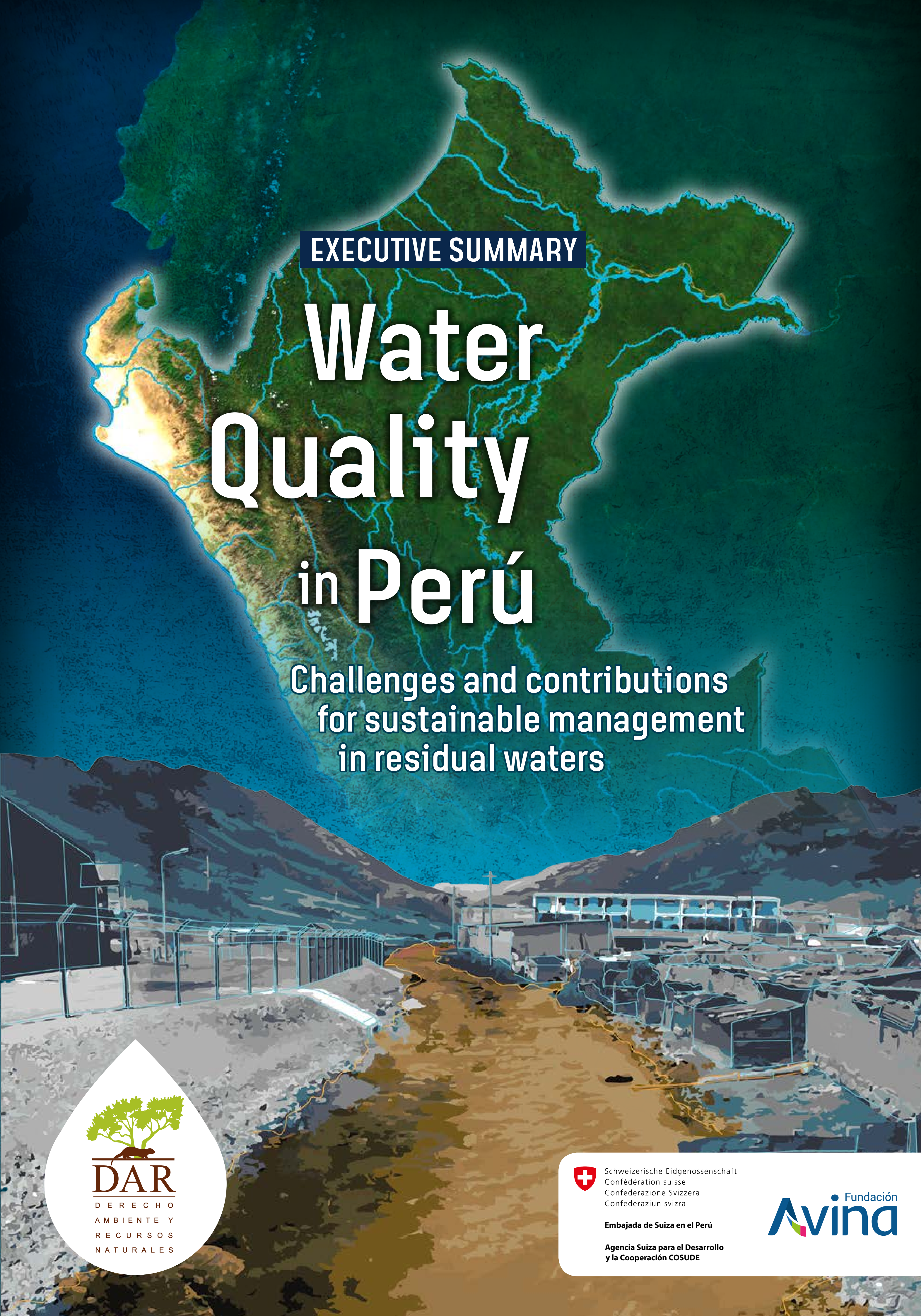

EXECUTIVE SUMMARY

Water Quality in Perú

Challenges and contributions for sustainable management in residual waters

DAR
DERECHO AMBIENTE Y RECURSOS NATURALES

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Embajada de Suiza en el Perú

Agencia Suiza para el Desarrollo y la Cooperación COSUDE

Fundación Avina

WATER QUALITY IN PERU
Challenges and contributions for sustainable management in residual waters
EXECUTIVE SUMMARY

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ABBREVIATIONS, ACRONIMS AND SYMBOLS

AAA	Water Administrative Authority
ALA	Local Water Authority
ANA	National Water Authority
AR	Residual Water(s)
ART	Treated Residual Water(s)
As	Arsenic
DARH	Administrative Directorate of Water Resources
DCPRH	Directorate of Water Resources Conservation and Planning
DEPHM	Directorate of Studies of Multisectoral Water Projects
DGCCI	Directorate of Knowledge Management and Institutional Coordination
DGCRH	Directorate of Water Resources Quality Management
DICAPI	General Directorate of Captaincies and Coastguards
DIGESA	General Directorate of Environmental Health
DREM	Regional Directorate of Energy and Mining
DUA	Water Usage Rights
ECA	Environmental Quality Standard
ECA-Agua	Environmental Quality Standards for Water
EPS	Lending Services Entities
EVAP	Environmental Preliminary Assesment
GORE	Regional Governments
IGA	Environmental Management Tools
INACAL	Quality National institute
INDECOPI	National Institute for the Defense of Free Competition and the Protection of Intellectual Property
L	Liter
LGA	Environmental General Law
LMP	Maximum Permissible Limits
LRH	Water Resources Law
MEF	Ministry of Economy and Finance
MINAGRI	Ministry of Agriculture and Irrigation
MINAM	Ministry of Environment
MINEM	Ministry of Energy and Mines
MINSA	Ministry of Health
MMC	Million cubic meters
mm	Millimeters
msnm	Meters above sea level
MVCS	Ministry of Housing, Constructiion and Sanitation

NMP	Most probable number
OEFA	Agency of Environmental Enforcement and Assesment
OMS	World Health Organization
OSINERGMIN	Supervisory Agency for Investment in Energy and Mining
PAVER	Discharge and Reuse of Residual Water Adaptation Program
PNRH	National Plan of Water Resources
PTAP	Potable Water Treatment Plan
SEDAPAL	Services of Potable Water and Sewerage of Lima
SENACE	Agency of Environmental Certification for Sustainable Investments
SENAMHI	National Meteorology and Hydrology Service
SERPAR	Park Service of Lima
SNGA	National System of Environmental Management
SNGRH	National System of Water Resources Management
SUNASS	National Superintendence of Sanitation Services
TMD	Tons of mineral per day
UH	Hydrographic Unit

NEOLOGISMS AND TECHNICALITIES

Bioabsorption	Biological absorption
Biosolid(s)	Solid organic waste
Hydrocarbon(s)/ Fossil Fuels	Related to Hydrocarbons
Nanofiltration	Tinyfiltration
Thermotolerant (s)	Heat tolerant

PRESENTATION

The Swiss Confederation, through the Global Program of the Water Initiative of Agencia Suiza para la Cooperación y Desarrollo (Swiss Agency for Cooperation and Development - COSUDE), has an important focus on the cooperation and aid to marginalized populations, relating to the access to water, the causes of poverty, inequalities and challenges linked to governance. This global program reveals the need of an effective water resources management, given that is crucial for the sustainable growth and the fight against poverty and inequalities.

Our actions respond to the global challenges which are presented in the water resources management, related to the access, supply and use of water. We influence to the local, national and overall global political dialogue through an integral management of the water resources centered to the access of potable water with emphasis in the rural areas that assure the environmental services, avoid the conflicts related to the water, that promote the dialogue about human rights, specially to overcome the gender inequalities.

For the reasons outlined we consider that the generation of knowledge, with relevant results that reflect the situation of the quality of the water in Peru is of main importance for the implementation of political policies that contribute to the recovery and protection of the water what will contribute to the traced goals by Sustainable Development (SDG) for the year 2030.

The executive summary corresponding to the technical study "Water quality in Peru, Challenges and contributions for sustainable management in residual waters" led by Derecho, Ambiente y Recursos (DAR), within the framework of the alliance COSUDE and Avina, it is a timely contribution to the efforts aimed to guarantee the water quality inasmuch as it motivates to the efficient and responsible management of residual waters. The study that constitutes in a collaboration tool for the government, public policies managers and professionals, in the implementation of the human right to water, officials and academic community in general we are pleased to be part of this effort and contribution to the institutionality and better practices of the integral water management

Martin Jaggi
Director of Cooperación Suiza COSUDE

INTRODUCTION

Peru is a highly vulnerable to the effects of the climate change with water scarcity being one of the major effects of this vulnerability. This added to the problem of the water quality that we face, makes the State face a series of challenges. If the corresponding key decisions are not taken, we will continue to be confronted with serious threats to public health, food safety, loss of ecosystems and sustainable economical development.

In this light we developed the study *"Water quality in Peru. Challenges and contributions for sustainable management in residual waters"* which describes the importance of water and residual water management, highlighting the need to improve the intersectorial coordination between competent authorities in charge of its management like National Water Authority (ANA), Ministry of Housing, Construction and Sanitation (MVCS), Ministry of Environment (MINAM). On the other hand, it provides a clear overview of the handling and control of industrial residual water discharges, with a proposal to incentivize water recycling and reuse to guarantee the water quality in our country.

This document provides the main results obtained about the water quality in our country and the management of residual treated water. Furthermore, it intends to provide contributions for the design of more detailed strategies and synergies between State entities and to provide inputs for elaborating policies related to management, use and water quality nationwide.

César Gamboa Balbín
Executive Director
Derecho, Ambiente y Recursos Naturales (DAR)

I. LEGAL FRAMEWORK AND PLANNING

1.1. Specific regulations in water management and discharge

Water resources management in Peru currently has the necessary legal architecture for the sustainable use of water resources as proven by the recent approval of the Law N?30588 that approves the reform of Peruvian Constitution recognizing the right of access to potable water as a constitutional right. Despite this, it is a challenge to connect the phase of discharge to the reuse of treated residual water into the integrated management of water resources. The inclusion of this phase into the integral process of water management, would mean a significant advancement towards an efficient management of water resources in our country, in particular as regards to the sustainability of water quality for human consumption, this way relieving many watersheds under pressure by water demand and by legal, informal and illegal water discharge.

1.2. Water Resource Policies

Our country has one policy and more than four plans and strategies oriented to water resource sustainable management in medium and long term. These however need to be integrated in order to generate a coordinated policy in the efficient management of water resources and residual water. **Chart 1** Shows a list of approved policies and plans.

