The Lithium Triangle in Chile: The Privilege of Commercial Water Rights



Marc Muller, Ellis Adams, Diane Desierto, and Portia Ozioma Chigbu

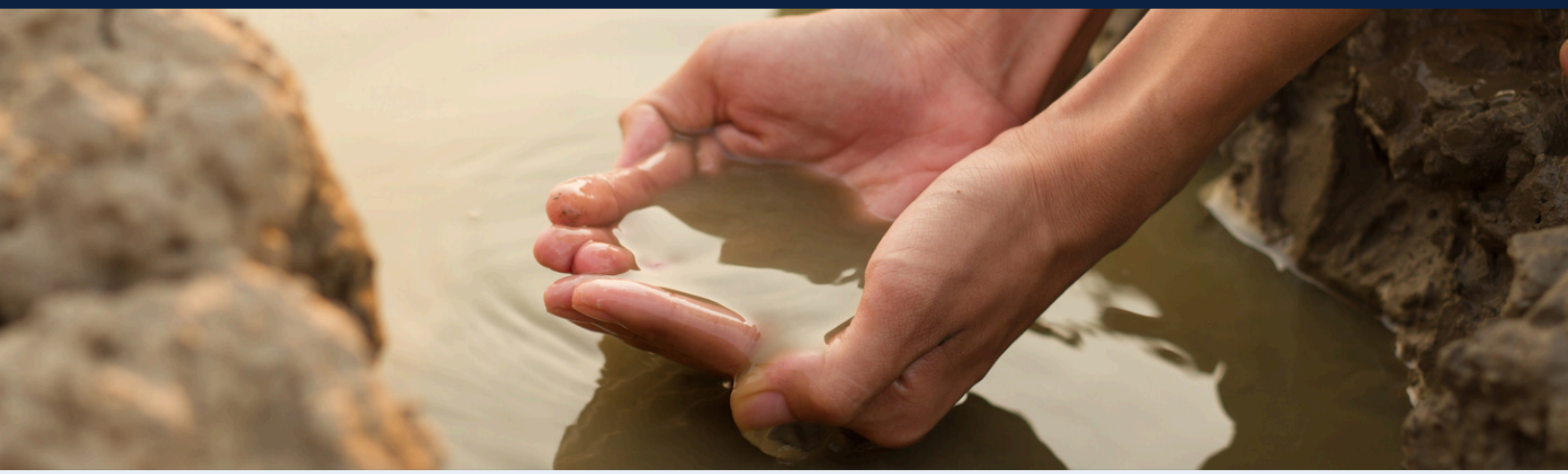
A case study series

investigating the human right to water.

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SUMMARY

Our case study series compiles secondary literature including peer-reviewed articles, white papers, and occasionally news articles to explore the implications of a specific industry on the human right to water and interrelated rights. Each case study examines the hydrological effects of a particular water-intensive industry, assesses the quality of key governance conditions, and then takes the perspective of one responsible party to consider key human rights questions related to the impacts of the industry. The analysis presented in this case study is the first to use the framework and contains a slightly different approach compared to later case studies in this series. Consequently, it does not adopt a specific target audience for the legal analysis, but rather maps out indicators and issues for government and mining companies.

The purpose of each case is not to assign direct responsibility. Rather, it is to consider all possible implications that could potentially arise from the mismanagement of water, and offer legally informed inquiries that could be further pursued in order to prevent future abuse. We also emphasize that because our analysis only consists of secondary information, the findings of each case should not be considered absolute. Each case is an entry point for further fact-finding. With this, all mistakes and misinterpretations of available evidence are our own.



ABSTRACT

Overview: Lithium mining activities in Chile's Salar de Atacama region cause severe environmental and hydrosocial effects for the Atacameño Indigenous communities. Key issues in this study include: mining activities' effect on water use not as a commodity alone, but as social and cultural goods for the Atacameño community and other communities in the Salar region; Chile's Water Code that privileges commercial water use for mining over other uses; and loss of water rights for Indigenous Peoples and rural communities.

Water Security Analysis

- Mining activities, consisting of groundwater for ore processing, sea water for ore processing, and brine abstraction for lithium production, create blue water and cultural water insecurities. This is due to the impact of ore processing and brine extraction on the living and work conditions of the Atacameño Indigenous communities.

Water Governance Analysis

- Facilitated by Chile's Water Code, Indigenous Peoples in Atacameño communities have lost their water rights to mining and drinking water companies.
- Conflicts have arisen between the government and companies on the one hand, and Atacameño Indigenous communities on the other hand, over depleting water supplies in Chile and increased threats to the cultural heritage, spiritual and cultural practices, and self-determination rights of Indigenous communities.

Legal Analysis

- Groundwater abstraction for ore processing and brine evaporation/abstraction is inconsistent with Chile's cross-cutting human rights obligations, including the rights to self-determination, non-discrimination, free disposition of natural resources, and non-deprivation of means of subsistence. It affects the interrelated rights to the highest attainable standard of physical and mental health, work, adequate living standards, and environment for vulnerable populations in the Indigenous communities.

INTRODUCTION

Located in the rain shadow of the Western Cordillera, Chile's Salar de Atacama is among the most arid places on Earth, receiving only about 25 mm of annual precipitation and experiencing approximately 2,000 mm of potential evapotranspiration annually (Garcés & Álvarez, 2020). The Salar is the terminal point of an endorheic basin, a hydrologic catchment that does not reach the sea. Rainwater and snowmelt from higher elevations progressively flow as infiltrated (fresh) groundwater into the Salar, where it is incrementally evaporated, leaving a large volume of concentrated brine (salty groundwater) underneath the salt flats. These contain large amounts of minerals, including the world's largest copper and lithium reserves (Pena & Huijbregts, 2014; Garcés & Álvarez, 2020). Copper has been mined in the rock formations surrounding the Salar for centuries, with the world's largest copper mining operation (La Escondida, operated by BHP, Rio Tinto, and JECO) located approximately 20 miles from the Salar. Lithium demand has boomed over the last few decades with the rise of Lithium batteries, and Chile is currently the world's second-largest producer. The government considers lithium a strategic resource of national interest and retains tight control over its extraction. Two private firms, SQM-Tianqi and Albemarle, have been granted licenses to extract up to 140,000 and 48,000 tons of lithium per year, respectively (Garcés & Álvarez, 2020).

The mining of copper and lithium is water-intensive, leading to increased challenges in the already water-stressed region. Chile's management of water markets through privatization and commodification has brought the commercial use of water for mining in direct tension with public water use, water needs for ecosystems, and Indigenous water use and cultural values. The commune of San Pedro de Atacama, which contains the Salar, is home to approximately 11,000 people and 16 communities. Half of this population belongs to Indigenous Atacameño (Likan Antai) groups (Liu & Agusdinata, 2020), who traditionally captured and channeled freshwater springs for subsistence agriculture at natural oases along the Andean foothills (Babidge & Bolados, 2018). Beyond subsistence, the Atacameño people believe the water has a sacred character, directly linking it to the land and the people; "water and land are life. The waters cannot be traded. Water is sacred. It is powerful, it is life, it is our vein, it is our blood ..." (Acameño farmer, cited in Jerez et al., 2021).

