspect it for leaks or damage. This is to ensure all connections are maintained and that panels are still in place around the asset.	Bi-monthly	1 operator 1 light 4WD vehicle

Asset name	Activity name	Requirement for activity	Description of activity	Frequency	Personnel and machinery
Risers	Facility inspection	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all assets to ensure there is no external interference (from weather, external construction/maintenance activities).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Water sampling integrity management plan (IMP)	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all pipelines to ensure there is no external interference (from weather, external construction/maintenance activities on roads).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Repairs/maintenance	Continued operation and to maintain the reliability of equipment	Additional repairs or maintenance may be required to rectify issues identified during inspections and may include: • riser repairs • riser replacement • riser upgrades.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
Pipelines (gas and water)	Right of way (ROW) survey	Maintain and monitor integrity (statutory requirement)	As part of AS2885 (page 44, Section 7.4.1), this is a statutory requirement to conduct a full visual inspection of all pipelines to ensure there is no external interference (from weather, external construction/maintenance activities of roads).	Annually (April/May)	1 operator 1 light 4WD vehicle
	Repairs/maintenance	Continued operation and to maintain the reliability of equipment	Additional repairs or maintenance may be required to rectify issues identified during inspections and may include: • erosion repairs • pipeline replacement • pipeline coating repairs • signage upgrade/installation.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
Water management pond (WMP)	Inspections/maintenance	Maintain and monitor integrity	Review and inspections of WMP facilities are conducted to check: • fence condition • erosion • liner condition • WMP level • access • signage • stabilisation.	Quarterly	1 operator 1 light 4WD vehicle
	Vegetation management	Maintain a safe operating environment	Vegetation management consists of the following activities: • mowing • slashing • whipper-snippering • weed spraying (if approved).	Quarterly (or as required)	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required
	As required maintenance	Maintain a safe operating environment	Additional maintenance required to be undertaken may include: • erosion repairs • installation or repairs to fencing • correction of stabilisation (e.g. reseeding) • repairs to WMP liners.	As required	Up to 2 operators Up to 2 light 4WD vehicles Truck or mobile equipment may also be required

Well lease rehabilitation and decommissioning

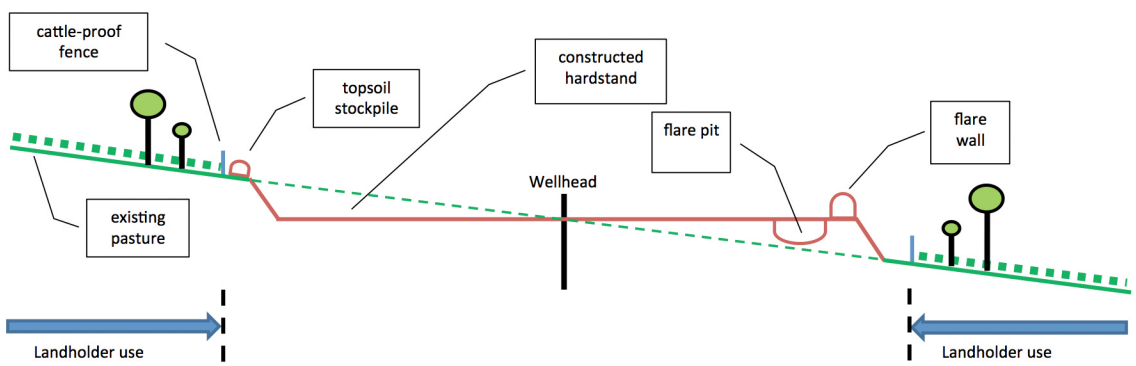
In accordance with regulatory requirements, Santos GLNG will progressively rehabilitate a well lease area when the flare pits and inground sumps on the pad are no longer required. Rehabilitation will continue progressively for the operational life of the well.

When the well and associated infrastructure is at the end of its life cycle and no longer operating, Santos GLNG will safely decommission it and complete the rehabilitation of the area, where practical, to a standard consistent with the surrounding land use.

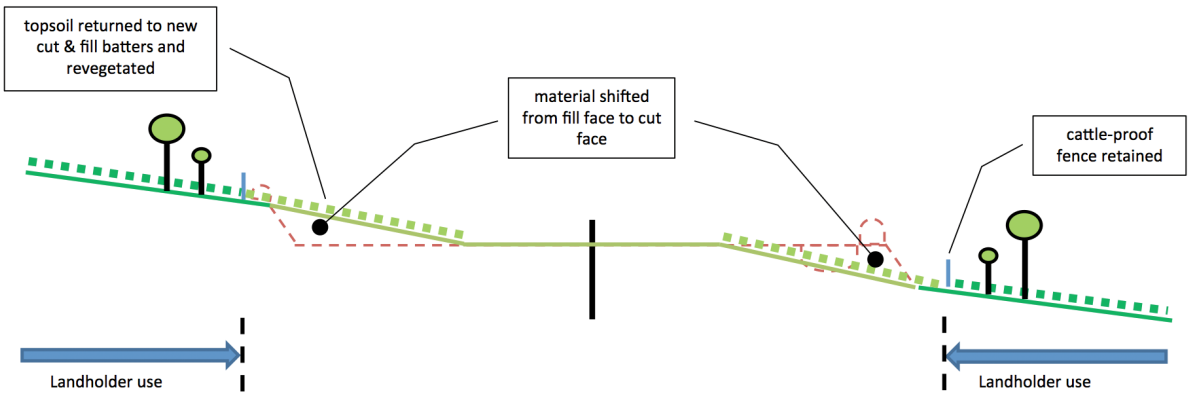
The well lease rehabilitation and decommissioning process consists of four stages which are in accord with the lifecycle of the well:

1. lease maintenance – this occurs from the time the pad is constructed to the time the well becomes operational.
2. resizing of the well pad and rehabilitation of cut and fill batters (slopes) – this occurs during the operational life of the well.
3. removal of cattle fences and the introduction of cattle panels – this occurs once the re-profiled areas have sufficiently rehabilitated.
4. plug and abandon – this occurs after the well reaches the end of its operational life.