Chart 1. List of policies and plans approved by Peruvian Government for an integrated management of water resource

DESCRIPTION	DESCRIPTION
National Sanitation Policy	Supreme Decree N° 007-2017-VIVIENDA
National Sanitation Plan 2017-2021	Supreme Decree N° 018-2017-VIVIENDA
National Strategy for Water Resources Quality	Chief Resolution N° 042-2016-ANA
Improvement Water Resources National Plan	Supreme Decree N° 013-2015-MINAGRI
Water Resources National Policy and Strategy National	Supreme Decree N° 006-2015-MINAGRI
Environmental Action Plan	Supreme Decree N° 014-2011-MINAM
Bicentennial Plan	Supreme Decree N° 054-2011-PCM
National Environmental Policy	Supreme Decree N° 12-2009-MINAM

Source: Authors

1.3. Planning in water resource and residual waters

The global organization World Resources Institute[1] (in charge of drafting studies about the environmental situation in the world) warned that in case of water resource 33 countries will face severe water stress by the year 2040 , locating Peru in the high range of water stress. According to the study of Nature Conservancy[2] that brings together the first global water stress database in more than 500 cities, identifies Lima amongst the twenty cities in the world with high level of water stress. Added to this there is also the main obstacle for water sustainability, that is pollution by direct discharge of residual waters without previous treatment[3]. This set of issues creates a latent problem that puts Peru under risk in terms of health, food safety and sustainable economical development for present and future generations.

Our country does not have the adequate resources to manage water resources and ***residual waters*** in a responsible, efficient and sustainable way. There are institutional, financial and normative barriers that impede accelerating the rhythm in that field. Because of that, actions have been taken by civil society and the State, to build a view of the country focused on the treatment and reuse of residual waters within the framework of the Sustainable Development Goals traced to year 2030 and universalization goals for water and sanitation services.

1 World Resource Institute. *Aqueduct projected water stress country rankings*. August, 2015. Available in: http://www.wri.org/resources/data-sets/aqueduct-projected-water-stress-country-rankings.

2 Global Environmental Change. *Water on an urban planet: Urbanization and the reach of urban water infrastructure*. June, 2014. Available in: http://www.sciencedirect.com/science/article/pii/S0959378014000880.

3 SUNASS. *Diagnosis of wastewater treatment plants in the field of operation of the entities sanitation service providers*. 2015

The first planning tools that view the issue of water resource management and the null, insufficient and deficient residual water treatment are constituted by the ***Bicentennial Plan***[4] and the ***National Environmental Action Plan***[5]. In those documents a commitment was made to encourage recycling and reuse of residual waters, a goal was traced to year 2021; the treatment of 100% of urban residual waters and 50% of them will be reused.

The ***Water Resources National Plan*** (PNRH)[6] on the other hand within the framework of ***National Environment Policy*** and the ***Water Resources National Strategy*** (PENRH)[7] reiterate the serious situation of the water quality resources and identify causes like: Poor management of residual water treatment systems and the limited control, supervision and control of residual water discharges, whether these are formal, informal or illegal.

The National Strategy for the Improvement of the Water quality Resources[8], proposes as a line of action, ***the recovery of the water quality resources*** and identifies tasks such as: i) Formalizing, through articulated and efficient procedures, water users of productive and population activities that discharge unauthorized residual water, projecting to 2021, 50% of formalized pourer in the Titicaca watersheds and 30% in the Atlantic and Pacific watersheds. Percentages that by 2025 would reach 100% and 50%, respectively. ii) Formulating and implement at the level of hydrographic units, programs and sustainable integral projects for the efficient treatment of wastewater, prioritizing its reuse, projecting by 2021 an additional 35% of sewerage and residual water treatment projects will be implemented a percentage that would increase to 2025 by 15%.

Considering the multisectoral nature of the water management institutionality, the Ministry of Housing, Construction and Sanitation approved the National Sanitation Policy[9] and the National Sanitation Plan[10], in whose scope, determinate the need to promote the use of technologies for the treatment of residual water in order to comply with the maximum permissible limits (LMP) for the quality of liquid effluent discharges from and environmental quality standards for water (ECA-Aguar), avoiding contamination of water sources, in addition to encouraging the use of sub products of residual water treatment.

The aforementioned planning instruments are based on the human right to water, and are aligned to the fulfillment of the sixth development objective for sustainable development of the United Nations by 2030[11], which aims to achieve zero and halving residual water without treatment. In that sense we hope that the implementation of national policies related to the efficient management of sewage is carried out promptly, given that the interest in maintaining the water quality resources and promote their care, since they constitute an unavoidable condition to reduce social inequality, safeguard food security, safeguard the health of the population and ecosystems; and sustain economic development.

4 National Committee for Strategic Planning-CEPLAN. *Peru towards 2021: Bicentennial Plan,* approved by Agreement National. March, 2011. Available in: https://www.mef.gob.pe/contenidos/acerc_mins/doc_gestion/PlanBicentenarioversionfinal.pdf.

5 National Plan of Environmental Action approved by Supreme Decree N ° 014-2011-MINAM. Available in: http://www.minam.gob.pe/wp-content/uploads/2013/08/plana_2011_al_2021.pdf.

6 National Plan of Water Resources (PNRH), approved by Supreme Decree N ° 013-2015-MINAGRI. Available in: http://www.ana.gob.pe/sites/default/files/plannacionalrecursoshidricos2013.pdf.

7 National Policy and Strategy of Water Resources (PENRH) approved by Supreme Decree N ° 006-2015-MINAGRI.Available in: http://www.ana.gob.pe/media/290336/politicas_estrategias_rh.pdf

8 National Strategy for the Improvement of the Water quality Resources, approved by Chief Resolution No. 042- 2016-ANA. Available at: http://www.ana.gob.pe/sites/default/files/publication/files/r.j._042-2016-ana_-_copia.pdf.

9 National Sanitation Policy approved by Supreme Decree N ° 007-2017-VIVIENDA. Available at: http://busquedas.elperuano.com.pe/normaslegales/decreto-supremo-que-aprueba-la-politica-nacional-de-saneamie-decree-supremo-n-007-2017-vivienda-1503314-7 /.

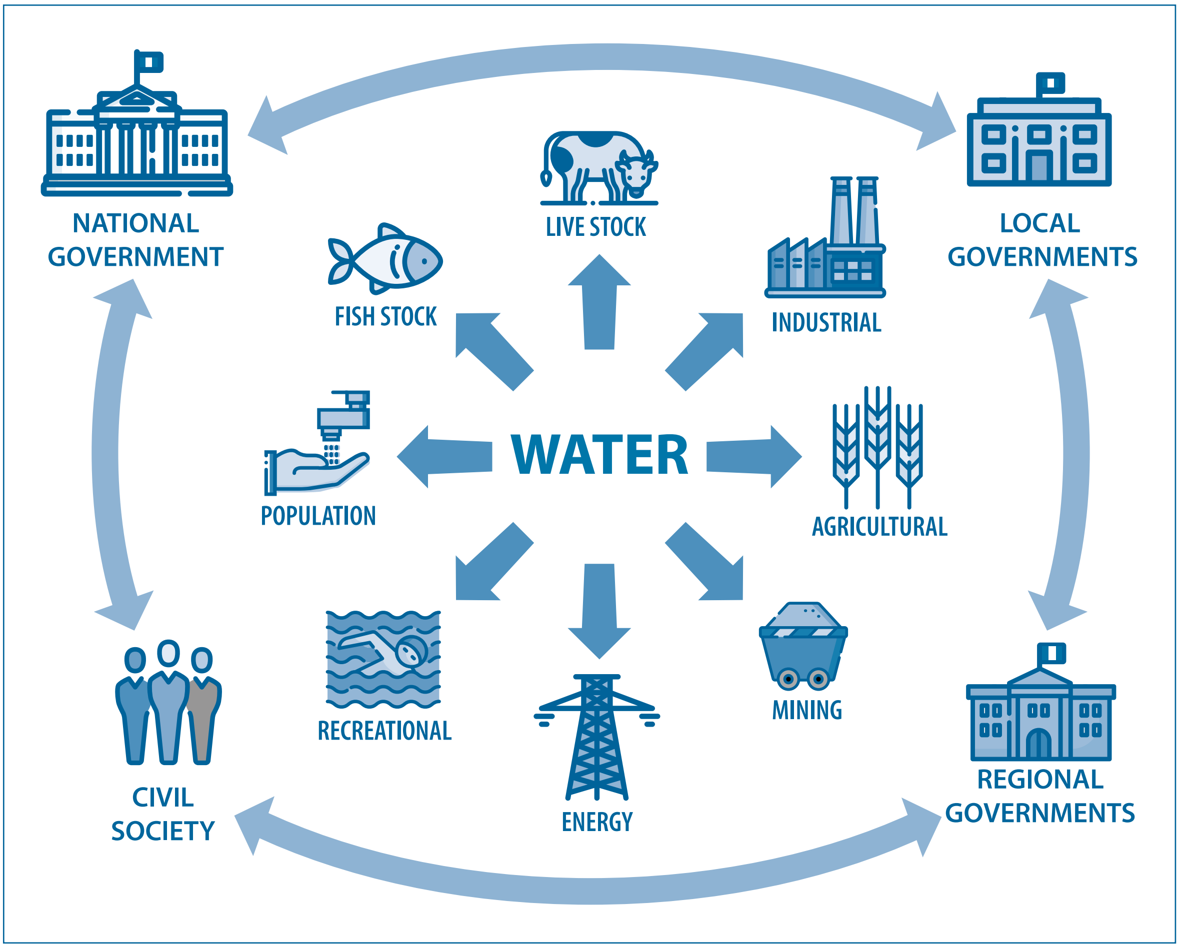
10 National Sanitation Plan approved by Supreme Decree N ° 018-2017-VIVIENDA. Available at: http://busquedas.elperuano.com.pe/normaslegales/decreto-supremo-que-aprueba-el-plan-nacional-de-sanitation-decree-supremo-n-018-2017-vivienda-1537154-9 /

11 UN: Sustainable Development Goals by 2030. *"(...) improve water quality by reducing pollution, the elimination of discharge and the minimization of the discharge of hazardous materials and chemicals, the halving the percentage of untreated residual water and a substantial increase in recycling and reuse in conditions of global security (...) "*. Available at: http://www.un.org/sustainabledevelopment/es/water-and-sanitation/.

