QGC
A BG Group business

14.0
Associated water management

14.0 Associated water management

#	Department Condition		Description	Completion date	Status
	Pre-Dec 2012	Post-Dec 2012			
42	**49g vii, 52a and 60a**		Affirmation that treatment plants are operational and producing water quality suitable for discharge to the Kenya to Chinchilla Pipeline and Woleebee Creek to Glebe Weir Pipeline in line with SunWater's respective BUA's	October 2014	○
43	**49g i to ix**		Affirmation that Central Gas Fields beneficial reuse scheme is operational	April 2013	●
44			Confirmation of Northern Gas Fields beneficial reuse scheme approval	April 2013	●
45			Affirmation that Northern Gas Fields beneficial reuse scheme is operational	October 2014	○
46			Provision of Northern Gas Fields interim baseline data analysis report	October 2014	
47			Completion of Northern Treatment Plant and Northern Gas Fields Emergency Response Procedure and Dam Safety Emergency Response Plan	October 2014	
48	**49 x**		Confirmation that salt regulated waste facility is approved	October 2014	○

● Commitments completed
○ Commitments work in progress
△ Evergreen Commitments
● Firm deliverables for that month

14.1 INTRODUCTION

Critical to the ongoing success of the QCLNG project is the careful management of CSG water produced from the coal seams during natural gas extraction. Both the quality and quantity of this CSG water will vary over time according to the unique geological attributes of a specific area, posing QGC a sizeable challenge and also a big opportunity. The challenge has been to develop and implement a sound water management strategy that provides a robust in-field regime together with enough flexibility to handle the potential for CSG water quality and quantity variations. The exciting opportunity is to make this 'new' water resource available for beneficial use in agriculture, industry and local communities. QGC ensures effective management of the likely changing CSG water production levels across the life of the project through accurately modelling future production and calibrating these models on a regular basis. This involves accurately predicting and mitigating identified potential cumulative impacts on the regional environment in line with project approval conditions.

14.2 QGC'S WATER MANAGEMENT STRATEGY

QGC's water management strategy spans the capturing of CSG water at the well site, pipelines and storage through to water treatment and delivery to regional users. The overarching objective is to minimise potential negative environmental impacts while maximising the benefits for local and regional communities. CSG water is separated from gas at the well site and dedicated infrastructure has been constructed to transport CSG water via gathering lines to temporary storages. It is then pumped to the new water feed ponds and from there to the water treatment plants, depending on its origin. QGC is using proven and widely-used Reverse Osmosis (RO) technologies which comprises pre-treatments systems, filtration (micro, ultra or nano), ion exchange, reverse osmosis, dosing and balancing systems as well as brine concentration and storage. The target for QGC's water treatment plants is to achieve up to 97% water recovery at a standard suitable for beneficial use. To manage predicted CSG water volume variations over the life of the project, the treatment facilities have been designed and sized using modular systems.

Implementation of QGC's water management strategy aligns with the parallel development of the Southern and Central Gas Fields and the Northern Gas Fields. This approach has enabled effective and efficient capture of associated CSG water and the development of centralised water treatment infrastructure with the minimum footprint.

CSG water produced in both the Southern and Central Gas Fields is gathered and pumped along pipelines to the Windibri water treatment plant and to the newly-commissioned Kenya Water Treatment Plant and the existing relocatable water treatment plant (in the Central Gas Fields). Treated water from the Kenya WTP supplies the Chinchilla Beneficial Use Scheme. About 150 km away, in the Northern Gas Fields near Wandoan, QGC is constructing the Northern WTP at Woleebee Creek. Treated water from the Northern WTP will supply the Dawson Valley Beneficial Use Scheme. This strategy materialises QGC's underlying philosophy of making this valuable new resource – treated CSG water – available for regional use. By investing in the necessary high quality water infrastructure and control systems, QGC is ensuring the optimal outcome for all stakeholders. A layout of QGC's water management facilities is shown in Figure 14-1.

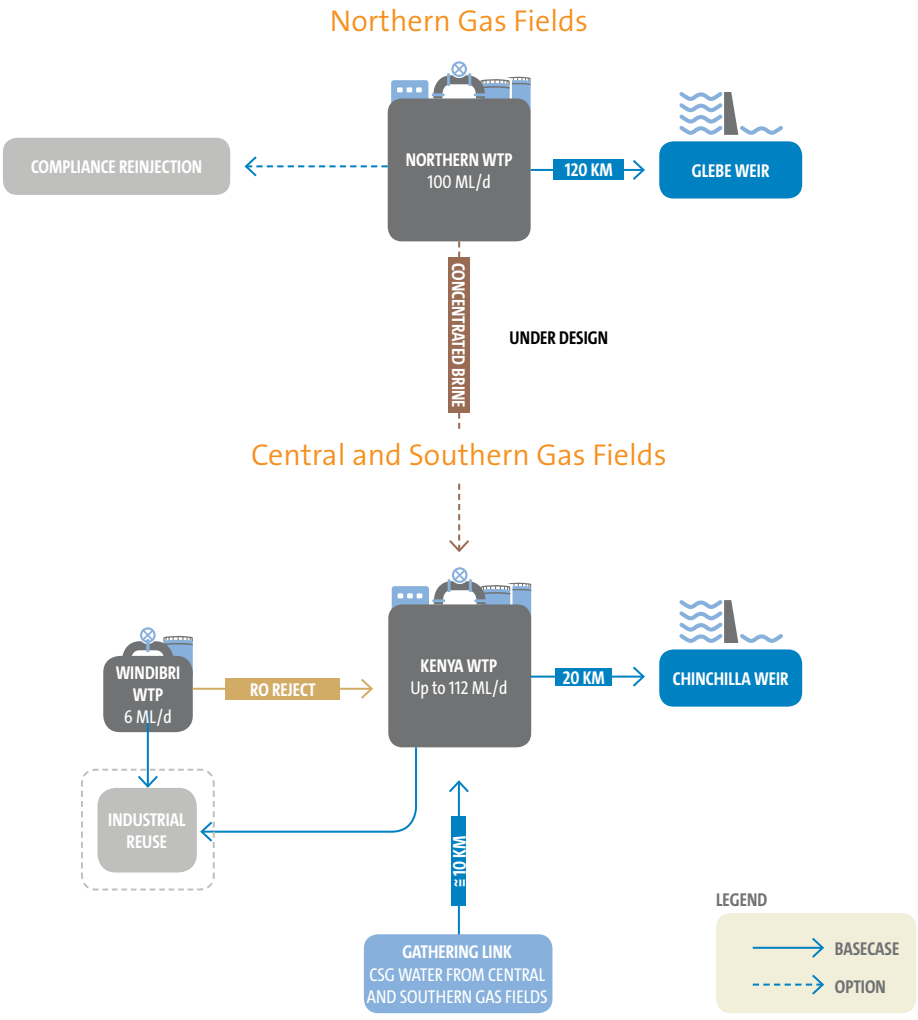

Figure 14-1 – Water infrastructure summary

14.3 FULFILLING QGC'S WATER MANAGEMENT VISION

The benefits of applying an adaptive management approach are evident in the evolution of QGC's water management strategy. As a 'starting point', the Stage 1 WMMP set out the elements of an envisaged water monitoring and management plan that is responsive to ongoing data collection, interpretation and further plan refinement. The Stage 2 WMMP then provided a more comprehensive description of QGC's planned water infrastructure, surface water monitoring programs and data gathering, analysis and interpretation. Implementation milestones to date have included:

- Successful operation of the trial Windibri Water Treatment Plant (6 ML/d capacity);
- Successful operation of the relocatable WTP at Kenya (12 ML/d capacity);
- Phased commissioning of the Kenya Water Treatment Plant (100 ML/d capacity);
- Successful operation of the Kenya to Chinchilla Weir pipeline to supply the SunWater-managed Chinchilla Beneficial Use Scheme along the pipeline;
- Construction commenced on the Northern WTP at Woleebee Creek (100 ML/d capacity);
- Advanced construction of Woleebee Creek to Glebe Weir pipeline to supply the SunWater-managed Dawson Valley Beneficial Use Scheme; and
- Finalisation of emergency discharge management plans.

This Stage 3 WMMP confirms the treated water management approach for the North and the brine management maturation (Chapter 15).

