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Summary report on stakeholder perspectives on Copiapó water management issues

A report submitted to AusAID as part of the study:

Copiapó River Basin – Analysis study of shortfalls in water rights, industrial usage and social requirements

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1. McFarlane, D. and Norgate, T. (2012). Summary report on Copiapó water yields and demands. Report to AusAID as part of the study: "Copiapó River Basin, Chile – analysis study of shortfalls in water rights, industrial usage and social requirements" from the Minerals Down Under Flagship, CSIRO.
2. McFarlane, D., Trefry, M., Moffat, K. and Lacey, J. (2012). Summary report on the current water rights framework in Chile. Report to AusAID as part of the study: "Copiapó River Basin, Chile – analysis study of shortfalls in water rights, industrial usage and social requirements' from the Minerals Down Under Flagship, CSIRO
3. Trefry, M., McFarlane, D., Moffat, K., Littleboy, A. and Norgate, T. (2012). Copiapó River Basin Water Management: Terms of Reference for Future Governance and Research Activities. Report to AusAID and Chilean stakeholders from the Minerals Down Under Flagship, CSIRO.

Executive summary

This report represents a key output of the project entitled '*Copiapó River Basin – Analysis study of shortfalls in water rights, industrial usage and social requirements'.* The project was developed jointly by AusAID, part of the Australian Government's Department of Foreign Affairs and Trade (DFAT), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Dirección General de Aguas (DGA) within the Chilean Ministerio de Obras Públicas. This report aims to aid in understanding: (i) how water management reform may be most effectively implemented; and (ii) the relationship between stakeholder perspectives and the current Water Rights framework under the 1981 Water Code and 2005 Amendment.

This report also seeks to provide an understanding of:

- the national legislative and social context within which the current water management issues in the Copiapó Basin are derived and exist,
- the nature of the water management issues in the Copiapó Basin from the perspective of different stakeholder groups,
- existing mechanisms and level of social capital available within and between stakeholder groups to address water management issues, and
- barriers to addressing water management issues in the Copiapó Basin.

A brief review of literature related to water management and water rights reform in Chile demonstrated that Chile has a strongly economically focused approach to water that is unique in the world. Within this system innovative market mechanisms for water allocation have been adopted, encouraging water-related investments and improved water efficiencies. This system has also led to unanticipated consequences such as the accumulation of unused water rights for hoarding and speculation or to prevent competitors from entering the market, and an increase in inter-sectoral water conflicts.

These and other issues were explored in this scoping study through the views and experiences of stakeholders in water and its management in the Copiapó Basin. Approximately 106 stakeholders in the Copiapó Basin were engaged in discussion using a semi-structured interview process. Conversations considered the nature of the stakeholders' interests and experiences with water; how they use and manage water; the problems they experience and the barriers to more sustainable and integrated management of the resource. Interviewees were drawn from a broad cross-section of stakeholder groups, including: Government agencies, Copiapó Basin citizens, water utilities, irrigation and agriculture, small farmers and Indigenous groups, mining sector, and research organisations and institutions.

These discussions produced a rich data set that was summarised according to several major themes.

The nature of the basin: most participants told a story of growth and strain in the Copiapó Basin as a table grape industry was introduced in the mid 1960s (increasing in scale in the 1980s), and more recently accommodated large scale mining as commodity prices have increased. These new industries have brought more people to the basin, increased house prices, and drawn heavily on the scarce water resources of the area.

The nature of the problem: There was universal agreement among discussants that there is a significant, real and urgent problem in the Copiapó Basin regarding water availability, use and management, and that a solution will necessarily involve all of the major stakeholders.

Problem attribution: A number of participants indicated that water scarcity had become worse in recent years, with each subsequent industry entering the basin (particularly mining) blamed by preceding water users. There was also a view that water users in the lower part of the basin were being inequitably affected by water use in the upper parts of the basin.

Separate solutions: collaboration between water stakeholders in addressing water scarcity issues was not a feature of the basin. Mining is introducing desalination technology for their operations, large scale agriculture introduced drip irrigation technology to drive efficiency, the water utility has been seeking to develop new wells in different parts of the basin to supply drinking water, and community and Indigenous groups were supportive of much stronger government intervention to ensure equitable access to water in the future.

Intergroup perspectives: Analysis of the data also revealed that the role of major stakeholders in the water management issues of the Copiapó Basin was often seen quite differently depending on group membership. These differences in problem attribution, positions regarding stakeholder roles in solving the problem, and power differences between the groups represent significant barriers to developing a more effective basin management plan.

Other barriers to change identified included differences in the knowledge base of stakeholders regarding technical aspects of the water resource, and differences in values regarding its use. The legislative context was also cited frequently as a barrier to solving problems in creative and flexible ways. Finally, stakeholders' experiences with what was known as the Copiapó Basin Water Table, a stakeholder round table developed to discuss water issues, may generate cynicism in any future similar processes. This Water Table also demonstrated that any future process will need to overcome the differences in goals, aspirations and capacity to collaborate that the different stakeholder groups bring to such participatory processes.

In conclusion, this scoping study identified the key stakeholders in the water management issues of the Copiapó Basin, their experiences and concerns, and some of the challenges a future project or initiative will need to overcome to realise more effective basin management. This report also described important shared perceptions of the problem and its potential solution: that there is a real and urgent problem of water scarcity to overcome, that all the groups have a stake in this problem, and that universally these groups view collaboration and shared responsibility as key to the development of an effective basin management plan.

1 Introduction

The project entitled '*Copiapó River Basin – Analysis study of shortfalls in water rights, industrial usage and social requirements'* was developed jointly by AusAID, part of the Australian Government's Department of Foreign Affairs and Trade (DFAT), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Dirección General de Aguas (DGA) within the Chilean Ministerio de Obras Públicas. The project was conducted between 1 May and 30 November 2012, and included two trips to Chile by Australian scientists and a trip to Australia by Chilean government managers.

