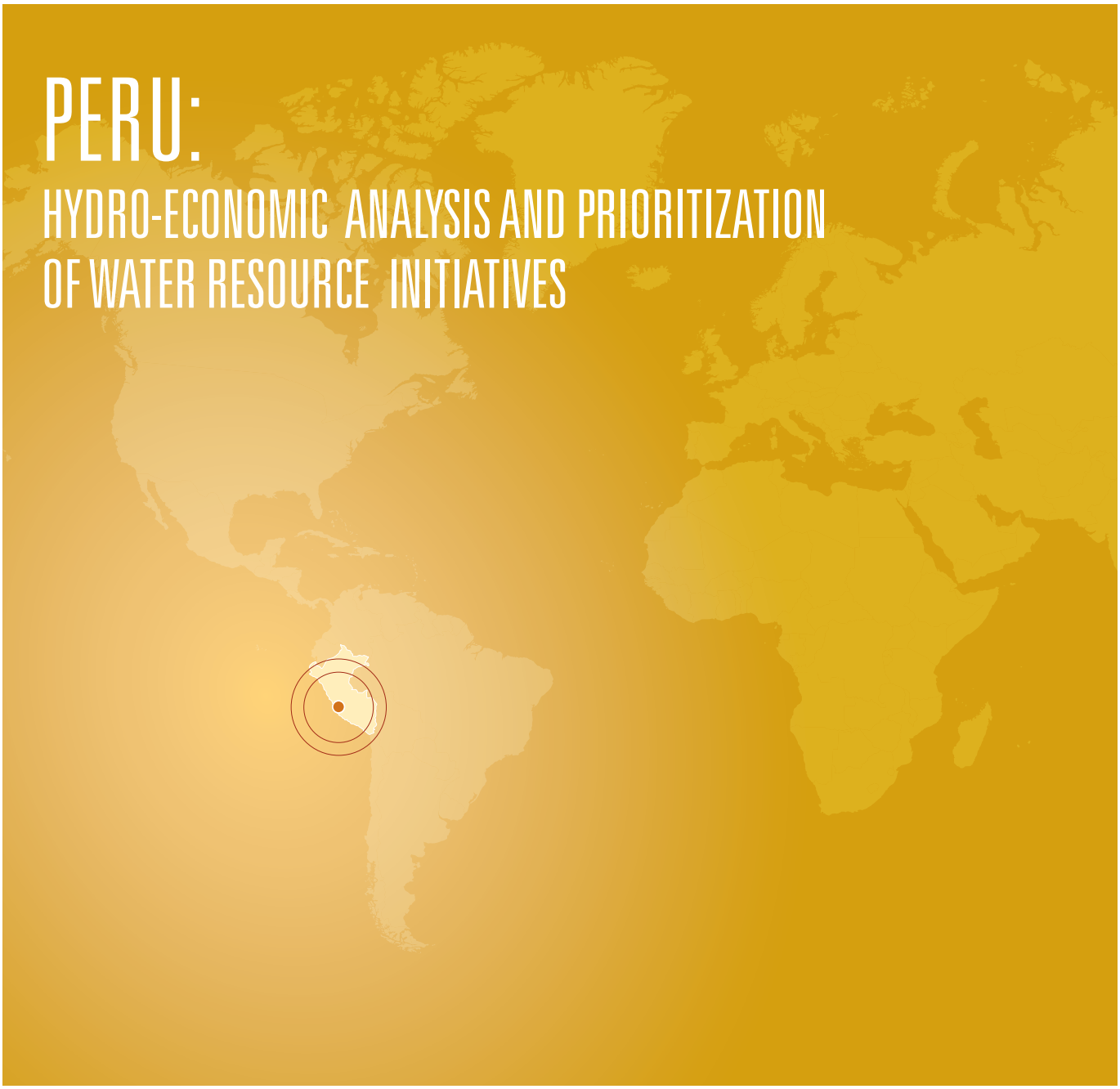
January 2015

2030 Water Resources Group

PERU:

HYDRO-ECONOMIC ANALYSIS AND PRIORITIZATION OF WATER RESOURCE INITIATIVES



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2030 Water Resources Group

Hydro-Economical Analysis and Prioritisation of Water Resources Initiatives in Peru

Final Report

AMEC Environment & Infrastructure
UK Limited in cooperation with IMDEA Institute and INCLAM

January 2015

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Executive Summary

This is an Executive Summary of the report entitled "Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru" submitted to the 2030 Water Resources Group (2030 WRG) by AMEC Environment and Infrastructure (AMEC). The report describes the activities and results of AMEC's study to advance the goals of the 2030 WRG Peru Partnership; a study which was led by AMEC with key support from INCLAM SA and IMDEA Water Institute. This summary describes the processes and outcomes of a review of water resource development interventions, the application of a hydro-economic (HE) tool, and a review of political, social and environmental impacts (PESIA), to identify a list of prioritised investments in each of six coastal basins, and the three catchments close to the capital Lima. The map on the following page shows the locations of the 6 basins and three additional catchments which are the focus of the study.

Purpose and Objectives

The purpose of this work is to provide an important value-add of the 2030 WRG Peru partnership with the Global Green Growth Initiative (GGGI) is to raise awareness, mobilize, and mobilise 'new actors' from the private sector to engage in water activities and the partnership. The Work Plan of the partnership is summarised as:

