



Water Treatment

**Chilean
experience:**

➤ **Construction of
a sewage and
waste water
treatment system
in a coastal
urban center**

Sewage collector construction

- Construction of a Net of collectors and a sewage and waste plant in order to decontaminate the Great Valparaíso's border coast





Zone characteristics

□ Location

- Chilean Central boarder coast, Valparaíso's region
- Greater Valparaíso: Valparaíso(402 Km²), Viña del Mar(122 Km²), Villa Alemana(97 Km²) y Quilpue(537 Km²);

□ Geography

- Coastal region (Valparaíso y Viña de Mar): Composed by a narrow extensive flat border coast and numerous hills
- Interior Region (Villa Alemana y Quilpue): little valley surrounded by a mountain range.
- Hydrography: Underground water sources and little "*Marga Marga*" river basin. (length 40 Km, river basin 420 Km²): It goes from the interior and ends Viña del Mar's downtown.

□ Demography

- Greater Valparaíso : 834.824 inhab.
- High population density:
 - 305,12 (inhab/ Km²), average.
 - 2.402,99 (inhab/ Km²) Viña de Mar y 688,43 (inhab/ Km²) Valparaíso
- 98,27% is urban population

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- The zone is the most important for tourist activity in the country.



Before the Collector

- Problem: the Boarder coaster and the river Marga-Marga's basin contamination
 - The pollutants' levels are higher than the allowed standards for human interaction.
 - Cause: Great sewages are download from the industrial and households sewerages.
 - The seriousness of the problem is bigger in Summer:
 - Increase on the population and the sewerages usage
 - Temperature's increase
 - Closest contact between the population and the sewages:
 - Great coastal extension in polluted and overcrowded beaches.
 - The River crosses Viña de Mar's downtown.
 - Costs
 - Health: the contact with sewages in the sea, strong odors and animal proliferation that are illnesses carriers.
 - Cleaning: Permanent cleaning costs by the City Hall
 - Tourism's reduction: one of the region's more Important economic activity.
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Solution

- A net collector and a treatment plant construction in Valparaíso and Viña de Mar cities.
 - The treatment net:
 - Picks up and deals with the home wastes, then
 - Apply a clean treatment for water,
 - Concentrates the industrial and home sewage in a pipe which downloads the wastes 1.2 km. into the sea. This is the Main and fundamental project: Sewage Collector submarine emissary type.
 - This collector is mainly for households sewage, the industrial residuals are treated for different plants, located near the factories. ("Ventanas" Oil Refinery to the north of Valparaíso)
 - The whole process coordination is in charge of the sanitary company: ESVAL