II. INSTITUTIONALITY OF WATER RESOURCE IN PERU

Multiple actors intervene in the management of water resources in Peru as it relates to its use and exploitation. Also, national, regional and local Government authorities have political and regulatory involvement in addition to sectors belonging to the different productive industries (agricultural, industrial, mining, oil, population, energy, recreational and other). Civil society plays an important role in the monitoring of the proper management of water resources.

Figure 1. Water Management and institutions involved



Source: ANA, 2010.

The bodies involved in water management in our country are the following:

Chart 2. List of entities involved in water management

National Water Authority (ANA)	Governing body and maximum technical-regulatory authority of the National Management System of Water Resources.
Ministry of the Environment (MINAM)	Environmental authority ensures the agreement between the management of the environment and provisions and management of water resources.
Ministry of Agriculture and Irrigation (MINAGRI)	Publishes the highest standards required to approve by (ANA) in order to facilitate good management of water resources.
Ministry of Housing, Construction and Sanitation (MVCS)	Under the role of universal access to potable water services and sanitation.
Regional and local governments	Harmonize their policies and objectives with the management of water resources, avoiding conflicts of competition and making effective the achievement of a good use of water resources
Organizations of agrarian and non-agrarian water users	Associations that participate in the management of the sustainable use of water.
The operating entities of the sectorial and multisectorial hydraulic sectors	Entities that manage the hydraulic infrastructure (water reservoirs, dams, water supply channels, etc.).

Source: Authors

The administrative offices that depend on the National Water Authority (ANA) and are directly linked to the control of residual water are: a) **Directorate of Water Resources Quality Management (DGCRH)**, responsible for organizing and conducting actions on protection and recovery of the water quality resources. b) **Directorate of Management of Water Resources (DARH)**, responsible for organizing and conduct actions related to the granting of rights to use water, administration of natural water sources and economic regime for the use of water. c) **Directorate of Water Resources Conservation and Planning (DCPRH)**, responsible to drive and organize actions for the conservation, elaboration and implementation of the planning instruments of the National System of Water Resources Management (SNGRH).

III. ASSESMENT OF WATER QUALITY

According to the National Strategy for the Improvement of the Water quality Resources- 2016, the National Water Authority (ANA) identified 41 hydrographic units (watershed) whose quality parameters exceed the quality standards for water (ECA-Agua), the main cause being discharge of industrial, domestic and municipal residual water.

The Directorate of Water Quality Management (DGCRH) of the ANA, assessed the main sources of in 2012. Discharge of municipal residual water from human activities in cities was identified as one of the main sources of pollution. Another important source is related to mining activities, such as informal mining and environmental liabilities.

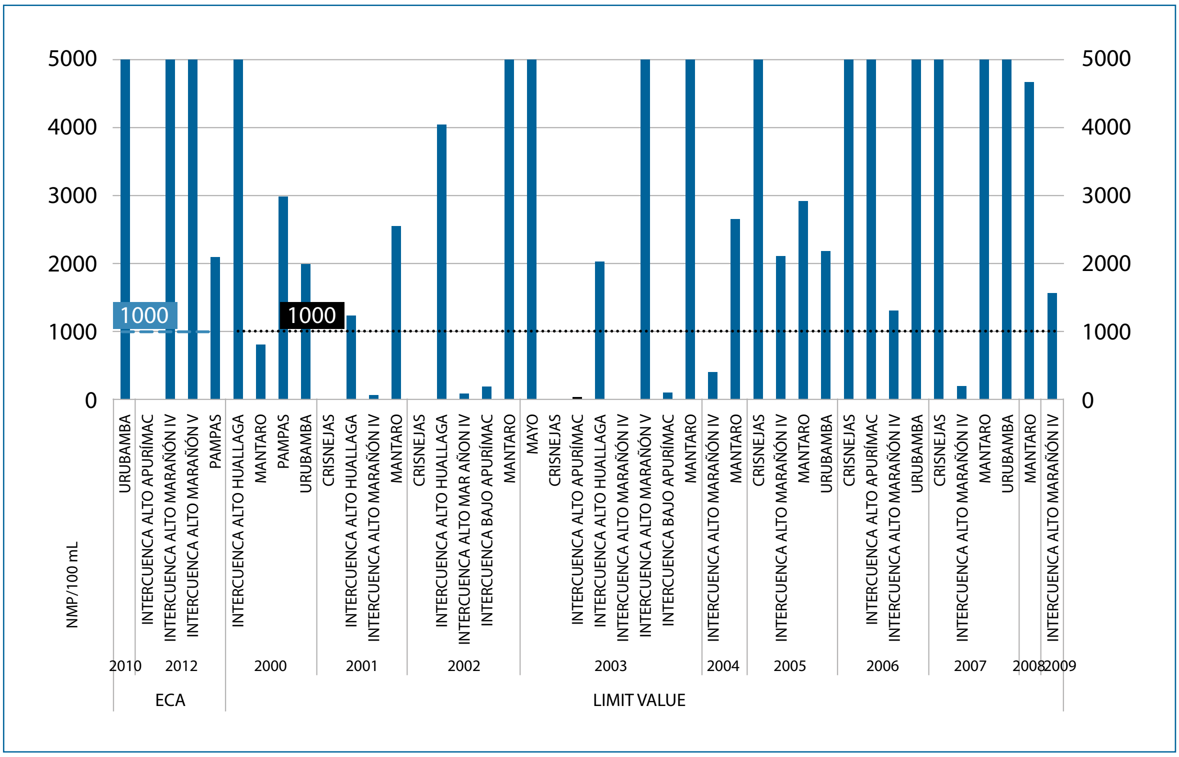
Chart 3. Type and origin of water resources pollution in Peru

BODY OF WATER	LOCATION	TYPE OF POLLUTION AND ORIGIN
Amazon River	Loreto	Affected by municipal residual water, discharge, floating faucets, oil spill.
Madre de Dios River and tributaries	Madre de Dios	Affected by illegal and informal mining.
Tambo River	Moquegua-Arequipa	Boron and Arsenic (natural origin).
San Juan River	Pasco	Affected by mining and municipal discharges.
Perene River	Pasco	Affected by mining and municipal discharges.
Piura River	Piura	Affected by discharge of municipal residual water.
Río Chira	Piura	Affected by discharge of municipal and agricultural, residual water.
Coata River	Puno	Discharge municipal residual water
Ramis River	Puno	Illegal and informal mining (discharge of mining tailings)
Ayaviri-Pucara River	Puno	Affected by discharge of municipal residual water.
Interior Bay of Puno- Titicaca Lake	Puno	Affected by discharge of municipal residual water..
Yunguyo Bay- Titicaca Lake	Puno	Affected by illegal and informal mining generated by Peruvian and Bolivian miners
Suches River	Puno	Affected by municipal discharge.
Sandia River	Puno	Affected by municipal discharge.
Tumbes River	Tumbes	Affected by municipal wastewater discharges,mining activities in Ecuador.
Huallaga River	Ucayali	Affected by discharge of municipal residual water

Source: ANA, 2012.

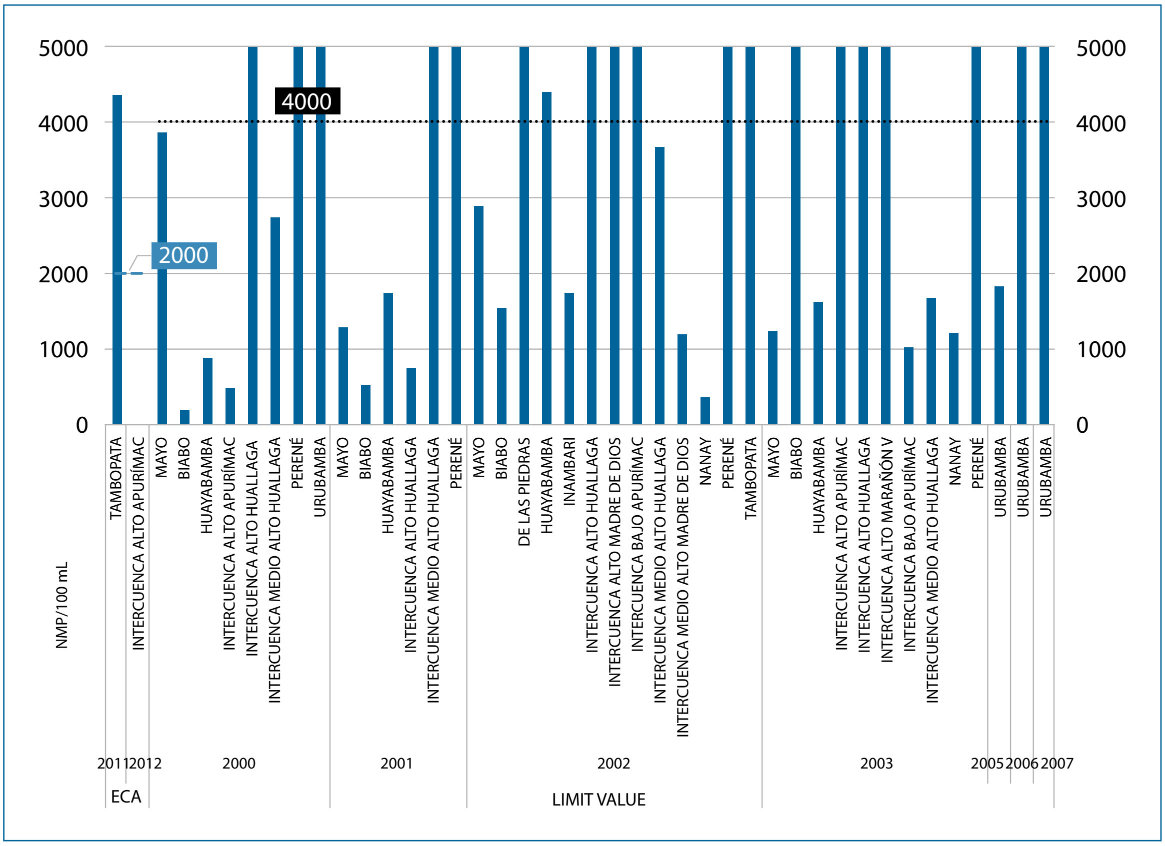
The above-mentioned assessment of the Water quality Resources of Peru, corresponding to a period of evaluation from April 2010 to December 2012, indicates that out of a total of 159 hydrographic units (watershed), 35 hydrographic units presented, on average, concentrations of pH parameters, electrical conductivity, thermotolerant coliforms, biochemical demand of oxygen, arsenic, mercury, cadmium, lead and iron above the approved ECA-Agua the year 2008 (corresponding to the Classification of natural bodies of surface water approved with Chief Resolution N ° 202-2010-ANA). This result is associated with the discharge of unauthorized residual water, environmental liabilities, solid waste and natural conditions (geological, environmental and hydrological factors).