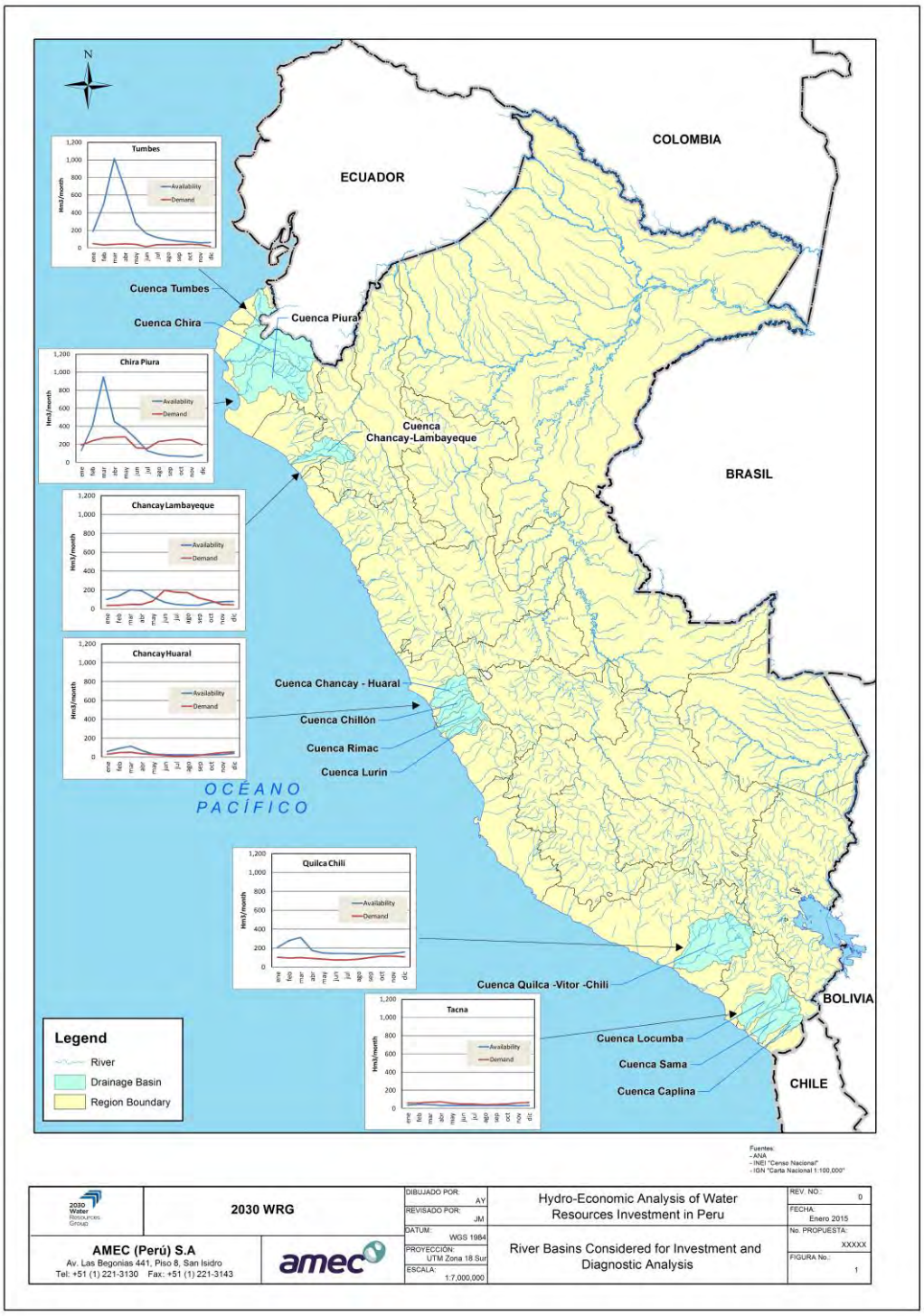
- Institutional setup; creation of Steering Committee and a public-private multi-stakeholder platform (MSP)
- Mapping of current initiatives and actors
- Analysis of financial instruments to promote private sector investment in the water sector
- Identification of gaps in current initiatives and roadmap for future work
- Promotion of investments to potential MSP partners
- Support integrated water resources management plans in key basins (that do not have one)
- Capacity building

The terms of reference (TOR) for this report require a targeted piece of analysis that will aggregate various sets of existing data, and package and deliver the information in a compelling format with key messages targeted to Peruvian private sector companies (water users, rather than water utilities), to the public sector and for civil society. The targeted analysis will provide key information for each sector to take an active role in projects that improve water resources management in Peru and help close any potential gap between projected water demand and sustainable supply for Peru.

The TOR require that the following main tasks be carried out and reported upon:

- Review the breadth and comprehensiveness of proposed investments in the coastal catchments of Peru in the National Water Resources Plan (2014), the 6 Coastal Water Resources Management Plans commissioned by the IDB and the World Bank, and the ongoing Water Resources Management Plans for the Chillón, Rímac and Lurín Catchments;

- Apply a suitable hydro-economic tool for cost-benefit analysis to the coastal catchments and the Rimac Basin, identifying priority investments;
- Review the political, social and environmental impacts of these interventions.



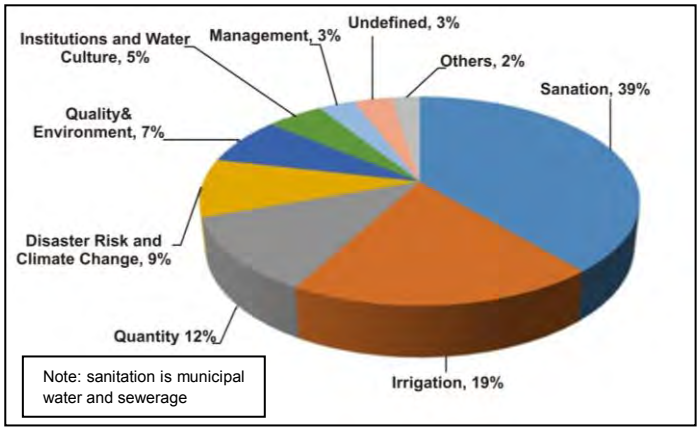
Data sources

The data used in the study was obtained through a review and synthesis of the existing water sector plans sourced from the entities shown in the inset table. From these data a database was compiled of the 2,303 planned water resource development interventions identified in those plans.