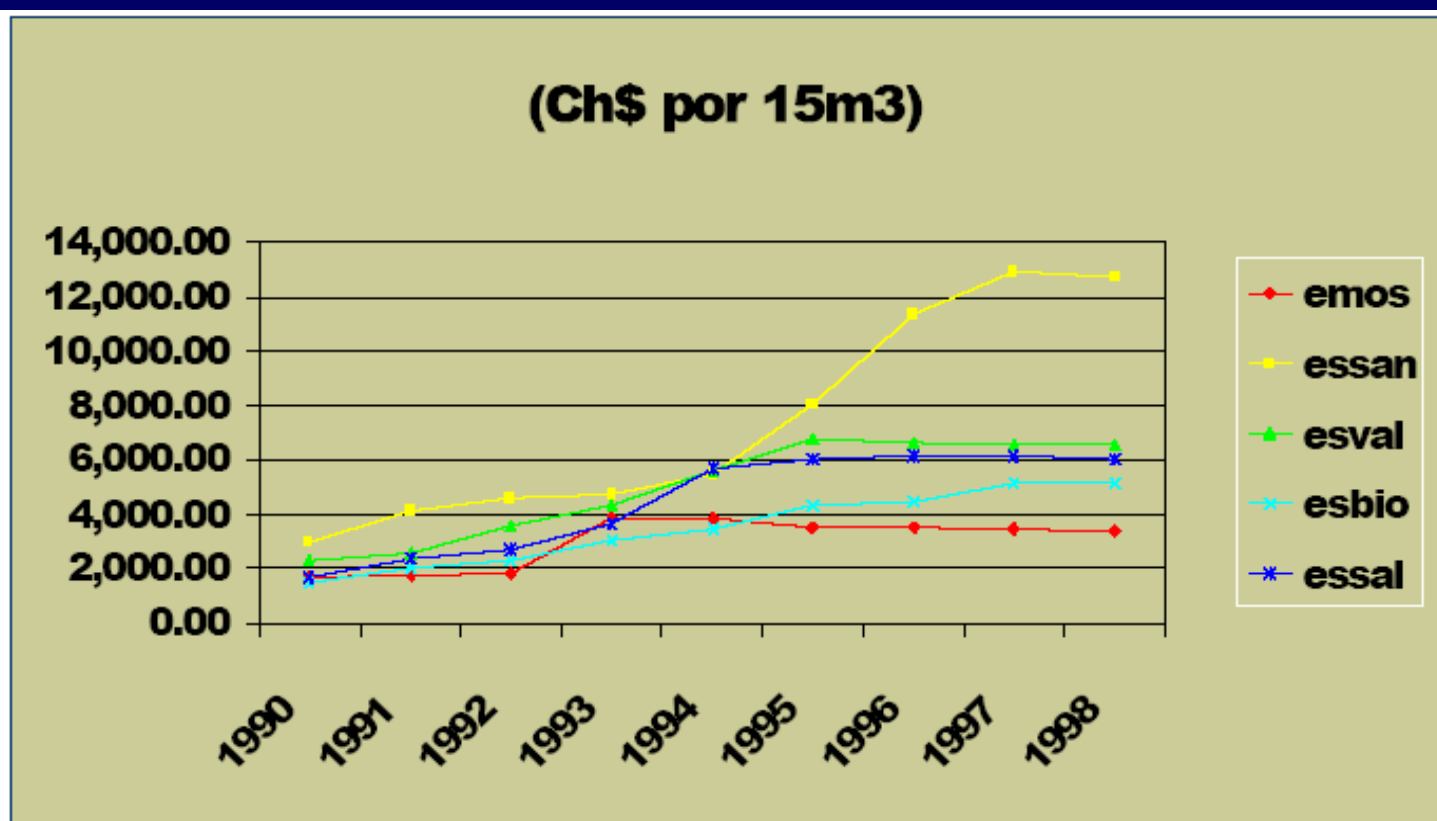


Main source of financing

- In 1990 the water supply and sewer net infrastructures had very poor coverage in the country and Great Valparaíso wasn't the exception.
- The size of the works need an important amount of resources. At this time the sanitary firms were owed by the state.
- The authorities applied as main financing principle the "use principle".
 - The fees for water supply and sewer services paying by the public increased since 1990 until 1995. (see next slide)
- Esval was privatized in 1998, by a indefinite concession to private capitals.
 - This mean to open to the stock market as a new source of financing
 - The posterior project for the region were financed by a rising in the capital increasing the number of stock in the market (2000)
- Actually the client's monthly bills presents different and additional cost due to the sewages treatment
 - Service Fix charge: \$794 (US\$1,7)
 - Potable Water Variable charge: \$5210 (US\$ 11,1)
 - Recollection Variable Charge: \$1210 (US\$ 2,6)
 - Water treatment Variable Charge:\$1539 (US\$ 3,3)
 - Total regular bill: \$8.753 (US\$18,7)
 - The last three variable charges assume a 9 m3 monthly per capita consumption. The Sanitary firms' tariffs are regulated by the government thru the Sanitary Services Superintendence (SISS)

Fee evolution during the nineties:

The tariffs paying by the public served by ESVAL rise until 1995. (green line)



Fuente: Ministerio de Economía



Construction's chronology :

- Beginning: Jan. 1993
 - Company “Consortio Oceánico” (Brazil-Argentina) starts the construction .
 - It predicts the ending on 1994's latest months.
 - Predicted costs: \$4.280 million pesos.(US\$22 million approx.)
 - Jun. 1993 Great excavations are made in Viña del Mar and Valparaíso
 - Six moats are constructed in Viña del Mar's downtown street.
 - Nov. 1994
 - It is announced the ending of the works on April 1995.
 - May 1995
 - The works are stopped for the lack of construction patents, because of the destruction provoked by the works.
 - They just resumed in 1997 by the Chilean company “Ovalle-Moore”
 - Ending of works: July 1999.
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In Summary...

- The construction was stopped in a total of 21 months.
- High costs
 - Road infrastructure damage:
 - Machines called “Topos” (moles) failed since they dug damaging the pavement.
 - High costs in inhabitants and tourists’ life quality
 - The construction activities and works lasted 6 years .
 - Traffic congestions, acoustic contamination, etc.
- Constant changes related to the executor companies:
 - The construction companies sued ESVAL alluding to contract problems.
- Final construction cost: US\$ 95 million. US\$181 per habitant or US\$514 per sanitary client in Viña del Mar and Valparaíso



Final treatment system: Treatment plant and submarine emissary

- There is a treatment plant in Valparaíso and Viña del Mar
- The collected sewages are subjected to a several stages treatment:
 - Water is filtered by means of grilles that eliminate wastes.
 - Fat removal by a flotation process
 - Sand elimination by a precipitation process
 - Then, the water passes through the submarine emissary that push it into the sea.
 - In the sea, the cleaning process ends
 - The biological agents still present in the water, are eliminated due to lower temperatures of the sea and the remoteness of the evacuation's place, related to the boarder cost.



