Viña Concha y Toro
FAMILY OF NEW WORLD WINERIES
Empresa B Certificada

Viña Concha y Toro Corporate Water Footprint Report

Period 2023

Sustainability Division

c

Content

Introduction

Freshwater is an increasingly scarce resource globally, and demand for it continues to rise, threatening its availability. As demand for water from all users increases, groundwater is being depleted, other aquatic ecosystems are being polluted and degraded, and it is becoming increasingly expensive to develop new sources of water.

Of all the sectors of the economy, agriculture is the most sensitive to a scenario of water scarcity. According to the records kept by "The World Bank" for Chile, the agricultural sector accounts for 70% of global annual freshwater withdrawals and more than 73% of consumptive use. On the other hand, it is the sector with the most possibilities or options for adjusting its use.

In almost all regions of the world, evapotranspiration from irrigated agricultural land represents the largest consumptive use of water withdrawn for human use. Agricultural water use continues to be determined by the steady growth in demand for agricultural products to meet the needs of the population.

In order to solve the difficulties mentioned above, several methodologies have emerged in recent years related to accounting for the use of water in the production of goods and services. One of the most widely used methodologies is the Water Footprint, which stands out because it quantifies, through a Life Cycle Analysis (LCA), not only the water consumed directly in the production of a good, but also considers its use in the supply chain and the alteration after it is used.

The term "Water Footprint" (or WFP) and the methodology were coined by Professor A.Y. Hoekstra and developed together with researchers from the University of Twente. Today the methodology has been adopted by a large number of companies and international organizations in their analysis programs.

Water Footprint measurement is ultimately intended to inform user decisions on resource allocation and in turn, improve public and investor confidence in how water resources have been managed and used during the reporting period. The WFP methodology for accounting, which allows water use analysis, considers 4 phases:

- Determine the objectives and level of analysis.
- Water Footprint Accounting.
- Analysis of WF sustainability.
- Formulation of a response.

The determination of the objectives and the level of analysis depends on the purpose or objective and can be at the global, national, regional, basin, company or product level. Within the framework, the measurement of the water footprint should consider two parts, the first is the direct footprint which refers to the consumption and pollution of freshwater caused by direct use by the nation, industry or individual. The second part is the indirect footprint which refers to water consumption and pollution associated with the production of raw materials or the supply chain.

This scheme, when applied to an industry, determines the direct footprint as the sum of the consumption of the production process plus an overhead, which is the consumption of the company that is not related to production. On the other hand, the indirect footprint corresponds to the footprint of the supply chain, which in turn is broken down into water consumption related to the production of supplies and their overhead.

Concha y Toro, as the leading exporter of wines in Latin America and one of the most important wine brands in the world, has made a commitment to its consumers to deliver products of excellent quality that also respond to the company's environmental commitment. For this reason, through its sustainability strategy, the company has taken concrete actions to reduce the environmental impact of its operations.

In this line of work, Concha y Toro has been measuring its carbon footprint since 2007, which has made it possible to evaluate the impact of each of the areas on climate change and to take actions aimed at reducing greenhouse gas emissions.

In relation to the management of water resources, Concha y Toro has identified that water use is a fundamental aspect both from a productive point of view, as well as from a corporate social responsibility point of view. In this context, Viña Concha y Toro was the first winery in the world and the first Chilean company to measure its water footprint since 2010.

This report corresponds to the continuation of this commitment, presenting the measurement of the water footprint of the operations carried out during the year 2023.

Objectives

General Objective

Determine Viña Concha y Toro's corporate Water Footprint for the period from January 1 to December 31, 2023.

Specific Objectives

- Analyze Viña Concha y Toro's Water Footprint by components for its agricultural, winemaking and operations units in Chile.
- Conduct a qualitative sustainability analysis of Viña Concha y Toro's Corporate Water Footprint.

1. Methodology

1.1. Water Footprint Network

The Water Footprint Network methodology (Hoekstra et al., 2011) was used to calculate Viña Concha y Toro's Water Footprint for the year 2022.

The WFP methodology visualizes human impacts on water systems related to production and consumption, considering the entire production and supply chain. In this way, it allows a better understanding and management of water scarcity and pollution.

The water footprint of an individual, community or company is defined as the total volume of water consumed to produce the goods and services consumed by individuals, communities or produced by the company; measured along its supply chain on direct and indirect water consumption. Direct consumptions are those in which water is consumed during the production process, while indirect consumptions are those consumed along the production chain of inputs. This indicator shows, specifically in space and time: the volumes of water consumed, the various sources used and the volumes of water altered by type of pollutant (Hoekstra et al., 2009).

The water footprint is divided into three components, depending on the origin of the water consumed and the quality with which it is returned to the environment: Green Footprint, Blue Footprint and Gray Footprint.

a. Green Footprint

Corresponds to all water that enters the system through precipitation and does not return to the system because it is incorporated into the product, evaporated or evapotranspired.

b. Blue Footprint

Corresponds to all water that enters the system from surface and/or groundwater bodies and does not return to the system because it is incorporated into the product, evaporated or evapotranspired.

c. Gray Footprint

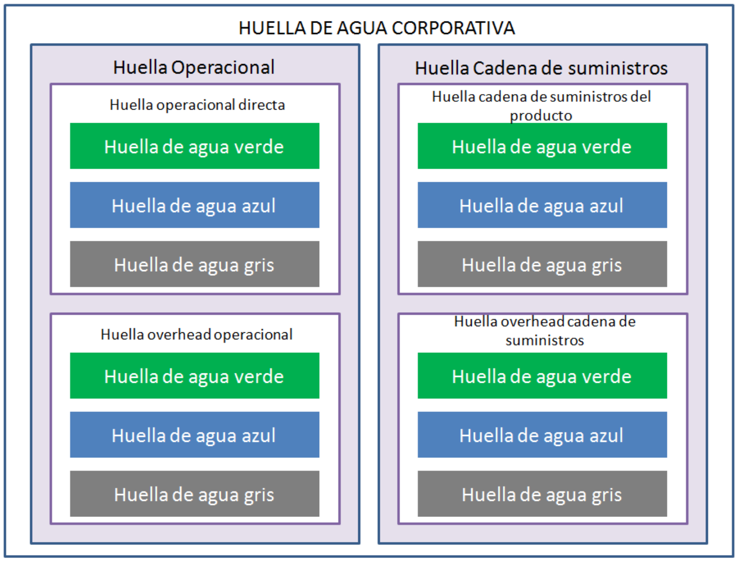
Corresponds to all the water that needs to be added to the discharge water to dilute the concentrations of contaminants until it has a quality equal to that of the water entering the system.

1.2. Corporate Water Footprint Components

The corporate water footprint is defined as the total volume of fresh water used directly and indirectly (through the supply chain) to carry out a company's or organization's processes. Thus, the corporate water footprint is composed of two components: the operational footprint (direct) and the supply chain footprint (indirect).

Furthermore, according to the source and type of water use, the water footprint methodology distinguishes between green, blue and gray water footprints, as illustrated in Figure 1.

Figure1 : Corporate Water Footprint Components



Source: Water Footprint State of Art (Hoekstra et al, 2009).

1.3. Scope of the study

Concha y Toro's corporate water footprint study incorporates the four components defined in point 3.1 according to the Water Footprint Network methodology, as illustrated in Figure 2 and described below.

Figure2 : Concha y Toro Water Footprint Components

Source: Prepared internally

The detail of the components is as follows:

1. Operational Water Footprint: Incorporates the footprint of winemaking and bottling operations. Presents values for blue, green and gray water footprint.
2. Crop Footprint: Includes the water footprint of grape production in Concha y Toro's own estates and the production of grapes produced by third parties.
3. Water Footprint Supply Chain: Incorporates the water footprint of dry supplies such as barrels, boxes, gelatins, among others.
4. Overhead Water Footprint: Incorporates the water footprint from fuel and electricity production for both operations and the supply chain. Presents values for blue and green footprint.

The study considers Viña Concha y Toro's water consumption from January 1 to December 31, 2023.

In the case of the operational footprint, the facilities shown in Table 1 are considered, corresponding to 100% of Viña Concha y Toro's operations in Chile.

Table1 : Viña Concha y Toro's winemaking and bottling operations.

Installation Name	
Pirque Packaging Plant	Lontué Winery
Vespucio Packaging Plant	Las Mercedes Winery
Lontué Packaging Plant	Peralillo Winery
Limarí Winery	Cachapoal Winery
San Javier Winery	Pirque Winery
Chimbarongo Winery	Puente Alto Warehouse
Curicó Warehouse	Nueva Aurora Winery
Lourdes Winery	Vespucio Warehouse

Source: Prepared internally

For the supply chain, the company's agricultural operations considered amount to 45 of its own estates, representing 99.9% of the grapes harvested in the period evaluated. The facilities considered are shown in Table 2:

Table2 : Viña Concha y Toro Agricultural Operations

Valley / Farm						
Limarí	Casablanca	Maipo	Cachapoal	Colchagua	Curicó	Maule
El Trapiche	The Triangle	Don Melchor	Idahue	Agua Santa	El Mirador	The Boldo
La Granja	Los Perales	El Llano	Las Pataguas	Chomedahue	Rauco	Lourdes
La Chica		The Marshal	Peumo	El Estero	San Ignacio	Butterflies
Los Acacios		The Protector	Requinoa	La Puerta	San Manuel	Quebrada de Agua
New Aurora		Quinta Maipo	Rucahue	Las Mercedes	Yungay	Saint Rachel
San Julian		St. Adolphus	El Durazno	Palo Santo	Quiahue	Villa Alegre

Quebrada Seca		Tocornal	Llallauquén	Ucuquer		Keule
		Santa Isabel		Nilahue		

Source: Prepared internally

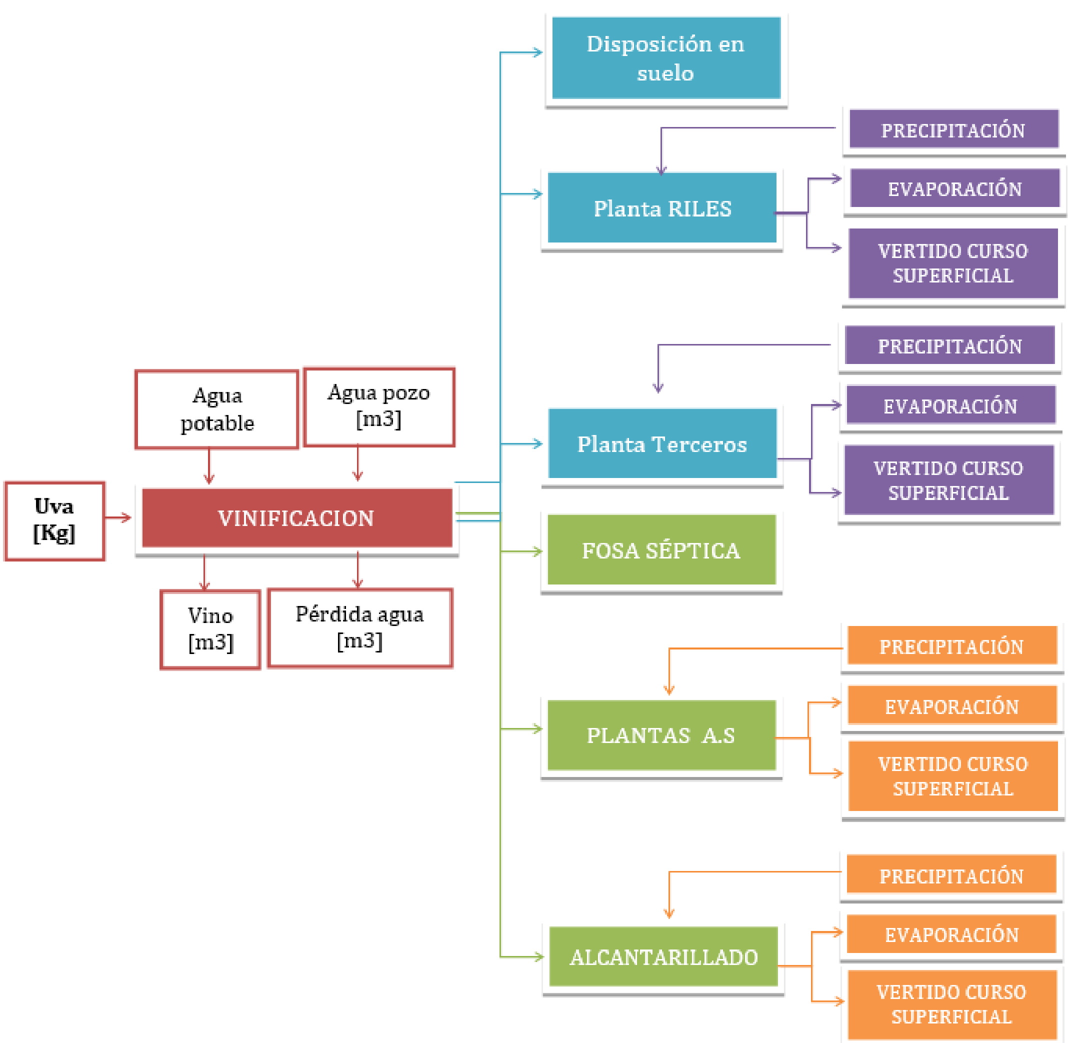
In addition, grapes produced by 339 external producers are considered for the supply chain.