Information source	Entity
National Water Resources Plan (PNRH)	ANA, National Water Authority
Basin Water Resources Management Plans (PGRHC)	ANA, Basin Water Resources Councils **(CRHC)**
Database of projects for investment at sectorial level	ProInversión agency of the Peruvian Government
Database of projects in the Sistema Nacional de Inversión Pública (SNIP)	Ministry of Economy and Finance (MEF)

A detailed review of the each of the projects interventions in the database was made. For the majority of interventions, many of the data needed for the subsequent analysis were missing or incomplete for a variety of reasons.

Filling these data gaps for all 2,303 potential investments was outside the scope of this project, however the information available did provide a good starting point for prioritisation, and gaps were filled later for projects which remained after a pre-screening process. The inset chart summarises the distribution of the interventions.



Diagnosis

The analysis revealed that 71% of the records relate to very specific small projects (largely drawn from the SNIP database). The remaining entries represent either interventions with a different degree of aggregation or just project idea notes with some data. The diversity is also reflected in the capital costs of different investment opportunities. These range from few thousand new Peruvian soles (PEN) to more than PEN 1 billion (350 million US$).

Reasonable information is available on financial parameters albeit at a detailed project level and includes data on capital costs, and operational and maintenance. To enable a cost-effectiveness analysis, a measure on the technical effectiveness such as volumes of water was required and, critically, less than 1% of records contain that information. Thus, a major effort was required to obtain technical effectiveness parameters, for instance using outputs from the hydrological models used in some of the basin plans (PGRHC) or from pre-feasibility and feasibility documents available from the SNIP database. The list of investment opportunities did not contain information on other environmental and/or social outcomes.

Best practice; green and indigenous practice

A diagnosis of the database of interventions was carried out to determine if there were any key best practice gaps. We concluded that there is a paucity of measures proposed for water reuse and demand management in the Municipal, Industrial and Mining sectors, to address supply-demand shortfalls. We also consider that managed aquifer recharge (MAR) could have been more evident as a means of storing excess run-off or treated wastewater.

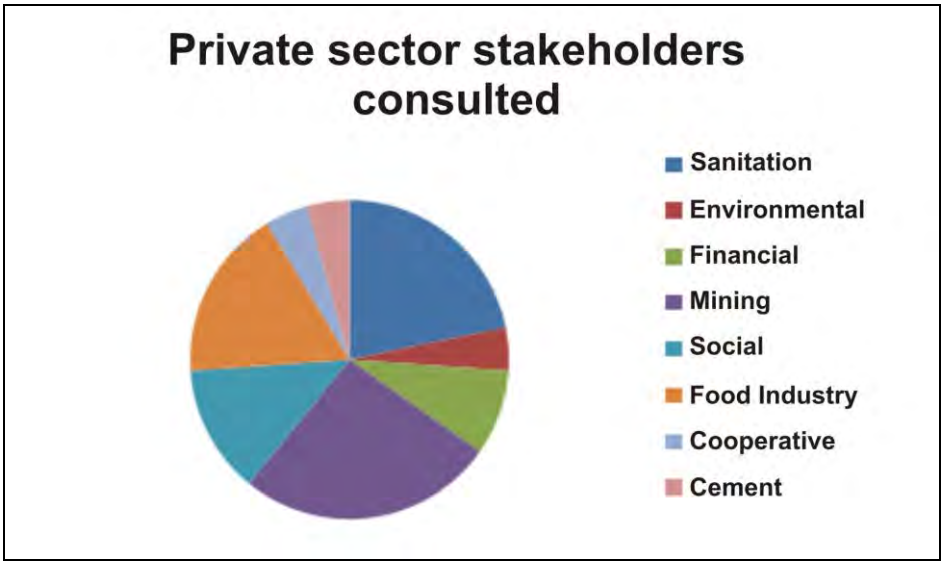
That said, **there are many examples of global Best Practice in water management already in existence in Peru** and given the significant challenges presented, considerable opportunity exists to embed many of these practices and local measures in the investment proposals. We believe that there are projects which would merit inclusion in the update to the 2030 WRG Catalogue of Case Studies and these are listed in the following table.

Sector	Project Summary	Water Security Impact	Best Practice Features	Why?
Municipal Water	Wastewater Treatment Plant (Municipal) San Miguel (Lima)	250 m^3 /day not used from the municipal fresh water supply	Irrigation of parks Reduced consumption of municipal water Drip Irrigation making evaporative losses lower	Lima is the second largest desert city in the world, with 9 million people living in an area that receives less than 5 cm of rainfall per year, yet this green practice allows many of the business and residential districts of Lima to have numerous green parks and tree-lined boulevards
Mining	Pampa de Pongo Mine Project (Bella Unión – Arequipa); it will have two water supplies: sea water and groundwater.	Desalination (6%) for potable water Sea water direct 29%) for mine processes Groundwater drainage (66%) for mine processes	Desalinization of seawater for potable supply, utilization of non-potable water to supply demands not requiring fresh water	Mining represents one of the principal economic engines of the Peruvian economy. While groundwater resources generally exist along the arid coastal plain, utilizing such supplies for mining activities that do not require potable water would reduce the availability of that resource for domestic and industrial uses requiring fresh water.
Indigenous techniques	Revitalization of ancient Andean Agricultural Terraces Systems	Improved water management and poverty reduction in indigenous communities in the Peruvian highlands	Land levelling for efficient irrigation, improved utilization of sparse rainfall during the dry season and improved drainage management during the wet season	Revival of ancient water management practices to improve water use efficiency and reduce poverty of indigenous communities. Potentially applicable in other impoverished indigenous communities around the world

Integrated hydro-economic (HE) and political, environmental and social (PESIA) analysis

To facilitate the diagnostic HE and PESIA analysis, a tiered screening process was applied to the original database. This process reduced the starting group of 2,303 projects to a group of 230 projects by removing duplicates, non-structural interventions, operation and maintenance projects, studies, projects less than US$1m, afforestation projects and other projects which were deemed not to bring about direct impact on closing the supply demand gap or improving water quality.