An **outcome** of this AusAID-CSIRO-DGA project is to:

'*Produce a preliminary integrated assessment of industrial, agricultural, environmental and social water use profiles and demand projections for the Copiapó Basin which will be a crucial starting point for future water technology integration/optimisation and management tools. Preliminary assessments of the hydrological and hydrogeological resources in the Copiapó Basin, together with preliminary assessments of water regulatory framework and stakeholder perspectives on water management and water needs must also be produced'*.

The **output** being met by this report is '*a preliminary Summary Report on Stakeholder Perspectives developed from results of facilitated stakeholder discussions and workshops in Chile'.*

This report aims to aid in understanding: (i) how water management reform may be most effectively implemented; and (ii) the relationship between stakeholder perspectives and the current Water Rights framework under the 1981 Water Code and 2005 Amendment. This report also seeks to provide an understanding of:

- the national legislative and social context within which the current water management issues in the Copiapó Basin are derived and exist,
- the nature of the water management issues in the Copiapó Basin from the perspective of different stakeholder groups,
- existing mechanisms and level of social capital available within and between stakeholder groups to address water management issues, and
- barriers to addressing water management issues in the Copiapó Basin.

The report draws on literature regarding the Chilean water management and legislative context and interviews and discussions with stakeholders in Santiago and Copiapó City conducted by the project team in Chile in July 2012. These interviews and discussions were not recorded and so the report is based on notes taken during and after these meetings by the project team.

This report is input into a '*Final Activity Report and Terms of Reference which will be developed in collaboration with and endorsed by key stakeholders including am Inter-Ministry CSIRO Project Advisory Group'*.

2 Literature Review – Stakeholders in the Chilean Water Management Landscape

> *The contested terrain of water requires not government or markets, but both; not public or private water enterprise, but both; not expertise or grass roots knowledge, but both; not water for nature or people, but both; not centralisation or decentralisation, but both* (Ingram, 2008, p.13).

That water is no longer readily available or accessible to all of the world's population is well established (United Nations, 2000). Increasing water scarcity around the world has been brought about by a range of factors including disturbances to terrain, ever increasing population demands to meet diverse needs, and sometimes, that water is simply not located where it is most needed. While there has been much attention focused on the physical aspects contributing to water scarcity and the effects of varying climate conditions (Cullen, 2007; United Nations, 2010), there are a range of other factors contributing to water scarcity that must also be addressed.

Water scarcity can be brought about, or exacerbated by, the ways the resource is managed. This can include the use of technological solutions such as dams or canals, or complex networks where delivery systems create inequities in distribution and access (Donahue & Johnston, 1998). Poor management of the resource can also see supplies degraded as a result of wastage or pollution. Further to this, water scarcity can also be created as a by-product of social systems and processes.

In the field of water resource management, market instruments have been used around the world to improve efficiencies and redirect available water resources to 'higher value' uses. Vocal supporters of the use of the free market approach to water trading systems as a mechanism for managing a scarce resource have included the World Bank among others (Rosengrant & Binswanger, 1994; Schleyer, 1994; Brehm & Quiroz, 1995; Hearne & Easter, 1995). But this approach has also raised questions as to whether an approach based purely on economic and resource use efficiency can adequately reflect the range of other ways water is also used and valued (Mehta, 2001, 2006, 2007; McDonald & Jehl, 2003; Bauer, 2004). In this regard, Bauer (1998, 2004) has highlighted the weaknesses of adopting too narrow an economic focus to the exclusion of social equity and environmental sustainability that are also central to the use and management of water. The ways this can play out in a landscape have been examined in the Chilean context, where according to a recent report, increasing water scarcity in the mining country of Chile has "lined up actors on all sides of the constitutional and human rights issues" (SDSG, 2008, p.12).

In dealing with these aspects of water scarcity, an understanding of the roles and needs of the various water stakeholders involved in water systems, and the social systems and framework within which they operate, is critical. While issues of water scarcity and water security are not a new cause of human conflict, they point to an opportunity for us to examine and shed light on the full range of water values, needs and demands. They also allow us to explore how we might negotiate solutions that bring a better balance to meeting the multiple and diverse needs of stakeholders and deliver sustainable economic, environmental and social outcomes. Our greatest water challenges can also hold the potential to become our greatest catalyst for cooperation. In the most difficult of situations, there can be opportunities to be found in harnessing the social capital that exists among water stakeholders so as to generate new solutions.

2.1 A brief overview of Chilean water reforms

In terms of understanding the social systems and processes that can shape water scarcity issues, it is instructive to consider the backdrop of economic, constitutional and legislative developments that have shaped the Chilean water management landscape. This section provides a very brief overview of some of the major water reforms that have occurred in Chile. It is not intended to provide a comprehensive historical analysis but rather to summarise recent reforms that shape the way various stakeholders interact in the current water management landscape.

While water use rights have been regulated and recorded since at least the *1819 Executive Decree*, the Chilean Constitution adopted in 1980 has provided a backdrop to the more recent developments in water management. "The Constitution guarantees the basic legal framework for a free-market economic model by defining very broad private property rights and economic freedoms and tightly restricting the regulatory authority of government agencies and the national Congress" (Bauer, 2004, p.35-36). These rights and freedoms can be defended in the judicial system and this system does have the power to overrule legislation. Bauer (2004, p.36) notes that "because water rights are explicitly protected by the Constitution's section on property rights, the definition of water rights cannot be altered except by a constitutional amendment or a legal interpretation that has broad political support". In terms of understanding how water conflicts are negotiated and resolved, and how subsequent debates over water management have played out, this overarching framework has shaped the ongoing institutional arrangements and enforcement of water rights in Chile. Its introduction also reflected a change in political direction away from socialist policies towards a strong paradigm of economic reform based on "neo-liberal economic policies, which supported private property rights, free markets and eventually increased international trade" (Hearne & Donoso, 2005, p.57).