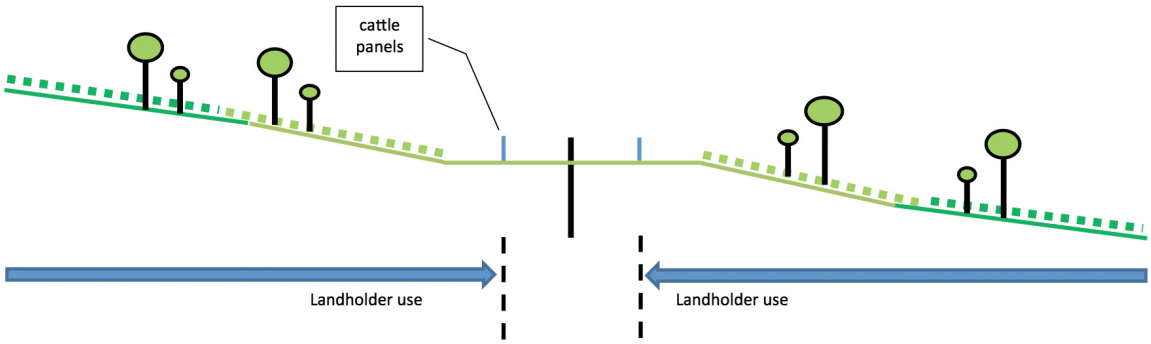
The four phases are shown in the diagrams below:



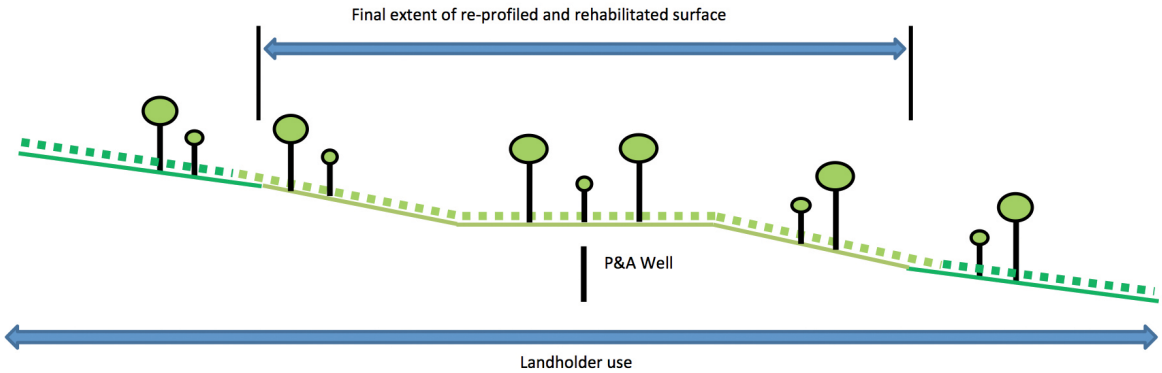
Stage 1: lease constructed for well drilling and completion



Stage 2: well operational and producing gas with reduced hardstand



Stage 3: well operational and producing gas with cattle panel protection



Stage 4: well plugged & abandonded and all land rehabilitated

Disturbance area

The rehabilitation and decommissioning of wells is undertaken inside the boundaries of the original disturbed areas.

Activities during well lease rehabilitation and decommissioning

Stage 1 activities

There is typically a period of time (several months to a year) between the construction of the lease area, drilling and completion works for the well, and connection of the well to the flowline network, when it then is deemed operational.

During this time, Santos GLNG will maintain the well lease and monitor the effectiveness of lease stabilisation controls that were installed at the time of lease pad construction.

Other effects such as erosion from heavy rainfall will be addressed on an as needed basis.

Duration of activity: up to one day as needed.

Machinery used during activity: light 4WD vehicle.

Personnel on site during activity:

- Santos GLNG field services officer
- civil contractors.

Stage 2 activities

Site inspection

Once the well is operational and the flare wall, flare pit and other inground sumps are no longer required, progressive rehabilitation of the lease area will commence.

Santos GLNG and its nominated civil contractor will visit the site and determine the scope of works required then begin the rehabilitation design process.

Duration of activity: up to one day.

Machinery used during activity:
light 4WD vehicle.