For the remaining 230 projects, the HE tool was applied as part of an analysis integrating hydrological information and financial information and, the cost-effectiveness analysis of the different alternatives was developed, resulting in cost curves. Finally, some key economic benefits were estimated for the two main groups of projects (irrigation and water & sanitation).



A PESIA analysis was made integral to the HE tool. Assessment and quantification of Political and Social factors is based on the wide experience of our project social impacts team, Peruvian government Social Conflict Databases, and over 25 interviews with representatives of a broad range of stakeholders involved with, or affected by, water resource development projects

The Social Impacts Assessment utilizes six key factors: Social Conflicts, Access to Water, Human Health, Social Equity, Reduced Exposure to Natural Disasters, and Organizational structure. To account for environmental impact, a method was developed to assign numerical values and quantitative weights to five key environmental factors, according to project type and hydrologic basin: Water quantity, Water quality, Hydro-morphology, Biodiversity, and Climate change.

Subsequent to feedback obtained during the stakeholder workshop held in Lima on 25th September 2014, the weightings shown in the inset table were applied to the integrated analysis.

Evaluation Factor			
Cost Effectiveness	Economic benefit	Environmental Impact	Social Impact
0.30	0.20	0.22	0.28

Assessment of the impacts of Climate Change and El Niño

We carried out an assessment of the extent to which the impacts of Climate Change and El Niño/La Niña oscillations have been taken into account in the sources of information which we studied. With regard to the water resource situation in Peru, the water production and storage capacity in the high mountain snowfields and glaciers are particularly vulnerable to a warming global climate. As highland temperatures increase and precipitation becomes more erratic, highland pastures, wetlands, and prairies are losing their capacity to provide their usual sponge-like regulation and filtration of water flows and groundwater recharge.

The observed micro-climate changes include prolonged droughts, more intense and shorter precipitation periods, and more intense frosts.

The future climate analysis presented in the national water plan (based on the SENAMHI, 2009 report) carries with it a number of uncertainties, and project planning based upon these scenarios should be considered preliminary.

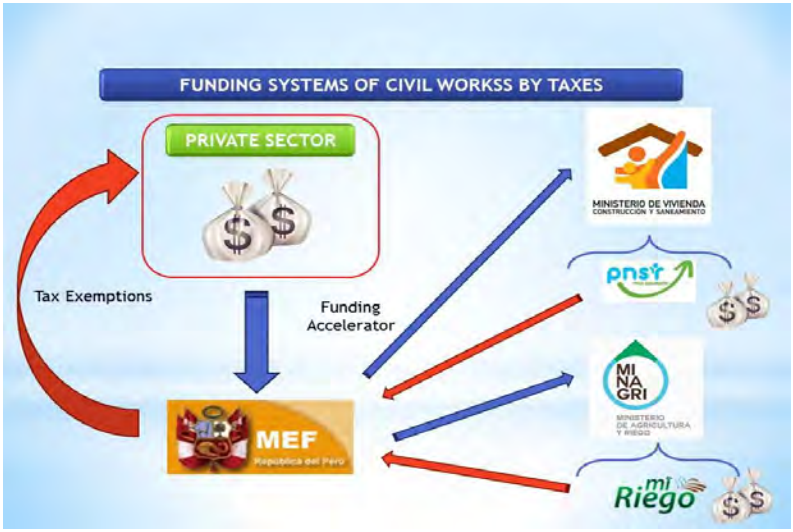
The hydrologic impact of El Niño and La Niña events is extreme rainfall. These often have significant disruptive effects on agriculture and other productive activities, and the El Niño effect is expected to increase in frequency as a result of climate change. In general, El Niño has stronger implications for the north of Peru, and most of the studies and climate models have been applied to this part of the country. As a result, the basin management plans for the south parts of the country do not present much analysis on the impact of El Niño effects.

In relation to future conditions, the SENAMIHI (2009) publication “Escenarios Climáticos en el Perú para el año 2030”, has made an extensive analysis of the climate evolution in Peru and yielded the following conclusions:

- Average annual maximum temperature is expected to increase 0.3ºC by 2030 and up to 0.7ºC to the end of 2050
- Precipitation tending to decrease by 10 to 30% from La Libertad southward to Tacna (south), and increase up to 20% to Tumbes and Piura (north), by 2030.

Due to the uncertainties described above in these studies, and the difficultly of assessing to what extent individual interventions had taken account of the studies, we did not revise any of the technical or financial data used in our HE and PESIA analysis as result of this overview.

Review of programme and project funding mechanisms



Whilst the principal objective of the stakeholder engagement process was for us to verify the assumptions made in our integrated HE and PESIA evaluation and prioritisation of interventions, the engagement enabled us to gain further knowledge of funding mechanisms in Peru which would and could apply to water interventions. We sought to identify which particular mechanisms would be relevant to the aims of 2030 WRG; that of catalysing collaboration of public, private and societal sectors. We believe that the **funding system of civil works through tax credits**[1] **has been very successful** in several private institutions, with the profit shared with the Government, beneficiaries and other private institutions. This system can fund pre-investment and investment studies; and given that the Government often has limitations to carry them out, the private sector gets an opportunity to participate at an early stage.

The programmes at a national level of the **Public-Private Associations are a good opportunity** for the private sector to invest.

The planned investments to be made in the water and sanitation sector will require at least 15 more years of investment to reach the goal of universal coverage. The water and sanitation sector has identified an investment need of Peruvian Nuevos Soles[2] (PEN) 53 billion for the period 2014-2021, weighed towards sewerage and wastewater treatment over drinking water. In the data bank of the SNIP, **there are viable projects still without budget**, which may be accelerated by the private sector's investment in the water and sanitation sector.