Under the Chilean Constitution, the first significant development to water policy occurred with the introduction of the 1981 Water Code. This law was designed to lay out "a strategic vision of water resources development that focused primarily on improving economic efficiency. The aim was to establish strong water use rights, create water markets, and reduce the role of the State in water development" (Williams & Carriger, 2006, p.3). The 1981 Water Code recognised water as a form of property that could ostensibly be managed separately from land and transferable water use rights were assigned that held all the characteristics of property under civil law. These water rights were freely tradeable, could be registered with titles offices, and all transfers of these rights were also required to be registered (Bjornlund & MacKay, 2002). In reality however less than half of these rights are officially registered and while the Director General de Aguas (DGA) also maintains the Public Water Cadastre, these records also tend to be incomplete. Bjornlund and MacKay (2002) state that the most accurate registers of water rights have tended to be maintained by the Water User Associations (WUAs) but these records tend to be localised and are not coordinated at a higher level.

When the State initially allocated these original water rights they were issued permanently, free of charge, without any limits placed on the quantity that could be requested, and to all private individuals who requested them (Williams & Carriger, 2006). These water use rights also "granted security to their owners that water would not be expropriated without due compensation and allowed for the possibility of reallocation through market transactions" (Hearne & Donoso, 2005, p.57). The 1981 Water Code also distinguished between consumptive and non-consumptive rights. Non-consumptive rights, which tend to be used for purposes such as power generation, allow users to withdraw surface water for use with the stipulation that it must be returned in the same state to the same water channel so that downstream users

also have access to it. Consumptive rights allow users full consumption of the resource, which means downstream users have no rights to return flow.

As a result of these sweeping reforms “water management policy in Chile [became] noteworthy for its innovative adoption of market mechanisms for water allocation” (Hearne & Donoso, 2005, p.53). There were clear benefits being realised in terms of encouraging water-related investments and improved water efficiencies (Williams & Carriger, 2006). Throughout the mid 1990s in particular, increasing attention from foreign academics and economists was focused on the performance and results achieved by the Chilean systems of water markets (Rosengrant & Binswanger, 1994; Schleyer, 1994; Brehm & Quiroz, 1995; Hearne & Easter, 1995). However despite its successes, the system also gave rise to some unanticipated problems such as the accumulation of unused water rights for hoarding and speculation or to prevent competitors from entering the market (Williams & Carriger, 2006), an increase in inter-sectoral water conflicts (Hearne & Donoso, 2005) and incidences of critical water rights being held by foreign interests (SDSG, 2008).

In order to address some of these problems, following some twelve years of debate, the Water Code Reform was passed in 2005. The revised Water Code also sought to address issues of social equity and environmental sustainability which had largely been absent from the earlier legislation. Key aspects of the reform included giving the President authority to exclude some water uses from economic competition when it could be demonstrated that doing so was necessary to preserving the public interest, requiring the DGA to address environmental aspects in the allocation of new water rights in order to promote sustainable aquifer management, and charging a fee for unused water rights to deter the practices of hoarding and speculation (Williams & Carriger, 2006). However, even in light of these reforms the judicial system remains the only way to resolve water conflicts between users. While river basin organisations were suggested as one mechanism for improving inter-sectoral conflict during the negotiations leading to these reforms, proposed models were ill defined and failed to win support from the public or the Congress (Hearne & Donoso, 2005).

2.2 Stakeholders in the Chilean water management landscape

Broadly, the key stakeholders involved can be mapped around their roles and interests in water resources. At the national level this includes:

- *Government agencies involved in water management*

  In accordance with the Chilean Constitution, Chile is a democratic republic with a unitary system of government. The territory itself is divided into fifteen regions (McFarlane, 2012). For each of these regions, there are regional administrative centres which report to the central government with each region governed by an Intendente, who acts as a representative of the President. Each region is managed by the Intendente and a Regional Council appointed to provide strategic oversight and decision making support. Underneath the level of regions, provinces are lead by Governors and cities by Mayors.

  Within the Ministry of Public Works, the Director General de Aguas (DGA) is responsible for monitoring and enforcing water use rights. The DGA’s key areas of responsibility are “promoting the management and administration of water resources in a sustainable framework, public interest and efficient allocation, as well as providing and disseminating information generated by hydrometric [analysis] and contained in the Public Water Cadastre in order to contribute to the country's competitiveness and improve the quality of life of people” (translated from Dirección General de Aguas, 2012). The DGA also

has a lead role in developing and enforcing national water policy, and contributed to shaping the reforms to the Water Code implemented in 2005.

However, the DGA has maintained a somewhat restricted role in water management and this has been "in accordance with the paradigm of limited state interference" (Hearne & Donoso, 2005, p.59). For the most part, the role of this agency has been limited to data collection and undertaking research studies, enforcing user association rules, issuing rights within a specified time, and the maintenance of registers (Bauer, 2004; Hearne & Donoso, 2005). Bauer (2009, p.599) has further suggested that the DGA is also limited in terms of its "regulatory authority over private water use and has no power to settle conflicts between water users. The agency cannot cancel or restrict existing water rights except by expropriating then under the Constitution's property articles, which would require specific legislation and payment in cash". The judicial system is currently the only mechanism available to address disputes among water users but this can be costly. New water rights can be requested from the DGA and "cannot be refused without infringing a constitutional guarantee" (Hearne & Donoso, 2005, p.57) but there must be technical evidence to support availability of water and any new use requests must not infringe upon existing water use rights. Requests may be refused in instances where aquifers can be shown to be fully allocated.

