SEDIMENT STUDY IN MAIPO RIVER

CONDUCTED FOR AESGENER

March 2008

Department of Civil Engineering
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1. SUMMARY AND CONCLUSION

Below are the results and main conclusions from the Sediment study of Maipo River developed for AES Gener. This study was intended to estimate the annual mean volume of sediment entrained by Maipo River and its main affluent under current conditions as well as to determine the effect of reducing flow rate due to water collection considered for PHAM for sediment volume entrained.

Bottom entrainment rate: Without project

Based on calculation results of the entrainment capacity of the upstream waterway Bocatoma Independiente, results of the analysis of a physical model of Maipo River at El Manzano[1], study of gravel mining rate in Santiago basin[2] [3], and also the quantitative analysis of downstream entrainment capacity after Bocatoma Independiente, the conclusion was that the expected value of the sediment transport rate in the area of Maipo River at Las Vertientes is around 9 million ton/year.

The expected contribution from Colorado River to this figure is around 1.8 - 2.2 million tons/year while the contribution from Yeso River is around 0.2-0.6 million tons/year, adding around 2.0-2.8 million tons/year between both of them.

Currently, Volcán River does not seem to contribute significantly with silt by sediment transport toward the lower basin of Maipo River. The expected value of sediment transport rate from this River is estimated in 0.2 million tons/year approx.

In general Maipo River seems to transport sediments at a rate close to its entrainment capacity. In the area of Las Melosas the sediment transport rate expected value is estimated between 5.9 and 6.3 million tons/year. In the area of San José such figure (including contribution from Volcán and Yeso Rivers) is around 6.7 to 7.1 million tons/year. As noted before the area of Las Vertientes, upstream Bocatoma Independiente the sediment transport rate expected value in Maipo River will be close to 9 million tons/year post-contribution from Colorado River.

Downstream to Bocatoma Independiente, the decrease in the River flow rate due to collection from Aguas Andinas and Asociación de Canalistas del Maipo (Association of users of Maipo River) produces a sudden decrease in the entrainment capacity of the River with high tendency to generate sediment embankments in the area. Therefore, there is a likelihood that it is in this area where major extraction operation of gravel takes place in the River streamway. These operations produce a major alteration in the streamway and its granulometric characteristics. It is estimated that nearly 2.4 million tons/year are mined in this area (up to the municipality of San Bernardo.)

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[1] López A. y Tapia, R. (1996) Diseño y construcción de un modelo físico para el estudio de una sección de control fluviométrico en un río de montaña: caso Río Maipo en El Manzano. Publicación CRH 95-89-I. Departamento de Ingeniería Civil, Universidad de Chile.
[2] CONAMA (1999) Caracterización de las emisiones de áridos y su posterior evaluación y control. Estudio realizado por Geotécnica Consultores.
[3] MOP-REG (1998) El río Maipo y sus afluentes como fuentes de abastecimiento de áridos. Región Metropolitana, V y VI. M.O.P. – REG Ingenieros Consultores.

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Sediment transport rate expected value downstream this area is estimated in slightly under 6 million tons/year.

Total Sediment Transport: Scenario without the Project

Based on the analysis of a database of suspended sediment transport readings in different DGA stations in the area under study as well as from spot readings taken as part of this study, the conclusion is that the expected value for suspended sediment transport rate in the area of Maipo at El Manzano is around 3.3 million tons/year. When the expected value of sediment transport rate is added to this figure, the total sediment transport rate expected value for the area under the study (that is, downstream Bocatoma Independiente included its collection) the number amounts to 12.3 million tons/year. Suspended sediment transport rate in the area will therefore amount to 27% approx. of the total sediment transport rate. This figure shows that the bed entrainment system is the main mechanism for transport of sediments.

The expected value for suspended sediment transport rate of Maipo River at San Alfonso ranges between 1.1 and 1.5 million tons/year while contribution from Volcán and Yeso Rivers would be around 0.14 and 0.03 million tons/year, respectively. The rest of the contribution will mainly come from Maipo River upstream the confluence of Volcán and Yeso Rivers with an expected value around 1.0 to 1.3 million tons/year. The expected value of the contribution from Colorado River to suspended sediment transport rate in Maipo River is estimated in 1.3 million tons/year approx.

Adding the expected values of sediment transport rate and suspended sediment transport rate result in the expected values of the total sediment transport rate. These values are 0.34, 0.23 to 0.63, 3.1 to 3.5 and 6.9 to 7.6 million tons/year in Volcán, Yeso, Colorado, and Maipo Rivers at Las Melosas, respectively.

Downstream Bocatoma Independiente, suspended sediment transport rate is reduced due to the extraction in the streamway. The expected value of suspended sediment transport rate is estimated in 2.0 to 2.3 million tons/year, approximately. The expected value of total sediment transport rate flowing downstream the municipalities of San Bernardo and Buin, will then be around 8 million tons/year (nearly 6 million tons/year of bed entrainment and 2 million tons/year of suspended sediment.) Most of these sediments are ultimately discharged into the Pacific Ocean in the area of Llolleo/San Antonio.

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Bottom entrainment rate: Scenario without the Project

The contribution of coarse sediment in the high area of Volcán River toward Maipo River under the current situation is very low, without any significant alteration from the Project. Coarse sediment contribution toward Maipo River coming from Yeso and Colorado Rivers will be affected by the Project. Under the most unfavorable calculation scenario it is possible to expect a decrease around 0.2 to 0.5 million tons/year in the expected values in the contribution from Yeso River and around 1.4 to 1.8 million tons/year in the expected values of the contribution from Colorado River. Therefore total reduction in expected values in the bed entrainment rate in the area of Maipo at Las Vertientes is around 2 million tons/year, equivalent to 22% of 8.9 million tons/year estimated for a scenario without the Project. The most favorable condition calculation shows a decrease in sediment transport rate down to 0.05 million tons/year in Yeso River and between 0.2 and 0.6 million tons/year in Colorado River whereas decrease at Las Vertientes is from 2 to 6% of bed sediment transport rate when compared with the scenario without the Project. Considering that both conditions for the calculation used are extreme cases, the expected value of an intermediate reduction of bed sediment transport rate around 1.3 million tons/year, amounting to 15% of the transport associated to the scenario without the Project has been considered.

The Project does not alter flow rates downstream Bocatoma Independiente and therefore the entrainment capacity in that area is not affected. Should mining rate of gravel in the area immediately downstream Bocatoma Independiente is kept at current levels, and then nearly 5.2 million tons/year would be transported toward the municipality of San Bernardo in the scenario with a Project. This value, when compared with the scenario without Project amounts to an approximate reduction of 14% in the expected value of gravel in that area.

Total Sediment Transport: Scenario with the Project

Streamways affected by the Project will generate a decrease in the contribution of suspended sediments toward Maipo River are Volcán, Yeso, and Colorado Rivers. The decrease in the expected value of suspended sediment transport rate in those Rivers is estimated at 0.05, 0.03, and 0.90 million tons/year. Total reduction associated is of 1 million tons/year approx., which amounts to 30% of the expected value of suspended sediment transport rate estimated for Maipo River at Las Vertientes in the scenario without the Project. The expected value of suspended sediment transport rate in the area of Maipo at Las Vertientes for the scenario with the Project will therefore be around 2.0 million tons/year.

When adding the expected values of both suspended and bed sediment transport rate in the scenario with Project in the area of Maipo at Las Vertientes an approximate value of 9.6 million tons/year, amounting to 78% of 12.3 million tons/year estimated for the scenario without Project is obtained (i.e., a 22% decrease).

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The expected value for total availability of sediments (including both suspended and bed sediment transport rate) in the area of San Bernardo, it is estimated of near 6.5 million tons/year, which amounts for 19% reduction in the total available sediment transport rate available in that area when compare to the scenario without Project.

Impact of the Project on the sediment balance of the system

As there is no integral management plan for extraction of gravel at Maipo River in place, current mining rates would seemingly be above the sustainable limit of the streamway as concluded from the background information reviewed. Under this scenario any disturbance to the system might lead to local issues in terms of erosion of the streamway as in the past with over-mining suffered during certain periods of time. Therefore, should estimate reductions in sediment availability downstream Bocatoma Independiente are added by the Project, regardless of not being intensive, might lead to local problems if no measures are adopted for a more rational management of both the streamway and available water and gravel resources. Clearly this management is to be conducted at basin level by the relevant authorities.

It is necessary to take into account that in both scenarios, with and without the Project, the effect will become a reality at the dam at El Yeso River where a static settling condition is reached. Therefore the streamway will cease to significantly contribute with sediment. This entails a 0.2 to 0.5 million tons/year-reduction in the bed entrainment rate estimated for the scenario without the Project. It is difficult to project when that situation will take place, particularly when considering that after 43 years of operation the dam shows no visible signs of a static settling.

Finally, it should be mentioned that the morphological characteristics of the Maipo when flowing into the valley are a consequence of the natural decrease in its capacity to entrain sediments, thus making that part of the sediments transported settle as well as the formation of islets and multiple streamways. Due to its nature, Maipo River (and in general, all Rivers not intervened) is not under a static condition but it is rather continuously in evolution in a dynamic equilibrium where flow rate, sediment, and morphology are constantly interaction and conditioning each other. The rate of change of the system can be altered (and accelerated) when disturbed in any manner, finding new equilibriums. This is the way sediment transport rates affluent to the system change or when under over-mined activities of gravel the flow might ultimately produce degradation in certain sub-streamways. These effects can however be reduced or controlled by an appropriate management of the system which, has to necessarily be comprehensive and inclusive of the whole streamway to the outlet. In this regard it is easy to observe the absence of a rational management in using gravels in the Maipo River system. When granting mining and extraction permits based on local criteria, the authorities do not consider the system reaction both in space and time and the way the system attempts to reach new equilibrium.

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2. AVAILABLE BACKGROUND INFORMATION

The following background information was used when conducting this study:

a) Topography and Bathymetric information

Different information sources relative to topography and shape of streamways were used as to represent accurately the land in the different modeling aimed at establishing the sediment transport rate.

A first group of sites was analyzed based on topographic surveys especially commissioned for this study and conducted by Mr. Genaro Cárcamo. These consisted of 11 cross-section profiles along a total length of 500m approx. in the direction of run-off (with 50m approx. spacing between profiles), and covering a strip down to the levels of maximum floods based on information on site. The advantage this source of information has is a more accurate illustration of bathymetry as these measurements were conducted for the existing shape of the bed. Below are the sites for which this information was available:

- Maipo at Las Melosas
- Volcán under water intake Volcán power plant
- Yeso upstream Maipo confluence

A second group of sites was modeled by determining cross-section profiles based on the topographic database AES Gener has which includes aerial surveys of wide areas of influence of PHAM, including high areas in the basins of Volcán, Yeso, and Colorado Rivers. This information is presented as maps of 1m contour lines. Bathymetry is established in a more approximate manner as mean bed slopes between contour lines and streamway width based on the information provided by those maps as ripple marks. Sites included in this group are:

- Colina stream
- La Engorda stream
- Canyon of el Morado
- Ravine Las Placas
- Colorado River

There are two cases not falling in any of the two previous groups: the site of Maipo at Las Vertientes and Maipo at San José. For the former information of 50m cross-section profiles from the (in progress) report “Hydraulic and Sediment behavior of Bocatoma Independiente from EMOS in Maipo River ("Comportamiento Hidráulico y Sedimentológico de la Bocatoma Independiente de EMOS en el Río Maipo,”) authored by Eduardo Ponce. For the latter site, Maipo at San José, bathymetric and topographic surveys were attempted but conduction of such works entailed serious risks, therefore the work was cancelled when the streamway in Maipo River increased considerable. Hence the topography was determined using a mean slope similar to the site of Maipo at Las Vertientes with streamway widths obtained from satellite images of the area and similar slope angles to the bed shapes typical in other sections of Maipo River.

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b) Hydrological Information

Hydrological information used in this study was provided by AES Gener for both streamways in the scenario without Project as well as streamway information collected for the power plants.

Streamway values are presented as monthly mean values and represent the following control points at the basin:

- Colina stream
- La Engorda stream
- Canyon of el Morado
- Ravine Las Placas
- Volcán under water intake Volcán power plant
- Yeso at outlet
- Maipo at Las Melosas
- Maipo at San Alfonso
- Maipo at El Manzano
- Colorado at outlet

With regard to stations downstream El Yeso Dam (Yeso at the outlet, Maipo at San Alfonso, and Maipo at El Manzano), the streamway series include effect on the control as per simulation of operation included in the information from the Fourth rating process of Aguas Andinas (public domain information).

Collections are taken at Colina stream, La Engorda stream, Canyon of el Morado, Las Placas ravine, Yeso and Colorado Rivers, therefore hydrological series for the scenario with Project are the available streamway minus the streamway to collect while the max collection value is the value allowed by water rights not considering the ecological streamway (Tables 2.1 and 2.2).

Statistics of Maipo at San Alfonso on the other hand is altered by the extraction at the basins of Volcán and Yeso Rivers as those streamways recover further downstream this control point.

While statistics of Maipo at Las Melosas and Maipo at El Manzano are considered the same for both scenarios with and without the Project. The first as there is no streamway extraction in the sub-basin defining this station; the second as streamways recovery takes place in the vicinity of this station; representation of the control point in the lower part of the basin (Maipo at Las Vertientes) require streamways to be the same. This is also necessary to use the rights pertaining water intakes existing in this section of the River.

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Table 2.1. AES Gener S.A. Water rights in streamways.

Month	Colina stream	La Engorda stream	El Morado canyon	Las Placas ravine	Yeso River	Colorado River*
September	1.20	0.83	0.99	0.59	15.00	-
October	1.82	1.26	1.49	0.90	15.00	-
November	3.36	2.10	2.76	1.00	15.00	-
December	5.54	2.10	3.70	1.00	15.00	-
January	6.00	2.10	3.70	1.00	15.00	-
February	4.21	2.10	3.45	1.00	15.00	-
March	2.82	1.96	2.31	1.00	15.00	-
April	1.71	1.18	1.40	0.84	15.00	-
May	1.31	0.91	1.07	0.64	15.00	-
June	1.17	0.81	0.97	0.57	15.00	-
July	1.24	0.87	1.02	0.57	15.00	-
August	1.06	0.73	0.87	0.46	15.00	-

Source: Information from AES Gener.
*: See detail of flow rates for extraction at Colorado River in the Hydrology Annex

Table 2.2. Ecological flow rates in streamways considered.

Streamway	Ecological flow rate [m3/s]
Colina stream (1)	0.30
La Engorda stream (1)	0.20
El Morado canyon (1)	0.24
Las Placas ravine (1)	0.14
Yeso River (1)	0.60
Colorado River (2)	3.12

Source: (1) Information from AES Gener
(2) "Evaluación de los Recursos Hídricos Superficiales en la cuenca del Río Maipo", Informe Técnico S.D.T. Nº 145, DGA

c) Sedimentometric Information

The most important source of information for suspended sediments is the statistics from the DGA in the stations of Volcán River at Queltehues, Maipo River at San Alfonso, Colorado River at the confluence with Maipo River, and Maipo River at El Manzano. With the exception of the station Volcán River at Queltehues that only has spot daily sampling (periodic), the rest also has monthly comprehensive sampling and with record longitudes as shown under Table 2.3. Fig. 2.1 illustrates the location of the stations.

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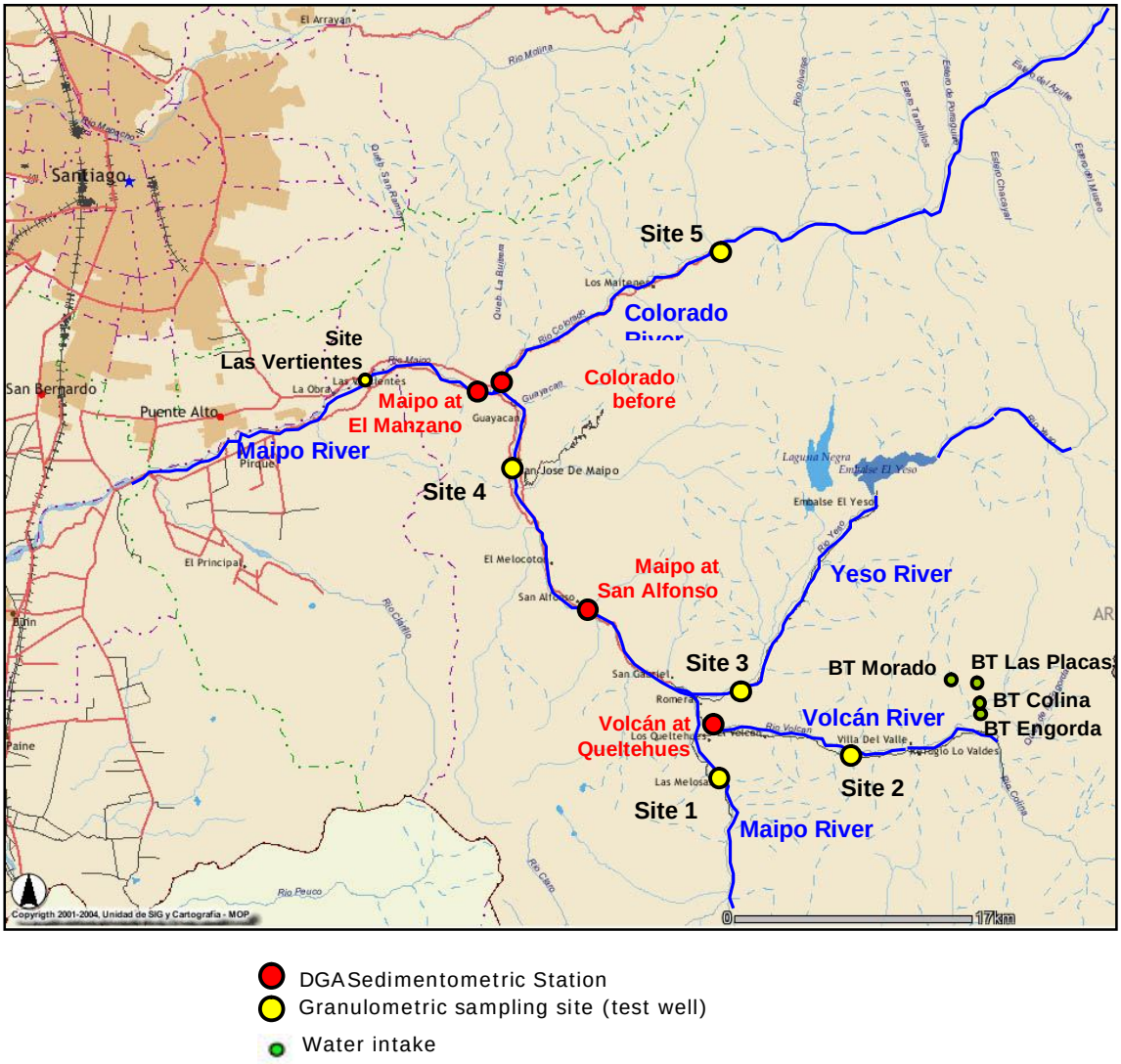

DGA Sedimentometric Station
Granulometric sampling site (test well)
Water intake

Figure 2.1. Location Map of different streamways and sites of interest for the Study

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Table 2.3. Registry of suspended sediments at DGA sedimentometric stations

Station	Comprehensive sampling	Periodic sampling
Volcán River at Queltehues	--	Oct 18, 1966 - Jul 01, 1985
Maipo River at San Alfonso	Sep 09, 1985 - Sep 07, 2006	Jun 11, 1985 - Dec 20, 2005
Maipo River at El Manzano	Sep 03, 1985 - Oct 03, 2006	Jun 26, 1965 - Aug 31, 2006
Colorado River at confluence Maipo River	Sep 05, 1985 - Sep 06, 2006	May 05, 1985 - Jul 12, 2006

Additionally, there is information about comprehensive sampling of suspended sediment at Volcán River upstream the confluence of Colina stream and Colina stream upstream Volcán River from February 15, April 21, and May 5, 1990.

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3. AREA SURVEY CAMPAIGN

Four visits were conducted to the area of the study at Maipo Canyon, two in September, one in October, and the last one in November, 2007. Different sections of the streamways of interest were visited from Volcán River in the vicinity of the location of the water intakes of PHAM at Valle de la Engorda; Maipo River upstream the confluence with Volcán; Yeso River between the area of the dam and the confluence with Maipo River; Maipo River between the confluence with Yeso River and the area at Las Vertientes; and Colorado River between the water intake Maitenes and confluence with Maipo River. Snow prevented reaching the area where the water intakes will be located at Valle de la Engorda, Colina ravine, and Morado River in September, hence the fourth visit was necessary in November. October's visit was done with the company that conducted the bathymetric and topographic surveys in the locations defined in previous visits. These visits were also useful, besides having a vision of the area under study, to define those areas where bathymetric and topographic surveys were to be made, location of test wells, sampling of suspended sediment, and determination of superficial granulometry.

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4. CHARACTERISTICS OF STREAMWAYS

4.1 Modeled Sections

Streamways analyzed for estimation purposes of their capacity for sediment transport are listed under the following Table 4.1. The typical length for a modeled section is 500m along which cross-section profiles are located with an average spacing of 50m.

Table 4.1. Characteristics of streamway sections used in Modeling

Streamway	Mean slope (%)	Length of modeled section (m)
Colorado River	2.1	500
El Volcán River	1.7	500
El Yeso River	3.1	500
Maipo River, area of Las Melosas	1.3	400
Maipo River, area of Las Vertientes	0.8	510
Maipo River, area of San José	1.1	500
Las Placas stream	17.9	500
El Morado stream	5.7	500
Colina stream	3.2	500
La Engorda stream	5.4	500

Figures 4.1 and 4.2 show the location maps of sections modeled, differentiating those sections located in the upper and lower sections of Maipo basin, respectively.

Modeled sections match the locations for granulometric sampling which due to the morphological characteristics are detailed in the complete description of the site in Section 4.2 along with the description of the material in the bed and access to the site.

The exceptions are:

- Las Placas ravine where it was not possible to have access, therefore the site was described using the properties from the rest of nearby streams;

- Maipo at Las Vertientes, where both granulometric and topographic information was obtained from external sources. The information is nonetheless added under Section 4.2 relative to the River morphology in the area.

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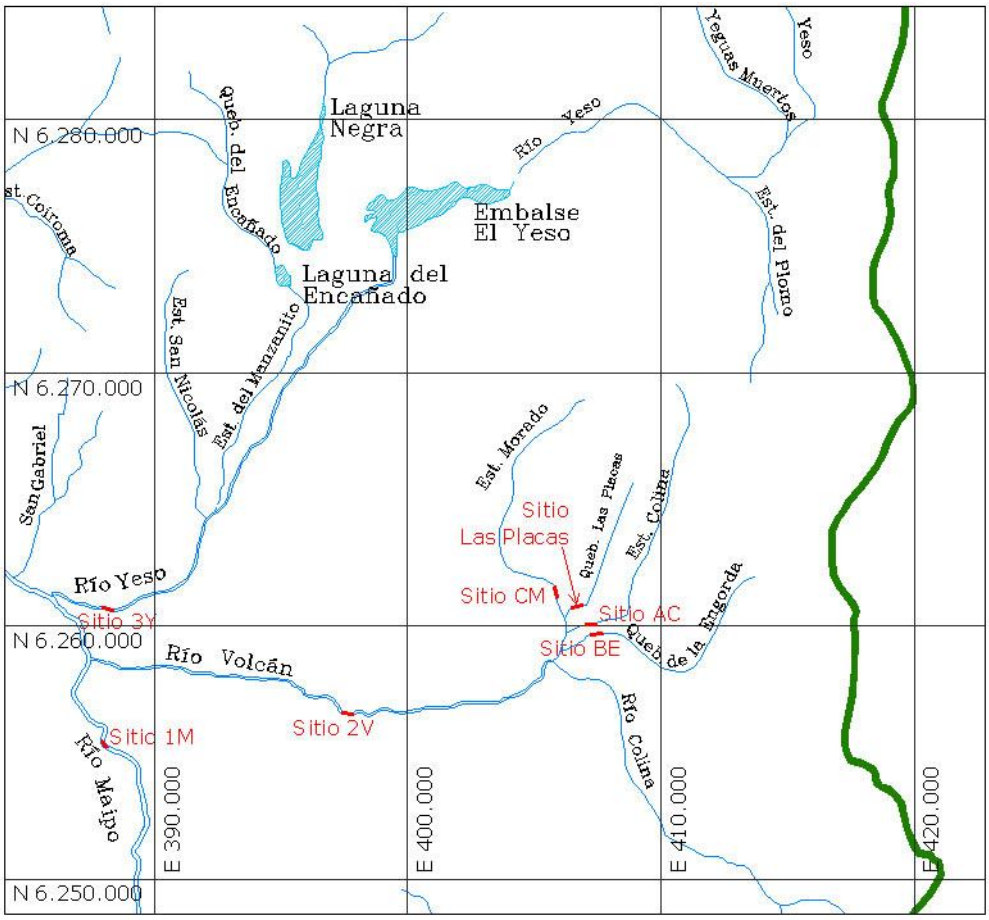

Figure 4.1. Location Map of Modeled sections (upper area).

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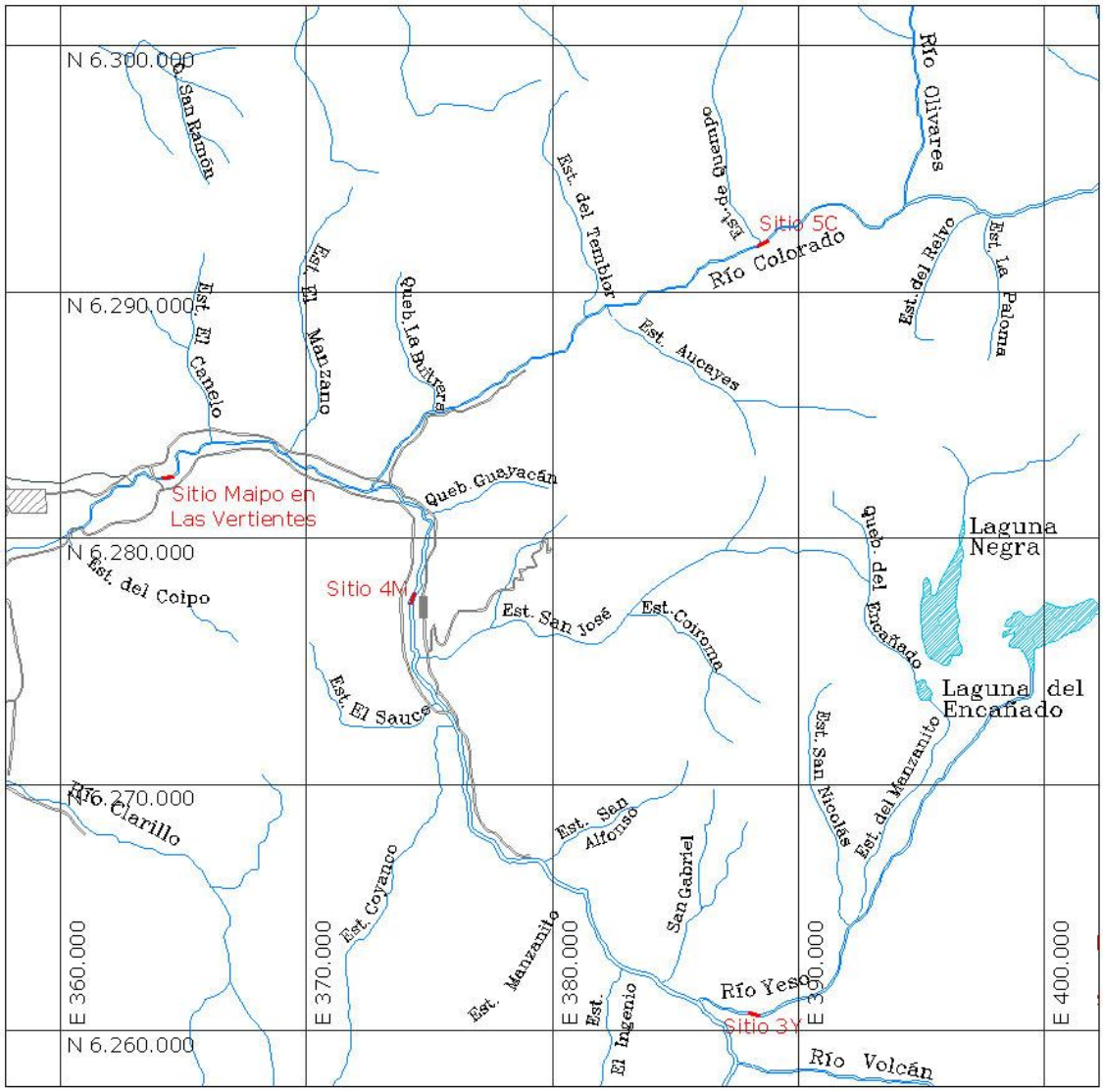

Figure 4.2. Location Map of Modeled sections (lower area).

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4.2 Granulometry

A total of 5 sites were selected for a comprehensive granulometric sampling: 2 in the streamway of Maipo River and 3 in its main tributaries: Colorado, Volcán, and Yeso Rivers. Visits were conducted in September 26-28, 2007, where sampling to streamways beds was done.

Due to accessibility conditions in the areas of water intakes at the ravines (La Engorda, Colina, and Morado) samplings were superficial. It was not possible to have access to the area of Las Placas, therefore average granulometry data from surrounding ravines was used.

Methodology

The work conducted at each of the sites consisted of digging a test well of approximately 1m x 1m on surface as to reach a maximum depth of 1m. Depth of the excavation is subject to the land contour (mainly due to the phreatic level or rocks hindering both the excavation as the granulometry sorting of the sample.)

The excavation was done by layers, first removing the crust of the bed with width similar to larger elements on the surface; then to proceed with the rest of the excavation in 10 to 15cm wide layers. All material from the excavation was screened using 4 meshes installed on site with several openings of 105, 61, 37, and 20cm. Heavier fragments remaining on each mesh were weighted on site and a representative sample was taken from the remaining fragments using a cracking procedure. Total weight of the fragment was recorded. The sample was then taken to the lab for further determination of the granulometry of the finer fraction which, thanks to the weighting on site allows determining the complete granulometry curve of the analyzed sample.

Additionally, a characterization of superficial sediments was conducted using photograph and tape measuring of greater sized fragments present in the sampling area.

Description of Sampling Sites

Below are the characteristics for each of the sites chosen as well as River properties and sediment flow as well access details to the site. Table 4.2 shows locations of the sites and the type of sampling conducted.

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Table 4.2. Location of sites for granulometric sampling

Site	Streamway	Type of sampling	UTM coordinates (Datum PSAD56)	
			N	E
1M	Maipo River (at Las Melosas)	Comprehensive	6.255.078	388.224
2V	Volcán River (between El Volcán and Baños Morales)	Comprehensive	6.256.547	397.757
3Y	Yeso River (near confluence with Maipo River)	Comprehensive	6.260.563	388.081
4M	Maipo River (at San José)	Comprehensive	6.277.716	374.373
5C	Colorado River (entre Alfalfal y Los Maitenes)	Comprehensive	6.291.844	388.592
AC	Colina stream	Superficial	6.260.027	407.255
BE	La Engorda stream	Superficial	6.259.708	407.463
CM	Morado stream	Superficial	6.261.356	405.716

a) Site 1M: Maipo River at Las Melosas

This sampling site is located near Refugio Las Melosas, downstream a bridge crossing Maipo River at the end of the public road and where a restricted access road belonging to Carabineros de Chile begins.

The streamway in this section shows a significant shield with sizes ranging from 25 toy 30cm in diameter. Also, a split takes place between two branches (8m each approx), producing a long islet with shield sizes increasing at the end of this singularity. On the right hand bank (looking downstream) a foothill shows up while on the left hand side is possible to see a flood plain currently covered with abundant vegetation. This indicates the level reached by the River during its typical floods when covering this area.

Upstream the sampling site (upstream the bridge) the streamway has similar characteristics in terms of morphology although without the division in several branches. Downstream the streamway flows into a wide curve and is narrowed to a rocky gorge as it can be seen further downstream toward the area of Queltehues.

Access to the sampling site was done using a public road to Refugio Las Melosas bordering a branch of the streamway to reach its midpoint in the islet already described.

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Figures 4.3 and 4.4 show the location of the test well and the shield in the site prior to the excavation, respectively.

Figure 4.3. Works for test well in Site 1M.

Figure 4.4. Shield in Site 1M.
(Extended measuring tape: 1.90m)

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b) Site 2V: Volcán River

This sampling point is located between the towns of El Volcán and Baños Morales, downstream the water intake at Volcán.

The area has a prominent shield with rocks with an average size of 30cm, but also with the occurrence of bodies with up to 1m diameter. Based on the make-up of the valley it can be assumed that there is a blend of material entrained by the River and contribution from lateral slides that have remained at the site as the flow have not been able to transport such material. A bank section was chosen for this site where it was possible to make the excavation at approximately10m from the main streamway due to the difficulties found to determine the granulometric determination of streamway material (see Figures 4.5 to 4.7).

Volcán streamway in this section has a base width of approximately 6m running along a 20m wide and from1 to 3m long box. Greater size particles occurring in the banks and streamway also have finer particles that visibly modify the transport flow during the day becoming suspended during the afternoon due to the increase in flow rate produced by thaw and which remain in the streamway during the morning hours.

Access to the area of sampling was done using the public road to Baños Morales, and approaching the streamway through a trail leading to a house in the area.

Figure 4.5 shows the location area of the test well while Figures 4.6 and 4.7 show the shield in the same location prior the excavation and in the adjacent portion to the water course, respectively.

Figure 4.5. Works for test well in Site 2V.

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Figure 4.6. Shield in Site 2V.
(Extended measuring tape: 0.50m)

Figure 4.7. Shield in Site 2V, along the water course.
(Extended measuring tape: 0.50m)

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c) Site 3Y: Yeso River

This sampling point is located 2km upstream the area of Romeral, approximately 5km upstream the confluence with Maipo River.

The section has a shield with particle sizes ranging from 5 to 30cm. It should be mentioned that there areas intervened for gravel mining upstream the area chosen as shown by material stockpiled near the streamway as well as access strips to the streamway. Therefore the sampling sector was selected based on searching non-intervened sections. Additionally, it was possible to confirm in future visits that the location area for the test well was flooded by the River with the increase in flow rate from thaw; thus the site is considered as representative of the River bed. Canyon of Yeso River starts downstream the selected site as is characteristic of the final leg in the confluence toward Maipo River.

Access to the sampling area was done using the public road to El Yeso dam, approaching the streamway going down the slope of the road.

Figures 4.8 and 4.9 show the location of the test well and the shield in the site prior to the excavation, respectively.

Figure 4.8. Works for test well in Site 3Y.

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Figure 4.9. Shield in Site 3Y.
(Extended measuring tape: 1.45m)

d) Site 4M: Maipo River at San José

This sampling point is located in San José de Maipo, near the vicinity of waste water discharge area from the town's treatment plant.

The sampled section shows the split in the streamway of Maipo River in two branches for a short leg (approximately 50m) created when the River box expands locally. The area is protected by rockfill dams on the northern bank (toward San José de Maipo), enclosed by a steep natural slope on the southern bank. Also upstream the sampling site, at 500m approx., is possible to see sand traps works for gravel mining from the River. The material of the shield identified has a maximum size of 20cm.

Access to the sampling area was done using a public road reaching the River gabions where descent to the selected point was done using the rockfill dam.

Figures 4.10 and 4.11 show the location of the test well and the shield in the site prior to the excavation, respectively.

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Figure 4.10. Works for test well in Site 4M.

Figure 4.11. Shield in Site 4M.
(Extended measuring tape: 1.05m)

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e) Site 5C: Colorado River

This sampling point is located downstream the sector of Alfalfal hydroelectric power plant, approximately 1Km from the bridge of public road to the power plant.

The streamway shows a division in two branches; the sampling point is located at the southern bank. It is possible to see the beginning of a branch that was dry at the time of the sampling. Further visits to the site allow seeing that there was a flow through this branch which shows a fine sediment on the shield of the branch.

The size of the material in the area adjacent to the bank is slightly greater which is confirmed in the sampling from the test well. Therefore a supplementary superficial sampling was conducted as to improve estimation of the size at the shield.

Access to the sampling area was done using the public road to Alfalfal power plant, approaching the streamway by going down using the road slope.

Figure 4.12 shows the location area of the test well while Figures 4.13 and 4.14 show the shield in the same location prior the excavation and in the adjacent portion to the water course, respectively.

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Figure 4.12. Works for test well in Site 5C.

Figure 4.13. Shield in Site 5C.
(Extended measuring tape: 1.00m)

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Figure 4.14. Shield in Site 5C, along the water course.
(Extended measuring tape: 0.50m)

f) Site Maipo at Las Vertientes

Although the source of the granulometric information from the site at Maipo at Las Vertientes is the (in progress) report Hydraulic and Sediment behavior of Bocatoma Independiente from EMOS in Maipo River ("Comportamiento Hidráulico y Sedimentológico de la Bocatoma Independiente de EMOS en el Río Maipo",) authored by Eduardo Ponce, below are the morphological characteristics of this section of the streamway.

This is a high intervention section on the streamway that has water intakes and gates. The modeled section where the information has been collected is located upstream the bridge located at the town of Las Vertientes crossing toward the municipality of Pirque. The streamway, with a total width of 70m approx, is split in two branches leaving a longitudinal strip of sand visible with low flow rate.

Figure 4.15 shows a satellite view of the area.

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Source: Google Earth
Figure 4.15. Satellite image of the area of Maipo at Las Vertientes.

g) Site AC: Colina stream

This sampling point is located approximately 2km upstream the confluence of this streamway with La Engorda stream. Its location is virtually the same where the AES Gener future water intake will be located for PHAM.

The width of the streamway is relatively constant, 6 to 7m in the sampling area. This stream runs along the northern side of a canyon valley with an eroded streamway 2 to 3m under the plain of the valley.

Access to the sapling area was done by foot from the public road to El Morado canyon following a trail in the hills.

Figure 4.16 shows superficial sampling activities and fine extraction from the streamway while Figure 4.17 illustrates one of the visits to the shield at the site.

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Figure 4.16. Sampling at Site AC, Colina stream.

Figure 4.17. Shield at Site AC, at the flooding plain.
(Extended measuring tape: 0.50m)

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h) Site BE: La Engorda stream

This sampling point is located approximately 2km upstream the confluence of this streamway with Colina stream. Similar to the last stream the location of the site is virtually the same location where the future AES Gener water intake will be located.

The streamway winds along the valley canyon overseeing the Colina stream on the southern side. In certain areas the River bed is 3 to 4m under the valley plain while for moments it becomes an excavated streamway in fine volcanic sediments covered by scarce vegetation. Small waterfalls were also observed. These were created by large boulders that presumably fell from the hills in the valley.

Access to the site was done under the same conditions to access the Colina stream. Also, it was necessary to cross La Engorda stream using an improvised bridge following the trail as to reach the Colina stream.

Figure 4.18 shows the sampling activities while Figure 4.19 illustrates one of the visits to the shield along the streamway.

Figure 4.18. Sampling at Site BE, La Engorda stream.

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Figure 4.19. Shield in Site BE, along the streamway.
(Extended measuring tape: 0.50m)

i) Site CM: El Morado stream

This sampling point is located approximately 3km upstream the confluence of this streamway with Colina stream. The sampling site is located around 200m upstream the location where the future AES Gener water intake will be located, matching the narrowing of the streamway where a bridge crosses.

The streamway, upstream the narrowing, runs through the canyon with several distinctive branches. The width of the branches in the sampled area is 3 and 5m, respectively. Inactive branches were also visible, some of them showing stagnated water and some of them were wet which confirms the streamway dynamics during the sampling period where inter-daily variations in flow rate from thawing produce significant changes in the active run-off surface.

Access to the site was done using a public road reaching the El Morado canyon. It was necessary to walk the last 2Km due to the poor conditions of the road (mud from thawing).

Figure 4.20 shows the sampling activities while Figure 4.21 shows one of the photographs of the shield at the flooding plain, western side.

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Figure 4.20. Sampling at Site CM, El Morado stream.

Figure 4.21. Shield in Site CM, along the streamway.
(Extended measuring tape: 0.50m)

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Granulometric Curves

Granulometry distribution for both the shield and the integrated substrate was determined based on the samples collected on site (Sites 1 to 5), superficial sampling of the shields (Site A to C and Las Placas ravine), and information available (test wells in the Maipo River at Las Vertientes). These are shown in Figures 4.22 to 4.31 along with the summary of characteristic sizes in Table 4.3.

Sampling sites 1-5 were treated as per the methodology previously detailed as to obtain a comprehensive granulometric curve when building the fine fragments measured at the laboratory with the coarser fragments measure on site. The study in both sites, 2 (Volcán) and 5 (Colorado) was supplemented with photograph superficial sampling to represent the coarser fragments of the shield.

Due to the difficulties found when accessing the sites with all the necessary equipment, sites A to C (streams at the head of Volcán River), only superficial sampling of the shield was done, with photograph records in characteristic sites, and recovering samples from the finer fragments from the streamway and flooding plain. Photograph records were translated to a calculation of volume as to determine the granulometry of the coarser fragment which added to the granulometric trials of the finer portion rendered a comprehensive granulometric curve. In the case of Las Placas ravine, as it was not possible to have access to the streamway, average granulometric data from the rest of the surrounding streams was used (Colina, La Engorda, and Morado).

Finally, the data from two test wells at Las Vertientes was used as part of the report (in progress) “Comportamiento Hidráulico y Sedimentológico de la Bocatoma Independiente de EMOS en el Río Maipo” authored by Eduardo Ponce. Data composition from both test wells and strata analyzed (2, 40cm layers) facilitated estimation of comprehensive granulometric curves as well as for the rest of the sites previously described.

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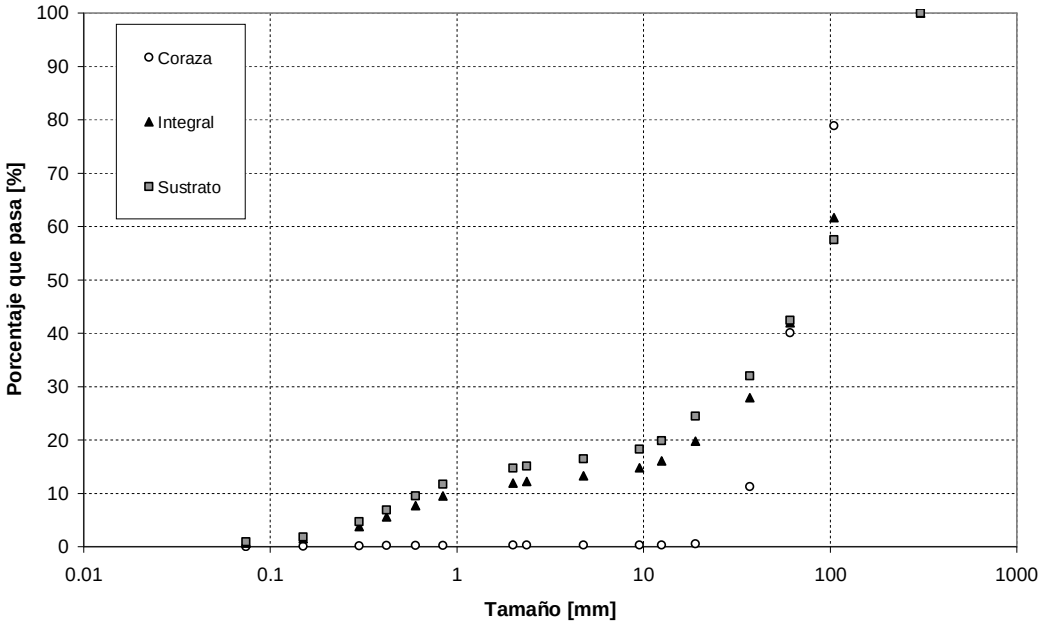

Particle size [mm]	Mesh	Shield	Comprehensive	Substrate
305		100.00	100.00	100.00
105		78.90	61.68	57.54
61		40.08	41.96	42.42
37		11.28	27.96	31.97
19	3/4''	0.55	19.80	24.42
12.5	1/2''	0.31	16.06	19.84
9.52	3/8''	0.30	14.80	18.29
4.76	4	0.29	13.30	16.42
2.36	8	0.28	12.23	15.11
2.0	10	0.28	11.89	14.68
0.84	20	0.25	9.49	11.71
0.6	30	0.23	7.71	9.51
0.42	40	0.20	5.57	6.86
0.3	50	0.17	3.79	4.66
0.15	100	0.09	1.49	1.83
0.074	200	0.03	0.71	0.87

Figure 4.22. Granulometry samples Site 1M, Maipo River at Las Melosas

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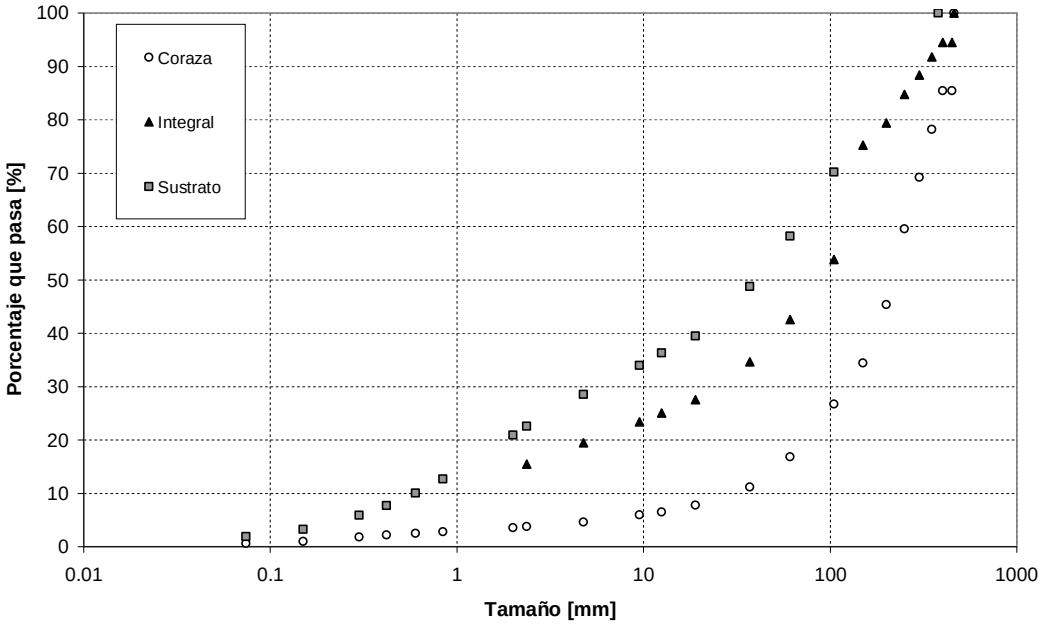

Particle size [mm]	Mesh	Shield	Comprehensive	Substrate
460		100.00	100.00	
450		85.45	94.51	
400		85.45	94.51	
350		78.21	91.78	100.00
300		69.23	88.39	-
250		59.51	84.72	-
200		45.35	79.38	-
150		34.38	75.24	-
105		26.73	53.80	70.20
61		16.81	42.56	58.17
37		11.20	34.61	48.79
19	3/4''	7.77	27.52	39.48
12.5	1/2''	6.52	25.05	36.27
9.52	3/8''	5.94	23.41	33.99
4.76	4	4.58	19.47	28.49
2.36	8	3.74	15.45	22.54
2.0	10	3.54	14.35	20.90
0.84	20	2.81	8.98	12.72
0.6	30	2.51	7.19	10.02
0.42	40	2.16	5.60	7.69
0.3	50	1.79	4.36	5.91
0.15	100	1.00	2.40	3.25
0.074	200	0.59	1.40	1.89

Figure 4.23. Granulometry samples Site 2V, Volcán River.