Figure 2. Average annual variation of thermotolerant coliforms by watershed corresponding to Class III and Category 3



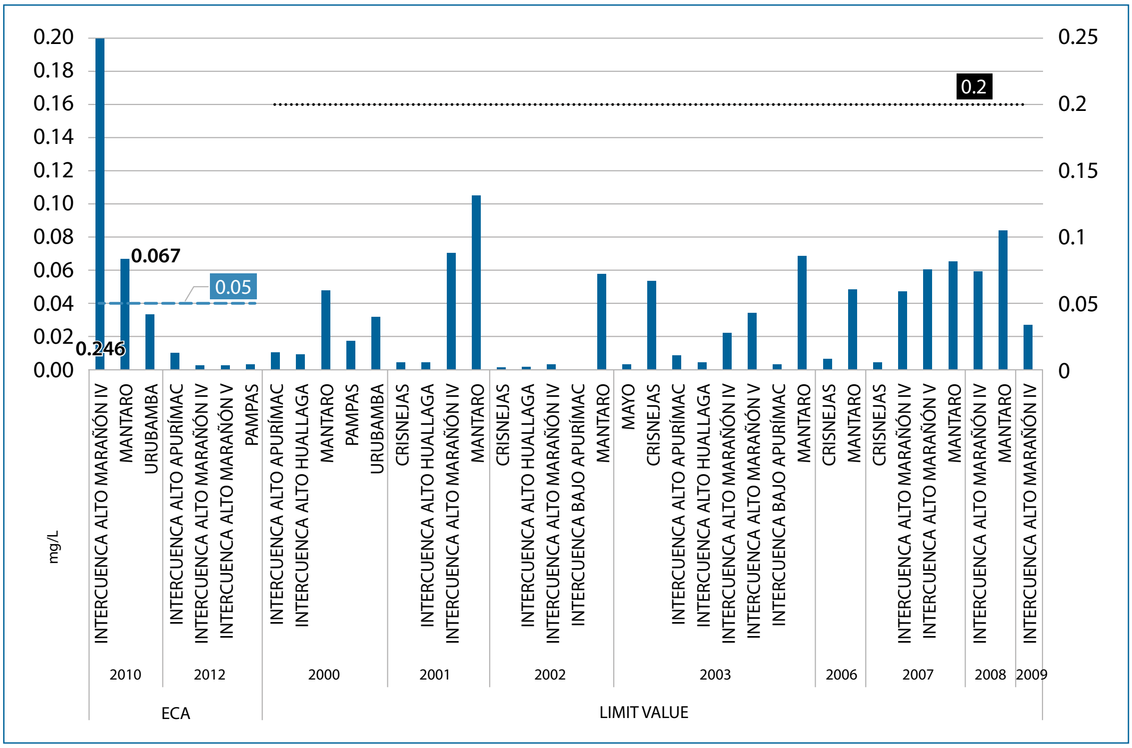
Source: DGCRH-ANA

Figure 3. Average annual variation of thermos-tolerant coliforms per corresponding watershed to Class IV and Category 4 (jungle rivers)



Source: DGCRH-ANA

Figure 4. Average annual variation of As per watershed corresponding to Class III y Category 3



Fuente: DGCRH-ANA.

IV. DISCHARGE OF RESIDUAL WATERS

It is important to point out that every community generates waste, both in solid and liquid form.For Metcalf & Eddy (1995), residual water is defined as *"the combination of liquid waste, or waters carrying waste, from both residences and of public institutions and industrial and commercial establishments, to which they can add, if necessary, ground, surface and rainwater"*.

Once treated, residual water can be reused, or reintroduced into the hydrological cycle by discharging in to the environment. This would be the first step of an indirect reuse process in the long term. The most common discharge methods are dumping and dilution in waters of the environment.

In Peru, the discharge of treated residual water is understood as the discharge of a residual effluent treated on a natural body of continental water (river, streams, lakes, lagoons) or maritime (sea). According to the Regulation of the Law of Water Resources it is excluded as residual water from ships and naval artifacts..

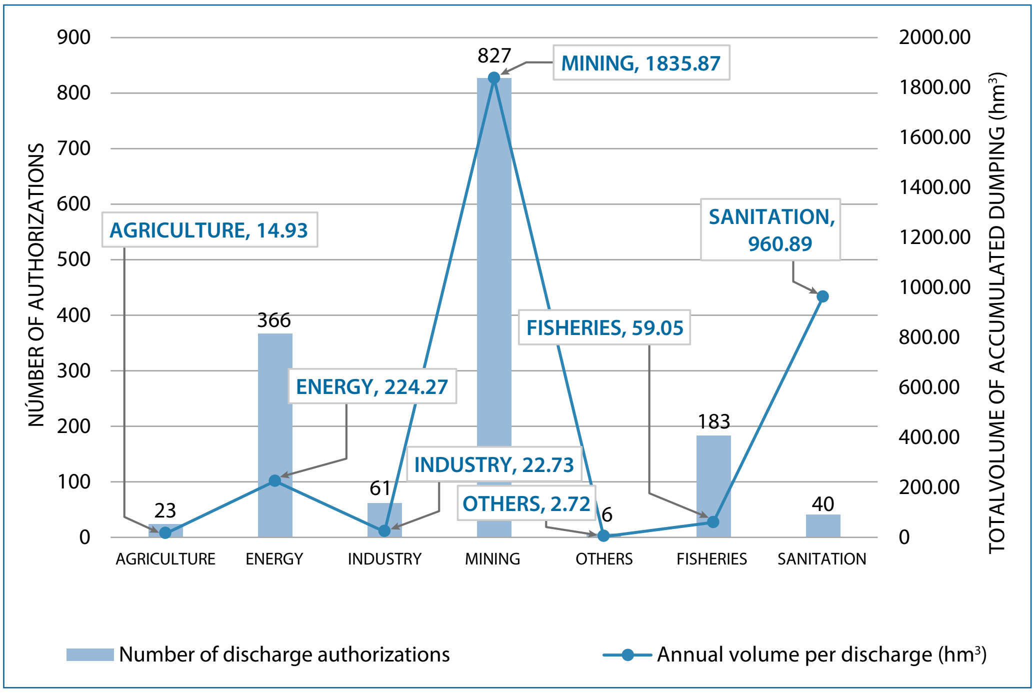
4.1. Discharge by economic activity

In terms of productive sectors, according to the 2009-2017 registries of the (ANA), the **mining** sector discharges the largest volume of treated residual water in the country, with a total of 1835.87 hm^3, representing 59% of the total accumulated volume within said period. The following sectors follow: the **sanitation** sector with 960.89 hm^3, equivalent to 31%; and **energy** activity with 224 hm^3, (7%).

The fisheries sector with 59.05 hm^3, represents 2% of the total volume of authorized discharge. It is worth mentioning that the agriculture sector produces lesser volume of treated wastewater, with a total of 15 hm^3. The sector called "others" has a discharge authorization of 3 hm^3, equivalent to 0.09%. These activities include road infrastructure projects, as well as Fenix Power discharge water.

The following figure shows us in detail, the correlation between the number of authorizations of discharge and the authorized volume of treated residual water dumping. The mining sector presents a direct relationship between authorizations granted and volume of dumping contrary to the sanitation sector where the significant volume of dumping is not in direct relationship with the discharge authorizations. Which implies that, not necessarily, to a greater number of authorizations corresponds greater volume of discharged water.

Figure 5. Dumping authorizations compared with total volume (hm^3) of residual water discharged by sectors 2009-2017



Source: ANA, 2017. Authors

4.2. Types of residual waters generated by sectors

Four (04) types of effluents are distinguished in the discharge register, these are:

Chart 4. Type of residual waters

TREATED RESIDUAL WATER	DEFINITION
Domestic	Those waters that before their treatment come from residential, commercial, and institutional sources that contain physiological waste and other waste from human activity (food preparation, personal hygiene, etc.).
Industrial	Those waters that before their treatment originated from the development of a productive process, including those coming from mining, agricultural activity, energy, agroindustry, among others.
Mining	Those treated waters that resulted from the work carried out inside the mine and that being in contact with mineralized bodies acquire characteristics that require treatment prior to its final disposal, and must be considered as residual water.
Municipal	Those waters that come from the domestic wastewater that can, include the mixture residual water of industrial origin, provided that they meet the requirements to be admitted in the combined type sewer systems.

Source: ANA. Authors.

Of these four types of treated wastewater, industrial discharges generate the greatest volume, representing 65% of the total discharges during 2009-2017, that is 2 042 hm^3. Discharges of municipal wastewater follow representing 28%, with a total volume of 885 hm^3. Domestic and mining residual water correspond with 4% and 2%, respectively.

The following table specifies in greater detail the total volume of treated wastewater (ART for its acronym in Spanish), authorized for discharging according to the type corresponding to the 2009-2017 period.

Chart 5. Volumen of treated residual water by type

TYPE OF ART	TOTAL VOLUME OF DUMPED ART (hm^3) 2009 - 2017	PERCENTAGE (%)
Treated Domestic Residual Water	128	4%
Treated Industrial Residual Water	2042	65%
Treated Mining Residual Water	65	2%
Treated Municipal residual Water	885	28%
TOTAL	**3120**	**100%**

Source: ANA, 2017. Authors

Please keep in mind that the residual industrial water also includes residual water related to the mining activities, specifically, those that come from the profit plants, clearing deposits. Therefore we will perform a more specific analysis, according to the type of residual water discharged and the corresponding sector.

As indicated above, the mining sector has the highest volumes of discharge of authorized residual water, generating three (3) types of wastewater (industrial, mining and domestic). The sanitation sector (also with three types of wastewater) integrates to municipal residual water, being the only sector that registers them. To these two (2) sectors, followed by energy that effects two (2) types of residual water discharge (domestic and industrial), as noted below.