A number of other government ministries are important to the management of water in Chile, and particularly in the context of the Copiapó Basin. These include the Ministries of Mining, Agriculture, Energy, Public Works, Housing and Urbanism, Economy, Land and Public Assets, Environment, and the Superintendency of Sanitary Services. Representatives from these ministries are members on an Inter-Ministry CSIRO Project Advisory Group (full details are contained in Appendix A) established at the beginning of the project and their views are reflected in the contents of this report.

- *The citizens of Chile*

Access to safe and affordable drinking water and sanitation services to support health and well-being is a core public expectation in the Copiapó Basin and Chile more broadly. Preliminary findings from the 2012 census indicate that there are currently 16,572,475 people in Chile (Instituto Nacional de Estadisticas, 2012). The 2002 census indicated there were 129,000 people in the Copiapó province although this is likely to be an underestimate (McFarlane & Norgate, 2012). The majority of the population in Chile and Copiapó province live in urban areas and have access to potable water supplies and sanitation services. However, the movement of populations or development of new towns can place pressure on existing infrastructure and water supplies. This has been the case in Copiapó City and surrounding towns which have experienced an influx of people in recent years to service the growing mining industry (see McFarlane & Norgate, 2012 and CONAMA-DGA, 2009 for a more detailed demographic description of the Basin).

Williams and Carriger (2006, p.5) observe that there is good "social discipline" among Chileans in that they tend to pay their water residential water bills, however any significant investment in water supply services will often be passed on to consumers. Such cost increases may adversely affect those who do not have the capacity to meet increased costs. A subsidy program has been administered by the Ministry of Social Planning (MIDEPLAN) in conjunction with municipal governments to ensure access is retained for poor households (Hearne & Donoso, 2005). These subsidies have been funded entirely from tax revenues.

- *Water utilities*

The provision of drinking water and sanitation services to residential populations tends to be managed by privatised water utilities operating at local and regional levels. The privatisation of water utility companies has reflected increased investment by the private sector in water infrastructure and contributed to a number of efficiency improvements. For example, private investment in sanitation by the water supply sector has seen the percentage of sewage being treated in Chile increase from just 17% in 1991 to 81% in 2005 (Williams & Carriger, 2006), and Superintendencia de Servicios Sanitarios (SISS) has this figure as 96.1% for urban areas in 2011 (SISS, 2011). While these companies function as private entities, the state investment corporation, CORFO, tends to own significant shares in most of them (Hearne & Donoso, 2005).

During the 1980s, these services were supplied by the National Sanitation Service. This agency also regulated these services throughout the country. However in 1990, the sector underwent a significant transformation with the formation of the new regional water companies. To manage the regulation of the supply of these services by these new entities, SISS was established. The SISS forms part of the Ministry of Public Works and sets the tariffs that will cover the cost of service provision (SISS, 2012). While the tariff structure "has eliminated cross subsidies that are common in the water supply and services systems" (Hearne & Donoso, 2005, p.61), the Chilean Government has implemented means-tested subsidies to poor households through MIDEPLAN as noted above (see Williams & Carriger, 2006). However any significant cost increases will present a challenge to maintaining a socially equitable supply system, particularly as tariff increases must be universal in their application by legislation. In the Copiapó Basin Aguas Chañar is the water utility company.

- *Irrigation and agriculture*

Water use in Chile is dominated by irrigation and it represents the majority of water use for consumptive purposes. Historically irrigation has comprised some 85% of consumptive water allocation with industrial uses accounting for 7% and mining and residential uses accounting for just over 4% each (Hearne & Donoso, 2005, p.54). In the northern part of Chile where water is limited, there is some specialised agriculture, mainly comprised of irrigated vineyards and the production of some fruits and vegetables (Comisión Nacional de Riego, 2012). The Copiapó Basin supports 12,753 ha of irrigated land, producing table grapes, olives, vegetables, and pomegranate (Comisión Nacional de Riego, 2012, see McFarlane & Norgate, 2012 for more detail).

Irrigation canals have been used in Chile since colonial times and there are now well over 4,000 Water User Associations (WUAs) established to manage these irrigated networks throughout the country (Dourojeanni & Jouralev, 1999 cited in Hearne & Donoso, 2005). There are three types of WUAs in Chile, many of which have professional management and are recognised by law:

- *Water communities*, any group of users sharing a common water source
- *Canal user associations*, formal associations that have legal status and may enter into contractual arrangements
- *Vigilance committees*, all users and associations that are operating on any river or stream (or part thereof) with responsibility for administering and allocating to water to different canals in the identified section of the water course (Hearne & Donoso, 2005). Because vigilance committees cover a larger geographic area, they may also include non-agricultural water users

as members (Bauer, 2004). However, according to Bauer (1998), these committees have not been successful in resolving inter-sectoral conflict that has arisen.

In the Copiapó Basin there is also a groundwater user association – CASUB (Comunidad de Aguas Subterráneas de Copiapó) – the only such group in Chile. It manages groundwater use in the lower part of the basin.

The Comisión Nacional de Riego (CNR) is an important stakeholder in water management in the Copiapó Basin, supporting the installation of drip irrigation systems and working with the Ministry of Agriculture to develop irrigation policy. For farmers, there was previously little incentive to sell their water rights without also selling their corresponding land. However, in more recent times, water markets have been used to transfer water rights from the agricultural sector to other industries. As Hearne & Donoso (2005) note, the use of water markets for trading water rights has not been common throughout the majority of Chile however where they have become more prevalent are in those areas experiencing greatest water scarcity, including the Copiapó Basin.