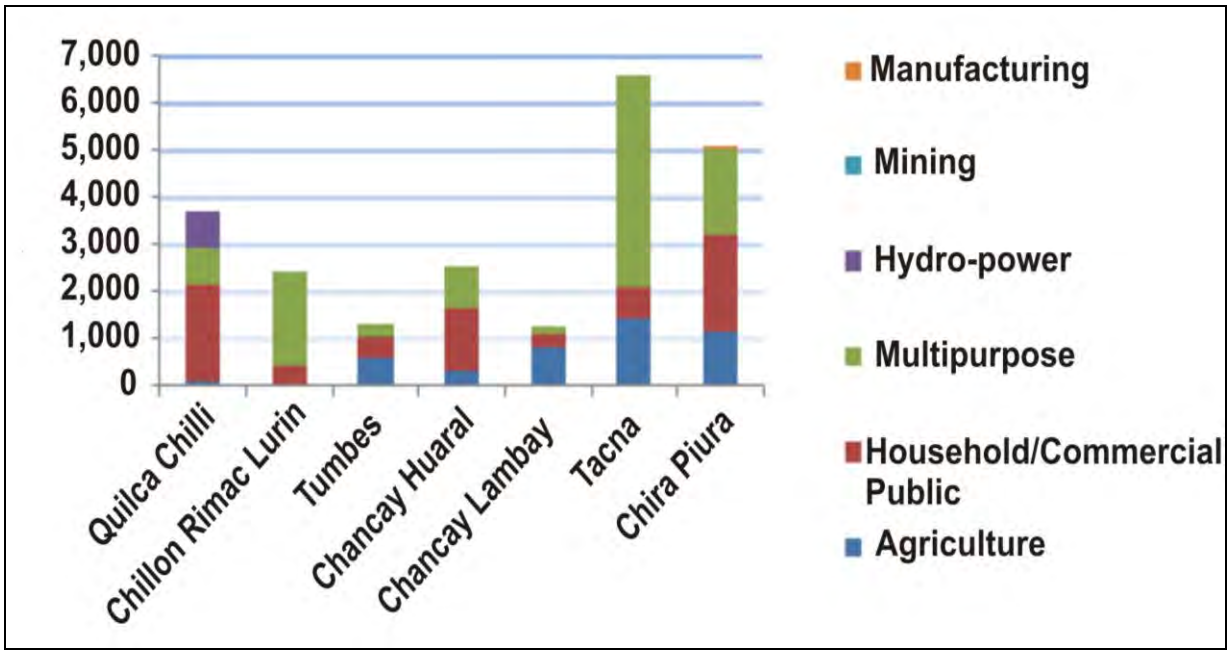
[1] National government program known as "Obras por Impuestos," or "Projects for Taxes"
[2] The national monetary unit

Results of the analysis

Our focus was on analysing the HE and PESIA impact for each of the 6 basins as well as the Chillón-Rímac-Lurín basins occupied by the Lima metropolitan area. The 204 investment alternatives for these basins (from the 230 which also contain investment opportunities in other coastal basins) have a total investment cost of some PEN 22 billion, and include projects which would reduce the supply demand gap by some 4,900 Hm^3/year.

When looking at the ten most highly ranked projects in each catchment, the resulting 70 projects have an investment cost of some PEN 7.6 billion (~35% of the total) and would reduce the supply demand gap by some 2,500 Hm^3/year (~45% of the total). In other words, the highest priority projects taking into account social and environmental factors have high leverage to reduce the supply demand gap.

The following chart illustrates the distribution of investment (in thousands of PEN) by basin by sector.



The table on the following page summarises these findings by basin, and shows the linkage of investment with the challenges in each basin.

		Tumbes	Chira Piura	Chancay-Lambayeque	Chancay-Huaral	Chillón - Rímac - Lurín	Quilca Chili	Tacna	Total
Hydrological data (water balance)	Water availability (Hm^3/yr)	3,290	3,074	1,161	538	N/A	2,128	406	10,597
	Water demand (Hm^3/yr)	439	2,751	1,082	374	N/A	1,138	681	6,495
Water Policy Challenges		Low-tech irrigation	Infrastructural deficit - regulation	High crop demand	Increase in population	Soil degradation	Infrastructural deficit	Mismatch: water availability & needs	
		Flood risk	Water scarcity	Soil degradation	Low-tech irrigation	Flood risk	Increased demand	Social conflict - transfer	
		Silting	Extreme events risk	Pollution	Infrastructural deficit - Storage	Infrastructural deficit	Pollution	Groundwater overexploitation	
		Pollution (mining)	Pollution – low water treatment	Low coverage of water services	Mining	Pollution		Irrigated land expansion	
			Industry discharges	Infrastructural deficit	Pollution (mining)			Soil salinization	
					Low sanitation & wastewater treatment			Saline water intrusion - aquifer	
								Coverage	
								Pollution	
Results from the total list of 204 prioritised IAs	Total investment cost (million PEN)	1,310	5,038	1,159	2,555	2,408	2,756	6,578	21.804
	Technical effectiveness (Hm^3/yr)	97	1,250	190	459	293	1,655	923	4,867
Results from top 10 of prioritised IAs	Top 10 projects (general typology plus important projects)	Irrigation	Irrigation	Irrigation	Irrigation	Reservoirs	Reservoirs	Irrigation	
		Tumbes WWTP	Piura WWTP		Conjunctive use	Water transfers	Arequipa WWTP	Reservoirs	
					Drinking water	Water treatment	Yura river regulation		
					Reservoirs				
	Total investment cost (million PEN)	250	943	82	228	2,385	2,425	1,257	7,570
	Technical effectiveness (Hm^3/yr)	83	670	83	180	293	475	690	2,474

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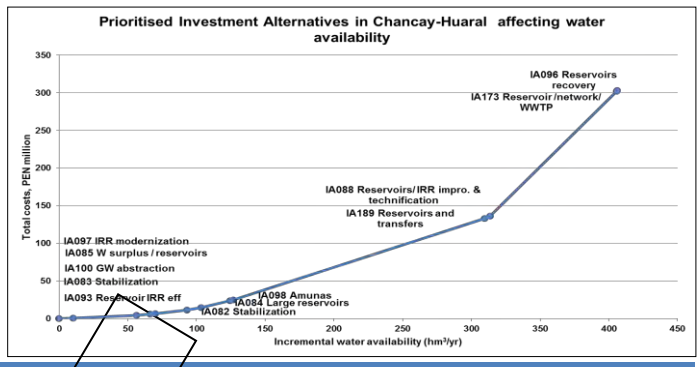
For each basin we produced a prioritised list of investments based on cost-effectiveness, a cost curve to illustrate cost-effectiveness, and a prioritised list of investment from the integrated analysis. The following figures are shown as an example, in **this case for the Chancay Huaral basin**, and showing the top ten ranked projects in the final table.



ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³)
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5.20	10.30
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33.50	46.10
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10.92	10.00
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4.16	3.70
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24.03	18.00
IA097	Modernization of irrigation conveyance infrastructure and canal lining.	32.76	23.00
IA202	Drainage system for agriculture in Jequetepeque Valley	27.22	35.30
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26.50	10.20
IA084	Large reservoirs – Purapa and Quiles.	62.14	21.00
IA098	Water harvesting through amunas (indigenous practice).	2.20	2.40
IA189	Reservoirs and water transfers in Huaura river basin	801.32	183.00
IA088	New reservoirs linked to efficiency improvements and technification of irrigation – Quipacaca and Yaco Coyonca.	20.72	4.00
IA173	Expansion of reservoirs, distribution networks, and construction of a drinking water treatment plant - Drinking water supply for the city of Lima	1,124.00	92.00

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24.03	18.00	5.00	2.67	2.60	3.80	3.67
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33.50	46.10	5.00	1.83	2.13	3.95	3.44
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5.20	10.30	5.00	1.67	1.95	4.00	3.38
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4.16	3.70	5.00	1.67	1.95	3.95	3.37
IA202	Drainage system for agriculture in Jequetepeque Valley	27.22	35.30	5.00	1.33	1.78	4.20	3.33
IA097	Modernization of irrigation conveyance infrastructure and canal lining.	32.76	23.00	5.00	1.17	2.00	3.70	3.21
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10.92	10.00	5.00	1.50	2.28	3.05	3.15
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26.50	10.20	4.00	1.67	1.95	3.95	3.07
IA084	Large reservoirs – Purapa and Quiles.	62.14	21.00	3.00	1.83	2.13	3.95	2.84
A098	Water harvesting through amunas (indigenous practice).	2.20	2.40	3.00	1.50	1.78	3.95	2.70

We also ranked all 230 projects in terms of the integral analysis and the resulting top 20 projects are shown below.

IA ID (Final)	Key economic sector	Water policy/ management challenge	River basin district/ catchment	Type of project	Title of the project / intervention	Capital investment cost (@ market prices in PEN)	Total Score
IA195	Household / Commercial / Public	Quality	Chancay-Huaral	WWT	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24,030,000	3.67
IA258	Household / Commercial / Public	Quality	Chira-Piura	WWT	Waste Water Treatment Plant San Martin	6,500,000	3.67
IA038	Agriculture	GAP	Tumbes	IRR	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas - Tumbes	23,325,700	3.45
IA083	Agriculture	GAP	Chancay-Huaral	D+R	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33,500,000	3.44
IA093	Agriculture	GAP	Chancay-Huaral	D+R	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5,200,000	3.38
IA017	Agriculture	GAP	Chira-Piura	IRR	Efficiency improvement through technified irrigation - mostly drip irrigation	25,805,948	3.37
IA085	Agriculture	GAP	Chancay-Huaral	D+R	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4,159,000	3.37
IA280	Household / Commercial / Public	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11,100,000	3.35
IA261	Household / Commercial / Public	Quality	Chira-Piura	WWT	Waste Water Treatment Plant Chulucanas	3,656,250	3.34
IA202	Agriculture	Flood	Chancay-Huaral	DRAIN	Drainage system for agriculture in Jequetepeque Valley	27,222,804	3.33
IA221	Agriculture	Flood	Santa	DRAIN	Improvement of drainage system in Huancaco sector - Viru, Libertad	8,613,944	3.33
IA019	Agriculture	GAP	Chira-Piura	IRR	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13,617,324	3.28
IA182	Multipurpose	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Reservoirs in Fortaleza river basin	60,430,000	3.27
IA125	Agriculture	GAP	Chancay-Lambayeque	D+R	SICAN dam system	1,630,000	3.27
IA284	Agriculture	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Jarumas dam - Sama river basin	37,175,100	3.24
IA097	Agriculture	GAP	Chancay-Huaral	IRR	Modernization of irrigation conveyance infrastructure and canal lining.	32,760,000	3.21
IA111	Agriculture	GAP	Chancay-Lambayeque	IRR	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5,880,000	3.21
IA120	Agriculture	GAP	Chancay-Lambayeque	IRR	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1,570,000	3.19
IA003	Agriculture	GAP	Chira-Piura	IRR	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10,301,669	3.18
IA100	Agriculture	GAP	Chancay-Huaral	WS	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10,920,000	3.15

The next three inset tables show these top 20 projects groups by Sector, Basin, and Project Typology

Sectors	Nr of projects	PEN total M
Agriculture	15	250
Household	4	45
Multipurpose	1	60

Basin	Nr of projects	PEN total M
Chancay-Huaral	7	138
Chira-Piura	5	60
Chancay-Lambayeque	3	10
Tacna	3	108
Tumbes	1	23

Project Types	Nr of projects	PEN total M
Irrigation	7	125
Storage	7	150
Wastewater Treatment	3	35
Water Supply	1	11
Drainage	2	35

Interpretation of the results

Peru is in the process of harnessing the potential of water for economic development through agriculture, hydropower, mining, and urban development. Freshwater sources are intensively used, especially in the most water scarce areas of the country where population and the most water intensive activities tend to concentrate.