Personnel on site during activity:

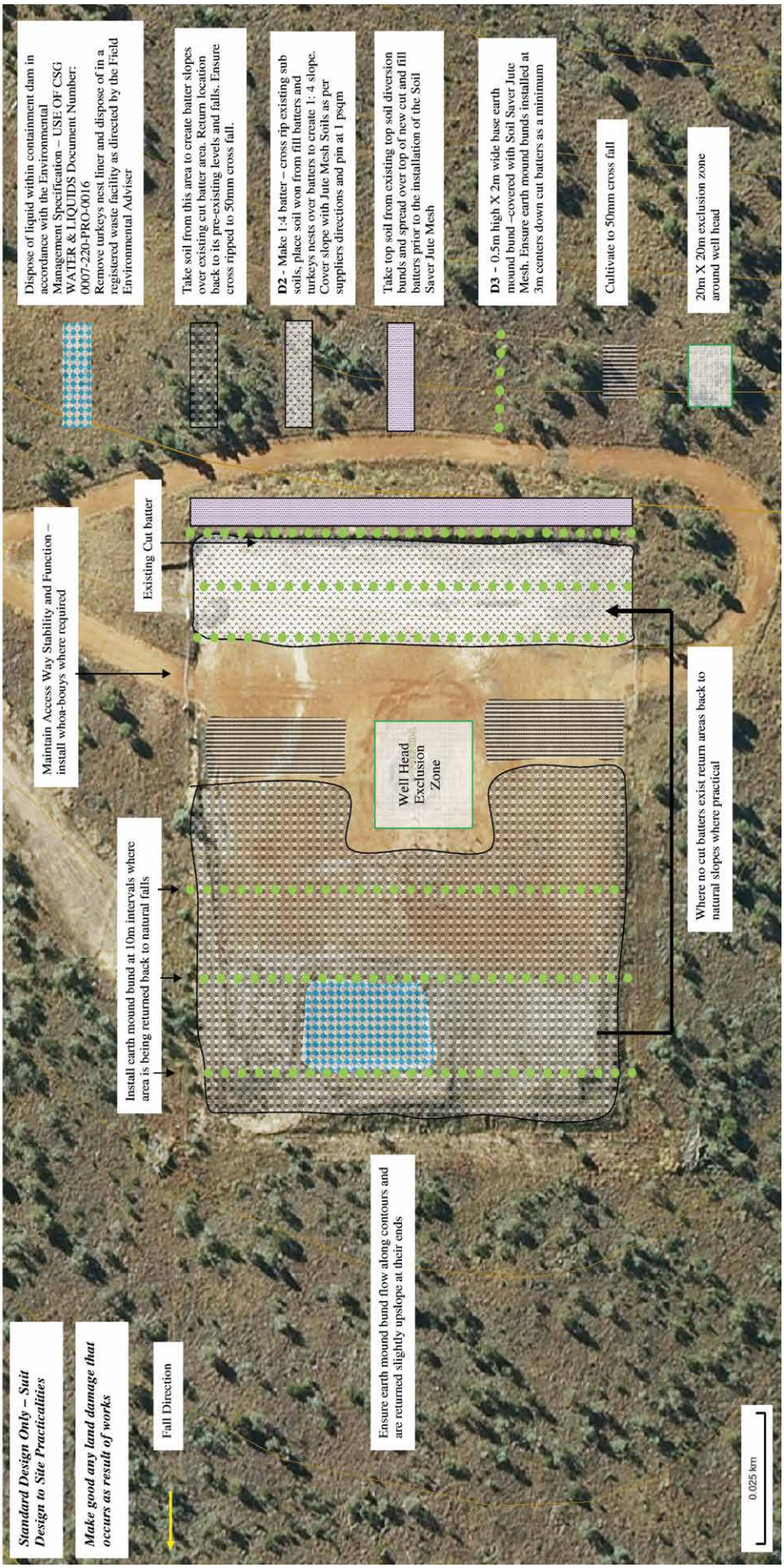
- Santos GLNG field services officer
- civil contractor.

Rehabilitation design

Following the site inspection, Santos GLNG will develop a site-specific progressive rehabilitation plan.

The plan will outline key tasks and a works execution schedule that takes into account seasonal growth factors and variables, such as topography, soil type, existing vegetation, availability of topsoil and future landholder use of the area.

The design will seek to maintain a properly stabilised site at all times to ensure erosion is mitigated and colonisation of the surrounding vegetation can occur.


Dispose of liquid within containment dam in accordance with the Environmental Management Specification – USE OF CSG WATER & LIQUIDS Document Number: 0007-220-PRO-0016
Remove turkeys nest liner and dispose of in a registered waste facility as directed by the Field Environmental Adviser
Take soil from this area to create batter slopes over existing cut batter area. Return location back to its pre-existing levels and falls. Ensure cross ripped to 50mm cross fall.
D2 - Make 1:4 batter – cross rip existing sub soils, place soil won from fill batters and turkeys nests over batters to create 1: 4 slope. Cover slope with Jute Mesh Soils as per suppliers directions and pin at 1 psqm
Take top soil from existing top soil diversion bunds and spread over top of new cut and fill batters prior to the installation of the Soil Saver Jute Mesh
D3 - 0.5m high X 2m wide base earth mound bund –covered with Soil Saver Jute Mesh. Ensure earth mound bunds installed at 3m centers down cut batters as a minimum
Cultivate to 50mm cross fall
20m X 20m exclusion zone around well head
Existing Cut batter
Maintain Access Way Stability and Function – install whoa-bouys where required
Install earth mound bund at 10m intervals where area is being returned back to natural falls
Well Head Exclusion Zone
Where no cut batters exist return areas back to natural slopes where practical
Ensure earth mound bund flow along contours and are returned slightly upslope at their ends
Standard Design Only – Suit Design to Site Practicalities
Make good any land damage that occurs as result of works
Fall Direction
0.025 km

Works execution

Once the design is finalised and Santos GLNG has checked and approved all health, safety, land access and internal environmental requirements, works can commence.