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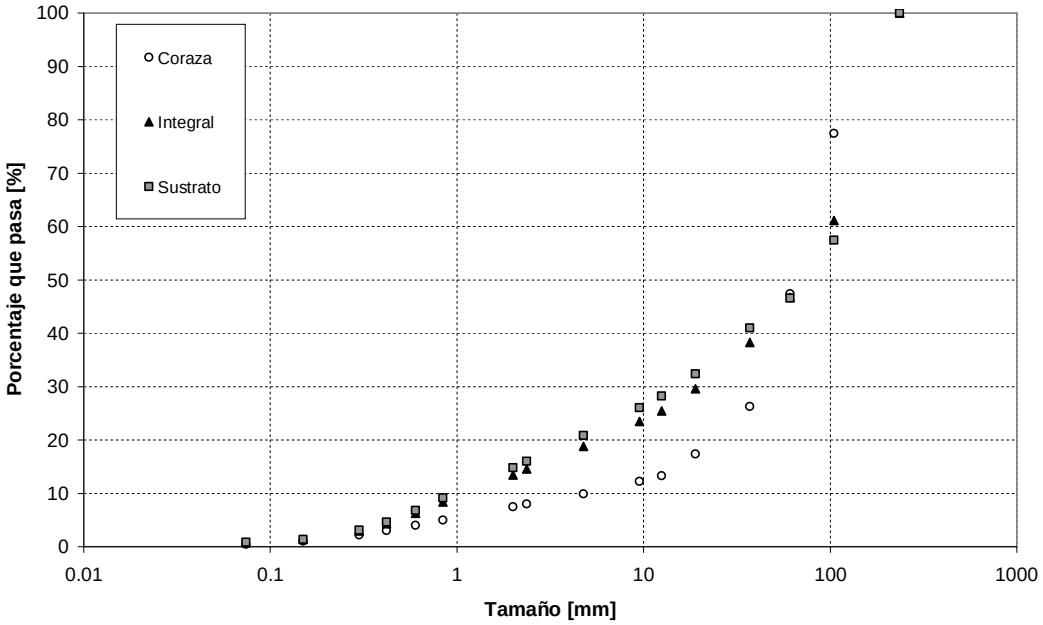

Particle size [mm]	Mesh	Shield	Comprehensive	Substrate
235		100.00	100.00	100.00
105		77.40	61.10	57.42
61		47.40	46.73	46.58
37		26.30	38.25	40.95
19	3/4''	17.38	29.61	32.38
12.5	1/2''	13.30	25.46	28.21
9.52	3/8''	12.22	23.46	26.00
4.76	4	9.92	18.81	20.82
2.36	8	8.03	14.55	16.02
2.0	10	7.50	13.43	14.77
0.84	20	4.99	8.35	9.10
0.6	30	3.99	6.29	6.80
0.42	40	3.00	4.30	4.60
0.3	50	2.20	2.92	3.09
0.15	100	1.03	1.32	1.39
0.074	200	0.47	0.77	0.84

Figure 4.24. Granulometry samples Site 3Y, Yeso River.

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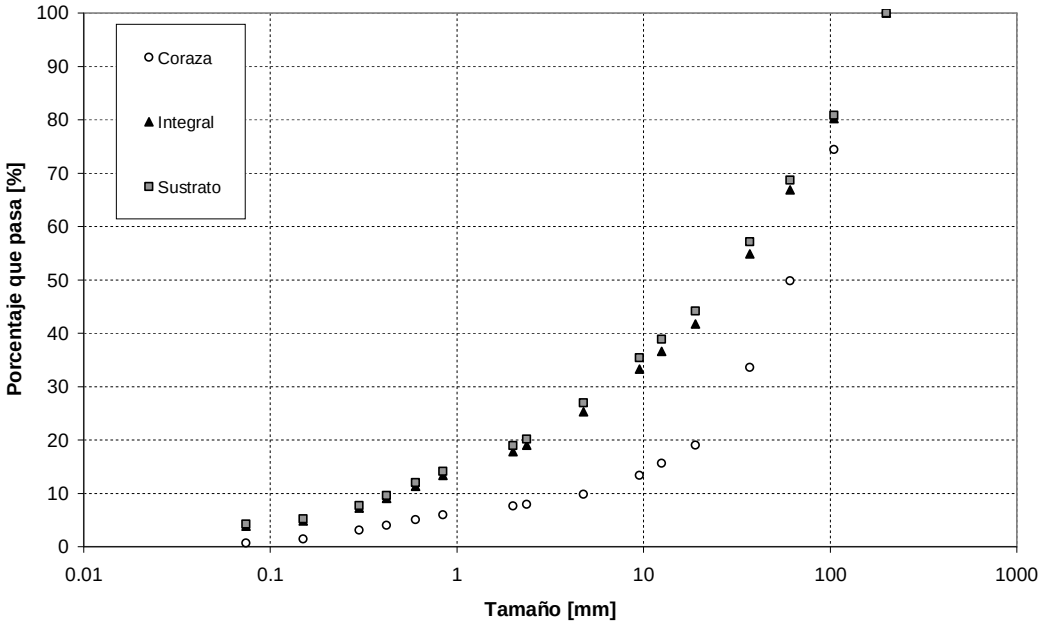

Particle size [mm]	Mesh or sieve Designation	Shield	Comprehensive	Substrate
200		100.00	100.00	100.00
105		74.43	80.19	80.80
61		49.82	66.87	68.68
37		33.58	54.88	57.14
19	3/4''	19.04	41.73	44.14
12.5	1/2''	15.65	36.63	38.85
9.52	3/8''	13.35	33.26	35.38
4.76	4	9.82	25.29	26.94
2.36	8	7.95	19.00	20.17
2.0	10	7.65	17.83	18.91
0.84	20	5.96	13.35	14.13
0.6	30	5.06	11.32	11.99
0.42	40	4.01	9.05	9.59
0.3	50	3.07	7.22	7.66
0.15	100	1.44	4.86	5.23
0.074	200	0.70	3.86	4.19

Figure 4.25. Granulometry samples Site 4M, Maipo River at San José.

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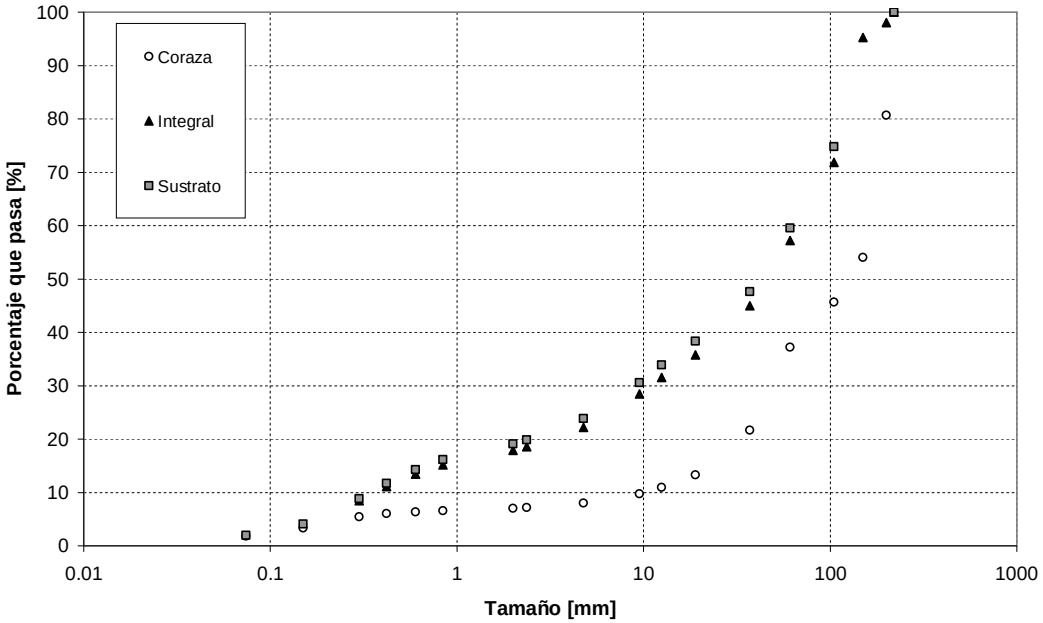

Particle size [mm]	Mesh or sieve Designation	Shield	Comprehensive	Substrate
220		100.00	100.00	100.00
200		80.71	98.02	-
150		54.07	95.28	-
105		45.69	71.83	74.82
61		37.19	57.24	59.54
37		21.69	44.95	47.61
19	3/4''	13.28	35.77	38.34
12.5	1/2''	10.97	31.53	33.89
9.52	3/8''	9.77	28.43	30.57
4.76	4	7.98	22.19	23.82
2.36	8	7.14	18.55	19.85
2.0	10	7.00	17.87	19.11
0.84	20	6.56	15.19	16.18
0.6	30	6.37	13.45	14.26
0.42	40	6.01	11.09	11.67
0.3	50	5.43	8.47	8.82
0.15	100	3.33	3.98	4.06
0.074	200	1.82	1.95	1.97

Figure 4.26. Granulometry samples Site 5C, Colorado River.

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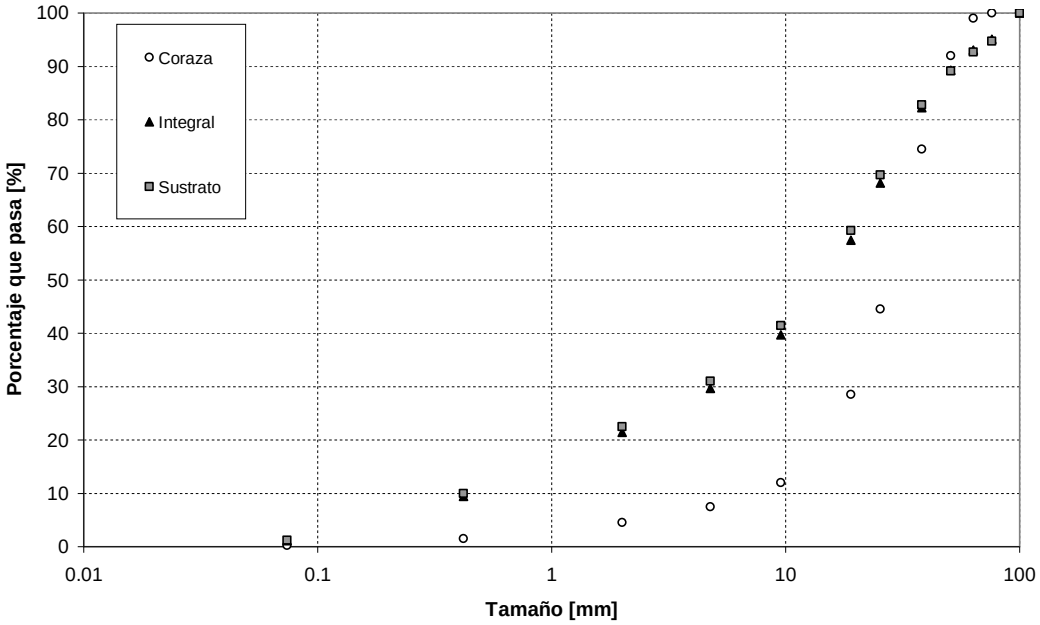

Particle size [mm]	Mesh	Shield	Comprehensive	Substrate
100			100.00	100.00
76.2	3''	100.00	95.06	94.75
63.5	2 1/2''	99.00	93.02	92.65
50.8	2''	92.00	89.29	89.12
38.1	1 1/2''	74.50	82.29	82.78
25.4	1''	44.50	68.18	69.66
19	3/4''	28.50	57.41	59.22
9.52	3/8''	12.00	39.69	41.42
4.76	4	7.50	29.63	31.01
2.0	10	4.50	21.40	22.46
0.42	40	1.50	9.45	9.95
0.074	200	0.25	1.14	1.20

Figure 4.27. Granulometry samples, Maipo River at Sector Las Vertientes.

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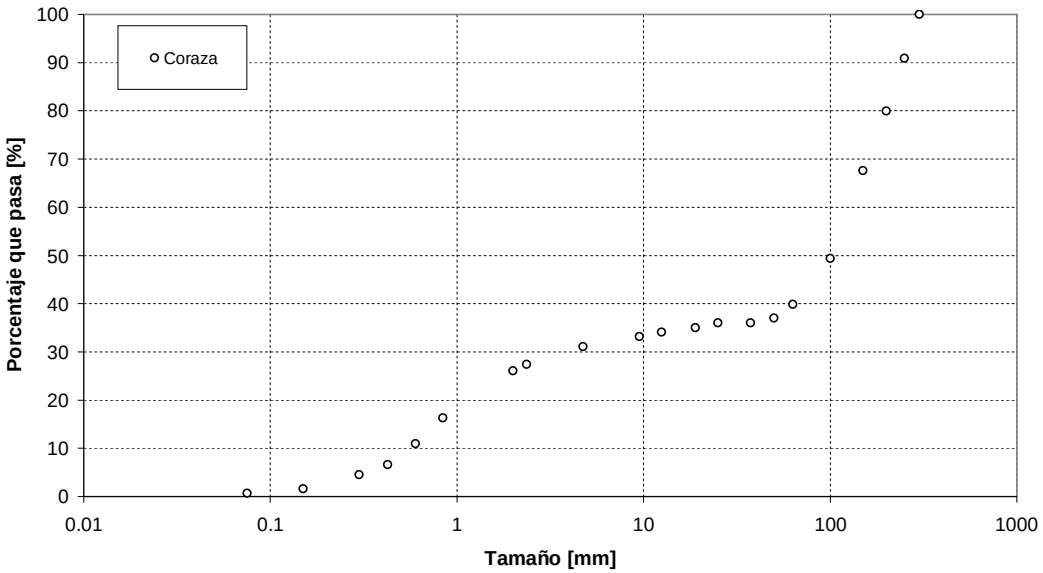

Particle size [mm]	Mesh	Shield
300		100.00
250		90.91
200		79.97
150		67.56
100		49.35
63		39.87
50		36.99
37		35.97
25	1''	35.97
19	3/4''	35.01
12.5	1/2''	34.07
9.52	3/8''	33.18
4.76	4	31.05
2.36	8	27.44
2.0	10	26.05
0.84	20	16.29
0.6	30	10.95
0.42	40	6.61
0.3	50	4.55
0.15	100	1.58
0.074	200	0.69

Figure 4.28. Granulometry samples shield Site AC, Colina stream.

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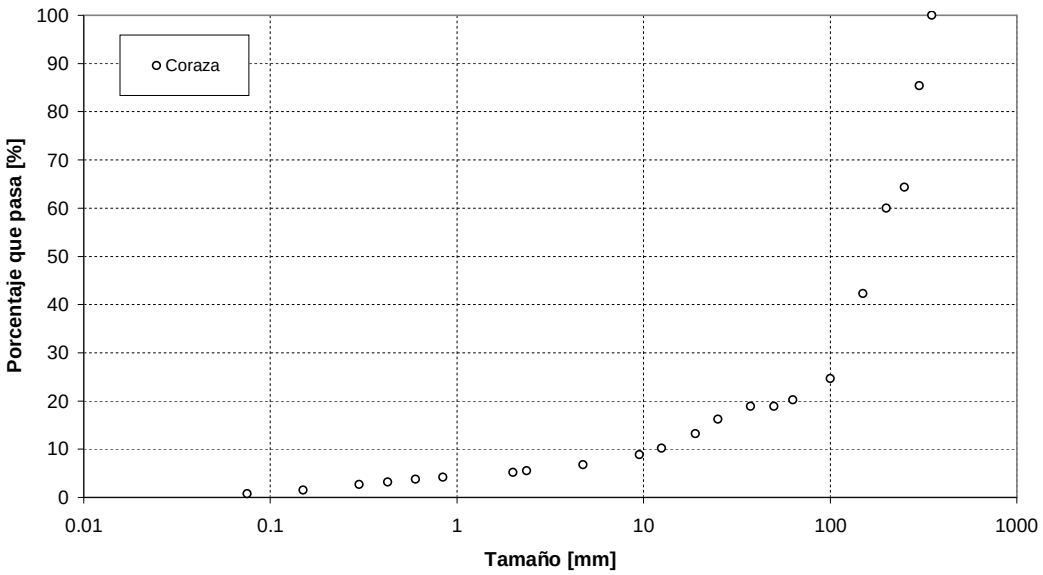

Particle size [mm]	Mesh or sieve Designation	Shield
350		100.00
300		85.42
250		64.31
200		59.99
150		42.27
100		24.66
63		20.20
50		18.89
37		18.89
25	1''	16.20
19	3/4''	13.18
12.5	1/2''	10.16
9.52	3/8''	8.82
4.76	4	6.77
2.36	8	5.48
2.0	10	5.22
0.84	20	4.18
0.6	30	3.74
0.42	40	3.21
0.3	50	2.65
0.15	100	1.50
0.074	200	0.76

Figure 4.29. Granulometry samples shield Site BE, La Engorda stream.

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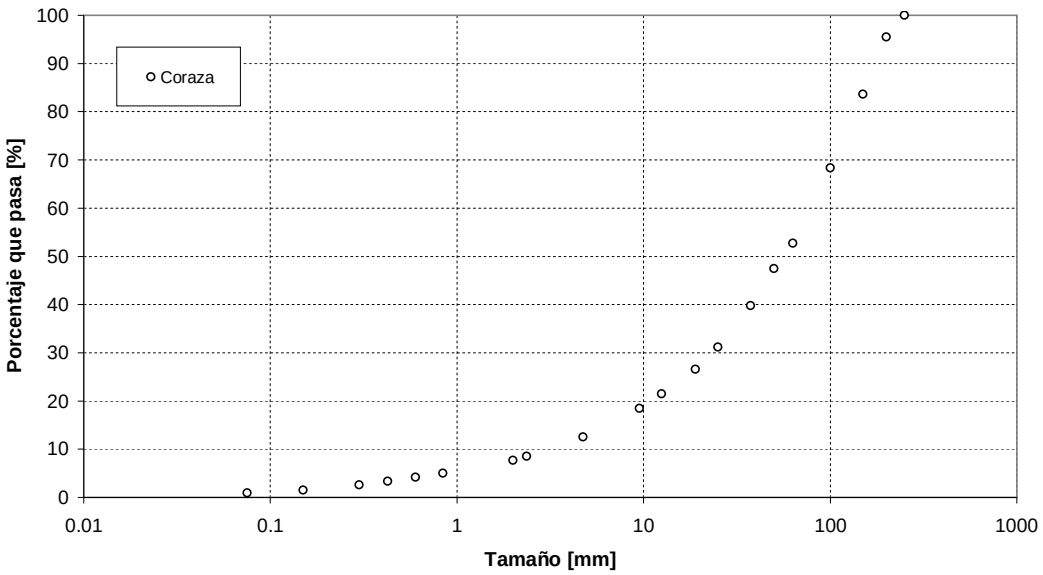

Particle size [mm]	Mesh	Shield
250		100.00
200		95.51
150		83.61
100		68.33
63		52.72
50		47.49
37		39.75
25	1''	31.12
19	3/4''	26.54
12.5	1/2''	21.45
9.52	3/8''	18.50
4.76	4	12.55
2.36	8	8.50
2.0	10	7.69
0.84	20	5.01
0.6	30	4.18
0.42	40	3.36
0.3	50	2.55
0.15	100	1.54
0.074	200	0.93

Figure 4.30. Granulometry samples shield Site CM, El Morado canyon.

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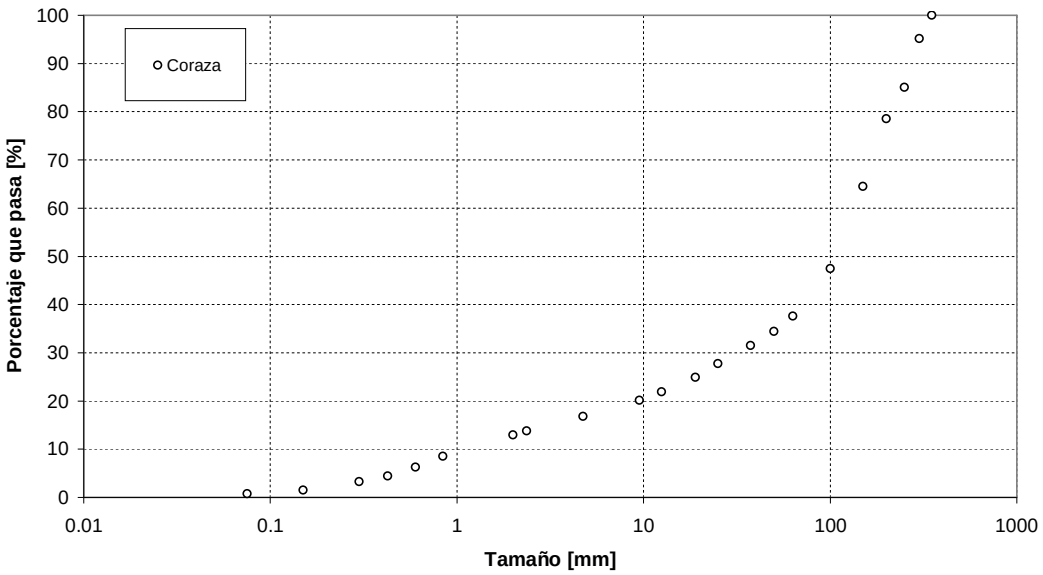

Particle size [mm]	Mesh or sieve Designation	Shield
350		100.00
300		95.14
250		85.07
200		78.49
150		64.48
100		47.45
63		37.60
50		34.46
37		31.54
25	1''	27.77
19	3/4''	24.91
12.5	1/2''	21.89
9.52	3/8''	20.17
4.76	4	16.79
2.36	8	13.80
2.0	10	12.99
0.84	20	8.49
0.6	30	6.29
0.42	40	4.39
0.3	50	3.25
0.15	100	1.54
0.074	200	0.79

Figure 4.31. Granulometry shield, Las Placas ravine.

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Table 4.3. Characteristic sizes of sampled sites (mm).

	Site 1M Maipo at Las Melosas			**Site 2V Volcán**		
	Shield	*Comprehensive*	*Substrate*	*Shield*	*Comprehensive*	*Substrate*
D_{90}	210.2	252.8	257.9	453.1	323.8	287.7
D_{84}	153.3	221.5	229.6	390.0	243.2	232.3
D_{50}	72.2	78.9	83.1	216.4	90.1	40.1
D_{16}	40.9	12.4	4.0	57.5	2.7	1.3

	Site 3Y Yeso			**Site 4M Maipo at San José**		
	Shield	*Comprehensive*	*Substrate*	*Shield*	*Comprehensive*	*Substrate*
D_{90}	177.5	201.6	204.5	162.8	152.0	150.5
D_{84}	143.0	181.5	186.2	140.6	123.3	120.8
D_{50}	64.8	71.0	74.9	61.3	30.3	27.1
D_{16}	16.8	3.2	2.4	13.2	1.5	1.3

	Site 5C Colorado			**Site Maipo at Las Vertientes**		
	Shield	*Comprehensive*	*Substrate*	*Shield*	*Comprehensive*	*Substrate*
D_{90}	209.6	139.9	174.3	49.3	53.2	54.0
D_{84}	203.4	128.4	146.9	45.0	41.2	40.5
D_{50}	128.1	46.9	41.8	27.7	15.0	14.1
D_{16}	24.8	1.2	0.8	11.8	1.3	1.2

	Site AC Colina stream	**Site BE La Engorda stream**	**Site CM El Morado canyon**	**Las Placas ravine**
	Shield	*Shield*	*Shield*	*Shield*
D_{90}	245.9	315.7	176.8	274.5
D_{84}	218.4	296.6	151.6	241.9
D_{50}	101.8	171.8	56.2	107.5
D_{16}	0.8	24.6	7.5	4.1

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4.3 Manning's Roughness Coefficient

To determine the magnitude of friction stress at the streamways need to consider different factors such as particle size in the streamway in contact with water, irregularities in cross-sections and along the flow, obstructions, vegetation, and the presence of meanders (bends). Therefore Manning's coefficient is determined using Cowan's method:

$$n = m\left(n_0 + n_1 + n_2 + n_3 + n_4\right)$$

where:

n_0: Base Manning's coefficient, depending on the roughness of the bed;
n_1: correction for wet perimeter irregularity;
n_2: correction for variation in shape and dimensions in cross-sections along the streamway;
n_3: correction for clogging;
n_4: correction for the presence of vegetation at the banks;
m: diversion factor of streamway or propensity to form meanders.

The relationship between base Manning's coefficient and particle sized is given by Strickler's formula to be applied using a characteristic size of shield in meters:

$$n_0 = \frac{d^{1/6}}{26.5}$$

Table 4.4 shows the results of applying the previous mathematical expressions to each of the sites selected. The values of n resulting from this calculation were compared with those associated to streamways similar to those in the study as presented in Water Supply Paper 1849 from the U.S. Geological Survey (Barnes H.H., 1967, Roughness Characteristics of Natural Channels).

Figures 4.32 to 4.39 show images of reference streamways for comparison purposes with USGS publication and determination of the corresponding factors as per Cowan's method.

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Table 4.4. Determination of Manning's roughness coefficient.

Site	d (mm)	n_0	n_1	n_2	n_3	n_4	m	n
1M Maipo River at Las Melosas	253	0.030	0.010	0.005	0	0	1	0.045
2V El Volcán River	274	0.032	0.010	0.005	0	0	1	0.047
3Y El Yeso River	202	0.029	0.010	0.005	0.010	0	1	0.054
4M Maipo River at San José	152	0.028	0.010	0.010	0.005	0	1	0.053
5C Colorado River	172	0.028	0.010	0.010	0	0	1	0.048
Maipo at Las Vertientes	53	0.023	0.010	0	0	0	1	0.033
AC Colina stream	102	0.026	0.010	0.005	0.010	0	1	0.051
BE La Engorda stream	172	0.028	0.010	0.010	0.010	0	1	0.058
CM El Morado canyon	56	0.023	0.005	0.005	0	0	1.15	0.038
Las Placas ravine	108	0.026	0.008	0.007	0.007	0	1.05	0.050

Notes:

- Sites 1M to 5C and Maipo at Las Vertientes used comprehensive diameter d_{90} as the characteristic diameter.
- - $_{50}$ of the shield as the characteristic diameter.
- Factors n_1, n_2, n_3, n_4 and m used for Las Placas ravine are the average of those used in other 3 sites of water intakes in the area (La Engorda, Colina, and Morado).

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Figure 4.32. Photograph of Maipo River streamway at Las Melosas.

Figure 4.33. Photograph of Volcán River streamway.

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Figure 4.34. Photograph of Yeso River streamway.

Figure 4.35. Photograph of Maipo River streamway at San José.

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Figure 4.36. Photograph of Colorado River streamway.

Figure 4.37. Photograph of Estero streamway.

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Figure 4.38. Photograph of La Engorda streamway.

Figure 4.39. Photograph of El Morado streamway.

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5. CHANNEL LINES

Based on the bathymetry and topography of the streamways already described and the hydrological information cited, the channel lines for the sections under study were determined using MOSSEM (software developed by the consulting company). Channel lines were calculated for several flow rates which include both the minimum and maximum flow rate for each section. Boundary conditions used are normal height for downstream end value, using the mean slope and Manning's coefficient of the section to analyze. Figures 5.1 to 5.10 illustrate the calculated channel lines while Annex 2 include the free surface and depth elevation values, as a function of the distance, for the different flow rates. The channel line in the Maipo River at Las Vertientes is calculated for each of the channels forming immediately upstream the barrier due to buildup of material from the bed along the streamway as to divide the water and to be captured by works of Aguas Andinas and Sociedad de Canalistas del Maipo for water collection.

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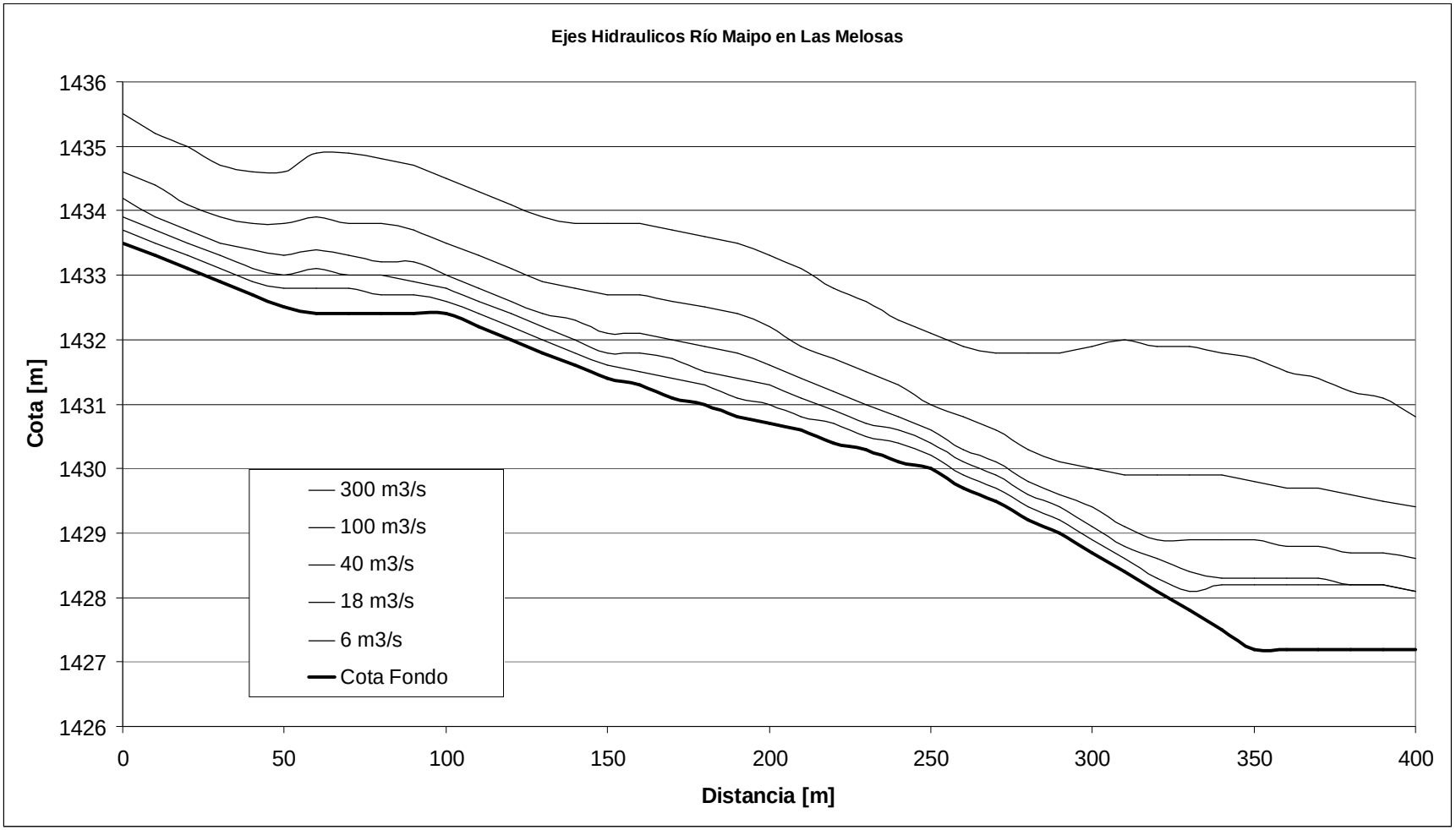

Figure 5.1. Channel line for a section of the Maipo River at Las Melosas

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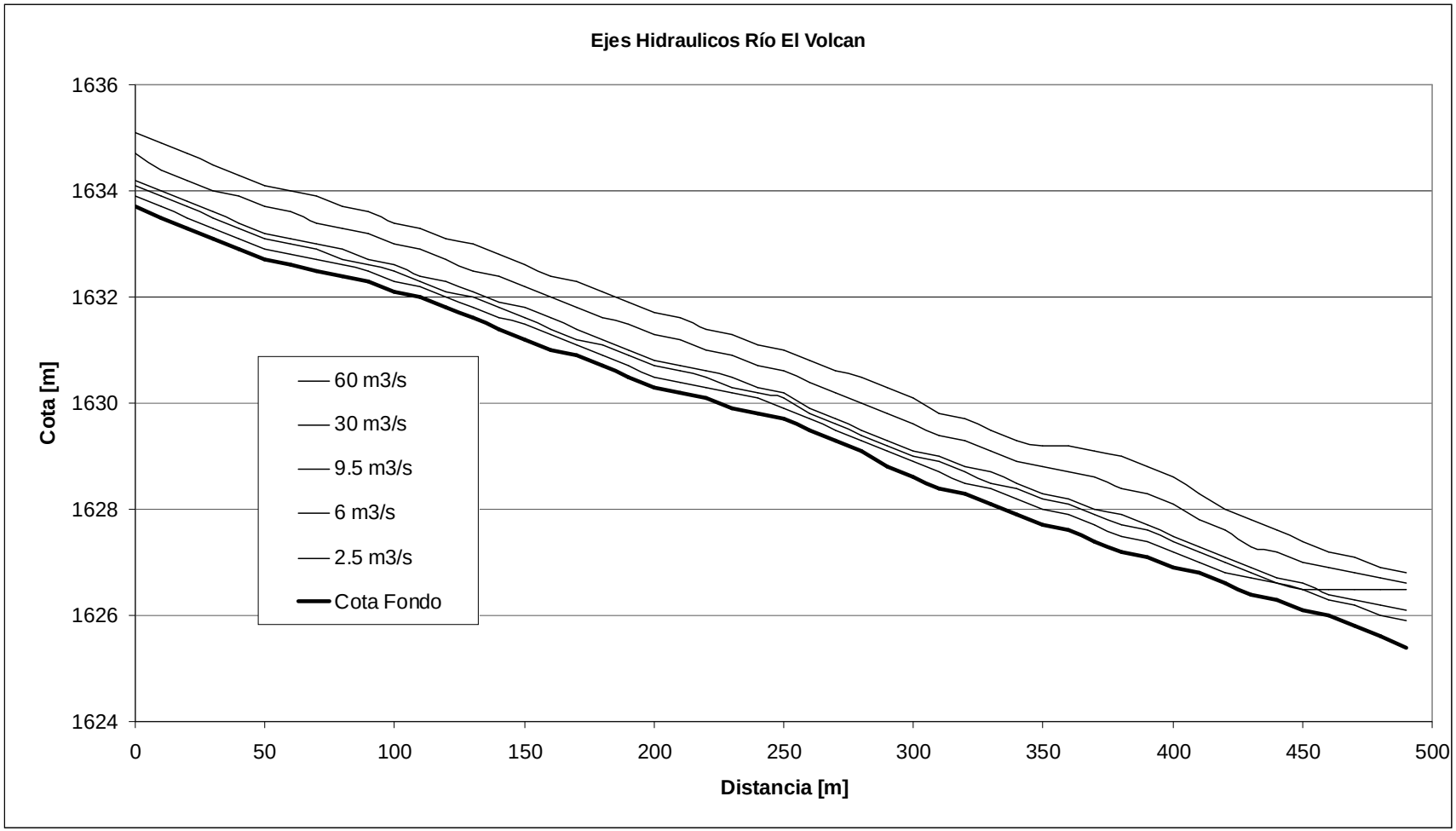

Figure 5.2. Channel line for a section of the Volcán River

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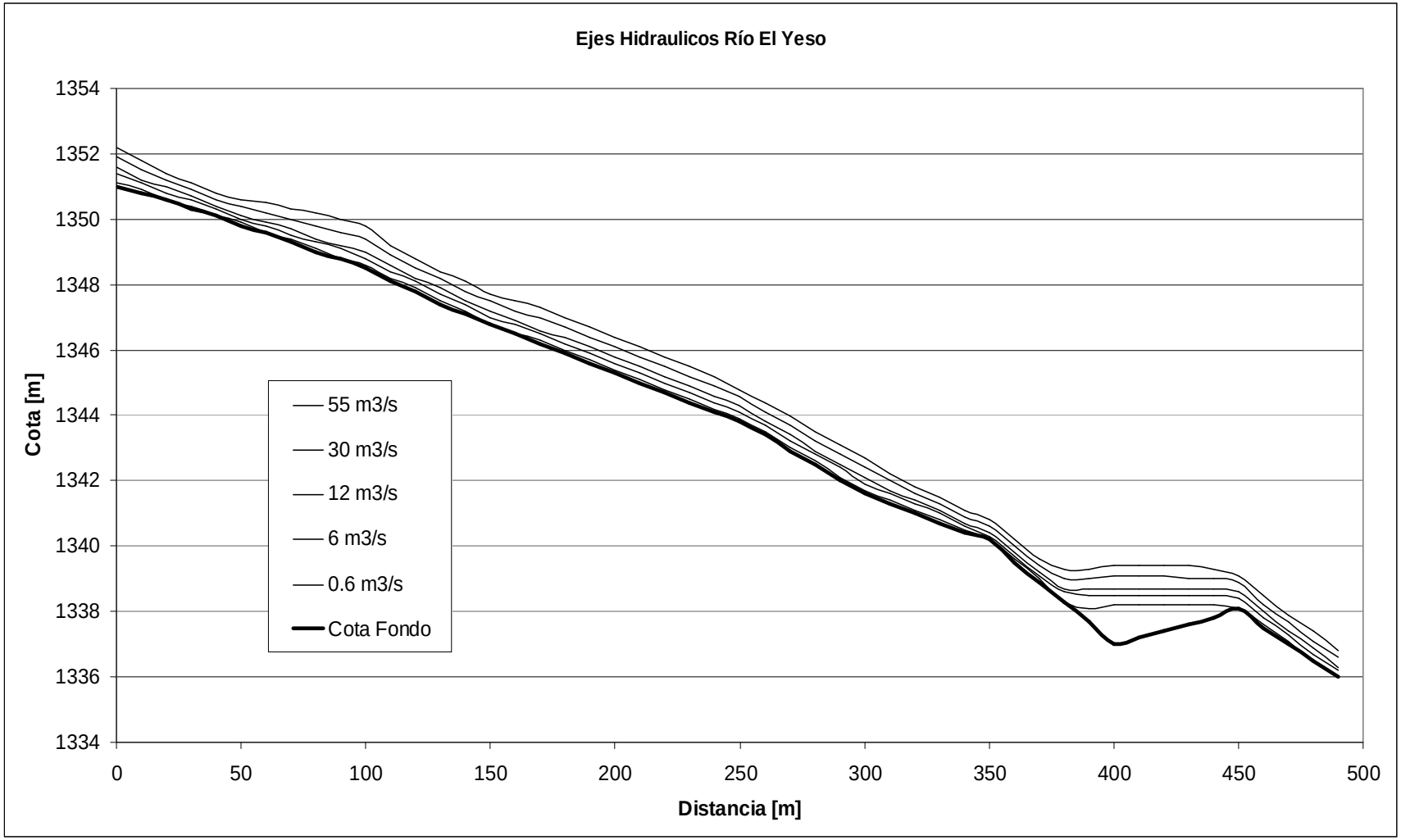

Figure 5.3. Channel line for a section of El Yeso River

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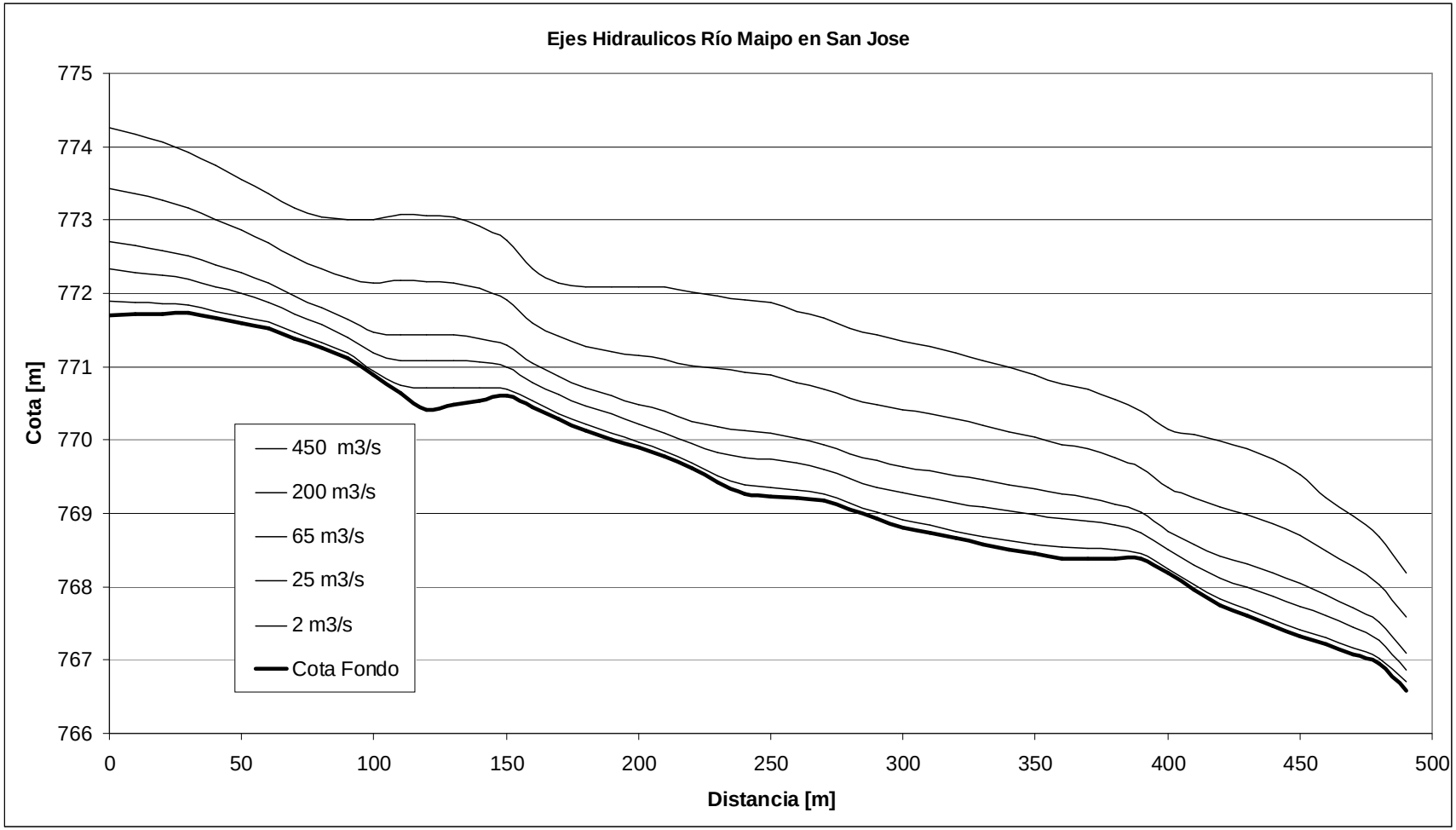

Figure 5.4. Channel line for a section of the Maipo River at San José

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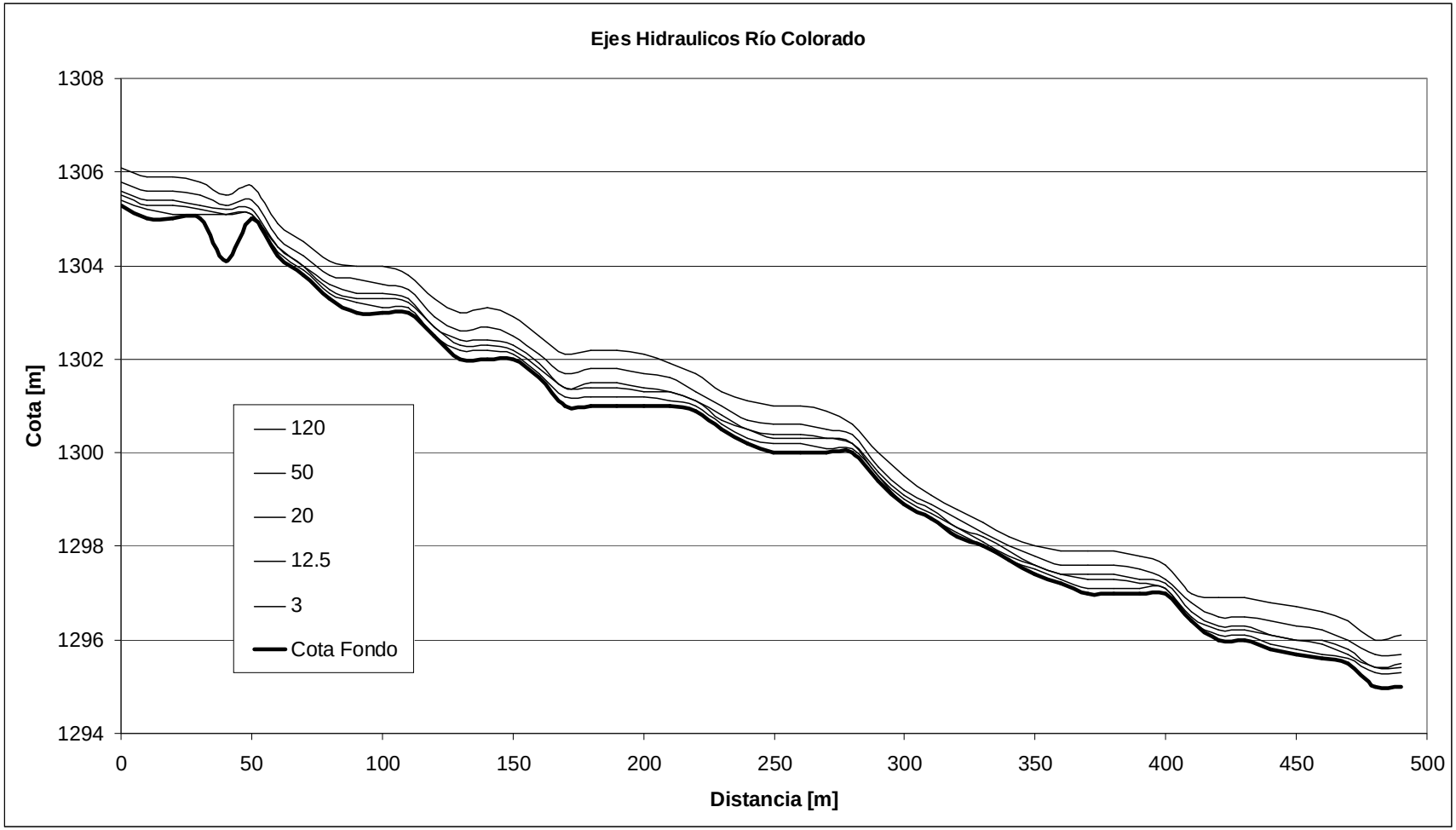