2. Viña Concha y Toro Water Footprint Quantification

2.1. Operational Water Footprint

To calculate the direct water footprint of the company's operations, a process analysis was performed to determine the water inputs and outputs of the system of each of the bottling plants and winemaking cellars, as illustrated in Figure 3.

Figure3 : Analysis of winemaking and bottling process



Source: Prepared internally

In the winemaking and bottling processes, water is mainly used for washing equipment, in heat exchangers and for cleaning inside the facilities.

The San Javier, Lourdes, Lontué, Cachapoal and Pirque facilities have an ILW treatment plant. In Chimbarongo, Puente Alto and Vespucio, the company has a contract with external companies responsible for the treatment and final disposal of liquid waste. Finally, in Curicó, Las Mercedes, Peralillo, Nueva Aurora and Limarí, the operation's liquid waste is disposed of on the ground through sprinkler irrigation.

2.1.1. Green Operational Water Footprint

Corresponds to precipitation water evaporated from storage reservoirs of the Company's own treatment plants and from storage systems open to the atmosphere of third-party plants, wastewater and sewage.

Due to the lack of information and to facilitate the calculation, the following considerations were taken into account:

- The facilities (winery and/or bottling plant) are not considered to have well water storage systems open to the atmosphere, but are covered facilities and do not receive rainwater entering the system.
- In facilities that have treatment plants with accumulation dams, the water evaporated from these is considered to be completed in the first instance with a green footprint. In the event that the evaporated water is greater than the precipitation captured by the dam, the difference is assumed as blue footprint.
- Due to the lack of information on the size of the wastewater treatment plants, contracts with third parties and sewerage, the percentage of green footprint obtained in the company's own WTPs is used to assign the volume of rainwater consumed or evaporated by these facilities.

2.1.2. Operational Water Footprint Blue

It corresponds mainly to the water evaporated in the washing and temperature exchange processes.

Due to the lack of information and to facilitate the calculation, the following assumptions and considerations are made:

- In those facilities where industrial wastewater and sewage are disposed directly into soils or septic tanks, it is considered that the water is returned to the system in compliance with current regulations (NCh. 1333) and does not contaminate groundwater and therefore does not constitute a gray footprint. It is therefore assumed that the water is returned to the system and that there is total efficiency during irrigation (there is no evaporation during water infiltration) and therefore constitutes 100% blue footprint.
- Hydrometeorological data from the Instituto de Investigaciones Agropecuarias (INIA) stations and our own stations were used to calculate precipitation and potential evapotranspiration. In cases where data were missing for long periods, this information was filled in with data from the year 2022 for the same missing dates.
- Due to the lack of information on the dimensions of the A.S. treatment plants, third-party plants and sewage systems, the percentage of blue footprint obtained in the plant's own RILs for these systems is used.

- Since the facilities do not keep records of the volume of water used for human consumption and hygienic facilities (bathrooms, casinos, etc.), the volume of wastewater from each facility was calculated according to the monthly number of workers under the assumption that each worker uses 100 liters of water per day with 21 days of work per month for the normal season and 26 days of work per month for the harvest season.
- Lourdes, Peralillo and Nueva Aurora may register a negative blue footprint, this occurs due to the temporary accumulation of RILs in dams that causes the volume of discharge to be greater than the volume of catchment and consumption of drinking water in some months. To avoid a negative blue footprint, it is considered that the total water input is equal to the volume of RIL discharged plus wastewater.
- Pirque has an SBR treatment system, so it is assumed that there are no water inflows from precipitation or outflows from evaporation.

2.1.3. Operational Water Footprint Gray

The gray operational water footprint is obtained by dividing the pollutant load (L, in mass/time) by the difference between the environmental quality standard water of this pollutant(c_{max}) and its natural concentration in the receiving water body .(C_{nat})

$$WF\ Operacional\ gris = \frac{L}{c_{max} - c_{nat}}$$

For the concentrations of various pollutants, their respective gray footprints do not add up. The methodology indicates that the element causing the largest contribution to the gray footprint should be selected and only this contribution should be considered in the total WFP accounting.

The following assumptions were taken into consideration for the calculation of the gray operational footprint:

- The critical parameter to be considered for the calculation is BOD5. For each facility, this value is considered as the maximum concentration of pollutant in the discharged water. Supreme Decree 90, issued in 2000 and revised in 2010 (DS90, 2010), establishes the emission standard for the regulation of pollutants associated with liquid waste discharges to marine and continental surface waters of the Republic of Chile and applies to the entire national territory. In the case of BOD5, DS90 establishes a maximum concentration of 35 [mg/L].
- In the case where the plant discharges its wastewater to the sewage system, the maximum concentration allowed by Supreme Decree 609, the latest version of which dates from 2004, is used as the value. In this case, DS609 establishes a maximum BOD5 concentration of 300 [mg/L].
- For cases where there is no BOD5 record for the discharged liquid waste, ac_{max} of 35 [mg/L], established by DS90, is assumed.
- For the natural concentrationC_{nat} in the receiving water bodies, a BOD5 value of 2 [mg/L] is assumed. This value was considered since there is no information regarding the natural water quality in the receiving water bodies into which each of the company's plants discharges.

In addition, the study includes the gray footprint derived from the generation of wastewater by the workers of each facility. The estimation of the volume of wastewater generation was based on the calculation of the number of workers at each facility, considering a standard consumption of 100 [Lts/day] per worker.

2.2. Water Footprint Own Grape

Forty-five of Concha y Toro's own estates are considered, representing 99.9% of the grapes harvested during 2023, with calculations of the water footprint of grape production separated by the aptitude (quality) of the grapes from each estate, excluding all non-productive quarters.

The following is a description of the processing of the information for the calculation:

- Valles - Meteorological information: Meteorological information was obtained through Agromet (INIA's Agrometeorological Network) and INIA's own weather stations. This information corresponds to daily data for the period between 01-01-2023 and 31-12-2023 for the parameters described in Table 3.

Table3 : Meteorological parameters used in the Study.

Data	Unit	Observation
ET_0	mm	
Minimum relative humidity (RHmin)	%	
Wind speed (W)	$m*s^{-1}$	Average speed recorded by the anemometer
Precipitation (PP)	mm	Daily accumulated precipitation

Source: Prepared internally

This information was requested for 13 meteorological stations, and then each farm was assigned to the station that best represents its parameters according to its proximity. Table 4 describes the stations considered and the farms assigned to each of them.

Table4 : Weather stations used

Valley	Station	Assigned Funds
Limarí	Talhuén	El Trapiche
Limarí	Quebrada Seca	Quebrada Seca
Limarí	Campo Lindo	Nueva Aurora, San Julián, La Granja, Lachica, Los Acacios
Casablanca	Casablanca - Emiliana Vineyard	El Triángulo, Los Perales
Maipo	La Platina	El Llano, Mariscal, San Adolfo, Santa Isabel, Don Melchor, La Protectora, Tocornal, El Llano, Mariscal, San Adolfo, Santa Isabel, Don Melchor, La Protectora, Tocornal
Maipo	Los Tilos	Quinta Maipo
Cachapoal	El Arenal	Rucahue
Cachapoal	Jean Buchanan High School	Idahue, Requínoa, Las Pataguas, Peumo, El Durazno, Llallauquén

Valley	Station	Assigned Funds
Colchagua	Hidango	Ucuquer, Palo Santo, Agua Santa
Colchagua	San Jorge - Los Niches	Chomedahue, El Estero, La Puerta, Las Mercedes, Nilahue
Curicó	San Jorge - Los Niches	Quiahue, Rauco, San Manuel, El Mirador, San Ignacio, Yungay
Maule	San Clemente	Quebrada de Agua, Mariposas, Santa Raquel, Lourdes
Maule	Santa Amada	Villa Alegre
Maule	Cauquenes	The Boldo, Keule

Source: Prepared internally

The meteorological information obtained gives rise to spreadsheets in which the information from each station is assigned to the nearby farms identified.

- Farm information: All information regarding agricultural operations (irrigation and production) was processed according to the productive surface of each farm, separating by grape aptitude (quality).

2.2.1. Calculation Methodology for the Water Footprint of Own Grape Production.

The manual published by the Water Footprint Network (WFN) in November 2009, which explains the methodologies proposed by Hoesktra et al. (2009) for calculating the water footprint of each color (green, blue and gray) in the case of a crop, product, business, company and consumer group for different spatial scales (province, country, basin), was used as a guide for estimating the water footprint of crops.

a. Reference evapotranspiration (ET_o)

FAO defines reference evapotranspiration as the sum of water losses by plant transpiration with those produced by soil evaporation from a standard cultivated area. This area is known as the reference area which corresponds to "A hypothetical reference crop with an assumed height of 0.12 [m], a fixed surface resistance of 70 [s m-1] and an albedo of 0.23". The reference crop could be compared to an extensive and uniformly tall crop of green, well-watered grass, actively growing and shading the entire soil (Allen et al., 1998).

One of the most widely used methods to determine ET_o is the FAO Penman-Monteith equation, because it provides the most accurate results similar to those resulting from empirical calculations (Allen et al., 1998). This equation is a clear, precise and simple representation of the physical and physiological factors that govern the evapotranspiration process, using climatic data on solar radiation, air temperature, humidity and wind speed ( ).

$$ETo = \frac{0.408\Delta\left(Rn - G\right) + \gamma \dfrac{900}{T+273} U_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34U_2)}$$

FAO Penman-Monteith Equation

Where,

- *Rn:* Net radiation on the crop surface (MJ/m^2).

- *G:* Ground Heat Flux ((MJ/m^2).
- *Γ: Psychometric constant (KPa/°C).*
- *U_2: Average wind speed at a height of 2 meters.*
- *e_s: Saturation vapor pressure (kPa).*
- *e_a: Actual vapor pressure (kPa).*

The details of the derivation of the equation for the calculation of ET_o, as well as the procedure to calculate it, can be found in Part A of the FAO 56 manual .[1]

In the present study, reference evapotranspiration was obtained directly from the meteorological stations.

b. Crop evapotranspiration (ET_c)

For the estimation of ET_c in the present study, the approximation of the dual crop coefficient, adjusted for meteorological conditions, was considered. The derivation of the formulas used and the calculation method are described in FAO manual 56 Part B, chapter 7.

Unlike the general method of estimating crop evapotranspiration using a single coefficient (ET_c = ET_c * K_c), the dual coefficient method consists of dividing K_c into two coefficients: one for crop transpiration, called the crop basal coefficient (K_{cb}), and the other for soil evaporation (K_e), so that the equation is as follows:

$$ET_c = ET_0 \cdot (K_{cb} + K_e)$$

This method is more complicated than the simple coefficient method, but it provides greater accuracy and allows comparing the difference in water demand in barns with drip irrigation vs. furrow irrigation, which is why it was selected for this study.

c. Crop Water Requirement (CWR)

Crop water requirement is defined as the inverse of crop evapotranspiration, i.e., the amount of water that must be supplied to the plant to compensate for losses caused by evapotranspiration, in order to achieve adequate growth and development (Allen et al., 1998). In other words, it is the water required to compensate for the amount of water lost through evapotranspiration. In numerical terms, it is equivalent to crop evapotranspiration (ET_c).

An intermediate step before being able to calculate the water footprint of the crop is to estimate the amount of water that must be applied by irrigation to satisfy the evapotranspiration demand. This will allow knowing what proportion of the water requirement is covered by irrigation (blue water) and what proportion is covered by precipitation (green water).

In the present study, a spreadsheet was generated for each type of irrigation system ("ET_c Drip", "ET_c Furrow", and "ET_c Tended", respectively), in which a daily soil water balance is made, which applies irrigation every time an

[1] Crop Evapotranspiration - Guidelines for Determining Crop Water Requirements [online] http://www.fao.org/docrep/009/x0490s/x0490s00.htm

established *irrigation criterion* is met. This criterion corresponds to a percentage defined by the user, with respect to the water storage capacity of the soil. This information can be found in the "CTE" sheet of each spreadsheet; Table 5 shows the example for the case of Ucuquer. The usable moisture corresponds to the height of the water column usable by plants and is a function of bulk density and field capacity for each soil texture. Thus, in the case of a clay loam soil, this height is 35 mm and given that it was established as an irrigation criterion to apply every time the usable moisture falls below 50%, then irrigation should be applied every time the soil has less than 17.5 mm of accumulated water.

Table5 : Usable soil moisture and irrigation criteria, Chomedahue.

Specific soil data	
Constant	Unit
Soil Type	Clay loam
Usable moisture (cm)	8,75
Usable moisture (mm)	87,5
Irrigation Criteria	0,5
Irrigate with HA < or = a:	43,75

Source: Valle Casablanca Spreadsheet, Internal Elaboration.