Chart 6. Annual average of the shedding (hm³ / year) of treated wastewater according to type and sector

SECTORS	ANNUAL AVERAGE OF ART BY TYPE (hm³/AÑO) (hm³/año)			
	Treated domestical residual water	Treated industrial residual water	Treated mining residual water	Treated municipal residual water
Agriculture	-	1.83	-	-
Energy	2.50	29.39	-	-
Industry	0.08	2.77	-	-
Mining	6.81	235.62	10.83	-
Others	-	1.36	-	-
Fish Stock	0.12	8.30	-	-
Sanitation	14.50	3.43	-	147.51

Source: ANA, 2017.Authors.

4.3. Where do the residual waters go?

The annual volume discharged in the receiving bodies, allows to identify the greatest discharge pressure on water resources by sector. According to the ANA discharge records, the main receiving bodies are: sea, lagoons, streams and rivers. Further we demonstrate the following classification:

Chart 7. Dumping of residual waters treated by sector

ENERGY AND SANITATION

- These sectors discharge an average annual volume of 24.41 hm³ and 270.64 hm³ respectively to the marine body.
- The high discharge volume by the sanitation sector, into the sea, has to do with residual water discharge collectors, through submarine emissaries installed in the regions of Lima and Callao.

MINING AND INDUSTRIAL

- The mining sector discharges an average of 28.78 hm³ into lagoons
- The industrial sector discharges an average of 0.17 hm³ into lagoons

MINING AND SANITATION

- The mining sector discharges the annual volume of 73.86 hm³ into streams
- The sanitation sector discharges the annual volume of 4.41 hm³ into streams

Source: ANA, 2017. Authors.

In this regard, the most significant discharges on the rivers are due to the mining activity with more of 145 hm³ per year, the sanitation activity, with an approximate discharge of 27.22 hm³ and the energy activity with 5.13 hm³, annually.

Chart 8. Annual average of dumping (hm³ / year) of ART over a receiving body by sector

RECEIVING BODY	ANNUAL AVERAGE OF DUMPING OVER RECEIVING BODIES BY SECTOR (hm³/year)						
	AGRICULTURE	ENERGY	INDUSTRY	MINING	OTHERS	FISHING	SANITATION
Sea	-	24.41	1.38	4.30	1.31	8.11	270.64
Channel	-	0.03	-	-	-	-	-
Injection	-	0.03	-	-	-	-	-
Lagoon	-	-	0.17	28.78	-	-	-
Stream	2.54	2.34	0.51	73.86	-	-	4.41
River	0.44	5.13	1.45	145.39	0.09	0.33	27.22

Source: ANA, 2017.Authors.

4.4. Discharge and parameter load in mining and energy sectors

The use of fresh water or water from water sources is fundamental for the metallurgical processes in general. Therefore, it is said that the quality of fresh water supply for the process it has an impact on mining metallurgical unit operations, and subsequently in compliance with regulations for the disposal of effluents.

Potential sources of pollutant discharge in mining activity come from mainly from:

a. Mine drainage (high concentration of metals)

b. Operations during the benefit process
   - Effluents. Organic, inorganic and reactive contaminants
   - Tailings. Elevated levels of heavy metals and reagents
   - Process water dams (water accumulation and leaching)

c. Waste deposits
   - Waste piles (clearing and stripping material, residual leaching)
   - Tailings fields
   - Residual water ponds

d. Mineral piles

e. Human activity
   - Sewage (pathogenic microorganisms)

f. Dumps (leaching and transport of waste)

The sector prioritized the control and regulation of residual treated water discharge for the parameters commonly characteristic of the activity, as it exists risk to human health and the environment. The values and parameters are observed in the chart of the Maximum Permissible Limits of the mining sector, approved by Supreme Decree No. 010-2010-MINAM.

Chart 9. Maximum permissible limits for the discharge of liquid effluents from mining-metallurgical activities

PARAMETERS	UNIT	LIMIT AT ANY TIME	LÍMIT FOR THE ANNUAL AVERAGE
pH		6-9	6-9
Total suspended solids	mg/L	50	25
Oils and fats	mg/L	20	16
Total cyanide	mg/L	1	0.8
Total arsenic	mg/L	0.1	0.08
Total cadmium	mg/L	0.05	0.04
Hexavalent chromium (*)	mg/L	0.1	0.08
Total copper	mg/L	0.5	0.4
Iron (dissolved)	mg/L	2	1.6
Total Lead	mg/L	0.2	0.16
Total Mercury	mg/L	0.002	0.0016
Total Zinc	mg/L	1.5	1.2

(*) In unfiltered simple.
Source: MINAM, 2010.

For the ANA, there are three types of wastewater treated in the mining sector:

a. Domestic residual water

b. Industrial residual water

c. Mining residual water

It is important to visualize the type of receiving body on which the waters are discharged residuals From this, the place with the highest load pressure on the body will be identified of water. In **Chart 10** below, we identify the bodies of water that receive the greatest discharge of residual water from the mining sector:

- Sea
- Lagoon
- Stream
- River

Of these, rivers and streams are the most impacted with wastewater discharges of that sector. On average, the rivers receive 145.39 hm^3 and the streams 73.86 hm^3 per year. They are followed by lagoons and the sea with 28.78 hm^3 and 4.30 hm^3 per year, respectively.

Analyzing the type of dischargeof treated residual water, we find that:

a. The largest volume of domestic wastewater is discharged over rivers with 4.46 hm^3/year followed by the discharge to the sea with 2.18 hm^3/year.
b. Mining is generally located near bodies of water and basin headwaters. Proof of this is that in all the discharges there are lagoons, present in all the basin headwaters. Annually, more than 134 hm^3/year of industrial wastewater is poured on rivers, as well as streams with 71.09 hm^3/year.
c. The mining residual waters coming from the underground works or from their contact with the mining component, by pits or deposit of minerals, are poured on the rivers, streams and lagoons with a volume of 7.96 hm^3/year, 7.29 hm^3/year and 4.97 hm^3/year, respectively.

We believe that the management of residual water, which comes from industrial and mining activities, should be integrated within the integrated water resources management approach. Residual water from the mining sector, be it industrial or mining, should be considered as a single unit, since there is synergy at all times of the activity between components of the beneficiation plant and mining operations.

Chart 10. Annual volume of discharge by type of treated residual water on the receiving body

TYPE OF TREATED RESIDUAL WATER / RECEIVING BODY	hm^3/year
Treated domestic residual water	
a. Sea	2.18
b. Lagoon	0.01
c. Stream	1.73
d. River	4.46
Treated Industrial Residual Water	
a. Sea	4.27
b. Lagoon	27.35
c. Stream	71.09
d. River	134.74
Treated mining residual water	
a. Lagoon	4.97
b. Stream	7.29
c. River	7.96

Source: ANA, 2017. Authors.

A requirement to grant the authorization of discharge of wastewater is compliance with the LMP, without affecting the receiving body. This compliance does not close the possibility that some metallic element exists as part of the effluent within the treated wastewater. If this is the case, it is important to carry out an exercise that helps determine the mass of chemical agent that is "officially" discharged over the body of water, in order to know the cumulative impact on the environment. *This exercise will serve to determine the accumulated pollutant load and its gray water footprint*.

In consideration of this, the limits of maximum permissible concentration must be analyzed (LMP) to estimate the load of chemical agents discharged to the bodies receivers. The tool to be used is the maximum concentration regulated in the LMP and the authorized volume of discharge.

If we assume that all the effluents comply with the LMP we could estimate the load of chemical agents (specific) on the receiving body, multiplying the volume of annual discharge. In the case of domestic residual water discharges, it has not been made some estimate, because the LMPs of the mining sector do not regulate parameters for domestic effluents treated; the parameters of interest being the level of metals heavy and risky activities.

In the following chart we observe that, annually, treated industrial wastewater authorized for discharge over rivers, carry more than 13 tons of arsenic, more than 26 tons of lead, more than 6 tons of cadmium, more than 67 tons of copper and little more than 202 tons of zinc.

Chart 11. Estimation of the mass load of chemical agents discharged to the receiving bodies in the mining sector

TYPE OF TREATED RESIDUAL WATER/RECEIVING BODY	hm^3/year DUMPED	ANNUAL TONS OF METALS IN AUTHORIZED TILLS IN THE MINING SECTOR				
		ARSENIC (t/annual)	LEAD (t/annual)	CADMIUM (t/annual)	COPPER (t/annual)	ZINC (t/annual)
Treated domestic residual water						
a. Sea	2.18	-	-	-	-	-
b. Lagoon	0.01	-	-	-	-	-
c. Stream	1.73	-	-	-	-	-
d. River	4.46	-	-	-	-	-
Treated industrial residual water						
a. Sea	4.27	0.43	0.85	0.21	2.14	6.41
b. Lagoon	27.35	2.74	5.47	1.37	13.68	41.03
c. Stream	71.09	7.11	14.22	3.55	35.55	106.64
d. River	134.74	13.47	26.95	6.74	67.37	202.11
Treated mining residual water						
a. Lagoon	4.97	0.50	0.99	0.25	2.49	7.46
b. Stream	7.29	0.73	1.46	0.36	3.65	10.94
c. River	7.96	0.80	1.59	0.40	3.98	11.94

Source: ANA, 2017. Authors

If we add to these measures the discharges of industrial residual water and treated mine-type wastewater, generated by the mining sector, we have an idea of the mass of chemical agents discharged on the receiving bodies. The result is that rivers and streams are bodies of water with more chemical charge pressure. By virtue of the data identified, it is shown that 22 tons of arsenic, 44 tons of lead, 11 tons of cadmium, 110 tons of copper and more than 331 tons of zinc are poured annually on rivers and streams.