Figure 5.5. Channel line for a section of the Colorado River

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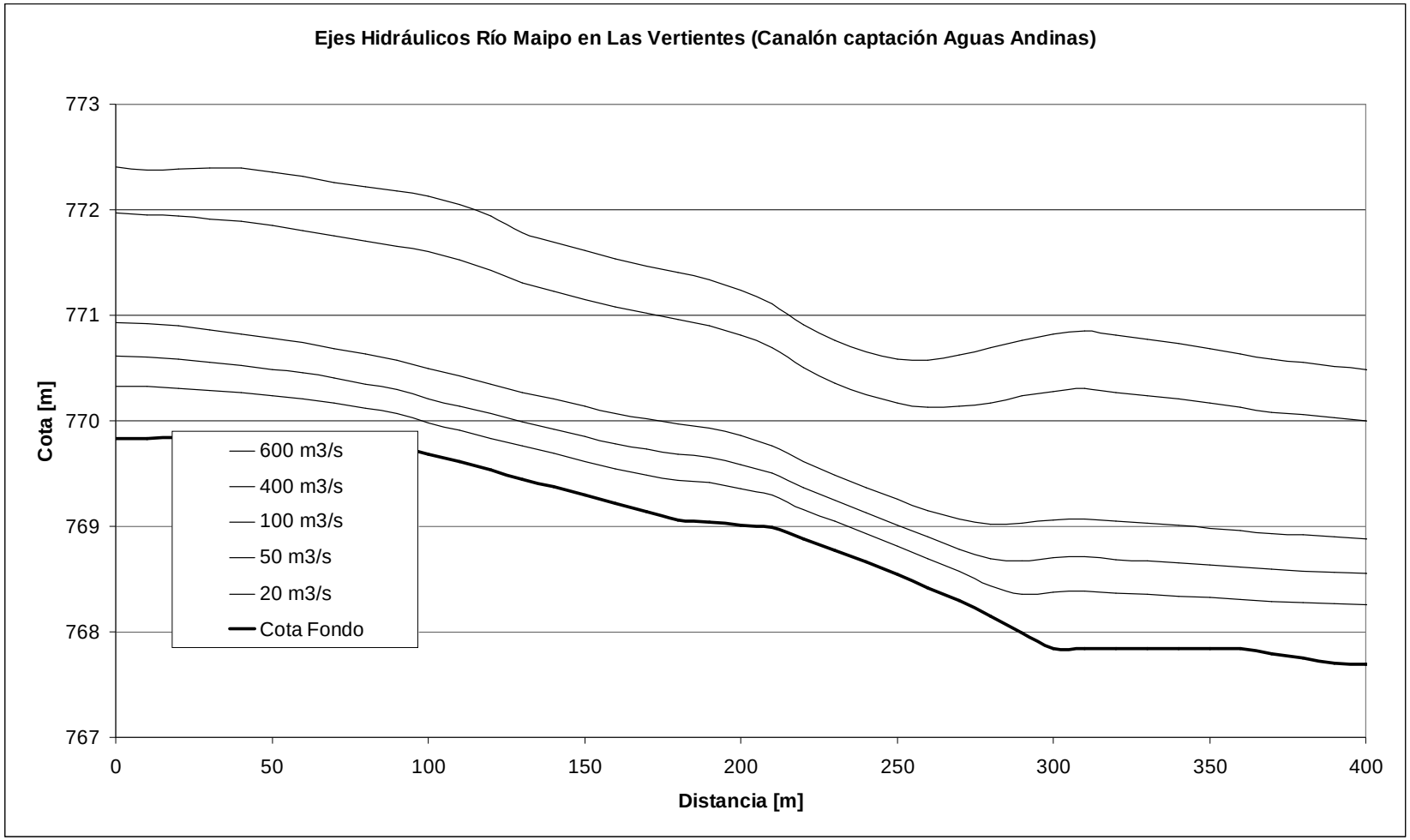

Figure 5.6a. Channel line for a section of the Maipo River at Las Vertientes.
Channel line at a flume of Aguas Andinas collection

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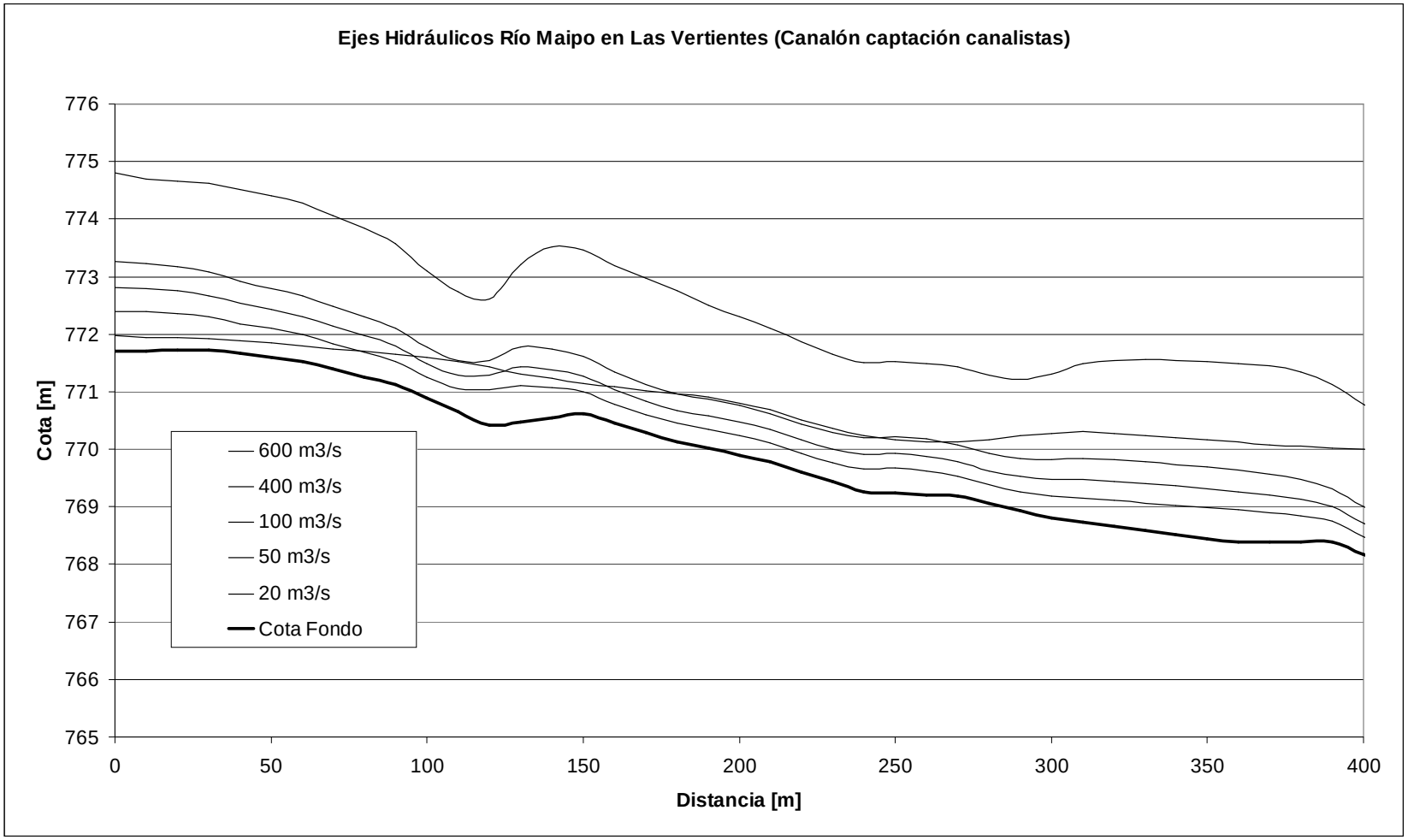

Figure 5.6b. Channel line for a section of the Maipo River at Las Vertientes.
Channel line at a flume of channel users' collection.

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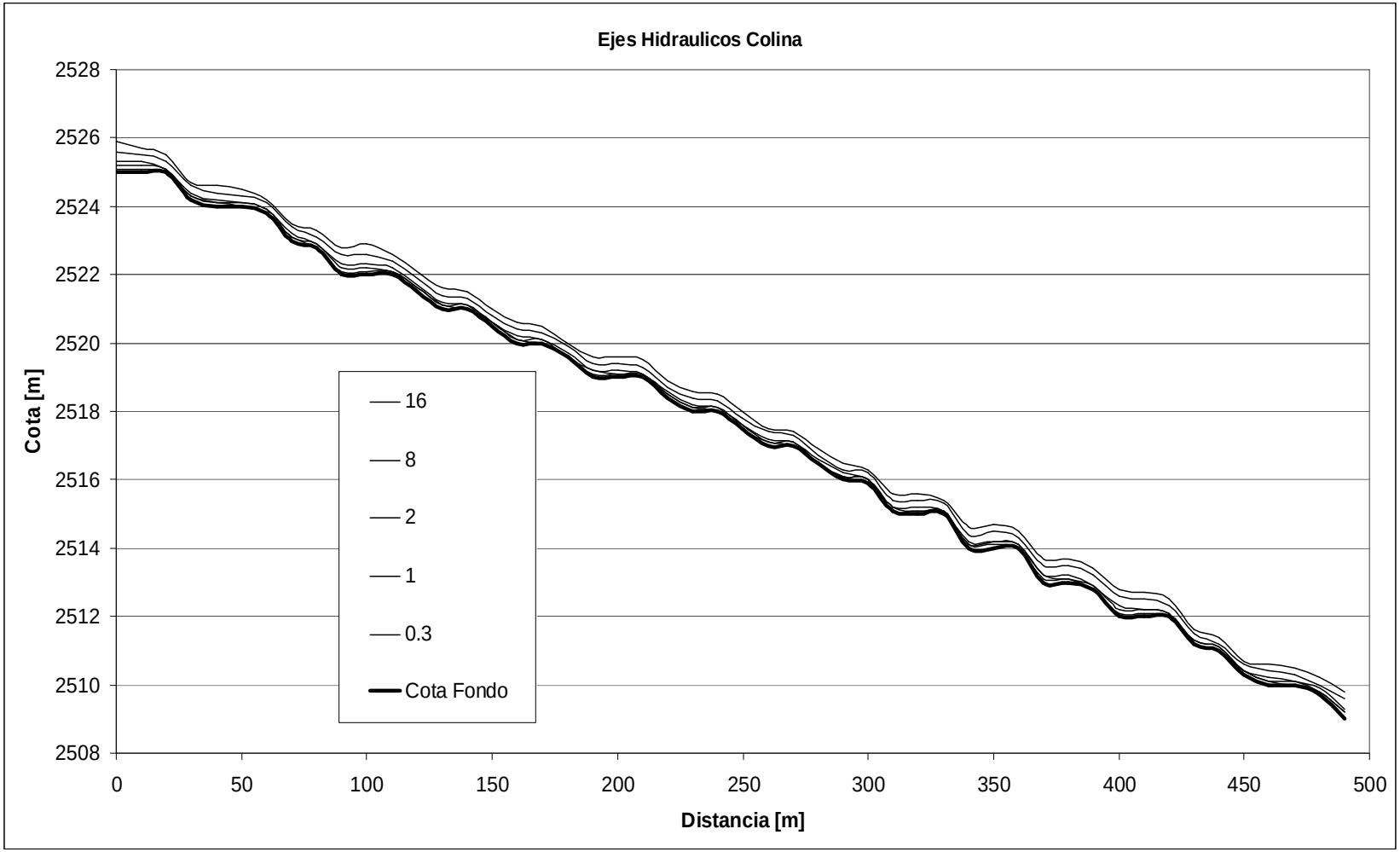

Figure 5.7. Channel line for a section of the Colina stream

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Figure 5.8. Channel line for a section of La Engorda stream

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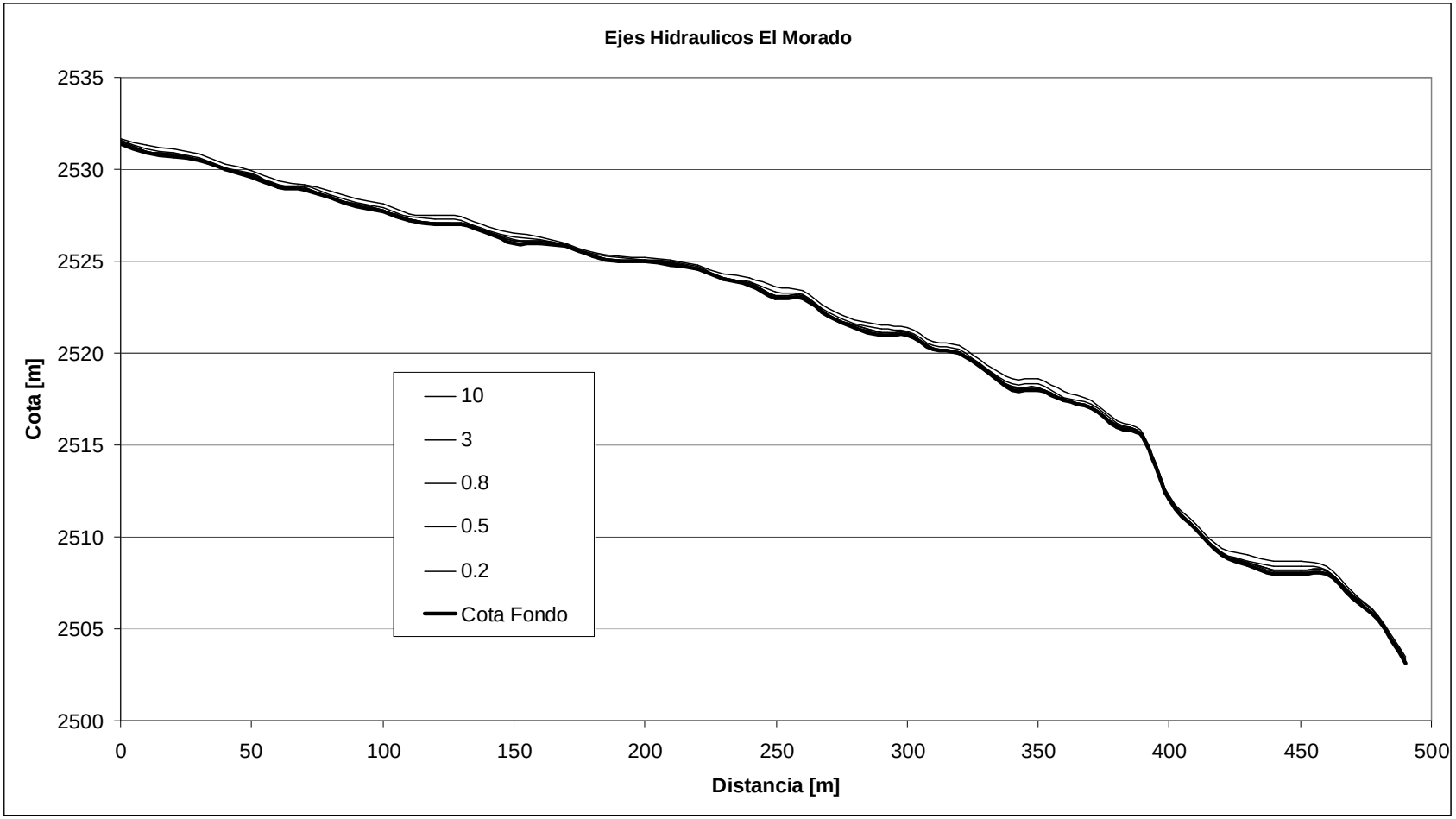

Figure 5.9. Channel line for a section of El Morado ravine

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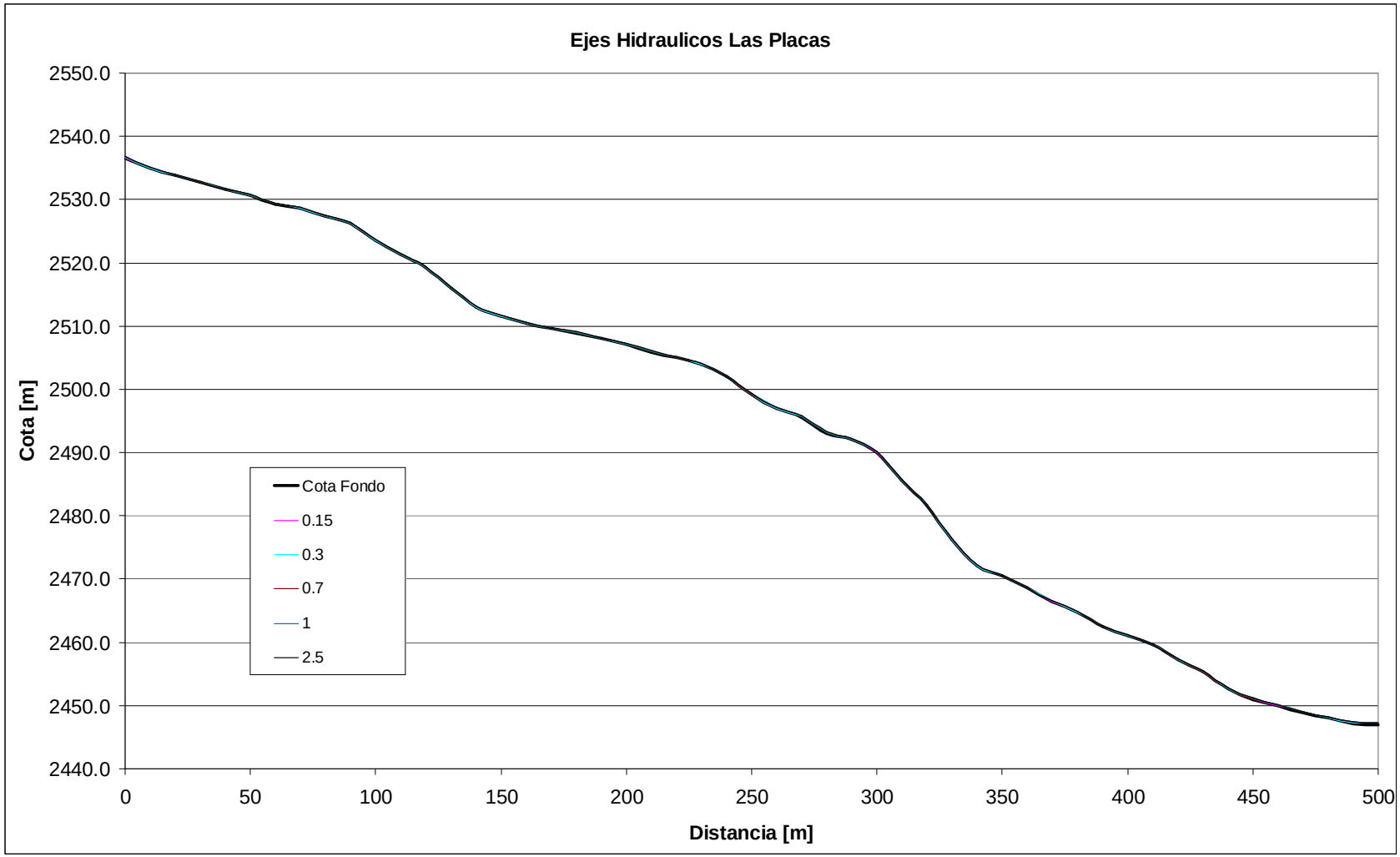

Figure 5.10. Channel line for a section of the Las Placas stream

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6. SEDIMENT TRANSPORT RATE

6.1 Ratio of Sediment transport rate used

One of the most used formulas for sediment transport rate worldwide, particularly in Chile, is Meyer-Peter and Müller (1948) which takes into account the presence of a critical shearing stress. A run-off with a bed shearing stress exceeding this critical value generates sediment transport, mainly in the saltation mode. Another equation for bed sediment transport rate is Ackers and White (1973) which, similarly to Meyer-Peter and Müller, has a strong empirical base. Generally mountain Rivers with extended granulometries including from sands to boulders, have a differentiated entrainment from the different granulometric fractions, forming a bed shield. The ratios already mentioned do not take into account such formation. While Parker (1990) and Wilcock and Crowe (2003) expressions do consider it as they have been developed using an empirical database, particularly for beds with coarse and extended granulometry. In particular, Wilcock and Crowe (2003) expression considers in a better way than Parker (1990) the effect of sand fragment present in the shallower layer of the bed upon transport of coarser fragments.

An analysis of transport equation from Wilcock and Crowe to the experimental data interestingly confirms the huge scattering of data. A two orders of magnitude difference in the sediment transport rate for approximately the same value of the shearing stress seem to be normal and within the behavior to be expected for such a phenomenon. It is important to bear this variability in mind when estimating the sediment transport rate in Rivers. Under no circumstance projected values should be accepted when these come from the calculation methodologies herein mentioned as it is recommended to compare results obtained from different methodologies as to ultimately accept a relatively wide range of values for design or analysis purposes.

Given the geo-morphological and granulometric characteristics of the streamways in the area of the study, a conclusion is the need to use all the four formulas of bed sediment transport rate previously indicated to estimate such variable. Meyer-Peter and Müller equation is used to have a reference based on the most used formula in this type of analysis, i.e. Ackers and White, given the good results reported by some researchers in extended and coarse granulometry beds. Parker and Wilcock and Crowe expressions are used given their direct application for this type of beds considering the non-linear characteristics of sediment transport processes. Particularly Wilcock and Crowe methodology are the most contemporary of the expressions considered directly applied to the streamways under study and which, initially, would render results more complex than those from Parker's.

It is important to emphasize that estimated values for sediment transport rate are potential values representing the entrainment capacity and not necessarily rates effectively transported by the River as the latter are dependent on sediment availability in the streamway. Such availability will be ensured or not by the supply of sediment upstream.

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Meyer-Peter, E., and Muller, R. (1948). "Formulas for bedload transport". Proceedings, 2nd Congress I.A.H.R., Stockholm.

Parker, G. (1990). "Surface-based bedload transport relation for gravel bed Rivers". J. Hydr. Res. Vol 28, No 4, pp. 417-436.

Wilcock, P., and Crowe, C. (2003) "Surface-based Transport Model for Mixed-Size Sediment." J. Hydr. Engrg., Vol. 129, No. 2, pp. 120-128.

6.2 Determination of bed sediment transport rate

All expressions for bed sediment transport rate mentioned in the previous section require data of hydraulic conditions of the flow (either bed shearing stress or mean speed and height of run-off). Therefore it is necessary to previously determine such characteristics for the different streamways in the study as to be able to establish the expected values for bed load entrainment based on a historical time series of streamways. Having this purpose in mind, MOSSEM (software developed by the consultant (González, 2006) was used and which also calculates bedload entrainment rates by applying different methodologies including Meyer-Peter and Müller, Ackers and White, Parker and Wilcock, and Crowe. For each of these expressions sediment transport rate was calculated as a function of the flow rate, for its values in the range of historical flow rates observed or estimated for the different streamways in the study. The results are shown in Figures 6.1 to 6.10.

If bed sediment transport rate is analyzed based on the flow rate for each of the streamways in the study is possible to observe, as is usual, that Meyer-Peter and Müller renders greater values for sediment transport rates. This expression is shown in the Figures as it is the most used in the country regardless the limitations already cited. Ackers and White usually provides the lowest values for sediment transport rates in most cases and as it will be shown below, those values are lower than current mining rates for gravel (study conducted by Geotécnica Consultores commissioned by CONAMA in 1999), therefore is not considered in the following analysis.

The two remaining expressions, Parker and Wilcock and Crowe best describe the bed entrainment process for beds with extended and coarse granulometry, thus being the most appropriate in their application in the streamways considered. One of the differences between both expressions is that Parker's does not consider sand transport in the analysis, that is, no transport of material less than 2 mm is considered. In general this expression results in entrainment rates lower than Wilcock and Crowe. However the behavior is less defined than Ackers and White, being similar in a couple of occasions (Colorado River and Colina stream, Figures 6.5 and 6.7); for the other cases entrainment rates are in the order of Ackers and White for low flow rates, approaching what Wilcock and Crowe project for high flow rates (Maipo River at Las Melosas, Maipo River at San José, La Engorda stream, El Morado

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canyon, Las Placas stream; Figures 6.1, 6.4, 6.8, 6.9, and 6.10, respectively). For the Maipo River at Las Vertientes (Figure 6.6) sediment transport rate given by Parker is slightly higher than Wilcock and Crowe.

After dismissing the other expressions to calculate the bed sediment transport rate and taking into account that Parker does not include sands and has a major variability with regard to other expressions analyzed, the following analysis uses Wilcock and Crowe.

6.3 Expected value of Bed Sediment transport rate

Based on available fluviometric statistics time series were defined for monthly mean flow rates for each of the streamways considered in the study. Using this information and bed sediment transport rates vs. flow rate already determined for each streamway, time series of associated entrainment rates were calculated. Then, bed sediment transport rate values associated to the different possibilities of exceedence for each month in the year were established. This analysis was conducted for the scenarios with and without the Project, taking into account the information provided by the owner with regard to flow rates collected by the Project for each streamways considered. The results are shown in Annex 3.

Table 6.1 shows a summary of the annual expected potential values of the sediment transport rate for each streamway analyzed using Wilcock and Crowe (2003). Formulas for bed sediment transport rates render values for the net volume of sediment by time unit. Translation of this volume to weight assumes a specific value of particles in 2.65 ton/m^3 (note: When silts associated to these entrainment rates are considered it is necessary to factor in their porosity as to obtain the effective thickness.)

Table 6.1. Expected potential bed sediment transport rate for scenarios with and without the Project

STREAMWAY	EXPECTED POTENTIAL SEDIMENT TRASNPORT RATE (*) SCENARIO WITHOUT THE PROJECT		EXPECTED POTENTIAL SEDIMENT TRASNPORT RATE (*) SCENARIO WITH THE PROJECT	
	m^3/s	Million tons/year	m^3/s	Million tons/year
Maipo River at Las Melosas	0.075	6.272	0.075	6.272
El Volcán River	0.003	0.213	0.001	0.111
El Yeso River	0.074	6.216	0.007	0.575
Maipo River at San José	0.131	10.961	0.096	8.005
Colorado River	0.092	7.711	0.019	1.627
Maipo River at Las Vertientes	0.107	8.932	0.107	8.932
Colina stream	0.023	1.917	0.005	0.378
La Engorda stream	0.002	0.167	0.0002	0.013
El Morado canyon	0.018	1.485	0.002	0.153
Las Placas stream	0.022	1.841	0.003	0.278

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(*) NOTE: Actual sediment transport rate is dependent on sediment availability in the basin and not necessarily the potential sediment transport rate. The expected value refers to the statistical concept and is associated to the likelihood of having each sediment transport rate.

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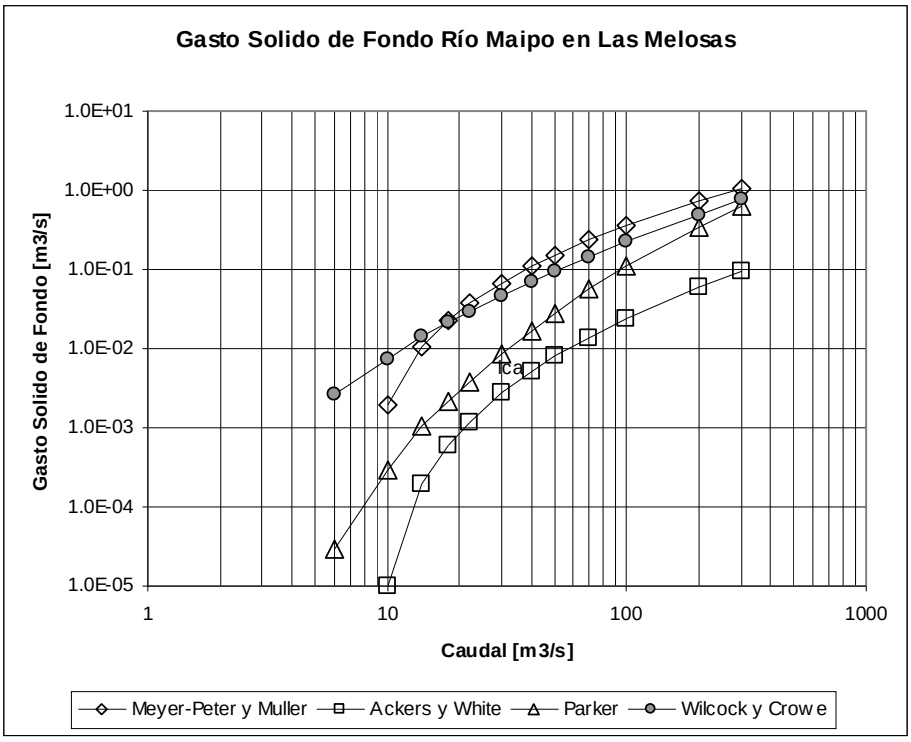

Figure 6.1. Bed sediment transport rate as a function of flow rate. Maipo River at Las Melosas

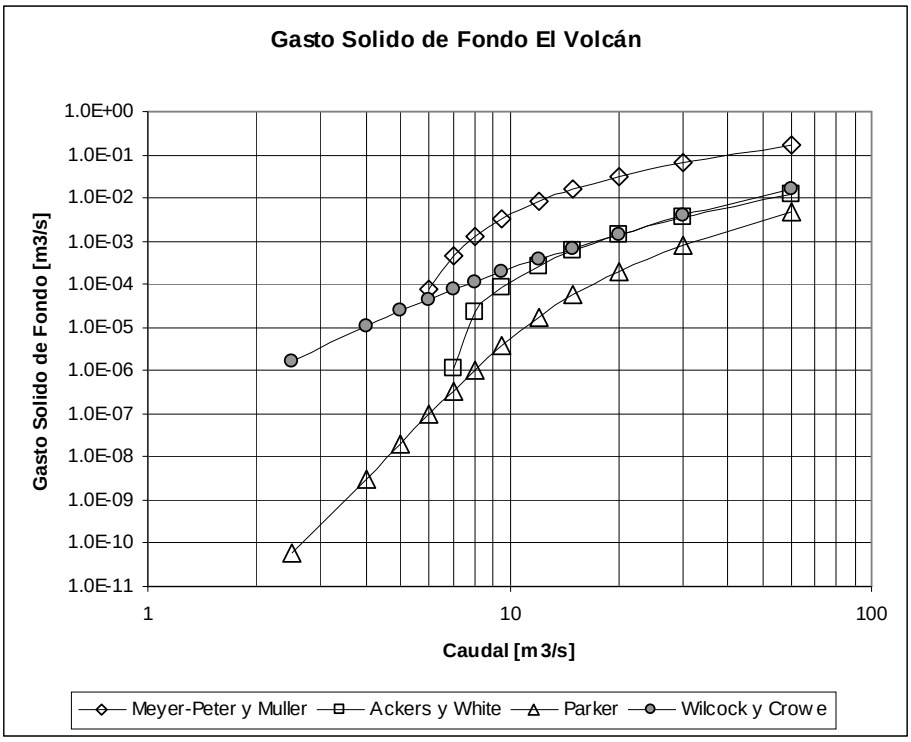

Figure 6.2. Bed sediment transport rate as a function of flow rate. El Volcán River

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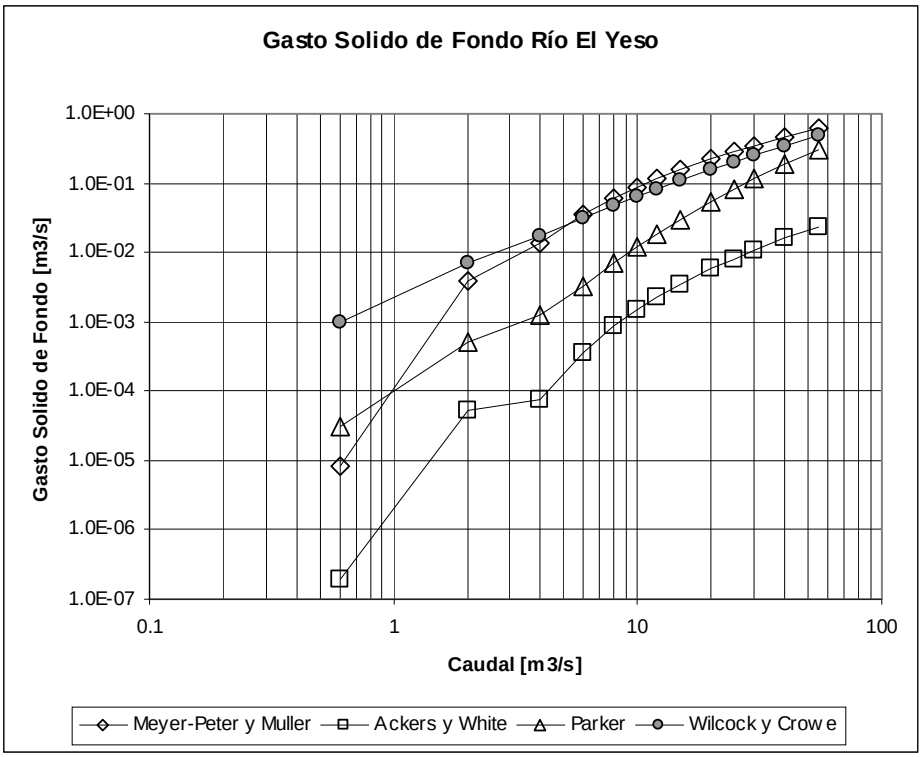

Figure 6.3. Bed sediment transport rate as a function of flow rate. El Yeso River.

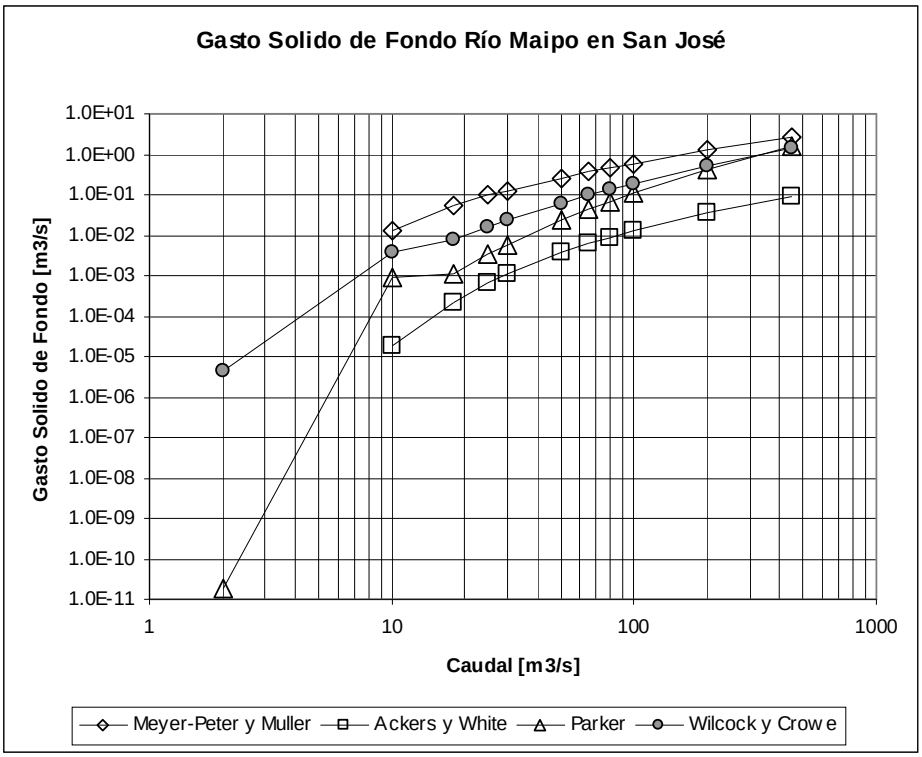

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Figure 6.4. Bed sediment transport rate as a function of flow rate. Maipo River at San José.

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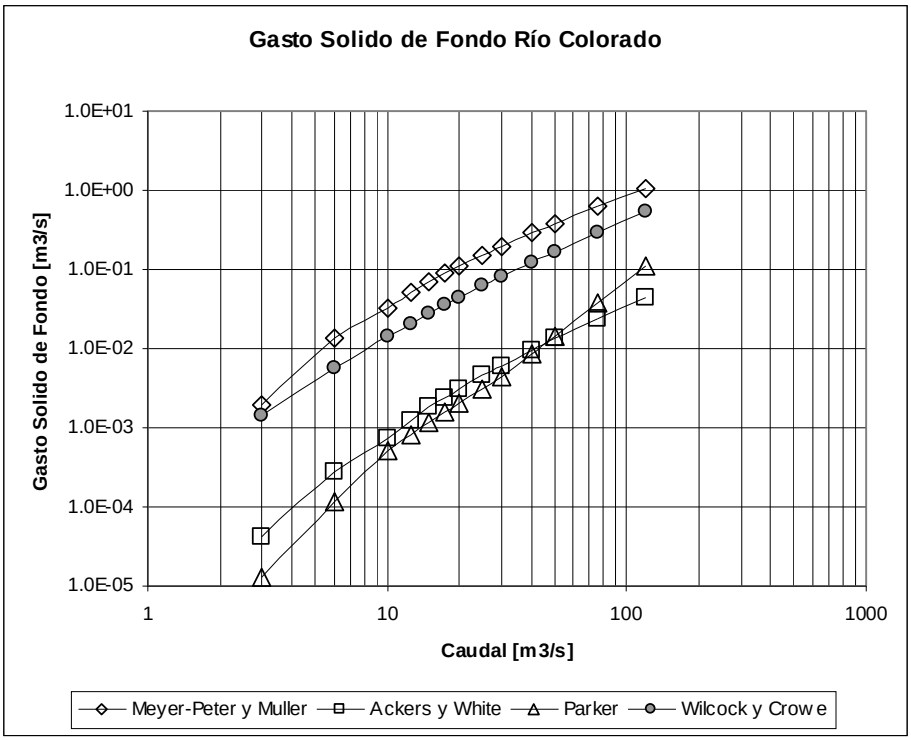

Figure 6.5. Bed sediment transport rate as a function of flow rate. Colorado River.

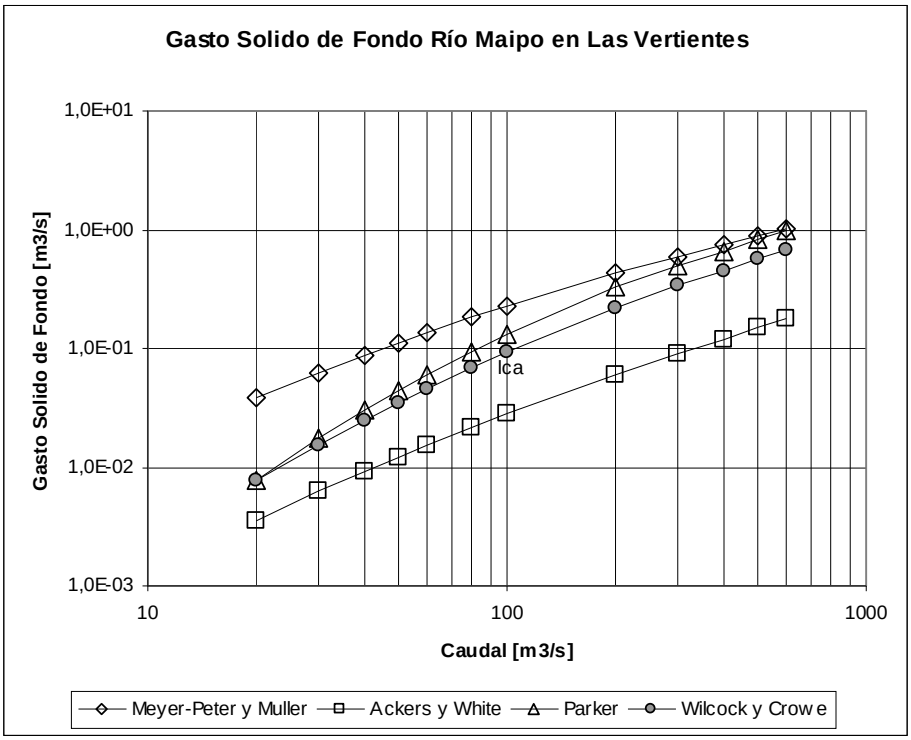

Figure 6.6. Bed sediment transport rate as a function of flow rate. Maipo River at Las Vertientes .

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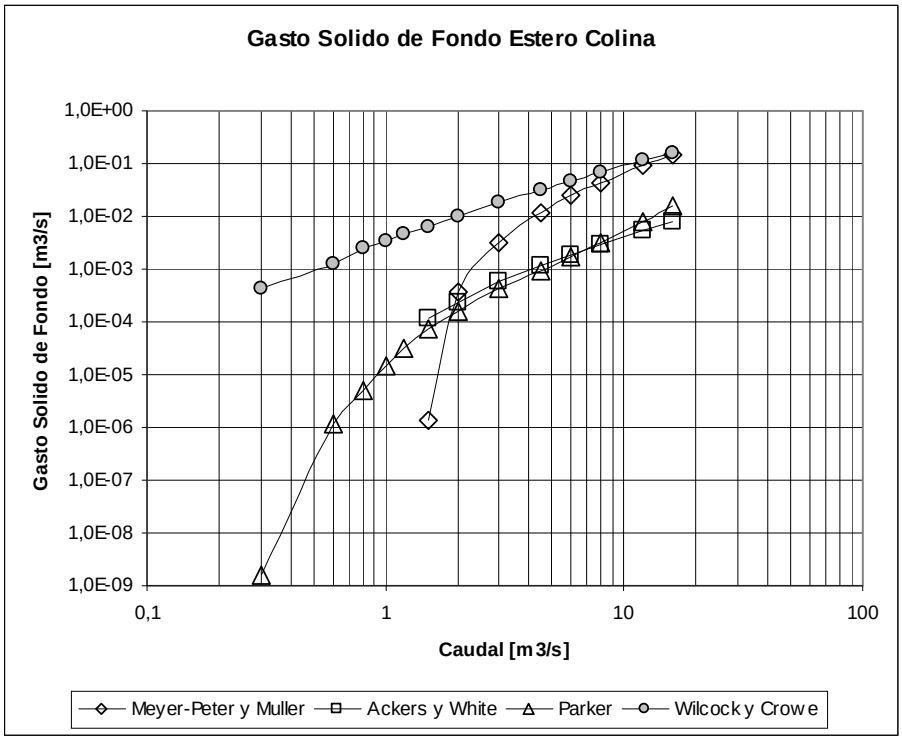

Figure 6.7. Bed sediment transport rate as a function of flow rate. Colina stream.

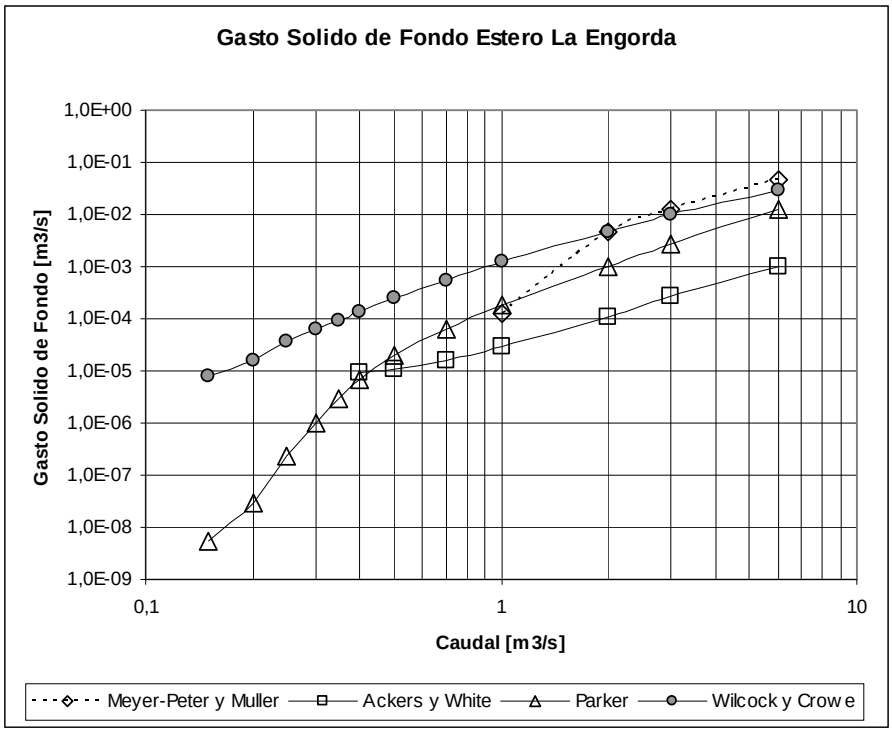

Figure 6.8. Bed sediment transport rate as a function of flow rate. La Engorda stream.

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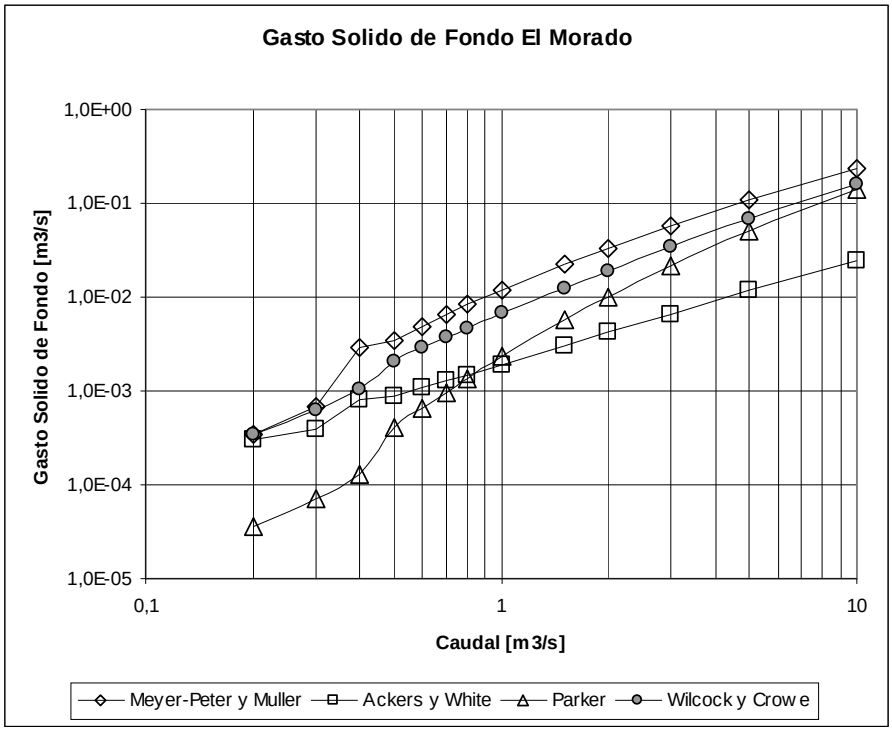

Figure 6.9. Bed sediment transport rate as a function of flow rate. El Morado canyon.