Totaling this information for each month and cross-referencing it with the information on effective monthly precipitation, the monthly water requirements by components are obtained. Table 6 shows the monthly water demand by components for Chomedahue

Table6 : Crop evapotranspiration [mm/month] by irrigation type according to components for Chomedahue.

Irrigation Type	Home	1	31	62	94	123	154	185	215	246	274	305	335	Total
	End	30	61	93	122	153	183	214	245	273	304	334	365	
	Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Sea	Apr	May	
Drip	Green	7,5	8,5	14,6	20,8	23,7	77,2	43,3	-	-	-	1,9	10,6	208,0
Drip	Blue	-	-	-	-	-	-	77,6	142,3	112,8	68,5	10,5	-	411,7
Drip	Total	7,5	8,5	14,6	20,8	23,7	77,2	120,9	142,3	112,8	8,5	12,4	10,6	619,7
Furrow	Green	14,3	6,3	28,0	34,4	25,7	94,8	35,5	-	-	-	3,5	20,0	272,6
Furrow	Blue	-	-	-	-	-	-	101,7	160,3	133,0	82,9	22,2	-	500,0
Furrow	Total	14,3	6,3	28,0	34,4	25,7	94,8	137,2	160,3	133,0	2,9	25,7	20,0	772,6
Laying	Green	7,0	9,4	33,0	38,5	27,0	94,8	37,3	-	-	-	4,9	23,1	295,0
Laying	Blue	-	-	-	-	-	-	78,8	157,9	133,1	5,3	14,9	-	470,0
Laying	Total	7,0	19,4	33,0	38,5	27,0	94,8	116,1	157,9	133,1	85,3	19,8	23,1	765,0

Source: Colchagua Valley Spreadsheet - Los Niches Station, Internal Elaboration.

Once the water requirements by components have been obtained, the maximum blue and green footprint potentials for each aptitude are available, depending on soil type, irrigation technology and agroclimatic conditions. Since grapevine cultivation is carried out under water stress, these water requirements overestimate the real values and it is necessary to correct these water requirements in order to obtain values closer to reality. Therefore, for the present study, the monthly information on crop water demand was crossed with the available supply, which is represented by the sum of the precipitation available to the plant plus irrigation. Thus, the cross-checking of information is carried out as follows:

$$CWR_{mes} = MIN[(Pp_{ef(mes)} + Riego_{mes}) ; ETc_{(mes)}]$$

$Pp_{ef\,(month)}$: Monthly effective precipitation.

The data for ETc are calculated in the previous point, while the effective precipitation is calculated by subtracting 5 millimeters, which are assumed as runoff loss, from the daily precipitation recorded by the meteorological station of each farm. On the other hand, sometimes the amount of irrigation applied to each quarter (in millimeters) is not directly available, since there are irrigation sectors that irrigate more than one quarter, so it is necessary to carry out a procedure for the allocation of irrigation by quarter. Finally, all the quarters are grouped according to the suitability of the grapes produced in each one.

In this way, the total water requirements by grape suitability are obtained as the sum of the monthly requirements.

d. Blue and Green Water Footprint of Own Grape

In the case of the green footprint, the maximum limit was established as the value obtained in the soil water balance, which is the total evapotranspiration from rainwater that was effectively available in the soil for plant use and was used by the plants, thus maximizing the use of rainwater.

In the case of the blue footprint, the amount of water needed by each crop from irrigation ($CWR_{irrigation}$) is determined by subtracting the water requirements of the crop with the value of the monthly green water demand used, as follows:

$$CWR_{azul} = CWR - ETc_{verde}$$

In the case of the barracks where there is no record of the volume of water applied by irrigation (irrigation by laying and furrow), the footprint values obtained in the soil water balance were considered.

In the case of water applied in phytosanitary and herbicide applications by the year 2022, this is considered entirely blue, since it does not return to surface or groundwater flow and therefore does not contaminate.

e. Own Grape Gray Footprint (Fertilization)

For this study, the application of fertilizers applied through irrigation was considered in the calculation of the gray footprint. In this case, pollutants are not discharged directly to surface sources, but are leached through irrigation, contaminating groundwater.

Since only the fraction of pollutants reaching freshwater bodies, and not the total amount used, the estimated application of each element is multiplied by the leaching fraction, which indicates the fraction of water that infiltrates and passes through the root zone, carrying a certain part of the fertilizers from the crop to the freshwater bodies.

The methodology indicates that the gray footprint of various pollutants should not be added up, but rather the element that causes the greatest contribution to the gray footprint should be selected and only this contribution should be considered in the total WFP accounting.

Considering the most soluble element, which in this case is nitrogen. The total amount applied per farm was obtained and based on this the gray footprint was calculated, assuming a leaching rate of 10% on the fraction not used by the plant (Hoekstra et al, 2009) and a maximum concentration in the aquifer of 10 mg/L (NCh. 409).

In this way, the gray footprint for each farm is obtained using the following formula:

$$WF_{gris} = \frac{\alpha * Ap}{C_{max} - C_{nat}}$$

Where,

- α: *Fracción de lixiviación*
- Ap: *Aplicación de N mediante fertilización* $[kg]$
- C_{max}: *Concentración máxima aceptable del contaminante* $[\frac{kg}{m^3}]$
- C_{nat}: *Concentración natural del contaminante* $[\frac{kg}{m^3}]$

Some considerations regarding the meteorological data used for the calculation of the own grape footprint are as follows:

- Hydrometeorological data from the Instituto de Investigaciones Agropecuarias (INIA) stations were used to calculate precipitation and potential evapotranspiration. In cases where data were missing for long periods, this information was filled in with data from the year 2021 for the same missing dates, as it is considered that these variables have a seasonal distribution and will not vary strongly from year to year.
- In cases where only 1 day was missing at the station, the average of the days surrounding the missing data was considered.

2.3. Third Party Grape Water Footprint

The water footprint of supplier grapes was calculated based on the results obtained for Concha y Toro's own grape production. The green and blue water footprint values were assigned according to the valley of origin and suitability of the grapes. For cases in which grapes of an aptitude that was not produced by Concha y Toro within the same valley were purchased within a valley, the value of the aptitude produced that best represents the aptitude of the grapes purchased was assigned. In this way, the following assumptions were established:

- The "Blend" grapes purchased from the Maipo Valley are assigned the green and blue water footprint value of the "Premium" grapes from the same valley.

In the case of the gray water footprint, the grapes purchased were assigned the value corresponding to the average gray footprint of each valley's own grapes, without distinction by aptitude. In the same way, the blue footprint was calculated for phytosanitary and herbicide application by calculating an average and applying it to the corresponding valleys.

2.4. Water Footprint Other Supplies

The calculation of the water footprint of other supplies was based on the use of reference values from international studies of water footprint measurements, which report blue and green footprint factors in relation to the material from which each of the inputs is made. Table 7 lists the inputs considered for the purposes of this study, the amount consumed and the material considered for the calculation.

Table7 : Main inputs considered for the year 2022.

Inputs	Tons	Quantity	Unit	Annual consumption
Bottles	67.921		tons	67.921
Tetra Paks		20.524.764	units	20.524.764
Boxes	4.373,8		tons	4.374
Partitions	1.029,4		tons	1.029
BIB Case Box	344,3		tons	344
BIB Bag	111,5		tons	111
BIB handles	82,7		tons	83
Tags	197,2		tons	197
Aluminum Covers		85.862.470	units	85.862.470
PVC capsules		28.059.777	units	28.059.777
Aluminum Capsules		32.790.107	units	32.790.107
Tin capsules		500.749	units	500.749
Agglomerate Cork		30.234.520	units	30.234.520
Natural Cork		6.231.691	units	6.231.691
Elastomeric Cork		24.553.923	units	24.553.923
Gelatin	20,1		tons	20
American oak barrels	21,9	437	units	437
French oak barrels	115,5	2.579	units	2.579

Source: Prepared internally

2.5. Water Footprint Overhead

The calculation of the water footprint overhead considers the amount of water used to produce the energy necessary to carry out the operations and grape production. In this case, fuels (diesel, gas and gasoline) and electricity used in Concha y Toro's wineries and winemaking plants, as well as in the production of its own grapes, are considered.

In the case of the water footprint from the use of fuels, only the blue water footprint is considered, considering that only water from surface and subway sources is used for the production of fuels.

In the case of the water footprint from electricity use, a water use factor was calculated for the electricity generation of the National Electric System (SEN) based on the study "*The water footprint of energy from* *biomass: A quantitative assessment and consequences of an increasing share of bio-energy in energy supply" (*Gerbens-Leenes et al. 2008)*,* which provides the reference values of water use (m^3/kWh) for electricity generation from different sources. With this data, the water use factor is calculated based on the distribution of the SEN energy matrix, obtained from the Energy Statistical Yearbook 2023 of the National Energy Commission (CNE), this calculation yielded an average water use for electricity generation in the SIC of 6.30 [m^3/MWh].

In addition, it is considered that a percentage of this footprint comes from biomass combustion, which in the case of the National Electric System (SEN) corresponds to 2.5% of the electricity matrix, therefore, it is considered that 2.5% of the water footprint from energy use is a green water footprint. In addition, it was considered that the facilities that have a "free client" modality do not have an associated water footprint, since hydroelectric generation is assumed.

The overhead water footprint of the supply chain for grape purchases was calculated based on own grape production, where for each ton of own grape production, a factor of electricity and fuel consumption was assigned by valley of origin.

In addition, the transportation of grapes to the wineries and wine between wineries and plants is considered part of the supply chain overhead. The transportation of wine between distribution centers and to customers (domestic and export) is considered part of operational overhead.

3. Results

Table 8 shows the overall results of Viña Concha y Toro's water footprint for the period 2023, broken down by scope. The total corporate water footprint amounts to 94,810,033 [m3], within which the blue component is the most significant, with 50% of the corporate total. It is followed by the green component, with 38.2%, and finally the gray component, with 11.8%. This is shown in Figure 4.

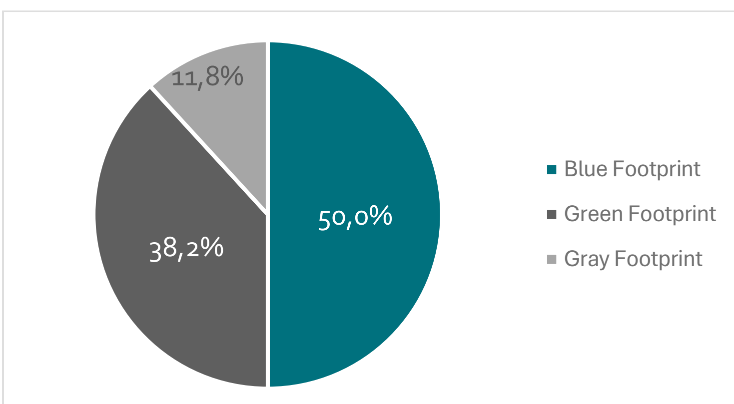
When broken down by scope, the most important component is the water footprint of the company's own crops, which represents 47.8% of the total and, for the purposes of this study, is part of the supply chain. This is followed by the water footprint of grape purchases and the supply chain in general, with 43.6% and 8.1%, respectively. The direct operational footprint (winemaking and bottling) represents only 0.03% of the corporate total.

Table8 : Corporate Water Footprint Viña Concha y Toro 2023

	HH Green [m3]	HH Blue [m3]	HH Gray [m3]	Total HH [m3]
Direct Operational Footprint	14.151	173.416	137.132	324.699
Water footprint supply chain				
Own crops	15.394.004	24.371.975	5.530.175	45.296.154
Purchase of grapes	14.036.104	21.838.922	5.504.667	41.379.694
Supply chain	6.805.735	862.729	-	7.668.464
Water footprint overhead				
Supply chain own crops	1.597	63.708	-	65.305
Supply chain purchase of grapes	1.262	50.421	-	51.683
Operational overhead	206	23.828	-	24.034
Total	36.253.060	47.384.999	11.171.975	94.810.033

Source: Prepared internally

Figure4 : Corporate Water Footprint by Components Viña Concha y Toro 2023



Source: Prepared internally

3.1. Operational Water Footprint

The result of the calculation of the operational water footprint of Concha y Toro's winemaking and bottling processes is 324,699 [m^3] during 2023, with the Pirque, Chimbarongo and Cachapoal facilities having the largest total footprints, representing 56.1% of the total operational water footprint. On the other hand, the Curicó and Puente Alto warehouses have the smallest total water footprints, as shown in Table 9.

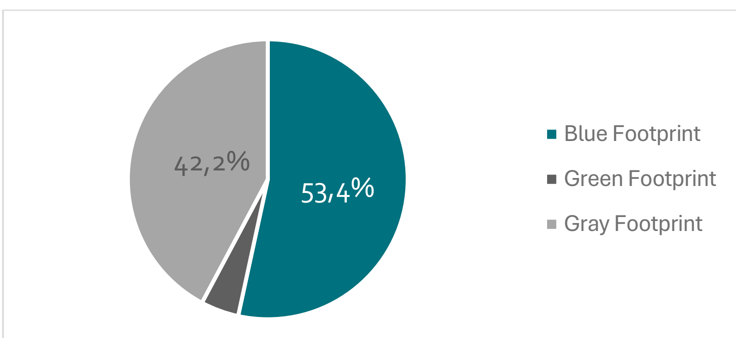
Table9 : Water Footprint of Direct Operations by Facility 2023.