This case study is important because it sheds light on the issues surrounding Chile's Water Code policies and its effect on Indigenous populations, access to water as a cultural and social good for Indigenous Persons, and the effect of water scarcity on the interrelated rights of affected communities.

The findings in this case study conclude that mining activities, of groundwater abstraction for ore processing and brine evaporation/abstraction, cause water insecurities for Indigenous Persons in the Atacameño communities. Furthermore, mining activities affect several interrelated rights of Indigenous Persons in Chile.



WATER SECURITY ANALYSIS

The economic and hydrosocial characteristics of the Atacameño Indigenous communities that rely on the water resources of Salar de Atacama are fairly homogeneous across the region. Therefore, we group them into one single stakeholder impact category (SIC). However, mining activities in the region are grouped into three distinct categories of hydro-industrial processes (CHIPS):

- **Groundwater for ore processing:** Mining requires several tons of water to concentrate and refine the extracted ore. In the Atacama region, this water is obtained from freshwater aquifers bordering the Salar, which may have a long-term impact on other culturally-significant water resources.
- **Sea water for ore processing:** Increasingly, mining companies substitute groundwater with desalinated seawater, which may affect water availability for local communities over the long term.
- **Brine abstraction for lithium production:** Lithium mining requires the extraction of massive amounts of salty groundwater. There may be long-term effects of the extraction and precipitation of the brine water on certain aspects of water security.

Only one SIC is relevant for this study:

- **Atacameño communities** consist of the Indigenous and farming communities that reside in the area being affected by groundwater pumping and brine abstraction processes.

Groundwater for Ore Processing

The water security assessment was carried out based on peer-reviewed literature that either reports on primary data (Level 3) or modeling results (Level 2). The accuracy level of each assessment is indicated in the results table.

Depending on the ore type, approximately 40-96 tons of water is required to concentrate and refine a ton of copper (Pena and Huijbregts, 2014), and 5-50 tons of water for a ton of battery-grade lithium (Flexer et al., 2018). In 2017, mining companies sourced about 80% of this water from freshwater aquifers adjacent to the Salar. These aquifers have substantial lateral flows towards the Salar, so the extent to which pumping by mining companies affect water availability in traditional springs and oases depends on the spatial configuration of the wells and local topography and hydrogeology condition. Such an effect has been documented or predicted in specific instances (e.g., Salar the Punta Negra, Pampa Colorada), but is certainly not universal. There is generally a high degree of uncertainty in the causal relationship between pumping by mining companies and decreased access to traditional water sources. The nature and amplitude of this uncertainty diverge between the communities (traditional knowledge) and the industries (modeling outputs), and failure to acknowledge and communicate might exacerbate water grievances (Babidge & Bolados, 2018). However, studies have reported a marked decline in traditional agriculture; this decline is associated with mining activities (e.g., Babidge & Bolados, 2018; Jerez et al., 2021). Mechanisms for calculating this decline include a decrease in crop yields, possibly related to aerosols associated with brine evaporation (see the Brine Abstraction section below), and opportunities for wage labor in mining or related industries.

Recent changes in regulations associated with the ratification of the International Labor Organization's Convention No. 169 recognize the territorial and consultative rights of Indigenous communities. This provides a platform for communities to negotiate items including measures for water source protection and cash compensations ($15 million annually for lithium, or 3.5% of the sales value; Garcés & Álvarez, 2020; Jerez et al., 2021). These sources of income and the associated access to imported food have likely increased local food security compared to traditional subsistence farming. Nevertheless, communities feel a sense of vulnerability and social fracturing due to their natural resources being treated as commodities and their communities as "subjects receiving resources" (Jerez et al., 2021). In this context, we associate groundwater abstraction for ore processing with an increase in virtual water security, but a decrease in both cultural water security and potentially blue water security (see Table 1 for definitions of water security).

Table 1. Definitions of Water Insecurity

Blue water insecurity
Refers to the type of water that can be physically transported or moved, such as rivers, lakes, aquifers, and other surface and groundwater sources. In simpler terms, it encompasses bodies of water that are visible and can be accessed for various purposes, such as irrigation, drinking, or industrial use.

Green water
Refers to rainfall and the subsequent effects of its scarcity or its excess, which may be exacerbated if a hydro-industrial process changes the landscape or influences rain patterns. This water cannot be easily accessed like blue water but plays a major role in aspects like farming and city storm resilience.

Economic water insecurity
Refers to the infrastructure, monetary, and resource requirements of accessing water sources that are present. Economic water insecurity occurs when water sources are available, but communities lack the resources to access it in a way that suits their needs. Examples include not being able to afford groundwater drilling technology or water treatment facilities.

Virtual water
Refers to situations where other types of water (blue, green, and economic) hypothetically could be substituted by trade imports. This is especially pertinent for food production, where water-intensive food could be substituted with food imports in order to alleviate the water stress of a region. In cases of blue/green/economic water scarcity, virtual water insecurity arises when food production in a water-scarce region cannot be easily substituted with food from elsewhere, perhaps due to trade restrictions, the isolation or poverty of a particular community, or the presence of physical barriers (such as a natural disaster cutting off a community from typical transportation routes).

Cultural water
Refers to a community's cultural or spiritual relationship to water and any associated activities and services. Often, this type of water often cannot be substituted with water from elsewhere due to the significance of a specific water source in and of itself. The category also refers to sites of significant cultural or spiritual meaning that could be threatened by water-based threats like floods or droughts.

Sea Water for Ore Processing

Mining companies are sourcing an increasing share of their ore processing water from the Pacific Ocean, located 200 km away and 3,500 meters below the Salar. As of 2020, copper operations at La Escondida were obtaining more than 40% of their ore-processing water from the ocean and vowed to stop using locally drawn fresh water by 2030. However, to our knowledge, desalinated seawater is not directly provided to communities, but is instead used by mining companies as a substitute for local groundwater for ore processing. Given the spatial heterogeneity and large uncertainty associated with groundwater flow, the water security implications for local communities are unclear. Nonetheless, ceasing the use of groundwater for ore processing could potentially raise water levels in community wells, suggesting a possible increase in blue water security for Indigenous communities in the Salar. It is worth noting, however, that our analysis does not consider the environmental externalities associated with desalinating and conveying water from the sea (e.g., energy generation, brine disposal), which might have human rights implications beyond the Salar.

Brine Abstraction

Lithium production involves the extraction of massive volumes, approximately 67.5 million cubic members (MCM) per year, (Garcés & Álvarez, 2020) of salty groundwater that lies under the salt flat and contains the Li+ ions. Up to 95% of the original brine water evaporates under ambient climatic conditions (evaporation pans) which allows the lithium to precipitate (Habashi, 1997), making the process the largest source of water consumption by volume. Extracting such a large amount of water has systemic hydrological implications. Remote sensing data estimate that water storage in the region, including soil moisture, groundwater, or surface water, decreases by about one millimeter per year (Liu & Agusdinata, 2020). Other estimates evaluate combined water abstractions to exceed the natural recharge rate by approximately 2 m^3/s (Jerez et al., 2021). This trend of decreasing water storage is statistically significant and substantial, given the arid nature of the region.