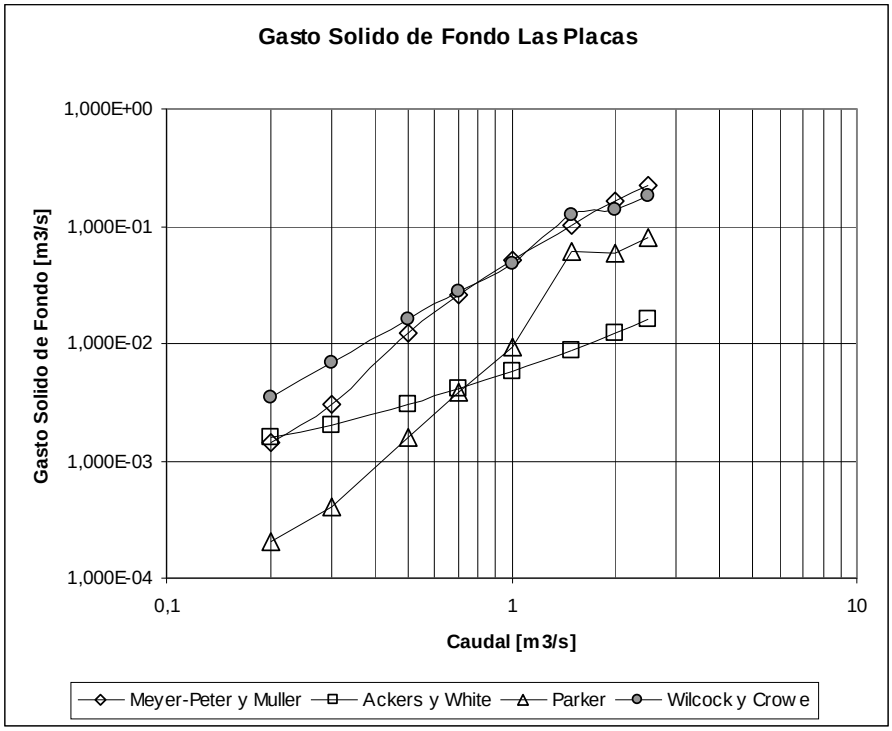

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Figure 6.10. Bed sediment transport rate as a function of flow rate. Las Placas stream.

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To conduct the sensitivity analysis of expected values for sediment transport rates the calculation was repeated using the values of entrainment rates projected by Ackers and White (1973) defining the inner elevation of these entrainment rates in all expressions used in this study. Table 6.2 shows the results.

Table 6.2. Expected potential bed sediment transport rate for scenarios with and without the Project. Ackers and White (1973).

STREAMWAY	EXPECTED POTENTIAL SEDIMENT TRASNPORT RATE (*) SCENARIO WITHOUT THE PROJECT		EXPECTED POTENTIAL SEDIMENT TRASNPORT RATE (*) SCENARIO WITH THE PROJECT	
	m^3/s	Million tons/year	m^3/s	Million tons/year
Maipo River at Las Melosas	0.007	0.556	0.007	0.556
El Volcán River	0.001	0.068	0.0002	0.018
El Yeso River	0.002	0.179	0.0002	0.013
Maipo River at San José	0.008	0.699	0.006	0.503
Colorado River	0.007	0.597	0.001	0.115
Maipo River at Las Vertientes	0.031	2.610	0.031	2.610
Colina stream	0.001	0.073	0.0001	0.011
La Engorda stream	0.002	0.004	0.0000	0.000
El Morado canyon	0.0001	0.308	0.001	0.052
Las Placas stream	0.003	0.245	0.001	0.099

(*) NOTE: Actual sediment transport rate is dependent on sediment availability in the basin and not necessarily the potential sediment transport rate. The expected value refers to the statistical concept and is associated to the likelihood of having each sediment transport rate.

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7. SUSPENDED SEDIMENT TRANSPORT RATE

As mentioned under Section 2 herein, the sources used to determine suspended sediment transport rate for the different streamways were varied, depending on availability of information. Therefore, DGA statistics from sedimentometric stations listed under Table 2.3 were used along with statistics from Maipo River at Las Melosas included in Bzdigian, (1989), and information restricted to one day of comprehensive sampling conducted in 1990 at Colina stream upstream the Volcán River, and at the Volcán River upstream the stream as delivered by AES Gener.

Additionally there is information regarding the concentration of suspended sediment determined for all streamways while developing the present study as well as in the streams north of Volcán River collected by AES Gener.

7.1. Analysis of available information

In those cases where statistics of periodic (conducted on a daily basis) and comprehensive sampling (monthly), the analysis was conducted based on periodic values as there is virtually no discrepancy between both. As per the study of Sanhueza et al. (2007), the correlation between comprehensive and periodic suspended sediment transport rate results, in average, the former is 9% greater than the second at the station of Maipo River at El Manzano and 28% at the station of Maipo River at San Alfonso. Periodic samples were preferred due to the following reasons: The difference between both types of sampling is marginal when accounting for data scattering and, mainly, periodic records allow for estimation of sediment transport rates even during floods or high flow rates. In the case of comprehensive sampling such records are not possible as the sampling day does not need to necessarily match a high flow rate day and, usually this type of sampling is not done when there are floods. The statistics shown in Bzdigian (1989) are monthly mean values. There is no major difference in correlations between suspended sediment transport rate and flow rate obtained using daily or monthly mean values as shown in Figure A4.5 from Colorado River upstream the confluence with Maipo River included in Annex 4. For this station daily periodic data and the resulting correlation is presented in a straight line along with the correlation obtained from monthly mean values presented in Bzdigian (1989), in a dot line. Both virtually coincide.

References

Bzdigian, K. (1989), “Patrones Sedimentológicos de los Principales Ríos de la Zona Central de Chile”. Memoria para optar al título de Ingeniero Civil. Universidad de Chile.

Sanhueza, K., R.A. López y F. Vidal (2007), “Recopilación y Análisis de Datos Sedimentométricos de la Cuenca del Maipo”, XVIII Congreso Chileno de Ingeniería Hidráulica, Santiago.

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7.2. Expected Suspended Sediment Transport Rate

Based on the previous data, the suspended sediment transport rate expected annually was determined. Table 7.1 shows the results. Table 7.2 shows suspended sediment transport rate measured in 1990 at the Volcán River upstream the Colina stream and at Colina stream upstream the Volcán River along with readings taken on the same day at the stations Maipo River at San Alfonso and Colorado River upstream the confluence with Maipo River. Readings for Volcán River at Queltehues are only until July 1, 1985. Therefore it is not possible to make a comparison with suspended sediment transport rate for that station. Regardless the constraints when comparing the sediment transport rate with only one reading, this can cast some light on the amount of sediment contributed by each streamway. Consequently the contribution of Colina stream to Maipo River at San Alfonso is of 1% approximately while the contribution of Volcán River to Maipo River at the confluence with Colina stream amounts to 7%. This figure is compared with the total expected annual value which amounts to almost 10%.

Table 7.1. Expected Suspended Sediment Transport Rate

STATION	SUSPENDED SEDIMENT TRANSPORT RATE (million tons/year)
Maipo River at Las Melosas	0.97
Volcán River at Queltehues	0.14
Maipo River at San Alfonso	1.48
Maipo River at El Manzano	3.29
Colorado River upstream confluence with Maipo River	1.31

Table 7.2. Comparison of suspended sediment transport rate

DATE	VOLCÁN RIVER UPSTREAM COLINA STREAM		COLINA STREAM UPSTREAM VOLCÁN RIVER		MAIPO RIVER AT SAN ALFONSO		COLORADO RIVER UPSTREAM CONFLUENCE WITH MAIPO RIVER	
	Q m^3/s	G_{ss} tons/day (M tons/year)	Q m^3/s	G_{ss} tons/day (M tons/year)	Q m^3/s	G_{ss} tons/day (M tons/year)	Q m^3/s	G_{ss} tons/day (M tons/year)
April 21, 1990	-	-	2.83	1.06 (0.0004)	32.8	129.65 (0.0473)	17.6	158.91 (0.0580)
May 5, 1990	2.43	12.90 (0.0047)	3.97	2.47 (0.0009)	38.9	184.35 (0.0673)	16.2	101.48 (0.0370)

Water samples were taken from the streamways during field works and visits. The samples were analyzed at a lab as to determine the amount of suspended sediment. Table 7.3 shows the results of these measurements.

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The suspended sediment content clearly reflects the nature of the contributing basins and Rivers with low content in Volcán River and increasing downstream in Maipo River

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Table 7.3. Suspended solid concentration measured in the study

CODE	STREAMWAY	SECTOR	DATE	TIME*	CONCENTRATION [mg/l]	NOTES
S01M-M01	Maipo River	Las Melosas	Sep 27, 2007	01:00 PM	12.67	north branch
S01M-M02	Maipo River	Las Melosas	Sep 27, 2007	01:00 PM	19.33	south branch
S01M-M03	Maipo River	Las Melosas	Oct 16, 2007	11:00 AM	6.7	MVS: Vegetal material
S01M-M04	Maipo River	Las Melosas	Nov 8, 2007	04:30 PM	380.7	
S02V-M01	Volcán	downstream BT Volcán	Sep 27, 2007	06:00 PM	74	10 m upstream test well site
S02V-M02	Volcán	downstream BT Volcán	Sep 27, 2007	06:00 PM	41.33	across from test well area
S02V-M03	Volcán	downstream BT Volcán	Oct 16, 2007	12:00 AM	6.7	
S02V-M04	Volcán	downstream BT Volcán	Nov 8, 2007	04:00 PM	154.7	
S03Y-M01	Yeso	upstream confl. Maipo	Sep 28, 2007	07:00 PM	2.67	8 m downstream test well site
S03Y-M02	Yeso	upstream confl. Maipo	Sep 28, 2007	07:00 PM	8	15 m downstream test well site
S03Y-M03	Yeso	upstream confl. Maipo	Oct 16, 2007	10:00 AM	17.3	
S03Y-M04	Yeso	upstream confl. Maipo	Nov 8, 2007	05:00 PM	44.7	
S04M-M01	Maipo River	San José	Sep 26, 2007	01:00 PM	49.33	10 m downstream test well site
S04M-M02	Maipo River	San José	Sep 26, 2007	01:00 PM	39.33	across from test well area
S04M-M03	Maipo River	San José	Oct 16, 2007	08:30 AM	17.3	
S04M-M04	Maipo River	San José	Nov 8, 2007	06:00 PM	358	
S05C-M01	Colorado	Alfalfal	Sep 28, 2007	01:00 PM	18	20 m upstream test well site, at streamway split in two branches (sampling in SE branch)
S05C-M02	Colorado	Alfalfal	Sep 28, 2007	01:00 PM	22	15 m downstream test well site
S05C-M03	Colorado	Alfalfal	Oct 16, 2007	02:00 PM	5.3	
S05C-M04	Colorado	Alfalfal	Nov 8, 2007	07:00 PM	157.3	
S-AC-M01	E. Colina	upstream future BT	Nov 8, 2007	11:30 AM	22.7	
S-BE-M01	E. La Engorda	upstream future BT	Nov 8, 2007	12:30 AM	168.7	
S-CM-M01	E. El Morado	upstream future BT	Nov 8, 2007	02:00 PM	6.7	
S-MSA-M04	Maipo River	San Alfonso	Nov 8, 2007	05:30 PM	394	

An appropriate analysis of Table 7.3 requires knowing the flow rates of each of the streamways on the day of the reading, information which is not available. However it is possible to draw conclusions using data collected. First, there is a major increase in suspended sediment transport rate observed in November with respect to the readings from September and October, due to thawing. It also reflects the relatively

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less production of suspended sediment in basins associated to Volcán, Yeso, and Colorado Rivers.

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ANNEX 1

HIDROLOGY (FLOWS)

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This annex contains the full listing of the data series used for the study. They belong to the following river beds and/or control points of the basin:

Colina Stream

La Engorda Stream, El Morado Canyon, Las Placas Creek

Volcán at the Volcán Plant Intake, Yeso at the outfall

Maipo at Las Melosas

Maipo at San Alfonso

Maipo at El Mansion

Colorado at the outfall

Where situation without and with Project should be present, there are withdrawals according to the use of the AES Gener water rights, according to the specifications shown in Chapter 3 of the Report.

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Table A.l. Series of average monthly flows [m^3/s] Colina Stream, condition without Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.76	1.12	2.87	6.23	8.04	6.35	3.61	1.94	1.14	0.87	0.83	0.83	2.88
1951/52	0.81	1.12	3.08	6.03	8.09	6.19	3.48	1.97	1.12	0.87	0.83	0.82	2.87
1952/53	0.84	1.15	2.93	6.02	8.17	6.73	3.56	2.03	1.13	0.89	0.84	0.88	2.93
1953/54	1.04	1.24	3.83	7.23	10.66	8.77	4.40	2.18	1.31	1.08	0.96	0.92	3.63
1954/55	0.93	1.23	3.26	5.75	7.77	6.67	3.67	2.00	1.07	0.73	0.64	0.65	2.86
1955/56	0.68	0.92	3.16	5.51	7.49	6.08	3.44	1.83	1.14	0.81	0.75	0.77	2.71
1956/57	0.78	1.08	3.47	5.79	8.45	7.56	3.82	1.99	1.05	0.80	0.74	0.77	3.02
1957/58	0.82	1.16	3.30	6.28	7.59	5.51	3.21	1.91	1.12	0.85	0.80	0.78	2.78
1958/59	0.98	1.46	4.26	6.47	8.00	6.53	3.40	2.08	1.21	0.91	0.89	0.94	3.09
1959/60	1.02	1.41	4.16	7.36	9.82	8.46	4.11	1.95	1.12	0.80	0.79	0.79	3.48
1960/61	1.03	1.17	3.62	6.41	7.72	6.07	3.49	2.15	1.19	0.91	0.85	0.83	2.95
1961/62	0.85	1.57	4.42	8.19	9.85	7.87	4.63	2.09	1.21	0.92	0.84	0.81	3.60
1962/63	0.86	1.15	3.52	6.10	6.77	5.96	3.26	1.91	1.08	0.82	0.80	0.75	2.75
1963/64	0.91	1.21	2.98	7.66	13.87	10.81	5.02	2.68	1.42	1.05	0.88	0.81	4.11
1964/65	0.81	1.04	2.96	5.17	7.35	6.59	3.44	2.04	1.18	0.91	0.86	1.02	2.78
1965/66	1.06	1.57	3.80	6.21	11.54	8.09	4.19	2.27	1.29	1.02	1.01	0.88	3.58
1966/67	0.94	1.38	3.60	5.84	7.50	6.64	3.45	2.01	1.14	1.05	0.71	0.66	2.91
1967/68	0.68	0.95	2.73	5.58	6.86	5.77	3.17	1.82	1.04	0.79	0.66	0.63	2.56
1968/69	0.61	0.76	2.49	4.68	6.60	5.58	3.09	1.65	0.90	0.76	0.68	0.67	2.37
1969/70	0.77	0.94	2.68	6.72	8.21	6.38	3.20	1.92	1.03	0.71	0.65	0.66	2.82
1970/71	0.73	1.22	3.26	6.09	5.45	4.97	3.54	1.97	0.91	0.64	0.71	0.72	2.52
1971/72	0.80	1.30	3.71	5.84	7.32	5.80	3.38	1.86	1.62	1.16	0.87	0.98	2.89
1972/73	1.08	1.35	3.15	6.75	11.26	9.11	4.69	2.86	1.52	0.97	0.88	0.78	3.70
1973/74	0.83	1.52	3.36	5.50	9.06	6.71	3.59	1.94	1.11	0.87	0.95	0.89	3.03
1974/75	0.89	1.63	3.83	6.57	12.17	7.41	3.80	2.04	1.06	0.78	0.73	0.73	3.47
1975/76	0.78	1.07	2.99	6.18	7.38	7.80	3.51	1.83	1.03	0.77	0.73	0.71	2.90
1976/77	0.74	0.92	3.05	5.70	8.02	5.83	3.47	1.94	1.09	0.82	1.02	1.06	2.80
1977/78	1.12	1.64	4.05	7.53	9.60	7.49	3.79	2.18	1.07	0.90	0.98	0.99	3.45
1978/79	0.96	1.36	3.38	7.60	10.84	7.34	3.96	2.38	1.44	0.97	0.82	0.90	3.50
1979/80	0.81	1.03	2.82	6.13	9.45	7.48	4.10	2.71	1.85	1.36	1.20	1.01	3.33
1980/81	1.04	1.38	3.67	8.37	11.05	9.22	4.42	2.27	1.37	1.00	0.85	0.83	3.79
1981/82	0.81	1.18	3.34	5.74	7.86	6.91	3.57	1.94	1.16	1.01	1.46	1.25	3.02
1982/83	1.43	1.46	3.58	9.18	16.13	13.39	6.33	3.20	1.72	1.18	1.04	0.98	4.97
1983/84	0.96	1.43	3.87	7.55	10.26	8.37	4.24	2.29	1.27	0.92	0.87	0.91	3.58
1984/85	1.02	1.66	3.55	7.23	11.54	8.73	4.84	2.49	0.71	1.11	1.02	0.93	3.74
1985/86	0.87	1.02	3.46	6.13	7.98	6.32	3.51	2.08	1.27	1.79	1.22	0.95	3.05
1986/87	1.03	1.41	3.40	7.67	11.89	9.54	4.69	2.36	1.39	1.12	1.34	1.14	3.92
1987/88	1.07	1.58	4.43	8.97	12.85	10.04	4.96	2.60	1.44	1.01	0.88	0.86	4.22
1988/89	0.70	1.20	3.37	5.67	7.85	7.00	3.55	1.95	1.09	0.77	0.69	0.85	2.89
1989/90	0.96	1.37	4.08	6.74	8.90	6.41	3.42	1.98	1.13	0.81	0.74	0.74	3.11
1990/91	0.84	1.04	3.12	5.59	7.63	6.30	3.56	1.97	1.47	1.33	1.12	1.03	2.92
1991/92	1.24	1.48	3.59	5.61	11.58	8.48	4.75	2.37	1.46	1.17	1.09	0.98	3.65
1992/93	1.12	1.66	3.74	7.10	11.03	8.46	4.38	2.53	1.72	1.41	1.38	1.12	3.80
1993/94	1.14	1.78	3.71	6.60	10.22	7.18	4.09	2.18	1.27	0.97	0.92	0.95	3.42
1994/95	0.88	1.33	4.27	7.39	9.25	6.74	3.74	2.20	1.24	0.93	0.84	0.81	3.30
1995/96	1.00	1.27	3.67	6.75	7.64	6.38	3.65	2.04	1.14	0.76	0.73	0.70	2.98
1996/97	0.69	0.83	2.40	4.49	6.66	6.24	3.11	1.81	1.01	0.98	0.93	1.06	2.52
1997/98	1.51	1.23	3.69	7.50	13.10	8.16	4.38	2.62	1.55	1.03	0.90	0.78	3.87
1998/99	0.73	1.06	2.84	4.71	6.37	5.85	3.15	1.80	1.01	0.73	0.67	0.68	2.47
1999/00	0.75	1.23	3.30	5.77	6.97	6.18	3.15	1.97	1.12	0.91	1.00	0.89	2.77
2000/01	0.90	1.65	3.59	8.01	11.09	8.66	4.31	2.28	1.36	1.00	0.97	1.09	3.74
2001/02	1.16	1.60	3.74	8.03	10.23	7.88	4.11	2.28	1.43	1.05	1.10	1.43	3.67
2002/03	1.33	1.66	3.91	7.41	11.55	9.15	4.76	2.52	1.46	1.14	1.01	0.98	3.91
2003/04	1.03	1.52	3.46	5.69	8.16	6.74	3.82	2.09	1.17	0.77	0.78	0.80	3.00
2004/05	0.98	0.93	2.83	5.82	7.89	6.33	3.40	1.97	1.17	1.12	1.10	1.14	2.89
2005/06	1.24	1.68	4.20	7.92	12.67	9.50	4.38	2.43	1.49	1.12	1.19	1.15	4.08
PROM	0.93	1.29	3.46	6.55	9.27	7.37	3.89	2.15	1.24	0.96	0.91	0.89	3.24
MAX	1.51	1.78	4.43	9.18	16.13	13.39	6.33	3.20	1.85	1.79	1.46	1.43	4.97
MIN	0.61	0.76	2.40	4.49	5.45	4.97	3.09	1.65	0.71	0.64	0.64	0.63	2.37

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Table A.2. Series of average monthly flows [m^3/s] Colina Stream, condition with Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.30	0.30	0.30	0.69	2.04	2.14	0.79	0.30	0.30	0.30	0.30	0.30	0.67
1951/52	0.30	0.30	0.30	0.49	2.09	1.98	0.66	0.30	0.30	0.30	0.30	0.30	0.63
1952/53	0.30	0.30	0.30	0.48	2.17	2.52	0.74	0.32	0.30	0.30	0.30	0.30	0.69
1953/54	0.30	0.30	0.47	1.69	4.66	4.56	1.58	0.47	0.30	0.30	0.30	0.30	1.27
1954/55	0.30	0.30	0.30	0.30	1.77	2.46	0.85	0.30	0.30	0.30	0.30	0.30	0.65
1955/56	0.30	0.30	0.30	0.30	1.49	1.87	0.62	0.30	0.30	0.30	0.30	0.30	0.56
1956/57	0.30	0.30	0.30	0.30	2.45	3.35	1.00	0.30	0.30	0.30	0.30	0.30	0.79
1957/58	0.30	0.30	0.30	0.74	1.59	1.30	0.39	0.30	0.30	0.30	0.30	0.30	0.54
1958/59	0.30	0.30	0.90	0.93	2.00	2.32	0.58	0.37	0.30	0.30	0.30	0.30	0.74
1959/60	0.30	0.30	0.80	1.82	3.82	4.25	1.29	0.30	0.30	0.30	0.30	0.30	1.17
1960/61	0.30	0.30	0.30	0.87	1.72	1.86	0.67	0.44	0.30	0.30	0.30	0.30	0.64
1961/62	0.30	0.30	1.06	2.65	3.85	3.66	1.81	0.38	0.30	0.30	0.30	0.30	1.27
1962/63	0.30	0.30	0.30	0.56	0.77	1.75	0.44	0.30	0.30	0.30	0.30	0.30	0.49
1963/64	0.30	0.30	0.30	2.12	7.87	6.60	2.20	0.97	0.30	0.30	0.30	0.30	1.82
1964/65	0.30	0.30	0.30	0.30	1.35	2.38	0.62	0.33	0.30	0.30	0.30	0.30	0.59
1965/66	0.30	0.30	0.44	0.67	5.54	3.88	1.37	0.56	0.30	0.30	0.30	0.30	1.19
1966/67	0.30	0.30	0.30	0.30	1.50	2.43	0.63	0.30	0.30	0.30	0.30	0.30	0.61
1967/68	0.30	0.30	0.30	0.30	0.86	1.56	0.35	0.30	0.30	0.30	0.30	0.30	0.46
1968/69	0.30	0.30	0.30	0.30	0.60	1.37	0.30	0.30	0.30	0.30	0.30	0.30	0.41
1969/70	0.30	0.30	0.30	1.18	2.21	2.17	0.38	0.30	0.30	0.30	0.30	0.30	0.70
1970/71	0.30	0.30	0.30	0.55	0.30	0.76	0.72	0.30	0.30	0.30	0.30	0.30	0.39
1971/72	0.30	0.30	0.35	0.30	1.32	1.59	0.56	0.30	0.31	0.30	0.30	0.30	0.52
1972/73	0.30	0.30	0.30	1.21	5.26	4.90	1.87	1.15	0.30	0.30	0.30	0.30	1.37
1973/74	0.30	0.30	0.30	0.30	3.06	2.50	0.77	0.30	0.30	0.30	0.30	0.30	0.75
1974/75	0.30	0.30	0.47	1.03	6.17	3.20	0.98	0.33	0.30	0.30	0.30	0.30	1.17
1975/76	0.30	0.30	0.30	0.64	1.38	3.59	0.69	0.30	0.30	0.30	0.30	0.30	0.73
1976/77	0.30	0.30	0.30	0.30	2.02	1.62	0.65	0.30	0.30	0.30	0.30	0.30	0.58
1977/78	0.30	0.30	0.69	1.99	3.60	3.28	0.97	0.47	0.30	0.30	0.30	0.30	1.07
1978/79	0.30	0.30	0.30	2.06	4.84	3.13	1.14	0.67	0.30	0.30	0.30	0.30	1.16
1979/80	0.30	0.30	0.30	0.59	3.45	3.27	1.28	1.00	0.54	0.30	0.30	0.30	0.99
1980/81	0.30	0.30	0.31	2.83	5.05	5.01	1.60	0.56	0.30	0.30	0.30	0.30	1.43
1981/82	0.30	0.30	0.30	0.30	1.86	2.70	0.75	0.30	0.30	0.30	0.30	0.30	0.67
1982/83	0.30	0.30	0.30	3.64	10.13	9.18	3.51	1.49	0.41	0.30	0.30	0.30	2.51
1983/84	0.30	0.30	0.51	2.01	4.26	4.16	1.42	0.58	0.30	0.30	0.30	0.30	1.23
1984/85	0.30	0.30	0.30	1.69	5.54	4.52	2.02	0.78	0.30	0.30	0.30	0.30	1.39
1985/86	0.30	0.30	0.30	0.59	1.98	2.11	0.69	0.37	0.30	0.62	0.30	0.30	0.68
1986/87	0.30	0.30	0.30	2.13	5.89	5.33	1.87	0.65	0.30	0.30	0.30	0.30	1.50
1987/88	0.30	0.30	1.07	3.43	6.85	5.83	2.14	0.89	0.30	0.30	0.30	0.30	1.83
1988/89	0.30	0.30	0.30	0.30	1.85	2.79	0.73	0.30	0.30	0.30	0.30	0.30	0.67
1989/90	0.30	0.30	0.72	1.20	2.90	2.20	0.60	0.30	0.30	0.30	0.30	0.30	0.81
1990/91	0.30	0.30	0.30	0.30	1.63	2.09	0.74	0.30	0.30	0.30	0.30	0.30	0.60
1991/92	0.30	0.30	0.30	0.30	5.58	4.27	1.93	0.66	0.30	0.30	0.30	0.30	1.24
1992/93	0.30	0.30	0.38	1.56	5.03	4.25	1.56	0.82	0.41	0.30	0.30	0.30	1.29
1993/94	0.30	0.30	0.35	1.06	4.22	2.97	1.27	0.47	0.30	0.30	0.30	0.30	1.01
1994/95	0.30	0.30	0.91	1.85	3.25	2.53	0.92	0.49	0.30	0.30	0.30	0.30	0.98
1995/96	0.30	0.30	0.31	1.21	1.64	2.17	0.83	0.33	0.30	0.30	0.30	0.30	0.69
1996/97	0.30	0.30	0.30	0.30	0.66	2.03	0.30	0.30	0.30	0.30	0.30	0.30	0.47
1997/98	0.31	0.30	0.33	1.96	7.10	3.95	1.56	0.91	0.30	0.30	0.30	0.30	1.47
1998/99	0.30	0.30	0.30	0.30	0.37	1.64	0.33	0.30	0.30	0.30	0.30	0.30	0.42
1999/00	0.30	0.30	0.30	0.30	0.97	1.97	0.33	0.30	0.30	0.30	0.30	0.30	0.50
2000/01	0.30	0.30	0.30	2.47	5.09	4.45	1.49	0.57	0.30	0.30	0.30	0.30	1.35
2001/02	0.30	0.30	0.38	2.49	4.23	3.67	1.29	0.57	0.30	0.30	0.30	0.37	1.21
2002/03	0.30	0.30	0.55	1.87	5.55	4.94	1.94	0.81	0.30	0.30	0.30	0.30	1.45
2003/04	0.30	0.30	0.30	0.30	2.16	2.53	1.00	0.38	0.30	0.30	0.30	0.30	0.71
2004/05	0.30	0.30	0.30	0.30	1.89	2.12	0.58	0.30	0.30	0.30	0.30	0.30	0.61
2005/06	0.30	0.30	0.84	2.38	6.67	5.29	1.56	0.72	0.30	0.30	0.30	0.30	1.61
PROM	0.30	0.30	0.40	1.13	3.29	3.16	1.07	0.48	0.31	0.31	0.30	0.30	0.95
MAX	0.31	0.30	1.07	3.64	10.13	9.18	3.51	1.49	0.54	0.62	0.30	0.37	2.51
MIN	0.30	0.30	0.30	0.30	0.30	0.76	0.30	0.30	0.30	0.30	0.30	0.30	0.39

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Table A.3. Series of average monthly flows [m^3/s] La Engorda Stream, condition without Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.27	0.40	0.80	1.79	2.28	1.75	1.03	0.53	0.36	0.31	0.30	0.30	0.84
1951/52	0.29	0.40	0.89	1.70	2.30	1.69	0.97	0.54	0.35	0.31	0.30	0.29	0.84
1952/53	0.30	0.41	0.83	1.70	2.33	1.91	1.00	0.57	0.36	0.32	0.30	0.32	0.86
1953/54	0.38	0.45	1.19	2.19	3.35	2.74	1.35	0.63	0.43	0.39	0.35	0.33	1.15
1954/55	0.34	0.44	0.96	1.59	2.17	1.88	1.05	0.55	0.34	0.25	0.22	0.22	0.83
1955/56	0.23	0.32	0.92	1.49	2.05	1.64	0.96	0.49	0.36	0.28	0.26	0.27	0.77
1956/57	0.28	0.38	1.05	1.60	2.44	2.25	1.11	0.55	0.33	0.28	0.26	0.27	0.90
1957/58	0.29	0.41	0.98	1.81	2.10	1.41	0.86	0.52	0.35	0.30	0.29	0.28	0.80
1958/59	0.36	0.54	1.37	1.88	2.26	1.83	0.94	0.59	0.39	0.32	0.32	0.34	0.93
1959/60	0.38	0.51	1.33	2.24	3.00	2.61	1.23	0.53	0.36	0.28	0.28	0.28	1.09
1960/61	0.38	0.42	1.11	1.86	2.15	1.64	0.98	0.62	0.38	0.32	0.30	0.30	0.87
1961/62	0.30	0.58	1.43	2.58	3.02	2.37	1.44	0.59	0.39	0.33	0.30	0.29	1.14
1962/63	0.31	0.41	1.07	1.73	1.76	1.59	0.88	0.52	0.34	0.29	0.28	0.26	0.79
1963/64	0.33	0.43	0.85	2.37	4.66	3.57	1.60	0.83	0.48	0.38	0.32	0.29	1.34
1964/65	0.29	0.36	0.84	1.35	2.00	1.85	0.96	0.57	0.38	0.33	0.31	0.37	0.80
1965/66	0.39	0.58	1.18	1.78	3.71	2.46	1.26	0.67	0.43	0.37	0.37	0.32	1.13
1966/67	0.34	0.50	1.10	1.63	2.06	1.87	0.96	0.56	0.36	0.38	0.25	0.23	0.85
1967/68	0.23	0.33	0.74	1.52	1.80	1.51	0.85	0.48	0.32	0.27	0.23	0.21	0.71
1968/69	0.21	0.25	0.65	1.15	1.69	1.44	0.81	0.41	0.27	0.26	0.24	0.23	0.63
1969/70	0.27	0.32	0.72	1.99	2.35	1.77	0.86	0.52	0.32	0.24	0.22	0.23	0.82
1970/71	0.26	0.44	0.96	1.73	1.22	1.19	1.00	0.54	0.27	0.22	0.25	0.25	0.69
1971/72	0.28	0.47	1.15	1.63	1.98	1.53	0.93	0.50	0.56	0.43	0.31	0.36	0.84
1972/73	0.40	0.49	0.92	2.00	3.59	2.88	1.47	0.91	0.52	0.35	0.32	0.28	1.18
1973/74	0.30	0.56	1.00	1.49	2.69	1.90	1.02	0.53	0.35	0.31	0.35	0.32	0.90
1974/75	0.32	0.61	1.19	1.93	3.97	2.18	1.10	0.57	0.33	0.27	0.25	0.25	1.08
1975/76	0.28	0.38	0.85	1.76	2.01	2.34	0.99	0.49	0.32	0.27	0.26	0.25	0.85
1976/77	0.26	0.31	0.88	1.57	2.27	1.54	0.97	0.53	0.34	0.29	0.37	0.39	0.81
1977/78	0.41	0.61	1.28	2.31	2.92	2.22	1.10	0.63	0.34	0.32	0.36	0.36	1.07
1978/79	0.35	0.50	1.01	2.34	3.42	2.16	1.17	0.71	0.49	0.35	0.30	0.32	1.09
1979/80	0.29	0.36	0.78	1.74	2.85	2.22	1.23	0.85	0.65	0.51	0.45	0.37	1.02
1980/81	0.38	0.50	1.13	2.66	3.51	2.93	1.35	0.66	0.46	0.36	0.30	0.30	1.21
1981/82	0.29	0.42	1.00	1.59	2.20	1.98	1.01	0.53	0.37	0.36	0.55	0.47	0.90
1982/83	0.54	0.54	1.09	2.99	5.58	4.63	2.14	1.05	0.60	0.44	0.38	0.36	1.69
1983/84	0.35	0.52	1.21	2.33	3.18	2.58	1.28	0.68	0.41	0.33	0.32	0.33	1.13
1984/85	0.38	0.62	1.08	2.19	3.71	2.72	1.53	0.76	0.19	0.41	0.37	0.34	1.19
1985/86	0.32	0.36	1.04	1.74	2.25	1.74	0.99	0.59	0.41	0.68	0.46	0.34	0.91
1986/87	0.38	0.51	1.02	2.37	3.85	3.06	1.47	0.70	0.46	0.41	0.51	0.42	1.26
1987/88	0.39	0.59	1.44	2.90	4.24	3.26	1.58	0.80	0.49	0.36	0.32	0.31	1.39
1988/89	0.24	0.43	1.01	1.56	2.20	2.02	1.00	0.53	0.34	0.27	0.24	0.31	0.85
1989/90	0.35	0.50	1.30	1.99	2.63	1.78	0.95	0.55	0.36	0.28	0.26	0.26	0.93
1990/91	0.30	0.36	0.90	1.53	2.11	1.73	1.01	0.54	0.50	0.50	0.42	0.38	0.86
1991/92	0.46	0.55	1.10	1.53	3.73	2.62	1.49	0.71	0.50	0.43	0.40	0.36	1.16
1992/93	0.42	0.62	1.16	2.14	3.50	2.61	1.34	0.77	0.60	0.53	0.52	0.42	1.22
1993/94	0.42	0.67	1.15	1.94	3.17	2.09	1.22	0.63	0.42	0.35	0.33	0.35	1.06
1994/95	0.32	0.48	1.37	2.26	2.77	1.91	1.08	0.64	0.40	0.33	0.30	0.29	1.01
1995/96	0.37	0.46	1.13	2.00	2.11	1.76	1.04	0.57	0.36	0.26	0.26	0.24	0.88
1996/97	0.24	0.28	0.61	1.08	1.72	1.71	0.82	0.48	0.31	0.35	0.34	0.39	0.69
1997/98	0.58	0.44	1.14	2.30	4.35	2.49	1.34	0.81	0.53	0.37	0.33	0.28	1.25
1998/99	0.26	0.37	0.79	1.16	1.60	1.55	0.84	0.47	0.31	0.25	0.23	0.24	0.67
1999/00	0.26	0.44	0.98	1.60	1.84	1.68	0.84	0.54	0.36	0.32	0.37	0.32	0.80
2000/01	0.33	0.61	1.10	2.51	3.52	2.70	1.31	0.67	0.45	0.36	0.36	0.40	1.19
2001/02	0.43	0.59	1.16	2.52	3.17	2.38	1.23	0.67	0.48	0.38	0.41	0.54	1.16
2002/03	0.50	0.62	1.23	2.27	3.71	2.89	1.50	0.77	0.49	0.42	0.37	0.36	1.26
2003/04	0.38	0.56	1.04	1.57	2.33	1.91	1.11	0.59	0.38	0.27	0.28	0.29	0.89
2004/05	0.36	0.32	0.79	1.62	2.22	1.74	0.94	0.54	0.38	0.41	0.41	0.42	0.85
2005/06	0.46	0.63	1.35	2.47	4.17	3.04	1.34	0.73	0.50	0.41	0.44	0.43	1.33
PROM	0.34	0.47	1.04	1.92	2.78	2.17	1.14	0.62	0.40	0.35	0.33	0.32	0.99
MAX	0.58	0.67	1.44	2.99	5.58	4.63	2.14	1.05	0.65	0.68	0.55	0.54	1.69
MIN	0.21	0.25	0.61	1.08	1.22	1.19	0.81	0.41	0.19	0.22	0.22	0.21	0.63

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Table AA. Series of average monthly flows [m^3/s] La Engorda Stream, condition with Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1951/52	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1952/53	0.20	0.20	0.20	0.20	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1953/54	0.20	0.20	0.20	0.20	1.25	0.64	0.20	0.20	0.20	0.20	0.20	0.20	0.32
1954/55	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1955/56	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1956/57	0.20	0.20	0.20	0.20	0.34	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.21
1957/58	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1958/59	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1959/60	0.20	0.20	0.20	0.20	0.90	0.51	0.20	0.20	0.20	0.20	0.20	0.20	0.28
1960/61	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1961/62	0.20	0.20	0.20	0.48	0.92	0.27	0.20	0.20	0.20	0.20	0.20	0.20	0.29
1962/63	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1963/64	0.20	0.20	0.20	0.27	2.56	1.47	0.20	0.20	0.20	0.20	0.20	0.20	0.51
1964/65	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1965/66	0.20	0.20	0.20	0.20	1.61	0.36	0.20	0.20	0.20	0.20	0.20	0.20	0.33
1966/67	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1967/68	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1968/69	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1969/70	0.20	0.20	0.20	0.20	0.25	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1970/71	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1971/72	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1972/73	0.20	0.20	0.20	0.20	1.49	0.78	0.20	0.20	0.20	0.20	0.20	0.20	0.36
1973/74	0.20	0.20	0.20	0.20	0.59	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.23
1974/75	0.20	0.20	0.20	0.20	1.87	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.34
1975/76	0.20	0.20	0.20	0.20	0.20	0.24	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1976/77	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1977/78	0.20	0.20	0.20	0.21	0.82	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.25
1978/79	0.20	0.20	0.20	0.24	1.32	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.30
1979/80	0.20	0.20	0.20	0.20	0.75	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.25
1980/81	0.20	0.20	0.20	0.56	1.41	0.83	0.20	0.20	0.20	0.20	0.20	0.20	0.38
1981/82	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1982/83	0.20	0.20	0.20	0.89	3.48	2.53	0.20	0.20	0.20	0.20	0.20	0.20	0.72
1983/84	0.20	0.20	0.20	0.23	1.08	0.48	0.20	0.20	0.20	0.20	0.20	0.20	0.30
1984/85	0.20	0.20	0.20	0.20	1.61	0.62	0.20	0.20	0.19	0.20	0.20	0.20	0.35
1985/86	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1986/87	0.20	0.20	0.20	0.27	1.75	0.96	0.20	0.20	0.20	0.20	0.20	0.20	0.40
1987/88	0.20	0.20	0.20	0.80	2.14	1.16	0.20	0.20	0.20	0.20	0.20	0.20	0.49
1988/89	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1989/90	0.20	0.20	0.20	0.20	0.53	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.23
1990/91	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1991/92	0.20	0.20	0.20	0.20	1.63	0.52	0.20	0.20	0.20	0.20	0.20	0.20	0.35
1992/93	0.20	0.20	0.20	0.20	1.40	0.51	0.20	0.20	0.20	0.20	0.20	0.20	0.33
1993/94	0.20	0.20	0.20	0.20	1.07	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.27
1994/95	0.20	0.20	0.20	0.20	0.67	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.24
1995/96	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1996/97	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1997/98	0.20	0.20	0.20	0.20	2.25	0.39	0.20	0.20	0.20	0.20	0.20	0.20	0.39
1998/99	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
1999/00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
2000/01	0.20	0.20	0.20	0.41	1.42	0.60	0.20	0.20	0.20	0.20	0.20	0.20	0.35
2001/02	0.20	0.20	0.20	0.42	1.07	0.28	0.20	0.20	0.20	0.20	0.20	0.20	0.30
2002/03	0.20	0.20	0.20	0.20	1.61	0.79	0.20	0.20	0.20	0.20	0.20	0.20	0.37
2003/04	0.20	0.20	0.20	0.20	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
2004/05	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
2005/06	0.20	0.20	0.20	0.37	2.07	0.94	0.20	0.20	0.20	0.20	0.20	0.20	0.43
PROM	0.20	0.20	0.20	0.25	0.81	0.39	0.20	0.20	0.20	0.20	0.20	0.20	0.27
MAX	0.20	0.20	0.20	0.89	3.48	2.53	0.20	0.20	0.20	0.20	0.20	0.20	0.72
MIN	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.20	0.20	0.20	0.20

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Table A.S. Series of average monthly flows [m^3/s] El Morado Canyon, condition without Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.47	0.70	1.37	3.07	3.91	3.00	1.76	0.91	0.63	0.54	0.52	0.52	1.45
1951/52	0.51	0.70	1.53	2.92	3.95	2.88	1.67	0.93	0.62	0.54	0.52	0.51	1.44
1952/53	0.53	0.72	1.42	2.92	4.01	3.27	1.72	0.98	0.63	0.55	0.53	0.56	1.49
1953/54	0.67	0.78	2.07	3.80	5.81	4.75	2.34	1.08	0.75	0.69	0.61	0.59	2.00
1954/55	0.59	0.78	1.66	2.73	3.72	3.23	1.81	0.95	0.58	0.44	0.38	0.39	1.44
1955/56	0.41	0.55	1.59	2.54	3.52	2.80	1.64	0.83	0.63	0.50	0.46	0.48	1.33
1956/57	0.49	0.66	1.81	2.75	4.21	3.88	1.91	0.95	0.56	0.49	0.45	0.48	1.55
1957/58	0.51	0.72	1.69	3.11	3.59	2.39	1.48	0.89	0.62	0.53	0.50	0.48	1.38
1958/59	0.63	0.95	2.38	3.24	3.88	3.13	1.61	1.01	0.68	0.57	0.57	0.60	1.61
1959/60	0.66	0.91	2.31	3.89	5.20	4.53	2.12	0.92	0.62	0.49	0.49	0.49	1.89
1960/61	0.67	0.73	1.92	3.20	3.68	2.79	1.68	1.06	0.66	0.57	0.53	0.52	1.50
1961/62	0.53	1.02	2.50	4.49	5.22	4.10	2.50	1.02	0.68	0.57	0.53	0.51	1.97
1962/63	0.55	0.72	1.85	2.98	2.99	2.72	1.51	0.89	0.59	0.50	0.50	0.46	1.35
1963/64	0.58	0.76	1.46	4.11	8.14	6.23	2.79	1.45	0.84	0.67	0.56	0.51	2.34
1964/65	0.51	0.64	1.44	2.30	3.42	3.18	1.64	0.98	0.66	0.57	0.54	0.66	1.38
1965/66	0.69	1.02	2.05	3.05	6.45	4.26	2.18	1.15	0.74	0.65	0.65	0.56	1.95
1966/67	0.60	0.88	1.91	2.79	3.52	3.21	1.65	0.96	0.63	0.67	0.44	0.40	1.47
1967/68	0.41	0.58	1.27	2.60	3.06	2.58	1.44	0.82	0.56	0.48	0.40	0.37	1.22
1968/69	0.36	0.44	1.10	1.94	2.87	2.44	1.39	0.70	0.46	0.46	0.42	0.41	1.08
1969/70	0.48	0.57	1.24	3.43	4.04	3.02	1.47	0.90	0.55	0.42	0.39	0.40	1.41
1970/71	0.45	0.77	1.66	2.97	2.04	2.00	1.71	0.93	0.46	0.38	0.43	0.45	1.19
1971/72	0.50	0.83	1.99	2.79	3.39	2.60	1.59	0.85	0.98	0.75	0.55	0.63	1.45
1972/73	0.70	0.86	1.58	3.45	6.25	5.00	2.55	1.58	0.90	0.61	0.56	0.48	2.04
1973/74	0.52	0.99	1.73	2.54	4.65	3.26	1.75	0.91	0.61	0.54	0.61	0.56	1.56
1974/75	0.57	1.07	2.07	3.32	6.91	3.76	1.90	0.99	0.57	0.47	0.45	0.45	1.88
1975/76	0.49	0.66	1.47	3.03	3.44	4.05	1.69	0.83	0.55	0.47	0.45	0.44	1.46
1976/77	0.45	0.55	1.51	2.69	3.90	2.62	1.66	0.91	0.59	0.50	0.66	0.69	1.39
1977/78	0.73	1.08	2.23	4.01	5.04	3.83	1.90	1.09	0.58	0.56	0.63	0.64	1.86
1978/79	0.62	0.87	1.75	4.06	5.95	3.72	2.02	1.23	0.85	0.61	0.52	0.57	1.90
1979/80	0.51	0.63	1.34	3.00	4.93	3.82	2.12	1.47	1.15	0.89	0.79	0.65	1.78
1980/81	0.68	0.89	1.96	4.62	6.10	5.08	2.35	1.15	0.80	0.63	0.53	0.52	2.11
1981/82	0.51	0.74	1.72	2.72	3.78	3.41	1.73	0.91	0.65	0.64	0.98	0.83	1.55
1982/83	0.96	0.94	1.89	5.21	9.78	8.11	3.73	1.82	1.05	0.77	0.68	0.63	2.96
1983/84	0.62	0.92	2.10	4.03	5.52	4.47	2.22	1.17	0.72	0.58	0.55	0.58	1.96
1984/85	0.66	1.09	1.87	3.80	6.45	4.73	2.65	1.31	0.32	0.71	0.66	0.59	2.07
1985/86	0.55	0.62	1.80	3.00	3.87	2.98	1.69	1.01	0.72	1.20	0.80	0.61	1.57
1986/87	0.67	0.91	1.76	4.12	6.70	5.32	2.55	1.21	0.81	0.72	0.89	0.75	2.20
1987/88	0.70	1.03	2.51	5.05	7.40	5.67	2.74	1.39	0.85	0.64	0.56	0.55	2.42
1988/89	0.43	0.75	1.74	2.67	3.78	3.47	1.72	0.91	0.60	0.47	0.42	0.54	1.46
1989/90	0.62	0.88	2.25	3.44	4.54	3.05	1.62	0.94	0.62	0.50	0.46	0.46	1.61
1990/91	0.53	0.64	1.55	2.61	3.62	2.96	1.73	0.93	0.87	0.87	0.74	0.67	1.48
1991/92	0.82	0.96	1.90	2.62	6.48	4.54	2.59	1.22	0.87	0.75	0.71	0.63	2.01
1992/93	0.73	1.09	2.00	3.70	6.08	4.53	2.32	1.34	1.05	0.93	0.92	0.74	2.12
1993/94	0.74	1.17	1.99	3.34	5.49	3.60	2.11	1.08	0.73	0.61	0.59	0.61	1.84
1994/95	0.56	0.85	2.39	3.91	4.79	3.29	1.86	1.10	0.70	0.58	0.53	0.51	1.75
1995/96	0.65	0.81	1.96	3.45	3.62	3.02	1.79	0.98	0.63	0.46	0.45	0.43	1.52
1996/97	0.42	0.49	1.04	1.81	2.92	2.92	1.40	0.81	0.53	0.62	0.59	0.69	1.19
1997/98	1.02	0.78	1.97	3.99	7.58	4.31	2.32	1.41	0.93	0.66	0.57	0.48	2.17
1998/99	0.45	0.65	1.35	1.97	2.70	2.64	1.43	0.81	0.54	0.44	0.41	0.42	1.15
1999/00	0.46	0.78	1.69	2.74	3.14	2.88	1.43	0.93	0.62	0.57	0.64	0.57	1.37
2000/01	0.57	1.08	1.90	4.36	6.12	4.68	2.27	1.16	0.79	0.64	0.63	0.71	2.07
2001/02	0.76	1.05	2.00	4.38	5.50	4.11	2.13	1.15	0.84	0.67	0.72	0.96	2.02
2002/03	0.88	1.09	2.13	3.92	6.46	5.03	2.60	1.33	0.87	0.73	0.65	0.63	2.19
2003/04	0.67	0.99	1.80	2.68	4.00	3.28	1.91	1.02	0.66	0.47	0.49	0.50	1.54
2004/05	0.63	0.56	1.35	2.77	3.80	2.98	1.61	0.93	0.65	0.72	0.72	0.75	1.46
2005/06	0.82	1.10	2.34	4.29	7.27	5.28	2.32	1.27	0.88	0.72	0.78	0.76	2.32
PROM	0.60	0.82	1.80	3.30	4.81	3.74	1.96	1.06	0.70	0.61	0.58	0.56	1.71
MAX	1.02	1.17	2.51	5.21	9.78	8.11	3.73	1.82	1.15	1.20	0.98	0.96	2.96
MIN	0.36	0.44	1.04	1.81	2.04	2.00	1.39	0.70	0.32	0.38	0.38	0.37	1.08