Installation	Blue Footprint [m^3].	Green Footprint [m^3].	Gray Footprint [m^3].	Total Footprint
San Javier	2.599	1.127	23.765	27.491
Chimbarongo	66.351	4.534	10.433	81.317
Curicó	2.466	162	27	2.656
Lourdes	1.995	619	2.932	5.546
Lontué	5.722	2.133	27.582	35.437
Las Mercedes-Lolol	4.992	-	-	4.992
Peralillo	3.755	235	-	3.990
Cachapoal	20.279	1.547	27.463	49.289
Pirque	16.942	-	34.542	51.484
Puente Alto	116	814	2.333	3.262
New Aurora	20.623	-	-	20.623
Vespucio	14.971	2.809	8.055	25.834
Limarí	12.606	172	-	12.777
Total	173.416	14.151	137.132	324.699

Source: Prepared internally

When analyzing the direct operational water footprint by component, as shown in Figure 5, the largest percentage of the operational water footprint corresponds to the blue water footprint equivalent to 53.4%, the gray water footprint is 42.2%, while the green water footprint is only 4.4%.

Figure5 : Direct Operational Water Footprint by Component Viña Concha y Toro 2023

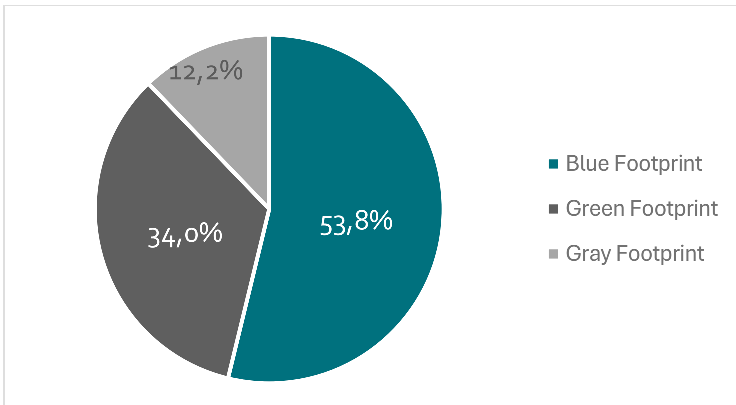


Source: Prepared internally

3.2. Water Footprint Own Grape

The result of the calculation of the water footprint attributable to the consumptive use of water in the production of grapes in Concha y Toro's own fields is 45,296,154 [m^3] during the year 2023. As shown in Figure 6, the water footprint of grape production is composed of 53.8% blue footprint, 34.0% green footprint, and 12.2% gray footprint.

Figure6 : Water Footprint of Concha y Toro Winery Grape Production 2023



Source: Prepared internally

The results include an own production of 149,077 [ton] of grapes in an area of 8,806 [ha]. The magnitude of the water footprint of each crop is related to a number of factors, among which are considered:

- Surface area of the farm [ha]: Directly related to total water consumption.
- Vine productivity [ton/ha].
- Water availability for vines (blue footprint): The volume and frequency of irrigation varies mainly according to evapotranspirative demand, which in turn is related to weather conditions. It also varies depending on the stage of development of the vine, given that in the early years the plantation is irrigated more intensively, which decreases once production is reached.
- Rainfall: affects the relationship between the blue and green components of the footprint.

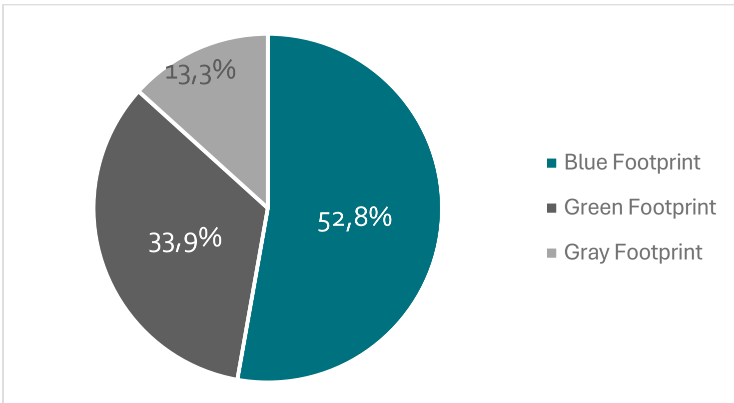
3.3. Third Party Grape Water Footprint

The water footprint of grape purchases from suppliers was calculated considering the entire volume of grapes purchased by Concha y Toro for the 2023 season. Due to the difficulty of having information on the crop and irrigation applied by suppliers, the blue, green and gray water footprint value was assigned based on the results obtained for Viña Concha y Toro's own production. The total volume purchased per valley and aptitude was considered, to which the water footprint factor corresponding to the company's own production was assigned.

In the case of the gray water footprint, the grapes purchased were assigned the average value obtained for own production considering only the origin (Valley), in the same way an average value was assigned for the blue footprint caused by the use of phytosanitary and herbicide applications.

According to the above, the result of the calculation of the water footprint attributable to the purchase of grapes from suppliers amounts to 41,379,694 [m^3] during the year 2023. As shown in Figure 7, the water footprint of grape purchases is composed of a 52.8% blue footprint, a 33.9% green footprint, and a 13.3% gray footprint.

Figure7 : Concha y Toro Winery's Water Footprint Grape Purchases 2023



Source: Prepared internally

The purchase of grapes for the period was classified into 7 valleys of origin that were assigned to 7 reference valleys according to their own production.

In percentage terms, the water footprint of Viña Concha y Toro's grape purchases is composed of 36.2% Maule Valley, 37.1% Colchagua Valley, 2.6% Limarí Valley, 9.8% Curicó Valley, 4.3% Maipo Valley, 7.2% Cachapoal Valley, 2.8% Casablanca Valley. Table 10 shows the results of the water footprint of grape purchases by valley of origin.

Table10 : Water Footprint Grape Purchase by Valley of origin 2023.

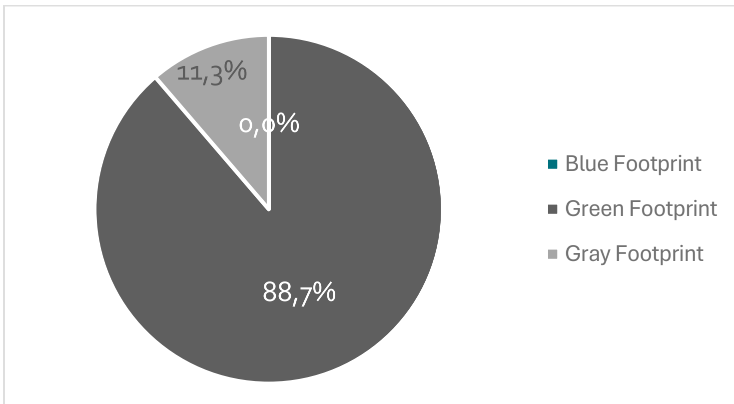
Valley	HH Green (m3)	HH Blue (m3)	HH Gray (m3)	Total HH (m3)
Cachapoal	529.646	800.254	299.757	1.629.657
Casablanca	301.047	480.426	57.338	838.811
Colchagua	4.877.509	5.938.839	2.114.168	12.930.516
Curicó	1.262.766	1.856.166	560.396	3.679.328
Limarí	128.897	324.217	65.098	518.212
Maipo	748.757	1.770.001	143.095	2.661.853
Maule	6.187.483	10.669.019	2.264.815	19.121.317
Totals	14.036.104	21.838.922	5.504.667	41.379.694

Source: Prepared internally

3.4. Water Footprint Supply Chain

The result of calculating the water footprint of the rest of the inputs considered (other than grapes) was 7,668,464 [m^3]. As shown in Figure 8, the largest percentage of the water footprint of the supply chain (excluding grapes) corresponds to the green water footprint, equivalent to 88.7%, while the blue water footprint represents 11.3%

Figure8 : Viña Concha y Toro Supply Chain Water Footprint 2023



Source: Prepared internally

Of the inputs considered, the one with the largest water footprint corresponds to cardboard boxes, as shown in Table 11, which is explained by the high green footprint required for the production of paper and cardboard.

Table11 : Supply Chain Water Footprint 2023.

Input	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3	Total Footprint [m3].
Bottles	461.860	-	-	461.860
Tetra Paks	-	1.436.733	-	1.436.733
Boxes	-	2.759.884	-	2.759.884
Partitions	-	649.533	-	649.533
BIB Case Box	-	217.255	-	217.255
BIB Bag	1.527	-	-	1.527
BIB handles	1.133	-	-	1.133
Tags	-	132.943	-	132.943
Covers	17.172	-	-	17.172
PVC capsules	28	-	-	28
Aluminum Capsules	6.558	-	-	6.558
Tin capsules	3.505	-	-	3.505
Agglomerate Cork	30.235	90.704	-	120.938
Natural Cork	6.232	39.260	-	45.491

Input	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3	Total Footprint [m3].
Elastomeric Cork	2.455	-	-	2.455
Gelatin	332.024	210.203	-	542.227
American oak barrels	-	152.513	-	152.513
French oak barrels	-	1.116.707	-	1.116.707
Total	862.729	6.805.735	-	7.668.464

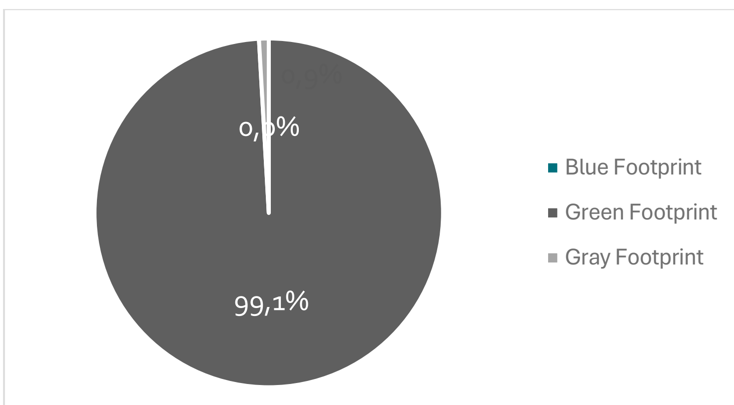
Source: Prepared internally

3.5. Water Footprint Overhead

3.5.1. Operational Overhead Water Footprint

The operational overhead water footprint yielded a value of 24,034 [m^3] and is composed of the water footprint of fuels and electricity used in Viña Concha y Toro's winemaking cellars and bottling plants. Figure 9 shows that 99.1% corresponds to blue water footprint and the remaining 0.9% to green water footprint.

Figure9 : Water Footprint Overhead Operational 2023



Source: Prepared internally

Table 12 shows the detail of the results of the operational overhead water footprint by type of footprint.

Table12 : Operational Overhead Water Footprint 2023.

Operational Overhead	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3].	Total Footprint [m3].
Electricity in warehouses	8.041	206	-	8.248
Fuels	3.058	-	-	3.058

Operational Overhead	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3].	Total Footprint [m3].
Fuel Distribution and Transportation	12.728	-	-	12.728
Total	23.828	206	-	24.034

Source: Prepared internally

3.5.2. Water Footprint Overhead Supply Chain

a. Water Footprint Overhead supply chain crops

The water footprint overhead supply chain of own crops yielded a result of 65,305 [m^3] and is composed of the water footprint of fuels and electricity used in Viña Concha y Toro's own estates.

Table 13 shows the detail of the results of the water footprint overhead supply chain by type of footprint.

Table13 : Water Footprint Overhead supply chain 2023.

	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3	Total Footprint [m3].
Overhead Own Grape	63.708	1.597	-	65.305

Source: Prepared internally

The overhead water footprint of third-party crops amounted to 51,683 [m^3] and is composed of the water footprint of fuels and electricity used on third-party farms.

Table 14 shows the detail of the results of the water footprint overhead supply chain purchase of grapes by type of footprint.

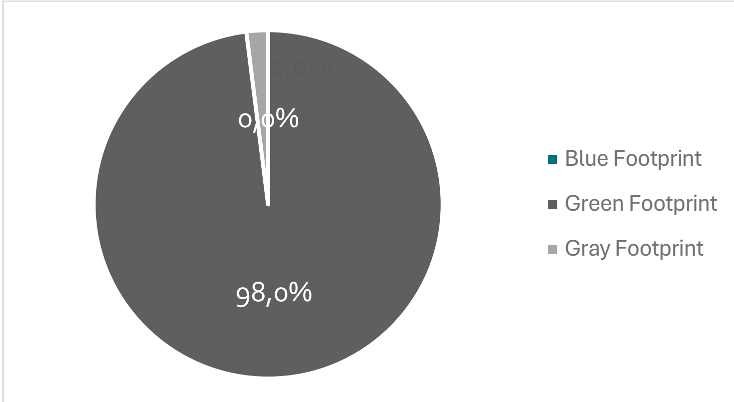
Table14 : Water Footprint Overhead grape supply chain 2023.