The sequence and nature of the works will vary from site to site to take account of local variations and seasonal fluctuations, but it will generally involve a key set of activities.

Fixtures, fittings and liners associated with the flare wall, flare pit and inground sumps are removed. New cut and fill batters of a much lower grade than those initially constructed are built by shifting the material from the fill side of the lease to the cut side and covering them with topsoil previously stockpiled at the top of the original cut batter.

Re-profiling of the area is supplemented with other sediment and erosion control measures to slow overland water flow and promote revegetation.

The size of the well pad hardstand area is significantly reduced during this process to a size that remains for the well's operational life.

Duration of activity: up to five days.

Machinery used during activity:

- bulldozers
- earthmovers of assorted sizes
- vacuum truck
- light 4WD vehicle.

Personnel on site during activity:

- Santos GLNG field service officer
- civil contractors.

Rock lined chute batter that controls surface water and captures sediments coming off the pad during wet weather.

Stage 2 works execution complete.

Stage 2 works execution complete.

Monitoring

Once execution is completed and the site stabilised and established for rehabilitation, Santos GLNG will carry out regular monitoring inspections.

These inspections ensure any environmental hazards that exist are promptly identified and rectified. It also ensures that the site is stable and rehabilitated in accordance with the design. This monitoring activity occurs throughout the life of the well lease area.

Duration of activity: up to two hours at a time.

Machinery used during activity: light 4WD vehicle.

Personnel on site during activity: Santos GLNG field service officer.

Stage 3 activities

Once the disturbed area, excluding the remaining hardstand operational area around the wellhead, is deemed to be rehabilitated back to its pre-existing condition, or in a state that will see it replicate its pre-existing condition in the near future, the cattle proof fence around the lease area will be removed. This is to allow pre-existing land use to continue up to the cattle panels area around the wellhead, where practical.

Duration of activity: up to one day.

Machinery used during activity: light 4WD vehicle.

Personnel on site during activity:

- Santos GLNG field service officer
- fencing contractor.

Well lease pad with cattle panels around the well lease surface infrastructure.

Well lease pad with grass cover returned and cattle panels around well lease surface infrastructure.

Stage 4 activities

Once the well reaches the end of its operational life, which could be 20 to 30 years the well will be plugged and abandoned. Its integrity will be monitored after it's plugged and abandoned to protect aquifers for future generations.

When monitoring is complete, the wellhead steel casings are cut and capped below the surface so they do not impede future surface activities.

The process usually involves a drill rig visit followed by a monitoring period. In certain circumstances a rig will be required to return to site to address any well integrity issues.

During this period, Santos GLNG will meet with landholders to ensure they are satisfied with the area and its rehabilitation status. Any final additional rehabilitation work is negotiated with the landholder and once complete, Santos GLNG will ask the landholder to sign off the area as satisfactory.

Refer to plug and abandon on page 41 for further information.

Duration of activity: up to three days

Machinery used during activity:

- light 4WD vehicles
- drill rig
- contractor trucks.

Personnel on site during activity:

- Santos GLNG field service officer
- drilling contractor
- other wellhead infrastructure contractors.

An example of completed rehabilitation after the wellhead is plugged and abandoned.

Appendix A: Overview of activities

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Seismic surveying	Seismic line preparation	Up to 2 months	Xx x 4m corridor (length of seismic line will differ for each site)	Slasher Grader Mulcher Bulldozer Stick rake Light 4WD vehicles	Up to 6
	Seismic recording	1 day per 10km of seismic line	Within existing corridor	Vibrator trucks Vibrator service truck Recording truck Light 4WD vehicles	Up to 22
	Pack up	1-2 days	Within existing corridor	Light 4WD vehicles	Up to 21
	Rehabilitation	Up to 4 days	Within existing corridor	Light 4WD vehicles Grader Bulldozer	Up to 4
Geotechnical investigations	Bore holes	Up to 2 days	0.25m x 0.25m x 2m (depth) per pipeline bore hole 0.25m x 0.25m x 15m (depth) per facility bore hole	Truck-mounted drilling rig; or Hand auger Light 4WD vehicles	Up to 6
	Test pits	Up to 3 days	2m x 5m x 3m (depth) per test pit	Tractor fitted with backhoe Excavator Light 4WD vehicles	Up to 6
Lease areas	Surveying and pegging	Up to 3 days	Nil	Light 4WD vehicles	Up to 3
	Ecological and cultural heritage survey	Up to 2 days	Within pegged area	Light 4WD vehicles	Up to 6
	Construction civil works	30-60 days	1-3 ha per lease area	Bulldozers Tippers Water truck Excavator Loader Grader Rollers Fencing equipment Conductor installing drilling rig Light 4WD vehicles	Up to 6