14.4 IMPLEMENTATION OF IN-FIELD INFRASTRUCTURE

The implementation of QGC's water management strategy must necessarily match gas field development. There are four critical interconnecting components that come into play following the capture of CSG water at the wellhead, namely:

- **Gathering Lines:** Installed across individual gas fields to transport produced CSG water from the wellhead to QGC's network of in-field storage facilities. An ongoing maintenance and leak detection program supports the integrity of all gathering lines;
- **Storage:** Comprises purpose-built in-field, regional and aggregation ponds – interconnected by water 'trunklines'. Water is pumped from in-field to regional ponds before being transported to aggregation ponds adjacent to water treatment plants. This storage network balances varying CSG water production levels, water treatment plant capacities and beneficial use demand.
- **Treatment:** Located at two major sites (Kenya and Woleebee Creek). Filtration and reverse osmosis technologies (see Figure 14-7) treat CSG water to required standards for beneficial use. The treated water is regularly sampled to ensure tight quality control; and
- **Beneficial Use:** Up to 97% of CSG water will become available for beneficial use. For delivery of most treated water to users, QGC is partnering with SunWater, a wholly-owned Queensland Government corporation, through the Chinchilla Beneficial Use Scheme and the Dawson Valley Beneficial Use Scheme. (Separately, the Windibri water treatment plant supplies industrial customers). Specific water quality requirements apply to these beneficial use schemes.

14.4.1 GATHERING CSG WATER FROM THE GAS FIELDS

CSG water is captured at the wellhead and pumped along gathering lines to in-field and regional water infrastructure in order to avoid any release into the environment. The QCLNG Project spans an area about 250 km by 50 km with a south-east to north-west orientation across the Surat Basin.

QGC's water management strategy focuses its major infrastructure facilities at two key sites: Kenya for all Southern Gas Fields and Central Gas Fields CSG water and Woleebee Creek for Northern Gas Field development. Buried gathering lines link individual fields to nearby storage ponds which are, in turn, linked to larger regional storage ponds. Trunklines transport CSG water on to larger aggregate ponds at either Kenya or Woleebee Creek ahead of the water treatment process.

In the Northern Gas Fields, QGC is constructing the Northern WTP at Woleebee Creek – about 150 km from the Kenya WTP (see Figure 14-3). It will receive CSG water from the Cam, Ross, Kathleen and nearby fields with the peak flow estimated at 72 ML/d. All water management and monitoring infrastructure, including gathering lines, storage ponds, pipelines and the Northern WTP are scheduled for completion to support the Northern Gas Fields depressurisation activities planned from Q4 2014.

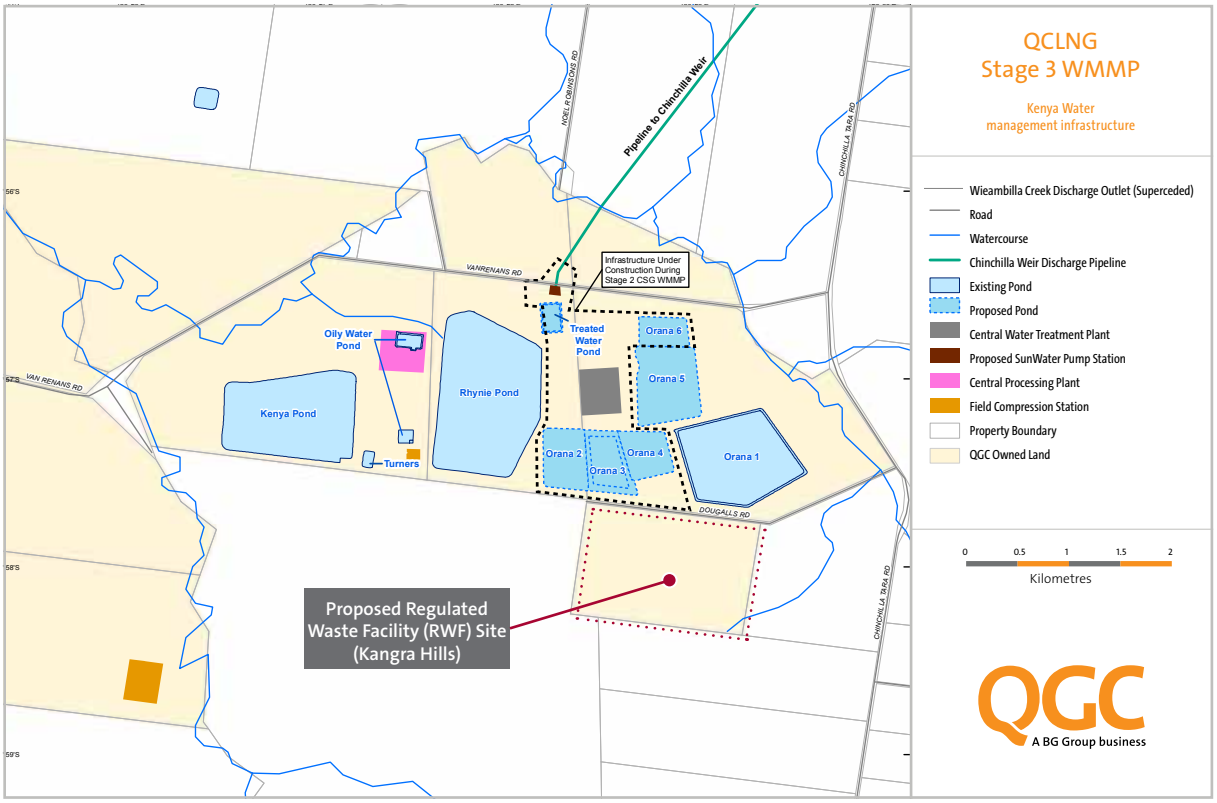

Figure 14-2 – Kenya water management infrastructure

Total capacity of the Kenya WTP has been raised to 100 ML/d with the addition of a fifth process train (i.e. the Stage 2 WMMP stated that capacity was 80 ML/d). The fifth train will cover scheduled offline cleaning or maintenance periods and enables additional potential capacity when required. Also located at Kenya is a 12 ML/d relocatable water treatment plant which remains operable and brings total regular Kenya treated water production to 92 ML/d (or potentially 112 ML/d as explained). Figure 14-4 illustrates the water management network in the Central and Southern Fields. Gathering lines from the Kenya, Argyle, Kate and nearby gas fields pump water into the aggregation ponds feeding into the Kenya WTP. The peak flow of CSG water from the Southern Gas Fields is estimated to be 72 ML/d with another 52 ML/d from the Central Gas Fields (NB: These peak flows will not occur simultaneously). Since 2005, the Central Gas Fields have hosted QGC's domestic gas production. These ongoing operations are supported by the 6 ML/d Windibri Water Treatment Plant on Petroleum Lease (PL) 201 and it continues to receive CSG water from the Berwyndale South, Berwyndale, Bellevue and nearby fields. Treated water is supplied from this facility to two industrial customers for beneficial use.

14.4.2 STORAGE

Purpose-built storage ponds enable QGC to store water safely while gathering and balancing flows to meet water treatment plant requirements and beneficial use demand. The location, number and capacity of ponds are based on the Field Development Plan (FDP) which determines the appropriate capacity and the need for pumps and other associated infrastructure. The number of required ponds may change due to updated subsurface information and actual CSG water production rates. QGC seeks to minimise the footprint of CSG water storage ponds as much as possible.