However, the extent to which this translates to decreased freshwater availability (as opposed to brine) remains uncertain. On the one hand, the evaporation process transfers long-term water stored as brine back into the active hydrological cycle, as the evaporated water eventually precipitates as rainfall. The degree to which evaporated water precipitates back into the Salar watershed remains an open question. A recent study estimates that approximately 20% of annual rainfall in the watershed is attributable to brine evaporation (Guzmán, 2021). Although this estimate carries substantial uncertainty, it suggests that brine evaporation added a significant amount of freshwater into the active hydrological system, enhancing green water security (i.e., less scarcity).

On the other hand, the gradual depletion of brine aquifers might cause freshwater to seep from the aquifers surrounding the salt flats and contribute to their depletion (Flexer et al., 2018). However, the significance of this phenomenon is very context-specific and depends on local topographic and hydrogeological characteristics, which are often confidential due to commercial interests. The little available information suggests that this phenomenon is not prevalent in the Atacama region (Marazuela et al., 2019), so we report no effect of brine evaporation on community blue water security.



Cultural water insecurity emerges from differing perceptions on the nature of the evaporated brine. The evaporated brine is too salty to be used for any other purpose and so does not have the opportunity costs typically associated with fresh blue water withdrawals. Consequently, firms extracting brine are not required to obtain water rights, which is the legal mechanism to which other industrial water users in the area are subject (Bustos-Gallardo et al., 2021). The Indigenous community, however, does consider brine as water and perceives lithium mining activities as processes by which water is mined and commodified (Jerez et al., 2021). Despite added food security through cash compensation for lithium mining, this process is contrary to the Atacameño world view, which deeply links water and its ecosystems to the land and people (Babidge & Bolados, 2018).

To summarize, we associate brine evaporation with a decrease in cultural water security, a decrease in virtual water security, and a possible increase in green water security.

"Despite added food security through cash compensation for lithium mining, this process is contrary to the Atacameño world view, which deeply links water and its ecosystems to the land and people."

Table 2. Summary of CHIPs vs SICs for Water Security for the Atacameño Communities

	Atacameño Communities
Initial conditions	G-
Groundwater for ore processing	B-* V+ C-
Seawater for ore processing	B+*
Lithium Brine	G+* B0* V+ C-

Table 2: G, B, E, V, and C stand for green, blue, economic, virtual, and cultural water security, respectively. A minus and a plus sign respectively indicate a decrease or increase in water security. Note that a decrease in water security can be associated with either water scarcity (drought) or excess (flood). Asterisks represent Level 2 accuracy in the sense that the assessment is either disputed (i.e., dependent on specific model conditions) or might vary substantially across communities depending on their specific location and local hydrogeology. All other (unmarked) assessments are drawn from peer-reviewed literature that analyzes primary data (Level 3).



WATER GOVERNANCE ANALYSIS

Based on the framework outlined in Section 2.3, we conceptualize governance as the socio-political context guiding the mining or extractive operation. This includes, but is not limited to, the role and influence of state and non-state actors, institutions, and their responsibilities, decision-making practices, and the capacity and interests of local communities where the operations are taking place. We extracted information from academic and gray literature using a spreadsheet with multiple columns mapping to different themes in our framework.

Given limited information in certain subthemes, we consolidated our findings into three major themes at the core of the governance framework: Chile's Water Policy Regime; Major Actors and Power Asymmetries in Chile's Water Policy Landscape; and Indigenous Participation, Water Rights, and Conflicts.

We find in Chile's case that the Water Code, underpinned by a neoliberal economic model, has privileged commercial water use for mining over other uses. In some cases, the Code granted exclusive water use rights to transnational mining companies without regard for Indigenous property, land, and livelihood, undermining community autonomy over water use decisions and causing conflicts. Mining is economically beneficial to the Chilean state, but for decades, many Indigenous peoples and rural communities have lost their water rights to mining and water companies, leading to land abandonment. Disjointed institutional arrangements and a lack of coordinated land and water governance have enabled intensive use of both surface and groundwater, resulting in negative ecological impacts on wetlands and other fragile ecosystems. Historically, regulatory lapses in the water sector, weak institutional protections for Indigenous Peoples and their land, and lack of appropriate revisions to the Water Code, led to conflicts among mining companies, local and Indigenous communities, and state agencies. Without an effective state and strong institutions for water, land, and environmental management, some communities formed partnerships with mining companies and negotiated new water use terms. While these partnerships are imperfect, they underscore the need for mining companies to dialogue, engage with communities, and be more transparent about their impacts. More recently, however, the Chilean government has responded to public pressure and mass protests to strengthen its regulation of water used for mining.

Chile's Water Policy Regime

Driven largely by neoliberal economic policies during the Pinochet regime (1973-1990), Chile instituted a Water Code in 1991, which commodified its water resources and handed considerable oversight to transnational corporations. The Water Code created a free market for water rights by deregulating its use and extraction, and it entirely privatized water management, supply, and allocation (Babidge & Bolados, 2018).



One goal of the Water Code was to drive economic growth by boosting the country's extractive and irrigation industries. The Water Code was set up to restrict state regulation of the water sector so as to streamline the acquisition and protection of private water rights. The Code allowed water rights to be purchased, sold, or transferred without any state involvement (Romero et al., 2012). These regulations were part of broader neoliberal economic policies that pushed for decentralized decision-making, resulting in an intensive abstraction of surface and groundwater, and encroachment on Indigenous land resources. The Chilean water law defines "use" in terms of water extraction (Borgias, 2018). The Water Code also gave state-based institutions the mandate to grant water rights to private corporations, enabling the latter to extract both surface and groundwater without accountability. Ultimately this vacuum of government oversight created conditions where power and profit determined the preservation or removal of water rights, and corporations were in charge of outlining their own water-use regulations.

Most of Chile's water governance challenges stem from inconsistencies in water rights and regulations due to weak governance in the decades since the Water Code's enactment (Boddenberg and Mortensen, 2020). Despite the intricate connections between land and water, water rights are allocated separately from land under the Code, with very little government regulation of land-water exchanges (Borgias, 2018). The separation of land and water governance was done on purpose to limit any constraints on water use (Romero et al., 2012). This separation of land and water-based institutions, in addition to poor coordination between institutions, is a form of governance failure that enables mining companies to extend their operations into Indigenous conservation territories and biodiversity protection sites without penalty. As a result, competition for water has increased. Even though a 1993 Indigenous Law recognized Indigenous rights over water on traditional land (Babidge & Bolados, 2018), many Indigenous people have lost their water rights to mining and drinking water companies (Romero et al., 2012). With no clear government requirements, companies have provided no transparent measurements of water extraction in Atacama, nor adequate information on the water supply in the area (Sherwood and Cambero, 2018).