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Minimal disturbance lease areas	Construction civil works	7 days	0.6-0.7 ha	Grader Slasher Front-end loader Backhoe or excavator Conductor installing drilling rig Fencing equipment Light 4WD vehicles	Up to 6
Temporary drilling and completions campsites	Construction civil works (concurrent with the lease area civil works)	30-60 days	0.25 ha per campsite	Bulldozers Tippers Water truck Excavator Loader Grader Rollers Light 4WD vehicles	Up to 6
	Set up	2 days	Contained within existing campsite disturbance area	Road trains Cranes Accommodation dongas Kitchen donga Laundry donga Cold room donga Generator and water skid Auxiliary water tank Dry store and rec skid Sewage processing unit	Up to 14
	Operations	Ongoing up to 52 weeks	Contained within existing campsite disturbance area	Rig change vehicles (Light 4WD vehicles and mini bus)	2 crews of 12 people each Operators for each vehicle Santos GLNG operating company representative Up to 3 visiting drilling specialists per day
Access roads	Construction civil works (concurrent with the lease area civil works)	30-60 days	Xxm x 18m new road Xxm x 18m upgraded road (length of access road will differ for each site)	Tippers Water truck Loader Grader Roller Light 4WD vehicles	Up to 6
	Operations and maintenance	Ongoing	Xxm x 8m new road Xxm x 8m upgraded road (length of access road will differ for each site)	Grader Light 4WD vehicles	Up to 2 operators for each vehicle

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Gas wells	Overbalanced drilling	2-30 days	Contained within existing lease area	Drilling rig trailer-mounted carrier Mud pumps Mud tanks Shacks 'Doghouse' attached to either a water tank skid or hydraulic power unit Generator skids Chemical skid 'Junk' skids (used for storage of miscellaneous equipment) Diesel fuel tank Settling tank with mounted centrifuge Skips for storing dry well cuttings storage Drill pipe handler or cat walk Drill pipe storage tubs Casing storage racks Forklift/telehandler	2 rig contractor crews typically with 6-8 members working in 12-hour shifts 4 Santos GLNG operating company representatives 6 rig contractor supervisors and tradesmen Up to 6 drilling specialists
	Third-party activity	Concurrent with drilling operations	Contained within existing lease area	Rigid truck, semi-trailers and road trains Cement trucks Wireline trucks Water trucks Vacuum trucks Light 4WD vehicles	As above
	Underbalanced drilling	2-30 days	Contained within existing lease area	As with overbalanced drilling with the addition of: Compressors Boosters Mist pump Surface pressure control equipment Blooie line Extra tanks for water storage Extra water trucks	As above and depending on the rig contractor, a specialist may be required to operate the air equipment
	Directional and horizontal drilling	Up to 30 days	Contained within existing lease area	As with overbalanced drilling with the addition of: Extra on site office for directional drillers Additional light 4WD vehicles Downhole tools for directional drilling Increased size and capability of equipment on surface	As above with up to 4 additional personnel
	Under-reaming	5-10 days	Contained within existing lease area	As with overbalanced drilling with the addition of: Particular drill bit	As above

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Rig-less operations	Wellhead installation	Up to 4 hours	Contained within existing lease area	Small rigid crane truck Light 4WD vehicles	2 representatives from wireline contractor Santos GLNG representative
	Wireline activities	1-4 days	Contained within existing lease area	Small rigid wireline truck Crane (for rig-less operations only, wireline contractor dependent) Light 4WD vehicles	Up to 4 representatives from wireline contractor Santos GLNG representative
	Perforating	Up to 4 hours	Contained within existing lease area	As above	As above
	Logging	Up to 2 days	Contained within existing lease area	As above	As above
Hydraulic fracturing	Fracture stimulation (if required)	2-5 days/well	Contained within existing lease area	High pressure pumps Prime movers Sand storage facility Chemical blender Hydration unit Data acquisition van Mechanical workshop Fuel truck Iron package and trailer Forklifts Temporary shacks Rigid truck, semi-trailers and road trains Water trucks Vacuum trucks Light 4WD vehicles	Up to 25 personnel
	Third-party and support activity	Concurrent with drilling operations	Contained within existing lease area	Rigid truck, semi-trailers and road trains Water trucks Wireline trucks Coiled tubing units Light 4WD vehicles	As required throughout
Coil tubing clean out	Coil tubing clean out	2-14 days	Contained within existing lease area	Coil tubing rig (truck-mounted self-propelled) Water tank (trailer-mounted) Shacks/offices (trailer-mounted) Fuel and generator skid Telehandler Semi-tanker water truck Light 4WD vehicles	Up to 25 personnel

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Initial completions and workovers	Overbalanced initial completions and workovers	2-3 days	Contained within existing lease area	Workover rig (truck-mounted) Pipe handler Mud pump and water tank (trailer-mounted) Water tanks (skid-mounted) Shacks/offices (trailer-mounted) Fuel and generator skid Flare tank Telehandler Semi-tanker water truck In some cases, a truck-mounted continuous-rod unit may also be used Light 4WD vehicles	1 crew (6 people), or 2 crews (12 people) for 24-hour operations Operators for each service vehicle 1-2 Santos GLNG operating company representatives Up to 3 visiting specialists per day
	Underbalanced workovers and cleanouts	Approximately 3-14 days per well	Contained within existing lease area	Workover rig (truck-mounted) Pipe handler (trailer-mounted) Mud pump (trailer-mounted) Water tanks (trailer-mounted) Air compressors One booster compressor Generator and control unit Shacks/offices (trailer mounted) Telehandler Semi-tanker water truck In some cases, a truck-mounted continuous-rod unit may also be used Light 4WD vehicles	2 crews (12 people) for 24-hour operations Operators for each vehicle 2 Santos GLNG operating company representatives for 24-hour operations Up to 3 visiting specialists per day
Nell maintenance operations	Flushby and co-rod operations	Less than 12 hours	Contained within existing lease area	Drilling rig trailer-mounted carrier Catwalk trailer Prime movers Supervision shack Crib room Water tanker Co-rod support and handling truck Co-rod reel	Flushby crew typically with 3 to 4 members working a 12-hour shift Co-rod crew typically with 2 to 3 members working a 12-hour shift Santos GLNG operating company representative
	Annular flush	Approximately 0.5 day		Water truck Light 4WD vehicles	Operators for each vehicle
	Third-party activity	As required	Contained within existing lease area	Rigid truck, semi-trailer and road trains Water tanks Vacuum trucks Light 4WD vehicles	Contractors as required