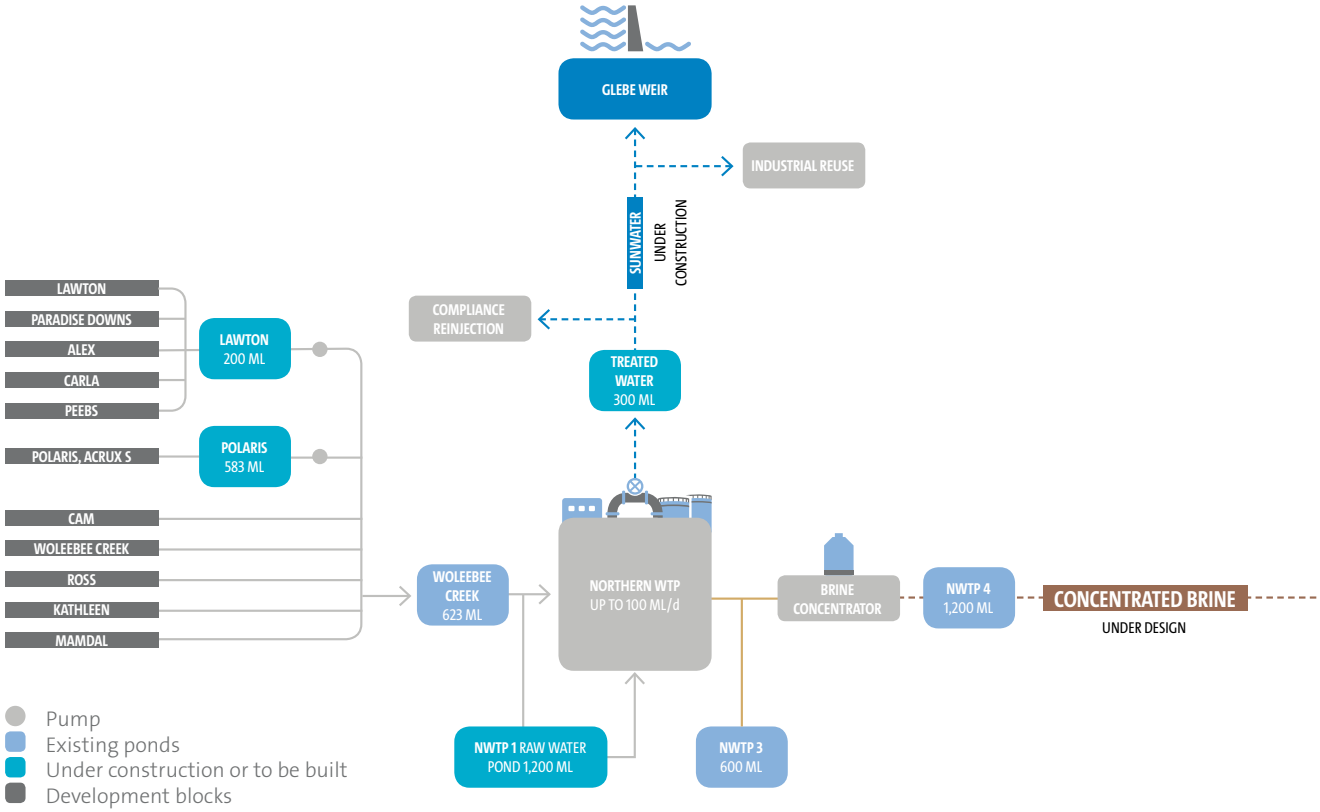

Figure 14-3 – Northern Gas Fields collection and storage networks

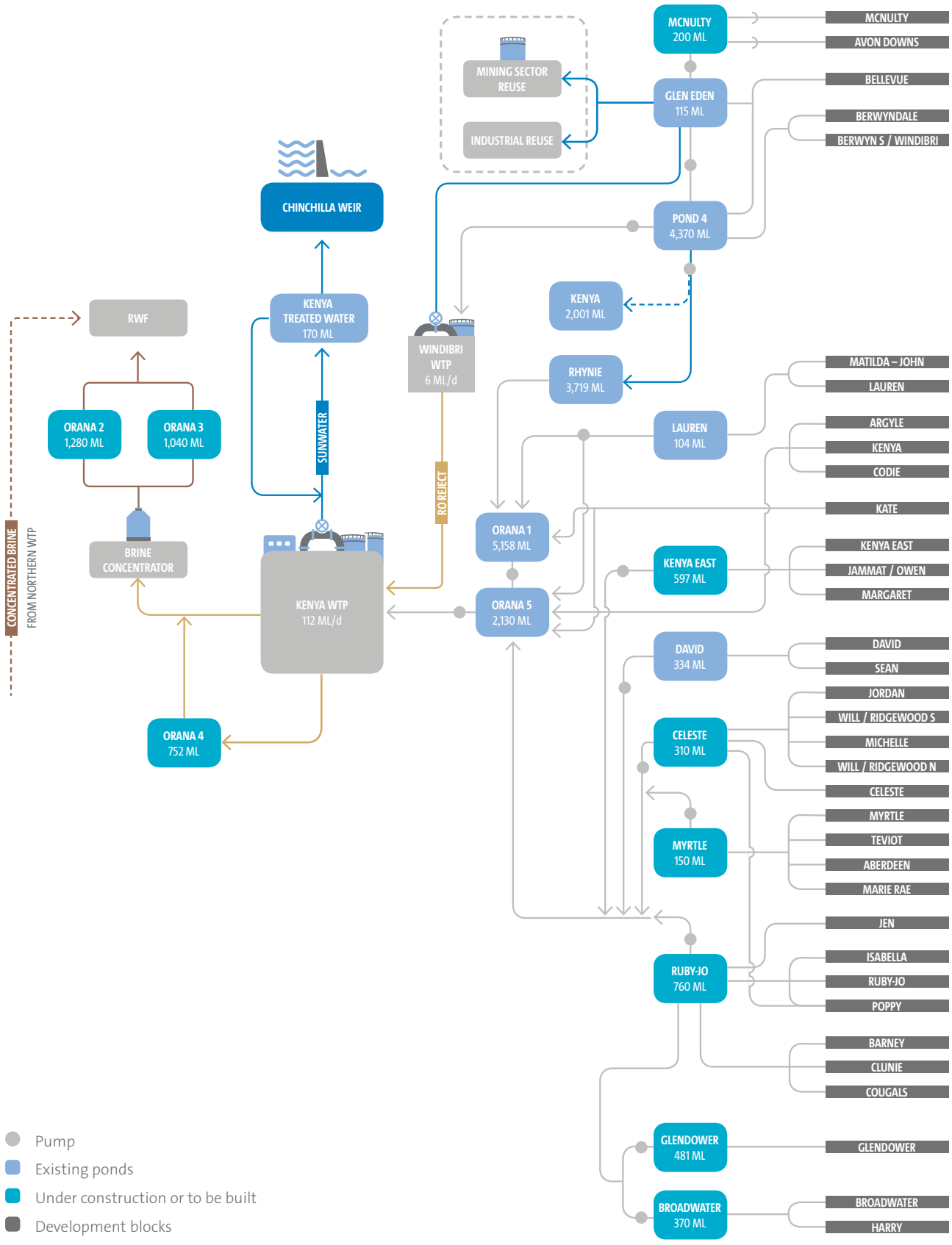

Figure 14-4 – Central and Southern Gas Fields collection and storage networks

14.4.2.1 CENTRAL AND SOUTHERN GAS FIELD STORAGES

QGC has in-field storages across the gas fields, regional ponds receiving water from in-field storages and aggregate ponds built adjacent to water treatment plants. Aggregate ponds hold CSG water and balance flows through the treatment facility. In-field storages temporarily hold water gathered from each wellhead. There will be a total of 22 in-field storages in the Central and Southern Gas Fields connected by larger diameter trunkline pipes to regional ponds and, eventually, to aggregate ponds (see Figure 14-4). For the purposes of QGC's water management system, the Central and Southern Gas Fields are viewed as one water capture, transportation and treatment zone. Water arrives at the aggregation ponds adjacent to the Kenya Water Treatment Plant ahead of treatment and distribution primarily to the Chinchilla Beneficial Use Scheme.

Production area (existing)	Pond	Capacity at Maximum Operating Level (MOL) (ML)
Central and Southern Gas Fields	Berwyndale South Pond 4	4,370
	Glen Eden	115
	Kenya Pond	2,001
	Rhynie Pond	3,719
	Orana 1 Pond	5,158
	Orana 5 Pond	2,130
	Lauren	104
	David	334
	Janda	433
	Jen 2	206
	Sean	189
Production area (under construction or being commissioned)	**Pond**	**Capacity at Maximum Operating Level (MOL) (ML)**
Central and Southern Gas Fields	Orana 2	1,280
	Orana 3	1,040
	Orana 4	752
	Treated Water Pond	170
	McNulty	200
	Ruby – Jo	760
	Kenya East	597
	Celeste	310
	Myrtle	150
	Glendower	481
	Broadwater	370

Table 14-1 – Existing and proposed major CSG water storage in the Central and Southern Gas Fields