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Table A.6. Series of average monthly flows [m^3/s] El Morado Canyon, condition with Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1951/52	0.24	0.24	0.24	0.24	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1952/53	0.24	0.24	0.24	0.24	0.31	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25
1953/54	0.24	0.24	0.24	0.24	2.11	1.30	0.24	0.24	0.24	0.24	0.24	0.24	0.48
1954/55	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1955/56	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1956/57	0.24	0.24	0.24	0.24	0.51	0.43	0.24	0.24	0.24	0.24	0.24	0.24	0.28
1957/58	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1958/59	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1959/60	0.24	0.24	0.24	0.24	1.50	1.08	0.24	0.24	0.24	0.24	0.24	0.24	0.42
1960/61	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1961/62	0.24	0.24	0.24	0.79	1.52	0.65	0.24	0.24	0.24	0.24	0.24	0.24	0.43
1962/63	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1963/64	0.24	0.24	0.24	0.41	4.44	2.78	0.48	0.24	0.24	0.24	0.24	0.24	0.84
1964/65	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1965/66	0.24	0.24	0.24	0.24	2.75	0.81	0.24	0.24	0.24	0.24	0.24	0.24	0.50
1966/67	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1967/68	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1968/69	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1969/70	0.24	0.24	0.24	0.24	0.34	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25
1970/71	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1971/72	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1972/73	0.24	0.24	0.24	0.24	2.55	1.55	0.24	0.24	0.24	0.24	0.24	0.24	0.54
1973/74	0.24	0.24	0.24	0.24	0.95	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.30
1974/75	0.24	0.24	0.24	0.24	3.21	0.31	0.24	0.24	0.24	0.24	0.24	0.24	0.49
1975/76	0.24	0.24	0.24	0.24	0.24	0.60	0.24	0.24	0.24	0.24	0.24	0.24	0.27
1976/77	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1977/78	0.24	0.24	0.24	0.31	1.34	0.38	0.24	0.24	0.24	0.24	0.24	0.24	0.35
1978/79	0.24	0.24	0.24	0.36	2.25	0.27	0.24	0.24	0.24	0.24	0.24	0.24	0.42
1979/80	0.24	0.24	0.24	0.24	1.23	0.37	0.24	0.24	0.24	0.24	0.24	0.24	0.33
1980/81	0.24	0.24	0.24	0.92	2.40	1.63	0.24	0.24	0.24	0.24	0.24	0.24	0.59
1981/82	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1982/83	0.24	0.24	0.24	1.51	6.08	4.66	1.42	0.42	0.24	0.24	0.24	0.24	1.31
1983/84	0.24	0.24	0.24	0.33	1.82	1.02	0.24	0.24	0.24	0.24	0.24	0.24	0.44
1984/85	0.24	0.24	0.24	0.24	2.75	1.28	0.34	0.24	0.24	0.24	0.24	0.24	0.54
1985/86	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1986/87	0.24	0.24	0.24	0.42	3.00	1.87	0.24	0.24	0.24	0.24	0.24	0.24	0.62
1987/88	0.24	0.24	0.24	1.35	3.70	2.22	0.43	0.24	0.24	0.24	0.24	0.24	0.80
1988/89	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1989/90	0.24	0.24	0.24	0.24	0.84	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.29
1990/91	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1991/92	0.24	0.24	0.24	0.24	2.78	1.09	0.28	0.24	0.24	0.24	0.24	0.24	0.53
1992/93	0.24	0.24	0.24	0.24	2.38	1.08	0.24	0.24	0.24	0.24	0.24	0.24	0.49
1993/94	0.24	0.24	0.24	0.24	1.79	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.37
1994/95	0.24	0.24	0.24	0.24	1.09	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.31
1995/96	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1996/97	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1997/98	0.24	0.24	0.24	0.29	3.88	0.86	0.24	0.24	0.24	0.24	0.24	0.24	0.60
1998/99	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
1999/00	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
2000/01	0.24	0.24	0.24	0.66	2.42	1.23	0.24	0.24	0.24	0.24	0.24	0.24	0.54
2001/02	0.24	0.24	0.24	0.68	1.80	0.66	0.24	0.24	0.24	0.24	0.24	0.24	0.44
2002/03	0.24	0.24	0.24	0.24	2.76	1.58	0.29	0.24	0.24	0.24	0.24	0.24	0.56
2003/04	0.24	0.24	0.24	0.24	0.30	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25
2004/05	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
2005/06	0.24	0.24	0.24	0.59	3.57	1.83	0.24	0.24	0.24	0.24	0.24	0.24	0.68
PROM	0.24	0.24	0.24	0.34	1.33	0.70	0.27	0.24	0.24	0.24	0.24	0.24	0.38
MAX	0.24	0.24	0.24	1.51	6.08	4.66	1.42	0.42	0.24	0.24	0.24	0.24	1.31
MIN	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24

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Table A.7. Series of average monthly flows [m^3/s] Las Placas Creek, condition without Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.11	0.16	0.42	0.91	1.18	0.93	0.53	0.29	0.16	0.12	0.12	0.12	0.42
1951/52	0.12	0.16	0.45	0.88	1.18	0.91	0.51	0.29	0.16	0.12	0.12	0.12	0.42
1952/53	0.12	0.16	0.43	0.88	1.19	0.98	0.52	0.30	0.16	0.13	0.12	0.13	0.43
1953/54	0.15	0.18	0.55	1.05	1.54	1.27	0.64	0.32	0.19	0.15	0.14	0.13	0.53
1954/55	0.13	0.17	0.47	0.84	1.14	0.98	0.54	0.29	0.16	0.10	0.09	0.09	0.42
1955/56	0.10	0.13	0.46	0.81	1.10	0.89	0.50	0.27	0.16	0.12	0.11	0.11	0.40
1956/57	0.11	0.15	0.50	0.85	1.23	1.10	0.56	0.29	0.15	0.11	0.10	0.11	0.44
1957/58	0.12	0.16	0.48	0.92	1.11	0.81	0.47	0.28	0.16	0.12	0.11	0.11	0.41
1958/59	0.14	0.21	0.61	0.94	1.17	0.96	0.50	0.30	0.17	0.13	0.13	0.13	0.45
1959/60	0.15	0.20	0.60	1.07	1.42	1.23	0.60	0.29	0.16	0.11	0.11	0.11	0.50
1960/61	0.15	0.17	0.53	0.94	1.13	0.89	0.51	0.31	0.17	0.13	0.12	0.12	0.43
1961/62	0.12	0.22	0.64	1.18	1.43	1.14	0.67	0.31	0.17	0.13	0.12	0.12	0.52
1962/63	0.12	0.16	0.51	0.89	1.00	0.88	0.48	0.28	0.16	0.12	0.11	0.11	0.40
1963/64	0.13	0.17	0.44	1.11	1.99	1.55	0.72	0.39	0.20	0.15	0.13	0.12	0.59
1964/65	0.12	0.15	0.43	0.76	1.08	0.97	0.50	0.30	0.17	0.13	0.12	0.14	0.41
1965/66	0.15	0.22	0.55	0.91	1.66	1.18	0.61	0.33	0.19	0.14	0.14	0.13	0.52
1966/67	0.13	0.20	0.52	0.86	1.10	0.97	0.51	0.29	0.16	0.15	0.10	0.09	0.42
1967/68	0.10	0.14	0.40	0.82	1.01	0.85	0.47	0.27	0.15	0.11	0.09	0.09	0.37
1968/69	0.09	0.11	0.37	0.69	0.98	0.82	0.46	0.24	0.13	0.11	0.10	0.10	0.35
1969/70	0.11	0.13	0.39	0.98	1.20	0.94	0.47	0.28	0.15	0.10	0.09	0.09	0.41
1970/71	0.10	0.17	0.48	0.89	0.82	0.74	0.52	0.29	0.13	0.09	0.10	0.10	0.37
1971/72	0.11	0.18	0.54	0.86	1.08	0.85	0.50	0.27	0.23	0.16	0.12	0.14	0.42
1972/73	0.15	0.19	0.46	0.98	1.63	1.32	0.68	0.41	0.22	0.14	0.12	0.11	0.53
1973/74	0.12	0.22	0.49	0.81	1.32	0.98	0.53	0.29	0.16	0.12	0.13	0.13	0.44
1974/75	0.13	0.23	0.55	0.96	1.75	1.08	0.55	0.30	0.15	0.11	0.10	0.10	0.50
1975/76	0.11	0.15	0.44	0.90	1.09	1.13	0.51	0.27	0.15	0.11	0.10	0.10	0.42
1976/77	0.10	0.13	0.45	0.84	1.17	0.86	0.51	0.28	0.16	0.12	0.14	0.15	0.41
1977/78	0.16	0.23	0.59	1.09	1.39	1.09	0.55	0.32	0.16	0.13	0.14	0.14	0.50
1978/79	0.14	0.19	0.49	1.10	1.57	1.07	0.58	0.35	0.21	0.14	0.12	0.13	0.51
1979/80	0.12	0.15	0.41	0.90	1.37	1.09	0.60	0.39	0.26	0.19	0.17	0.14	0.48
1980/81	0.15	0.20	0.53	1.21	1.60	1.33	0.64	0.33	0.20	0.14	0.12	0.12	0.55
1981/82	0.12	0.17	0.49	0.84	1.15	1.01	0.52	0.28	0.17	0.14	0.21	0.18	0.44
1982/83	0.20	0.21	0.52	1.32	2.31	1.91	0.91	0.46	0.25	0.17	0.15	0.14	0.71
1983/84	0.14	0.20	0.56	1.10	1.49	1.21	0.62	0.33	0.18	0.13	0.12	0.13	0.52
1984/85	0.15	0.23	0.52	1.05	1.67	1.26	0.70	0.36	0.11	0.16	0.14	0.13	0.54
1985/86	0.12	0.15	0.50	0.90	1.17	0.93	0.51	0.30	0.18	0.25	0.17	0.13	0.44
1986/87	0.15	0.20	0.49	1.11	1.71	1.38	0.68	0.34	0.20	0.16	0.19	0.16	0.56
1987/88	0.15	0.22	0.64	1.29	1.85	1.45	0.72	0.38	0.21	0.14	0.13	0.12	0.61
1988/89	0.10	0.17	0.49	0.83	1.15	1.02	0.52	0.29	0.16	0.11	0.10	0.12	0.42
1989/90	0.14	0.19	0.59	0.98	1.30	0.94	0.50	0.29	0.16	0.12	0.11	0.11	0.45
1990/91	0.12	0.15	0.45	0.82	1.12	0.92	0.52	0.29	0.21	0.19	0.16	0.15	0.43
1991/92	0.18	0.21	0.52	0.82	1.67	1.23	0.69	0.35	0.21	0.17	0.15	0.14	0.53
1992/93	0.16	0.23	0.54	1.03	1.59	1.23	0.64	0.37	0.25	0.20	0.20	0.16	0.55
1993/94	0.16	0.25	0.54	0.96	1.48	1.05	0.60	0.32	0.18	0.14	0.13	0.14	0.50
1994/95	0.12	0.19	0.62	1.07	1.34	0.99	0.55	0.32	0.18	0.13	0.12	0.12	0.48
1995/96	0.14	0.18	0.53	0.98	1.12	0.94	0.53	0.30	0.16	0.11	0.10	0.10	0.43
1996/97	0.10	0.12	0.36	0.67	0.98	0.92	0.46	0.27	0.15	0.14	0.13	0.15	0.37
1997/98	0.21	0.17	0.53	1.09	1.88	1.18	0.64	0.38	0.22	0.15	0.13	0.11	0.56
1998/99	0.10	0.15	0.42	0.70	0.94	0.86	0.46	0.27	0.15	0.10	0.10	0.10	0.36
1999/00	0.11	0.18	0.48	0.85	1.03	0.91	0.46	0.29	0.16	0.13	0.14	0.13	0.40
2000/01	0.13	0.23	0.52	1.16	1.60	1.25	0.63	0.33	0.19	0.14	0.14	0.15	0.54
2001/02	0.16	0.23	0.54	1.16	1.48	1.15	0.60	0.33	0.21	0.15	0.16	0.20	0.53
2002/03	0.19	0.23	0.57	1.08	1.67	1.32	0.69	0.37	0.21	0.16	0.14	0.14	0.56
2003/04	0.15	0.22	0.50	0.84	1.19	0.99	0.56	0.31	0.17	0.11	0.11	0.11	0.44
2004/05	0.14	0.13	0.42	0.85	1.16	0.93	0.50	0.29	0.17	0.16	0.16	0.16	0.42
2005/06	0.18	0.24	0.61	1.15	1.82	1.37	0.64	0.35	0.21	0.16	0.17	0.16	0.59
PROM	0.13	0.18	0.50	0.96	1.35	1.07	0.57	0.31	0.18	0.14	0.13	0.13	0.47
MAX	0.21	0.25	0.64	1.32	2.31	1.91	0.91	0.46	0.26	0.25	0.21	0.20	0.71
MIN	0.09	0.11	0.36	0.67	0.82	0.74	0.46	0.24	0.11	0.09	0.09	0.09	0.35

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Table A.S. Series of average monthly flows [m^3/s] Las Placas Creek, condition with Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	0.11	0.14	0.14	0.14	0.18	0.14	0.14	0.14	0.14	0.12	0.12	0.12	0.14
1951/52	0.12	0.14	0.14	0.14	0.18	0.14	0.14	0.14	0.14	0.12	0.12	0.12	0.14
1952/53	0.12	0.14	0.14	0.14	0.19	0.14	0.14	0.14	0.14	0.13	0.12	0.13	0.14
1953/54	0.14	0.14	0.14	0.14	0.54	0.27	0.14	0.14	0.14	0.14	0.14	0.13	0.18
1954/55	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.10	0.09	0.09	0.13
1955/56	0.10	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.13
1956/57	0.11	0.14	0.14	0.14	0.23	0.14	0.14	0.14	0.14	0.11	0.10	0.11	0.14
1957/58	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.13
1958/59	0.14	0.14	0.14	0.14	0.17	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.14
1959/60	0.14	0.14	0.14	0.14	0.42	0.23	0.14	0.14	0.14	0.11	0.11	0.11	0.16
1960/61	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.12	0.12	0.14
1961/62	0.12	0.14	0.14	0.18	0.43	0.14	0.14	0.14	0.14	0.13	0.12	0.12	0.16
1962/63	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.13
1963/64	0.13	0.14	0.14	0.14	0.99	0.55	0.14	0.14	0.14	0.14	0.13	0.12	0.24
1964/65	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.12	0.14	0.14
1965/66	0.14	0.14	0.14	0.14	0.66	0.18	0.14	0.14	0.14	0.14	0.14	0.13	0.19
1966/67	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.10	0.09	0.13
1967/68	0.10	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.11	0.09	0.09	0.13
1968/69	0.09	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.11	0.10	0.10	0.12
1969/70	0.11	0.13	0.14	0.14	0.20	0.14	0.14	0.14	0.14	0.10	0.09	0.09	0.13
1970/71	0.10	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.09	0.10	0.10	0.13
1971/72	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.14	0.14
1972/73	0.14	0.14	0.14	0.14	0.63	0.32	0.14	0.14	0.14	0.14	0.12	0.11	0.19
1973/74	0.12	0.14	0.14	0.14	0.32	0.14	0.14	0.14	0.14	0.12	0.13	0.13	0.15
1974/75	0.13	0.14	0.14	0.14	0.75	0.14	0.14	0.14	0.14	0.11	0.10	0.10	0.18
1975/76	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.11	0.10	0.10	0.13
1976/77	0.10	0.13	0.14	0.14	0.17	0.14	0.14	0.14	0.14	0.12	0.14	0.14	0.14
1977/78	0.14	0.14	0.14	0.14	0.39	0.14	0.14	0.14	0.14	0.13	0.14	0.14	0.16
1978/79	0.14	0.14	0.14	0.14	0.57	0.14	0.14	0.14	0.14	0.14	0.12	0.13	0.17
1979/80	0.12	0.14	0.14	0.14	0.37	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.16
1980/81	0.14	0.14	0.14	0.21	0.60	0.33	0.14	0.14	0.14	0.14	0.12	0.12	0.20
1981/82	0.12	0.14	0.14	0.14	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
1982/83	0.14	0.14	0.14	0.32	1.31	0.91	0.14	0.14	0.14	0.14	0.14	0.14	0.32
1983/84	0.14	0.14	0.14	0.14	0.49	0.21	0.14	0.14	0.14	0.13	0.12	0.13	0.17
1984/85	0.14	0.14	0.14	0.14	0.67	0.26	0.14	0.14	0.11	0.14	0.14	0.13	0.19
1985/86	0.12	0.14	0.14	0.14	0.17	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14
1986/87	0.14	0.14	0.14	0.14	0.71	0.38	0.14	0.14	0.14	0.14	0.14	0.14	0.21
1987/88	0.14	0.14	0.14	0.29	0.85	0.45	0.14	0.14	0.14	0.14	0.13	0.12	0.23
1988/89	0.10	0.14	0.14	0.14	0.15	0.14	0.14	0.14	0.14	0.11	0.10	0.12	0.13
1989/90	0.14	0.14	0.14	0.14	0.30	0.14	0.14	0.14	0.14	0.12	0.11	0.11	0.14
1990/91	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
1991/92	0.14	0.14	0.14	0.14	0.67	0.23	0.14	0.14	0.14	0.14	0.14	0.14	0.19
1992/93	0.14	0.14	0.14	0.14	0.59	0.23	0.14	0.14	0.14	0.14	0.14	0.14	0.19
1993/94	0.14	0.14	0.14	0.14	0.48	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.17
1994/95	0.12	0.14	0.14	0.14	0.34	0.14	0.14	0.14	0.14	0.13	0.12	0.12	0.15
1995/96	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.11	0.10	0.10	0.13
1996/97	0.10	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13
1997/98	0.14	0.14	0.14	0.14	0.88	0.18	0.14	0.14	0.14	0.14	0.13	0.11	0.20
1998/99	0.10	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.10	0.10	0.10	0.13
1999/00	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.14
2000/01	0.13	0.14	0.14	0.16	0.60	0.25	0.14	0.14	0.14	0.14	0.14	0.14	0.19
2001/02	0.14	0.14	0.14	0.16	0.48	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.17
2002/03	0.14	0.14	0.14	0.14	0.67	0.32	0.14	0.14	0.14	0.14	0.14	0.14	0.20
2003/04	0.14	0.14	0.14	0.14	0.19	0.14	0.14	0.14	0.14	0.11	0.11	0.11	0.14
2004/05	0.14	0.13	0.14	0.14	0.16	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
2005/06	0.14	0.14	0.14	0.15	0.82	0.37	0.14	0.14	0.14	0.14	0.14	0.14	0.22
PROM	0.13	0.14	0.14	0.15	0.38	0.20	0.14	0.14	0.14	0.13	0.12	0.12	0.16
MAX	0.14	0.14	0.14	0.32	1.31	0.91	0.14	0.14	0.14	0.14	0.14	0.14	0.32
MIN	0.09	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.11	0.09	0.09	0.09	0.12

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Table A.9. Series of average monthly flows [m^3/s] Volcán River, condition without Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	5.50	8.15	11.73	24.00	20.96	15.88	12.28	7.53	6.50	6.26	6.13	6.15	10.92
1951/52	5.99	8.17	13.79	22.39	21.17	15.13	11.42	7.74	6.35	6.29	6.19	6.02	10.89
1952/53	6.27	8.39	12.30	22.36	21.52	17.54	11.91	8.35	6.47	6.48	6.22	6.69	11.21
1953/54	8.14	9.29	20.91	31.95	32.54	26.55	17.66	9.74	8.15	8.26	7.38	7.02	15.63
1954/55	7.08	9.17	15.43	20.20	19.78	17.26	12.72	8.01	5.90	4.95	4.33	4.45	10.77
1955/56	4.69	6.25	14.56	18.23	18.53	14.66	11.14	6.40	6.53	5.74	5.35	5.60	9.81
1956/57	5.70	7.71	17.44	20.46	22.76	21.21	13.69	7.98	5.66	5.60	5.26	5.57	11.59
1957/58	6.03	8.48	15.87	24.39	18.97	12.16	9.58	7.20	6.34	6.11	5.90	5.65	10.56
1958/59	7.60	11.42	24.98	25.88	20.76	16.68	10.86	8.80	7.24	6.68	6.73	7.20	12.90
1959/60	8.00	10.88	24.10	32.94	28.81	25.18	15.68	7.56	6.37	5.65	5.79	5.75	14.73
1960/61	8.11	8.59	18.93	25.46	19.55	14.61	11.47	9.46	6.99	6.63	6.31	6.15	11.85
1961/62	6.31	12.40	26.53	39.57	28.93	22.56	19.22	8.93	7.19	6.74	6.30	6.01	15.89
1962/63	6.46	8.46	17.93	22.97	15.34	14.13	9.89	7.20	5.95	5.78	5.86	5.35	10.44
1963/64	6.96	8.99	12.81	35.35	46.70	35.56	21.89	14.57	9.25	7.97	6.69	6.00	17.73
1964/65	6.00	7.38	12.63	15.55	17.93	16.93	11.11	8.47	6.93	6.70	6.45	7.93	10.33
1965/66	8.40	12.39	20.64	23.81	36.40	23.56	16.22	10.64	8.01	7.70	7.85	6.65	15.19
1966/67	7.22	10.61	18.72	20.93	18.55	17.14	11.20	8.15	6.55	7.97	5.04	4.54	11.38
1967/68	4.70	6.55	10.39	18.84	15.76	13.28	9.28	6.36	5.60	5.50	4.53	4.22	8.75
1968/69	4.04	4.73	8.14	11.64	14.62	12.44	8.74	4.68	4.26	5.23	4.76	4.62	7.32
1969/70	5.60	6.45	9.93	27.89	21.72	16.01	9.48	7.31	5.54	4.77	4.45	4.51	10.30
1970/71	5.19	9.10	15.48	22.84	8.65	9.76	11.80	7.75	4.33	4.13	4.98	5.15	9.10
1971/72	5.85	9.83	19.79	20.92	17.77	13.42	10.68	6.75	11.14	9.08	6.56	7.55	11.61
1972/73	8.53	10.29	14.41	28.10	35.18	28.06	19.65	16.26	10.13	7.25	6.60	5.66	15.84
1973/74	6.15	12.00	16.44	18.18	25.46	17.47	12.14	7.51	6.22	6.29	7.30	6.70	11.82
1974/75	6.75	13.02	20.86	26.72	39.22	20.52	13.57	8.49	5.74	5.43	5.17	5.17	14.22
1975/76	5.70	7.70	12.93	23.56	18.06	22.27	11.63	6.42	5.45	5.37	5.20	5.01	10.78
1976/77	5.26	6.19	13.46	19.80	20.87	13.55	11.34	7.49	6.03	5.81	7.96	8.31	10.51
1977/78	8.91	13.12	23.00	34.30	27.85	20.90	13.54	9.80	5.92	6.61	7.55	7.65	14.93
1978/79	7.39	10.45	16.61	34.85	33.35	20.25	14.69	11.66	9.41	7.22	6.11	6.80	14.90
1979/80	5.98	7.29	11.23	23.18	27.17	20.87	15.63	14.87	13.33	10.94	9.72	7.86	14.01
1980/81	8.21	10.61	19.37	41.03	34.26	28.56	17.77	10.59	8.71	7.51	6.31	6.19	16.59
1981/82	5.98	8.75	16.26	20.10	20.15	18.35	11.99	7.49	6.76	7.60	12.17	10.20	12.15
1982/83	11.92	11.39	18.57	47.41	56.71	46.97	30.81	19.50	12.07	9.28	8.21	7.60	23.37
1983/84	7.40	11.08	21.27	34.51	30.75	24.80	16.56	10.86	7.75	6.79	6.59	6.89	15.44
1984/85	8.01	13.25	18.21	31.94	36.42	26.38	20.65	12.72	2.48	8.58	7.93	7.10	16.14
1985/86	6.58	7.19	17.38	23.18	20.70	15.74	11.62	8.81	7.74	15.02	9.87	7.27	12.59
1986/87	8.06	10.88	16.80	35.47	37.96	29.97	19.65	11.47	8.88	8.71	11.03	9.14	17.33
1987/88	8.45	12.56	26.62	45.75	42.18	32.16	21.45	13.82	9.43	7.60	6.66	6.48	19.43
1988/89	4.91	8.90	16.51	19.55	20.12	18.74	11.85	7.54	6.08	5.34	4.85	6.34	10.89
1989/90	7.39	10.54	23.30	28.01	24.77	16.15	10.96	7.91	6.45	5.73	5.28	5.29	12.65
1990/91	6.25	7.38	14.10	18.93	19.14	15.63	11.94	7.76	9.65	10.68	8.97	8.08	11.54
1991/92	10.06	11.60	18.66	19.09	36.61	25.26	20.07	11.61	9.64	9.10	8.61	7.61	15.66
1992/93	8.94	13.26	20.01	30.90	34.16	25.20	17.54	13.11	12.06	11.46	11.45	8.96	17.25
1993/94	9.08	14.42	19.80	26.91	30.59	19.51	15.56	9.79	7.81	7.26	7.03	7.35	14.59
1994/95	6.63	10.13	25.08	33.20	26.28	17.61	13.15	9.97	7.49	6.83	6.27	5.99	14.05
1995/96	7.80	9.57	19.38	28.14	19.17	15.98	12.53	8.43	6.56	5.22	5.25	4.90	11.91
1996/97	4.78	5.36	7.30	10.16	14.88	15.38	8.87	6.21	5.27	7.32	7.12	8.36	8.42
1997/98	12.67	9.18	19.54	34.07	43.33	23.84	17.54	14.01	10.42	7.81	6.83	5.65	17.07
1998/99	5.25	7.58	11.42	11.87	13.59	13.64	9.12	6.15	5.29	4.91	4.65	4.76	8.19
1999/00	5.36	9.20	15.83	20.34	16.22	15.12	9.14	7.74	6.38	6.65	7.75	6.77	10.54
2000/01	6.84	13.15	18.64	38.11	34.41	26.07	17.03	10.72	8.61	7.54	7.52	8.66	16.44
2001/02	9.30	12.74	20.02	38.31	30.63	22.61	15.72	10.71	9.32	7.99	8.73	11.86	16.49
2002/03	10.92	13.25	21.71	33.36	36.45	28.21	20.12	13.04	9.62	8.85	7.88	7.63	17.59
2003/04	8.07	11.96	17.38	19.74	21.48	17.58	13.70	8.91	6.87	5.32	5.71	5.92	11.89
2004/05	7.63	6.31	11.39	20.69	20.29	15.76	10.86	7.77	6.84	8.67	8.73	9.11	11.17
2005/06	10.07	13.49	24.48	37.42	41.39	29.78	17.52	12.21	9.86	8.65	9.57	9.25	18.64
PROM	7.16	9.77	17.34	26.53	26.38	20.37	14.18	9.48	7.46	7.17	6.89	6.70	13.28
MAX	12.67	14.42	26.62	47.41	56.71	46.97	30.81	19.50	13.33	15.02	12.17	11.86	23.37
MIN	4.04	4.73	7.30	10.16	8.65	9.76	8.74	4.68	2.48	4.13	4.33	4.22	7.32

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Table A.10. Series of average monthly flows [m^3/s] Volcán River, condition with Project.

ANO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	QMA
1950/51	4.74	6.65	7.15	13.27	8.21	6.56	6.72	4.73	5.09	5.29	5.23	5.24	6.57
1951/52	5.12	6.67	8.72	11.92	8.37	6.03	6.02	4.89	4.97	5.31	5.27	5.14	6.54
1952/53	5.34	6.84	7.58	11.89	8.72	7.74	6.42	5.38	5.07	5.46	5.30	5.66	6.78
1953/54	6.78	7.52	14.31	19.95	19.74	15.79	11.10	6.58	6.35	6.83	6.20	5.92	10.59
1954/55	5.96	7.43	9.96	10.17	7.33	7.54	7.08	5.10	4.63	4.27	3.83	3.93	6.44
1955/56	4.11	5.20	9.30	8.76	6.44	5.69	5.80	3.87	5.11	4.88	4.62	4.82	5.72
1956/57	4.90	6.32	11.50	10.35	9.96	10.55	7.87	5.08	4.45	4.78	4.55	4.79	7.09
1957/58	5.15	6.91	10.30	13.60	6.75	3.91	4.53	4.48	4.97	5.17	5.05	4.86	6.31
1958/59	6.37	9.14	17.84	14.85	8.06	7.13	5.57	5.77	5.65	5.61	5.69	6.06	8.15
1959/60	6.68	8.73	17.07	20.78	16.01	14.42	9.48	4.76	4.99	4.81	4.96	4.94	9.80
1960/61	6.76	6.99	12.63	14.50	7.17	5.66	6.06	6.34	5.46	5.57	5.37	5.24	7.31
1961/62	5.37	9.89	19.18	27.23	16.13	11.80	12.37	5.88	5.62	5.66	5.36	5.14	10.80
1962/63	5.49	6.89	11.87	12.41	4.17	5.32	4.78	4.48	4.67	4.91	5.02	4.62	6.22
1963/64	5.87	7.29	7.97	23.04	33.90	24.80	14.77	10.77	7.18	6.61	5.66	5.13	12.75
1964/65	5.13	6.07	7.83	6.85	6.01	7.31	5.77	5.48	5.42	5.63	5.48	6.62	6.13
1965/66	6.98	9.88	14.07	13.11	23.60	12.80	9.93	7.36	6.24	6.40	6.56	5.63	10.21
1966/67	6.07	8.53	12.47	10.69	6.46	7.45	5.84	5.21	5.13	6.61	4.38	3.99	6.90
1967/68	4.12	5.43	6.12	9.20	4.47	4.71	4.28	3.84	4.41	4.69	3.98	3.74	4.92
1968/69	3.60	4.02	4.41	4.05	3.65	4.11	3.87	2.56	3.38	4.49	4.16	4.05	3.86
1969/70	4.81	5.35	5.77	16.54	8.92	6.65	4.45	4.57	4.36	4.13	3.93	3.97	6.12
1970/71	4.50	7.38	10.00	12.30	0.00	2.20	6.33	4.90	3.43	3.63	4.33	4.47	5.29
1971/72	5.01	7.93	13.34	10.69	5.90	4.81	5.42	4.14	8.64	7.45	5.56	6.33	7.10
1972/73	7.08	8.28	9.19	16.72	22.38	17.30	12.72	12.23	7.86	6.05	5.60	4.86	10.86
1973/74	5.24	9.59	10.73	8.72	12.66	7.69	6.61	4.72	4.88	5.31	6.13	5.67	7.33
1974/75	5.71	10.37	14.27	15.56	26.42	9.94	7.77	5.50	4.51	4.64	4.48	4.48	9.47
1975/76	4.89	6.31	8.06	12.91	6.11	11.52	6.20	3.89	4.29	4.60	4.51	4.36	6.47
1976/77	4.55	5.15	8.46	9.88	8.14	4.90	5.96	4.70	4.73	4.94	6.65	6.91	6.25
1977/78	7.37	10.44	16.12	22.01	15.05	10.28	7.75	6.63	4.65	5.56	6.33	6.40	9.88
1978/79	6.20	8.40	10.86	22.55	20.55	9.70	8.68	8.24	7.31	6.03	5.21	5.74	9.96
1979/80	5.11	6.00	6.77	12.58	14.37	10.25	9.44	11.03	10.54	8.87	7.99	6.57	9.13
1980/81	6.84	8.53	12.97	28.69	21.46	17.80	11.19	7.32	6.78	6.26	5.37	5.27	11.54
1981/82	5.11	7.11	10.60	10.10	7.61	8.32	6.49	4.70	5.29	6.32	9.85	8.35	7.49
1982/83	9.66	9.12	12.36	35.07	43.91	36.21	22.98	15.23	9.44	7.61	6.83	6.37	17.90
1983/84	6.22	8.89	14.62	22.22	17.95	14.04	10.20	7.55	6.05	5.70	5.58	5.82	10.40
1984/85	6.68	10.54	12.08	19.95	23.62	15.62	13.64	9.17	1.98	7.07	6.62	5.98	11.08
1985/86	5.58	5.92	11.45	12.58	8.01	6.46	6.19	5.78	6.03	12.29	8.10	6.11	7.88
1986/87	6.72	8.73	11.01	23.16	25.16	19.21	12.71	8.08	6.90	7.17	8.98	7.54	12.12
1987/88	7.02	10.01	19.26	33.41	29.38	21.40	14.37	10.12	7.32	6.32	5.64	5.50	14.15
1988/89	4.28	7.22	10.79	9.71	7.58	8.60	6.37	4.74	4.77	4.58	4.23	5.39	6.52
1989/90	6.21	8.47	16.38	16.64	11.97	6.75	5.65	5.03	5.05	4.87	4.57	4.57	8.01
1990/91	5.32	6.07	8.95	9.26	6.87	6.38	6.45	4.91	7.49	8.67	7.42	6.74	7.04
1991/92	8.24	9.28	12.43	9.38	23.81	14.50	13.10	8.21	7.48	7.47	7.14	6.37	10.62
1992/93	7.39	10.54	13.53	19.07	21.36	14.44	11.00	9.50	9.43	9.27	9.30	7.41	11.85
1993/94	7.50	11.43	13.35	15.71	17.79	9.14	9.39	6.62	6.09	6.06	5.92	6.17	9.60
1994/95	5.61	8.17	17.93	21.00	13.48	7.79	7.43	6.78	5.85	5.73	5.34	5.12	9.18
1995/96	6.52	7.73	12.98	16.75	6.90	6.63	6.92	5.45	5.13	4.48	4.54	4.27	7.36
1996/97	4.18	4.51	3.77	2.99	3.84	6.20	3.96	3.73	4.15	6.11	5.99	6.95	4.70
1997/98	10.24	7.44	13.12	21.79	30.53	13.08	11.00	10.28	8.08	6.49	5.77	4.86	11.89
1998/99	4.54	6.22	6.91	4.22	2.92	4.97	4.15	3.68	4.17	4.24	4.08	4.16	4.52
1999/00	4.63	7.45	10.27	10.27	4.80	6.02	4.17	4.90	5.00	5.59	6.48	5.72	6.27
2000/01	5.78	10.47	12.41	25.77	21.61	15.31	10.59	7.43	6.70	6.28	6.31	7.18	11.32
2001/02	7.66	10.15	13.54	25.97	17.83	11.85	9.52	7.42	7.24	6.62	7.23	9.68	11.23
2002/03	8.90	10.54	15.01	21.13	23.65	17.45	13.14	9.44	7.47	7.28	6.58	6.39	12.25
2003/04	6.72	9.55	11.45	9.84	8.68	7.77	7.88	5.86	5.38	4.56	4.90	5.07	7.30
2004/05	6.39	5.24	6.89	10.52	7.71	6.47	5.57	4.92	5.35	7.14	7.23	7.52	6.75
2005/06	8.25	10.72	17.40	25.08	28.59	19.02	10.98	8.72	7.65	7.13	7.87	7.63	13.25
PROM	6.02	7.89	11.52	15.67	13.98	10.46	8.30	6.40	5.83	5.99	5.81	5.67	8.63
MAX	10.24	11.43	19.26	35.07	43.91	36.21	22.98	15.23	10.54	12.29	9.85	9.68	17.90
MIN	3.60	4.02	3.77	2.99	0.00	2.20	3.87	2.56	1.98	3.63	3.83	3.74	3.86

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Table A.11. Series of average monthly flows [m^3/s] Maipo River at Las Melosas.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1950/51	17.82	14.57	10.09	10.50	10.90	14.55	24.65	45.02	78.23	47.73	38.53	27.78	28.36
1951/52	17.44	13.03	15.57	15.50	17.03	17.41	27.20	52.07	80.10	58.75	31.83	35.19	31.76
1952/53	16.58	15.12	13.94	15.19	16.54	18.91	20.29	39.69	69.26	44.78	40.91	24.49	27.98
1953/54	21.23	12.24	12.52	12.76	18.83	28.86	34.24	95.34	141.83	104.71	69.16	41.67	49.45
1954/55	24.69	15.50	15.70	20.50	23.56	26.02	42.31	80.40	74.12	48.31	35.40	25.98	36.04
1955/56	16.67	15.36	10.65	8.52	9.22	10.43	16.12	47.13	49.78	39.67	35.06	19.79	23.20
1956/57	19.67	17.39	12.38	15.32	16.64	17.17	23.69	61.07	51.53	33.90	21.30	19.17	25.77
1957/58	19.27	11.80	9.02	11.92	9.77	12.62	25.69	64.16	80.80	83.97	52.25	42.32	35.30
1958/59	25.61	21.54	18.87	14.65	11.45	20.50	46.27	46.45	69.86	38.30	30.98	30.08	31.21
1959/60	16.84	16.42	15.14	16.28	19.42	20.52	27.39	66.92	120.03	66.27	22.00	18.52	35.48
1960/61	19.02	16.79	15.16	14.10	17.13	18.77	29.78	64.42	76.96	47.96	30.06	45.68	32.99
1961/62	20.43	20.48	23.40	12.69	25.44	17.70	37.97	79.39	127.14	96.58	63.37	35.92	46.71
1962/63	23.59	16.41	13.80	13.15	15.29	17.58	30.12	66.69	68.01	40.40	31.10	31.98	30.68
1963/64	18.50	14.32	12.58	14.77	15.42	21.87	23.80	48.30	175.35	165.40	68.14	39.87	51.53
1964/65	20.66	16.55	20.40	12.39	14.10	16.49	25.08	37.35	45.14	49.15	33.66	29.60	26.71
1965/66	26.00	13.96	12.92	11.86	16.82	20.84	39.26	91.60	96.60	110.57	80.70	41.04	46.85
1966/67	24.63	15.31	14.37	15.19	11.61	16.64	41.10	58.75	86.30	63.72	52.84	27.61	35.67
1967/68	19.00	14.59	6.27	9.17	12.71	9.68	24.34	42.70	66.30	43.70	38.50	21.86	25.73
1968/69	17.76	13.31	11.22	10.06	9.39	9.12	9.75	23.09	10.27	13.93	21.84	18.93	14.06
1969/70	8.87	8.71	12.76	10.58	10.73	13.43	16.56	48.60	115.50	54.55	33.30	26.07	29.97
1970/71	17.36	14.16	8.19	11.41	11.47	12.94	19.68	37.90	45.00	34.35	24.32	11.80	20.72
1971/72	10.21	9.43	8.86	10.25	12.39	16.91	37.10	82.90	75.70	56.90	31.67	23.17	31.29
1972/73	10.89	26.01	37.00	19.40	25.60	31.27	43.40	77.50	148.02	234.64	107.76	93.72	71.27
1973/74	33.55	18.95	19.50	18.54	16.53	15.83	21.91	60.73	85.93	76.73	46.28	31.55	37.17
1974/75	18.24	13.71	12.38	16.45	11.75	17.62	40.81	84.97	99.86	90.68	59.30	33.47	41.60
1975/76	21.53	12.24	12.12	11.30	11.93	14.41	22.55	42.90	79.30	48.83	32.71	26.30	28.01
1976/77	13.90	9.12	10.59	10.29	10.53	14.36	21.51	49.64	57.70	52.11	30.25	22.01	25.17
1977/78	14.30	13.93	13.57	20.69	18.38	27.60	60.20	92.50	135.55	96.44	58.52	37.52	49.10
1978/79	21.83	18.49	16.53	20.82	20.11	24.38	36.40	77.90	199.56	178.65	84.65	43.70	61.92
1979/80	24.56	15.51	10.91	15.33	17.36	21.97	30.00	68.13	88.80	124.30	73.50	43.66	44.50
1980/81	40.96	38.27	30.43	26.87	20.50	28.75	40.70	84.70	161.10	99.21	73.07	46.60	57.60
1981/82	26.79	22.67	19.17	15.13	16.32	18.51	29.97	64.22	69.48	58.25	37.14	26.54	33.68
1982/83	17.60	15.13	34.97	30.95	28.89	43.98	52.47	115.96	271.07	299.00	182.72	96.46	99.10
1983/84	44.45	31.40	22.14	21.32	21.52	20.50	43.76	93.78	122.74	92.95	64.56	44.04	51.93
1984/85	23.03	16.69	12.36	15.40	15.19	19.93	43.53	76.55	141.73	145.33	91.09	52.38	54.43
1985/86	25.41	29.18	18.42	16.32	14.83	14.94	24.49	65.63	80.93	60.93	46.39	29.78	35.60
1986/87	19.25	17.73	63.80	18.87	19.01	26.67	44.69	57.93	144.45	133.63	98.90	60.72	58.80
1987/88	27.33	19.63	17.81	29.40	28.79	29.02	48.45	121.77	185.26	169.18	112.76	64.04	71.12
1988/89	33.44	20.93	16.15	13.79	15.92	17.89	28.65	63.17	58.70	49.75	43.06	37.05	33.21
1989/90	16.08	13.20	11.25	10.35	20.80	26.94	34.73	86.61	103.18	60.46	33.26	26.91	36.98
1990/91	19.05	15.83	13.59	12.14	12.29	16.49	28.39	55.56	60.20	46.95	33.01	23.87	28.11
1991/92	27.55	22.70	21.13	30.40	18.30	29.12	37.12	99.22	108.70	118.84	83.70	56.50	54.44
1992/93	29.40	23.35	21.34	18.96	17.75	21.91	48.24	92.60	114.70	101.40	71.98	43.83	50.46
1993/94	34.53	20.86	27.28	22.40	17.44	25.13	33.60	56.87	104.61	113.51	55.02	34.60	45.49
1994/95	23.44	17.95	17.76	22.17	17.84	24.74	33.21	67.20	122.50	74.18	55.85	40.51	43.11
1995/96	27.55	21.21	20.17	15.19	15.64	23.16	30.97	84.19	99.92	53.60	49.35	31.45	39.37
1996/97	16.30	13.02	11.09	9.86	11.02	9.69	19.49	45.15	38.63	16.23	18.56	23.33	19.36
1997/98	16.67	7.36	21.36	18.03	21.23	32.56	42.99	96.66	172.81	182.31	116.30	58.23	65.54
1998/99	33.73	23.54	18.14	13.97	12.01	11.36	23.34	34.06	45.52	37.49	39.24	22.58	26.25
1999/00	15.38	11.54	10.25	9.15	9.39	17.40	33.23	68.45	72.28	58.20	34.16	23.79	30.27
2000/01	18.09	13.18	27.46	25.52	16.85	18.19	50.55	93.12	186.27	134.74	110.38	51.90	62.19
2001/02	31.48	25.27	16.48	24.95	29.25	30.93	47.43	74.22	161.55	84.00	67.75	41.87	52.93
2002/03	22.83	18.36	21.76	16.79	23.54	19.04	30.42	62.14	123.10	126.19	93.47	61.30	51.58
2003/04	35.38	22.59	23.87	22.20	19.54	24.63	34.22	68.85	79.85	72.07	59.03	35.96	41.52
2004/05	25.69	16.72	14.94	13.58	15.10	21.70	29.34	46.68	69.94	62.38	37.60	32.66	32.19
2005/06	8.25	10.72	17.40	25.08	28.59	19.02	10.98	8.72	7.65	7.13	7.87	7.63	13.25
PROM	22.15	17.21	17.45	16.40	16.89	20.33	32.57	66.40	100.10	84.00	55.29	36.52	40.44
MAX	44.45	38.27	63.80	30.95	29.25	43.98	60.20	121.77	271.07	299.00	182.72	96.46	99.10
MIN	8.25	7.36	6.27	8.52	9.22	9.12	9.75	8.72	7.65	7.13	7.87	7.63	13.25