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Plug and abandon	Plug and abandon	7-28 days per well	Contained within existing lease area	Workover rig, or small drilling rig Carrier Mud pump Storage water tanks Skids Air compressors Booster Dongas to accommodate the current activities Third-party cement unit and bulker Third-party wireline unit for perforation tool and mechanical plug setting	2 crews of 12 people each Operators for each vehicle Santos GLNG operating company representative Up to 3 visiting drilling specialists per day
	Ongoing monitoring	1 day/month over 6-12 months	Contained within existing lease area	Light 4WD vehicles	Operators for each vehicle
Modular open water storage tanks (MOWST)	Construction civil works (concurrent with lease area civil works) • 3.4 megalitre (ML) and 7ML MOWSTs only •1.8ML MOWST will be constructed inside the existing lease area	10 days	Up to 1 hectare each MOWST	Grader Roller Water truck Backhoe/excavator Light 4WD vehicles	Up to 6
	MOWST construction – tank install	Up to 6 days	Contained within existing MOWST disturbance area	Telescopic handler Generator Light 4WD vehicles	Up to 6
	MOWST construction – liner install	Up to 6 days	Contained within existing MOWST disturbance area	Telescopic handler Liner welding equipment Light 4WD vehicles	Up to 6
	Connections, testing and clean up	Up to 3 days	Contained within existing MOWST disturbance area	Grader Rollers	Up to 6
	Operations Removal of water from the MOWST	6-18 months	Contained within existing MOWST disturbance area and associated access roads	Water trucks	Operators for each vehicle
Flowlines (for gas and water)	Clear and grade	Up to 2 days (per 500m)	Xxm x 12m/20m within approved construction corridor (length of flowline will differ for each site)	Grader Bulldozer Light 4WD vehicles	Cultural heritage personnel Environmental adviser and associated contractors Construction supervisor Up to 20 personnel

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Flowlines (for gas and water)	String, weld, trench, lay and bury Flowline trenches are backfilled at the end of each day	2-4 days (per 500m)	As above	Excavators Line tamer Trenching machine Grader Prime mover and extendable trailer Crane HDPE 'fast fusion' machine Water trucks Air compressor Light 4WD vehicles	Up to 20
	Post-construction reinstatement	Up to 3 days	Within existing disturbance area	Grader Excavator Mulcher Light 4WD vehicles	3 construction personnel 1 site supervisor
	High point vents (concurrent with flowline string, weld, trench, lay and bury)	As above	3m x 3m above flowline	As above	As above
	Low point drains	Up to 14 days	Up to 10m x 10m	Crane Excavator Delivery truck Light 4WD vehicles	Up to 4
	Manifolds/tie-ins/take off stations	Up to 10 days	Up to 10m x 10m	Crane Excavator Delivery truck Light 4WD vehicles	Up to 4
	Testing of flowlines	1-7 days depending on the length of the flowline	Nil	Water truck Fill/hydro test pump Light 4WD vehicles	Up to 4
	Operations and maintenance	Quarterly checks, as required	Nil	Earthmoving equipment, if required Light 4WD vehicle	Up to 2
Buried powerlines	Clear and grade	Up to 2 days (per 500m)	Xxm x 12m/20m within approved Right of Way (ROW) (length of powerline will differ for each site)	Grader Bulldozer Light 4WD vehicles	Up to 6
	Trench, lay and bury	Up to 2 days (per 500m)	As above	Excavator Trenching machine grader Crane Tippers Water trucks Air compressor Light 4WD vehicles	Up to 40

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Buried powerlines	Operations and maintenance	Quarterly checks and as required	Nil	Light 4WD vehicles	Operators for each vehicle
Aboveground powerlines	Clear and grade	0.25km per day	As above	Grader Bulldozer Dump truck Crew truck Light 4WD vehicles	Up to 20
	Pole foundations	0.5km per day	As above	Concrete truck Boring machines Light 4WD vehicles	Up to 7
	Pole assembly and erection	0.5km per day	6.5-20m high	80 tonne crane Guide crane Pole transporter Light 4WD vehicles	Up to 11
	Conductor stringing	0.6km per day	As above	Drum pullers Winch truck Brake truck Water truck Light 4WD vehicles	Up to 11
Gas transmission pipelines	Surveying and pegging	3 days	Nil	Light 4WD vehicles	Up to 3
	Clear and grade	Up to 2 days (per 500m)	Xx x 25m within easement or approved construction ROW (length of pipeline will differ for each site)	Grader Bulldozer Light 4WD vehicles	Up to 20
	Delivery of pipe, string and weld	Up to 2 days (per 500m)	As above	Prime movers and extendable trailers Cranes Hydraulic bending machine Automated welding machines Air compressor Radiographic X-ray machines Ultrasonic testing equipment Light 4WD vehicles	Up to 20
	Trenching	1 day (per 2km)	As above	Excavators Automated trenching machine Grader Water trucks Light 4WD vehicles	Up to 6