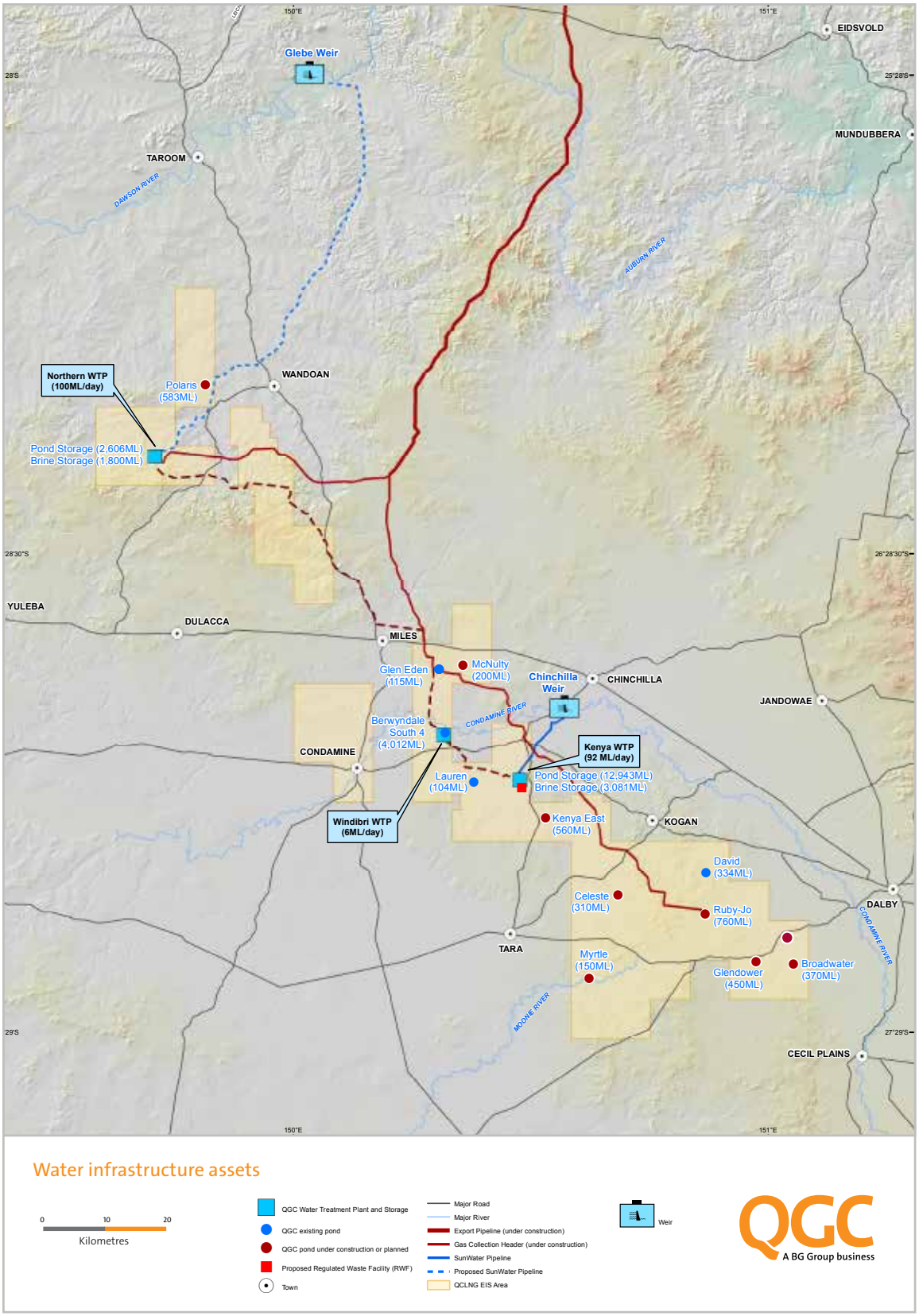

Figure 14-5 – Water infrastructure assets

Table 14-1 shows the volumes for existing and proposed Central and Southern Gas Fields storage ponds. Proposed Central Gas Fields ponds include the Orana 2 and Orana 3 Concentrated Brine Ponds. Orana 4 was completed in 2012 and stores RO reject from the Kenya and nearby relocatable water treatment plants. Orana 5 is a raw CSG water pond feeding into the treatment plants.

When fully operational, the storage and pipeline network will have up to six regional ponds in the Southern Gas Fields transferring water to the Kenya Water Treatment Plant and a treated water pond at Kenya sending water by pipeline to the Chinchilla Beneficial Use Scheme.

Both existing and proposed Central Gas Fields pond locations are shown in Figure 14-2.

14.4.2.2 NORTHERN GAS FIELDS STORAGES

The Northern Gas Fields will have a total of two in-field storages as shown in Figure 14-6. Without the current need for regional ponds, CSG water will be pumped directly into the aggregation pond adjacent to the Northern WTP at Woleebee Creek. Water storage cells 1, 2 and 3 are existing exploration and appraisal (E&A) ponds being converted into CSG water ponds ahead of the scheduled commissioning of the Northern WTP. Additional sedimentation, concentrated brine, RO reject and treated water storage (i.e. five) ponds are proposed (with two future regional ponds possibly required to service the Polaris and Lawton development blocks).

Production area (existing)	Pond	Capacity at Maximum Operating Level (MOL) (ML)
Northern Gas Fields	Northern Raw Water (existing E&A) Ponds	623
Production area (proposed)	**Pond**	**Capacity at Maximum Operating Level (MOL) (ML)**
Northern Gas Fields	Clarified Water Pond	1,200
	NWTP 2 Treated Water	300
	NWTP 3 RO Reject	600
	NWTP 4 Concentrated Brine	1,200
	NWTP 5 Sedimentation	220
	Lawton	200
	Polaris	583

Table 14-2 – Existing and proposed Northern Gas Fields water storages

14.4.2.3 REGULATED STORAGE MANAGEMENT

Many QGC ponds that meet the 'regulated structure' criteria are designed in line with The Manual for Assessing Hazard Categories and Hydraulic Performance of Dams, issued by the Queensland regulator (DEHP) and used for hazard category assessment and design certification as a 'regulated structure'.

14.4.2.4 POND SITING

Storages are designed to withstand flood criteria at a specified location, without causing environmental harm. QGC seeks to site water storage ponds above the one-in-100 years flood level although this is not a requirement of Condition 49g (viii) of EPBC Approval 2009/4974. Internal QGC/BG Group standards specify that storage ponds must be sited above the one-in-100 years flood level with specific design features to protect pond embankments if geographical constraints mean that pond installation below that flood level is unavoidable. The only location where this applies is the Broadwater regional pond which is located on the Condamine Valley flood plain.

The siting and design of any storage pond on a flood plain must eliminate the potential to concentrate, divert or alter flood waters in a way that could cause harm or pose an unacceptable risk to people or property. Each QGC pond has its own operational plan and is designed to contain a one-in-100 years, 72-hour storm event above the Mandatory Reporting Level (MRL). During Queensland's record 2010 and 2011 floods, QGC storages performed well, with neither major damage nor water releases needed to manage storage volumes.

In all cases, QGC fulfils Australian codes and standards and Queensland legislation and regulations covering pond siting. QGC seeks to fully comply with all environmental approvals and other applicable legal requirements. QGC/BG Group organisational culture and values mean that its people always seek to exceed those expectations. Where applicable legal requirements exceed QGC/BG Group standards, the Group's Technical Authority is alerted immediately so that any apparent differences can be investigated and rectified as needed.