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Table A.12. Series of average monthly flows [m^3/s] Yeso River. condition without Project.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1952/53	9.21	11.34	10.27	10.17	9.58	9.24	5.81	3.29	3.41	2.48	2.67	8.22	7.14
1953/54	10.79	11.26	10.01	10.42	9.60	10.85	7.49	7.99	46.89	30.80	23.08	18.45	16.47
1954/55	14.19	11.77	10.60	11.62	10.42	10.78	8.10	6.65	10.30	16.40	11.98	13.87	11.39
1955/56	9.61	11.75	9.67	9.19	8.69	8.25	5.31	4.15	3.89	12.78	12.80	13.67	9.15
1956/57	10.26	11.69	9.60	13.18	11.09	10.89	6.97	5.42	7.31	10.36	20.17	7.31	10.35
1957/58	9.84	11.19	9.37	9.88	8.41	8.22	10.20	5.62	3.42	4.04	6.37	6.53	7.76
1958/59	11.18	12.72	10.79	10.81	8.70	9.88	8.57	4.11	3.43	2.28	2.32	8.39	7.77
1959/60	9.24	11.91	10.11	10.76	9.70	9.50	6.29	5.41	11.82	18.06	10.35	10.82	10.33
1960/61	9.82	11.97	10.11	10.32	9.68	9.60	6.58	5.25	4.04	10.42	10.14	13.35	9.27
1961/62	10.33	12.55	11.62	10.41	10.74	9.43	7.57	6.59	20.27	23.46	18.33	15.29	13.05
1962/63	12.93	11.91	9.86	9.76	9.36	9.41	7.00	5.40	9.35	16.74	14.22	12.56	10.71
1963/64	10.16	11.96	10.02	10.46	9.01	9.72	8.93	8.10	12.53	35.54	25.13	16.53	14.01
1964/65	13.44	11.93	11.13	9.97	7.97	9.72	6.76	7.39	6.72	2.61	2.42	7.06	8.09
1965/66	8.87	11.90	10.08	10.24	9.25	9.94	7.73	6.33	10.48	25.38	17.95	15.45	11.97
1966/67	13.41	11.74	9.96	10.91	8.35	8.87	5.69	4.50	10.00	15.75	15.07	12.42	10.56
1967/68	10.20	11.63	8.48	9.70	7.72	10.44	6.86	6.07	3.07	9.45	4.78	6.27	7.89
1968/69	10.47	11.45	8.66	9.93	9.96	10.71	12.22	10.34	11.17	12.00	10.68	11.78	10.78
1969/70	12.76	6.22	3.50	4.77	3.17	2.80	5.85	5.81	4.95	2.77	5.46	6.40	5.37
1970/71	9.30	11.49	9.22	8.24	8.42	8.50	6.07	9.25	4.54	11.12	10.36	12.57	9.09
1971/72	12.88	14.55	12.25	4.31	3.81	3.01	6.26	2.84	3.95	2.86	1.90	6.31	6.25
1972/73	8.70	13.42	15.64	13.10	11.56	11.63	10.06	9.06	6.40	18.69	37.24	25.43	15.08
1973/74	20.00	13.80	10.91	11.22	9.58	8.74	6.01	5.02	10.69	20.25	15.26	13.66	12.09
1974/75	9.75	11.49	9.60	10.80	8.75	9.03	7.91	6.94	8.16	22.17	13.51	13.72	10.99
1975/76	10.82	11.26	9.94	9.75	8.78	8.51	6.08	4.72	2.35	10.07	9.92	12.01	8.68
1976/77	8.97	10.77	9.66	9.92	10.41	8.89	7.08	4.70	6.93	2.70	2.71	12.25	7.91
1977/78	9.39	11.52	10.20	11.65	9.89	11.52	7.94	7.09	22.41	25.70	19.17	14.22	13.39
1978/79	11.01	11.65	9.37	17.13	10.46	10.51	5.78	8.23	26.40	40.89	25.28	17.25	16.16
1979/80	12.25	11.77	9.33	10.57	9.28	10.12	10.49	5.49	3.12	24.20	17.39	17.39	11.78
1980/81	15.65	15.72	12.91	12.90	12.08	10.83	6.77	5.12	30.25	26.53	22.81	17.48	15.76
1981/82	12.83	13.27	10.84	10.53	9.17	9.56	6.61	5.62	3.42	15.18	12.46	12.39	10.16
1982/83	9.30	11.71	14.13	13.36	11.34	13.69	9.32	8.91	38.47	55.37	43.99	26.11	21.31
1983/84	20.60	15.39	11.39	11.78	10.06	9.88	8.65	7.89	26.09	22.98	16.62	13.67	14.58
1984/85	10.18	11.96	9.60	10.96	8.60	9.79	8.62	5.64	18.14	28.68	22.19	18.04	13.53
1985/86	14.25	13.92	10.71	10.77	9.28	8.60	6.32	5.33	13.13	16.78	13.61	13.24	11.33
1986/87	10.61	12.49	18.64	11.28	10.00	10.11	8.76	4.84	30.17	35.04	27.43	19.79	16.60
1987/88	14.81	12.42	10.60	13.41	10.95	11.26	9.21	19.70	37.50	40.23	27.48	20.63	19.02
1988/89	16.52	13.37	10.29	10.26	9.10	9.46	6.82	5.17	7.17	11.59	11.84	11.59	10.26
1989/90	9.17	11.78	9.78	9.93	10.31	10.93	7.55	6.28	4.54	11.38	10.26	11.04	9.41
1990/91	10.78	11.92	10.15	11.01	8.75	9.38	5.66	3.15	2.45	2.92	4.28	13.03	7.79
1991/92	10.59	14.31	11.21	11.92	9.51	9.95	9.27	7.46	11.39	30.96	21.34	18.12	13.84
1992/93	13.21	12.26	12.30	12.59	10.74	11.86	9.76	5.98	9.50	21.17	25.29	15.16	13.32
1993/94	13.15	12.61	12.72	12.37	9.73	10.63	7.42	4.77	4.59	19.87	13.08	13.38	11.19
1994/95	9.83	12.53	10.97	12.33	10.17	10.57	7.37	5.43	5.18	15.32	12.28	12.07	10.34
1995/96	10.59	12.67	11.41	11.29	9.42	10.31	7.10	6.12	4.43	3.12	9.31	10.30	8.84
1996/97	9.96	11.38	10.13	9.83	9.00	8.52	7.21	10.20	9.12	7.56	7.26	6.32	8.87
1997/98	9.61	11.24	11.63	11.49	10.39	11.84	8.55	7.30	6.84	6.65	5.30	7.01	8.99
1998/99	10.37	13.41	10.66	10.67	9.17	8.79	6.55	5.25	3.75	8.23	2.61	6.29	7.98
1999/00	9.87	11.15	9.98	9.69	8.72	9.77	7.37	5.51	3.14	3.26	2.39	6.33	7.26
2000/01	9.35	11.78	12.75	13.00	9.63	9.51	9.09	7.07	7.29	3.20	5.09	8.31	8.84
2001/02	11.33	13.30	11.12	12.52	11.40	11.57	9.46	5.32	10.20	21.22	16.42	13.98	12.32
PROM	11.45	12.18	10.68	10.86	9.40	9.71	7.62	6.40	11.29	16.74	14.00	12.87	11.10
MAX	20.60	15.72	18.64	17.13	12.08	13.69	12.22	19.70	46.89	55.37	43.99	26.11	21.31
MIN	8.70	6.22	3.50	4.31	3.17	2.80	5.31	2.84	2.35	2.28	1.90	6.27	5.37

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Table A.14. Series of average monthly flows [m^3/s] Maipo River at San Alfonso, condition without Project.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1952/53	37.33	37.64	35.60	37.40	37.64	40.28	39.84	61.53	102.94	75.11	66.75	48.12	51.68
1953/54	44.91	34.15	33.76	34.53	41.34	56.52	59.09	137.53	234.11	179.31	127.72	83.22	88.85
1954/55	53.91	40.71	40.54	47.21	48.52	51.64	69.09	113.24	112.34	90.63	69.95	56.30	66.17
1955/56	38.14	37.80	29.20	25.49	25.64	26.84	31.86	73.25	78.01	76.47	67.27	47.74	46.48
1956/57	40.28	41.03	32.28	39.59	38.77	39.08	44.22	93.25	85.95	73.09	68.03	43.78	53.28
1957/58	41.30	32.57	27.61	31.74	27.40	31.15	50.72	94.94	117.50	114.59	75.95	62.29	58.98
1958/59	48.90	46.94	42.19	37.00	29.91	44.51	76.94	84.96	107.82	67.23	54.93	52.89	57.85
1959/60	38.92	40.89	37.43	40.07	42.81	44.63	51.70	107.63	177.32	121.91	63.71	48.70	67.98
1960/61	40.49	40.37	36.22	35.65	38.16	42.69	52.08	98.53	115.37	84.01	59.30	74.89	59.81
1961/62	44.88	46.25	49.43	34.53	50.16	39.01	67.31	125.39	201.19	159.15	112.08	75.92	83.77
1962/63	50.43	40.82	35.55	34.46	35.83	39.03	52.74	99.96	108.29	82.75	66.86	57.87	58.72
1963/64	39.80	36.81	33.01	36.75	34.86	45.27	51.90	81.62	239.02	258.74	139.50	84.49	90.15
1964/65	54.37	43.48	46.80	34.15	31.14	38.75	45.25	63.46	72.76	75.50	58.14	50.50	51.19
1965/66	46.76	37.48	34.61	33.45	39.96	45.93	68.98	130.46	143.53	184.65	129.03	77.83	81.05
1966/67	54.14	40.28	37.53	40.14	30.95	38.23	63.02	91.32	134.20	104.62	91.23	54.73	65.03
1967/68	41.56	37.52	26.03	27.69	27.37	28.13	44.88	65.73	94.91	78.41	62.79	40.27	47.94
1968/69	40.00	34.10	27.32	28.55	25.35	25.69	32.56	45.39	35.91	44.09	48.59	42.07	35.80
1969/70	28.45	22.10	26.05	22.62	21.40	24.26	35.57	73.33	159.65	85.87	64.30	45.05	50.72
1970/71	38.39	34.98	25.39	26.71	26.18	30.58	41.31	73.23	79.27	57.41	47.66	38.90	43.33
1971/72	33.78	31.39	27.67	23.65	24.18	27.97	59.52	112.00	108.99	83.68	51.33	43.36	52.29
1972/73	29.16	58.93	75.44	48.84	54.06	60.76	75.88	115.74	195.49	306.23	184.31	145.58	112.54
1973/74	77.60	49.38	44.48	43.33	37.19	35.81	46.29	91.26	122.70	131.01	84.91	61.23	68.77
1974/75	39.48	35.90	32.93	41.01	31.59	39.03	71.75	125.06	145.05	164.01	98.46	65.00	74.11
1975/76	45.45	33.27	31.91	30.69	30.01	33.26	41.96	68.48	111.19	82.79	71.06	53.47	52.80
1976/77	32.46	28.58	29.61	29.59	29.68	33.06	39.92	75.22	97.10	82.22	50.80	48.88	48.09
1977/78	34.61	35.97	34.49	48.19	43.02	57.28	90.76	136.08	205.85	159.94	108.59	69.72	85.38
1978/79	47.22	40.72	36.32	61.55	45.94	49.70	58.36	116.70	277.70	267.68	138.65	81.50	101.84
1979/80	54.12	42.23	31.91	37.90	38.63	44.61	59.94	93.60	122.73	188.27	118.67	81.81	76.20
1980/81	80.00	79.03	64.85	59.62	50.65	56.44	65.32	113.79	243.94	171.36	133.96	87.54	100.54
1981/82	55.96	51.75	44.31	37.83	37.15	39.75	52.51	95.48	100.47	99.91	73.56	54.53	61.93
1982/83	38.28	38.53	67.86	68.33	59.96	82.69	84.99	158.23	379.92	436.02	292.64	163.98	155.95
1983/84	94.47	68.68	50.77	49.43	46.29	44.26	73.65	136.14	196.34	157.05	114.31	79.61	92.58
1984/85	49.35	41.89	33.50	38.95	35.99	44.20	75.95	111.34	205.24	224.32	149.70	97.60	92.34
1985/86	58.37	52.97	44.50	41.57	36.47	35.07	43.87	98.07	125.89	105.31	81.32	58.33	65.15
1986/87	43.04	43.70	118.06	47.74	42.67	52.96	74.61	88.46	224.37	220.30	167.46	106.87	102.52
1987/88	59.61	47.34	43.76	64.99	58.17	57.50	81.52	185.04	286.86	267.72	184.74	113.36	120.88
1988/89	71.07	50.56	40.01	36.24	36.92	37.60	51.34	94.18	92.25	87.74	79.63	64.50	61.84
1989/90	36.48	35.40	30.55	29.25	44.13	53.31	61.23	129.10	146.45	108.56	64.64	51.97	65.92
1990/91	43.35	39.37	33.69	34.24	31.00	37.59	46.36	78.61	87.24	74.87	59.29	54.46	51.67
1991/92	51.17	56.01	50.98	61.84	42.26	56.80	69.76	138.55	149.46	199.84	137.42	101.23	92.94
1992/93	59.59	51.56	51.45	49.02	43.67	52.47	83.53	129.84	168.26	170.66	130.71	82.05	89.40
1993/94	68.09	52.86	61.28	55.25	42.45	52.79	64.33	90.71	146.53	175.07	94.27	68.14	80.98
1994/95	48.19	44.08	42.33	49.67	41.46	49.30	58.77	109.14	173.61	124.40	82.84	70.22	74.50
1995/96	53.77	47.87	45.33	38.63	36.31	48.48	55.17	121.50	143.08	82.16	70.91	58.16	66.78
1996/97	38.58	35.34	30.50	28.98	28.76	26.30	36.66	68.43	61.85	41.68	45.15	41.36	40.30
1997/98	35.98	26.66	47.66	43.54	47.16	67.53	70.37	136.63	229.12	248.98	146.84	88.97	99.12
1998/99	65.48	55.00	43.17	37.09	31.08	29.20	43.23	56.26	65.78	63.72	50.85	40.86	48.48
1999/00	34.68	31.72	28.94	27.20	26.25	37.85	57.62	99.48	103.41	83.57	56.39	42.18	52.44
2000/01	39.18	35.72	55.75	55.58	38.98	40.34	84.59	131.45	248.54	182.32	143.19	83.04	94.89
2001/02	59.94	54.87	41.20	54.08	58.63	61.20	80.78	109.70	225.75	145.78	105.46	76.63	89.50
PROM	48.03	42.47	41.43	40.43	38.08	43.55	58.79	102.58	151.83	139.01	96.92	68.43	72.63
MAX	94.47	79.03	118.06	68.33	59.96	82.69	90.76	185.04	379.92	436.02	292.64	163.98	155.95
MIN	28.45	22.10	25.39	22.62	21.40	24.26	31.86	45.39	35.91	41.68	45.15	38.90	35.80

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Table A.15. Series of average monthly flows [m^3/s] Maipo River at San Alfonso, condition with Project.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1952/53	25.87	25.53	24.95	26.92	27.79	30.71	33.08	54.12	89.66	60.44	54.89	35.01	40.75
1953/54	31.75	22.09	23.32	23.78	31.31	44.91	50.43	123.54	207.11	151.51	101.96	61.66	72.78
1954/55	37.17	27.74	29.11	35.01	37.60	40.35	59.85	101.73	92.61	63.18	48.85	37.39	50.88
1955/56	26.23	25.39	19.45	16.40	17.03	18.61	26.10	64.44	65.25	52.21	46.11	29.32	33.88
1956/57	28.09	28.52	22.42	26.28	27.50	27.99	36.46	82.48	69.13	50.53	42.36	31.25	39.42
1957/58	29.16	20.77	18.01	21.75	18.82	22.65	39.55	84.35	103.89	98.94	61.93	51.31	47.59
1958/59	35.60	33.46	31.06	25.94	21.01	33.99	66.69	74.30	93.95	52.84	43.66	39.81	46.03
1959/60	27.25	28.00	26.86	28.87	32.56	34.40	43.86	95.79	153.95	94.11	43.20	32.28	53.43
1960/61	28.47	27.62	25.87	25.10	28.26	32.33	44.49	87.58	100.96	61.81	40.80	56.73	46.67
1961/62	32.03	32.77	37.35	23.78	39.11	29.24	57.83	112.05	173.85	131.35	86.32	54.38	67.51
1962/63	35.05	27.94	25.21	24.37	26.19	29.24	44.77	89.10	88.98	56.58	44.43	40.80	44.39
1963/64	27.52	24.17	22.72	26.05	25.72	35.06	41.87	69.28	214.78	230.94	113.74	62.38	74.52
1964/65	37.73	30.09	34.91	23.75	22.90	28.76	37.78	51.87	57.93	61.57	46.70	38.70	39.39
1965/66	35.50	24.66	24.05	22.84	30.00	35.17	59.34	118.16	122.95	156.85	103.27	56.69	65.79
1966/67	38.05	27.37	26.86	28.54	22.18	28.81	55.85	81.16	114.56	77.53	67.08	37.56	50.46
1967/68	29.01	25.08	16.79	17.94	19.70	17.70	37.50	55.99	82.79	58.26	50.04	29.60	36.70
1968/69	27.61	22.06	18.45	18.68	15.52	15.15	20.22	31.92	17.75	21.73	30.18	26.02	22.11
1969/70	14.17	15.60	22.41	17.86	18.26	21.27	29.22	63.96	143.95	70.89	50.09	34.21	41.82
1970/71	26.95	22.91	16.13	18.55	17.82	21.99	34.11	59.11	64.79	38.24	30.35	21.46	31.03
1971/72	18.65	16.55	15.52	19.29	20.29	24.73	51.96	103.31	95.41	69.55	41.41	32.39	42.42
1972/73	18.45	43.61	58.81	35.34	41.88	48.28	64.41	102.05	178.31	278.43	158.55	123.64	95.98
1973/74	58.58	33.90	32.98	31.70	27.42	26.76	38.47	81.14	103.16	103.21	60.48	42.64	53.37
1974/75	27.54	23.67	22.95	29.65	22.41	29.56	61.78	112.12	126.32	136.21	74.97	46.08	59.44
1975/76	32.25	21.39	21.78	20.85	21.14	24.55	35.09	59.49	98.79	61.36	50.98	36.63	40.36
1976/77	21.55	17.26	19.78	19.57	19.22	24.06	32.40	66.13	80.86	67.39	40.04	31.85	36.68
1977/78	23.03	23.75	24.01	35.82	32.33	44.81	80.74	122.72	178.56	132.14	82.96	50.30	69.27
1978/79	33.65	28.40	26.50	45.33	34.83	38.60	51.13	103.32	250.40	239.88	113.11	60.49	85.47
1979/80	39.06	28.96	21.99	27.03	28.90	34.22	48.77	84.25	109.61	160.47	93.04	60.63	61.41
1980/81	61.16	61.23	50.47	45.58	37.87	44.83	57.07	102.87	216.60	143.56	108.20	65.96	82.95
1981/82	40.45	37.14	32.81	26.96	27.67	29.92	44.86	84.80	87.64	72.78	51.67	37.24	47.83
1982/83	26.79	25.95	53.06	53.26	47.37	67.34	74.00	143.71	352.58	408.22	266.88	141.14	138.36
1983/84	75.19	51.27	38.30	36.87	35.59	33.79	63.41	122.20	169.04	129.25	88.55	60.18	75.30
1984/85	36.47	28.83	23.41	27.59	26.93	33.68	65.22	100.18	178.24	196.52	123.94	75.59	76.38
1985/86	41.16	39.16	32.88	30.09	26.67	26.07	36.89	87.41	102.76	77.63	59.03	40.26	50.00
1986/87	30.00	30.10	100.33	35.28	32.11	42.11	64.31	78.43	197.05	192.50	141.70	84.94	85.74
1987/88	42.01	33.55	32.23	50.13	46.23	45.40	70.36	162.68	259.52	239.92	158.98	91.28	102.69
1988/89	52.37	35.68	29.04	25.56	27.44	28.11	43.45	83.88	75.83	64.21	58.25	48.03	47.66
1989/90	25.11	22.91	20.60	19.30	33.46	41.80	52.21	116.51	131.15	84.98	45.58	36.22	52.48
1990/91	30.28	26.66	23.29	23.12	22.13	27.89	39.99	70.91	75.72	60.28	46.36	36.54	40.26
1991/92	38.33	40.14	38.37	48.96	32.00	45.64	58.77	125.45	128.95	172.04	111.66	79.26	76.63
1992/93	43.57	37.75	38.12	35.56	32.29	39.66	71.66	117.98	147.52	142.86	104.95	60.95	72.74
1993/94	51.94	38.23	46.96	41.33	31.76	41.17	54.52	80.08	131.35	147.27	71.43	49.19	65.44
1994/95	35.80	30.43	30.76	36.85	30.71	38.31	50.03	97.15	156.83	96.88	61.34	53.03	59.84
1995/96	40.59	34.16	33.42	27.00	26.62	37.49	46.83	109.58	127.86	67.37	52.85	42.86	53.89
1996/97	26.24	23.14	20.23	19.04	19.73	17.78	29.20	55.30	46.17	23.68	29.31	30.73	28.38
1997/98	24.49	14.91	35.42	31.53	35.97	53.87	60.67	123.51	210.59	230.13	131.38	76.01	85.71
1998/99	51.98	39.86	31.79	25.96	21.72	20.31	35.91	47.10	54.98	45.42	40.16	30.20	37.12
1999/00	22.94	20.05	18.89	17.54	17.54	27.95	49.11	89.01	90.80	69.49	45.50	31.48	41.69
2000/01	27.58	23.16	42.54	41.91	28.91	30.37	73.41	118.74	229.51	166.92	127.93	68.89	81.66
2001/02	45.92	40.26	29.41	40.95	46.35	48.59	69.33	98.49	203.81	117.98	79.70	57.05	73.15
PROM	34.33	29.28	30.25	29.15	28.30	33.32	49.90	91.03	133.10	115.76	76.54	51.16	58.51
MAX	75.19	61.23	100.33	53.26	47.37	67.34	80.74	162.68	352.58	408.22	266.88	141.14	138.36
MIN	14.17	14.91	15.52	16.40	15.52	15.15	20.22	31.92	17.75	21.73	29.31	21.46	22.11

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Table A.16. Series of average monthly flows [m^3/s] Maipo River at **El** Manzano.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1952/53	59.40	60.14	53.60	54.20	58.39	65.18	75.24	95.04	149.92	123.62	119.65	82.16	83.05
1953/54	65.25	52.10	50.35	52.03	69.60	89.91	112.49	194.53	325.11	262.13	197.07	135.67	133.85
1954/55	86.33	59.34	61.67	71.27	74.09	77.91	98.18	161.24	154.34	158.13	113.57	83.88	100.00
1955/56	60.11	54.18	45.07	40.42	42.39	45.70	58.76	105.03	120.88	117.90	103.58	73.31	72.28
1956/57	59.74	65.69	48.58	55.60	58.49	62.27	68.39	128.99	116.70	120.20	111.12	74.58	80.86
1957/58	60.39	46.46	46.45	47.08	44.56	48.40	74.49	129.32	173.02	185.86	119.93	102.32	89.86
1958/59	73.22	64.40	57.69	55.35	44.78	65.11	123.42	126.16	156.65	114.53	100.34	89.17	89.23
1959/60	68.62	62.39	53.63	63.27	63.81	71.13	87.50	158.14	244.46	185.78	115.71	88.70	105.26
1960/61	63.29	56.97	60.49	59.36	61.93	69.39	91.08	162.53	193.37	145.81	115.01	115.72	99.58
1961/62	79.08	66.20	77.43	52.03	76.69	63.53	116.95	189.66	292.00	237.67	164.08	125.52	128.40
1962/63	75.53	59.52	59.45	52.07	62.13	61.13	89.44	165.96	180.29	146.39	115.69	88.05	96.31
1963/64	64.41	52.81	49.92	54.13	61.11	71.17	102.26	124.52	322.02	359.95	228.88	142.86	136.17
1964/65	84.77	62.68	66.28	52.40	46.24	52.15	61.65	83.96	97.62	107.00	94.22	85.38	74.53
1965/66	63.34	51.28	50.51	48.75	73.76	75.12	111.28	184.46	207.57	277.93	182.03	119.39	120.45
1966/67	77.27	58.91	61.93	61.49	56.95	74.73	92.62	137.16	174.70	166.62	153.55	91.60	100.63
1967/68	67.09	56.74	39.35	39.35	38.85	44.13	68.85	86.81	136.33	122.98	108.45	67.87	73.07
1968/69	58.13	49.56	42.73	40.11	38.76	36.69	46.25	65.88	64.35	76.09	86.46	69.56	56.21
1969/70	40.71	36.70	41.35	33.02	35.80	39.82	51.28	96.03	230.24	140.98	117.73	78.56	78.52
1970/71	60.00	50.67	41.85	44.22	41.88	45.08	72.40	97.93	121.09	95.04	82.17	64.34	68.06
1971/72	48.74	44.90	40.38	36.85	38.48	46.97	89.62	170.76	171.31	143.12	90.43	67.91	82.46
1972/73	46.53	87.16	113.82	75.23	96.83	104.46	126.59	185.74	295.49	468.17	282.77	222.90	175.47
1973/74	121.48	79.19	68.28	73.29	63.16	56.32	69.83	150.56	182.84	196.62	131.69	99.78	107.75
1974/75	64.08	54.66	51.23	61.61	57.79	61.27	111.75	174.35	211.32	245.01	147.86	103.31	112.02
1975/76	69.67	50.47	47.41	45.62	55.51	55.16	63.96	96.14	151.19	139.19	104.45	77.71	79.71
1976/77	50.96	44.08	49.01	42.39	42.08	50.51	60.82	114.52	134.20	119.42	81.80	81.07	72.57
1977/78	54.69	49.67	51.29	75.40	73.08	94.08	162.51	212.72	330.85	251.94	167.69	105.82	135.81
1978/79	72.42	59.12	51.92	98.56	75.64	80.20	118.76	203.70	409.89	401.44	223.65	137.00	161.02
1979/80	84.52	71.63	54.61	51.25	66.43	71.68	100.50	131.94	189.73	275.27	172.67	126.46	116.39
1980/81	126.38	119.00	92.55	91.61	77.95	86.24	107.42	166.79	351.05	251.00	206.97	134.82	150.98
1981/82	83.36	83.85	73.51	59.13	55.05	56.25	74.51	131.58	154.30	167.18	122.42	77.93	94.92
1982/83	57.48	57.33	106.45	111.22	101.06	143.15	145.59	227.23	545.92	606.02	459.24	261.98	235.22
1983/84	151.18	104.17	80.07	82.63	80.49	76.66	143.65	214.77	314.34	252.05	202.06	123.01	152.09
1984/85	74.29	62.54	51.18	67.45	61.89	73.90	126.75	167.34	306.24	307.36	217.53	152.26	139.06
1985/86	90.15	77.88	67.08	59.17	60.35	56.10	65.07	143.07	183.89	168.71	133.72	91.03	99.68
1986/87	64.13	66.20	175.72	82.54	72.86	75.16	110.21	160.76	323.64	354.27	271.93	164.55	160.16
1987/88	90.31	69.24	70.26	105.71	123.87	103.30	144.52	283.05	410.08	394.85	279.18	187.10	188.46
1988/89	118.29	74.70	59.91	54.14	58.62	55.20	75.34	137.88	140.35	148.64	147.33	106.23	98.05
1989/90	65.28	58.70	47.75	43.45	75.05	88.50	120.53	216.10	230.06	181.76	121.91	87.43	111.38
1990/91	66.75	59.82	51.61	50.52	52.94	63.01	77.22	116.93	134.34	128.37	103.99	82.76	82.36
1991/92	77.57	83.47	81.08	101.40	78.56	102.40	118.26	203.55	219.46	278.84	203.42	154.23	141.85
1992/93	92.69	82.06	78.95	71.42	65.07	81.17	131.83	193.84	233.26	277.57	199.71	120.25	135.65
1993/94	105.79	82.99	91.83	86.53	73.16	74.39	106.72	141.09	215.05	263.87	153.09	113.17	125.64
1994/95	67.19	62.48	60.53	73.77	70.49	81.14	95.69	160.81	261.61	186.07	134.74	107.62	113.51
1995/96	80.63	64.97	62.23	56.03	56.11	75.58	86.46	168.50	209.74	128.06	114.11	97.36	99.98
1996/97	66.28	53.94	45.50	43.88	40.66	39.83	47.87	85.44	91.43	85.72	76.99	68.46	62.17
1997/98	53.25	40.69	70.88	65.76	81.91	119.95	117.08	204.06	324.24	390.24	215.66	133.89	151.47
1998/99	103.81	77.22	61.24	52.68	45.71	40.74	59.27	81.82	103.97	112.62	94.37	69.74	75.27
1999/00	51.50	44.49	40.28	39.02	41.20	62.36	85.94	137.70	155.05	142.66	92.14	65.66	79.83
2000/01	57.48	51.69	83.10	84.61	70.61	65.58	138.61	185.49	353.86	301.10	213.19	126.86	144.35
2001/02	90.95	78.54	61.09	83.42	93.02	89.08	124.20	166.93	320.10	221.36	165.38	122.99	134.76
PROM	74.29	63.27	62.98	62.05	63.12	69.78	96.19	152.57	222.39	214.66	155.23	109.00	112.13
MAX	151.18	119.00	175.72	111.22	123.87	143.15	162.51	283.05	545.92	606.02	459.24	261.98	235.22
MIN	40.71	36.70	39.35	33.02	35.80	36.69	46.25	65.88	64.35	76.09	76.99	64.34	56.21

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Table A.17. Series of average monthly flows [m^3/s] Colorado River, condition without Project.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1950/51						12.30	21.40	20.90	46.10	43.30	35.00	30.90	29.99
1951/52	18.74	15.10	12.40	14.80	15.00	14.50	19.70	31.30	57.70	84.20	44.80	33.32	30.13
1952/53	17.46	14.40	13.70	13.20	12.70	17.70	20.70	30.70	44.12	47.65	45.00	28.20	25.46
1953/54	18.60	14.30	16.00	15.39	16.56	22.18	28.36	47.72	65.14	69.65	58.69	42.90	34.62
1954/55	28.27	17.81	15.91	15.30	15.20	15.40	17.20	36.70	41.40	36.60	36.70	24.40	25.07
1955/56	17.49	12.70	12.30	11.30	11.00	12.70	15.00	30.50	35.20	40.10	30.10	23.40	20.98
1956/57	15.00	13.73	13.10	10.40	11.90	14.80	18.50	26.80	27.30	39.56	37.00	28.00	21.34
1957/58	17.50	12.60	12.60	11.20	11.00	13.20	16.40	25.40	52.50	62.00	43.50	32.58	25.87
1958/59	18.85	14.60	13.92	13.50	11.80	14.60	24.66	36.50	45.70	41.10	38.78	29.90	25.33
1959/60	17.40	14.50	12.30	17.70	12.80	23.40	24.90	39.50	46.47	52.11	42.78	36.20	28.34
1960/61	21.01	16.30	14.00	14.40	15.20	16.40	27.10	54.50	72.50	50.41	48.70	36.54	32.25
1961/62	22.61	17.10	19.80	15.70	15.80	18.60	33.70	58.10	72.10	63.50	50.70	39.60	35.61
1962/63	22.70	16.00	14.90	12.60	13.90	15.60	29.40	52.90	57.60	54.40	41.80	29.29	30.09
1963/64	19.72	14.50	12.90	14.23	19.05	23.76	36.29	31.25	80.18	91.94	86.39	48.34	39.88
1964/65	24.85	17.73	13.80	12.10	14.39	12.06	12.48	19.34	19.01	31.46	29.87	28.74	19.65
1965/66	16.27	12.94	10.89	10.38	18.72	15.23	29.38	53.11	58.67	75.80	51.52	33.25	32.18
1966/67	20.65	15.78	13.84	15.28	13.16	18.69	23.45	36.26	37.50	51.27	60.27	30.57	28.06
1967/68	20.44	15.35	12.77	10.20	9.80	10.88	14.60	15.08	32.90	36.60	38.71	22.72	20.00
1968/69	13.83	6.82	11.78	9.42	8.33	7.37	8.47	16.40	25.07	31.94	32.88	23.00	16.28
1969/70	10.02	7.90	8.99	8.60	8.20	9.54	11.01	22.35	55.92	45.75	45.59	27.75	21.80
1970/71	17.04	14.21	12.80	13.57	14.11	11.72	21.30	20.48	34.31	31.76	29.60	21.35	20.19
1971/72	11.74	10.91	9.62	12.98	12.47	15.64	24.49	42.71	51.39	49.62	38.81	22.24	25.22
1972/73	13.82	15.10	21.60	16.01	22.98	25.79	31.08	49.77	94.41	107.41	88.35	59.82	45.51
1973/74	34.57	24.25	19.71	20.81	17.21	19.59	18.73	33.85	39.89	60.64	45.92	31.65	30.57
1974/75	19.71	14.97	16.61	16.78	15.42	17.10	27.83	37.48	53.29	72.54	46.57	31.18	30.79
1975/76	18.89	13.35	12.70	12.34	12.46	13.90	18.84	20.77	35.37	40.85	26.98	18.95	20.45
1976/77	15.80	12.89	12.32	10.49	9.56	10.60	14.06	23.52	28.70	33.57	29.24	26.75	18.96
1977/78	15.97	13.68	14.12	19.06	15.56	22.76	35.95	59.78	80.74	66.72	51.44	32.15	35.66
1978/79	22.32	17.01	14.62	22.40	17.88	20.90	35.17	55.16	98.80	98.21	56.87	42.53	41.82
1979/80	25.99	18.58	14.72	13.24	15.47	16.37	22.21	28.49	40.33	63.42	45.56	37.67	28.50
1980/81	33.22	30.47	18.23	23.30	21.54	22.55	29.75	42.68	84.85	74.43	70.95	45.09	41.42
1981/82	23.95	21.77	17.32	17.21	17.37	15.56	21.35	33.07	44.05	56.68	41.41	22.11	27.65
1982/83	17.85	16.29	28.86	33.35	27.45	33.07	36.94	61.92	115.53	114.02	97.50	61.20	53.66
1983/84	38.40	26.40	21.60	22.44	19.71	18.60	33.40	63.39	89.87	90.69	75.41	34.86	44.56
1984/85	22.31	16.33	12.85	17.87	18.41	20.44	34.69	47.66	61.10	81.59	54.60	43.90	35.98
1985/86	25.10	19.20	16.10	15.60	13.90	13.00	17.90	40.40	55.20	60.20	50.00	32.10	29.89
1986/87	18.10	16.30	38.61	26.29	18.70	19.20	27.40	44.20	82.80	102.37	79.88	47.10	43.41
1987/88	25.70	21.45	17.72	35.20	31.40	28.66	30.74	71.42	95.30	98.78	94.05	60.50	50.91
1988/89	38.10	23.00	17.20	14.40	14.40	13.60	19.30	36.20	47.70	57.40	64.40	34.40	31.68
1989/90	19.80	14.60	12.50	11.70	19.90	22.30	34.80	63.80	69.30	61.39	48.15	30.34	34.05
1990/91	19.20	15.00	12.60	11.70	12.20	15.60	19.57	34.20	40.25	48.60	43.60	27.54	25.00
1991/92	20.60	21.50	19.30	28.30	21.60	29.40	34.00	54.80	62.30	73.90	64.60	46.60	39.74
1992/93	25.40	20.80	20.59	18.00	17.40	22.40	33.90	46.00	63.30	89.09	56.60	36.70	37.52
1993/94	26.60	24.12	24.00	21.60	19.10	20.70	27.90	40.30	54.90	74.10	49.50	37.20	35.00
1994/95	18.00	16.00	14.80	17.60	15.70	17.50	22.10	44.30	69.90	61.00	43.70	30.00	30.88
1995/96	20.80	17.00	15.50	14.20	13.80	18.50	20.30	40.00	56.60	42.00	38.80	31.00	27.38
1996/97	17.80	13.70	11.70	10.60	10.50	10.00	9.69	14.40	24.20	38.60	30.80	22.16	17.85
1997/98	13.49	10.44	19.55	13.05	17.66	30.08	32.07	53.86	78.88	122.16	54.44	33.04	39.89
1998/99	25.06	18.51	15.12	14.07	11.14	10.73	13.85	20.87	37.88	41.72	37.39	23.97	22.53
1999/00	13.24	11.36	10.41	8.93	13.20	12.02	21.96	35.25	41.86	49.39	35.19	22.13	22.91
2000/01	15.19	12.19	19.47	17.86	14.03	17.55	36.06	45.38	86.08	97.91	59.24	36.23	38.10
2001/02	23.29	17.55	15.03	20.13	23.12	23.49	34.86	44.44	85.23	67.11	49.90	37.77	36.83
2002/03	17.26	15.78	17.37	21.40	18.19	27.77	37.21	44.25	85.80	99.47	76.28	53.57	42.86
2003/04	33.02	24.15	20.99	17.52	17.59	16.56	26.35	40.14	47.17	58.24	45.06	34.46	31.77
2004/05	20.83	15.12	12.95	10.41	9.94	15.17	14.81	25.35	38.50	46.24	40.06	24.49	22.82
PROM	20.92	16.37	15.83	16.04	15.66	17.78	24.60	39.01	57.25	63.29	50.17	33.86	31.00
MAX	38.40	30.47	38.61	35.20	31.40	33.07	37.21	71.42	115.53	122.16	97.50	61.20	53.66
MIN	10.02	6.82	8.99	8.60	8.20	7.37	8.47	14.40	19.01	31.46	26.98	18.95	16.28

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Table A.18. Series of average monthly flows [m^3/s] Colorado River, condition with Project.

ANO	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC	ENE	FEB	MAR	QMA
1950/51						3.12	7.23	3.12	8.10	5.30	3.12	5.12	5.02
1951/52	3.73	3.45	3.12	5.90	4.80	3.60	4.94	5.89	21.30	46.20	7.54	6.11	9.72
1952/53	3.12	3.12	3.12	4.70	3.48	6.09	5.96	8.79	7.23	9.65	6.04	3.12	5.37
1953/54	3.12	3.12	4.04	7.44	4.33	5.40	8.70	13.81	27.14	31.65	20.69	10.13	11.63
1954/55	8.84	4.92	3.44	6.40	5.17	4.46	3.58	11.16	6.10	3.12	3.12	3.12	5.29
1955/56	3.12	3.12	3.12	3.12	3.12	3.76	3.12	6.94	3.12	3.12	3.12	3.12	3.49
1956/57	3.12	3.12	3.12	3.35	3.43	5.25	5.91	4.67	3.12	3.12	3.12	3.75	3.76
1957/58	3.12	3.12	3.12	3.39	3.12	3.45	4.34	3.12	17.66	24.00	7.34	8.47	7.02
1958/59	4.71	3.89	3.12	5.45	3.12	3.12	6.75	10.31	10.72	3.12	3.12	3.40	5.07
1959/60	3.12	3.12	3.12	8.44	3.12	8.06	7.25	10.73	8.47	14.11	4.11	3.12	6.40
1960/61	3.26	3.12	3.12	3.98	3.12	3.52	8.21	18.70	34.50	12.41	9.62	3.12	8.89
1961/62	5.08	3.12	4.61	4.49	5.28	5.88	11.66	20.65	34.10	25.50	12.70	3.75	11.40
1962/63	3.12	3.12	3.14	3.20	4.21	4.59	9.44	17.83	19.60	16.40	3.22	3.78	7.64
1963/64	3.12	3.87	3.48	5.29	8.98	11.57	12.56	3.12	42.18	53.94	48.39	15.37	17.66
1964/65	3.12	3.12	3.12	3.12	4.90	3.12	3.12	4.78	3.12	3.12	3.12	3.76	3.46
1965/66	3.12	3.12	3.12	3.12	7.60	3.12	5.76	18.63	20.67	37.80	18.92	5.13	10.84
1966/67	3.12	3.12	3.12	4.42	3.49	6.35	5.36	8.98	7.01	13.27	22.27	3.69	7.02
1967/68	3.12	3.12	3.12	3.12	3.12	3.12	4.62	3.12	4.09	3.12	4.47	3.12	3.44
1968/69	3.12	3.12	5.19	3.15	3.28	3.12	3.92	4.42	10.50	12.38	3.82	5.38	5.12
1969/70	3.12	3.12	3.29	3.90	3.47	3.91	3.57	3.27	17.92	7.75	6.43	3.12	5.24
1970/71	3.12	3.12	3.46	4.53	4.77	3.12	6.43	3.12	6.95	8.54	7.24	3.70	4.84
1971/72	3.12	3.12	3.12	4.98	4.06	4.27	4.69	10.39	13.39	11.62	3.12	3.49	5.78
1972/73	3.12	3.54	9.01	4.88	10.28	10.42	10.60	16.94	56.41	69.41	50.35	21.82	22.23
1973/74	3.12	3.12	5.22	9.45	6.18	7.82	4.71	7.67	7.27	22.64	7.57	3.12	7.32
1974/75	3.12	3.12	5.32	6.37	5.02	5.19	8.33	9.29	16.51	34.54	8.57	3.12	9.04
1975/76	3.12	3.12	3.12	3.24	3.17	3.83	4.75	3.12	5.00	5.16	3.12	3.12	3.66
1976/77	3.12	3.12	3.12	3.12	3.12	3.12	3.28	4.32	3.53	3.12	3.12	3.12	3.27
1977/78	3.12	3.12	3.63	8.82	5.65	5.79	6.83	25.58	42.74	28.72	13.44	5.12	12.71
1978/79	3.85	3.41	4.18	10.62	5.83	8.67	9.74	20.06	60.80	60.21	18.87	4.42	17.55
1979/80	3.12	3.12	3.12	3.19	3.12	4.41	5.18	7.40	8.15	25.42	7.56	3.52	6.44
1980/81	8.53	10.75	3.12	8.58	7.51	8.33	8.66	12.47	46.85	36.43	32.95	6.14	15.86
1981/82	5.34	8.15	4.04	5.99	6.84	4.32	3.12	11.30	10.80	18.68	3.12	3.12	7.07
1982/83	3.12	3.23	16.10	14.20	9.56	9.07	9.49	23.43	77.53	76.02	59.50	23.20	27.04
1983/84	5.83	5.86	3.12	3.12	3.70	3.18	7.57	31.12	51.87	52.69	37.41	3.12	17.38
1984/85	3.12	3.12	3.12	3.62	3.12	3.80	6.42	10.55	23.10	43.59	16.60	5.66	10.48
1985/86	4.55	3.15	3.12	3.70	3.51	3.57	4.33	11.20	17.20	22.20	10.88	3.12	7.54
1986/87	3.12	3.12	18.14	9.88	4.98	3.64	5.39	13.18	44.80	64.37	41.88	8.05	18.38
1987/88	3.12	3.12	3.12	10.32	12.15	11.57	3.90	31.54	57.30	60.78	56.05	21.13	22.84
1988/89	6.86	4.78	3.78	3.97	4.58	3.83	3.12	9.01	10.35	19.40	24.94	3.12	8.15
1989/90	3.30	3.56	3.51	3.12	8.20	7.83	13.28	24.35	31.30	23.39	9.08	3.12	11.17
1990/91	4.04	3.33	3.12	3.12	3.12	3.89	4.43	7.96	3.12	10.60	4.63	3.12	4.54
1991/92	5.09	5.69	6.14	12.32	8.78	12.05	11.04	27.29	24.30	35.90	26.60	13.64	15.74
1992/93	3.12	3.14	5.14	4.92	4.87	7.23	9.14	10.82	25.30	56.19	17.32	4.05	12.60
1993/94	8.13	4.92	6.61	6.68	5.35	6.24	8.25	9.70	21.83	35.13	10.40	3.12	10.53
1994/95	3.12	3.26	3.75	4.66	4.88	5.57	6.74	9.97	30.31	21.63	4.74	3.12	8.48
1995/96	3.12	3.40	3.79	3.89	4.12	5.60	5.17	7.22	17.33	3.12	3.12	3.12	5.25
1996/97	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	4.62	3.12	3.40	3.27
1997/98	3.12	3.12	6.55	4.22	8.92	13.68	11.64	22.58	40.74	84.16	15.21	3.12	18.09
1998/99	3.12	3.12	3.12	3.40	3.12	3.12	3.12	3.12	6.19	8.29	3.12	3.12	3.83
1999/00	3.12	3.12	3.12	3.12	6.11	3.12	8.30	11.37	5.12	10.29	8.11	3.12	5.67
2000/01	3.12	3.12	10.09	5.50	5.13	5.47	13.93	14.64	46.61	59.91	21.24	4.07	16.07
2001/02	3.86	3.85	3.83	8.96	11.30	10.47	13.82	13.25	47.23	29.11	11.90	3.12	13.39
2002/03	3.12	3.12	3.86	10.37	3.12	11.12	11.37	6.62	47.80	61.47	38.28	14.46	17.89
2003/04	3.12	5.07	5.32	3.12	3.12	3.82	5.44	11.08	8.12	19.81	5.98	3.71	6.48
2004/05	4.31	3.41	3.36	3.12	3.12	4.63	3.12	8.37	8.14	7.22	3.12	3.12	4.59
PROM	3.79	3.68	4.44	5.41	5.09	5.63	6.81	11.55	22.43	26.61	14.30	5.55	9.61
MAX	8.84	10.75	18.14	14.20	12.15	13.68	13.93	31.54	77.53	84.16	59.50	23.20	27.04
MIN	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.27

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ANNEX 2

HYDRAULIC AXES

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Table A2.1. Hydraulic Axes Colina Stream

		Flow [m3/s]												
Distance	Top Bottom	0.3	0.6	0.8	1	1.2	1.5	2	3	4.5	6	8	12	16
X=														
0	2525.000	2525.130	2525.182	2525.208	2525.232	2525.253	2525.281	2525.323	2525.393	2525.479	2525.551	2525.635	2525.776	2525
10	2525.000	2525.098	2525.138	2525.159	2525.178	2525.195	2525.218	2525.251	2525.308	2525.378	2525.438	2525.508	2525.626	2525
20	2525.000	2525.041	2525.063	2525.075	2525.087	2525.097	2525.111	2525.133	2525.172	2525.222	2525.266	2525.319	2525.412	2525
30	2524.220	2524.274	2524.299	2524.316	2524.327	2524.339	2524.355	2524.380	2524.423	2524.476	2524.522	2524.576	2524.666	2524
40	2524.000	2524.082	2524.114	2524.132	2524.146	2524.160	2524.179	2524.207	2524.253	2524.310	2524.358	2524.413	2524.506	2524
50	2524.000	2524.047	2524.071	2524.084	2524.096	2524.107	2524.123	2524.145	2524.185	2524.235	2524.278	2524.329	2524.417	2524
60	2523.780	2523.815	2523.834	2523.843	2523.853	2523.862	2523.874	2523.892	2523.925	2523.967	2524.005	2524.051	2524.133	2524
70	2523.000	2523.052	2523.077	2523.092	2523.103	2523.115	2523.131	2523.155	2523.196	2523.249	2523.295	2523.350	2523.447	2523
80	2522.790	2522.831	2522.853	2522.866	2522.878	2522.888	2522.903	2522.926	2522.966	2523.020	2523.068	2523.126	2523.231	2523
90	2522.000	2522.114	2522.149	2522.184	2522.193	2522.213	2522.239	2522.278	2522.342	2522.423	2522.491	2522.571	2522.709	2522
100	2522.000	2522.110	2522.157	2522.180	2522.202	2522.222	2522.249	2522.288	2522.355	2522.438	2522.510	2522.594	2522.737	2522
110	2522.000	2522.053	2522.082	2522.097	2522.112	2522.125	2522.143	2522.171	2522.219	2522.281	2522.336	2522.401	2522.514	2522
120	2521.530	2521.578	2521.602	2521.616	2521.629	2521.640	2521.656	2521.680	2521.723	2521.777	2521.824	2521.880	2521.978	2522
130	2521.000	2521.083	2521.113	2521.135	2521.146	2521.160	2521.179	2521.207	2521.253	2521.311	2521.360	2521.416	2521.512	2521
140	2521.000	2521.043	2521.066	2521.078	2521.090	2521.100	2521.115	2521.137	2521.175	2521.224	2521.267	2521.318	2521.406	2521
150	2520.520	2520.560	2520.580	2520.592	2520.602	2520.612	2520.626	2520.646	2520.682	2520.727	2520.767	2520.815	2520.898	2520
160	2520.000	2520.077	2520.104	2520.124	2520.135	2520.148	2520.166	2520.192	2520.236	2520.291	2520.337	2520.391	2520.483	2520
170	2520.000	2520.041	2520.063	2520.075	2520.086	2520.096	2520.110	2520.132	2520.169	2520.217	2520.259	2520.309	2520.397	2520
180	2519.560	2519.599	2519.619	2519.630	2519.641	2519.650	2519.664	2519.684	2519.719	2519.766	2519.806	2519.855	2519.941	2520
190	2519.000	2519.091	2519.121	2519.146	2519.156	2519.171	2519.191	2519.220	2519.269	2519.329	2519.379	2519.438	2519.536	2519
200	2519.000	2519.081	2519.114	2519.131	2519.147	2519.161	2519.180	2519.208	2519.256	2519.315	2519.365	2519.424	2519.525	2519
210	2519.000	2519.038	2519.058	2519.069	2519.080	2519.089	2519.102	2519.122	2519.157	2519.203	2519.243	2519.292	2519.379	2519
220	2518.430	2518.471	2518.493	2518.505	2518.515	2518.525	2518.539	2518.561	2518.597	2518.645	2518.686	2518.736	2518.823	2518
230	2518.000	2518.077	2518.106	2518.125	2518.137	2518.150	2518.168	2518.194	2518.239	2518.294	2518.341	2518.397	2518.491	2518
240	2518.000	2518.040	2518.061	2518.072	2518.084	2518.094	2518.107	2518.128	2518.165	2518.212	2518.253	2518.303	2518.391	2518
250	2517.490	2517.531	2517.552	2517.564	2517.574	2517.584	2517.598	2517.618	2517.655	2517.701	2517.742	2517.791	2517.876	2517
260	2517.000	2517.075	2517.102	2517.121	2517.131	2517.144	2517.161	2517.186	2517.228	2517.280	2517.324	2517.376	2517.463	2517
270	2517.000	2517.037	2517.057	2517.067	2517.078	2517.087	2517.099	2517.119	2517.152	2517.195	2517.233	2517.278	2517.358	2517
280	2516.470	2516.507	2516.526	2516.537	2516.546	2516.555	2516.568	2516.586	2516.619	2516.660	2516.697	2516.740	2516.816	2516
290	2516.000	2516.058	2516.083	2516.098	2516.108	2516.119	2516.134	2516.156	2516.194	2516.240	2516.279	2516.325	2516.403	2516
300	2515.950	2515.979	2515.999	2516.003	2516.012	2516.019	2516.029	2516.045	2516.072	2516.108	2516.140	2516.178	2516.246	2516
310	2515.050	2515.114	2515.140	2515.161	2515.168	2515.181	2515.198	2515.223	2515.266	2515.318	2515.363	2515.415	2515.503	2515
320	2515.000	2515.076	2515.108	2515.123	2515.137	2515.150	2515.168	2515.194	2515.238	2515.293	2515.340	2515.395	2515.489	2515
330	2515.000	2515.032	2515.053	2515.059	2515.068	2515.076	2515.087	2515.105	2515.136	2515.176	2515.213	2515.257	2515.336	2515
340	2514.000	2514.088	2514.113	2514.142	2514.146	2514.161	2514.181	2514.210	2514.259	2514.319	2514.370	2514.429	2514.531	2514
350	2514.000	2514.086	2514.122	2514.139	2514.156	2514.170	2514.190	2514.220	2514.271	2514.334	2514.388	2514.451	2514.561	2514
360	2514.000	2514.037	2514.060	2514.069	2514.079	2514.089	2514.103	2514.123	2514.160	2514.208	2514.251	2514.304	2514.399	2514
370	2513.000	2513.089	2513.118	2513.146	2513.153	2513.169	2513.191	2513.223	2513.277	2513.346	2513.405	2513.475	2513.596	2513
380	2513.000	2513.065	2513.099	2513.117	2513.135	2513.151	2513.172	2513.205	2513.261	2513.333	2513.395	2513.470	2513.600	2513
390	2512.770	2512.821	2512.849	2512.865	2512.879	2512.893	2512.911	2512.939	2512.989	2513.055	2513.113	2513.184	2513.309	2513
400	2512.000	2512.120	2512.157	2512.191	2512.203	2512.222	2512.249	2512.287	2512.351	2512.431	2512.498	2512.577	2512.710	2512
410	2512.000	2512.098	2512.138	2512.158	2512.177	2512.193	2512.215	2512.247	2512.301	2512.367	2512.423	2512.487	2512.597	2512
420	2512.000	2512.040	2512.062	2512.072	2512.084	2512.094	2512.107	2512.128	2512.164	2512.211	2512.252	2512.302	2512.387	2512
430	2511.190	2511.240	2511.263	2511.278	2511.288	2511.298	2511.313	2511.335	2511.371	2511.417	2511.457	2511.503	2511.581	2511
440	2511.000	2511.034	2511.053	2511.061	2511.070	2511.078	2511.090	2511.107	2511.137	2511.175	2511.209	2511.249	2511.319	2511
450	2510.320	2510.359	2510.378	2510.391	2510.400	2510.409	2510.422	2510.441	2510.475	2510.518	2510.556	2510.600	2510.677	2510
460	2510.000	2510.075	2510.104	2510.123	2510.135	2510.148	2510.166	2510.193	2510.238	2510.294	2510.342	2510.398	2510.494	2510
470	2510.000	2510.045	2510.069	2510.081	2510.094	2510.105	2510.120	2510.143	2510.183	2510.234	2510.280	2510.335	2510.431	2510
480	2509.740	2509.777	2509.796	2509.807	2509.817	2509.827	2509.840	2509.860	2509.896	2509.943	2509.987	2510.040	2510.135	2510
490	2509.000	2509.199	2509.191	2509.226	2509.234	2509.254	2509.277	2509.311	2509.368	2509.436	2509.506	2509.586	2509.706	2509
500	2509.000	2509.213	2509.220	2509.243	2509.265	2509.287	2509.310	2509.346	2509.405	2509.476	2509.551	2509.638	2509.764	2509