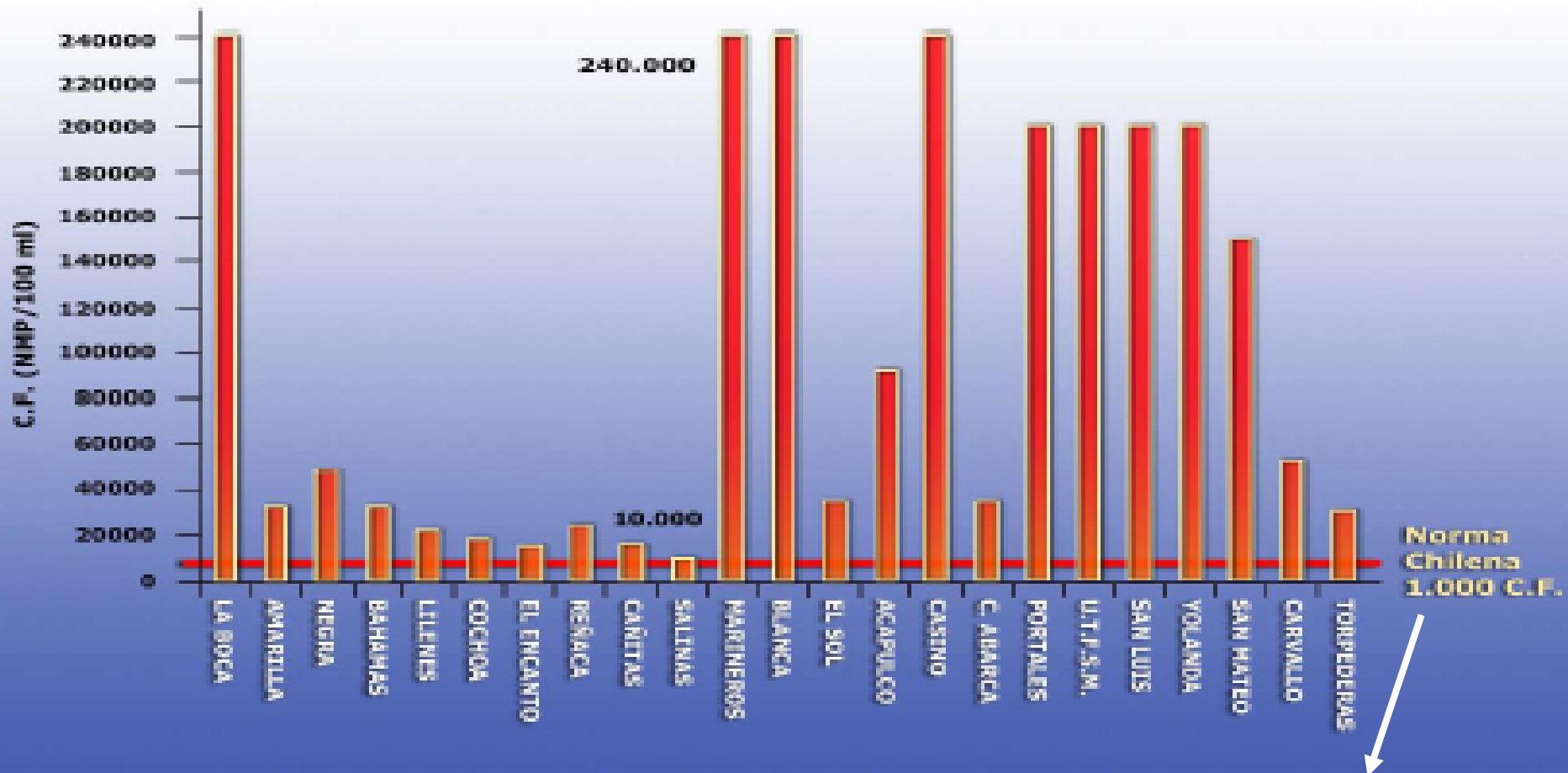
After the Collector

- Improvement on population's life quality
 - Clean rivers and beaches, elimination of strong odors and improvement on the cultural and natural landscapes.
 - Less cleaning costs by the authorities and sanitary companies
 - Beaches and rivers pollution problems:
 - They exist but they are sporadic; they are of a quick-solve matter and of a less contaminated level in comparison to the previous one and before the collectors' construction.
 - They have been diminishing since the collectors' construction.
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Fecal particulates concentration in Valparaíso's beaches (1996)

Coliformes Fecales en Valparaíso (1996)

Source: Sociedad de Fomento Fabril (SOFOFA)



They all are up to the norm: 1.000 c.f.

Fecal particulates concentration in Valparaíso's beaches (2002)

Coliformes Fecales en Valparaíso (2002)

Source: Sociedad de Fomento Fabril (SOFOFA)