Major Actors and Power Asymmetries in Chile's Water Policy Landscape

Multiple actors with different stakes, motivations, and interests operate in Chile's water policy landscape. These include mining companies/projects such as Candelaria-Lundin, Cerro Negro Norte-CNN-CAP, Caserones, and Mantoverde-Anglo American, as well as the government, Indigenous groups, farming communities, and social activists. National and international mining companies attempt to acquire the necessary water resources by buying water rights from local communities, installing wells, regularizing illegal logging, etc. (Romero et al., 2012). While many actors are involved in water management in Chile, transnational and national mining corporations control most water resources (Jerez et al., 2021).

"Ultimately this vacuum of government oversight created conditions where power and profit determined the preservation or removal of water rights, and corporations were in charge of outlining their own water-use regulations."

Although mining companies in Chile are repeatedly criticized for their water use, community engagement tactics, and water rights violations, some do engage with communities through corporate social responsibility strategies. Some companies provide financial resources for community needs in exchange for water (Jerez et al., 2021). For example, in 2012 and 2016, Albemarle signed agreements with Atacameño to provide funds for community projects (Jerez et al., 2021). Similarly, in 2007, an Atacameño community partnered with Minera Escondida, a mining company, to renew a ten-year water deal and incorporate new arrangements for better environmental reporting and community development (Babidge, 2013). Other companies have compensation measures in place, though these are mostly environmentally focused rather than socially focused, e.g., habitat enhancement and fish restocking (Campero et al., 2021). Caserones' environmental impact assessment (EIA) approval included terms to supply locals with desalinated water while they continued consuming groundwater. It should be noted that efforts like this, however, create dependency relationships (Campero et al., 2021).

Indigenous Participation, Water Rights, and Conflicts

Numerous conflicts have occurred between companies, the government, and Indigenous communities as the depleted water supply threatens the local cultural heritage, livelihoods, and spiritual and cultural practices (Garcés & Álvarez, 2020; Babidge, 2016). Conflicting viewpoints between Andean cultures who see water as an essential part of their community and livelihoods, and corporations who see water as a commodity, have led to protests, hunger strikes, and lawsuits. Atacameño rituals involving "feeding" the Earth, utilize water and are threatened by drought (Babidge, 2016). Indigenous moral teachings emphasize interconnectedness with nature through water and are conceptually opposed to mining water stewardship (Babidge, 2016).

As previously mentioned, the Chilean government has not enforced rules regarding Indigenous prior consent, which has led to Indigenous Peoples' difficulties in obtaining justice, especially given that these communities have few formal property rights (Boddenberg and Mortensen, 2020). In some instances, companies claim water rights illegally, taking away resources from Indigenous people and rural communities and forcing them to relocate without the ability to effectively protest (Romero et al., 2012). Government oversight could ensure transparency when it comes to how water is managed. However, in reality, a lack of transparency has hindered Indigenous communities' abilities to calculate the impact, and therefore inhibited their ability to resist. As an example, quantities of extracted water are often invisible to local people (Babidge, 2016). Additionally, the mining industry has had disastrous effects on the wildlife and biodiversity of the Atacama region due to their exploitation of water resources, which in turn has threatened agriculture and tourism in these communities (Babidge, 2016).



Recently, there have been many water-related suits filed against mining companies (specifically Albemarle and SQM) detailing the exploitation of resources due to the fact that no clear limits have been placed on water extraction, nor have the companies provided adequate information on water supply in the area (Sherwood and Cambero, 2018). Other conflicts surround the extent of ecological damage done by mining companies. The Peoples' Council organized street rallies against the Minera Escondida Limitada (MEL) extraction proposal of Pampa Colorada; NGOs supported this through campaigns and petitions; and Chile's environmental commission, la Comisión Regional del Medio Ambiente (COREMA), rejected the environmental impact assessment for MEL's project (Babidge, 2016). Social movement actors have taken the role of monitoring extractive development, facilitating legal reforms, and promoting different development models to fill in for the weak regulatory work of the state (Borgias, 2018).

These conditions clearly demonstrate the need for the Chilean government to update its water management policies. However, the pathway forward is not straightforward. Recently regulations and restrictions have been introduced that pressure companies to consult Indigenous groups. However, movements like these often force mining companies to implement expensive water solutions (such as establishing desalination plants) that are not always financially feasible (Azzopardi, 2020). There is also a scholarly debate about the new Chilean constitution weakening water protection as private property (Azzopardi, 2020).

Neither the Chilean authorities nor the companies have a clear picture of the water situation, making any decision difficult (Sherwood and Cambero, 2018). The Plurinational Observatory of Andean Salt Flats (Opsal), a civil society advocacy organization, advocates for a holistic approach to regulating the Atacama that respects ecology and culture and allows for Indigenous participation in water governance. Meanwhile, many progressives were elected into Chile's constitutional assembly in 2021, which serves as a chance to enact inclusive water and other preservation laws. If these water rights advocates succeed in lobbying for the enactment of inclusive water laws, the focus will shift to the government's ability and willingness to clarify and enforce rights, regulations, and monitoring going forward.

LEGAL MATRIX AND NARRATIVE

In this subsection, we apply a legal decision-making matrix to assess the human rights consequences of water insecurity. We focus specifically on the two water management measures that created water insecurity impacts: groundwater abstraction for ore processing and brine evaporation. We exclude sea water conveyance policies from this assessment due to the preliminary finding of no probable impact on water insecurity or stress. We use the following Water Insecurity and Governance Analytical and Legal Matrices to frame human rights law-based inquiries required for a detailed assessment of company operations, whether through groundwater abstraction or brine evaporation, and the company's human rights impacts. At this juncture, given the brief synthesis of the case study, we do not introduce any granular assessment of attribution or imputation of responsibility to either business actors or State actors. However, we intentionally highlight potential human rights violations that may involve legal responsibility toward affected communities, such as Indigenous peoples, rural or urban communities, and particularly vulnerable groups including women, children, and persons with disabilities. Neither do we consider, at this point, any possible legal defenses against responsibility. The main objective of applying the Water Insecurity Analytical and Legal Matrices is to guide, frame, and prepare the human rights law-based assessments (as well as any fact-finding or field investigations). These assessments should inform any subsequent company-level decision-making process concerning the human rights impacts of each water management measure.