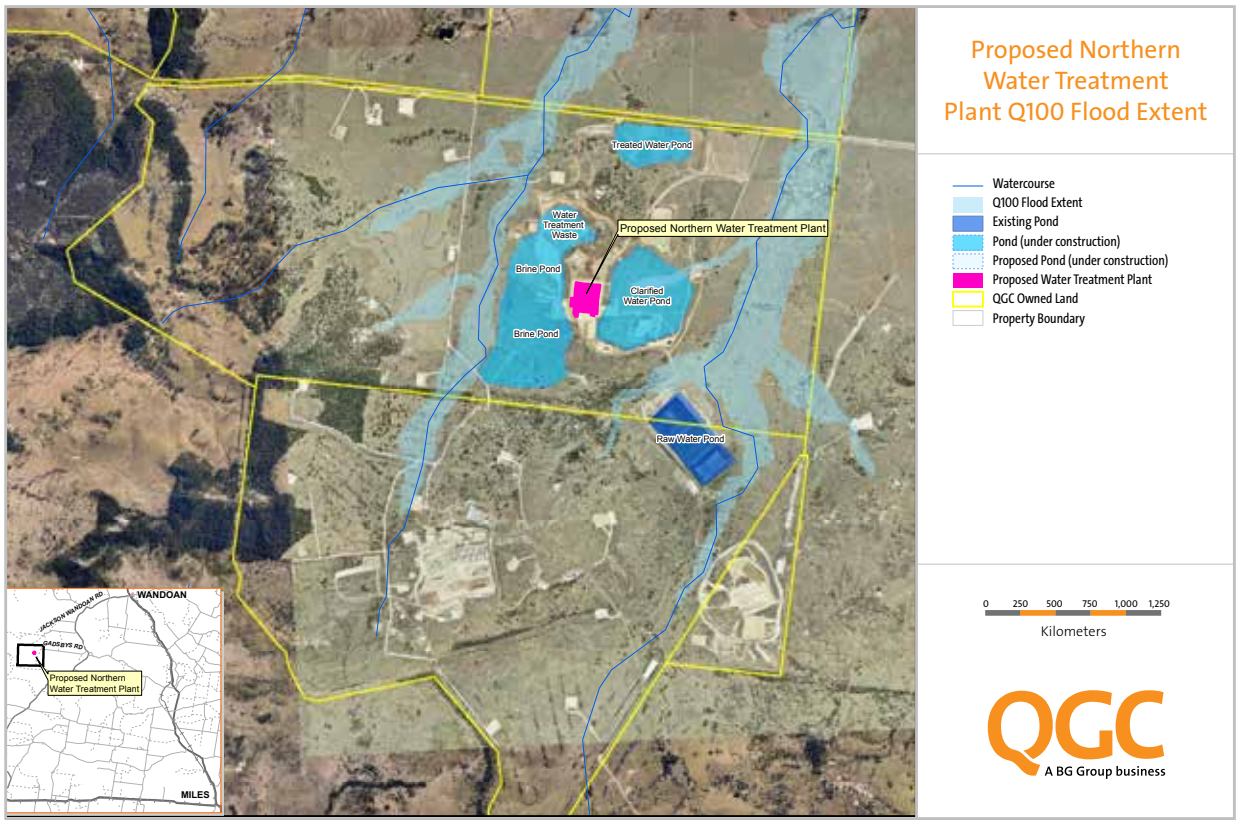

Figure 14-6 – Northern WTP and storage ponds, with the Q100 flood extent

14.4.2.5 POND MANAGEMENT SYSTEM

QGC uses interlinking registers and procedures at the core of its pond management system, including the Regulated Ponds Register, Ponds Status Report and Ponds Basis of Design. The Regulated Ponds Register lists each QGC pond by name and location. It contains information on each pond's purpose, hazard category, operational status, liner details, seepage detection, footprint, surface area, dimensions, operating levels,design certification and inspection details. As each new regulated storage achieves operational status, specifically tailored Individual Pond Operations Plans (IPOP) are prepared showing operational procedures, monitoring procedures and guidelines. Each plan has dimensional and volumetric pond characteristics as well as 'per construction' drawings, with its physical attributes and pond design details. The IPOP sets out the all of the operational parameters and requirements including information on the area's sensitive receptors.

14.4.2.6 QGC'S UWOP FOR MONITORING POND WATER LEVELS AND QUALITY

QGC is developing a Unified Water Operations Platform (UWOP) to measure and monitor water production, storage and treatment. UWOP builds on an extensive water instrumentation platform to satisfy regulatory, commercial and stakeholder requirements. UWOP uses a surface water modelling tool and will monitor and manage water quantity and quality from the wellhead through to release of treated water to SunWater for delivery to end users. In this way, more informed day-to-day decisions will assist efficient water network operation. Each storage pond's operational plan (storage ponds greater than 25 ML capacity) includes guidelines and schedules for water level and water quality monitoring programs. The water quality testing suite includes field parameters, major cations and anions, dissolved metals and a range of organics.

14.4.2.7 STORAGE POND MAINTENANCE – ANNUAL INSPECTIONS AND ACTION RESPONSE PLANS

Annual inspections of QGC's regulated storage ponds are completed in line with Environmental Authority (EA) conditions. In 2012, QGC's annual inspection program captured a number of recommendations for management action. Ponds were assessed comprehensively for integrity and the results reported against a performance and deterioration hierarchy. The key inspection parameters included:

- Operational status;
- Hazard category (low, significant or high);
- Structural geotechnical characteristics (integrity);
- Hydraulic adequacy and condition, and dam safety adequacy;
- Incidents that may impact pond integrity; and
- Seepage detection.

Table 14-3 shows QGC's storage pond integrity hierarchy. All operational ponds are managed at a maintenance level condition to ensure integrity and reduced maintenance activity.

Issue	Description	Conclusion
Maintenance level condition	The pond has no issues that affect the operation of the asset	Pond operable with routine maintenance
Serviceability Limit State (SLS)	The pond has issues that may impair the durability or substantially increase maintenance of the asset	Pond operable with increased maintenance
Ultimate Limit State (ULS)	The pond has issues that have caused the asset to fail	Pond must be taken out of service

Table 14-3 – Hierarchy of pond integrity assessment

QGC's Action Response Plan shows the necessary remedial actions and the timeline involved in addressing recommendations made in the annual inspections program. Any 'priority items' or 'maintenance items' are noted for each storage pond and agreed internal key performance indicators guide response implementation.

14.4.2.8 POND DECOMMISSIONING PLAN

QGC's pond decommissioning plan was applied to the decommissioning and rehabilitation of 11 existing evaporation storage ponds. The plan establishes targets, actions and KPIs for each stage of a process aligned with the superseded DEHP Coal Seam Gas Water Management Policy 2009, requiring evaporation ponds remediation and a transition to new pond standards. Table 14-4 summarises the decommissioning program.

Both evaporation and aggregate dams must now have:

- Floors and sides made of material to contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life, including any decommissioning and rehabilitation period;
- Systems to detect any passage of the wetting front or entrained contaminants through the dam floor or sides; and
- A capacity to rectify any passage of the wetting front through the dam floor or sides, or alternatively decommissioning and rehabilitation.

In October 2011, QGC submitted four voluntary draft Transitional Environmental Programs (TEPs) with DEHP to address the decommissioning and rehabilitation of the 11 storage ponds for progressive rehabilitation with three years. The plans provide clear and structured decommissioning and rehabilitation milestones for all listed ponds. The TEPs were approved by DEHP and are being implemented as part of QGC's strategy to transition away from the use of evaporation ponds.

Pond	Volume	Lot on plan	Location (N-E)	EA	Tenement	Status
Aberdeen Pond	47.5 ML at MOL	6 DY694	276114,698505 – Zone 56	PEN100020207	ATP621	○
Bellevue Pond 2	4.5 ML at MOL	371 RP897023	229159,7040467 – Zone 56	PEN100020207	PL247	○
Berwyndale South Pond 1	67.4 ML at MOL	1 SP187939	234084, 7024700 – Zone 56	PEN100068707	PL201	○
Berwyndale South Pond 2	222.7 ML at MOL	1 SP187939	233840, 7024716 – Zone 56	PEN100068707	PL201	○
Berwyndale South Pond 3	620.7 ML at MOL	1 SP187939	233369, 7024999 – Zone 56	PEN100068707	PL201	○
Kenya East Pond	32 ML at MOL	13 RP133003	254076, 701021 – Zone 56	PEN101252410	PLA278	○
Robinson Pond	54.5 ML at Crest	27 RG188	245790, 7019297 – Zone 56	PEN100020207	PL228	○
Turners Pond	20.5 ML at Crest	20 RG34	247287, 7010219 – Zone 56	PEN100020207	PL180	○
Wambo Downs Pond 1	79.2 ML at Crest	2 RP10845	249922, 7027943 – Zone 56	PEN100020207	PL229	○
Woleebee Creek Pond 1	1.7 ML at Crest	13 FT792	771390, 7087985 – Zone 55	PEN101741410	PL276/ATP651	○
Woleebee Creek Pond 2	1.5 ML at Crest	13 FT792	771445, 7087955 – Zone 55	PEN101741410	PL276/ATP651	○

Table 14-4 – Pond decommissiong program, ○ = Commenced, ● = Completed

14.5 TREATMENT OF CSG WATER

Treatment of CSG water for subsequent beneficial use is integral to QGC's water monitoring and management strategy. The primary treatment process uses proven filtration and Reverse Osmosis (RO) technology, allowing naturally varying CSG water qualities to be treated to meet required standards and SunWater's delivery requirements.

Water quality measurements are usually expressed in terms of Total Dissolved Salts (TDS) and, for the QCLNG project, TDS figures (based on 12-month appraisal well production averages) are:

- Southern Gas Fields: 4,700 mg/L;
- Central Gas Fields: 2,800 mg/L; and
- Northern Gas Fields: 5,000 mg/L.

The Kenya and Northern WTPs will provide treated water which meets the water quality limits set in their respective approvals (BUA and Recycled Water Management Plan Appendix P and Q). The RO process achieves a recovery ratio of 90% and the treated water has a low TDS measure. The 10% 'RO reject' is fed to the brine concentrator which recovers an incremental 70% as treated water, raising total recovery to 97%. The remaining brine concentrate (3%) is retained. Figure 14-7 shows the major components of the water treatment process from CSG water storage and pre-treatment systems through to the RO process, concentration of the RO reject and ultimately delivery of treated water for beneficial use. If the in-line monitoring systems detect any out-of-specification water, it is sent back to the aggregation pond and recirculated through the water treatment plant. Table 14-5 lists the key treatment infrastructure.