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Gas transmission pipelines	Lay, tie-in and bury	1 day (per 1km)	As above	Pipelayer tractors Padding machine Rubber tyred grader Compactor Bulldozers Excavators Light 4WD vehicles	Up to 6
	Creek crossings	Average 14 days per creek crossing	As above	Side booms Excavators Tippers Welding equipment Light 4WD vehicles	Up to 15
	Road crossings	Average 1 day per road crossing	As above	Excavators Tippers Welding equipment Static roller Cranes Light 4WD vehicles	Up to 13
	Hydro-testing	1-7 days	As above	Water truck Compressor Water pumps Water tanks Light 4WD vehicles	Up to 6
	Cleanup and rehabilitation	Up to 3 days	As above	Bulldozer Grader Tractor and harrows Seeding equipment Light 4WD vehicles	Up to 8
	Operations and maintenance	Ongoing	As required, but within the easement or approved operational ROW	Small machinery, when required Light 4WD vehicles	Up to 4
Fibre optic cables	Clear and grade	Up to 2 days (per 500m)	Xxm x 12m/20m within easement or approved construction ROW (length of fibre optic cable will differ for each site)	Grader Bulldozer Light 4WD vehicles	Up to 20
	String, trench, lay and bury fibre optic cable trenches are backfilled at the end of each day	Up to 2 days (per 500m)	As above	Excavators Trenching Machine Graders Stringing Trucks Cranes Light 4WD vehicles	Up to 20

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Fibre optic cables	Operations and maintenance	Quarterly checks, as required	Within easement or approved operational ROW	Light 4WD vehicle	Operators for each vehicle
Laydown areas	Clear and grade	Up to 7 days	Between 1-25ha	Bulldozer Roller Grader	Up to 6
	Operations	As required	As above	Trucks Forklifts Cranes	Operators for each vehicle
Water management ponds (WMP)	Clear and grade	7-14 days	Up to 20ha	Bulldozers Loaders Graders Rollers Scrapers Excavators Light 4WD vehicles	Up to 20
	Construction	4-6 months	As above including greenfield area: • campsite • laydown area • stockpile area • spoil pile • contractor storage area	D10 Bulldozer Tippers Scrapers Compactors Water trucks Excavators Loader Graders Roller Light 4WD vehicles	Up to 31
	Operations and maintenance	Quarterly checks, as required	Up to 8ha	Light 4WD vehicles	Operators for each vehicle
Communication towers	Construction	7-30 days	Up to 2ha 30m to 160m high	Concrete trucks Auger Trencher Digger Rockbreaker Crane Light 4WD vehicle	1 operator per machine
	Maintenance	Quarterly checks, as required	Up to 0.25ha 30m to 160m high	Light 4WD vehicles	Operators for each vehicle

Asset name	Activity phase	Duration	Disturbance area	Machinery	Personnel
Water monitoring bores	Construction civil works	30-60 days	Up to 1ha each lease area	Bulldozers Tippers Water Truck Loader Grader Roller Light 4WD vehicles	Up to 6
Water monitoring bores	Drilling	5-25 days per bore	Within existing lease area	Truck-mounted drilling rig Drilling support vehicles Gas blow-off preventer mud pump Mud tank Mud shaker Cement truck Logging vehicle Waste removal trucks Water supply truck Telehandler/forklift Drilling rod loader Equipment storage/shipping containers Site offices	Up to 12 people each Up to 4 visiting drilling specialists per day
	Post drilling activities	1-3 days	Within existing lease area	Groundwater pump Generator power supply and fuel cell Lay-flat hosing Water truck Light 4WD vehicles	Up to 2
	Drilling lease and campsite rehabilitation	0.5 day per month	Within existing lease area	Grader Excavator	Operators for each vehicle
	Telemetry station installation	0.5-1 day	Within existing lease area	Light 4WD vehicles	Operators for each vehicle
	Maintenance	Nil	Within existing lease area	Light 4WD vehicles	Operators for each vehicle