- *Small farmers and Indigenous groups*

According to Bauer (2004, p.92), "there are several hundred thousand peasants and small farmers in Chile, generally referred to as *campesinos*, throughout the country." Although most of the Indigenous population is distributed throughout the south of the country, there are also a number of Indigenous communities located in the northern desert and mountain regions of Chile. Among these Indigenous Chileans, poor farmers and small landholders, issues of social equity in the management and distribution of water come to the fore but as Bauer (2004, p.92) also points out the problems "that many of these farmers face have causes that predate the 1981 Water Code and reflect deeper problems of poverty and social inequality".

These problems have been summarised as being related to a lack of legal titles held by these stakeholders. Although it is recognised that informal or traditional rights may exist, under the Water Code, "water use rights need to be officially registered in order to be protected" (Hearne & Donoso, 2005, p.58). These stakeholders also tend to have limited voice or power to influence within water user organisations (if they are part of an established network), and in cases of conflict, the costs of accessing the legal system tend to be prohibitive and beyond their reach (Bauer, 2004). For traditional farmers (and Indigenous peoples), there are significant social and cultural values underpinning their access to water and their irrigation practices, which cannot be rationalised or accounted for within an economic framework (Bjornlund & McKay, 2002).

In terms of addressing these issues, in 1993 the National Corporation for Indigenous Development (CONADI) was formed and legislation passed giving Indigenous peoples the right to claim their traditional land and water rights. This law also required the DGA to address and defend Indigenous water rights (Hearne & Donoso, 2005). However, Boelens and de Vos (2010) claim that in practice this law can be overruled by the Water and Mining Codes. Further to this, in 2008, Chile also ratified the International Labour Organisation's (ILO) *Indigenous and Tribal Peoples Convention No. 169* which is an international legally binding instrument that requires full consultation and participation of Indigenous and tribal peoples in all matters that concerns their rights (ILO, 2012). While these commitments demonstrate commitment to preserving the rights of Indigenous Chileans, Boelens and de Vos (2010) argue that there remains a need to address long standing power imbalances and discrimination.

Another stakeholder in the water management landscape are the non government organisations (NGOs) and political and environmental lobby groups that have a role in working with Indigenous communities and small farmers or alternatively are focused on bringing attention to issues of environmental sustainability in decisions about water management. Growing demand on groundwater resources in the north or the impact of developing hydropower in the south are examples of issues these groups address.

- *Mining sector*

Chile is an important mining country in the global context. It is the world's leading copper producer producing 34% of the world's supply in 2010 (USGS, 2010). Alongside copper, Chile is also a major producer of gold, silver, iron and coal (see McFarlane & Norgate, 2012 for more detail). The development of the mining sector over recent years has been integral to the rapid development of Chile's economy. While the main legislation governing mining activity is the Mining Code, there are a number of related institutions that are involved in the negotiation, approval and monitoring of Chilean mines. These include:

- The Mining Ministry, which administers the concession system under the Mining Code at the national level
- CODELCO, the state owned copper company, also the world's largest copper producer, with some influence on government policies and priorities
- COCHILCO, the Chilean Copper Commission, responsible for strategic planning for state owned copper enterprises
- SERNAGEOMIN, the Chilean geology and minerals service, responsible for monitoring mine safety and reviewing closure plans
- CONAMA, the National Commission for the Environment, responsible for coordinating environmental policies among multiple Ministries and administering reviews of environmental impacts associated with mining development
- SONAMI, the national peak industry body representing the industry's interests (SDSG, 2008, p.5).

Further to this network of stakeholders operating in the mining sector, in 2007, the Chilean Government through its Mining Ministry, formed the Public-Private Board for Water Resource Management to bring together the public and private sectors to work together to generate new solutions for managing Chile's water resources (COCHILCO, 2008). The members of this Board include private sector interests from mining but also representatives from the National Agriculture Association and the National Health Service Company. The aim is to use this forum to connect all sectors with a stake in water management.

- *Research organisations and institutions*

Chile has a number of large universities which contribute to research on water issues. The Universidad de Atacama, Universidad de Chile, and Pontificia Universidad Católica de Chile, all contribute science and technology transfer to sectors related to water and its management, often partnering with institutions such as CORFO (Corporation for Fostering Production) to deliver benefit on the ground.

- *Hydro-electric power*

A further and significant use of water in the Chilean context is in the generation of hydro-electric power. However, as hydro-electric operations are not present in the north of Chile they are not discussed here.

3 Method and Results

To gain the insights of stakeholders in the Copiapó Basin, the project team sought to interview a broad cross-section of people and groups in both Santiago and Copiapó City. The project team was supported in creating a broad list of interviewees by its DGA hosts. Approximately 106 stakeholders were interviewed using a semi-structured interview process (see Appendix A for a full list of stakeholder groups engaged); the project team engaged in a broad ranging conversation about the nature of the stakeholders' interests and experiences with water; how they use and manage water; the problems they experience and the barriers to more sustainable and integrated management of the resource. In their responses, participants generally started by providing an overview of the context from their perspective, a description of their broad experiences in relation to water and its management, and the nature of the problems they and basin more generally is facing. The project team also participated in a public meeting with the region Intendenté and community and local government leaders.

Stakeholders interviewed included representatives from: various government ministries and departments; the mining industry; the agriculture industry (both large and small producers); water user groups; community and Indigenous groups; other industries such as construction; NGOs; water utilities (Santiago and Copiapó City); and universities. The project team had a simultaneous translator present in most of the conversations allowing for a natural and often vigorous exchange. Often the DGA hosts would sit in on the conversations as well[1].