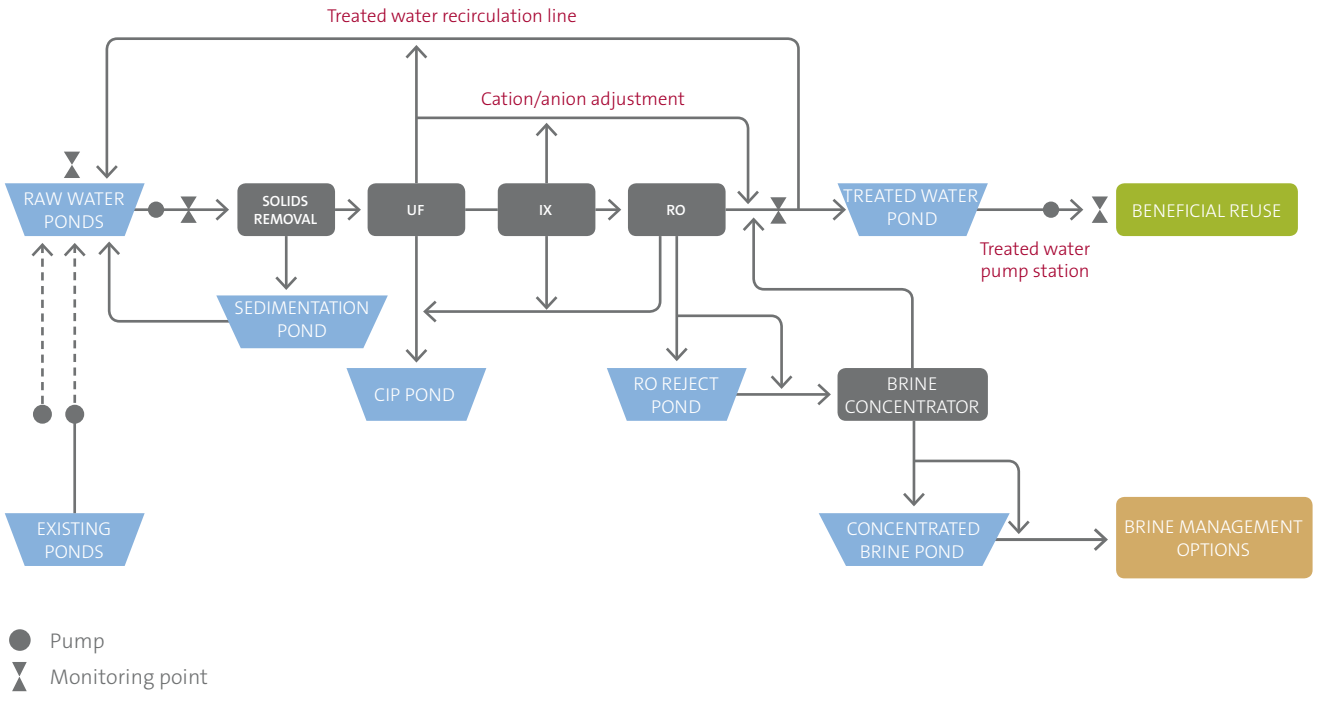

Figure 14-7 – Water treatment process (Kenya WTP and Woleebee WTP)

Infrastructure	Capacity (ML/d)	Processes	Location	Status	Supplies
Kenya Water Treatment Plant	Up to 100	CSG water	Kenya	Operational	Chinchilla beneficial use scheme
Relocatable water treatment plant	12	CSG water	Kenya	Operational	Chinchilla beneficial use scheme
Windibri water treatment plant	6	CSG water	Windibri	Operational	Local industrial reuse (CPS and Yancoal)
Northern WTP	100	CSG water	Woleebee Creek	Under construction	Dawson Valley beneficial use scheme
Brine concentrators (treat RO reject to produce distillate)	10	RO reject	Kenya and Woleebee Creek	Process proving / Under construction	Chinchilla and Dawson Valley beneficial use schemes and brine management

Table 14-5 – Water treatment works during S3 WMMP period

14.5.1 CENTRAL AND SOUTHERN GAS FIELDS WATER TREATMENT

CSG water in the Central and Southern Gas Fields is treated at the Kenya Water Treatment Plant. This plant has a stated capacity of up to 100 ML/d based on five 20 ML/d RO trains, utilising one train for schedule cleaning and maintenance change outs and periodic additional production as needed. Construction has been completed and the plant is currently being operated. The nearby operating relocatable water treatment plant offers an additional 12 ML/d capacity, comprising four 3 ML/d RO trains. CSG water from predominantly domestic market, non-QCLNG Project gas wells from the Berwyndale South, Berwyndale, Bellevue and adjacent fields is captured by gathering lines and pumped to the regional storage pond at Berwyndale South. This CSG water is fed into the Windibri Water Treatment Plant (on Petroleum Lease 201) which has a total capacity of 6 ML/d.

14.5.2 NORTHERN GAS FIELDS WATER TREATMENT

CSG water in the Northern Gas Fields will be treated at the Northern WTP. Currently under construction, this plant has a capacity of 100 ML/d based on five 20 ML/d RO trains. It is expected to be commissioned and operational by late 2014. Gathering lines and trunklines will pipe the CSG water to aggregation ponds adjacent to the Northern WTP on QGC's Woleebee Creek block.

14.5.3 BRINE CONCENTRATION

Chapter 15 describes in detail QGC's brine management strategy which spans the brine concentration process and ongoing management of the resultant brine concentrate. QCLNG's base case is the development of a Regulated Waste Facility for salt storage.

14.5.4 ENSURING SUSTAINED DELIVERY OF IN-SPECIFICATION WATER

Under its partnering arrangements with SunWater, QGC must ensure that treated water meets quality requirements under the relevant BUA (and RWMP) when it reaches the designated handover point – the treated water pump station. SunWater then takes ownership of the water for use under each of the beneficial use schemes.

Continuous monitoring prevents out-of-specification water from reaching the treated water pump station. QGC has installed rigorous monitoring checkpoints to track water quality throughout the treatment process. This includes sampling at the CSG wellhead, the CSG water storage ponds, the water treatment plant's inlets and outlets – and again in the wet well of the treated water pump station.

If an in-line monitor detects out-of-specification water quality, treatment plant outflow into the treated water storage pond will cease and the identified out-of-specification water will be redirected into an aggregation pond to again be fed into the water treatment plant. At the hand-over point – the treated water pump station – online monitoring and SCADA systems provide a water quality 'OK' or 'NOT OK' signal. Receipt of a 'NOT OK' signal shuts down the SunWater-managed pumps, effectively preventing any out-of-specification water being delivered to end users.

For QGC's network, detection of out-of-specification water entering the treated water storage pond or the treated water pumping station will direct the water or stop the treatment process. Temporary pumps and pipelines will then drain the systems so that the water is diverted to CSG water storage ponds and treated again. These temporary pumps and pipelines would only be deployed if required.

14.5.5 WATER TREATMENT PLANT OPERATION AND MAINTENANCE

QGC's primary expertise is in natural gas and the company has sought leading water infrastructure operational expertise for ongoing operation and maintenance of its Surat Basin water treatment plants. A 20-year contract has been awarded to Veolia Water Australia Pty Ltd and since June 2013, Veolia Water technical personnel have been operating and maintaining the Kenya Relocatable Water Treatment Plant. The handover of the Kenya Plant is expected upon completion of commissioning. When the Northern WTP is commissioned, Veolia Water will assume control of the entire facility.

14.6 BENEFICIAL USE

The Waste Reduction and Recycling Act 2011 (Qld) enables beneficial use to transform perceptions of a 'waste' product into appreciation of a valued 'resource'. For QGC, this means transforming CSG water into a valued, quality, new resource for mining, industrial, agricultural and municipality use. QGC's actions to avoid or minimise potential environmental harm create opportunities to enhance social and economic outcomes for the region.

SunWater manages both the Chinchilla Beneficial Use Scheme and the Dawson Valley Beneficial Use Scheme to:

- Satisfy the relevant regulatory approvals framework;
- Identify (then prevent or mitigate) potential environment impacts,
- Provide water quality levels at least equal to current background levels;
- Ensure investment viability by supporting sufficient beneficial user uptake;
- Address seasonal and other demand (quantity and quality) variations;
- Consider associated social and community issues;
- Map beneficial user locations relative to water delivery solutions; and
- Address adequately the cost and technical feasibility of scaled-up beneficial use.

Each beneficial use scheme satisfies this management criteria in order to enable optimal beneficial use of suitably treated water. The two schemes are detailed further below.

14.6.1 CHINCHILLA BENEFICIAL USE SCHEME

The Chinchilla Beneficial Use Scheme is the outlet solution for QGC's Kenya Water Treatment Plant in the Central and Southern Gas Fields. The scheme covers the 20 km Kenya to Chinchilla Pipeline from the Kenya Water Treatment Plant to Chinchilla Weir on the Condamine River. Importantly, it manages distribution of treated water along the pipeline and within the Condamine River area. Figure 14-8 outlines the components of the scheme, the division of management responsibilities between QGC and SunWater and the relevant approvals in place.

Figure 14-8 also shows the scheme's monitoring locations. At the water treatment plant, continuous in-line water quality monitoring will focus particularly on key parameters such as pH and electrical conductivity. Weekly sampling and independent analysis for major cations, anions and selected trace elements will ensure water is treated to the required standard. The SunWater Beneficial Use Approval (BUA) ENBU02701811 (see Table 14-6) defines the required quality parameters and monitoring frequency. The BUA authorises the beneficial use of up to 31,025 ML a year (or 85 ML a day) of treated water for agricultural (irrigation and stock watering) production and as a supplement to Chinchilla's town water supply.