WATER INSECURITY ANALYTICAL AND LEGAL MATRIX:

Table 4. Water Security Analytical and Legal Matrix: Groundwater Abstraction for Ore Processing

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
A. Is groundwater abstraction for ore processing consistent with the Republic of Chile's cross-cutting human rights law obligations?	**Availability of Water**: Challenges to availability for all demographics affected. **Water Quality**: Possible diversity in water quality. **Accessibility of Water**: Challenges for all communities to access water.	**Water as a Social Good**: Not clear from the described measure if the measure takes into account the nature of water as a social good. **Water as a Cultural Good**: The described measure completely overlooks the nature of water as a cultural good for Indigenous peoples of the Atacama region.	**Protection and Preservation of Intergenerational Rights and Interests**: Not described in the case study. **Non-Retrogression Obligation:** Not described in the case study if the Republic of Chile and the private sector operators of groundwater abstraction are taking steps to avoid a lower quality of human rights protection.
1. Right to Self-Determination	Investigate possible adverse impacts to the Atacama Indigenous peoples' free pursuit of economic, social and cultural development.	Does groundwater abstraction for ore processing recognize that water held as a social and cultural good affects Atacama Indigenous peoples' free pursuit of economic, social and cultural development? Does the International Labor Organization (ILO) Convention 169 consultation and compensation mechanism suffice to respect the right of Atacama Indigenous peoples to self-determination, particularly the free pursuit of their development in relation to water as a social and cultural good?	Requires further investigation if the groundwater abstraction operations contain any counterpart policy for sustainability and non-retrogression (not lowering the human rights protections of Atacama Indigenous peoples and Salar communities). If there is such a sustainability policy written into the groundwater abstraction operations, is it consistent with their right to self-determination?
2. Non-Discrimination	Uncertainty in pumping by mining companies and decreased access to traditional water sources could infringe the non-discrimination obligation owed towards Atacama Indigenous peoples	When water is treated only as a commodity or economic resource, and groundwater abstraction for ore processing wholly overlooks the nature of water as a social good and cultural good (especially with 80% freshwater coming from Salar aquifers), is there differential treatment, based on a prohibited ground (e.g. ethnicity or culture), with the intent to discriminate, that impedes the enjoyment of the right to water in its dimensions as social and cultural goods?	If there is a sustainability policy that applies to groundwater abstraction operations, is it consistent with the guarantee against non-discrimination?

Table 4. Water Security Analytical and Legal Matrix: Groundwater Abstraction for Ore Processing Continued

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
3. Free Disposition of Natural Resources	Documented interference with freshwater aquifers bordering the Salar raises questions on the Atacama Indigenous peoples' rights to freely dispose of their natural resources under the principle of mutual benefit and international law. This requires further investigation to determine if the compensation and consultation mechanism to negotiate with Atacama Indigenous peoples under domestic law is consistent with the right to free disposition.	Did the original arrangements reached by the private sector mining companies to conduct groundwater abstraction for ore processing contain any language that obtained free and meaningful consent by the Atacama Indigenous peoples (and other affected communities in the Salar) to the free disposition of their natural resources, especially as to water dispositions through pumping by mining companies, that result in counterpart decreases in available water to Indigenous peoples and other affected communities?	Did the original arrangements reached by the private sector mining companies to conduct groundwater abstraction for ore processing contain any sustainability policy, where such policy is informed by the right to free disposition of natural resources of the Atacama Indigenous peoples and affected Salar communities, based on the principle of mutual benefit and international law?
4. Non-Deprivation of Subsistence Means	Investigate if groundwater abstraction for ore processing is depriving Atacama Indigenous peoples of means of subsistence	Investigate if the long-term implementation of groundwater abstraction for ore processing would result in deprivation of water as a social good and cultural good in a manner that erodes their means of subsistence.	Investigate if the formulation and implementation of a sustainability policy could help avoid triggering any deprivation of water as a means of subsistence, especially for Atacama Indigenous peoples and the most vulnerable groups.
5. Right to Equal Enjoyment of Human Rights	Investigate if all water users (especially vulnerable groups such as women, children, persons with disabilities, Atacama Indigenous peoples) are equally enjoying all human rights in the context of the ongoing groundwater abstraction processes	When water use, allocation, and extraction is regarded exclusively as a matter of managing economic resources, while at the same time excluding the multiple dimensions of water as social and cultural goods, there is NO equal enjoyment of all human rights by the Atacama Indigenous peoples, and other affected Salar communities.	Investigate if any sustainability policy formulated and applied to groundwater abstraction for ore processing would uphold or undermine the right of Atacama communities and peoples to equal enjoyment of human rights.

Table 4. Water Security Analytical and Legal Matrix: Groundwater Abstraction for Ore Processing Continued

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
B. Is groundwater abstraction for ore processing consistent with the Republic of Chile's specifically interrelated human rights?	***Requires fact-finding and field investigation in specific community contexts and into company operations and oversight over groundwater abstraction for ore processing**	***Requires fact-finding and field investigation with affected Salar communities and Atacama indigenous peoples, as well as Chilean environmental and cultural ministry/regulatory authorities**	***Requires fact-finding and field investigation (especially interviews with affected communities and Chilean regulatory authorities)**
Availability of Water	1. Rights to highest attainable standard of physical and mental health 2. Rights to work and just and favorable work conditions 3. Specific human rights protections for vulnerable groups (women, children, Indigenous peoples, persons with disabilities, etc.) 4. Rights to an adequate standard of living 5. Baseline civil and political freedoms	Specific human rights (treaty-based and custom-based) to the preservation and protection of social and cultural goods, including environmental preservation of natural resources and public commons, as well as Indigenous peoples' rights to cultural integrity, identity, and human dignity	1. Human right to a healthy environment and the State's duties to prohibit causing transboundary harm 2. Human rights-related legal principles on accountable governance, transparency in governmental decision-making, and community participation in public affairs 3. International Covenant on Economic, Social, and Cultural Rights (ICESCR) Article 2 progressive realization and non-retrogression obligations 4. Are Sustainable Development Goals (SDG) 6 targets adversely affected by groundwater abstraction for ore processing?
Water Quality	1. Right to the highest attainable standard of physical and mental health 2. Right to a healthy environment 3. Right to benefits of scientific progress and applications	Do the scientific and technical standards on water quality also consider its multidimensional uses/nature as social goods and cultural goods?	Do the scientific and technical standards on water quality contain any considerations for long-term sustainability of water quality for future generations, and the non-retrogression of these water quality standards as applied to all Atacama communities?

Table 4. Water Security Analytical and Legal Matrix: Groundwater Abstraction for Ore Processing Continued

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
Accessibility of Water	1. **Physical Accessibility**: Does groundwater abstraction for ore processing generate impacts on civil and political rights to freedom of movement and choice of residence, privacy, security, as well as rights to just and favorable conditions of work, education, cultural participation, and gender equality? 2. **Economic accessibility**: Does groundwater abstraction for ore processing (or any reliance on privatized markets for water) result in less affordable water for Atacama Indigenous peoples and other affected communities in the Salar? How do groundwater abstraction operations affect Chile's obligation under ICESCR Article 2(1) to take steps for the progressive realization of Covenant rights, such as social security, social insurance, social protection measures? 3. **Informational accessibility**: Do Atacama Indigenous peoples and Salar communities have rights to information, public participation, and transparency with respect to these groundwater abstraction operations?	Does water accessibility factor in the need for water as a social and cultural good to Atacama Indigenous peoples and affected Salar communities?	Do accessibility policies consider the long-term sustainability of access to water for all communities, and not just the mining companies or industrial users?