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Table A2.2. Hydraulic Axes La Engorda Stream

		Flow [m3/s]											
Distance	Top Bottom	0.15	0.2	0.25	0.3	0.35	0.4	0.5	0.7	1	2	3	6
X=													
0	2534.000	2534.050	2534.059	2534.068	2534.076	2534.083	2534.090	2534.103	2534.125	2534.154	2534.231	2534.292	2534.
10	2533.000	2533.066	2533.078	2533.089	2533.099	2533.108	2533.117	2533.133	2533.160	2533.196	2533.286	2533.355	2533.
20	2532.660	2532.717	2532.727	2532.737	2532.746	2532.754	2532.762	2532.776	2532.801	2532.834	2532.919	2532.985	2533.
30	2532.000	2532.050	2532.060	2532.068	2532.076	2532.083	2532.090	2532.103	2532.125	2532.155	2532.232	2532.293	2532.
40	2531.000	2531.050	2531.060	2531.068	2531.076	2531.084	2531.090	2531.103	2531.126	2531.156	2531.234	2531.295	2531.
50	2530.000	2530.088	2530.102	2530.115	2530.126	2530.137	2530.146	2530.164	2530.195	2530.233	2530.329	2530.401	2530.
60	2529.930	2529.978	2529.987	2529.995	2530.003	2530.010	2530.017	2530.029	2530.051	2530.080	2530.157	2530.218	2530.
70	2528.710	2528.765	2528.776	2528.785	2528.793	2528.801	2528.809	2528.823	2528.848	2528.880	2528.963	2529.029	2529.
80	2528.000	2528.089	2528.104	2528.117	2528.128	2528.139	2528.150	2528.168	2528.200	2528.240	2528.340	2528.416	2528.
90	2527.920	2527.973	2527.983	2527.992	2528.000	2528.008	2528.016	2528.029	2528.054	2528.086	2528.171	2528.238	2528.
100	2527.000	2527.101	2527.116	2527.129	2527.141	2527.152	2527.162	2527.181	2527.212	2527.251	2527.349	2527.423	2527.
110	2527.000	2527.045	2527.054	2527.061	2527.069	2527.075	2527.082	2527.093	2527.114	2527.142	2527.214	2527.271	2527.
120	2526.060	2526.131	2526.143	2526.153	2526.163	2526.171	2526.179	2526.194	2526.219	2526.251	2526.330	2526.389	2526.
130	2526.000	2526.036	2526.043	2526.050	2526.055	2526.061	2526.066	2526.075	2526.093	2526.115	2526.174	2526.222	2526.
140	2525.060	2525.122	2525.132	2525.141	2525.149	2525.157	2525.164	2525.177	2525.199	2525.227	2525.298	2525.352	2525.
150	2525.000	2525.035	2525.041	2525.047	2525.053	2525.058	2525.063	2525.072	2525.088	2525.109	2525.165	2525.210	2525.
160	2524.370	2524.408	2524.415	2524.421	2524.427	2524.433	2524.438	2524.447	2524.465	2524.487	2524.545	2524.592	2524.
170	2524.000	2524.065	2524.074	2524.082	2524.089	2524.096	2524.102	2524.114	2524.134	2524.159	2524.222	2524.269	2524.
180	2524.000	2524.027	2524.030	2524.034	2524.038	2524.041	2524.045	2524.051	2524.063	2524.078	2524.119	2524.152	2524.
190	2523.050	2523.079	2523.085	2523.090	2523.094	2523.098	2523.102	2523.110	2523.123	2523.140	2523.184	2523.220	2523.
200	2522.640	2522.665	2522.670	2522.674	2522.678	2522.681	2522.685	2522.692	2522.703	2522.718	2522.760	2522.793	2522.
210	2522.000	2522.044	2522.051	2522.058	2522.064	2522.070	2522.075	2522.085	2522.102	2522.124	2522.180	2522.223	2522.
220	2521.920	2521.947	2521.950	2521.954	2521.958	2521.961	2521.965	2521.971	2521.983	2521.999	2522.041	2522.076	2522.
230	2521.000	2521.061	2521.071	2521.079	2521.087	2521.093	2521.100	2521.112	2521.132	2521.158	2521.222	2521.272	2521.
240	2521.000	2521.033	2521.039	2521.044	2521.049	2521.054	2521.059	2521.067	2521.083	2521.103	2521.157	2521.201	2521.
250	2520.480	2520.515	2520.522	2520.528	2520.533	2520.538	2520.543	2520.552	2520.568	2520.589	2520.645	2520.691	2520.
260	2520.000	2520.037	2520.044	2520.050	2520.056	2520.062	2520.067	2520.076	2520.093	2520.115	2520.172	2520.218	2520.
270	2519.610	2519.643	2519.649	2519.655	2519.660	2519.665	2519.669	2519.678	2519.693	2519.712	2519.764	2519.806	2519.
280	2519.000	2519.031	2519.034	2519.039	2519.044	2519.048	2519.052	2519.060	2519.073	2519.091	2519.138	2519.176	2519.
290	2518.000	2518.067	2518.076	2518.085	2518.093	2518.101	2518.107	2518.120	2518.141	2518.168	2518.235	2518.286	2518.
300	2518.000	2518.033	2518.039	2518.045	2518.050	2518.055	2518.060	2518.068	2518.084	2518.104	2518.159	2518.203	2518.
310	2517.330	2517.374	2517.383	2517.390	2517.397	2517.404	2517.410	2517.422	2517.442	2517.469	2517.540	2517.597	2517.
320	2517.000	2517.082	2517.095	2517.105	2517.115	2517.124	2517.133	2517.148	2517.174	2517.208	2517.293	2517.359	2517.
330	2517.000	2517.039	2517.046	2517.053	2517.059	2517.065	2517.071	2517.081	2517.100	2517.125	2517.192	2517.247	2517.
340	2516.000	2516.093	2516.107	2516.120	2516.131	2516.142	2516.151	2516.169	2516.200	2516.239	2516.338	2516.415	2516.
350	2516.000	2516.051	2516.061	2516.070	2516.078	2516.086	2516.093	2516.107	2516.132	2516.164	2516.251	2516.321	2516.
360	2515.000	2515.057	2515.068	2515.078	2515.086	2515.095	2515.102	2515.117	2515.142	2515.175	2515.260	2515.329	2515.
370	2514.540	2514.592	2514.602	2514.611	2514.619	2514.627	2514.634	2514.647	2514.671	2514.702	2514.783	2514.848	2514.
380	2514.000	2514.053	2514.063	2514.072	2514.080	2514.088	2514.095	2514.108	2514.131	2514.162	2514.240	2514.302	2514.
390	2513.610	2513.648	2513.655	2513.662	2513.668	2513.673	2513.678	2513.688	2513.706	2513.729	2513.790	2513.840	2513.
400	2512.510	2512.547	2512.550	2512.554	2512.559	2512.564	2512.569	2512.577	2512.592	2512.612	2512.665	2512.707	2512.
410	2511.000	2511.037	2511.043	2511.048	2511.054	2511.059	2511.064	2511.073	2511.090	2511.111	2511.168	2511.213	2511.
420	2510.040	2510.107	2510.118	2510.127	2510.136	2510.144	2510.152	2510.165	2510.189	2510.218	2510.292	2510.348	2510.
430	2510.000	2510.035	2510.041	2510.047	2510.053	2510.058	2510.063	2510.072	2510.088	2510.110	2510.168	2510.215	2510.
440	2509.130	2509.184	2509.193	2509.202	2509.209	2509.217	2509.223	2509.236	2509.257	2509.285	2509.356	2509.411	2509.
450	2509.000	2509.037	2509.045	2509.051	2509.057	2509.062	2509.068	2509.077	2509.095	2509.118	2509.179	2509.228	2509.
460	2508.480	2508.520	2508.527	2508.534	2508.540	2508.546	2508.552	2508.562	2508.581	2508.605	2508.671	2508.724	2508.
470	2508.000	2508.076	2508.088	2508.098	2508.107	2508.115	2508.123	2508.138	2508.162	2508.193	2508.273	2508.334	2508.
480	2508.000	2508.035	2508.042	2508.048	2508.053	2508.059	2508.064	2508.073	2508.090	2508.113	2508.174	2508.225	2508.
490	2507.130	2507.196	2507.210	2507.223	2507.235	2507.248	2507.258	2507.276	2507.304	2507.341	2507.431	2507.508	2507.
500	2507.000	2507.122	2507.142	2507.162	2507.181	2507.201	2507.212	2507.233	2507.259	2507.296	2507.384	2507.469	2507.

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Table A2.3. Hydraulic Axes El Morado Stream

		Flow [m3/s]											
Distance	Top Bottom	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1	1.5	2	3	5
X=													
0	2531.396	2531.429	2531.438	2531.446	2531.453	2531.460	2531.466	2531.472	2531.483	2531.507	2531.528	2531.564	2531.6
10	2530.902	2530.942	2530.953	2530.962	2530.971	2530.978	2530.985	2530.992	2531.005	2531.031	2531.054	2531.093	2531.1
20	2530.690	2530.728	2530.739	2530.748	2530.756	2530.763	2530.770	2530.777	2530.789	2530.815	2530.837	2530.876	2530.9
30	2530.457	2530.487	2530.495	2530.503	2530.509	2530.515	2530.521	2530.526	2530.536	2530.558	2530.578	2530.611	2530.6
40	2529.951	2529.984	2529.993	2530.001	2530.008	2530.014	2530.020	2530.026	2530.036	2530.059	2530.078	2530.112	2530.1
50	2529.643	2529.670	2529.677	2529.683	2529.689	2529.695	2529.700	2529.705	2529.714	2529.733	2529.751	2529.781	2529.8
60	2529.000	2529.044	2529.055	2529.065	2529.073	2529.081	2529.088	2529.095	2529.107	2529.134	2529.156	2529.194	2529.2
70	2528.910	2528.941	2528.950	2528.958	2528.965	2528.971	2528.977	2528.983	2528.993	2529.016	2529.037	2529.072	2529.1
80	2528.461	2528.493	2528.502	2528.509	2528.516	2528.522	2528.528	2528.534	2528.545	2528.568	2528.588	2528.623	2528.6
90	2528.000	2528.038	2528.048	2528.057	2528.065	2528.073	2528.080	2528.086	2528.098	2528.124	2528.147	2528.186	2528.2
100	2527.738	2527.771	2527.780	2527.788	2527.795	2527.802	2527.809	2527.815	2527.826	2527.850	2527.872	2527.910	2527.9
110	2527.214	2527.257	2527.269	2527.279	2527.288	2527.297	2527.305	2527.312	2527.326	2527.356	2527.381	2527.425	2527.4
120	2527.000	2527.069	2527.084	2527.096	2527.107	2527.117	2527.127	2527.135	2527.151	2527.184	2527.212	2527.260	2527.3
130	2527.000	2527.034	2527.044	2527.053	2527.060	2527.067	2527.074	2527.080	2527.092	2527.118	2527.141	2527.181	2527.2
140	2526.539	2526.572	2526.582	2526.590	2526.597	2526.604	2526.610	2526.616	2526.628	2526.652	2526.674	2526.712	2526.7
150	2526.039	2526.096	2526.109	2526.121	2526.130	2526.140	2526.148	2526.156	2526.170	2526.200	2526.225	2526.268	2526.3
160	2526.000	2526.034	2526.043	2526.051	2526.058	2526.064	2526.070	2526.076	2526.087	2526.110	2526.130	2526.163	2526.2
170	2525.774	2525.797	2525.804	2525.809	2525.814	2525.819	2525.823	2525.827	2525.835	2525.852	2525.867	2525.892	2525.9
180	2525.295	2525.319	2525.325	2525.331	2525.336	2525.341	2525.345	2525.350	2525.357	2525.375	2525.389	2525.415	2525.4
190	2525.000	2525.044	2525.053	2525.061	2525.068	2525.074	2525.080	2525.085	2525.095	2525.116	2525.133	2525.162	2525.2
200	2525.000	2525.023	2525.030	2525.036	2525.041	2525.046	2525.050	2525.054	2525.062	2525.079	2525.094	2525.120	2525.1
210	2524.840	2524.862	2524.868	2524.874	2524.879	2524.883	2524.887	2524.891	2524.899	2524.915	2524.930	2524.955	2524.9
220	2524.577	2524.597	2524.603	2524.608	2524.612	2524.616	2524.620	2524.624	2524.631	2524.646	2524.659	2524.683	2524.7
230	2524.000	2524.028	2524.036	2524.043	2524.049	2524.055	2524.060	2524.065	2524.074	2524.095	2524.113	2524.145	2524.1
240	2523.714	2523.742	2523.749	2523.756	2523.763	2523.769	2523.774	2523.779	2523.789	2523.811	2523.831	2523.867	2523.9
250	2523.000	2523.076	2523.092	2523.106	2523.118	2523.129	2523.140	2523.149	2523.167	2523.206	2523.239	2523.297	2523.3
260	2523.000	2523.033	2523.042	2523.051	2523.058	2523.065	2523.072	2523.078	2523.089	2523.115	2523.138	2523.179	2523.2
270	2522.000	2522.036	2522.046	2522.054	2522.062	2522.069	2522.076	2522.082	2522.094	2522.120	2522.143	2522.183	2522.2
280	2521.398	2521.438	2521.449	2521.459	2521.468	2521.476	2521.483	2521.490	2521.504	2521.532	2521.557	2521.601	2521.6
290	2521.000	2521.070	2521.085	2521.097	2521.108	2521.118	2521.127	2521.136	2521.151	2521.185	2521.213	2521.260	2521.3
300	2521.000	2521.031	2521.039	2521.047	2521.054	2521.061	2521.067	2521.072	2521.083	2521.108	2521.129	2521.167	2521.2
310	2520.150	2520.199	2520.211	2520.222	2520.232	2520.241	2520.249	2520.257	2520.271	2520.302	2520.329	2520.375	2520.4
320	2520.000	2520.032	2520.042	2520.050	2520.057	2520.064	2520.070	2520.076	2520.088	2520.113	2520.135	2520.175	2520.2
330	2519.000	2519.034	2519.044	2519.052	2519.060	2519.067	2519.074	2519.080	2519.092	2519.118	2519.142	2519.183	2519.2
340	2518.000	2518.078	2518.095	2518.109	2518.121	2518.133	2518.144	2518.154	2518.172	2518.212	2518.245	2518.302	2518.3
350	2518.000	2518.047	2518.060	2518.072	2518.083	2518.093	2518.102	2518.111	2518.128	2518.165	2518.198	2518.256	2518.3
360	2517.383	2517.429	2517.442	2517.452	2517.462	2517.471	2517.480	2517.487	2517.502	2517.534	2517.562	2517.611	2517.6
370	2517.000	2517.032	2517.042	2517.049	2517.057	2517.063	2517.070	2517.075	2517.087	2517.111	2517.132	2517.170	2517.2
380	2516.000	2516.034	2516.043	2516.051	2516.059	2516.065	2516.072	2516.077	2516.088	2516.112	2516.132	2516.167	2516.2
390	2515.420	2515.444	2515.448	2515.450	2515.454	2515.458	2515.462	2515.465	2515.472	2515.487	2515.500	2515.522	2515.5
400	2512.086	2512.108	2512.114	2512.119	2512.123	2512.127	2512.131	2512.135	2512.142	2512.158	2512.171	2512.194	2512.2
410	2510.398	2510.423	2510.429	2510.436	2510.441	2510.446	2510.451	2510.455	2510.463	2510.481	2510.497	2510.525	2510.5
420	2509.000	2509.036	2509.046	2509.054	2509.062	2509.069	2509.075	2509.082	2509.093	2509.119	2509.141	2509.178	2509.2
430	2508.518	2508.559	2508.570	2508.581	2508.590	2508.599	2508.607	2508.614	2508.629	2508.661	2508.690	2508.739	2508.8
440	2508.000	2508.103	2508.125	2508.143	2508.159	2508.174	2508.188	2508.200	2508.223	2508.273	2508.314	2508.385	2508.4
450	2508.000	2508.096	2508.117	2508.135	2508.152	2508.166	2508.179	2508.192	2508.215	2508.265	2508.308	2508.382	2508.5
460	2508.000	2508.034	2508.043	2508.052	2508.059	2508.067	2508.073	2508.080	2508.092	2508.118	2508.142	2508.185	2508.2
470	2506.698	2506.728	2506.736	2506.744	2506.750	2506.756	2506.762	2506.767	2506.777	2506.799	2506.818	2506.852	2506.9
480	2505.468	2505.491	2505.497	2505.503	2505.508	2505.513	2505.517	2505.521	2505.529	2505.546	2505.561	2505.588	2505.6
490	2503.132	2503.175	2503.185	2503.193	2503.200	2503.207	2503.213	2503.219	2503.230	2503.254	2503.274	2503.307	2503.3
500	2502.900	2503.066	2503.065	2503.075	2503.075	2503.076	2503.077	2503.079	2503.084	2503.109	2503.131	2503.166	2503.2

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Table A2.4. Hydraulic Axes Las Placas Stream

		Flow [m3/s]								
Distance	Top Bottom	0.15	0.2	0.3	0.5	0.7	1	1.5	2	2.5
X=										
0	2536.620	2536.647	2536.652	2536.661	2536.675	2536.687	2536.703	2536.725	2536.744	2536.761
10	2535.000	2535.027	2535.032	2535.041	2535.056	2535.068	2535.083	2535.105	2535.124	2535.141
20	2533.810	2533.836	2533.841	2533.849	2533.863	2533.874	2533.889	2533.911	2533.929	2533.946
30	2532.680	2532.704	2532.709	2532.717	2532.730	2532.741	2532.755	2532.775	2532.793	2532.809
40	2531.570	2531.594	2531.599	2531.607	2531.620	2531.631	2531.645	2531.665	2531.683	2531.698
50	2530.670	2530.691	2530.695	2530.701	2530.713	2530.722	2530.735	2530.753	2530.768	2530.783
60	2529.350	2529.376	2529.381	2529.390	2529.404	2529.416	2529.431	2529.452	2529.470	2529.487
70	2528.700	2528.722	2528.726	2528.734	2528.746	2528.756	2528.770	2528.790	2528.807	2528.823
80	2527.340	2527.365	2527.369	2527.377	2527.391	2527.402	2527.416	2527.437	2527.455	2527.472
90	2526.240	2526.260	2526.264	2526.270	2526.281	2526.291	2526.303	2526.322	2526.337	2526.351
100	2523.600	2523.622	2523.626	2523.634	2523.646	2523.656	2523.669	2523.687	2523.704	2523.719
110	2521.380	2521.403	2521.407	2521.414	2521.426	2521.437	2521.450	2521.469	2521.486	2521.501
120	2519.270	2519.290	2519.294	2519.300	2519.311	2519.320	2519.332	2519.350	2519.365	2519.378
130	2515.980	2516.000	2516.004	2516.011	2516.022	2516.031	2516.043	2516.060	2516.075	2516.089
140	2513.000	2513.025	2513.030	2513.038	2513.052	2513.063	2513.078	2513.096	2513.114	2513.129
150	2511.590	2511.617	2511.622	2511.631	2511.645	2511.657	2511.673	2511.695	2511.714	2511.731
160	2510.410	2510.438	2510.443	2510.453	2510.468	2510.480	2510.497	2510.520	2510.540	2510.557
170	2509.560	2509.590	2509.595	2509.605	2509.620	2509.634	2509.651	2509.675	2509.696	2509.714
180	2508.940	2508.965	2508.970	2508.978	2508.992	2509.003	2509.018	2509.040	2509.059	2509.076
190	2508.000	2508.024	2508.029	2508.037	2508.050	2508.061	2508.075	2508.095	2508.113	2508.129
200	2507.060	2507.082	2507.086	2507.093	2507.105	2507.116	2507.129	2507.148	2507.165	2507.180
210	2505.930	2505.955	2505.959	2505.967	2505.981	2505.992	2506.006	2506.027	2506.045	2506.062
220	2505.000	2505.025	2505.030	2505.039	2505.052	2505.064	2505.079	2505.101	2505.120	2505.138
230	2504.000	2504.022	2504.026	2504.033	2504.045	2504.056	2504.069	2504.089	2504.106	2504.122
240	2501.960	2501.982	2501.986	2501.993	2502.004	2502.014	2502.027	2502.047	2502.063	2502.078
250	2499.180	2499.205	2499.210	2499.218	2499.231	2499.243	2499.258	2499.278	2499.296	2499.313
260	2497.000	2497.029	2497.034	2497.043	2497.059	2497.072	2497.089	2497.111	2497.132	2497.150
270	2495.640	2495.664	2495.669	2495.677	2495.690	2495.701	2495.716	2495.738	2495.757	2495.774
280	2493.130	2493.161	2493.166	2493.176	2493.193	2493.207	2493.225	2493.247	2493.268	2493.287
290	2492.030	2492.056	2492.061	2492.070	2492.084	2492.096	2492.112	2492.136	2492.156	2492.174
300	2490.020	2490.041	2490.045	2490.052	2490.063	2490.072	2490.085	2490.107	2490.121	2490.136
310	2485.550	2485.570	2485.574	2485.580	2485.591	2485.600	2485.612	2485.629	2485.643	2485.656
320	2481.570	2481.587	2481.593	2481.596	2481.605	2481.613	2481.623	2481.644	2481.652	2481.663
330	2476.320	2476.337	2476.342	2476.346	2476.355	2476.363	2476.374	2476.389	2476.408	2476.415
340	2472.210	2472.231	2472.235	2472.242	2472.253	2472.263	2472.275	2472.294	2472.301	2472.315
350	2470.520	2470.540	2470.543	2470.550	2470.561	2470.570	2470.581	2470.597	2470.614	2470.627
360	2468.650	2468.668	2468.671	2468.677	2468.686	2468.694	2468.705	2468.721	2468.733	2468.745
370	2466.530	2466.547	2466.551	2466.556	2466.565	2466.573	2466.584	2466.598	2466.611	2466.622
380	2464.720	2464.735	2464.738	2464.743	2464.751	2464.758	2464.768	2464.781	2464.792	2464.803
390	2462.450	2462.467	2462.470	2462.475	2462.484	2462.492	2462.502	2462.515	2462.528	2462.538
400	2461.100	2461.116	2461.119	2461.124	2461.132	2461.139	2461.149	2461.162	2461.174	2461.184
410	2459.630	2459.645	2459.648	2459.653	2459.662	2459.669	2459.678	2459.692	2459.704	2459.714
420	2457.280	2457.299	2457.302	2457.309	2457.319	2457.328	2457.339	2457.355	2457.369	2457.381
430	2455.390	2455.411	2455.414	2455.421	2455.432	2455.442	2455.454	2455.473	2455.488	2455.503
440	2452.620	2452.652	2452.658	2452.669	2452.686	2452.700	2452.719	2452.744	2452.766	2452.785
450	2451.000	2451.064	2451.075	2451.094	2451.124	2451.148	2451.177	2451.215	2451.247	2451.275
460	2450.000	2450.045	2450.053	2450.067	2450.090	2450.109	2450.133	2450.166	2450.193	2450.217
470	2448.930	2448.968	2448.975	2448.987	2449.006	2449.023	2449.044	2449.072	2449.097	2449.118
480	2448.000	2448.035	2448.041	2448.052	2448.071	2448.086	2448.106	2448.132	2448.155	2448.175
490	2447.240	2447.314	2447.321	2447.334	2447.354	2447.371	2447.391	2447.412	2447.437	2447.459

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Table A2.5. Hydraulic Axes Colorado River

		Flow [m3/s]											
Distance	Top Bottom	3	6	10	12.5	15	17.5	20	25	30	40	50	75
X=													
0	1305.288	1305.369	1305.414	1305.462	1305.488	1305.512	1305.535	1305.557	1305.597	1305.634	1305.701	1305.762	1305.893
10	1305.000	1305.154	1305.213	1305.271	1305.302	1305.330	1305.355	1305.379	1305.422	1305.462	1305.532	1305.594	1305.727
20	1305.000	1305.149	1305.207	1305.264	1305.295	1305.322	1305.347	1305.370	1305.413	1305.452	1305.521	1305.582	1305.713
30	1305.000	1305.119	1305.166	1305.214	1305.239	1305.262	1305.284	1305.304	1305.340	1305.374	1305.433	1305.487	1305.603
40	1304.096	1305.058	1305.082	1305.112	1305.128	1305.142	1305.156	1305.169	1305.194	1305.216	1305.258	1305.296	1305.381
50	1305.000	1305.059	1305.090	1305.126	1305.146	1305.165	1305.183	1305.201	1305.233	1305.264	1305.320	1305.373	1305.492
60	1304.233	1304.302	1304.332	1304.367	1304.386	1304.404	1304.421	1304.437	1304.467	1304.495	1304.546	1304.594	1304.701
70	1303.798	1303.864	1303.901	1303.939	1303.959	1303.978	1303.996	1304.013	1304.045	1304.075	1304.129	1304.179	1304.291
80	1303.294	1303.380	1303.424	1303.471	1303.496	1303.520	1303.542	1303.563	1303.602	1303.639	1303.705	1303.766	1303.899
90	1303.000	1303.158	1303.222	1303.286	1303.320	1303.350	1303.379	1303.405	1303.454	1303.499	1303.579	1303.651	1303.806
100	1303.000	1303.146	1303.207	1303.270	1303.304	1303.335	1303.364	1303.390	1303.440	1303.485	1303.566	1303.639	1303.798
110	1303.000	1303.079	1303.122	1303.169	1303.195	1303.219	1303.242	1303.263	1303.304	1303.341	1303.410	1303.473	1303.613
120	1302.455	1302.538	1302.581	1302.628	1302.653	1302.677	1302.699	1302.720	1302.759	1302.796	1302.864	1302.926	1303.062
130	1302.000	1302.157	1302.219	1302.281	1302.314	1302.343	1302.371	1302.396	1302.443	1302.487	1302.565	1302.634	1302.784
140	1302.000	1302.154	1302.219	1302.285	1302.320	1302.352	1302.382	1302.409	1302.460	1302.506	1302.588	1302.662	1302.820
150	1302.000	1302.093	1302.142	1302.196	1302.225	1302.252	1302.277	1302.301	1302.346	1302.386	1302.461	1302.529	1302.678
160	1301.649	1301.728	1301.770	1301.816	1301.842	1301.866	1301.888	1301.909	1301.949	1301.987	1302.056	1302.118	1302.258
170	1301.009	1301.180	1301.249	1301.317	1301.352	1301.384	1301.413	1301.441	1301.492	1301.539	1301.623	1301.696	1301.851
180	1301.000	1301.208	1301.291	1301.372	1301.415	1301.453	1301.489	1301.521	1301.581	1301.634	1301.728	1301.810	1301.983
190	1301.000	1301.189	1301.266	1301.343	1301.383	1301.420	1301.454	1301.485	1301.543	1301.595	1301.688	1301.770	1301.944
200	1301.000	1301.161	1301.229	1301.298	1301.335	1301.368	1301.399	1301.428	1301.481	1301.529	1301.615	1301.691	1301.856
210	1301.000	1301.112	1301.168	1301.226	1301.257	1301.285	1301.312	1301.337	1301.383	1301.425	1301.501	1301.569	1301.717
220	1300.873	1300.957	1301.002	1301.049	1301.075	1301.099	1301.121	1301.142	1301.182	1301.218	1301.285	1301.344	1301.476
230	1300.529	1300.612	1300.656	1300.701	1300.726	1300.749	1300.771	1300.791	1300.829	1300.864	1300.928	1300.986	1301.112
240	1300.230	1300.324	1300.374	1300.426	1300.455	1300.480	1300.504	1300.527	1300.568	1300.607	1300.675	1300.736	1300.867
250	1300.000	1300.165	1300.229	1300.292	1300.325	1300.355	1300.382	1300.408	1300.454	1300.496	1300.570	1300.635	1300.772
260	1300.000	1300.157	1300.220	1300.282	1300.315	1300.344	1300.372	1300.397	1300.444	1300.485	1300.560	1300.626	1300.767
270	1300.000	1300.127	1300.180	1300.233	1300.261	1300.287	1300.311	1300.334	1300.375	1300.413	1300.480	1300.540	1300.670
280	1300.000	1300.064	1300.099	1300.136	1300.156	1300.175	1300.193	1300.210	1300.242	1300.272	1300.325	1300.374	1300.483
290	1299.390	1299.453	1299.486	1299.520	1299.539	1299.556	1299.573	1299.588	1299.617	1299.643	1299.692	1299.736	1299.834
300	1298.869	1298.940	1298.975	1299.012	1299.032	1299.050	1299.067	1299.083	1299.113	1299.141	1299.190	1299.235	1299.332
310	1298.553	1298.622	1298.656	1298.693	1298.712	1298.730	1298.747	1298.763	1298.792	1298.819	1298.867	1298.910	1299.003
320	1298.246	1298.312	1298.346	1298.381	1298.400	1298.417	1298.433	1298.449	1298.477	1298.503	1298.550	1298.592	1298.682
330	1297.954	1298.018	1298.051	1298.085	1298.103	1298.120	1298.136	1298.151	1298.179	1298.204	1298.250	1298.291	1298.381
340	1297.684	1297.746	1297.778	1297.811	1297.829	1297.846	1297.862	1297.877	1297.904	1297.929	1297.976	1298.017	1298.109
350	1297.424	1297.485	1297.518	1297.552	1297.572	1297.589	1297.606	1297.622	1297.652	1297.679	1297.730	1297.777	1297.879
360	1297.176	1297.254	1297.296	1297.342	1297.368	1297.391	1297.413	1297.433	1297.472	1297.508	1297.572	1297.630	1297.756
370	1297.000	1297.146	1297.203	1297.261	1297.291	1297.318	1297.344	1297.367	1297.411	1297.450	1297.520	1297.583	1297.717
380	1297.000	1297.138	1297.193	1297.248	1297.278	1297.304	1297.329	1297.352	1297.394	1297.432	1297.500	1297.561	1297.694
390	1297.000	1297.114	1297.161	1297.209	1297.235	1297.258	1297.280	1297.300	1297.338	1297.372	1297.434	1297.490	1297.612
400	1297.000	1297.058	1297.089	1297.123	1297.142	1297.160	1297.176	1297.192	1297.221	1297.249	1297.299	1297.345	1297.450
410	1296.379	1296.446	1296.480	1296.516	1296.536	1296.555	1296.572	1296.588	1296.619	1296.649	1296.703	1296.752	1296.864
420	1296.000	1296.116	1296.166	1296.217	1296.244	1296.269	1296.292	1296.314	1296.355	1296.393	1296.462	1296.525	1296.663
430	1296.000	1296.089	1296.137	1296.189	1296.217	1296.244	1296.269	1296.292	1296.336	1296.377	1296.452	1296.520	1296.670
440	1295.816	1295.916	1295.969	1296.025	1296.055	1296.083	1296.109	1296.134	1296.181	1296.223	1296.301	1296.372	1296.528
450	1295.693	1295.812	1295.869	1295.928	1295.960	1295.989	1296.016	1296.042	1296.089	1296.132	1296.212	1296.283	1296.439
460	1295.641	1295.748	1295.801	1295.856	1295.885	1295.913	1295.939	1295.963	1296.009	1296.049	1296.125	1296.194	1296.343
470	1295.535	1295.621	1295.663	1295.708	1295.734	1295.758	1295.781	1295.803	1295.845	1295.881	1295.953	1296.019	1296.160
480	1295.000	1295.315	1295.319	1295.345	1295.368	1295.392	1295.418	1295.445	1295.490	1295.524	1295.607	1295.684	1295.830
490	1295.000	1295.338	1295.353	1295.381	1295.403	1295.428	1295.455	1295.483	1295.530	1295.559	1295.644	1295.724	1295.871
500	1294.820	1295.333	1295.335	1295.344	1295.356	1295.372	1295.393	1295.417	1295.454	1295.467	1295.545	1295.623	1295.756

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Table A2.6. Hydraulic Axes - El Yeso River

		Flow [m3/s]											
Distance	Top Bottom	0.6	2	4	6	8	10	12	15	20	25	30	40
X=													
0	1351.040	1351.144	1351.248	1351.347	1351.423	1351.487	1351.544	1351.595	1351.664	1351.765	1351.853	1351.930	1352.068
10	1350.800	1350.883	1350.967	1351.046	1351.108	1351.159	1351.205	1351.247	1351.304	1351.386	1351.459	1351.522	1351.636
20	1350.560	1350.631	1350.704	1350.774	1350.829	1350.875	1350.916	1350.953	1351.003	1351.077	1351.142	1351.198	1351.300
30	1350.320	1350.383	1350.448	1350.511	1350.561	1350.603	1350.641	1350.675	1350.722	1350.790	1350.851	1350.904	1350.999
40	1350.080	1350.137	1350.196	1350.253	1350.299	1350.339	1350.374	1350.406	1350.450	1350.515	1350.573	1350.625	1350.718
50	1349.840	1349.891	1349.945	1349.999	1350.043	1350.081	1350.115	1350.147	1350.191	1350.256	1350.316	1350.370	1350.469
60	1349.568	1349.623	1349.682	1349.742	1349.791	1349.834	1349.873	1349.910	1349.960	1350.038	1350.109	1350.176	1350.299
70	1349.296	1349.356	1349.421	1349.487	1349.541	1349.589	1349.633	1349.674	1349.732	1349.820	1349.901	1349.978	1350.121
80	1349.024	1349.091	1349.163	1349.237	1349.298	1349.353	1349.402	1349.449	1349.513	1349.613	1349.704	1349.791	1349.949
90	1348.752	1348.827	1348.909	1348.993	1349.061	1349.123	1349.179	1349.230	1349.301	1349.410	1349.509	1349.604	1349.772
100	1348.480	1348.562	1348.650	1348.739	1348.812	1348.879	1348.937	1348.990	1349.064	1349.175	1349.275	1349.372	1349.539
110	1348.134	1348.213	1348.295	1348.377	1348.443	1348.500	1348.551	1348.598	1348.662	1348.758	1348.843	1348.922	1349.062
120	1347.788	1347.865	1347.945	1348.024	1348.087	1348.141	1348.190	1348.234	1348.295	1348.384	1348.464	1348.536	1348.665
130	1347.442	1347.517	1347.595	1347.672	1347.734	1347.786	1347.834	1347.876	1347.935	1348.022	1348.098	1348.167	1348.290
140	1347.096	1347.170	1347.246	1347.322	1347.383	1347.434	1347.480	1347.522	1347.580	1347.665	1347.740	1347.807	1347.927
150	1346.750	1346.826	1346.904	1346.981	1347.042	1347.094	1347.140	1347.183	1347.242	1347.328	1347.404	1347.471	1347.593
160	1346.470	1346.546	1346.625	1346.704	1346.767	1346.821	1346.870	1346.915	1346.976	1347.067	1347.148	1347.222	1347.354
170	1346.190	1346.265	1346.345	1346.423	1346.486	1346.541	1346.591	1346.636	1346.698	1346.791	1346.875	1346.952	1347.090
180	1345.910	1345.985	1346.064	1346.142	1346.205	1346.260	1346.310	1346.355	1346.418	1346.512	1346.597	1346.676	1346.818
190	1345.630	1345.704	1345.782	1345.860	1345.923	1345.978	1346.028	1346.074	1346.137	1346.231	1346.317	1346.397	1346.541
200	1345.350	1345.422	1345.499	1345.576	1345.639	1345.694	1345.743	1345.788	1345.851	1345.945	1346.031	1346.110	1346.252
210	1345.046	1345.120	1345.198	1345.276	1345.339	1345.393	1345.442	1345.487	1345.549	1345.640	1345.722	1345.796	1345.929
220	1344.742	1344.818	1344.897	1344.977	1345.040	1345.095	1345.144	1345.189	1345.251	1345.341	1345.422	1345.494	1345.623
230	1344.438	1344.515	1344.597	1344.677	1344.742	1344.797	1344.846	1344.891	1344.953	1345.043	1345.122	1345.194	1345.320
240	1344.134	1344.213	1344.296	1344.376	1344.441	1344.496	1344.545	1344.590	1344.650	1344.739	1344.817	1344.889	1345.012
250	1343.830	1343.904	1343.982	1344.060	1344.121	1344.177	1344.224	1344.267	1344.326	1344.412	1344.488	1344.558	1344.679
260	1343.384	1343.459	1343.537	1343.614	1343.676	1343.729	1343.776	1343.819	1343.878	1343.964	1344.041	1344.110	1344.232
270	1342.938	1343.015	1343.095	1343.174	1343.236	1343.290	1343.338	1343.381	1343.441	1343.528	1343.605	1343.675	1343.799
280	1342.492	1342.571	1342.653	1342.734	1342.798	1342.853	1342.901	1342.946	1343.006	1343.095	1343.173	1343.244	1343.369
290	1342.046	1342.128	1342.212	1342.295	1342.361	1342.417	1342.467	1342.512	1342.574	1342.664	1342.744	1342.815	1342.942
300	1341.600	1341.692	1341.782	1341.869	1341.936	1341.991	1342.042	1342.088	1342.150	1342.240	1342.319	1342.390	1342.515
310	1341.310	1341.386	1341.461	1341.534	1341.591	1341.639	1341.682	1341.721	1341.774	1341.852	1341.921	1341.982	1342.092
320	1341.020	1341.085	1341.151	1341.216	1341.266	1341.309	1341.348	1341.383	1341.430	1341.500	1341.562	1341.617	1341.717
330	1340.730	1340.788	1340.847	1340.905	1340.951	1340.990	1341.025	1341.057	1341.100	1341.165	1341.221	1341.273	1341.364
340	1340.440	1340.492	1340.545	1340.597	1340.639	1340.675	1340.707	1340.736	1340.775	1340.834	1340.886	1340.934	1341.019
350	1340.150	1340.193	1340.233	1340.273	1340.308	1340.340	1340.367	1340.392	1340.427	1340.478	1340.525	1340.570	1340.648
360	1339.528	1339.572	1339.633	1339.658	1339.694	1339.726	1339.754	1339.781	1339.817	1339.873	1339.923	1339.969	1340.053
370	1338.906	1338.956	1338.986	1339.049	1339.090	1339.124	1339.157	1339.187	1339.229	1339.293	1339.351	1339.402	1339.499
380	1338.284	1338.349	1338.424	1338.492	1338.553	1338.598	1338.647	1338.691	1338.753	1338.844	1338.925	1338.991	1339.118
390	1337.662	1338.144	1338.254	1338.369	1338.458	1338.537	1338.601	1338.659	1338.735	1338.844	1338.938	1339.027	1339.168
400	1337.040	1338.151	1338.275	1338.396	1338.488	1338.574	1338.641	1338.700	1338.780	1338.893	1338.991	1339.085	1339.235
410	1337.242	1338.151	1338.275	1338.396	1338.489	1338.575	1338.642	1338.702	1338.783	1338.898	1338.997	1339.091	1339.244
420	1337.444	1338.151	1338.275	1338.395	1338.486	1338.570	1338.636	1338.695	1338.774	1338.887	1338.983	1339.075	1339.224
430	1337.646	1338.151	1338.274	1338.391	1338.480	1338.562	1338.626	1338.683	1338.759	1338.868	1338.961	1339.050	1339.193
440	1337.848	1338.150	1338.270	1338.380	1338.464	1338.542	1338.602	1338.656	1338.727	1338.829	1338.916	1339.000	1339.135
450	1338.050	1338.143	1338.243	1338.334	1338.405	1338.472	1338.524	1338.570	1338.631	1338.720	1338.797	1338.873	1338.993
460	1337.528	1337.606	1337.686	1337.761	1337.821	1337.874	1337.919	1337.960	1338.015	1338.097	1338.168	1338.234	1338.347
470	1337.006	1337.076	1337.148	1337.217	1337.272	1337.320	1337.362	1337.400	1337.452	1337.529	1337.598	1337.660	1337.770
480	1336.484	1336.548	1336.614	1336.681	1336.732	1336.775	1336.815	1336.851	1336.901	1336.975	1337.042	1337.102	1337.210
490	1335.962	1336.025	1336.087	1336.192	1336.224	1336.248	1336.281	1336.315	1336.363	1336.436	1336.503	1336.559	1336.668
500	1335.440	1335.616	1335.655	1336.058	1335.982	1335.887	1335.864	1335.884	1335.919	1335.998	1336.072	1336.116	1336.232

Coordinates X=O: E 388439.011, N 6260729.132

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Table A2.7. Hydraulic Axes - El Volcán River