Not surprisingly, most of the projects ranking higher in the prioritisation of investments are programmes to increase water use efficiency in irrigation at different levels. We have also noted the prevalence of major water storage and inter-basin transfer projects, many of which are for irrigation only and others with multipurpose uses. The concern around surface and ground water quality degradation explains the major effort foreseen in the country to expand or build wastewater treatment plants and sewer systems

The trade-off to be faced by Peruvian policy makers and private investors in the country is how to reconcile the need to substantially reduce the infrastructural deficit in the country and, at the same time, to avoid severe indebtedness, major environmental liabilities, social conflicts, and to provide effective responses to close the water gap.

With major infrastructural investments planned one may expect the infrastructural deficit to be reduced in the next few decades. These measures, though, may not necessarily result in a real contribution to curb the existing negative trends towards increased scarcity, higher drought risk and pollution of surface and ground water.

Integrated water resources management and a contemporary approach to water planning in an emerging economy like Peru is not so much about replacing supply-side with demand-side alternatives but rather to combine them in an integrated approach. The analysis of alternatives in isolation and only from a sectorial perspective is somewhat misleading because synergies between different investment alternatives and trade-offs are of paramount importance.

Having made those qualifications of the findings, three major groups can be identified in the prioritised list of investments:

- **Agriculture**, with planned investments in efficiency improvement through technified irrigation (mostly drip irrigation); improved off-site infrastructure; implementation of major and minor infrastructures for groundwater irrigation; and canal lining.

- **Household, commercial and public** uses, with planned investments in dams and reservoirs, improvement of groundwater abstraction points for household supply or major investments in WWTPs (with the challenge to tackle energy inputs to ensure feasibility).
- **Multipurpose** infrastructures, such as the Chili reservoirs, or those in the Fortaleza sub-catchment, or the combined system of reservoirs and water transfer in the Pisco river basin.

Key messages

We believe that in these groups of projects there are a number of possible foci for the 2030 WRG's objectives in Peru. With a perspective of an objective to catalyse collaborative partnerships in Peru, we have grouped key messages in two thematic areas, and we have commented on potential implementation routes involving collaborative structures.

An overarching key message relates to the role played by water in the Peruvian economy. Peru's major exports are fisheries, agro-food products, minerals, oil and natural gas and, to a lesser extent, textiles, pulp and paper and chemicals. These are all water-intensive commodities which will depend increasingly on well managed water resources. Recognising that the wider (macroeconomic) impacts of water policy and management are critical, hydro-economic analyses can provide a firm foundation for development of policy and prioritisation of interventions.

From a basin perspective; and purely as a starting point:

a) **The Tacna catchment** has severe water stress which the 10 highest priority projects would go a long way to resolving by generating some 690 Hm/3 of water for an investment of PEN 1,257 m. These projects are dominated by irrigation efficiency and reservoirs, and include alternative means of generating more supply through transfer or desalination.

b) **The Chancay-Huaral** catchment also has severe water stress and within its 10 highest ranked projects are 7 which are within the 20 highest ranked across all catchments. They would generate some 180 Hm^3/year of water for an investment of PEN 228 m and make a significant move toward more water security in the basin. The projects include irrigation, reservoirs and municipal water supply/sanitation.

c) **The Chira-Piura catchment** is one of the largest and also has severe water stress. The 10 highest ranked projects would generate some 670 Hm^3/year of water for an investment of PEN 943 m and make a significant move toward more water security in the basin. The projects are dominated by irrigation efficiency and municipal wastewater treatment.

From a sector and project type perspective:

a) **The agriculture sector** is by a significant margin that which features mostly in the top 10 projects in the catchments and in the overall top 20 projects, where they account for PEN 250 m (some 70%) of investment. We can see significant potential for wastewater reuse, although this would require not only investments in relevant infrastructures but also the introduction of appropriate economic instruments.

b) **Irrigation improvement and efficiency projects** feature highly in most of the catchments and in the overall top 20 they account for PEN 125 m of investment. It is necessary to bear in mind that some water savings at a plot level may not result in improved water efficiency at a basin level, which calls for hydro-economic analysis at a watershed scale to factor this in.

c) **Dams and reservoir projects** feature highly in most of the catchments and in the overall top 20 they account for PEN 150 m of investment.

d) **Municipal (urban and rural) wastewater treatment projects** feature in several of the catchments and in the overall top 20 they account for PEN 35 m of investment.

Implementation routes

We believe that the **Funding System of Civil Works by Tax Credit** offers an advantageous tax position (in the income tax) for private sector investment in what are traditionally public sector projects. Of the 11 investment areas within that scheme, one is the construction, improvement and expansion of drinking water and sanitation systems. Further, the fact that the **Public-Private Associations** already in place in Peru mean that the principles of private-public-civic society collaboration are already established.

Potential private sector comparative advantages

The most beneficial project types identified in this study (irrigation efficiency, dams and reservoirs, wastewater treatment) lend themselves to **application of private sector technological, financial and project management resources**. Verification of this conclusion is evident in the 2030 WRG catalogue of case studies. Further, the experience of the private sector (potentially in other territories) in some of **the potential intervention opportunities** (managed aquifer recharge, re-use of treated wastewater, utility operations) may be a source of “win-win” collaboration.

An initial roadmap for discussion – moving to “Convene”

Whilst we recognise the need for a “roadmap towards the actual implementation of projects to close the water gap”, we do not feel that it is appropriate to propose such an important concept without a review of the key messages with the 2030 WRG partnership.

Purely as a starting point for discussion, we suggest that the following matrix could be used as a framework to consider how to convene stakeholder groups for subsequent discussion around key messages. Groups could be convened based on either axis of the table, and stakeholders could be represented in Groups on either axis depending upon their interest.