	Blue Footprint [m3].	Green Footprint [m3].	Gray Footprint [m3] [m3].	Total Footprint [m3].
Overhead Own Grape	50.421	1.262	-	51.683

Source: Prepared internally

Figure 10 shows that 98% corresponds to blue water footprint and only 2% to green water footprint for both own and third-party crops.

Figure10 : Overhead Water Footprint Grape Supply Chain 2023



Source: Prepared internally

4. Analysis of Results

4.1. Water Footprint of Viña Concha y Toro's Wine

The water footprint of a product is associated with its process and the contributions of the supply chain. To calculate the average water footprint of Viña Concha y Toro's wine production, the total water footprint was divided by total wine sales during the measurement period.

Viña Concha y Toro's total water footprint for the period 2023 was 94,810,033 [m^3/year] and the total wine sales considered were 187,751,520 [lts/year], which gives an average of 505 liters of water per liter of wine. Taking the water footprint value to a 125 ml glass of wine, the value is 63.1 [lts/glass].

Thus, each glass of wine produced by Viña Concha y Toro is composed of 31.5 [lts] of blue water footprint, 24.1 [lts] of green water footprint and 7.4 [lts] of gray water footprint.

This number represents a reduction of 4.2% compared to the previous year, mainly due to lower crop water demand, in addition to a 3% reduction in sales volume.

It should be noted that there is a migration of part of the blue footprint towards the green footprint, this is mainly associated with the fact that in 2022 it rained less than in 2023.

4.2. Gaps and Areas for Improvement

- Dam discharge accounting system: It is suggested that a dam discharge accounting system be implemented to avoid distortions in the final water disposal data. The lack of this record affects the accuracy of the blue water footprint, generating negative values in some months. In addition, it is recommended to adjust the flows measured in the extraction to avoid negative water footprints.

- Process water reuse: It is necessary to establish a closed system for the reuse of process water in plants and warehouses. This would help reduce water consumption and water footprint. An adequate treatment system is required to treat contaminated water and ensure its reuse within the same or other processes.

- Technical and technological water management: It is recommended that flow meters be installed at critical points in the process to determine water inflows and detect leaks in real time. This will improve efficiency through operating indicators such as cost per cubic meter. The implementation of recycling stations for water used in washing will also contribute to reducing water extraction or consumption. Work is currently underway on a water monitoring and management system for irrigation extraction flows, for water used during the winemaking and bottling processes, and for processes within the ILW treatment plants.

- Supplier Development Program: It is proposed to collect information on the irrigation and cultivation practices of grape suppliers, especially the most significant ones, in order to more accurately calculate the water footprint of the grapes purchased. This information will also serve to share best practices and reduce the water footprint in the supply chain.
    - In this context, it is suggested to collect information on the irrigation and cultivation practices of its grape suppliers (at least the most significant ones), in order to be able to establish more realistic assumptions for the calculation of the water footprint of the grapes purchased. Another opportunity derived from this information gathering will be to be able to share good practices with these suppliers to reduce their water footprint.

- Improvement in irrigation data recording: It is suggested to standardize and automate the irrigation control system, which is currently operated manually. This will ensure more accurate data and adjusted to reality, which will allow a more precise calculation of the Water Footprint.

5. Sustainability Analysis

Although the water footprint is a quantitative indicator of the appropriation of fresh water, which was developed in an analogous way to the ecological footprint, which is an indicator of the use of productive space, the number alone does not allow us to measure the impacts generated in the places where water is extracted. The sustainability analysis of the water footprint makes it possible to compare the value of the water footprint with the sustainability of water extraction in the territory, considering the environmental, social and economic dimensions.

The sustainability of the water footprint of a product, a company or a consumer depends on the geographical contexts in which the different components of the footprint are found. Generally, when a watershed has water scarcity or pollution problems, this cannot be fully attributed to the footprint of a given product or company, but if the given footprint contributes to the unsustainability situation, it can be indicated that the water footprint is unsustainable.

5.1. Viña Concha y Toro's Water Footprint Location

The largest percentage of Concha y Toro's water footprint is originated by its own grape production and that of third parties, which represents 91.4% of the total. This production takes place entirely in Chilean territory.

The river basins from which the grapes are sourced are shown in Table 15, which indicates the estates corresponding to each basin.

Table15 : Location of Concha y Toro's Watersheds and Estates 2023

Watershed	Fundo	Valley
045 Limarí River	El Trapiche	Limarí
	Lachica	Limarí
	La Granja	Limarí
	Los Acacios	Limarí
	New Aurora	Limarí
	Quebrada Seca	Limarí
	San Julian	Limarí
057 Maipo River	Lo Mackenna	Maipo
	Qta. Maipo	Maipo
	Tocornal	Maipo
	The Protector	Maipo
	Don Melchor	Maipo
	Marshal	Maipo
060 Rapel River	Agua Santa	Marchigue
	Palo Santo	Marchigue
	Ucuquer	Marchigue
	Peumo	Rapel
	Requinoa	Rapel
	Las Pataguas	Rapel
	Llallauquén	Rapel
	El Durazno	Rapel
	Rucahue	St. Vincent
	Idahue	St. Vincent
	Chomedahue	Colchagua
	La Puerta	Colchagua
	El Estero	Colchagua
061 Coastal - Rapel - Nilahue	Las Mercedes	Colchagua
	Nilahue	Colchagua
	Quiahue	Colchagua
	The Triangle	Casablanca

Watershed	Fundo	Valley
	Pirque	Maipo
	Santa Isabel	Maipo
071 Mataquito River	Rauco	Curicó
	San Manuel	Curicó
	San Ignacio	Curicó
	Yungay	Curicó
	El Mirador	Curicó

Watershed	Fundo	Valley
055 Coastal - Aconcagua - Maipo	Los Perales	Casablanca
073 Maule River	The Boldo Keule	Maule Maule
	Villa Alegre	Maule
	Quebrada De Agua	Maule
	Butterflies	Maule
	Lourdes	Pencahue
	Saint Rachel	Pencahue

Source: Prepared internally

5.2. Background of the Basins

5.2.1. Limarí River Basin

The Limarí River basin is located in the IV Region of Coquimbo between the Elqui River basin to the north and the Choapa River basin to the south. The climatic types present in the basin are Semiarid with abundant clouds, temperate semiarid with winter rains, and cold semiarid with winter rains, characterized by low rainfall and water deficit during nine months of the year (DGA, 2004a).

Agricultural land use in the basin comprises 80,011 [ha], equivalent to 7% of the total area, and according to 1997 data, the main crops grown in the basin are annual and permanent forage crops, fruit trees, vegetables, vines and vineyards (DGA, 2004a).

Regarding irrigation capacity, the Limarí River basin has 466 canals and 3 major reservoirs, whose gross demand according to 1997 data is 790,840,000 [m^3/year] and it is estimated for 2017 a demand of 647,601,000 [m^3/year] considering technological improvements and irrigation efficiency (DGA, 2004a).

The Limarí River Basin has a total of 10,087 [ha] belonging to the National System of Protected Wildlife Areas corresponding to the Fray Jorge National Park and Pichasca Natural Monument (DGA, 2004a).

5.2.2. Maipo River Basin

The Maipo River basin covers practically the entire Metropolitan Region and part of the V and VI Regions, draining an area of 15,304 [km^2]. The Maipo River has a length of 250 [km] and is the main source of water for the Metropolitan Region, supplying 70% of the demand for drinking water and about 90% of the demand for irrigation. The Maipo river basin has two climatic types: Temperate Mediterranean type with prolonged dry season and high altitude cold in the Andes Mountains (DGA, 2004b).

Agricultural use in the basin includes 246,447 [ha] of agricultural land and 22,916 [ha] of rotational crops in meadows, mainly in the western sector of the city of Santiago. The main crops grown in the basin are forage plants, fruit trees, vineyards and wine grapevines, cereals and vegetables (DGA, 2004b).

The Maipo river basin has 634 canals, most of which are located on the Maipo and Mapocho rivers, 447 minor reservoirs and 14 major reservoirs for an irrigable area of approximately 100,000 [ha]. According to 1997 data, the basin had 32,811 users, of which 9.7% are organized in 37 Canal Owners Associations and 37 Water Communities (DGA, 2004b).

Runoff in the coastal sector of the basin is approximately 99.5 [mm/year] and in the central-northern sector it does not exceed 7 [mm/year], while the estimated gross demand in 1997 was 110.2 [m^3/s] (DGA, 2004b).

5.2.3. Rapel River Basin

The Rapel River basin is located in the VI Region of General Libertador Bernardo O'Higgins and has a total surface area of 13,695 [km($^{2)}$]. The Rapel River is formed by the union of the Cachapoal and Tinguiririca rivers (DGA, 2004c).

The main economic activities in the basin are agriculture, forestry and mining, with agricultural activity standing out due to the large surface area used and the amount of water required. According to 1991 data, the basin had 1,270 irrigation canals (3,422.6 km), regulated by 334 minor reservoirs and 9 major reservoirs (DGA, 2004c).

Within this watershed there are 6,474 [ha] belonging to the National System of State Protected Wildlife Areas (SNASPE), equivalent to 1% of the total surface area of the watershed and corresponding to the Las Palmas de Cocalán National Park and Los Cipreses River National Reserve (DGA, 2004c).

5.2.4. Maule River Basin

The Maule River basin has a surface area of 20,295 [km^2] and is located in the VII Region of Maule. It is under the influence of a Mediterranean climate, characterized by hot summers and dry, cold and wet winters, and has at least two consecutive months of summer with water deficit (DGA, 2004d).

The main economic activity in the basin is agriculture and livestock farming, which, due to the climatic characteristics, is developed mainly under irrigated conditions (CADE DGA, 2004d).

The Maule River Basin has 9 main rivers, from which derive 1,530 main canals covering an irrigated area of 196,916 [ha]. In addition, there are three sets of irrigation works in this basin with 64 canals and an irrigated area of 27,865 [ha]. The water demand for irrigation in 1993 was 137,910 [m^3/sec] (DGA, 2004d).

The areas under official protection belonging to the National System of Wildlife Areas Protected by the State (SNASPE) located in the basin correspond to:

- Los Bellotos del Melado National Reserve
- Radal Siete Tazas National Reserve
- Altos del Lircay National Reserve

5.2.5. Mataquito River Basin

The Mataquito River basin is located in the VII Region of Maule and has an extension of 6,190 [km^2] and is the smallest of the Andean basins in this area. The basin has a Mediterranean climate with at least two consecutive months of summer with a water deficit (DGA, 2004e).

The climate and soils of this region give it a great agricultural potential, which determines that its production is mainly silvo-agricultural, with corn, wheat, apples, grapevines and other types of vegetables being the main crops. Agricultural land covers 110,477 [ha], equivalent to 17% of the basin's total (DGA, 2004e).

According to 1997 data, the Mataquito River has 116 canals draining an area of 13,589 [ha], while the Teno River has 201 canals with an irrigated area of 34,987 [ha] and the Lontué River has 206 canals irrigating 55,645 [ha]. The basin has 13,744 users and a gross demand of 62.7 [lts/sec] (DGA, 2004e).

The Mataquito River basin has no protected wildlife areas belonging to the National System of State Protected Areas (SNASPE) (DGA, 2004e).

5.3. Sustainability Analysis by Watershed

The main focus of interest for sustainability analysis is the blue footprint, since the green footprint has low alternative uses and environmental impacts and the gray footprint represents a low percentage of the total footprint.

On the other hand, the blue footprint of grape growing, both its own and that of third parties, corresponds to 98% of Viña Concha y Toro's total blue footprint for the period 2023, which is why the analysis focuses on this component.

To determine the sustainability of the water footprint in each of the basins where grapes are grown, the blue footprint of each basin associated with Concha y Toro was compared with some studies developed by the Dirección General de Aguas in relation to the characterization of the basins. One of the studies analyzed corresponds to "Estimates of water demand and future projections" developed in 2007 by Ayala, Cabrera y Asociados for the DGA (DGA, 2007a and DGA, 2007b). The purpose of this study is to estimate future demands for 10 and 25 year horizons, identifying critical areas either due to scarcity or intensive use.

The blue water footprint derived from Viña Concha y Toro's own grape cultivation (excluding overhead) amounts to 24,371,975 [m^3] during 2023.

If we compare the total water footprint for own grape cultivation with the blue footprint, the latter corresponds to 54% as a percentage, which is detailed in Table 16:

Table16 : Water Footprint compared to Blue Footprint.