The following represents a summary of those conversations developed from notes and discussion within the project team and serves to provide a brief set of insights into the perspectives of water stakeholders in the Copiapó Basin. Interview notes were compared among the members of the project team and key themes discussed. The lead social scientist then coded the consolidated notes according to these key themes and summarised the perspectives of discussants by stakeholder group for reporting. Theme summaries were then reviewed by project team members and CSIRO peers to ensure the data reported is accurate and fair.

3.1 The nature of the Basin – growth and strain

It was the general view of discussants that the Copiapó Basin is a valley that has seen demand for the scarce water resources it holds increase steadily with: the introduction of table grapes in the mid 1960s; the increased importance and scale of this crop from the mid 1980s; the increase in mining activity from the early 1990s; and more rapidly in the last 10 years in response to high global commodity prices. Agriculture and mining now represent significant industrial drivers of the Chilean and regional context. As the discussants in this scoping study indicated, these industries have and are driving an influx of people into the region and this is changing the nature of the relationships between people, place, industry, and water.

[1] The project team considered that DGA presence in interviews may stifle discussion. However, conversations were robust and often drew DGA members in to clarify regulatory points or comment on government action, and participate in general discussion. The project team also had a plan to engage stakeholders that appeared to be uncomfortable with DGA presence separately at a later time although this was not necessary due to the openness of the conversation that ensued.

Discussants indicated that Copiapó City and the broader region has experienced some of the highest population growth rates in the country, and this trend is expected to continue in the future as the $US26 billion in approved foreign investment in new and expanding mining projects comes on line. Mining operations in Region III predominantly house their workers locally, with thousands of workers and their families residing in Copiapó City and surrounding towns such as Tierra Amerilla or in encampments higher up the basin. The water utility in Copiapó City is expecting 35,000 new houses in the region by 2014, 15,000 of which will be within their area of responsibility. As with other mining regions around the world, property prices have increased significantly with this demand for housing, with a number of discussants suggesting house prices in Copiapó City are some of the highest in the country.

The consequences of this recent growth, overlayed on a mature agricultural industry and existing population centres and infrastructure, have been increasing pressure on a diminishing water resource. Government discussants suggested that some areas of the basin may already be facing a situation where some wells may not support further extraction, which substantiates reports from other stakeholders that the water table has dropped significantly in recent years and extraction points to supply drinking water to Copiapó City have been moved progressively down the valley. The quality of drinking water in the basin is not high; with reports to the project team that even low income residents of the city purchase bottled water to drink. The potential for social unrest and even conflict in this context was mentioned by several discussants, with the water utility indicating its machinery and equipment had been the target of direct action by community members in the past.

3.2 The nature of the problem

There was universal agreement among discussants that there is a significant, real and urgent problem in the Copiapó Basin regarding water availability, use and management, and that a solution will necessarily involve all of the major stakeholders. A representative from the mining industry indicated that ‘fixing the problem will (and should) hurt’. Most stakeholders interviewed also indicated they were willing to be part of this dialogue, and believed local leadership was critical to any future success. Currently, however, ‘everyone is looking for their own solution’ rather than working together in any coordinated manner, according to another mining industry representative. Finally, a number of stakeholder groups indicated that water and energy were linked in the growth of the basin and subsequent strain it is experiencing, particularly as mining is focused on sourcing desalinated water for its operations and this process is energy intensive. Increasing population demands on water and energy infrastructure was also a stated concern.

3.3 Problem attribution: "Dressing a saint by taking the clothes of another saint"

A number of participants indicated that water scarcity had become worse in recent years, although attribution for this scarcity sometimes differed among stakeholders groups. Mining industry representatives indicated that the basin had deteriorated recently as a result of drier weather, overallocation of water resources, and some agricultural users selling their underutilised allocations to mining interests who had then used the full allocation for their operation. A water user group representative also indicated the problem had become more severe in the last 4-5 years although this was attributed exclusively to mining expansion and that industry’s purchase of water rights accumulated by farmers. Taking a broader perspective on the issue, a political representative indicated that it was the market that had failed to resolve issues related to water management.

There was a strong perception among a number of groups engaged that water users higher up the basin were impacting those in the lower parts of the basin, shifting the problem so that it is experienced inequitably. This view was expressed by water user groups, community members and representatives of Indigenous groups engaged in this process. Indigenous representatives also indicated that 'we all blame each other' for causing a problem that most stakeholders considered would only be resolved collaboratively.

3.4 'Looking for their own solution'

It is instructive to consider the responses of the various stakeholder groups to the issue of water scarcity. In line with the above observations, a summary of these responses demonstrates that collaboration is not currently a dominant feature of the Copiapó Basin in managing water:

GROUNDWATER USER GROUP (CASUB)

- Currently installing sophisticated telemetry devices on wells in the lower part of the basin (180 to date) to monitor water use by its members (predominantly small scale farmers) with CNR financial assistance
- Supporting a Water Bank to centrally control allocation of water to all basin users, separating community from industry users
- Proposing industry users donate water allocations for social use and no new users enter the basin

AGRICULTURE

- Upstream, have implemented drip feed irrigation systems across the basin to drive efficiency
- Large operations employ holding dams and advanced pumping systems to move water around
- Downstream, promoting a Water Bank to centrally control allocation of water to all basin users, separating community from industry users

MINING

- Deploying water efficient technologies for mineral processing
- Deploying desalination technology for exclusive use by mining operations in the basin, largely eliminating the need to draw water from the basin

COMMUNITY ADVOCACY GROUPS AND COLLA

- Suggesting water resources should be centrally controlled by government, no new users enter the basin, and human consumption be prioritised over industrial uses

WATER UTILITY

- Shifted extraction sites up the basin to secure water for use
- Increasing proportion of recycled water supplied for industrial use

GOVERNMENT

- Commissioned numerous studies to understand hydrology of the basin

- Sought amendments to Water Code to reform water management practices
- Commissioned original Water Table, a multi stakeholder forum
- Specific initiatives such as cloud-seeding to increase precipitation and the Kaukauri Park development to provide visible water and irrigated parkland in Copiapó City for residents

3.5 Inter-group perspectives

In conversations with stakeholders in both Santiago and Copiapó City it was clear that each group had clear views of their own experiences and frustrations regarding water management in the Copiapó Basin, and often views on the roles that other stakeholders were playing and might play in this context. A selection of these perspectives are summarised in Table 1.