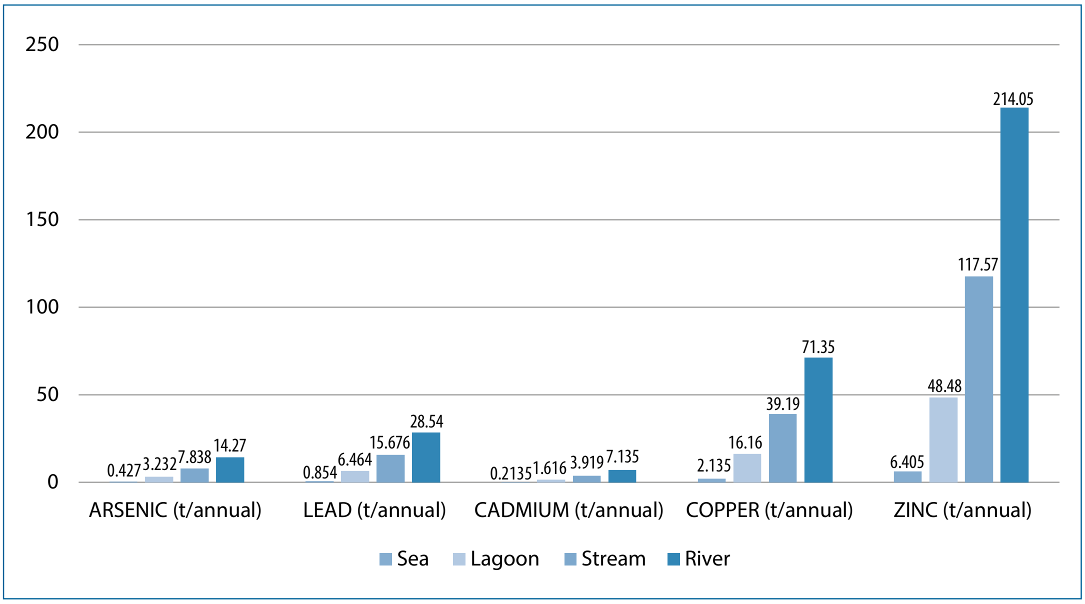
Chart 12. Estimation of annual metal discharge (tons / year) in mining sector discharges in the types of authorized industrial and mine wastewater

TREATED INDUSTRIAL AND MINING RESIDUAL WATER	ARSÉNIC (t/annual)	LEAD (t/annual)	CADMIUM (t/annual)	COPPER (t/annual)	ZINC (t/annual)
a. Sea	0.427	0.854	0.2135	2.135	6.405
b. Lagoon	3.232	6.464	1.616	16.16	48.48
c. Stream	7.838	15.676	3.919	39.19	117.57
d. River	14.27	28.54	7.135	71.35	214.05

Source: ANA, 2017. Authors.

The following figure shows didactically that rivers and streams support greater discharge of metals, given that they present the highest levels of mass with respect to the lagoon and the sea.

Figure 6. Loading of pollutants discharged annually 2009-2017. Mining sector



Source: ANA, 2017. Authors.

4.5. Energy activity

This productive activity can be integrated into the electric and hydrocarbon subsectors. In the case of electricity activities, water is used for generation purposes, its use is non-consumptive. In hydrocarbon activities water use is consumptive therefore water use and therefore the generation of residual water are necessary.

According to the discharge records, in this activity two types of residual water are generated:

- Domestic residual water
- Industrial residual water

Of these two types of residual water, domestic residual water amounts to, on average, 2.5 hm^3 / year of. Industrial residual water amounts to 29.39 hm^3 / year, being the second most significant activity that discharges effluents, after mining activity.

In oil exploration, production, transportation or refining operations, water use is essential. The same applies in industrial processes; this is how they are generated also contaminated waste (injection water, congenital, bitter water, process water, waste, rain, cooling, tank cleaning, household waste, etc.).

The way to discharge these residual effluents is prior treatment, where they must be comply with the LPM and not generate alteration of the RCTs for water. The attached chart shows us the discharge limits for that activity constituted by 21 parameters.

According to the discharge registry of the ANA, the most significant discharge of domestic residual water treated in the energy sector is given to the streams (2.26 hm^3) and rivers (0.24 hm^3) per year. On the other hand, the most important loads discharge of treated industrial residual water are carried out on the sea, with 24.41 hm^3 / year, followed by unloading on rivers and streams 5.71 0.11 hm^3 / year.

It should be noted that the sector is constituted by two sub-sectors, electricity generation and hydrocarbons. In this sense, the calculation of the mass load of the chemical elements has prioritized the hydrocarbon activities, due to the impacts that the activity supposes. In this regard inform that the injection and discharge on a channel is a particular case of oil activity, so both only occur in the energy sector. In the following table the calculations are observed.

Chart 13. Average annual discharge of domestic residual water and treated industrial plants on hydrocarbon activity receptor

TYPE OF RESIDUAL WATER TREATED AND SPILLED TO A RECEIVING BODY	hm^3/year
Treated domestic residual water	
a. Sea	0.03
b. Injection	0.01
c. Stream	2.248
d. River	0.172
Treated industrial residual water	
a. Sea	24.406
b. Channel	0.026
c. Injection	0.029
d. Stream	0.110
e. River	0.723

Source: ANA, 2017. Authors

In the chart can be seen that annually, the treated industrial residual water from the Oil activity is significantly poured into the sea, rivers and streams. It should be noted that the scope of rivers and streams are related to the Peruvian Amazon. Annually, about five tons of arsenic are discharged into the sea, 122 tons of barium, 488 total petroleum hydrocarbons, and just over two tons of lead and hexavalent chromium.

In the case of the Amazon, up to 140 kilograms of arsenic, more than three tons of barium, a little more than 14 tons of petroleum hydrocarbons, 70 kilos of lead as well as hexavalent chromium would be poured on the rivers annually.

Chart 14. Estimation of the mass load of chemical agents discharged to the receiving bodies in the hydrocarbon activity as part of discharge authorizations

TYPE OF TREATED RESIDUAL WATER/ RECEIVING BODY	hm^3/year	ANNUAL TONS OF METALS IN AUTHORIZED DUMPS IN THE ENERGY SECTOR (HYDROCARBONS)				
		ARSENIC (t/annual)	BARIUM (t/annual)	TOTAL PETROLEUM HYDROCARBON (t/annual)	LEAD (t/annual)	HEXAVALENT LEAD (t/annual)
Treated Domestic Residual Water						
a. Sea	**0.03**	-	-	-	-	-
b. Lagoon	**0.01**	-	-	-	-	-
c. Stream	**2.248**	-	-	-	-	-
d. River	**0.172**	-	-	-	-	-
Treated Industrial Residual Water						
a. Sea	**24.41**	4.88	122.03	488.12	2.44	2.44
b. Channel	**0.03**	0.01	0.13	0.52	0.003	0.003
c. Injection (wells)	**0.03**	0.01	0.15	0.58	0.003	0.003
d. Stream	**0.11**	0.02	0.55	2.20	0.01	0.01
e. River	**0.72**	0.14	3.62	14.46	0.07	0.07

Source: ANA, 2017. Authors

Next, the integration of the load of chemical elements on the rivers and streams is specified, according to the discharge authorizations. We find that, annually, more than 160 kilograms of arsenic, four tons of barium, 16.66 tons of petroleum hydrocarbons, more than 80 kilograms of lead and hexavalent chromium are discharged:

Chart 15. Estimation of the mass load of chemical agents discharged into rivers and streams in hydrocarbon activity as part of the discharge authorizations

RECEIVING BODY	ARSENIC (t/annual)	BARIUM (t/annual)	TOTAL PETROLEUM HYDROCARBON (t/annual)	LEAD (t/annual)	HEXAVALENT CHROMIUM (t/annual)
Rivers and streams	0.1666	4.165	16.66	0.0833	0.0833

Source: ANA, 2017. Authors

V. REUSE OF TREATED RESIDUAL WATERS

The entity responsible for managing the reuse of treated residual water in our country is the ANA. According to the Chief Resolution N ° 224-2013-ANA, two situations occur for the reuse of residual water:

1. **If authorization for reuse is not required:**

   When the destination of the treated residual water is the same for which it was authorized. Meaning that, if the authorization for the use of water was for industrial processing, and then the residual effluent is treated to be recirculated again in industrial processing, no authorization is required.

2. **In case authorization of reuse is necessary:**

   The following elements should be considered:

   - That the residual water (AR), previously treated, meet the parameters of quality standards established by the sectoral authority, generally guides of the World Health Organization (WHO).
   - The approved environmental management instrument has contemplated the environmental evaluation of the reuse.
   - The treated residual effluent does not endanger human health, flora, fauna or affect other uses.
   - There is a right to use water (DUA) for the activity that generates the residual water.

5.1. Control obligations of discharge and reuse

The responsible of the discharge or reuse authorization must install measurement systems of treated residual water to record the accumulated volume of waste and report its results to the ANA, with the frequency established in the respective authorization. Of other side, it is established that the responsible for the reuse must perform the control of the parameters of water quality in accordance with the provisions of the respective authorization.

It should be noted that during the elaboration of the investigation the person in charge of the area was asked of discharges of the DGCRH, if, during the inspections carried out by said area, take samples for analysis of treated residual water for reuse; the answer was negative.

5.2. Authorizations of Reuse in Peru

From a review to the ANA Discharge Register, within the period 2009-2017[12], it has been granted a total of 191 reuse authorizations, totaling a total volume of 126.79 hm^3, as can be seen in the following chart:

Chart 16. Record of total discharges between 2009-2017of the ANA

DEPARTAMENT	N° OF RESOLUTIONS 2009-2017	TOTAL VOLUMEN 2009-2017 (hm^3)
Lima	48	27.05
Loreto	27	0.17
Piura	20	6.38
Ica	16	3.94
Ancash	12	4.84
La Libertad	12	7.45
Cajamarca	9	9.21
Callao	9	3.94
Junín	6	0.29
Tacna	6	29.3
Arequipa	5	32.99
Ayacucho	5	0.12
Moquegua	5	0.07

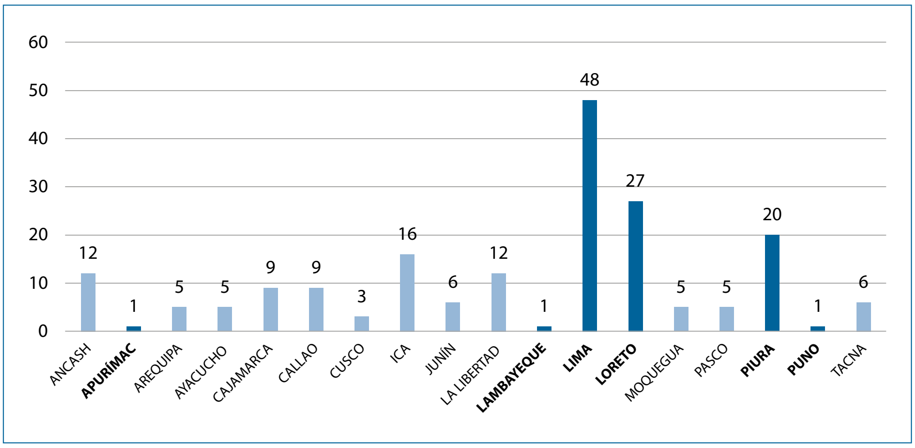
12 The records for the years 2009 and 2017 do not cover the whole year, given that in the case of 2009 there are only four (4) records between November 23 and December 21. For the year 2017 there is only an authorization of January 18, 2017. In that sense, within the annual average estimates, the records of those years have not been considered since they increase the uncertainty of the annual average estimate.