Characteristics of resource	Quality limit	Limit type	Monitoring frequency
Electrical Conductivity (µS/cm)	500	Maximum	Continuous
pH (pH unit)	6.5 to 8.5	Range	Continuous
Total suspended solids (mg/L)	175	Maximum	Monthly
Calcium (mg/L)	6	Minimum	Weekly
Chloride (mg/L)	135	Maximum	Weekly
Fluoride (mg/L)	0.5	Maximum	Weekly
Magnesium (mg/L)	4.5	Minimum	Weekly
Sodium (mg/L)	95	Maximum	Weekly
Sulphate (mg/L)	8.8	Maximum	Weekly
Total Dissolved Solids (mg/L)	320	Maximum	Weekly
Alkalinity (mg/L)	20	Minimum	Weekly
SAR	6	Maximum	Weekly
Boron (mg/L)	1.0	Maximum	Weekly

Table 14-6 – Water quality requirements for discharge to Chinchilla Weir

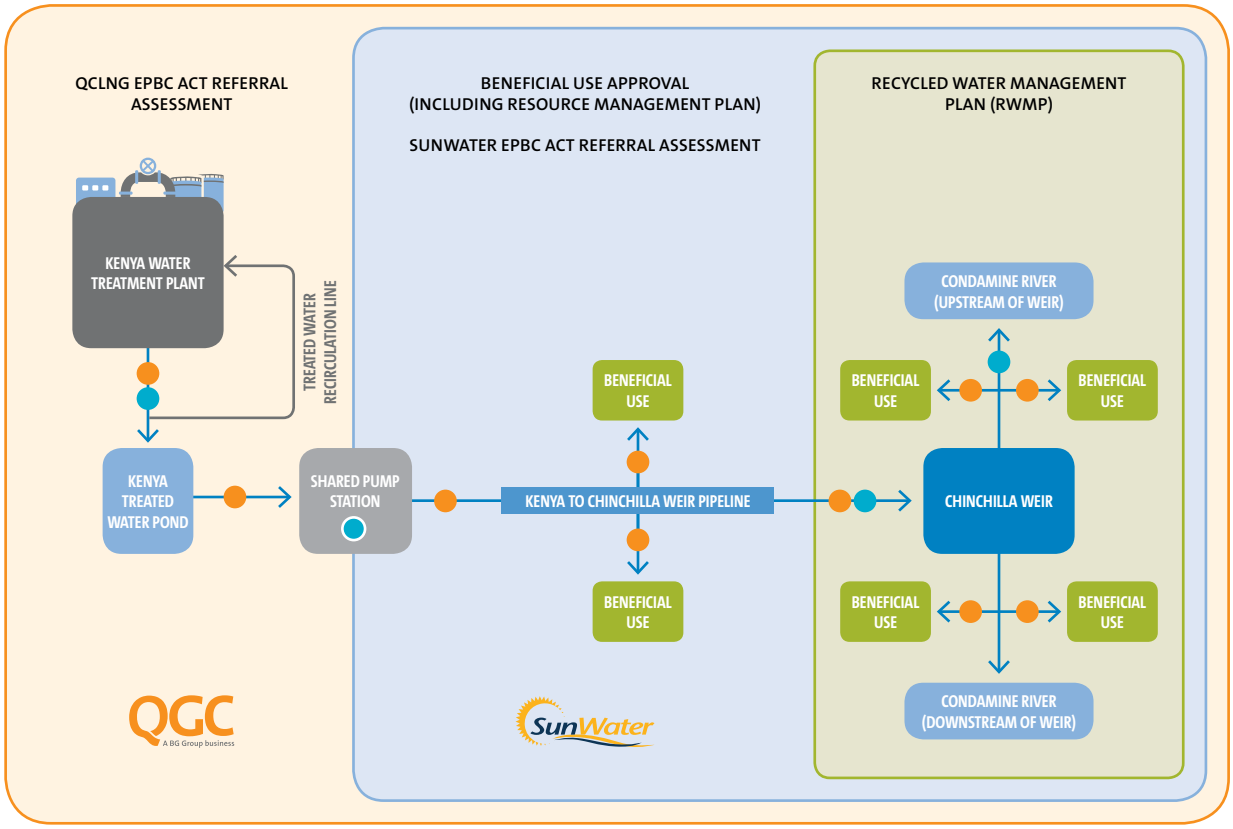

Figure 14-8 – Linkage to Chinchilla Beneficial Use Scheme

Figure 14-9 – Chinchilla Weir, on the Condamine River

SunWater's BUA requires development, implementation and maintenance of a Resource Management Plan. The RMP's principal objective is to manage the water resource while preventing material or serious harm or environmental nuisance. A copy of this has been lodged with DEHP. This includes a periodic review of monitoring data and findings. The SunWater BUA will also provide water quality targets and clarify contaminant concentrations or levels indicating environmental impacts while using its sampling regime to derive site-specific reference values within two years of the BUA approval (depending on wet season flow). The Chinchilla Weir Discharge and Pipeline Project, as the scheme was initially called, was referred by SunWater to the Department for assessment under the EPBC Act and was deemed not to be a 'controlled action' (2001/6000) in July 2011 (see Appendix P). This decision covered CSG water transportation, treatment and discharge into the Condamine River at the Chinchilla Weir.

Initially, QGC had developed a Receiving Environment Monitoring Program (REMP) to provide a technically rigorous water quality data foundation to enable assessment of any potential environmental harm to receiving surface waters. In line with condition 60(a) (letter dated 24/09/2013 ref:2011/00973), QGC is responsible for treating all CSG water as required before discharge into the Kenya to Chinchilla Pipeline (EPBC 2011/6000). SunWater is responsible for monitoring the treated water discharges into the Chinchilla Weir in accordance with its EPBC referrals and BUAs.

Currently, QGC is transporting treated water along the 20 km SunWater-owned pipeline to Chinchilla Weir, servicing pipeline route irrigators (as part of Stage 1 development). The approval by the Queensland Water Supply Regulator (QWSR) for discharging water into Chinchilla Weir (i.e. Stage 2 of the development) has been received on 18 July 2013 (Appendix P), thereby enabling the licenced extraction and use within the Condamine River section of the beneficial use scheme. Specific progress to date includes:

- The Chinchilla Weir Beneficial Use Scheme commenced supply of treated CSG water to users along the pipeline from December 2012 following completion of commissioning of the Water Treatment Plant (WTP) and pipeline;
- QGC and SunWater's interim Recycled Water Management Plan (RWMP) was approved on 18 July 2013 by the Department of Energy and Water Supply (DEWS) to allow the indirect supply of treated CSG water to a drinking water service provider as a source of drinking water in Chinchilla Weir. The release of treated CSG water is authorised under the interim RWMP only to the 18 April 2014;
- Supply of treated CSG water to users along the pipeline and users within the Chinchilla Weir Water Supply Scheme (CWWSS) commenced in August 2013 following the approval of the interim RWMP.

While still in its early stages, the Chinchilla Beneficial Use Scheme promises the region access to a significant additional water resource during QGC's operations in the area.

14.6.2 DAWSON VALLEY BENEFICIAL USE SCHEME

The Dawson Valley Beneficial Use Scheme is for QGC's Northern WTP, located at Woleebee Creek in the Northern Gas Fields. Treated water will be transported along the 120 km Woleebee Creek to Glebe Weir Pipeline for distribution to customers along the pipeline route and within the Dawson Valley Water Supply Scheme and Glebe Weir section of the Dawson River, although a small volume of water will be used to investigate groundwater reinjection (see Chapter 12). The Dawson Valley Beneficial Use Scheme was granted a BUA (ENBU424054412) (Appendix Q) on 8 March 2013. Table 14-7 shows the defined water quality parameters and monitoring frequencies that apply.

The Dawson Valley Beneficial Use Scheme BUA is valid for 20 years from first treated water release into the Woleebee Creek to Glebe Weir pipeline and authorises the use of up to 36,500 ML a year (100 ML a day) of treated water for agricultural (including stock watering), industry and urban water supply. Figure 14-10 outlines the division of infrastructure management responsibilities between QGC and SunWater along with the relevant approvals held.