Valley	Total Water Footprint m3	Blue Water Footprint m3	Percentage Blue Footprint vs. Total Footprint

Cachapoal	9.265.161	4.534.570	49%
Casablanca	839.902	481.051	57%
Colchagua	7.828.702	3.728.495	48%
Curicó	4.661.693	2.364.956	51%
Limarí	4.892.845	3.012.750	62%
Maipo	3.328.441	2.193.485	66%
Maule	14.479.410	8.056.667	56%
Total	45.296.154	24.371.975	54%

Source: Prepared internally

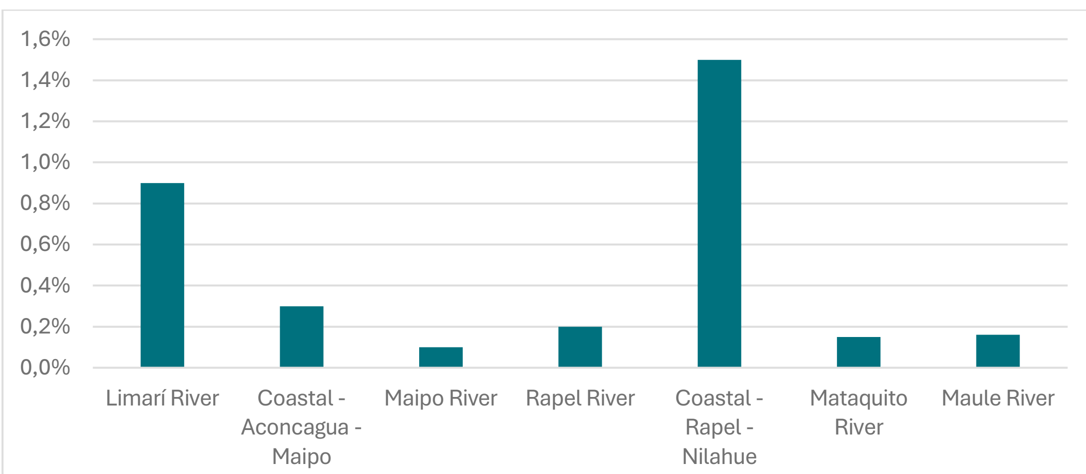
The values to be compared with the blue water footprint of grape crops in each basin associated with Viña Concha y Toro were the values of agricultural water demand [m^3] and water demand for wine grapes [m^3] of each reference basin provided by the aforementioned DGA study. The results obtained are shown in Figure 11 and Figure 12.

In relation to water demand for agricultural production, the highest results are found in the coastal basin of the Rapel-Nilahue River and the Limarí River basin, with 1.5% and 0.9%, respectively.

In the case of water demand for wine production, the highest results are found in the Limarí River basin and the Maipo River basin, with 17.7% and 17.6%, respectively.

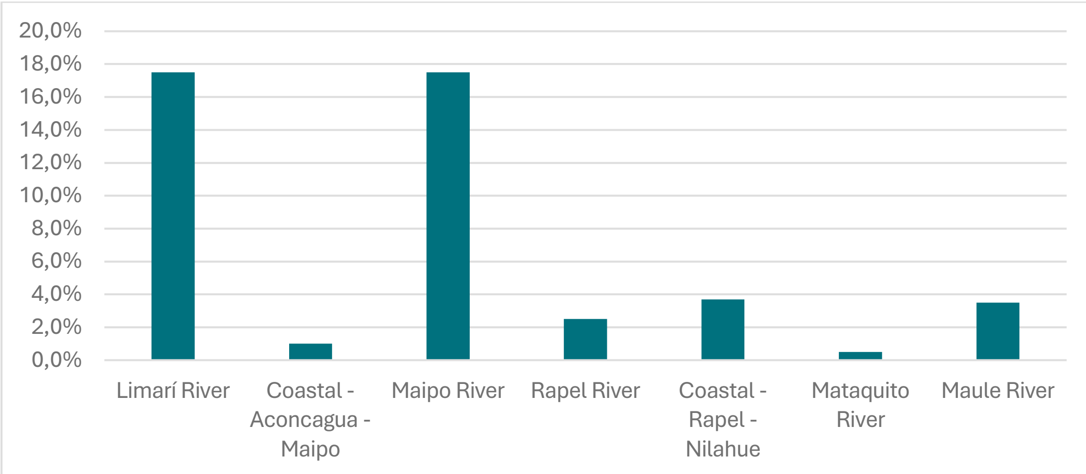
It is worth mentioning that these data are comparative with data from 2007, so these percentages are probably lower in reality given the increase in crop areas in recent years.

Figure11 : Blue Water Footprint of Concha y Toro in relation to water demand for agricultural production by watershed.



Source: Prepared internally with data from DGA, 2007A and DGA, 2007B.

Figure12 : Concha y Toro's Blue Water Footprint in relation to water demand for wine production by river basin.



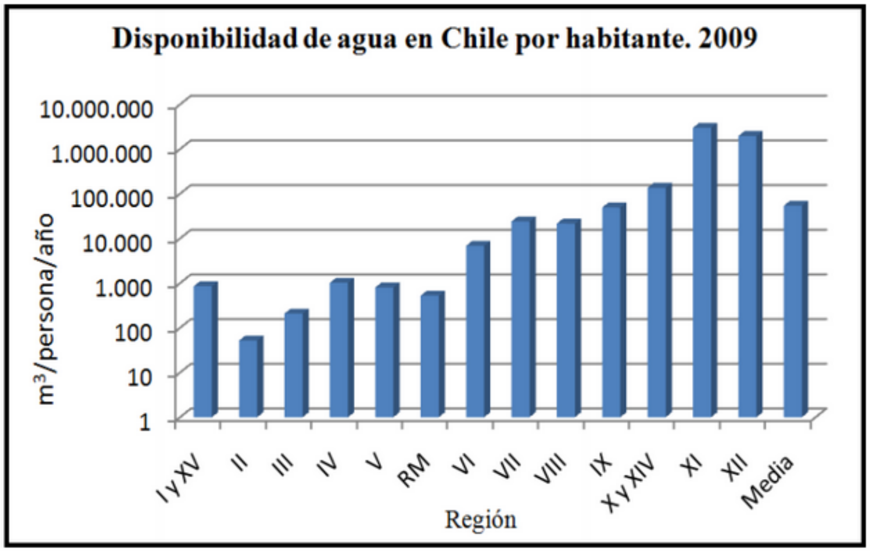
Source: Prepared internally with data from DGA, 2007A and DGA, 2007B.

5.4. Operations in Water Stressed Areas

The UN defines water scarcity as "The point at which the aggregate impact of all users, under a given institutional order, affects the supply or quality of water, such that the demand of all sectors, including the environmental sector, cannot be fully met". Defining two variables that determine water scarcity are its natural availability or supply, determined in turn by environmental and ecological conditions, and the social and economic demand for the resource.

Within the world context, Chile could be considered a privileged country in terms of water resources. When considering the entire Chilean territory, the volume of water from precipitation that flows through surface and subway watercourses is 53,000 m^3 per person per year, 8 times the world average (6,600 m^3/person/year), and 25 times the minimum of 2,000 m^3/person/year that is internationally defined as the threshold for sustainable development. However, when analyzing this average value at the regional level, the reality is different, as shown in Figure 13: from the Metropolitan Region to the north, arid conditions prevail; the average water availability is below 800m^3/person/year (World Bank, 2010), while towards the south it exceeds 10,000m^3/person/year.

Figure13 : Water Availability in Chile per Inhabitant



Región	m³/pers/año
I y XV	854
II	52
III	208
IV	1.020
V	801
RM	525
VI	6.829
VII	23.978
VIII	21.556
IX	49.273
X y XIV	136.207
XI	2.993.535
XII	1.959.036
Media	**53.953**

Source: World Bank, 2011

Considering that Viña Concha y Toro has operations from the IV Region of Coquimbo to the VII Region of Maule, under the aforementioned conditions the company has facilities located in regions with water stress, with water availability below 1,700 m³/person/year according to the World Water Assessment Programme (The United Nations World Water Development Report 4, 2012). As shown in Table 17, there are 25 company facilities between regions IV and VII, these are distributed in 17 farms, 3 bottling plants and 5 warehouses.

Table17 : Facilities in regions under Water Stress

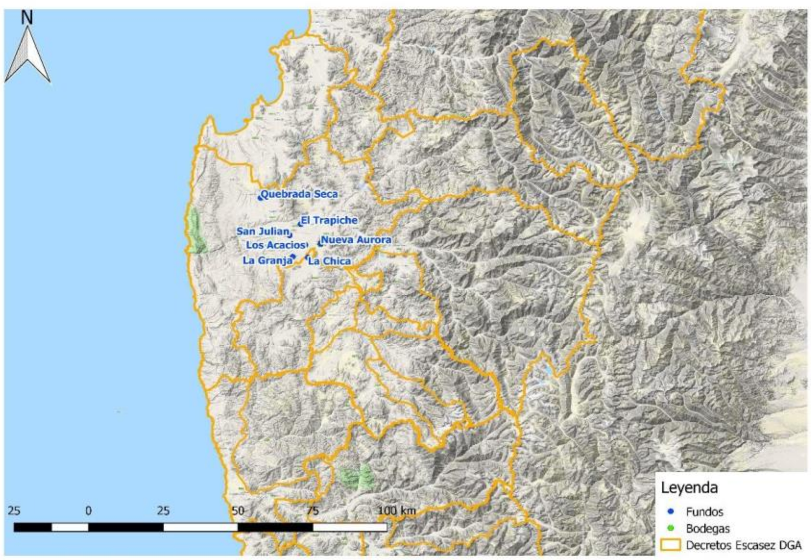
Region	Type of installation	Installation Name	m3/person/year
IV	Winery	New Aurora	1.020
	Fundo	El Trapiche	1.020
	Fundo	La Granja	1.020
	Fundo	La Chica	1.020
	Fundo	Los Acacios	1.020
	Fundo	New Aurora	1.020
	Fundo	Quebrada Seca	1.020
	Fundo	San Julian	1.020
V	Fundo	The Triangle	1.020
	Fundo	Los Perales	801
Metropolitan Region	Plant and Warehouse	Pirque	801
	Plant and Warehouse	Vespucio	525

	Plant and Warehouse	Lo Espejo	525
	Winery	Puente Alto	525
	Fundo	Don Melchor	525
	Fundo	The Protector	525
	Fundo	Marshal	525
	Fundo	Pirque	525
	Fundo	Quinta Maipo	525
	Fundo	St. Adolphus	525
	Fundo	Santa Isabel	525
	Fundo	Tocornal	525

Source: Prepared internally

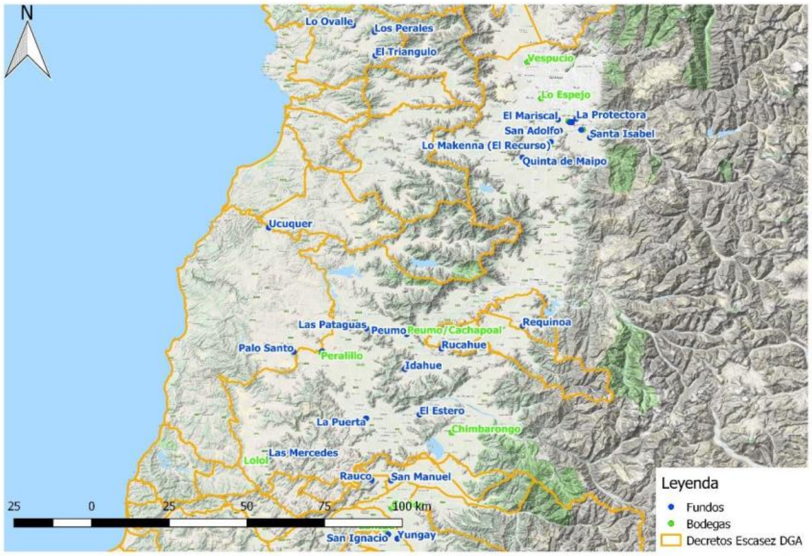
In addition, the water scarcity decree of the Directorate General of Water (DGA) of July 2019 and the Water Risk Atlas of the World Resources Institute (WRI) were used to determine the water stress condition of the vineyard's estates and wineries. Figure 14 to Figure 16 show the water stress zones defined by the DGA, where it can be seen that 38 of the 45 estates are in water stress zones.