DEPARTAMENT	N° OF RESOLUTIONS 2009-2017	TOTAL VOLUMEN 2009-2017 (hm^3)
Pasco	5	0.18
Cusco	3	0.61
Apurímac	1	0.01
Lambayeque	1	0.24
Puno	1	0.02
TOTAL	191	126.79

Source: ANA, 2017. Authors

The department of Lima has 48 authorizations for reuse, being the most representative and numerous. Loreto and Piura follow with 27 and 20 authorizations respectively. The regions that have the least number of reuse authorizations are Puno, Lambayeque and Apurimac with one (1) authorization granted in each region according to the following figure.

Figure 7. Number of reuse authorizations granted per department 2009-2017



Source: ANA, 2017.Authors

In the case of Lima, the largest number of authorizations corresponds to the industrial sector with 16, followed by the mining and sanitation sectors, both with 9 authorizations as you can see in the following chart:

Chart 17. Register of authorizations for reuse between 2009-2017 of the ANA

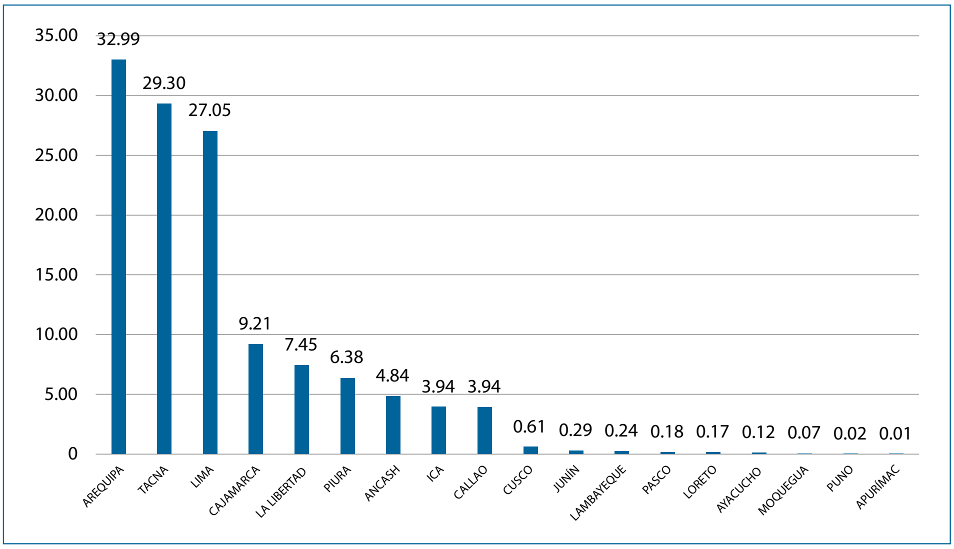
AUTHORIZATIONS OF REUSE IN LIMA 2009 -2017	N°
Industry	16
Mining	9
Sanitation	9
Agriculture	4
Energy	4
Fishery	4
Others	2
TOTAL	48

Source: ANA, 2017. Authors

5.3. Volume of the Authorizations of Reuse in Peru

Regarding the total volume of reuse granted between the 2009-2017 periods, the department of Arequipa has a greater volume of water reused with about 33 hm^3 of a total of 126.79 hm^3 at a national level; this department is followed by Tacna with 29.3 and Lima with 27 hm^3.

Figure 8. Volume of wastewater reused by department 2009-2017 in Peru (hm³)



Source: ANA, 2017. Authors

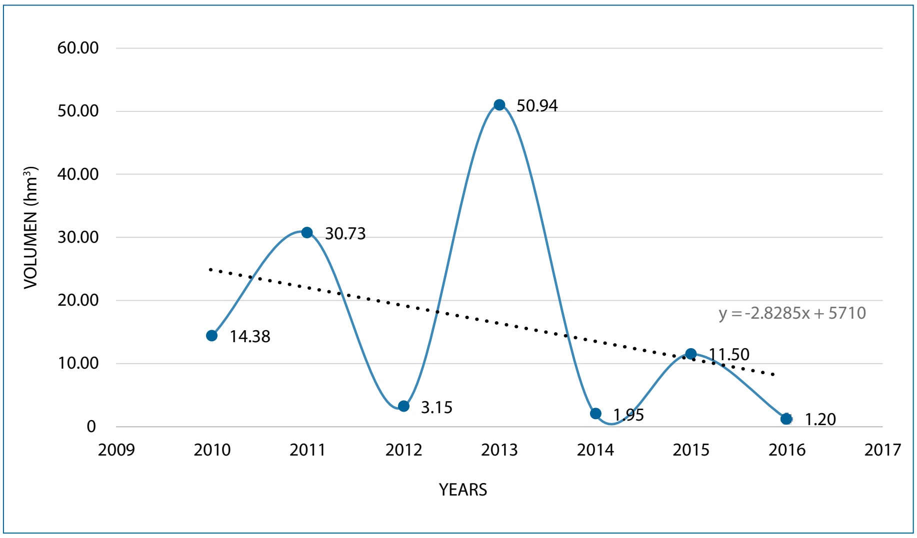
The three departments (Arequipa, Tacna and Lima) that lead the largest volume of reused water are found in the coastal desert strip of Peru, the Pacific slope. The ANA has reported the alert for water depletion, especially in the department of Tacna.

5.4. Tendency of reuse of treated residual water

The reuse of treated residual water in Peru is considered. But the trend of this measure has decreased. From 2010 to 2016, the volume is reduced from 14. 38 hm³ at 1.20 hm³, showing a negative growth slope with a factor of -2.82.

The calculation has not used the data for the years 2009 and 2017 because they are incomplete. Despite of this, the data shows the need to influence a policy of reuse and recirculation of treated residual water.

Figure 9. Volume of wastewater reused by AAA 2009-2017 in Peru (hm³)



Source: ANA, 2017. Authors

The largest volume of authorized reuse during the seven years analyzed to determine the annual average was in 2013, with a value of 50.94 hm³. Of this figure, 36 hm³ correspond to the mining sector and 14 hm³ for sanitation[13]:

13 ANA. Discharge reports 2009-2017.

- **Mining sector.** It is due to the annual reuse granted to Sociedad Minera Cerro Verde in Arequipa (31.5 hm^3). This company uses residual water from the city of Arequipa for its mining operations.
- **Sanitation Sector**, the largest volume awarded was to the Irrigators Commission "Sub Irrigation Sector Ate", with 13.6 hm^3 of water coming from the Residual Water Treatment Plant of Santa Clara, in the region of Lima.

5.5. Purpose of reuse of the treated residual water

In correspondence with what is indicated above, we know where the treated residuals waters come from, according to type. However, it is necessary to know their destination. There exist six main uses of the treated residual water that the ANA registers in the authorizations that grants.

- Watering
- Processes recirculation
- Environmental mitigation
- Watering and environmental mitigation
- Cleaning and maintenance
- Watering,cleaning and maintenance

Of these six, the use for irrigation represents, 63.61% of the total reuse of treated residual water or 80,657 hm^3 in absolute terms. We highlight this, because it is directly related to agricultural products for human consumption. In this regard, it is necessary to evaluate the destination and cumulative effect of wastewater from the industrial and mining sectors.

Chart 18. Reuse of treated residual water

REUSE MAIN PURPOSE	REUSE TOTAL VOLUME (hm^3)	PERCENTAGE (%)	DESCRIPTION OF REUSE
Watering	80.657	63.61%	• High stem forest species. • Green areas (grass, arboreal and ornamental species). • Parks and gardens. • Agricultural products such as: oil palm, corn and other agricultural products
Recirculation processes	34.465	27.18%	• Recirculation Concentrator Plant. • Leaching of processes. • Washing of machines. • Metallurgical purposes. • Mining use (Cerro Verde).
Environmental mitigation	9.789	7.72%	• Irrigation of access roads. • Control of dust inside the installation and works. • Compaction of lands.
Watering and environmental mitigation	1.838	1.45%	• Combined use for irrigation of green areas, tree species and dust control, we cannot distinguish how much one is used from another. Combination of uses.
Cleaning and maintenance	0.035	0.03%	• Cleaning of hygienic services and infrastructure cleaning in general.
Watering,cleaning and maintenance	0.008	0.01%	• Combined use for cleaning, maintenance of the facility (hygienic services, floors, etc.) and irrigation of green areas.
TOTAL	**126.792**	**100%**	

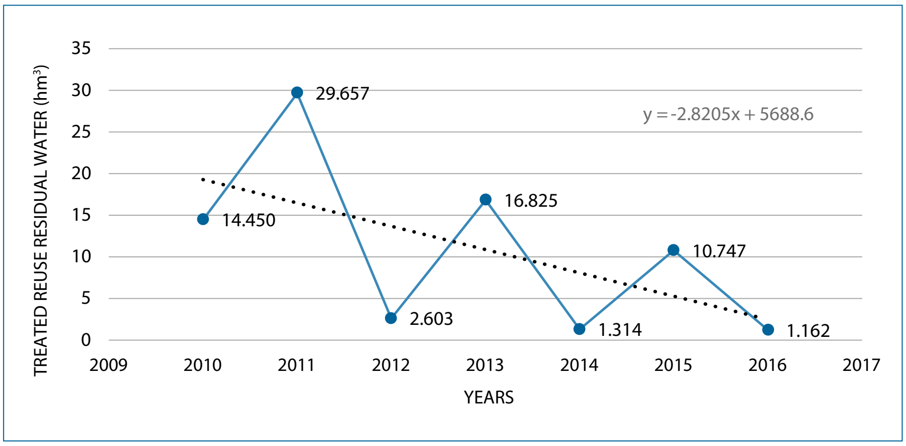
Source: ANA, 2017. Authors.

Following the proportional relation by uses of treated residual water, the annual average of the reuse of treated residual water corresponds to watering with about 11 hm^3 / year, followed by the activity of recirculation of processes with 5.7 hm^3 / year.

From 2010 to 2016, the volume of reuse authorizations for **irrigation** comes decreasing drastically, going from 14.45 hm^3 to 1162 hm^3; that is, on average reduction is almost 3 hm^3 / year according to the linear trend equation. This reduction would be consequence of the absence of a policy to promote the reuse of treated residual water.

In the case of industrial activities, it would be consequence of the change of reuse by environmental mitigation, mainly dust irrigation.