Table 1. Stakeholder perspectives on water issues

Stakeholder group	Own perspective	Other perspectives
Agriculture	• Efficient water users • Long history in the valley • Experiencing real and dramatic decrease in water availability • Increased competition (Peru) creating additional pressure • No room for new users in the system	• Long history in the valley • Well connected with each other and politically powerful • Very profitable • Marginally profitable, would leave valley if they could sell their water rights • Biggest users of water, some inefficiency in use
Mining industry	• Hold much greater rights than use • Very efficient water users • Always get blamed for water availability issues • Not the largest water user in basin • Seen as a source of resources (money) to support water management • Concerned when community demonstrate or are unhappy about water • View community/Colla as critical local stakeholders • Disparity in the way industries are treated under environmental legislation	• Water use low in absolute terms but proportionally very high in Sector 4 • Problem created/exacerbated with mining expansion in the last 5 years • Should pay for community desalination, make 'first sacrifice' • Face stricter environmental conditions • Can afford to pay more for water, and should • No regard for the environment • Mining welcome but cannot place more pressure on the system
Community /Colla	• Strong connection with water, and between land and water • Human consumption should be prioritised • Marginalised in water management and debate – want to have connection to water recognised • Other projects/users receive priority • Community voice not heard	• Some groups seeking to nationalise water resources • Seeking stronger powers for government to control/distribute water rights • Some do not think the problem is the community's to solve • Not against development but seeking balance in how it progresses • Community do not value water as a scarce resource or have great knowledge about the resource
Utility	• Water is undervalued in terms of real cost (less than half) and as a resource • Illegal extraction a significant problem • Caught in the middle of a range of	• Seeking water in areas not accessed previously • Shifting problem to new areas of the basin

	powerful stakeholders • Do not have a strategic long term plan for basin	• Tariffs paid by community consumers should not subsidise industry • Providing poor quality water
Central Government	• Committed to finding a solution • Invested heavily in studies/analysis of basin hydrology • Lacking understanding of how surface and groundwater interact • Problem is socially, culturally and legally complex • Opportunity for Copiapó to be an example for other areas of Chile • Past decisions (e.g. over allocation) make reform difficult	• Have an important role to play in solution through leadership/ coordination • Have been weak/ineffective in managing problem to date • Do not always trust data and information provided by users • Need a state vision for solution but local leadership to implement • There have been many studies – it is time for action

3.6 Barriers to change

Throughout the discussions, the project team also explored perceived barriers to change in water management practices in the Copiapó Basin. Three main themes from these conversations are summarised here.

3.6.1 KNOWLEDGE AND VALUES AROUND WATER

Lack of knowledge was mentioned by a range of stakeholders in multiple ways. The main industry stakeholders and the government indicated that while significant effort and resources had been invested in conducting hydrological studies of the basin, there was a lack of integration of surface and groundwater modelling which would potentially offer new insights for basin management. There also seemed to be an issue around trust in available data and reports which had been prepared by individual stakeholders.

It was reported that there is a lack of knowledge among the broader community regarding the nature of the water resource, its scarcity and efficient consumption. The water utility indicated, for example, that current consumption was approximately 170L/day per person in Copiapó City, and as high as 200L/day per person at times. It was also pointed out that unlike stealing energy it was not a criminal act to steal water, thus reflecting a low institutional value on water.

3.6.2 LEGISLATION

Most parties interviewed expressed frustration with the 1981 Water Code and 2005 Amendment. As discussed, under this legislation the government has limited powers to change the way water is managed, allocated or even monitored in the Copiapó Basin. The DGA representatives expressed frustration, for example, that they were not able to enter a property to see if water was being illegally extracted. Other government departments are similarly unable to effectively contribute to a sustainable water management plan as their own legislated powers were limited in the context of water; for example, the environment department reported they have no real powers regarding water flows even if they identify environmental impacts associated with water use. Finally, there is currently little cross-ministerial or departmental interaction or coordination in the management of water and related issues (e.g. energy, environmental health, urban planning, mining and agriculture) with regards to the valley or Chile more broadly.

For the main water utility in the Copiapó Basin, the prioritisation of human consumption was considered to be inadequately reflected in law, leading to structural inequity in the way tariffs for use are calculated (i.e. all users pay the same tariff) and few options for increasing tariffs selectively. Equally, agricultural users expressed frustration that the law does not allow flexibility in the management of the resource, while community and Indigenous stakeholders felt their interests were not appropriately reflected in legislation. Specifically for the Colla people, the disconnection of water and land rights in legislation was considered problematic.

3.6.3 CAPACITY TO COLLABORATE: THE WATER TABLE

Water scarcity has been recognised by most stakeholders in the Copiapó Basin as a problem for a number of years. Even before the recent exacerbation of the problem reported by some discussants, the need to come together to develop collaborative approaches to water was acknowledged. Chief among these attempts was a Water Table established between 2006 and 2010. The project team discussed this initiative at length with stakeholders as it provides insights into the potential shape of a future Water Table or similar governance arrangement, and the way that such arrangements have different value for different groups.