Table 5. Water Security Analytical and Legal Matrix: Brine Evaporation or Abstraction

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
A. Is brine evaporation/abstraction consistent with the Republic of Chile's cross-cutting human rights law obligations?	**Availability of Water**: Challenges to availability for all demographics affected. **Water Quality**: Possible diversity in water quality. Accessibility of Water: Challenges for all communities to access water. *NOTE that it is not clear from the case study if brine evaporation resulted in the gradual depletion of brine aquifers or actually added a substantial amount of freshwater into the active hydrological system	**Water as a Social Good**: It is not clear from the described measure if the measure takes into account the nature of water as a social good. **Water as a Cultural Good**: The described measure completely overlooks the nature of water as a cultural good for Indigenous peoples of the Atacama region. *NOTE that brine extraction does not require firms to obtain water rights, since evaporated brine is too salty for any other purpose that it is not understood as an economic resource of water. However, note that Atacama Indigenous communities still view brine as water, consistent with their multidimensional understanding of water as a social and cultural good.	**Protection and Preservation of Intergenerational Rights and Interests:** Not described in the case study. **Non-Retrogression Obligation:** It is not described in the case study if the Republic of Chile and the private sector operators of groundwater abstraction are taking steps to avoid a lower quality of human rights protection. *Given the ambiguous nature of brine (not water according to economic approaches, but water for cultural and Indigenous communities), would a sustainability policy be feasible?
1. Right to Self-Determination	Investigate possible adverse impacts on the Atacama Indigenous peoples' free pursuit of economic, social and cultural development	Does brine evaporation and abstraction recognize that water held as a social and cultural good affects Atacama Indigenous peoples' free pursuit of economic, social and cultural development? Does the ILO Convention 169 consultation and compensation mechanism suffice to respect the right of Atacama Indigenous peoples to self-determination, particularly the free pursuit of their development in relation to water as a social and cultural good?	Requires further investigation to determine if the brine evaporation or abstraction contain any counterpart policy for sustainability and non-retrogression (not lowering the human rights protections of Atacama Indigenous peoples and Salar communities). If there is such a sustainability policy written into the brine evaporation or extraction operations, is it consistent with their right to self-determination?
2. Non-Discrimination	Is brine evaporation a de jure or de facto discriminatory operation, when Chilean law does not in fact recognize brine as legally protected water?	When water is treated only as a commodity or economic resource, is there differential treatment, based on a prohibited ground (e.g. ethnicity or culture), with the intent to discriminate, that impedes the enjoyment of the right to water in its dimensions as social and cultural goods? When brine evaporation or abstraction wholly overlooks the nature of water as a social good and cultural good, is there differential treatment, based on a prohibited ground (e.g. ethnicity or culture), with the intent to discriminate, that impedes the enjoyment of the right to water in its dimensions as social and cultural goods?	If there is a sustainability policy that applies to brine evaporation and abstraction operations, is it consistent with the guarantee against non-discrimination?

Table 5. Water Security Analytical and Legal Matrix: Brine Evaporation or Abstraction Continued

TWO-TIERED TEST	ADEQUACY	MULTIDIMENSIONALITY	SUSTAINABILITY
3. Free Disposition of Natural Resources	Not clear from the case study whether the brine evaporation or abstraction arrangements were done with appropriate consultation with and consent of Atacama Indigenous peoples. It requires further investigation to determine if the compensation and consultation mechanism for negotiating with Atacama Indigenous peoples under domestic law is consistent with the right to free disposition.	Did the original arrangements reached by the private sector mining companies, to conduct brine evaporation or abstraction, contain any language that obtained free and meaningful consent by the Atacama Indigenous peoples (and other affected communities in the Salar)? If so, did such language enable the free disposition of their natural resources, especially as to water dispositions through pumping by mining companies that result in counterpart decreases in available water to Indigenous peoples and other affected communities?	Did the original arrangements reached by the private sector mining companies to conduct brine evaporation or abstraction contain any sustainability policy based on the principle of mutual benefit and international law? If so, is this policy informed by the right to free disposition of natural resources of the Atacama Indigenous peoples and affected Salar communities?
4. Non-Deprivation of Subsistence Means	Investigate whether brine evaporation or abstraction is actually depriving Atacama Indigenous peoples of their means of subsistence considering that brine does not have economic or household consumption uses.	Investigate if the long-term implementations of brine evaporation or abstraction would result in deprivation of water as a social good and cultural good, in a manner that erodes their means of subsistence.	Investigate if the formulation and implementation of a sustainability policy could help avoid triggering any deprivation of water as a means of subsistence, especially for Atacama Indigenous peoples and the most vulnerable groups.
5. Right to Equal Enjoyment of Human Rights	Investigate if all water users (especially vulnerable groups such as women, children, persons with disabilities, and Atacama Indigenous peoples) are equally enjoying all human rights in the context of the ongoing brine abstraction processes, given that brine is devoid of economic or household consumption uses.	When brine use, allocation, and extraction is regarded exclusively as a matter of managing a resource that is NOT legally regarded or protected as a water resource, while at the same time excluding its possible multiple dimensions of brine as social and cultural goods, there is NO equal enjoyment of all human rights by the Atacama Indigenous peoples, and other affected Salar communities.	Investigate if any sustainability policy formulated and applied to brine evaporation or abstraction would uphold or undermine the right of Atacama communities and peoples to equal enjoyment of human rights.

Table 5. Water Security Analytical and Legal Matrix: Brine Evaporation or Abstraction Continued

TWO-TIERED TEST	ADEQUACY	MULTI DIMENSIONALITY	SUSTAINABILITY
B. Is brine evaporation or abstraction consistent with the Republic of Chile's specifically interrelated human rights?	***Requires fact-finding and field investigation in specific community contexts, as well as into company operations and oversight of brine abstraction and evaporation operations.**	***Requires fact-finding and field investigation with affected Salar communities and Atacama Indigenous peoples, Chilean environmental and cultural ministry/regulatory authorities.**	***Requires fact-finding and field investigation (especially interviews with affected communities and Chilean regulatory authorities).**
Availability of Water	1. Rights to the highest attainable standard of physical and mental health. 2. Rights to work and just and favorable work conditions 3. Specific human rights protections for vulnerable groups (women, children, Indigenous peoples, persons with disabilities) 4. Right to an adequate standard of living 5. Baseline civil and political freedoms	Specific human rights (treaty-based and custom-based) to preservation and protection of social and cultural goods, including environmental preservation of natural resources and public commons, Indigenous peoples' rights to cultural integrity, identity, and human dignity	1. Human right to a healthy environment and State duties to prohibit causing transboundary harm. 2. Human rights-related legal principles on accountable governance, transparency in governmental decision-making, community participation in public affairs 3. ICESCR Article 2 progressive realization and non-retrogression obligations. 4. Are SDG 6 targets significantly and negatively affected by brine evaporation or abstraction operations?
Water Quality	1. Rights to the highest attainable standard of physical and mental health 2. Right to a healthy environment 3. Right to benefits of scientific progress and applications	Do the scientific and technical standards on water quality also consider its multidimensional uses/nature as social goods and cultural goods?	Do the scientific and technical standards on water quality contain any considerations for the long-term sustainability of water quality for future generations, and the non-retrogression of these water quality standards as applied to all Atacama communities?

