

Groundwater as a Drought Water Supply Source – Planning and investigation are the essential requirements

By John Ross, Senior Project Manager – Groundwater Projects, currently at Sydney Catchment Authority. Email john.ross@sca.nsw.gov.au. substantive position at Parsons Brinckerhoff. Email jross@pb.com.au

Introduction

Severe drought has been a feature of eastern Australian climate for the last decade and there is great uncertainty regarding future rainfall patterns given the realisation that climate change is here.

Councils in western NSW in the Murray Darling Basin are familiar with drought and the consequences on local communities. Emergency water supplies are core to some of the range of issues that local communities need to face to overcome the impacts of severe drought. However it is still typical in the 21st century that important water supply options for towns and cities for drought and growth augmentation are not identified, protected and reserved.

This must now be a priority for local communities given the likely severity of climate change, the pending institutional and regulatory changes in the Murray Darling Basin, and finite resources and over-allocation of resources in some catchments.

Groundwater is a potential water source that should be looked at closely for cities, towns and villages of all sizes to provide additional water supplies. Yes groundwater is over-allocated in some catchments but there are some areas and sources that are under utilised and have potential for development (or at least reserved for the future), and town water supplies are given priority access and use. There are some useful examples of investigation methods from the 2004/2006 Metropolitan Water Plan (the Plan) for Sydney that have application for others across NSW and Australia.

On reflection, two years into resource investigations for Sydney, the key aspects of developing a new groundwater resource (or expanding an existing resource area) are:

- Identify the potential resource areas early
- Protect the groundwater catchment from inappropriate land uses
- Prove the resource dimensions, sustainability and development feasibility
- Communicate with local communities
- Evaluate all the technical and environmental issues for the required planning approvals

This paper discusses the planning and investigation methodology required to obtain sufficient knowledge and information regarding resource development and details the application of the methodology for all the SCA's priority investigation sites and in particular the Upper Nepean catchment where borefield development is pending.

Initial Planning

Step 1 – Have a plan - plan for the future and investigate augmentation options including groundwater (even if it has been disregarded in the past) and investigate supply/quality protection opportunities.

If there are important water catchments or groundwater capture areas supplying borefields, protect the yield and water quality by implementing appropriate planning measures.

Step 2 – Work the plan early – complete a comprehensive desktop evaluation of all groundwater prospects and targets from first principles. Start protecting prime targets that may be the focus of future development.

Geological mapping has been updated over the last 25 years and even in this time, new groundwater discoveries have been made in areas where prospects were previously considered poor and groundwater sources had been disregarded.

Introduce planning measures early and implement progressively as the situation allows. Use LEPs to redirect contaminating land uses to other areas. Encourage land uses that protect natural attributes of the catchment, have low water consumption and low water quality impact. If land acquisitions or easements are required, plan for the future.

Step 3 – Communicate early and often – inform local communities about the areas under consideration and the range of options being considered.

Communities prefer information early and often, and with reasonable certainty. Early communication strategies can also be tailored to educate people regarding groundwater resource development and management.

Resource Investigations

Step 4 – Complete initial investigations – for new groundwater sources it is important to know whether the resource targets are suitable for water supply development. Preliminary testing should capture the important resource characteristics to determine whether to proceed with more detailed studies.

Step 5 – Progress pilot studies and sustainability trials – if initial investigations suggest that a resource is prospective then more extensive testing and supporting environmental studies are required. Depending on the timing, pilot studies may have to progress quickly if in drought but if in average rainfall years, more time could be allowed to complete the required studies. Above all don't leave the studies to the next drought.

Step 6 – Continue the dialogue – inform local communities about the progress of investigations.

Released information should be simple, informative and display progress and likely outcomes. However it should not be tied to final decisions on development, design, operational periods and impacts. These would all be considered in the Environmental Assessment or similar planning documentation.

Step 7 – Engineering feasibility and design – engineering feasibility and concepts can commence early but towards the end of the final investigation stages is there sufficient confidence in the potential and sustainability of a particular site to proceed to borefield design, construction, and commissioning.

Borefield Development

Step 8 – Planning approvals – new schemes and large augmentation to existing schemes will require new planning approvals. Depending on the nature and size of the scheme, the approvals may require an Environmental Impact Assessment (EIS), Environmental Assessment (EA) or Review of Environmental Factors (REF) documentation. Supplementary approvals are also required from the NSW Department of Water and Energy (DWE) (bore licenses) and potentially the Commonwealth Department of Environment and Water Resources (DEW) if the development is likely to cause a significant impact on threatened species or an endangered ecological community under the EPBC Act.