Figure 10. Reuse trend for irrigation



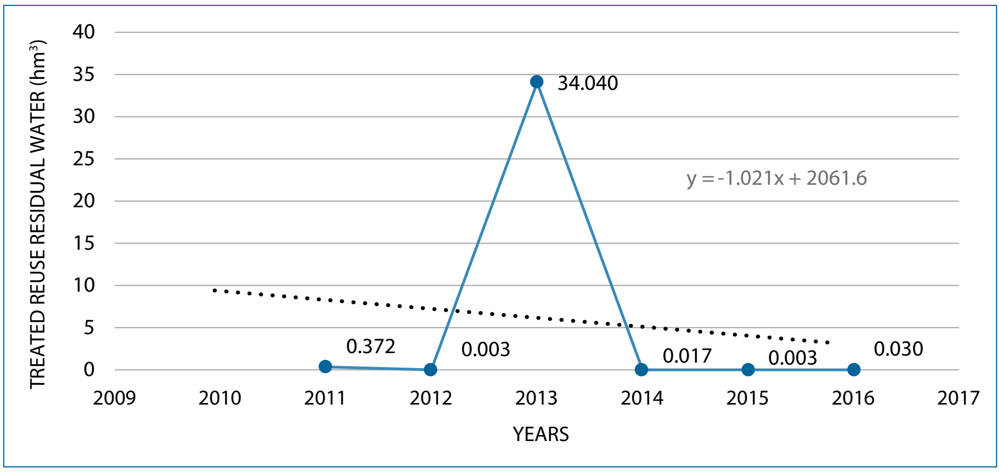
Source: ANA, 2017. Authors

The reuse for the recirculation in the *industrial processes* comes diminishing of 0.372 hm^3 in the year 2010 to 0.030 hm^3, in 2016 (almost at the rate of 1 hm^3 per year). This reduction is not as significant as the reuse for irrigation. Therefore, if the reuse is increased by recirculation, the treatment of wastewater by the extractive industries would allow recovering and sustaining the water quality, which would be beneficial for the community.

However, the trend shows a discouraging panorama in environmental and social terms. The corporate policies of recirculation of residual water reduce significantly the demand for fresh water, benefiting watersheds with greater availability of dilution water within the natural processes of self-purification of water bodies.

Therefore, it is beneficial to promote, from all sectors (State, private sector and civil society) the implementation of recirculation mechanisms for treated residual water in its industrial processes. The following figure shows the negative trend of reuse as recirculation in the processes of the productive sectors of the country.

Figure 11. Reuse trend in recirculation of industrial processes



Source: ANA, 2017. Authors

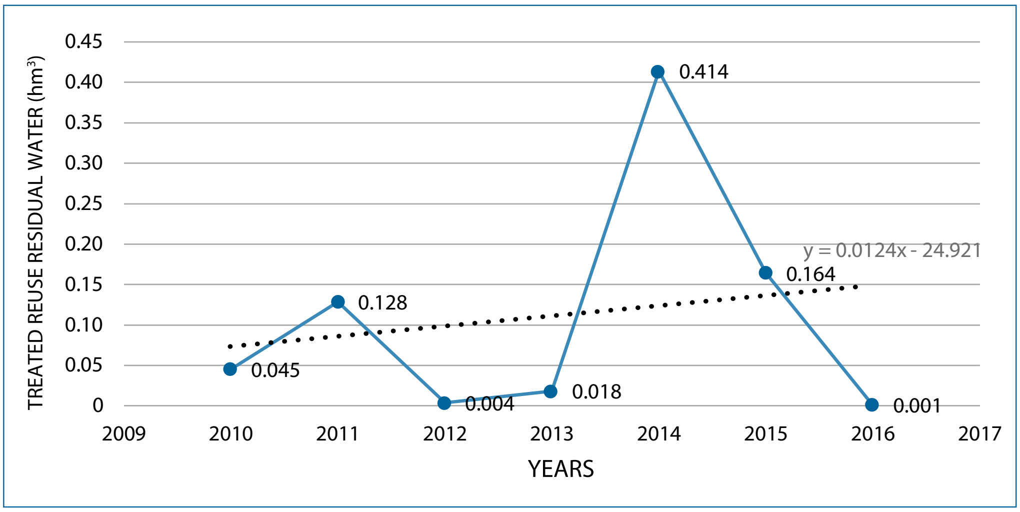
In the case of reuse due to environmental mitigation, a slight increase trend is observed due to the authorized volumes during the year 2014, with 0.4 hm^3, followed by the year 2015, with 0.16 hm^3. Being the largest volumes authorized during the seven years analyzed.

Although, the trend is slightly positive,this type of reuse is strictly applied to dust control of access roads and surface areas. From a review to environmental oversight and oversight procedures of the OEFA, we identify the no analysis of the quality of the treated water for dust control or irrigation purposes of access roads. The ANA does not analyze the quality of this type of residual water either (confirmed even by an official of the DGCRH in an interview held for this document).

The importance of controlling the quality of treated residual water, subject to reuse for purposes of environmental mitigation, is due to the lack of demand to monitor the final uses, whether for agricultural irrigation or recirculation in an industrial process. The treated residual water and recirculated can go unnoticed control. This weakness can be transferred in terms of chemical charge to another receiving body (soil or groundwater), that cumulatively, could contain certain chemical agents, meaning a serious long-term environmental problem.

It is necessary to control and monitor the quality of this treated residual water, by the competent authorities. In addition to analyze the quality of the component end of its destination, which are indirectly discharged on the soil component.

Figure 12. Reuse trend for environmental mitigation



Source: ANA, 2017. Authors

A method to know the route of the treated reused residual water, is found in the analysis of the type of residual water versus the end use. In that sense, treated residual water of households is used for watering, with 31,085 hm^3; and the use for environmental mitigation with 0.999 hm^3.

On the other hand, the reuse of treated mining wastewater is used for mitigation environmental, with 0.049 hm^3. The reuse of treated municipal wastewater is destined for irrigation, with 32,178 hm^3, followed by reuse for mining recirculation with 31.5 hm^3. Should be considered that this indicator complies with the authorized values of reuse for the extension of the installed capacity of Sociedad Minera Cerro Verde in Arequipa.

RECOMMENDATIONS

Residual water, water quality for human consumption and safeguarding related rights: dignity, health, food safety and sustainability of ecosystems

- The criteria or standards that are implemented for safe and productive management of residual water must be adapted to the environmental, social, economic and financial conditions, considering the axis of public and environmental health.
- It is necessary to implement guidelines that identify the gray water footprint in industries, to promote responsible management of treated wastewater and generate a significant alternative to recover threatened river watersheds.
- Residual water can be reliable as a source of supply and for other uses that do not involve drinking water, as long as they are established sanitary and toxicological controls.

Monitoring, guarding and supervision of the risk of residual water management

- It is recommended that the residual water reuse control and management programs have the health component. This will allow demonstrating the risk and / or rejection of different reuse alternatives for treated residual water.
- If industrial discharges are detected over water sources, a classification of risk by chemical, biological and physical-chemical contaminants, especially as regards heavy metals and toxic substances.
- It is necessary to implement, as part of environmental assessment and supervision, the evaluation of the effect that the reuse of treated waste water of type industrial and mining activities for the purposes of dust mitigation and irrigation of agricultural products and vegetable species.

Development of academic research and technology innovation programs

- Selected technologies for residual water treatment and disposal for their reuse must be technically appropriate, economically viable and in accordance with the geographical reality. In addition, the population and competent entities must be informed about its characteristics.
- Currently, there are advanced technological methods for treatment residual industrial and domestic water, which reach quality levels for recirculation of residual water in the productive processes of companies. These methods must be disseminated in its implementation and operation.
- Promote a center of technological efficiency in order to develop new technologies for the purification and treatment of sustainable and adequate wastewater to the environmental conditions of the country.

Equitable access to water, prioritizing vulnerable communities and empowering social actors (indigenous peoples, peasant communities and civil society)

- Promote and strengthen water governance with the creation of platforms intergovernmental organizations to promote efficient and responsible water management residuals within the framework of integrated management of water resources.
- The State, through the Ministry of Housing, Construction and Sanitation (MVCS),Ministry of the Environment (MINAM), Ministry of Agriculture and Irrigation (MINAGRI), the National Water Authority (ANA) and the National Superintendence of Sanitation Services(SUNASS) should promote policies, of short and medium term, that encourage reuse of residual water as an alternative to the demands of quantity and water quality resources in vulnerable river watersheds.
- The State must pay special attention to the critical situation that characterizes the watersheds, hydraulically fragile ecosystems and areas where are located indigenous peoples and / or peasant communities; considering the social and environmental parameters
- Respect, preserve, value and practice ancestral knowledge about the sustainable management of water resources and protection of water quality. In virtue of this corresponds to promoting their inclusion within the political and regulatory framework

- The right to prior consent of indigenous peoples must be guaranteed on issues that involve residual water treatment and reuse projects. Also, ensure informed participation and monitoring processes of civil society, in general, in the decision making, in this regard

Competencies, planning and government policies within the framework of management of water resources with an integrated vision, considering the management of residual water (SUNASS, MVCS, OEFA, MINAM, ANA, MINAGRI, MINSA)

- The competences of each sector must be defined and delimited, in order to understand and differentiate the role that each institution plays and its technical capabilities to fulfill your goals.
- Each entity plays a complementary role, however, to generate duplication of functions would imply unnecessary costs in the public budget.
- The National Water Authority (ANA) must assume the role previously played by the General Directorate of Health (DIGESA): issue the binding opinion on matters of health, regarding the authorization of discharge of treated wastewater based on the compliance with the environmental quality standards (ECA-Agua), and the maximum permissible limits (LMP).
- Consider the reduction of the term of adaptation of the Lending Entities of Service (EPS) for the granting of discharge authorizations. This will benefit the environmental sustainability of investment projects in sanitation and will grant the population fully assured that the water it consumes is safe.

Framework of proposals and initiatives to contribute to efficient management and responsible for water resources and wastewater

- Promote and ensure the reuse of treated wastewater through recirculation of industrial processes, which will ensure greater investment in treatment systems, better control, less pollutant load on water bodies and greater volume of fresh water for self-cleaning.
- The State must implement programs that encourage the industrial sector, the ofefficient and sustainable wastewater management, promoting its recycling and reuse within theoperating processes. Granting a certification of this effect for recognition of responsible companies in the management of the quality of the water resource.
- The industrial sector must build corporate policies that are aimed at zero discharge, a situation that must contribute to the fulfillment of the Sustainable Development Goals by the year 2030.