Table 5. Water Security Analytical and Legal Matrix: Brine Evaporation or Abstraction Continued

TWO-TIERED TEST	ADEQUACY	MULTI DIMENSIONALITY	SUSTAINABILITY
Accessibility of water	1. Physical accessibility: Does brine evaporation or abstraction generate impacts on civil and political rights to freedom of movement and choice of residence, privacy, security, as well as rights to just and favorable conditions of work, education, cultural participation, and gender equality? 2. Economic accessibility: Does brine evaporation or abstraction (or any reliance on privatized markets for water) result in less affordable water for Atacama Indigenous peoples and all other affected communities in the Salar? How do brine evaporation operations affect Chile's obligation under ICESCR Article 2(1) to take steps for the progressive realization of Covenant rights such as social security, social insurance, social protection measures? 3. Informational accessibility: Do Atacama Indigenous peoples and Salar communities have rights to information, public participation, transparency with respect to these brine evaporation or abstraction operations?	Does water accessibility factor in the need for accessibility based on water as a social and cultural good to Atacama Indigenous peoples and affected Salar communities?	Do accessibility policies consider the long-term sustainability of such access to water for all communities, and not just the mining companies or industrial users?



Table 6. Water Governance Analytical and Legal Matrix

ELEMENTS OF THE HUMAN RIGHT TO WATER AND RELATED RIGHTS	INDICATOR 1: INFLUENTIAL ACTORS IN WATER GOVERNANCE	INDICATOR 2: EVIDENCE OF PARTICIPATORY, INCLUSIVE, OR DECENTRALIZED WATER MANAGEMENT	INDICATOR 3: TRANSPARENCY AND ACCOUNTABILITY ARRANGEMENTS AND ENFORCEMENT	INDICATOR 4: THREATS TO HYDROSOCIAL (LIVELIHOOD, CULTURAL, RELIGIOUS) RELATIONS
Element 1: ADEQUACY **Availability of water** **Water Quality** **Accessibility of Water** a) Cross-cutting Obligations b) Interrelated and Specific Human Rights Obligations of the Republic of Chile	Does the vacuum in governmental oversight make corporations wholly autonomous in determining their own water use and water adequacy regulations? *For field investigation	Do mining companies' engagements with Chilean Indigenous peoples and specifically vulnerable affected communities, through corporate social responsibility strategies suffice in providing evidence of desired participation and decentralization?	Does Chilean law (especially under the Water Code) sufficiently address information transparency on policies affecting adequacy? Does Chilean law provide for accountability for violations to the Water Code? Does the Chilean government enforce the Water Code and related environmental and Indigenous laws?	Given existing threats to hydrosocial relations in the Atacama, what role is there under Chilean law that provides for the responsibility of Chilean water regulators and government leaders? What is the business (ethical and legal) responsibility of the private sector operating in the Atacama region when they affect the adequacy of water with threats to hydrosocial relations?
Element 2: MULTIDIMENSIONALITY **Water as a Social Good** **Water as a Cultural Good** a) Cross-Cutting Obligations b) Interrelated Specific Human Rights Obligations of the Republic of Chile	Does the Water Code's allocation of water rights separately from land rights effectively recognize the multidimensionality of water? *For field investigation, due diligence, and legal analysis with Chilean legal experts	Do the disputes involving water rights and Indigenous participation vis-à-vis the operation of corporate actors provide for meaningful, comprehensive, and equally-resourced participation by all parties to the dispute resolution process?	Given the dearth of holistic or integrated regulations within the Atacama region that respects ecology, culture, and allows for Indigenous participation in water governance, what role can the private sector play?	Do current public and private responses to threats to hydrosocial relations recognize the multidimensional nature of water and the ensuing legal obligations of the Republic of Chile? What is the business (ethical and legal) responsibility of the private sector when threats to hydrosocial relations arise?
Element 3: SUSTAINABILITY **Protection and Preservation of Intergenerational Rights and Interests** **Non-retrogression Obligation** a) Cross-cutting Obligations b) Interrelated and Specific Human Rights Obligations of the Republic of Chile	Are the sustainability policies (if any) of the influential actors in water governance sufficiently consistent with the Republic of Chile's cross-cutting and interrelated human rights obligations of the Republic of Chile? Does the Chilean Government have any role in prescribing sustainability standards to these influential actors?	Do Chilean Indigenous peoples and specifically vulnerable affected communities have any co-authorship over sustainability policies crafted by the influential State and non-State (corporate) actors in water governance? Is there an environment that engages multiple approaches of sustainability?	Does the Chilean water policy and institutional environment make it easier to monitor and extend sustainability oversight? Is there transparency, a defined fair accountability mechanism, and strong enforcement of sustainability guarantees?	Do threats to hydrosocial relations impact the long-term ability of the Republic of Chile to safeguard and ensure sustainability? To what extent can the private sector have a role in supporting and respecting sustainability in the face of threats to hydrosocial relations?

DISCUSSIONS AND CONCLUSION

The legal analysis for water insecurity reveals that embarking on mining activities would adversely affect multiple rights of the Atacameño Indigenous communities, ranging from water adequacy to the multidimensional uses of water as a social and cultural good. Furthermore, the impact of mining activities on these communities raises concerns about long-term sustainability.

The foremost human rights challenges include the rights to the highest attainable standard of physical and mental health, a healthy environment, and employment for Indigenous communities. Furthermore, mining activities raise questions of crosscutting human rights obligations—such as the rights to self-determination, non-discrimination, free disposition of natural resources, and non-deprivation of affected communities' means of subsistence.

The legal analysis of water governance failures raises questions about how weak Chilean law and governmental oversight may create conditions for unregulated corporate management of water, which in turn impacts the rights of Indigenous communities in the Atacama region. In addition to interrogating the governance architecture of the country, the matrix also emphasizes the importance of Indigenous participation in decision-making. This participation relies heavily on corporate transparency and a willingness to integrate Indigenous perspectives, particularly regarding the multidimensional uses of water for social and cultural purposes.



Caveat

The analysis presented in this case study represents the first application of the Realizing Rights for Water Framework. Consequently, it does not target a specific audience for the legal analysis but instead maps out indicators and issues relevant to both government entities and mining companies.

Additional Reflections on the Analytical and Legal Matrices

The Water Governance Failure Analytical and Legal Matrix is, in reality, a strategic template for setting the parameters for a more detailed multidisciplinary, mixed methods assessment of Chile's compliance or non-compliance with the human right to water in the specific context of the Atacama region. This compliance, or lack thereof, may be borne out of the absence of regulation, the deficiency of existing regulations, or the poor enforcement of regulatory requirements on private actors. This template/framework can provide useful direction for researchers to understand the topography of elements, cross-cutting obligations, and interrelated specific human rights obligations that gravitate around the human right to water as a matter of law, policy, and governance. It can also clarify the factual and legal questions necessary to provide the most comprehensive and integrative picture of the consistency or inconsistency of a set of business operations as they relate to the human right to water. The framework is open to quantitative and qualitative approaches that can address these factual and legal questions in order to approximate the best research practices to inform business decision-making.