The project team understands the Water Table had two phases, the first led by the regional Intendente and the second led by a regional identity known to all stakeholders. The DGA provided secretariat and logistical support. In the first phase of the Water Table the membership was narrow, restricted mainly to industry and government representatives. A local identity was then asked to chair the Table and membership was broadened to include additional stakeholders, some of whom did not have any direct connection or interest in the issues. The purpose of the Water Table was to hold multi-stakeholder discussion regarding water issues , resolve them if possible, commission research into particular aspects of the basin where required (e.g. the Golder Associates, 2006), and generally offer a forum in which to discuss common issues around water.

Stakeholders interviewed for this project were split regarding the effectiveness and benefit of the Water Table. Those that expressed support for the Table indicated that it: facilitated a sense of inclusion in the dialogue around water management; enabled them to contribute to the development of a common vision regarding water; was useful in building trust between the parties and developing a common identity around the problem; and in its latter stages, better reflected the nature of the problem through its diverse membership.

Those that thought the Water Table had not been successful reflected that: it was focused on diagnosis and talking rather than action; participating wore down the members; the broad membership in the latter stages of the Water Table meant nothing substantial was achieved and its agenda was politicised; and it failed to fulfil the expectations of many of its members. In general, those groups that reported finding the Water Table a useful, validating experience were of lower status and power, while those with greater resources and power in the valley engaged in the process but did not feel it was a productive institution. However, it is important to note that most stakeholders interviewed were supportive of the creation of a new Water Table, building on the successes of the first.

4 Conclusion

The nature of the water resources in the Copiapó Basin means that the valley's stakeholders are consistent in their characterisation of water scarcity as a problem and in their belief that a solution to this problem must involve all of the parties working together. Any strategy to find a solution must overcome some significant barriers, however. These include moving beyond attributing the cause of the problem to other groups and considering the role and resources that each group may bring to a genuine dialogue around how to achieve better basin-wide management of the water resource. This will not be easy in a context where the water resource is scarce, creating competition and conflict between users, and a legal framework that is not flexible and difficult to reform quickly.

Defining the role of government in this solution will also be important, with most users seeking a stronger role for government in water management and a central, perhaps coordinating, role in developing a solution to the basin's water management problem. And while there was a strong feeling among stakeholders that local leadership and central government support was important in developing and executing a strategy for water management, such a process will need to overcome cynicism among stakeholder groups developed through the experience of the Water Table and previous attempts to address the water management issue.

To date each of these water users reported working separately to develop responses to the lack of water, variously driving efficiency in their practices, sourcing water from outside the basin, seeking to restrict access to the existing water or encouraging the government to take a stronger line on how water is distributed and governed. Despite these efficiencies, most users recognised that it will only be through coordinated action that a sustainable water management strategy is developed, and that despite the faults in its original form, institutions like the Water Table are potential vehicles for supporting this coordination.

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Appendix A Stakeholder groups and organisations engaged May/June 2012

Project Inter-Ministerial Working Group

Ministry Representation
COMISION NACIONAL DE RIEGO
VIVIENDA Y URBANISMO
AGRICULTURA
ENERGIA
SERVICIOS SANITARIOS
MINERIA
ECONOMIA
OBRAS PUBLICAS
MEDIO AMBIENTE
BIENES NACIONALES

Senior administrative authorities and elected officials

Name
INTENDENCIA (ATACAMA)
GOBERNADOR (COPIAPO)
SENADORA
CÁMARA DE DIPUTADOS
SEREMI - MOP
ALCALDE DE LA MUNICIPALIDAD DE COPIAPÓ
SECRETARIO REGIONAL MINISTERIAL DE OBRAS PÚBLICAS
SECRETARIO REGIONAL MINISTERIAL DE AGRICULTURA
SECRETARÍA REGIONAL MINISTERIAL DE MINERÍA
DIRECTORA REGIONAL DE LA SUPERINTENDENCIA DE SERVICIOS SANITARIOS
DIRECTOR GENERAL DE AGUAS

Regional authority and departments

CPL
MINAGRI
CNR -MINAGRI
INDAP
DOH
MOP
BIENES NACIONALES
DOH
MMA
MINVU
DGA
SOCONAC LTDA.

Mining and construction companies and representative bodies

Name
MINA CANDELARIA
COCHILCO
CAP MINERIA CNN
BARRICK GOLD
KINROSS GOLD
LUMINA COOPER
ANGLO AMERICAN
CODELCO
PUCOBRE
CONSEJO MINERO
CC CONSTRUCCIÓN

Community actors and representatives

Name
CONACOP
JJVV COPIAPO UNION COMUNAL
MOVIMIENTO SOCIOAMBIENTAL VALLE DEL HUASCO
ATACAMA LIMPIO
ASOCIACIÓN NACIONAL DE MUJERES RURALES E INDIGENAS
COMUNIDAD COLLA
REGIONAL CORPORACIÓN NACIONAL INDÍGENA
POR LA DEFENSA DEL AGUA DE
CORPORACIÓN PARA EL DESARROLLO DE LA REGIÓN DE ATACAMA
GERENTE CORPORACIÓN PARA EL DESARROLLO DE LA REGIÓN DE ATACAMA
COMUNIDAD COLLA RÍO JORQUERA Y SUS AFLUENTES
COMUNIDAD INDÍGENA COLLA SERRANÍA POBLETE
COMUNIDAD INDÍGENA COLLA SERRANÍA
CONADI
other

Agriculture representatives

Name
CASUB
SOCONAC
FRUT. Y EXP. ATACAMA
EMPRESAS CABO DE HORNOS
JVRC

Water utilities

Name
AGUAS CHAÑAR
AGBAR

Research, development and higher education institutions

Name
PTI HIDRICO
CORPROA
UNIVERSIDAD DEL MAR
FOOD AND AGRICULTURE ORGANISATION, UNITED NATIONS
CORFO
FUNDACION CHILE

NGO

Name
FUNDACIÓN CASA DE LA PAZ

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