Step 9 – Design, construct and commission – it may take several years to get to this final stage if starting with a Greenfield development.

An Example of the Planning and Investigation Methodology - Upper Nepean Catchment

Under the Metropolitan Water Plan, a commitment was made by the Government to consider the development of groundwater sources once dam storage supplies decline to 40% of capacity. Even if borefield development does not occur, it is recognised that the investment in investigations has substantially increased the knowledge of groundwater availability and reserves in the greater Sydney region.

Investigations commenced in December 2004 when dam storage levels were around 43.4%. Supply levels have oscillated around the low to mid 40% mark for the last two years but in late 2006 and early 2007 dropped to the mid to high 30%. As a result, the initial investigations at the seven priority areas are now complete and further studies on the more prospective sites are being progressed. The completed priority areas are:

- Avon and Nepean Dams
- Upper Canal (near Appin)
- **Upper Nepean Catchment (near Kangaloon)**
- Megalong Valley
- **Western Sydney (Leonay)**
- Illawarra (Kembla Grange)
- Warragamba and **Wallacia**.

Those areas shown in **bold** are those that are successful from the initial and pilot investigations. Other areas (outside the seven priority areas and not yet investigated) may also have potential to provide additional water in such severe drought periods.

All the different stages of the methodology have been applied (with incremental success) to the extensive groundwater investigations in the Upper Nepean catchment area.

Plan

Initial planning for groundwater as a drought contingency supply occurred in early 2003. A desktop project investigating groundwater as a drought contingency supply across a large portion of the Sydney Basin was awarded to Parsons Brinckerhoff (PB). These recommendations were incorporated into the groundwater investigation component of the 2004 Metropolitan Water Plan.

Investigate

The SCA is managing the ongoing investigation and borefield development program, which began in December 2004. There have been three investigation stages – initial studies to prove resource potential, pilot studies to confirm resource dimensions and characteristics and linkages with surface water and the environment; and pumping trial to confirm sustainability and environmental linkages.

The investigation methodology has involved substantial technical and environmental studies, data analysis and ongoing monitoring required to prove resource potential and sustainable development is possible. These studies include:

- Deep drilling and extended pumping test studies
- Shallow monitoring around sensitive ecosystems and water courses
- Water quality and age dating
- Groundwater modelling

- Ecosystem surveys
- Peer reviews

Communicate

Substantial communication has been undertaken for the whole groundwater program and the Upper Nepean source area in particular. The initiatives include an exhibition of the summary documents for the groundwater program, release of all the technical groundwater reports, web based information, regular newsletters, and an active Community Reference Group (CRG) to improve dialogue with the local community.

Engineering feasibility

SCA's experience is that extended pumping trials are often required from fractured rock aquifers to assess long term sustainability and feasibility of development. Once sufficient bore location and yield information is available then concept and preliminary design work can be completed. Final design is generally part of the final design and construct (D&C) contract for the augmentation.

Planning approvals

This groundwater borefields have been declared critical infrastructure under Part 3A of the EP&A Act. A project application has been made for the Upper Nepean (Kangaloon) source area and the preparation of an Environmental Assessment to go on exhibition is almost complete.

SCA has also been in dialogue with the Commonwealth DEW and the NSW DWE.

Design and construct

Initial designs have been prepared and are of sufficient detail that the project components could be tendered for construction immediately on completion of the planning approvals process and the current pumping trial.

Conclusion

The primary outcome of the environmental and technical studies is that a large drought water supply borefield is viable in the Upper Nepean Catchment near Kangaloon and development is proceeding. Planning approvals are progressing and final designs are being prepared.

Based on the results of the initial drilling program and the follow-up pilot studies, this groundwater source has suitable attributes to develop as a water supply source during periods of severe drought. It can now be developed quickly because:

- sufficient data has been collected to prove resource potential and sustainability
- the potential borefield area is mostly within SCA owned lands areas
- bore locations and connecting pipelines are close to flowing streams that could be used to deliver water by run-of-river to existing storage dams
- there is little private development of deep groundwater in this catchment
- water is available under the current Water Sharing Plan calculations
- development can be in stages and can be accelerated or decelerated as required.