Figure14 : Water Stress Zones according to DGA, North Zone



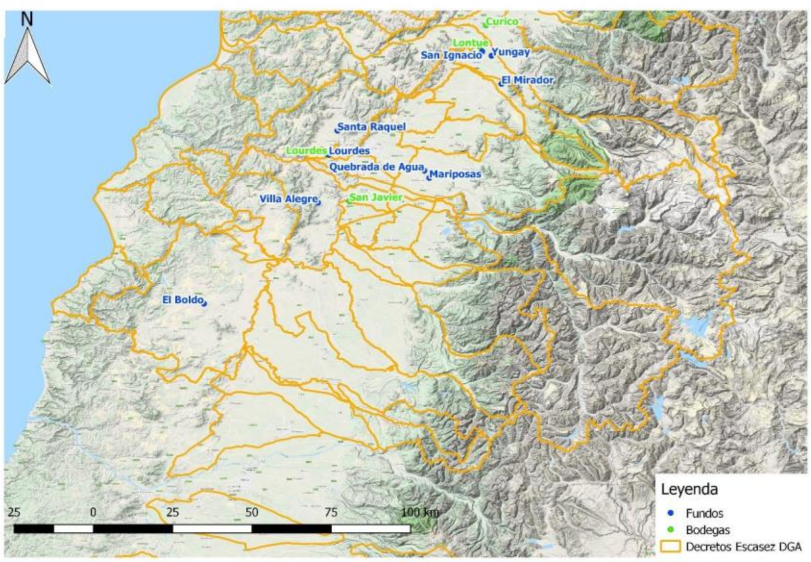
Source: General Directorate of Water

Figure15 : Water Stress Zones according to DGA, Central Zone



Source: General Directorate of Water

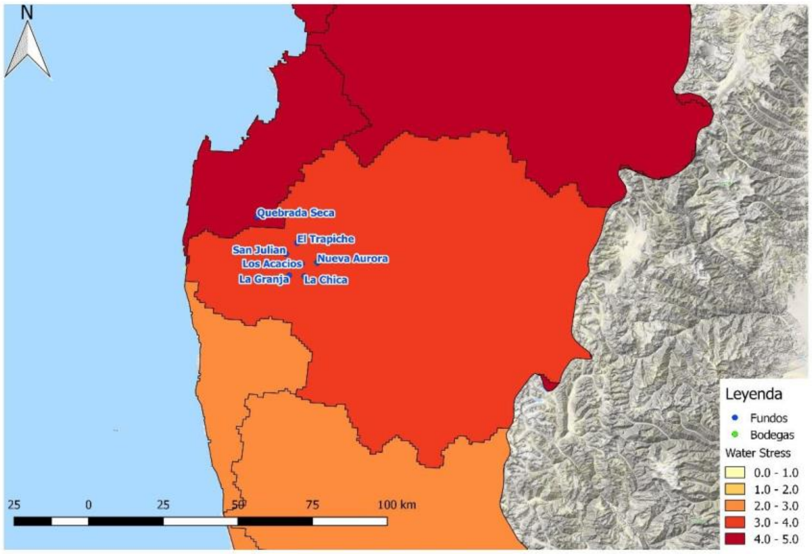
Figure16 : Water Stress Zones according to DGA, Southern Zone



Source: General Directorate of Water

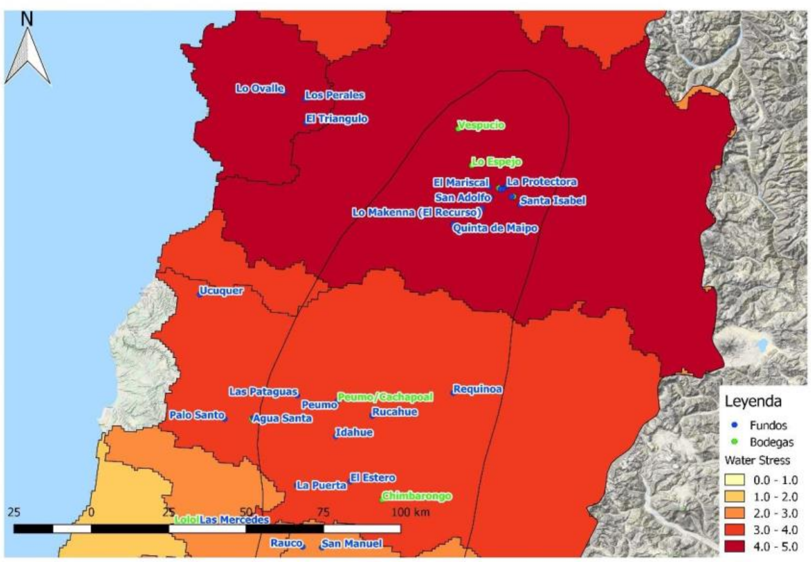
Figure 17 to Figure 19 show the areas that are under water stress according to the WRI, showing that 100% are at some type of risk, with 11 estates at high risk, 27 at risk and 7 at medium risk.

Figure17 : Water Stress Zones according to WRI, North Zone



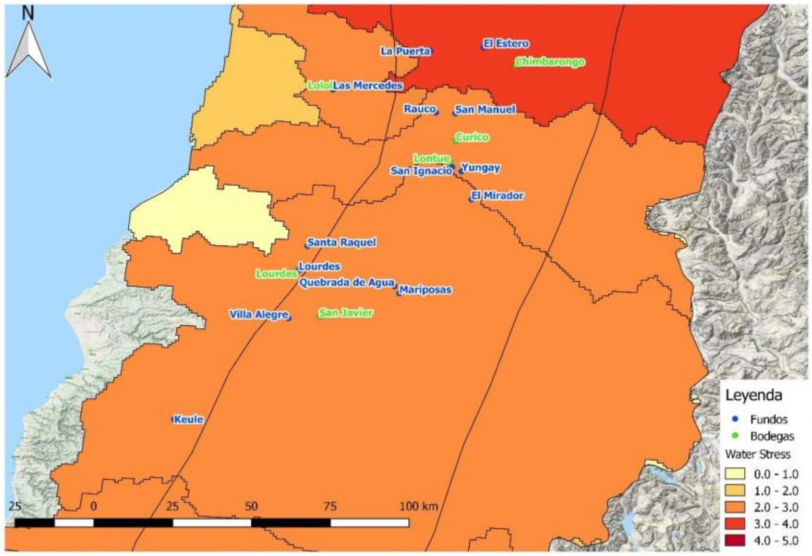
Source: World Resources Institue

Figure18 : Water Stress Zones according to WRI, Central Zone



Source: World Resources Institue

Figure19 : Water Stress Zones according to WRI, South Zone



Source: World Resources Institue

According to the above, the DGA decree shows that 61.4% of the company's own production is located in water stress zones, while according to the WRI this number rises to 89.8% of the production in estates that are at high or very high risk.

5.5. Climate Change and Expected Impacts

Chile complies with Article 4, number 8 of the UNFCCC on countries that are considered especially vulnerable: it has low-lying coastal areas; arid, semi-arid areas; areas with forest cover and areas exposed to forest deterioration; a country prone to natural disasters; areas prone to drought and desertification; urban areas with atmospheric pollution problems; and areas with fragile ecosystems, including mountain systems.

Climate projections show a range of possibilities for the future climate. This will depend on the evolution of global society, present and future technologies, energy sources used, population growth, and actions and policies on climate change, among other factors. Consequently, impacts are also a function of these variables.

As part of the preparation of the National Climate Change Adaptation Plan (Chilean Ministry of the Environment, 2014), simulations were carried out for scenarios RCP2.6 and RCP8.5, which correspond to the most favorable and most unfavorable scenario, respectively, from the point of view of carbon dioxide concentrations in the atmosphere. From these simulations, temperature and precipitation projections are obtained for two periods: 2011-2030 and 2031-2050, on the historical basis of 1961-1990.

The impacts on temperature, precipitation, extreme events and impacts at the sectoral level are described below.

5.5.1. Temperature Impacts

A temperature increase is projected for the entire Chilean territory, with a gradient from higher to lower, from north to south and from mountain range to ocean. It should be noted that the average warming in Chile is lower than the global average warming. For the nearby period, between 2011 and 2030, temperature increases fluctuate between 0.5 °C for the southern zone and 1.5 °C for the large northern and altiplanic zone. For the period between 2031 and 2050, the warming pattern is maintained, but with higher values.

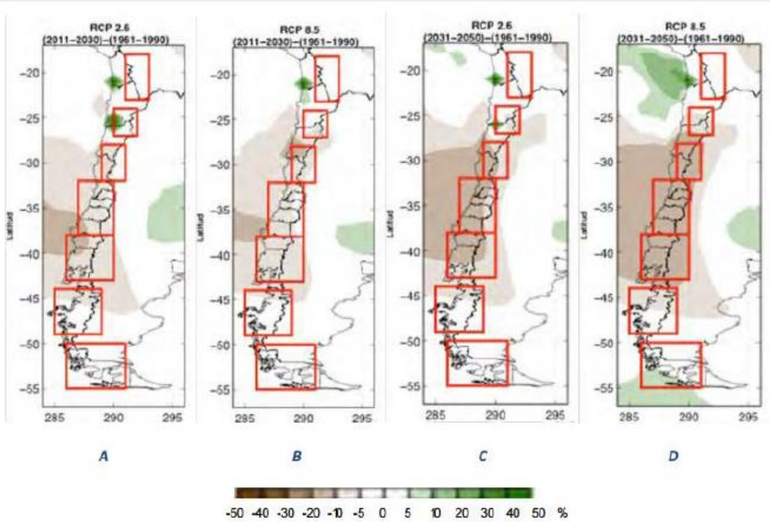
The RCP8.5 scenario projects the highest CO2 concentrations, with temperature increases of up to 2°C. The RCP2.6 scenario, which implies strong climate mitigation policies, slows the temperature increase to a global average of 2°C. The greatest warming is expected to occur in the northern highlands and at high altitudes, above the Andes Mountains.

5.5.2. Impacts on Precipitation

For the nearby period, between 2011 and 2030, precipitation decreases between 5 and 15% are projected for latitudes 27°S to 45°S, that is, between the Copiapó River basin and the Aysén River basin.

For the period 2031 to 2050, the decrease in precipitation is maintained and intensified. It is observed that the zone located between 35°S and 45°S, approximately between the Mataquito River basin and the Aysén River basin, shows a fairly robust signal of precipitation decrease. Figure 20 shows the percentage changes in precipitation for each zone, in the analysis periods.

Figure20 : Percentage changes of precipitation by area



Source: Ministry of Environment 2014

5.5.3. Impacts on the Forestry and Livestock Sector

The effects of climate change on temperatures and precipitation, together with soil erosion due to rainfall and desertification, will have different impacts on the productivity of the forestry and livestock sector. ECLAC (2012) distinguishes three main types of impacts in this context: impacts on soil quality, impacts on productivity and impacts on the occurrence of pests and diseases.

With regard to soils and under climate scenario A2, the change in climatic conditions would generate a significant increase in the magnitude and extent of erosion processes in the country, from the Coquimbo Region to the Los Lagos Region, with all its environmental, productive and social effects.

In the case of impacts on productivity, rainfed agriculture is expected to be affected by changes in temperature and precipitation, while irrigated agriculture will only be affected by higher temperatures in those places where no changes in water availability are projected. In general terms, productivity improvements are expected in the south of the country and in parts of the central valley, and productivity losses in the rest of the country, especially in those regions with irrigation restrictions.

With respect to the possible impact on the occurrence of pests and diseases, it is only possible to put forward some hypotheses that require empirical confirmation (ECLAC 2012). Among them, it is expected that the incidence of diseases that arise in high humidity environments, such as grapevine botrytis, will be reduced. Regarding the pest problem, there is the hypothesis that an increase in temperature tends to favor both the number of insect generations and the expansion of the size of their distribution area.

5.5.4. Impact on Water Resources

Since this is a cross-cutting resource, the impacts on its availability will directly affect the irrigation capacity for vine cultivation.

According to vulnerability studies developed in the country (AGRIMED, 2008; U. de Chile, 2010; ECLAC, 2012c), considering the effects of the increase in temperatures and the decrease in precipitation expected for a large part of the central-southern zone of the country, a reduction in average monthly flows is estimated for the basins located between the Coquimbo and Los Lagos regions (30°S and 42°S parallels). The studies show a significant reduction of flows in the Elqui, Illapel, Aconcagua, Maipo, Cachapoal, Teno, Cautín and other rivers.

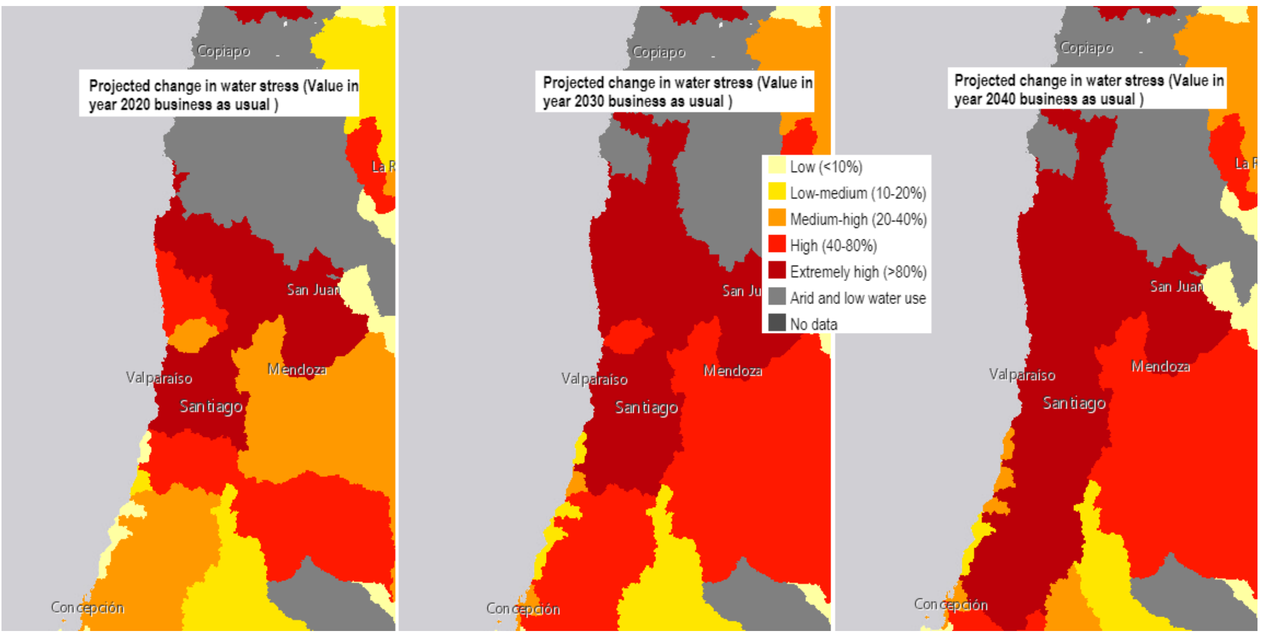
According to academics from the Water Resources and Environment Division (RHMA) of the University of Chile, all the water systems (Illapel, Aconcagua, Teno and Cautín basins) will have a reduction -both in flow and precipitation- between 20% and 40% and temperature increases between 1 and 4°C. There will be changes in seasonality; for example, in the case of the Aconcagua and Teno, there will be an advance of *peak* flows and significant reductions in flow in all water systems.