Thus, unlike the narrow 'indicators' approach (e.g. the Danish Institute for Human Rights, The AAAQ Framework, and the Right to Water), we do not, ex-ante, prescribe data points or set proxy values (e.g., infant nutrition statistics or maternal mortality as the basis for checking the box or indicator on the right to health) for eliciting answers to the factual and legal questions we identify in either the Water insecurity Analytical and Legal Matrices. Nor do we cabin our analysis of the human right to water in isolation from all interdependent, indivisible, and universal human rights. Likewise, the above Water Governance Failures Analytical and Legal Matrix does not take prescriptive or normative directions but rather sets the parameters of inquiries and field investigations on water governance failures in relation to the elements of the human right to water, cross-cutting human rights obligations and specifically interrelated human rights obligations of the State concerned. Neither do we, at this point of preliminary mapping, preoccupy ourselves with any purported definitive characterizations of "violation" versus "no violation" of human rights law, which many indicator-based approaches tend to prematurely conclude, often based on a fragmented assessment of both facts and law.

Our multidisciplinary framework invites layered scrutiny into the consequences of business decisions and operations, recognizing that a more extended human rights impact assessment, human rights due diligence process, and even possibly a post-operation human rights audit will require answering the factual and legal questions we frame under our comprehensive analytical and legal framework. Only after necessary field investigations, fact-finding, and data analysis can one definitively test facts against the relevantly applicable law, including written laws such as statutes, codes, administrative regulations, and jurisprudence in common law jurisdictions, as well as unwritten laws like customary law, regional law, and international law as applicable to the State concerned.

> "This template/framework can provide useful direction for researchers to understand the topography of elements, cross-cutting obligations, and interrelated specific human rights obligations that gravitate around the human right to water as a matter of law, policy, and governance."

In the case of the Lithium triangle in Chile, it is clear from this preliminary examination that the cultural water insecurity and possible blue water insecurity arising from groundwater abstraction for ore processing, as well as the cultural water insecurity in brine evaporation or abstraction, also invites attention to likely human rights impacts on the right to water and related cross-cutting and interrelated human rights violations. The apparent water governance failures in Chile, as contextualized from the standpoint of influential actors, evidence of participation, transparency, accountability, and threats to hydrosocial relations, likewise yield preliminary sites of apparent gaps and inconsistencies in human rights law compliance. Our framework attests to the need for business decision-makers to elicit the necessary information under feasible and actionable frameworks to inform their policies well before any hard conclusions of violations, factual assertions, or legal characterizations are made involving the human right to water and its corresponding cross-cutting obligations and interrelated human rights.

> "Our framework attests to the need for business decision-makers to elicit the necessary information under feasible and actionable frameworks to inform their policies well before any hard conclusions of violations, factual assertions, or legal characterizations are made involving the human right to water and its corresponding cross-cutting obligations and interrelated human rights."

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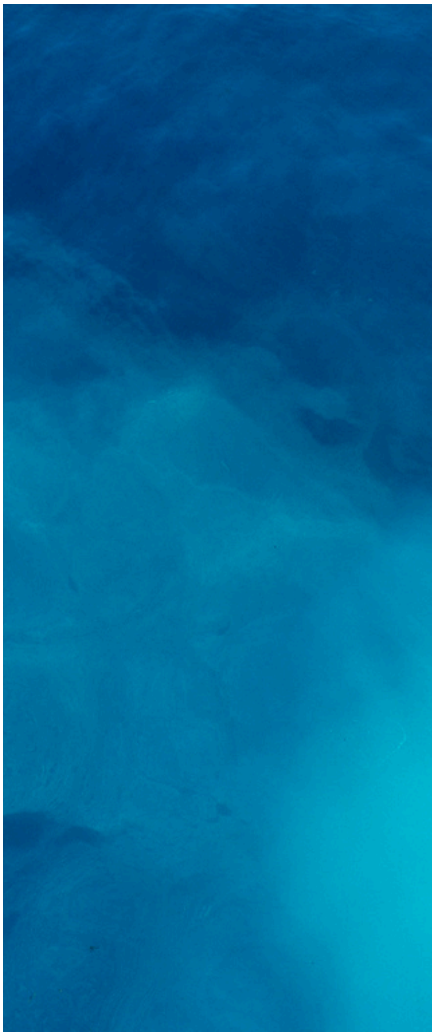
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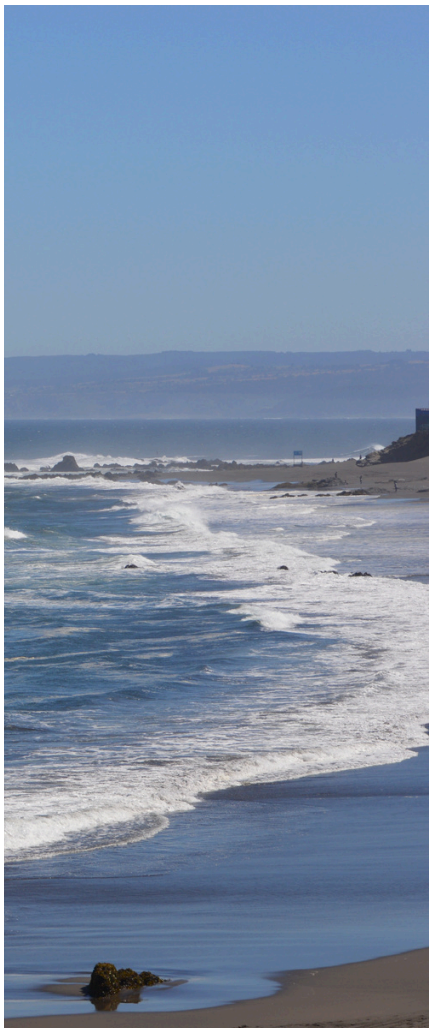




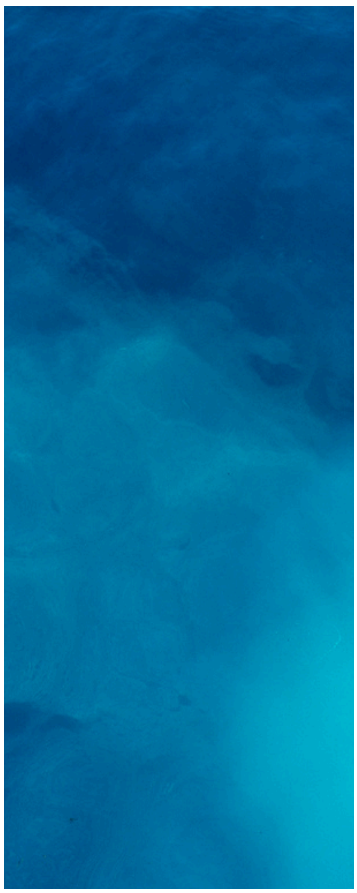














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3150 Jenkins Nanovic Halls
Notre Dame, Indiana 46556 USA
(574) 631-2940
pulte.nd.edu