Appendix B: Glossary

Term	Reference
Advanced activity	Advanced activity, for a provision about a petroleum authority, means an authorised activity for the authority (other than a preliminary activity). Examples: • levelling of drilling pads and digging sumps • earthworks associated with pipeline installation • vegetation clear-felling • constructing an exploration camp, concrete pad, sewage or water treatment facility or fuel dump • geophysical surveying with physical clearing • carrying out a seismic survey using explosives • constructing a track or access road • changing a fence line *Definition from Petroleum and Gas (Production and Safety) Act 2004 (Qld) Schedule 2*
Agreement to vary (ATV)	Page 9
Appraisal well	Page 23
Authority to prospect (ATP)	Page 22
Blooie line	Page 27
Bubble line	Page 77
Cased-hole logging	Logging activities that are performed once the casing is installed.
Cathodic protection (CP) system	Page 62
Completions rig	Page 37
Conduct and compensation agreement (CCA)	Page 7
Continuous rod (co-rod)	Page 40
Corehole	Page 22
Cultural heritage	Page 6
Cut and fill	Civil construction of the lease area where the material excavated ('cut') is used as fill to build any required embankments.
Department of Environmental and Heritage Protection (DEHP)	This Queensland Government department is responsible for managing the health of the environment to protect Queensland's unique ecosystems, including its landscapes and waterways, as well as its native plants and animals and biodiversity. The department's role is to act as a strong environmental regulator which supports sustainable long-term economic development of Queensland.
Doghouse	A room at the same elevation adjacent to the drilling floor which houses the driller and drilling team.
Drill or rod string	A column, or string, of drill pipe that transmits drilling fluid (via the mud pumps) and torque to the drill bit.
Drilling rig	The machine used to drill a wellbore.
Entry notice	Page 6
Flaring	Pages 27,28
Flushby	A Flushby unit is smaller and faster than conventional workover rigs, yet equally capable of performing all types of light well servicing.
Frac spread	Page 34
Gravel capped	Placing gravel on the ground to protect it from weather and provides erosion control.
High density polyethylene (HDPE)	Water lines made from HDPE, commonly referred to as polypipe.
High point vent (HPV)	Page 48
Hydro-testing	Page 65

Term	Reference
In vehicle monitoring system (IVMS)	Internal Santos GLNG system that all employees, contractors and subcontractors must have installed within their vehicles. The IVMS must be able to monitor as a minimum: • driver of the vehicle at any given time • vehicle speed • distance travelled • time of journey (start and end) • driver seat belt engaged • harsh braking • four wheel drive engaged (where fitted) on unsealed roads • IVMS unit disconnection/tampering (battery, antenna, settings) • identification details (vehicle ID, time, date, longitude, latitude, event type)
Letter of offer	A letter provided to the landholder that accompanies the CCA. The letter provides the contact details of the landholder's Santos GLNG landholder liaison and outlines the proposed compensation being offered within the CCA. The letter of offer gives Santos GLNG an opportunity to highlight specific details that may be unique to that particular CCA and outline any other relevant information.
Liquefied natural gas	Natural gas, mainly methane which has been liquefied at -161°C.
Low point drain (LPD)	Page 49
Minimal disturbance lease (MDL)	Page 18
Open-hole logging	Logging activities performed in the drilling phase, before the well is lined with casing.
Overbalanced	Page 26
Perforating	Page 31-32
Petroleum activities	Petroleum activities means: (a) the exploration, distillation, production, processing, refining, storage and transport of petroleum. (b) the distillation, production, processing, refining, storage and transport of fuel gas. (c) authorised activities for petroleum authorities. (d) other activities authorised under this Act for petroleum authorities. *Definition from Petroleum and Gas (Production and Safety) Act 2004 (Qld) s3 Main Purpose of Act*
Petroleum lease (PL)	Page 22
Pipeline inspection gadget (PIG)	Page 65
Preliminary activities	A preliminary activity for a provision about a petroleum authority means an authorised activity for the permit or licence that will have no impact, or only a minor impact, on the business or land use activities of any owner or occupier of the land on which the activity is to be carried out. Examples: • walking the area of the permit or licence • driving along an existing road or track in the area • taking soil or water samples • geophysical surveying not involving site preparation • aerial, electrical or environmental surveying • survey pegging. *Definition from Petroleum and Gas (Production and Safety) Act 2004 (Qld) Schedule 2.*
Pre-start meeting	Page 8
Production well	Page 23
Progressive cavity pump (PCP)	Page 36
Rehabilitation	Page 84
Re-scout	Page 7
Right of way (ROW)	Page 59

Term	Reference
Rules of conduct	Santos GLNG has standard Rules of Conduct that our employees and contractors are to adhere to whilst on the landholder's land. The Rules of Conduct form part of the CCA. As part of negotiations Santos GLNG are able to include or modify these.
Roma underground gas storage (RUGS)	Page 23
Site scout	Page 6
Site permit process	Page 8
Terms and conditions	The terms and conditions as detailed in a CCA.
Test pits	Page 15
Tool box	Page 8
Top set	When the shallower stages of the hole have been drilled.
Trenching	Page 47 and 61
Underbalanced	Page 27
Under-reaming	Page 28
Wellhead	Page 29
Wireline	Page 30-31
Workover	Page 36

Appendix C: ACRONYMS

APIA	Australian Pipeline Industry Association
ATP	authority to prospect (tenure)
ATV	agreement to vary
BOP	blow out preventer
CCA	conduct and compensation agreement
CP	cathodic protection
DEHP	Environmental and Heritage Protection
EIS	environmental impact statement
FOC	fibre optic cable
GLNG	Gladstone Liquefied Natural Gas (Project)
GVM	gross vehicle mass
HDPE	high density polyethylene
HPV	high point vent
ILI	in-line intelligent
IMP	integrity management plan
IVMS	in vehicle monitoring system
LNG	liquefied natural gas
LPD	low point drain
MDL	minimal disturbance leases
MLV	main line valve
MOWST	modular open water storage tank
P&A	plugging and abandoning
PCP	progressive cavity pump
PIG	pipeline inspection gadget
PL	petroleum lease (tenure)
ROW	right of way
RUGS	Roma underground gas storage
WMP	water management pond

Version 3

Santos
GLNG