Release point and monitoring location	Characteristics of resource	Quality limit	Limit type	Monitoring frequency
Cockatoo Creek Inlet located at 25°27'58.02" S and 150°2'1.24" E	Boron	1 mg/L	Maximum	Weekly
	Boron	0.68 mg/L (Bioavailable)	Median	Weekly
	Ammonia	0.4 mg/L	Maximum	Weekly
	pH	6.5-8.5	Range	Continuous
	Electrical Conductivity (EC)	340 µ S/cm (80^{th} percentile)	Rank	Continuous
	Arsenic (dissolved fraction)	0.024 mg/L	Maximum	Weekly
	Chromium VI (dissolved fraction)	0.001 mg/L	Maximum	Weekly
	Iron (dissolved fraction)	0.3 mg/L	Maximum	Weekly
	Lead (dissolved fraction)	0.0034 mg/L	Maximum	Weekly
	Manganese (dissolved fraction)	1.9 mg/L	Maximum	Weekly
	Nickel (dissolved fraction)	0.011 mg/L	Maximum	Weekly
	Selenium (dissolved fraction)	0.005 mg/L	Maximum	Weekly
	Total petroleum hydrocarbons			
	• C6-C9	Monitor – no limit		Weekly
	• C10-C14	Monitor – no limit		Weekly
	• C15-C28	Monitor – no limit		Weekly
	• C29-C36	Monitor – no limit		Weekly
	Chlorophyll	Monitor – no limit		Weekly
	Dissolved oxygen	Monitor – no limit		Continuous
SunWater Pump Station located at 26°15'24" S and 149°43'19" E	Turbitidity	1-50 NTU	Range	Continuous
	Copper (dissolved fraction)	0.0014 mg/L	Maximum	Weekly
	Zinc (dissolved fraction)	0.008 mg/L	Maximum	Weekly

Table 14-7 – Water quality requirements for discharge to Glebe Weir

Figure 14-10 also shows the scheme's monitoring locations. At the Northern WTP, continuous in-line quality monitoring will focus particularly on key indicator parameters such as pH and electrical conductivity. Weekly sampling and analysis of major cations, anions and selected trace elements will ensure that the water is treated to the required standard.

Sampling locations were specified in the BUA approval by DEHP (Appendix Q). The Dawson Valley Beneficial Use Scheme was declared a 'controlled action' by the Department in preliminary documentation on 22 December 2011 (2011/6181). With assistance from QGC, SunWater provided the necessary documentation and received EPBC Act approval with conditions on 27 September 2012.

The Woleebee Creek to Glebe Weir Pipeline Project Beneficial Use Approval was submitted on 28 August 2012 and was approved on the 8 March 2013 by the Department of Environment and Heritage Protection (DEHP). The BUA is to supply users along the 120 km pipeline and users within the Dawson Valley Water Supply Scheme (DVWSS). The pipeline and DVWSS is operated by SunWater and is a similar arrangement to the Chinchilla Weir beneficial Use Scheme.

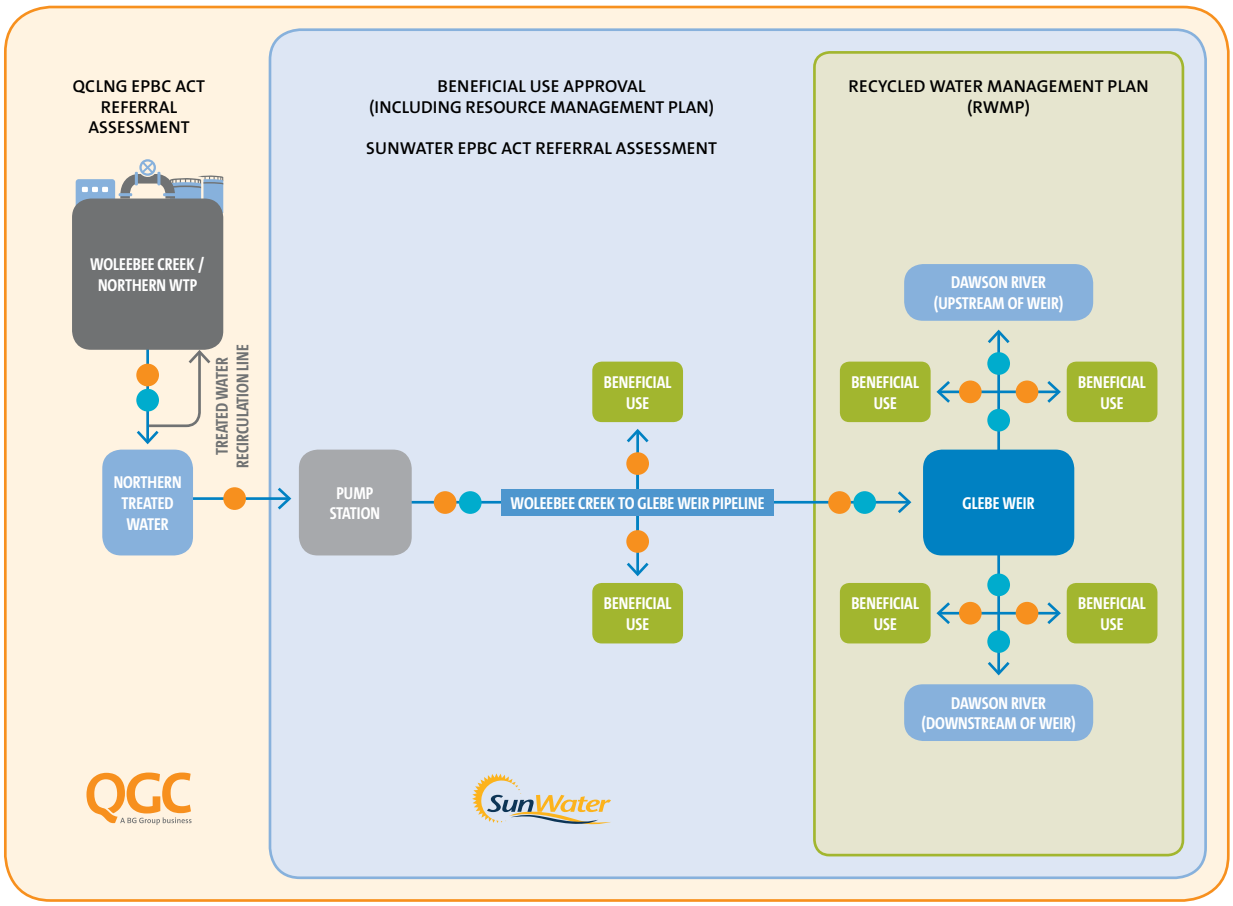

Table 14-10 – Linkage to the Dawson Valley Beneficial Scheme

SunWater has developed an extensive REMP for the Dawson River to provide a technically rigorous water quality data foundation for assessment of potential environmental harm to receiving surface waters. QGC retains responsibility for supplying water treated to an acceptable standard. When operational, QGC's Northern WTP will be managed to ensure its treatment processes deliver water to SunWater to the standard required under the Dawson Valley Beneficial Use Scheme. SunWater is currently preparing a Recycled Water Management Plan (RWMP) for the scheme.

14.7 SUMMARY

QGC's surface water management strategy is being implemented as planned with the objective of creating a new water resource for the beneficial use of regional mining, industry, agriculture and communities. With completion and commissioning of the Kenya Water Treatment Plant, treated water satisfying quality requirements can now flow to SunWater for approved delivery to Chinchilla Beneficial Use Scheme end users. Meantime, construction of the Northern WTP and SunWater's pipeline will soon realise the objective of treated water for supplying the Dawson Valley Beneficial Use Scheme for SunWater customers in the region.

Throughout the water management network, particular attention is paid to environmental protection in terms of both the capture of CSG water and its storage and handling through to treatment using filtration and reverse osmosis technology. Automation and a whole-of-network control and management system is being installed to ensure sustainable water monitoring and management standards across the QCLNG project area.

The status of the Commitments relevant to associated water management is as follows:

#	Department Condition		Description	Completion date	Status
	Pre-Dec 2012	Post-Dec 2012			
42	**49g vii, 52a and 60a**		Affirmation that treatment plants are operational and producing water quality suitable for discharge to the Kenya to Chinchilla Pipeline and Woleebee Creek to Glebe Weir Pipeline in line with SunWater's respective BUA's	October 2014	○
43	**49g i to ix**		Affirmation that Central Gas Fields beneficial reuse scheme is operational	April 2013	●
44			Confirmation of Northern Gas Fields beneficial reuse scheme approval	April 2013	●
45			Affirmation that Northern Gas Fields beneficial reuse scheme is operational	October 2014	○
46			Provision of Northern Gas Fields interim baseline data analysis report	October 2014	
47			Completion of Northern Treatment Plant and Northern Gas Fields Emergency Response Procedure and Dam Safety Emergency Response Plan	October 2014	
48	**49 x**		Confirmation that salt regulated waste facility is approved	October 2014	○

● Commitments completed
○ Commitments work in progress
△ Evergreen Commitments
● Firm deliverables for that month

Water is a vital resource for communities, agriculture and industry throughout Queensland.