		Flow [m3/s]											
Distance	top	2.5	4	5	6	7	8	9.5	12	15	20	30	6
X=	Bottom												
0	1633.670	1633.907	1633.982	1634.025	1634.065	1634.102	1634.137	1634.186	1634.260	1634.339	1634.457	1634.654	1
10	1633.474	1633.709	1633.784	1633.827	1633.866	1633.903	1633.937	1633.985	1634.058	1634.137	1634.252	1634.447	1
20	1633.278	1633.512	1633.586	1633.629	1633.668	1633.705	1633.739	1633.786	1633.859	1633.937	1634.051	1634.243	1
30	1633.082	1633.315	1633.390	1633.432	1633.472	1633.508	1633.542	1633.590	1633.662	1633.739	1633.854	1634.044	1
40	1632.886	1633.122	1633.197	1633.240	1633.280	1633.317	1633.351	1633.399	1633.472	1633.550	1633.665	1633.856	1
50	1632.690	1632.945	1633.024	1633.069	1633.109	1633.147	1633.182	1633.231	1633.305	1633.384	1633.500	1633.692	1
60	1632.580	1632.834	1632.911	1632.956	1632.996	1633.034	1633.068	1633.117	1633.190	1633.269	1633.385	1633.578	1
70	1632.470	1632.715	1632.790	1632.834	1632.873	1632.909	1632.943	1632.991	1633.063	1633.140	1633.254	1633.446	1
80	1632.360	1632.595	1632.668	1632.710	1632.748	1632.783	1632.816	1632.863	1632.933	1633.008	1633.120	1633.308	1
90	1632.250	1632.474	1632.544	1632.584	1632.620	1632.654	1632.686	1632.731	1632.799	1632.873	1632.982	1633.168	1
100	1632.140	1632.343	1632.409	1632.447	1632.482	1632.515	1632.546	1632.590	1632.657	1632.729	1632.837	1633.021	1
110	1631.960	1632.166	1632.234	1632.273	1632.309	1632.343	1632.375	1632.419	1632.488	1632.562	1632.672	1632.859	1
120	1631.780	1631.993	1632.063	1632.103	1632.140	1632.175	1632.208	1632.253	1632.323	1632.399	1632.511	1632.701	1
130	1631.600	1631.821	1631.893	1631.935	1631.973	1632.008	1632.042	1632.088	1632.160	1632.236	1632.350	1632.541	1
140	1631.420	1631.650	1631.723	1631.766	1631.805	1631.841	1631.875	1631.922	1631.994	1632.072	1632.186	1632.378	1
150	1631.240	1631.474	1631.549	1631.592	1631.631	1631.668	1631.702	1631.749	1631.822	1631.900	1632.014	1632.206	1
160	1631.048	1631.282	1631.356	1631.398	1631.437	1631.474	1631.508	1631.555	1631.627	1631.705	1631.819	1632.012	1
170	1630.856	1631.091	1631.165	1631.208	1631.248	1631.284	1631.318	1631.366	1631.439	1631.517	1631.632	1631.825	1
180	1630.664	1630.901	1630.976	1631.020	1631.060	1631.097	1631.131	1631.180	1631.253	1631.332	1631.448	1631.643	1
190	1630.472	1630.714	1630.791	1630.836	1630.877	1630.914	1630.950	1630.999	1631.073	1631.153	1631.271	1631.467	1
200	1630.280	1630.543	1630.623	1630.669	1630.711	1630.750	1630.786	1630.836	1630.911	1630.991	1631.109	1631.304	1
210	1630.168	1630.429	1630.508	1630.553	1630.594	1630.631	1630.666	1630.715	1630.788	1630.866	1630.979	1631.167	1
220	1630.056	1630.308	1630.385	1630.429	1630.468	1630.505	1630.539	1630.586	1630.657	1630.733	1630.844	1631.027	1
230	1629.944	1630.187	1630.261	1630.303	1630.341	1630.376	1630.409	1630.455	1630.524	1630.598	1630.706	1630.885	1
240	1629.832	1630.062	1630.132	1630.172	1630.209	1630.243	1630.274	1630.318	1630.384	1630.456	1630.561	1630.737	1
250	1629.720	1629.922	1629.987	1630.024	1630.059	1630.091	1630.121	1630.163	1630.227	1630.296	1630.399	1630.574	1
260	1629.500	1629.701	1629.766	1629.804	1629.839	1629.872	1629.902	1629.945	1630.011	1630.083	1630.189	1630.372	1
270	1629.280	1629.486	1629.553	1629.592	1629.628	1629.661	1629.693	1629.737	1629.805	1629.879	1629.990	1630.180	1
280	1629.060	1629.272	1629.342	1629.382	1629.419	1629.454	1629.486	1629.532	1629.603	1629.680	1629.795	1629.992	1
290	1628.840	1629.060	1629.133	1629.175	1629.214	1629.250	1629.284	1629.332	1629.406	1629.486	1629.605	1629.808	1
300	1628.620	1628.857	1628.934	1628.978	1629.019	1629.057	1629.093	1629.143	1629.219	1629.301	1629.422	1629.626	1
310	1628.444	1628.693	1628.772	1628.817	1628.858	1628.896	1628.932	1628.981	1629.055	1629.134	1629.249	1629.438	1
320	1628.268	1628.526	1628.606	1628.652	1628.694	1628.732	1628.767	1628.817	1628.890	1628.968	1629.081	1629.264	1
330	1628.092	1628.359	1628.441	1628.487	1628.529	1628.567	1628.603	1628.652	1628.726	1628.803	1628.915	1629.096	1
340	1627.916	1628.193	1628.276	1628.323	1628.365	1628.404	1628.440	1628.489	1628.563	1628.641	1628.754	1628.937	1
350	1627.740	1628.028	1628.113	1628.161	1628.204	1628.244	1628.280	1628.331	1628.407	1628.488	1628.604	1628.797	1
360	1627.574	1627.868	1627.956	1628.006	1628.052	1628.093	1628.132	1628.186	1628.267	1628.354	1628.481	1628.692	1
370	1627.408	1627.707	1627.798	1627.849	1627.896	1627.939	1627.980	1628.036	1628.120	1628.211	1628.343	1628.566	1
380	1627.242	1627.545	1627.638	1627.691	1627.739	1627.784	1627.825	1627.883	1627.970	1628.063	1628.199	1628.429	1
390	1627.076	1627.383	1627.477	1627.530	1627.579	1627.623	1627.665	1627.724	1627.812	1627.906	1628.044	1628.277	1
400	1626.910	1627.213	1627.305	1627.357	1627.404	1627.448	1627.489	1627.545	1627.631	1627.724	1627.859	1628.087	1
410	1626.754	1627.018	1627.098	1627.144	1627.186	1627.224	1627.261	1627.311	1627.388	1627.470	1627.593	1627.802	1
420	1626.598	1626.839	1626.912	1626.954	1626.993	1627.028	1627.061	1627.108	1627.179	1627.255	1627.369	1627.564	1
430	1626.442	1626.664	1626.733	1626.772	1626.809	1626.842	1626.873	1626.917	1626.984	1627.057	1627.165	1627.349	1
440	1626.286	1626.493	1626.559	1626.596	1626.631	1626.663	1626.694	1626.736	1626.801	1626.871	1626.976	1627.153	1
450	1626.130	1626.326	1626.390	1626.428	1626.463	1626.495	1626.526	1626.569	1626.635	1626.706	1626.811	1626.986	1
460	1625.950	1626.164	1626.235	1626.277	1626.315	1626.351	1626.385	1626.432	1626.503	1626.579	1626.689	1626.866	1
470	1625.770	1626.007	1626.083	1626.127	1626.169	1626.207	1626.243	1626.293	1626.367	1626.445	1626.556	1626.728	1
480	1625.590	1625.869	1625.944	1625.991	1626.035	1626.075	1626.114	1626.166	1626.240	1626.318	1626.426	1626.587	1
490	1625.4 10	1625.777	1625.837	1625.882	1625.927	1625.969	1626.009	1626.062	1626.133	1626.210	1626.311	1626.449	1
500	1625.230	1625.747	1625.780	1625.816	1625.859	1625.901	1625.942	1625.993	1626.059	1626.133	1626.223	1626.323	1

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Table A2.8. Hydraulic Axes Maipo Rivera at Las Melosas

		Flow [m3/s]											
Distance	Top Bottom	6	10	14	18	22	30	40	50	70	100	200	300
X=													
0	1433.510	1433.727	1433.804	1433.868	1433.925	1433.977	1434.070	1434.171	1434.262	1434.422	1434.625	1435.146	1435.546
10	1433.298	1433.508	1433.582	1433.644	1433.699	1433.749	1433.838	1433.936	1434.023	1434.176	1434.371	1434.868	1435.248
20	1433.086	1433.291	1433.363	1433.424	1433.478	1433.527	1433.615	1433.711	1433.796	1433.946	1434.136	1434.613	1434.975
30	1432.874	1433.076	1433.149	1433.211	1433.267	1433.317	1433.407	1433.506	1433.593	1433.744	1433.933	1434.394	1434.734
40	1432.662	1432.882	1432.965	1433.035	1433.098	1433.154	1433.253	1433.361	1433.455	1433.616	1433.812	1434.267	1434.575
50	1432.450	1432.784	1432.885	1432.968	1433.039	1433.103	1433.213	1433.332	1433.435	1433.612	1433.828	1434.320	1434.618
60	1432.442	1432.795	1432.899	1432.984	1433.057	1433.123	1433.238	1433.363	1433.474	1433.665	1433.906	1434.493	1434.886
70	1432.434	1432.765	1432.863	1432.944	1433.014	1433.077	1433.189	1433.310	1433.418	1433.606	1433.847	1434.459	1434.912
80	1432.426	1432.730	1432.823	1432.899	1432.965	1433.025	1433.131	1433.247	1433.350	1433.532	1433.765	1434.368	1434.832
90	1432.4 18	1432.685	1432.769	1432.840	1432.901	1432.957	1433.056	1433.166	1433.264	1433.437	1433.661	1434.247	1434.706
100	1432.410	1432.611	1432.685	1432.747	1432.803	1432.853	1432.945	1433.046	1433.138	1433.302	1433.516	1434.082	1434.529
110	1432.212	1432.402	1432.471	1432.529	1432.582	1432.630	1432.717	1432.814	1432.902	1433.060	1433.268	1433.821	1434.258
120	1432.014	1432.205	1432.274	1432.332	1432.384	1432.432	1432.519	1432.616	1432.704	1432.862	1433.070	1433.624	1434.057
130	1431.816	1432.009	1432.079	1432.139	1432.192	1432.241	1432.330	1432.430	1432.521	1432.685	1432.901	1433.471	1433.908
140	1431.618	1431.816	1431.889	1431.951	1432.007	1432.059	1432.154	1432.262	1432.360	1432.537	1432.769	1433.369	1433.818
150	1431.420	1431.636	1431.716	1431.786	1431.849	1431.907	1432.014	1432.134	1432.244	1432.441	1432.693	1433.328	1433.793
160	1431.274	1431.515	1431.606	1431.685	1431.756	1431.822	1431.942	1432.075	1432.195	1432.407	1432.674	1433.335	1433.817
170	1431.128	1431.390	1431.489	1431.574	1431.650	1431.721	1431.847	1431.985	1432.109	1432.324	1432.594	1433.259	1433.748
180	1430.982	1431.267	1431.373	1431.464	1431.543	1431.616	1431.745	1431.886	1432.010	1432.224	1432.492	1433.152	1433.640
190	1430.836	1431.146	1431.256	1431.349	1431.430	1431.503	1431.632	1431.771	1431.893	1432.104	1432.367	1433.018	1433.503
200	1430.690	1431.014	1431.123	1431.214	1431.292	1431.363	1431.487	1431.620	1431.738	1431.942	1432.197	1432.837	1433.323
210	1430.552	1430.835	1430.929	1431.008	1431.077	1431.139	1431.250	1431.371	1431.479	1431.670	1431.914	1432.551	1433.055
220	1430.4 14	1430.674	1430.761	1430.834	1430.897	1430.954	1431.056	1431.169	1431.269	1431.448	1431.680	1432.300	1432.810
230	1430.276	1430.518	1430.600	1430.667	1430.727	1430.781	1430.876	1430.982	1431.076	1431.244	1431.464	1432.065	1432.575
240	1430.138	1430.362	1430.438	1430.502	1430.557	1430.608	1430.698	1430.798	1430.887	1431.047	1431.256	1431.836	1432.344
250	1430.000	1430.193	1430.263	1430.321	1430.374	1430.421	1430.507	1430.602	1430.687	1430.841	1431.043	1431.608	1432.120
260	1429.742	1429.933	1430.002	1430.061	1430.113	1430.161	1430.248	1430.345	1430.432	1430.589	1430.795	1431.369	1431.907
270	1429.484	1429.678	1429.748	1429.808	1429.861	1429.910	1429.998	1430.096	1430.185	1430.344	1430.555	1431.161	1431.776
280	1429.226	1429.424	1429.495	1429.556	1429.610	1429.660	1429.749	1429.849	1429.940	1430.104	1430.325	1431.008	1431.756
290	1428.968	1429.170	1429.242	1429.304	1429.359	1429.410	1429.502	1429.604	1429.699	1429.872	1430.117	1430.950	1431.828
300	1428.710	1428.911	1428.985	1429.047	1429.104	1429.156	1429.252	1429.361	1429.465	1429.663	1429.963	1430.992	1431.913
310	1428.398	1428.612	1428.692	1428.759	1428.821	1428.880	1428.991	1429.122	1429.254	1429.514	1429.912	1431.063	1431.968
320	1428.086	1428.331	1428.418	1428.484	1428.559	1428.631	1428.773	1428.947	1429.124	1429.455	1429.910	1431.052	1431.934
330	1427.774	1428.147	1428.227	1428.251	1428.355	1428.460	1428.655	1428.880	1429.093	1429.450	1429.902	1431.012	1431.877
340	1427.462	1428.161	1428.217	1428.143	1428.288	1428.422	1428.645	1428.880	1429.092	1429.437	1429.873	1430.950	1431.796
350	1427.150	1428.169	1428.234	1428.157	1428.302	1428.433	1428.646	1428.870	1429.074	1429.404	1429.824	1430.859	1431.677
360	1427.150	1428.169	1428.231	1428.157	1428.296	1428.422	1428.627	1428.842	1429.037	1429.351	1429.747	1430.716	1431.487
370	1427.150	1428.163	1428.217	1428.118	1428.255	1428.379	1428.580	1428.790	1428.982	1429.287	1429.673	1430.610	1431.362
380	1427.150	1428.157	1428.204	1428.077	1428.212	1428.334	1428.529	1428.732	1428.920	1429.213	1429.587	1430.489	1431.227
390	1427.150	1428.152	1428.190	1428.028	1428.160	1428.281	1428.469	1428.664	1428.847	1429.126	1429.483	1430.339	1431.062
400	1427.150	1428.146	1428.175	1427.965	1428.095	1428.215	1428.395	1428.580	1428.757	1429.016	1429.351	1430.137	1430.840

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Table A2.9. Hydraulic Axes Maipo River at San José

		Flow [m3/s]										
Distance	Top Bottom	2	10	18	25	30	50	65	80	100	200	450
X=												
0	771.700	771.891	772.104	772.235	772.327	772.384	772.577	772.696	772.802	772.929	773.425	774.264
10	771.710	771.879	772.081	772.206	772.294	772.349	772.534	772.649	772.752	772.875	773.356	774.173
20	771.720	771.863	772.049	772.167	772.250	772.302	772.478	772.588	772.686	772.803	773.267	774.061
30	771.730	771.836	772.004	772.113	772.190	772.239	772.404	772.508	772.601	772.713	773.156	773.923
40	771.663	771.764	771.920	772.021	772.093	772.139	772.294	772.392	772.479	772.584	773.004	773.738
50	771.597	771.693	771.838	771.932	772.000	772.043	772.188	772.280	772.362	772.461	772.860	773.563
60	771.530	771.609	771.737	771.822	771.883	771.922	772.054	772.139	772.215	772.308	772.682	773.354
70	771.393	771.467	771.586	771.664	771.721	771.757	771.883	771.963	772.035	772.124	772.489	773.159
80	771.257	771.328	771.439	771.513	771.567	771.602	771.723	771.802	771.875	771.964	772.340	773.049
90	771.120	771.180	771.280	771.349	771.401	771.435	771.558	771.640	771.716	771.812	772.224	773.008
100	770.883	770.942	771.046	771.123	771.184	771.224	771.372	771.472	771.564	771.677	772.149	773.010
110	770.647	770.742	770.897	771.010	771.094	771.147	771.329	771.444	771.548	771.673	772.176	773.074
120	770.4 10	770.708	770.888	771.007	771.090	771.144	771.324	771.438	771.540	771.664	772.164	773.056
130	770.477	770.710	770.890	771.007	771.090	771.143	771.321	771.434	771.536	771.659	772.153	773.037
140	770.543	770.706	770.873	770.983	771.060	771.109	771.277	771.383	771.479	771.595	772.066	772.916
150	770.610	770.692	770.833	770.929	770.997	771.041	771.193	771.290	771.377	771.484	771.920	772.720
160	770.450	770.526	770.648	770.729	770.789	770.828	770.960	771.045	771.121	771.215	771.603	772.336
170	770.290	770.364	770.481	770.561	770.619	770.657	770.785	770.867	770.941	771.032	771.411	772.149
180	770.130	770.206	770.326	770.406	770.464	770.502	770.631	770.714	770.790	770.883	771.280	772.077
190	770.013	770.088	770.206	770.287	770.345	770.383	770.514	770.599	770.678	770.777	771.207	772.079
200	769.897	769.969	770.085	770.164	770.223	770.261	770.396	770.486	770.570	770.676	771.145	772.079
210	769.780	769.848	769.963	770.043	770.104	770.144	770.289	770.387	770.480	770.596	771.104	772.080
220	769.607	769.677	769.796	769.882	769.949	769.993	770.154	770.262	770.363	770.489	771.022	772.013
230	769.433	769.511	769.649	769.751	769.829	769.881	770.061	770.179	770.287	770.420	770.967	771.963
240	769.260	769.382	769.559	769.678	769.764	769.819	770.009	770.130	770.240	770.374	770.923	771.917
250	769.233	769.358	769.539	769.657	769.741	769.795	769.981	770.100	770.209	770.342	770.885	771.871
260	769.207	769.321	769.488	769.598	769.677	769.729	769.907	770.022	770.128	770.257	770.790	771.763
270	769.180	769.269	769.419	769.522	769.598	769.647	769.820	769.933	770.037	770.165	770.693	771.655
280	769.057	769.145	769.290	769.392	769.468	769.518	769.693	769.808	769.913	770.042	770.571	771.527
290	768.933	769.023	769.174	769.281	769.362	769.414	769.598	769.717	769.825	769.956	770.489	771.436
300	768.810	768.911	769.075	769.190	769.276	769.331	769.522	769.643	769.753	769.886	770.417	771.352
310	768.733	768.836	769.008	769.128	769.216	769.272	769.464	769.586	769.696	769.828	770.353	771.269
320	768.657	768.762	768.939	769.061	769.150	769.207	769.399	769.520	769.629	769.760	770.279	771.182
330	768.580	768.690	768.875	768.999	769.089	769.145	769.336	769.456	769.563	769.692	770.202	771.092
340	768.513	768.629	768.821	768.945	769.034	769.090	769.277	769.394	769.499	769.625	770.125	770.997
350	768.447	768.578	768.772	768.894	768.980	769.035	769.216	769.330	769.432	769.554	770.038	770.889
360	768.380	768.543	768.732	768.849	768.931	768.983	769.156	769.265	769.362	769.479	769.944	770.766
370	768.383	768.529	768.707	768.818	768.896	768.945	769.111	769.216	769.309	769.422	769.876	770.687
380	768.387	768.507	768.664	768.764	768.835	768.881	769.035	769.132	769.221	769.328	769.764	770.561
390	768.390	768.463	768.590	768.676	768.739	768.779	768.918	769.008	769.090	769.190	769.606	770.393
400	768.177	768.247	768.362	768.440	768.498	768.536	768.668	768.754	768.834	768.932	769.346	770.153
410	767.963	768.035	768.152	768.236	768.297	768.337	768.478	768.570	768.656	768.761	769.207	770.077
420	767.750	767.831	767.963	768.051	768.118	768.161	768.313	768.413	768.504	768.616	769.087	769.986
430	767.610	767.694	767.831	767.929	767.999	768.045	768.204	768.307	768.401	768.516	768.995	769.894
440	767.470	767.556	767.700	767.796	767.868	767.914	768.075	768.178	768.272	768.387	768.860	769.738
450	767.330	767.420	767.565	767.664	767.735	767.781	767.938	768.039	768.130	768.242	768.695	769.528
460	767.207	767.296	767.437	767.530	767.598	767.641	767.788	767.882	767.967	768.069	768.483	769.225
470	767.083	767.168	767.301	767.389	767.452	767.492	767.630	767.718	767.798	767.894	768.283	768.975
480	766.960	767.027	767.130	767.212	767.267	767.303	767.427	767.507	767.580	767.669	768.031	768.682
490	766.577	766.698	766.800	766.818	766.865	766.898	767.013	767.088	767.157	767.240	767.576	768.183
500	766.193	766.688	766.601	766.559	766.569	766.595	766.707	766.787	766.857	766.940	767.248	767.812

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Table A2.10. Hydraulic Axes Maipo River at Las Vertientes (Left Channel)

		Flow [m3/s]											
Distance	top	20	30	40	50	60	80	100	200	300	400	500	600
X=	bottom												
0	769.830	770.330	770.440	770.533	770.615	770.689	770.820	770.934	771.375	771.704	771.973	772.202	772.403
10	769.830	770.322	770.432	770.524	770.605	770.678	770.807	770.921	771.358	771.683	771.949	772.175	772.373
20	769.840	770.310	770.416	770.506	770.586	770.657	770.785	770.897	771.332	771.662	771.937	772.176	772.390
30	769.840	770.290	770.394	770.481	770.559	770.629	770.753	770.863	771.297	771.632	771.915	772.166	772.394
40	769.840	770.263	770.363	770.448	770.523	770.591	770.713	770.821	771.255	771.598	771.892	772.155	772.396
50	769.830	770.237	770.334	770.416	770.489	770.556	770.675	770.782	771.211	771.553	771.848	772.112	772.355
60	769.830	770.208	770.302	770.382	770.453	770.518	770.636	770.741	771.166	771.507	771.803	772.069	772.313
70	769.810	770.166	770.256	770.334	770.404	770.467	770.582	770.686	771.109	771.451	771.748	772.016	772.262
80	769.780	770.121	770.208	770.283	770.351	770.414	770.528	770.630	771.054	771.398	771.699	771.969	772.218
90	769.760	770.069	770.153	770.227	770.294	770.356	770.469	770.572	770.999	771.349	771.653	771.928	772.179
100	769.680	769.984	770.068	770.143	770.211	770.274	770.389	770.494	770.931	771.289	771.600	771.878	772.133
110	769.610	769.914	769.999	770.074	770.142	770.206	770.321	770.427	770.865	771.220	771.528	771.803	772.054
120	769.530	769.836	769.922	769.997	770.065	770.129	770.245	770.349	770.782	771.129	771.429	771.696	771.939
130	769.450	769.761	769.847	769.922	769.990	770.053	770.168	770.270	770.689	771.022	771.306	771.558	771.787
140	769.380	769.692	769.779	769.855	769.924	769.987	770.102	770.205	770.621	770.948	771.227	771.473	771.695
150	769.300	769.615	769.704	769.782	769.851	769.915	770.031	770.135	770.551	770.875	771.150	771.393	771.612
160	769.220	769.545	769.637	769.716	769.787	769.852	769.969	770.073	770.488	770.810	771.083	771.323	771.539
170	769.140	769.485	769.579	769.659	769.731	769.797	769.914	770.018	770.431	770.750	771.020	771.257	771.470
180	769.060	769.440	769.535	769.615	769.687	769.752	769.868	769.971	770.379	770.694	770.959	771.192	771.403
190	769.040	769.413	769.505	769.583	769.653	769.717	769.830	769.931	770.331	770.640	770.900	771.128	771.334
200	769.010	769.360	769.447	769.522	769.589	769.651	769.760	769.858	770.248	770.551	770.807	771.032	771.234
210	768.990	769.293	769.375	769.446	769.509	769.568	769.673	769.767	770.144	770.439	770.690	770.910	771.110
220	768.880	769.161	769.238	769.304	769.365	769.420	769.520	769.610	769.973	770.259	770.503	770.719	770.914
230	768.770	769.046	769.121	769.186	769.245	769.298	769.396	769.483	769.839	770.120	770.360	770.573	770.765
240	768.660	768.932	769.007	769.071	769.129	769.183	769.280	769.367	769.723	770.005	770.246	770.460	770.653
250	768.540	768.813	768.888	768.953	769.012	769.067	769.166	769.255	769.622	769.915	770.164	770.385	770.584
260	768.420	768.694	768.770	768.837	768.897	768.954	769.057	769.152	769.543	769.857	770.124	770.360	770.573
270	768.300	768.571	768.650	768.721	768.787	768.848	768.962	769.066	769.499	769.842	770.134	770.390	770.620
280	768.150	768.435	768.527	768.612	768.689	768.762	768.895	769.015	769.494	769.863	770.173	770.444	770.689
290	767.990	768.361	768.481	768.584	768.675	768.757	768.904	769.032	769.533	769.914	770.233	770.512	770.763
300	767.840	768.377	768.502	768.607	768.700	768.783	768.931	769.061	769.568	769.954	770.278	770.562	770.817
310	767.840	768.383	768.509	768.615	768.708	768.792	768.941	769.073	769.586	769.977	770.304	770.592	770.850
320	767.840	768.368	768.492	768.596	768.688	768.772	768.920	769.050	769.559	769.947	770.272	770.557	770.814
330	767.840	768.354	768.476	768.580	768.671	768.754	768.900	769.029	769.533	769.917	770.239	770.521	770.775
340	767.840	768.339	768.460	768.562	768.652	768.734	768.879	769.007	769.505	769.885	770.204	770.482	770.733
350	767.840	768.323	768.442	768.544	768.633	768.714	768.857	768.983	769.477	769.852	770.166	770.440	770.687
360	767.840	768.305	768.423	768.524	768.612	768.692	768.834	768.959	769.446	769.816	770.125	770.395	770.637
370	767.790	768.285	768.403	768.502	768.590	768.669	768.809	768.933	769.413	769.777	770.081	770.345	770.582
380	767.750	768.275	768.392	768.490	768.577	768.655	768.795	768.917	769.393	769.754	770.055	770.317	770.551
390	767.700	768.265	768.380	768.477	768.563	768.640	768.778	768.899	769.371	769.728	770.026	770.285	770.518
400	767.690	768.258	768.372	768.468	768.553	768.629	768.765	768.885	769.352	769.706	770.001	770.258	770.488
410	767.690	768.247	768.358	768.452	768.534	768.610	768.743	768.860	769.319	769.666	769.957	770.210	770.436
420	767.680	768.234	768.342	768.433	768.513	768.586	768.716	768.830	769.277	769.617	769.901	770.148	770.369
430	767.650	768.222	768.326	768.414	768.492	768.563	768.689	768.800	769.235	769.565	769.841	770.081	770.296
440	767.620	768.214	768.316	768.403	768.480	768.550	768.674	768.783	769.212	769.539	769.812	770.049	770.261
450	767.590	768.208	768.308	768.393	768.468	768.537	768.659	768.767	769.191	769.515	769.786	770.022	770.233
460	767.670	768.202	768.300	768.383	768.457	768.525	768.645	768.751	769.171	769.492	769.761	769.996	770.207
470	767.760	768.179	768.270	768.347	768.416	768.479	768.592	768.693	769.092	769.400	769.661	769.888	770.093
480	767.840	768.123	768.202	768.270	768.331	768.387	768.489	768.580	768.945	769.232	769.476	769.689	769.883
490	767.650	767.886	767.952	768.010	768.062	768.110	768.197	768.276	768.595	768.848	769.064	769.254	769.427
500	767.460	767.692	767.753	767.807	767.856	767.900	767.980	768.053	768.342	768.573	768.774	768.945	769.103
510	767.270	767.551	767.602	767.655	767.704	767.746	767.821	767.891	768.154	768.372	768.573	768.726	768.875

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Table A2.11. Hydraulic Axes Maipo River at Las Vertientes (Right Channel)

		Flow [m3/s]											
Distance	top	20	30	40	50	60	80	100	200	300	400	500	600
X=	bottom												
0	771.700	772.399	772.560	772.695	772.813	772.918	773.102	773.261	773.834	774.210	774.472	774.658	774.797
10	771.710	772.386	772.545	772.678	772.795	772.899	773.081	773.236	773.799	774.163	774.410	774.580	774.700
20	771.720	772.354	772.507	772.636	772.748	772.849	773.025	773.177	773.733	774.104	774.362	774.540	774.660
30	771.730	772.300	772.445	772.567	772.674	772.771	772.940	773.087	773.633	774.010	774.285	774.482	774.619
40	771.663	772.183	772.317	772.430	772.531	772.621	772.782	772.923	773.458	773.842	774.135	774.358	774.520
50	771.597	772.096	772.223	772.331	772.426	772.513	772.667	772.801	773.320	773.699	773.996	774.231	774.411
60	771.530	771.992	772.113	772.216	772.308	772.391	772.539	772.669	773.171	773.542	773.838	774.079	774.271
70	771.393	771.831	771.947	772.045	772.133	772.213	772.354	772.479	772.963	773.323	773.614	773.855	774.054
80	771.257	771.683	771.794	771.889	771.973	772.050	772.186	772.306	772.771	773.119	773.402	773.640	773.840
90	771.120	771.517	771.623	771.713	771.792	771.865	771.994	772.108	772.550	772.882	773.153	773.383	773.580
100	770.883	771.247	771.343	771.424	771.496	771.561	771.676	771.777	772.170	772.465	772.708	772.916	773.096
110	770.647	771.044	771.137	771.215	771.282	771.342	771.448	771.539	771.891	772.155	772.375	772.565	772.730
120	770.4 10	771.040	771.140	771.220	771.289	771.349	771.452	771.539	771.859	772.096	772.294	772.468	772.619
130	770.477	771.114	771.239	771.344	771.435	771.517	771.660	771.783	772.237	772.561	772.815	773.030	773.215
140	770.543	771.070	771.188	771.289	771.379	771.461	771.607	771.738	772.252	772.647	772.974	773.260	773.515
150	770.610	770.998	771.103	771.194	771.277	771.352	771.489	771.613	772.117	772.521	772.869	773.182	773.468
160	770.450	770.780	770.872	770.953	771.027	771.095	771.221	771.335	771.817	772.217	772.572	772.896	773.198
170	770.290	770.602	770.688	770.764	770.833	770.897	771.016	771.124	771.589	771.985	772.341	772.671	772.978
180	770.130	770.446	770.532	770.606	770.674	770.737	770.852	770.957	771.408	771.793	772.141	772.462	772.760
190	770.013	770.347	770.436	770.513	770.582	770.646	770.761	770.865	771.294	771.648	771.961	772.245	772.507
200	769.897	770.233	770.323	770.402	770.472	770.536	770.651	770.755	771.172	771.507	771.798	772.060	772.300
210	769.780	770.103	770.192	770.270	770.339	770.403	770.518	770.621	771.030	771.353	771.629	771.875	772.099
220	769.607	769.924	770.013	770.089	770.158	770.222	770.335	770.436	770.837	771.148	771.413	771.647	771.861
230	769.433	769.766	769.858	769.936	770.007	770.071	770.184	770.285	770.677	770.976	771.229	771.453	771.657
240	769.260	769.665	769.763	769.847	769.919	769.985	770.100	770.201	770.584	770.868	771.109	771.321	771.514
250	769.233	769.667	769.770	769.856	769.932	770.001	770.121	770.225	770.616	770.898	771.129	771.332	771.517
260	769.207	769.613	769.714	769.800	769.877	769.946	770.069	770.177	770.586	770.879	771.113	771.315	771.495
270	769.180	769.533	769.628	769.710	769.785	769.852	769.974	770.082	770.499	770.803	771.044	771.247	771.428
280	769.057	769.385	769.477	769.557	769.630	769.697	769.818	769.926	770.347	770.654	770.898	771.102	771.281
290	768.933	769.265	769.361	769.446	769.523	769.594	769.722	769.836	770.276	770.594	770.842	771.047	771.224
300	768.810	769.180	769.290	769.386	769.473	769.552	769.694	769.818	770.293	770.634	770.901	771.119	771.304
310	768.733	769.152	769.275	769.381	769.476	769.561	769.713	769.846	770.353	770.724	771.021	771.270	771.485
320	768.657	769.106	769.234	769.344	769.440	769.527	769.682	769.816	770.334	770.720	771.036	771.308	771.551
330	768.580	769.062	769.193	769.303	769.400	769.487	769.642	769.776	770.296	770.688	771.013	771.298	771.556
340	768.513	769.024	769.155	769.265	769.361	769.448	769.601	769.736	770.256	770.651	770.981	771.274	771.541
350	768.447	768.984	769.113	769.221	769.316	769.402	769.554	769.687	770.207	770.605	770.942	771.241	771.516
360	768.380	768.944	769.069	769.174	769.267	769.351	769.501	769.633	770.152	770.556	770.899	771.205	771.488
370	768.383	768.903	769.022	769.123	769.212	769.294	769.440	769.570	770.092	770.503	770.854	771.169	771.460
380	768.387	768.844	768.954	769.048	769.132	769.210	769.349	769.474	769.980	770.384	770.733	771.047	771.337
390	768.390	768.746	768.843	768.929	769.005	769.076	769.205	769.322	769.803	770.194	770.535	770.845	771.134
400	768.177	768.482	768.567	768.643	768.712	768.776	768.893	769.001	769.456	769.836	770.175	770.488	770.782
410	767.963	768.250	768.330	768.400	768.464	768.524	768.634	768.736	769.171	769.545	769.885	770.201	770.500
420	767.750	768.044	768.123	768.191	768.254	768.312	768.418	768.516	768.939	769.306	769.641	769.954	770.249
430	767.610	767.930	768.012	768.083	768.148	768.207	768.314	768.412	768.818	769.158	769.464	769.744	770.005
440	767.470	767.815	767.891	767.962	768.027	768.088	768.197	768.295	768.694	769.017	769.302	769.561	769.800
450	767.330	767.737	767.786	767.847	767.908	767.967	768.077	768.175	768.571	768.883	769.154	769.398	769.622
460	767.207	767.723	767.727	767.761	767.808	767.860	767.966	768.064	768.459	768.765	769.026	769.259	769.471
470	767.083	767.726	767.707	767.702	767.716	767.750	767.840	767.932	768.325	768.629	768.884	769.110	769.314
480	766.960	767.728	767.710	767.685	767.654	767.646	767.687	767.759	768.143	768.447	768.701	768.923	769.124
490	766.577	767.729	767.714	767.688	767.633	767.564	767.463	767.437	767.782	768.098	768.362	768.593	768.800
500	766.193	767.737	767.733	767.727	767.708	767.681	767.575	767.371	767.471	767.788	768.059	768.296	768.508
510	765.810	767.739	767.737	767.735	767.722	767.709	767.679	767.577	767.273	767.549	767.819	768.060	768.276

Coordinates X=O: E 363981.89, N 6282179.00

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ANNEX 3

BOTTOM SOLIDS VOLUME FOR DIFFERENT SURPLUS PROBABILITIES

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Expected bottom solids volume without Project Maipo River at Las Melosas.

Figure A3.1 Surplus Probability of the expected bottom solids volume.

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Maipo River at Las Melosas.

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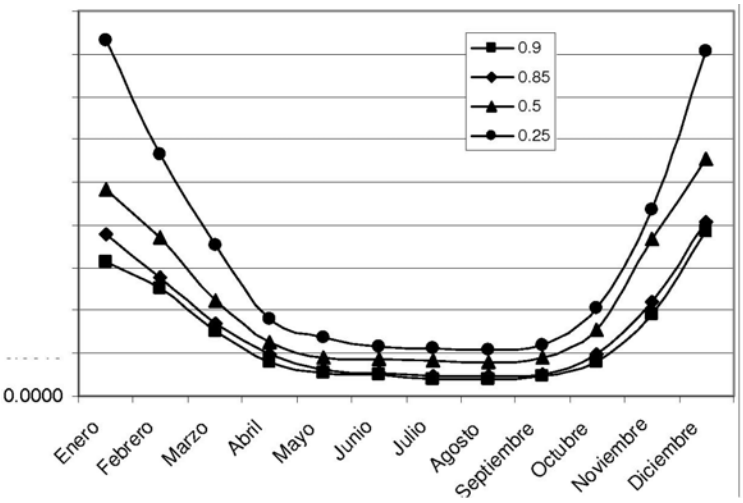
Expected solids volume at the bottom without Project El Volcán River



Expected solids volume at the bottom with Project El Volcán River

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Figure A3.2 Surplus Probability of the expected bottom solids volume.

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Expected solids volume at the bottom without Project El Yeso River

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Figure A3.3 Surplus Probability of the expected bottom solids volume. El Yeso River

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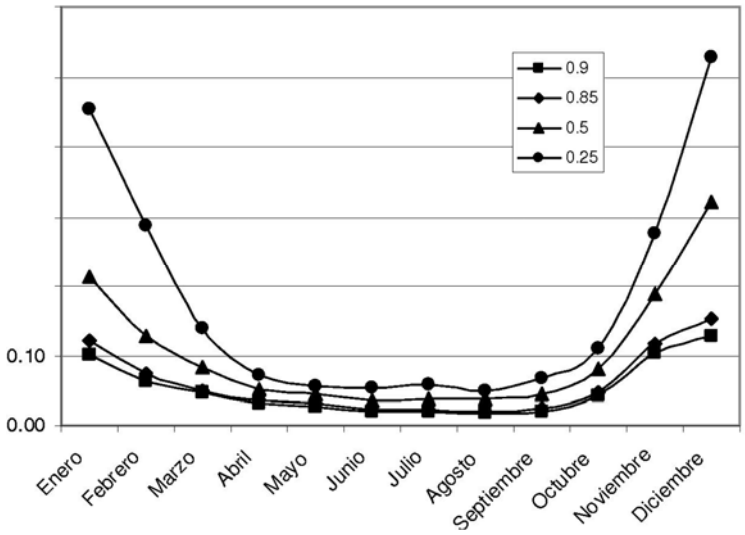
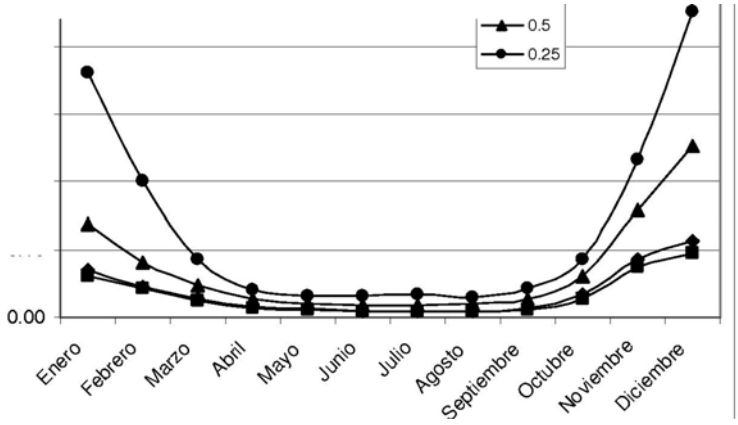
Expected solids volume at the bottom without Project. Maipo River at San José



Expected solids volume at the bottom with Project Maipo River at San José



. Figure A3.A Surplus Probability of the expected bottom solids volume. Maipo River at San José.

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Expected solids volume at the bottom without Project Colorado River

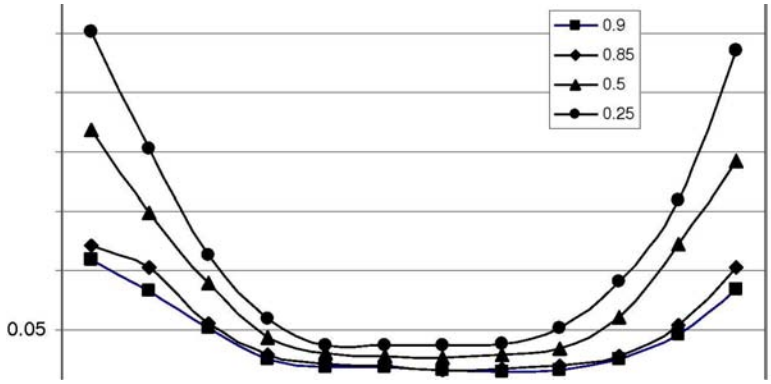

Figure A3.5 Surplus Probability of the expected bottom solids volume. Colorado River.

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Expected solids volume at the bottom without Project. Maipo River at Las Vertientes

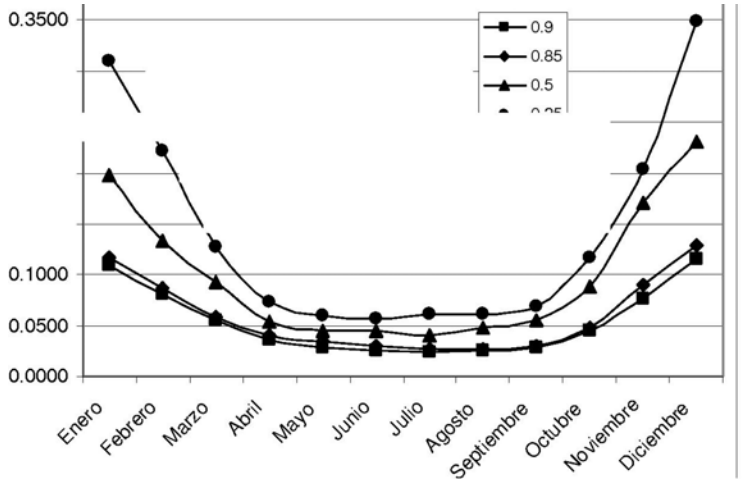

Figure A3.6 Surplus Probability of the expected bottom solids volume. Maipo River at Las Vertientes.

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Expected solids volume at the bottom with Project. Colina Stream

Figure A3.7 Surplus Probability of the expected bottom solids volume. Colina Stream.

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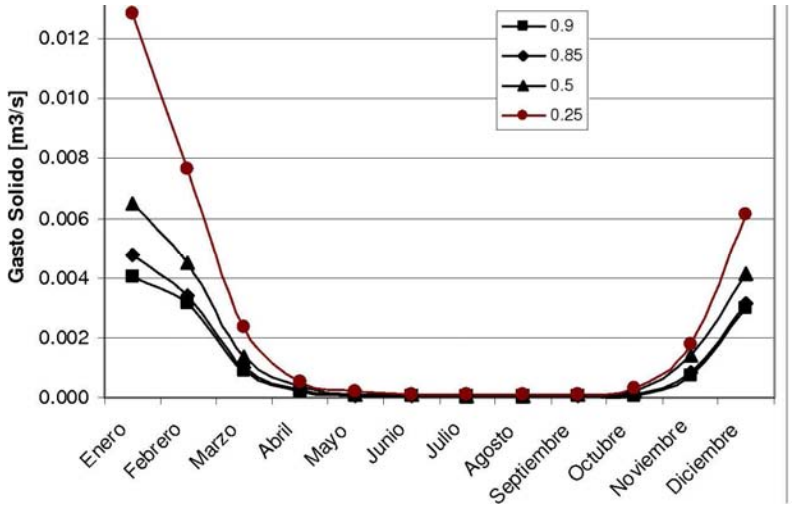
Expected solids volume at the bottom without Project. La Engorda Stream



Expected solids volume at the bottom with Project. La Engorda Stream

Figure A3.8 Surplus Probability of the expected bottom solids volume. La Engorda Stream

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Expected solids volume at the bottom with Project. El Morado Canyon

Figure A3.9 Surplus Probability of the expected bottom solids volume. El Morado Canyon

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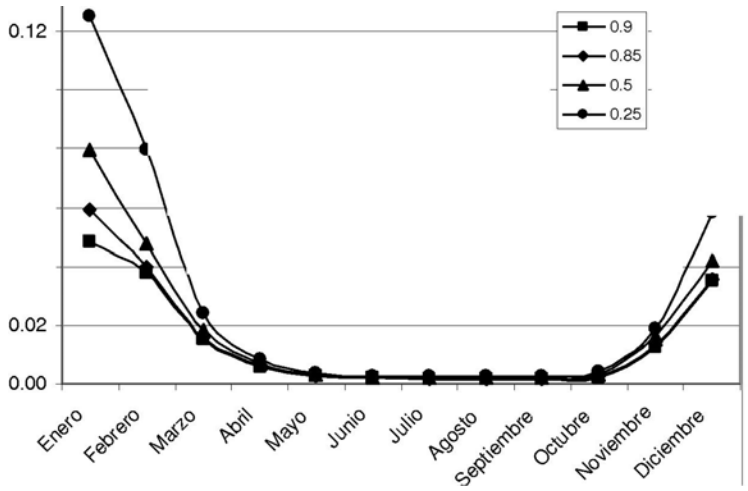
Expected solids volume at the bottom without Project. Las Placas Creek



Expected solids volume at the bottom with Project. Las Placas Creek

Figure A3.10 Surplus Probability of the expected bottom solids volume. **Las Placas Creek.**

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ANNEX 4

VOLUME OF SOLIDS IN SUSPENSION

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Maipo River at Las Melosas

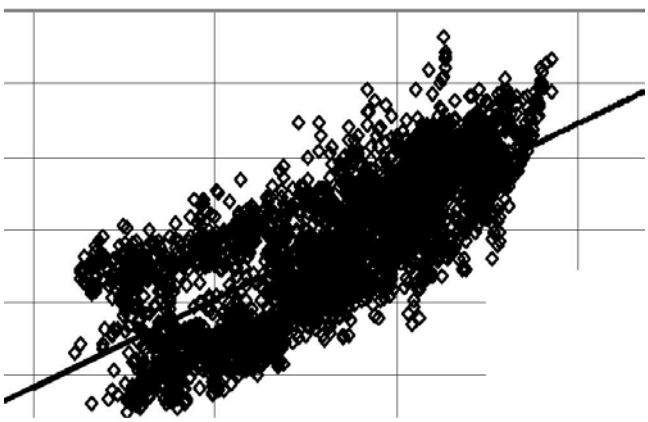
$Gss = 0.488\ Q^{1.9946}$
1.E+01
1.E+02
1.E+03
1.E+04
1.E+05
1.E+00 1.E+01 1.E+02 1.E+03
Q m3/s
Gss (kg/day)

Figure A4.1. Discharge curve of the solids in suspension.

Maipo River at Las Melosas.

Figure A4.2. Discharge curve of the solids in suspension.

Volcán River at Queltehues



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Maipo River at San Alfonso

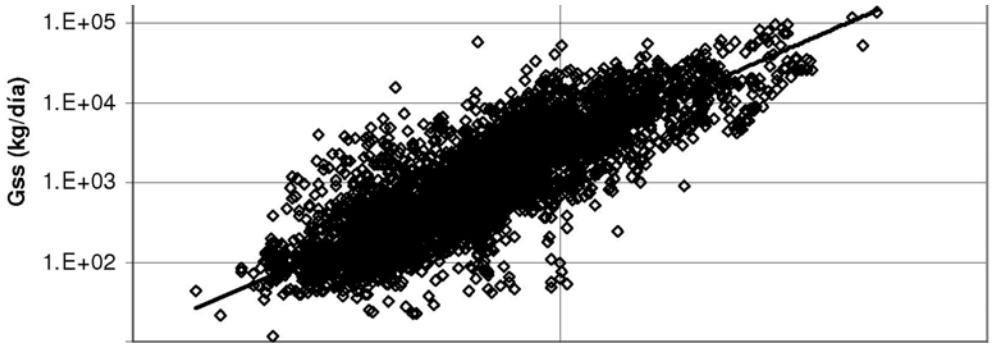

Figure A4.3. Discharge curve of the solids in suspension.

Maipo River at El Manzano

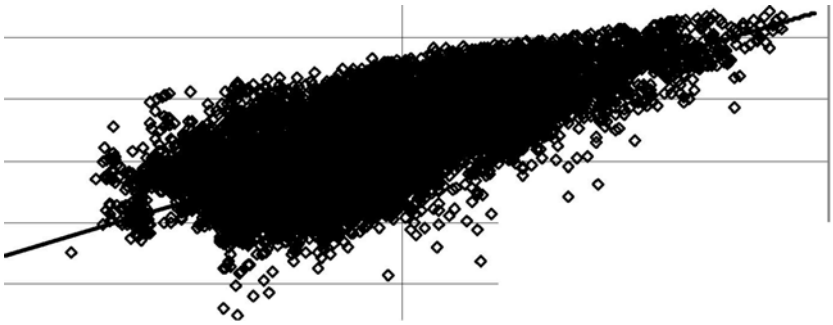

Figure A4.4. Discharge curve of the solids in suspension.

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Colorado River before confluence with Maipo River

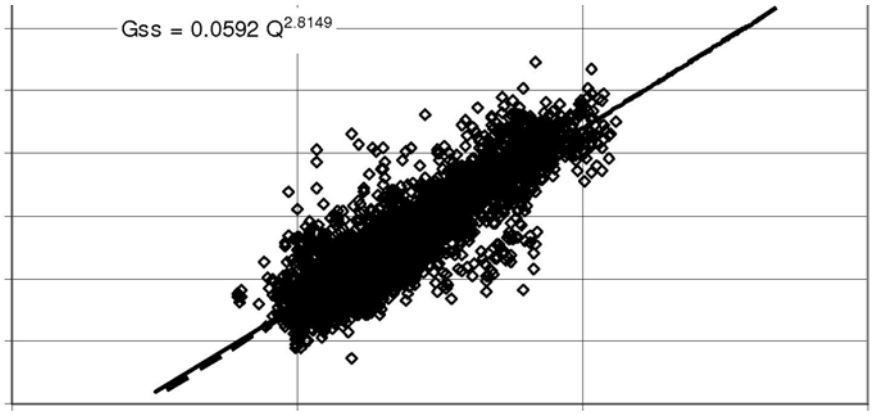

Figure A4.5. Discharge curve of the solids in suspension.

Colorado River before confluence with Maipo River

The segmented line represents the correlation obtained with the monthly averages data shown in Bzdigian (1989), Gss = 0.0483 Q2.S522.

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Figure A4.6. Solids in suspension volume surplus probability. .

Maipo River at Las Melosas.

Volcán River at Queltehues

Surplus probability(%)

Figure A4.7. Solids in suspension volume surplus probability.

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Figure A4.8. Solids in suspension volume surplus probability.

Maipo River at San Alfonso.

Maipo River at El Manzano

Surplus probability(%)

Figure A4.9. Solids in suspension volume surplus probability.

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Colorado River before confluence with Maipo River

Surplus probability(%)

Figure A4.10. Solids in suspension volume surplus probability

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