The rise in the 0°C isotherm, as a result of the increase in temperatures, would reduce the capacity to store snow throughout the year, in addition to altering the date on which the flows occur in the basins, especially those with snowfall influence, such as those of the Limarí and Illapel rivers, where this component will be significantly affected, reducing the flows available during the summer season.

One of the direct impacts of climate change on foreseeable water resources that has been little studied to date is the impact of glacier retreat. This could become significant, especially in those basins with high percentages of glacier cover and high demand for water resources. Basins, such as those located between the Aconcagua and Cachapoal rivers, will be affected by the decrease in the contributions made by these bodies during dry periods.

The WRI also provides relevant information regarding water availability predictions. Figure 21 shows the areas where there will be water shortages in future years, considering a scenario where environmental practices remain largely unchanged (*business as usual*).

Figure21 : WRI estimates for water availability for the years 2020, 2030 and 2040.



Source: World Resources Institute

In addition, the report released by the DGA, in conjunction with the Foundation for Technology Transfer of the Catholic University entitled "Application of the Methodology for Updating the National Water Balance in the Basins of the Northern and Central Macrozones" is taken into consideration. Table 18 shows the precipitation and runoff values for the different basins in which Viña Concha y Toro is present, where it can be seen that the predictions say that there will be a considerable decrease in precipitation and runoff over the next 20 years, while irrigation demand will increase slightly.

Table18 : Historical data and future water balance predictions.

	Precipitation (mm/year)			Runoff (mm/year)			Irrigation Demand (mm/year)		
Basin/Year	85-15	30-40	Var (%)	85-15	30-40	Var (%)	85-15	30-40	Var (%)
Limarí	163,9	162,0	-1,2	84,8	80,1	-5,6	46,1	47,0	2,0
Casablanca	381,1	352,7	-7,4	132,3	115,3	-12,9	31,8	32,6	2,6
Maipo	499,2	463,0	-7,3	303,2	272,3	-10,2	125,1	128,2	2,5

Rapel	823,9	746,5	-9,4	510,1	443,6	-13,0	206,2	210,9	2,3
Mataquito	1125,9	1010,7	-10,2	854,2	739,6	-13,4	151,8	155,2	2,3
Maule	1334,7	1213,0	-9,1	914,8	795,6	-13,0	161,0	163,7	1,7

Source: General Water Directorate 2018

6. Conclusions

According to what is presented in the report, it can be seen that the largest water footprint of the company is found in the grape production process, which concentrates 47.9% of the total, considering direct and overhead water footprint, where the production of grapes from third parties is the second largest source of water footprint with 43.6% of the total water footprint. In relation to the above, it is important to mention that the calculation of the water footprint of third-party grape production is based on Concha y Toro's grape production, under the assumption that these have a similar vineyard management to that of the company, which could be underestimating the result due to the certain possibility that producers do not have the same drip irrigation coverage in their plantations.

Due to the great relevance of the grape production process in the total water footprint, the options for reducing the water footprint are related to vineyard management and irrigation, but if we consider that 99% of the company's productive surface has drip irrigation, the reduction options would mean switching to new precision irrigation technologies that are currently not sufficiently widespread within the national territory and require large investments for their implementation.

In relation to irrigation, a possible source of improvement for the determination of plant evapotranspirative demand is the use of more sophisticated methods for the estimation of the crop coefficient (K_c), since this coefficient is obtained from the literature and does not distinguish between different grapevine strains.

The third source of water use with the largest share in the total water footprint is the supply chain (other than grapes), which represents 8.1%. This result shows the relevance of working together with the company's main input suppliers in order to adjust the measurement assumptions and at the same time work to reduce the water footprint of these inputs.

On the other hand, the water footprint derived from the operations of warehouses and packaging plants represents 0.3% of the total, presenting a low impact on the total footprint, but great opportunities for improvement due to the lack of internal records of water use and discharges that exist to date in the company.

In terms of components, the blue water footprint presents the largest proportion of the total footprint with 47,384,999 [m^3] representing 50.0%, followed by the green water footprint with 36,253,060 [m^3], representing 38.2%.

As for the gray component of the footprint, this represents 11.8% of the company's total footprint and derives mainly from the use of fertilizers in vine cultivation (99% of the total gray footprint). This component can be reduced by using fertilizers with a lower percentage of nitrogen, in addition to studying the effects that the different chemical components can produce when mixed, as they can cause a synergistic effect and thus be more polluting than the simple sum of each one separately.

Finally, when comparing the results of this measurement with the international reference values for the water footprint of wine, it can be seen that Viña Concha y Toro's water footprint is 40% lower than the international industry average of 109 [lts water/glass of wine] provided by the Water Footprint Network. This result is mainly explained by 2 factors:

The use of drip irrigation, which is highly efficient in the use of water in irrigation and allows crops to be managed under water stress, i.e. delivering less water to the crop than its real water demand.

The climatic conditions of the national territory result in a green water footprint that represents only 38.2% of the total footprint and 193.1 [lts water/lt wine], far below international reference studies for winemaking in countries such as Italy, where the green footprint represents 98% of the total and 828 [lts water/lt wine], or New Zealand, where this component represents 74% of the total and 815 [lts water/lt wine].

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8. Annexes

8.1. Assumptions used for the calculation of the dry input footprint

8.1.1. Non-agricultural products

The technical specifications of the composition of non-agricultural products were provided to the Fundación Chile team for the 2009 study. On that occasion, the values of each input were derived based on their composition and references from third-party studies, which were reviewed in this study to validate their validity.

The assumptions used in the calculation of each of the inputs are presented below.

a. Plastic Products: Synthetic Corks, Stretch Film

In the case of plastic products, the values published for the water footprint of plastics production in the Borealis study, 2009[2] were applied. In this study, the results indicate that the water footprint of Polystyrene (PE) is 13.7 [m^3/ton], while the footprint of Polypropylene (PP) is 13.1 [m^3/ton].

In the case of synthetic corks, a material mix of 50%/50% and an average weight of 6.2 [g] each was assumed. In the case of film stretch, the PE factor was used directly.

b. Aluminum Products: Aluminum Lids

The water footprint of aluminum was estimated for the calculation of the caps. The water uptake information was obtained from the life cycle analysis conducted by Pricewaterhouse Coopers and Ecobilian for AMORIN in 2008[3] and Cong *et al*, 2009 .[4]

The total water withdrawal per ton of aluminum produced is 35.13 [lts/ton]. A consumptive use factor of 10% was assumed. On the other hand, an average weight per cap of 4.6 [gr] was considered.

c. PVC capsules

In this case, the water footprint of PVC was estimated based on the information on water uptake that appears in the study by PwC and Ecobilian, 2008. This study mentions that water withdrawal for PVC production is 12

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[2] Katsoufis, 2009. Cradle to gate water footprint analysis of Borealis Group Polyolefin Value Chain. Master of Science Thesis. Stockholm, Sweden.

[3] Pricewaterhouse Coopers, Ecobilian. 2008. Evaluation of the environmental impacts of cork stoppers versus aluminum and plastic closures. Corticeria Amorim SA. Portugal.

[4] Cong, L.; Ugochukwu, S., 2009. Investigating the water footprint of tetra pack Carton economy's Beverage portfolio. Lund University, Sweden.

[lts/kg]. The factor was calculated considering a consumptive use of 10% of the extraction and an average mass of 0.86 [gr] per PVC capsule.

d. PVC/Aluminum Capsules

As in the case of synthetic corks, fractions of 50%/50% by mass were considered for PVC and Aluminum. Each capsule weighs an average of 4.7 g; maintaining the consumptive use factor of 10% on the extractions.

e. Metal capsules

The metal capsules are composed mainly of tin, so the water footprint of this metal was estimated. The water withdrawal information was obtained from a study carried out by Wepperinst Institute[5] . This study mentions an extraction value of 10,958 m3/Ton. Considering a consumptive use factor of 10% and a weight of 6.1 g per unit, the product footprint corresponds to 0.007 m^3/capsule.

f. Glass

As in the previous cases, the water footprint of the glass was estimated based on the information on water withdrawals for the production process, multiplied by a use factor of 10%. For this case, the water withdrawal value for extraction was obtained from Van der Leeden *et* al, 1990[6] ; and the glass manufacturing process was 68 m^3/Ton. Thus, the water footprint value of the material is 6.8 m^3/Ton.

g. Paper and cardboard

Water footprint values for paper and paperboard were obtained directly from Van Oel, 2010 .[7]

8.1.2. Agricultural products

For agricultural products, a more detailed estimation of the water footprint was made, since a greater volume of water is expected to be used in their production. As in the previous study, the inputs considered in this category were:

- Corks
- French and American oak barrels
- Gelatins

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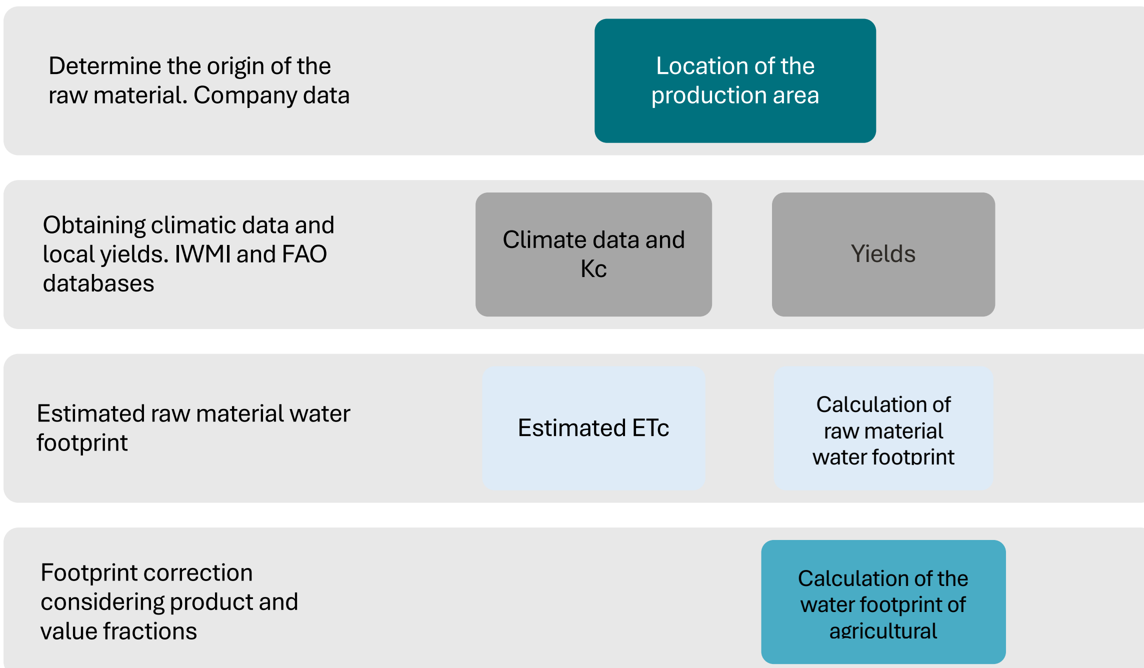
[5] Wuppertal Institute for Climate, Environment and Energy: Material intensity of materials, fuels, transport service

[6] Van der Leeden, F., Troise, F. L., Todd, D. K., 1990. The wáter Encyclopedia- Second Edition. Lewis Publishers.

[7] Van Oel, P. R., Hoekstra, A. Y., 2010. The green and blue water footprint of paper products: methodological considerations and quantification. UNESCO-IHE. The Netherlands.

The general methodology of the Water Footprint Network for agricultural products was used for all three cases, as in the previous study. This methodology consists of the following steps:

- Locate the place where the products originate. Information from weather stations was then obtained from the IWMI database[8] , as well as crop constants and average yields of raw materials.
- The values obtained for raw materials are corrected by the factors corresponding to the product and value fractions, which in this case were obtained from FAO, 2003 . [9]



[8] http://www.iwmi.cgiar.com

[9] FAO, 2003c. Technical Conversion Factors for Agricultural Commodities, Food and Agriculture Organization of the United Nations, Italy.