				Basin Axis		
				Tacna	Chancay Huaral	Chira Piura
Sector and Project Axis	Agriculture and Multipurpose		Irrigation improvement and efficiency			
		Household	Dams and reservoirs			
			Municipal wastewater treatment projects (inc re-use)			
			Other potential interventions			

List of Acronyms

AAA:	Autoridades Administrativas del Agua (Water Management Authorities)
AGR:	Agriculture
AIA:	Actual Investment Alternatives
AID:	Direct influence area
AII:	Indirect influence area
ALA:	Autoridades Locales del Agua (Local Water Authorities) ANA:
ANA:	Autoridad Nacional de Agua (National Water Authorities)
BCR:	Benefit-Cost ratio
CAPEX:	Capital Expense
CBA:	Cost-Benefit analysis
CBO:	Community-based organization
CCA:	Climate change adaptation
CRHC:	Consejos de Recursos Hídricos de Cuencas (Basin Water Resources Councils)
CRU:	Climate Research Unit
CSR:	Corporate Social Responsibility
D+R:	Dams and reservoirs
DRAIN:	Drainage
ECF:	Elemental chlorine free
EDA:	Acute diarrhoea diseases ENSO:
ENSO	El Niño Southern Oscillation
ENV	Environment
ESS	Ecosystem services
GAP:	Closing the water gap
GDP	Gross Domestic Product
GGGI	Global Green Growth Initiative
HCA:	Human Capital Approach
HE:	Hydro-Economic
HP:	Hydropower
ICEN:	Indice Costero El Niño (Coastal Index “El Niño”)
IDB:	Interamerican Development Bank
IFC:	International Finance Corporation
IMWR:	Integrated Management of Water Resources
INRENA:	Instituto Nacional de Recursos Naturales (National Institute for Natural Resources)
IRR:	Irrigation
MAN:	Manufacturing
MAR:	Managed Aquifer recharge
MEF:	Ministry of Economy and Finance
MIN:	Mining
MINAGRI:	Ministerio de Agricultura y Riego (Ministry of Agriculture and Irrigation)
MINAM	Ministerio del Ambiente (Ministry of Environment)
MoU:	Memorandum of Understanding
NCAR:	US Agency National Center for Atmospheric Research

NGO:	Non-governmental organisation
NWRMP	National Water Resource Management Plan
OPEX:	Operational Costs
PEN:	Peruvian soles
PESIA:	Political, Environmental and Social Impact Assessment
PGRHC:	Plan de Gestion de Recursos Hidricos de Cuencas (Basin Water Resources Management Plans)
PIA:	Potential Investment Alternatives
PIN:	Project idea notes
PMGRH	Programa de Modernización de la Gestión Integrada de los Recursos Hídricos (Project for Modernization of Water Resources Management)
PNRH:	Plan Nacional de Recursos Hidricos (Nacional Water Resources Plan) PNSU:
PNSR:	National Programme of Rural Sanitation
PNSU:	National Programme of Urban Sanation
PPA:	Private-Public Associations
PRA	Poverty Reduction and Alleviation Project
QA:	Quality assurance
REC:	Residential
S:	Sanitation
SEDAPAL:	Servicio de Agua Potable y Alcantarillado de Lima (Potable water and sewerage service for Lima)
SENAMHI:	Servicio de Nacional de Meteorología e Hidrologia (National Service of Meteorology and Hydrology)
SNIP:	Sistema Nacional de Inversion Publica (National System of Public Investment)
ToR:	Terms of reference
UNFCCC:	United Nations Framework Convention on Climate Change
USAID:	United States Agency for International Aid
WEAP:	Water Evaluation and Planning system model
WEF:	World Economic Forum
WI:	Water Initiative
WPP:	Water purification treatment plant
WRG:	Water Resource Group
WRMP:	Water Resource Management Plan
WS&S:	Water supply and sanitation
WWT:	Wastewater treatment
WWTP:	Wastewater treatment plant

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Appendices

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Appendix G Prioritisation Analysis Investment Alternatives

Appendix H Workshop Report

1.0 Introduction

This report describes the activities and results of AMEC's project to advance the goals of the 2030 Water Resources Group Peru Partnership. This project was led by AMEC with key support from INCLAM SA and IMDEA Water Institute. The report summarises the outcomes of a review of water resource development interventions, the application of a hydro-economic tool, and a review of political, social and environmental impacts, to identify a list of prioritised investments in each of the six coastal basins that were the subject to pilot plans.

The remainder of **Section 1** provides a summary of the 2030 WRG organizational history, the history of its Peru Partnership, and the goals and objectives of this project. The report is organized into six additional sections:

- **Section 2** summarizes a review of the water resource investment opportunities for the Pacific coastal basins of Peru, and the application of a screening and diagnostic analysis of those potential investments;
- **Section 3** introduces and describes the Hydro-Economic (HE) tool which is subsequently utilised to evaluate and prioritise the investment alternatives;
- **Section 4** describes the stakeholder engagement process, and the criteria used to integrate a Political, Environmental, and Social Impact Assessment (PESIA) analysis with the HE analysis;
- **Section 5** presents the results of the application of the HE tool and PESIA to prioritise the potential investments;
- **Section 6** discusses mechanisms by which the private section can invest in water resources projects with substantial public benefit in Peru, and
- **Section 7** provides a summary of "take home" messages from the study and presents a set of recommendations to advance the 2030 WRG Peru Partnership toward meeting the Partnership goals

1.1 2030 WRG History

Since 2006, the World Economic Forum (WEF) and its Members have been bringing the attention of policy makers to the inter-related global risks of crises in water supply and food shortage. In parallel, the International Finance Corporation (IFC) has been working towards its mission of investing US$1bn each year in water security projects and thereby increasing water supply to 100 million additional people and safe sanitation to 20 million people. In 2006, the World Economic Forum's (WEF) Water Initiative (WI) embarked upon its Water Partnership Project work stream with the objective of creating partnerships between government, development agencies, NGOs, and WEF Industry Partners in regions of special interest to WEF members. The partnerships seek to develop a body of water-related projects contributing economic benefits while being also attractive to sources of finance in the private sector.

In 2008 a number of multinational businesses (some of them members of WEF) and IFC joined forces and the 2030 Water Resources Group (2030 WRG) was launched. The group sought to develop a new

fact base of potential levers and associated costs for addressing water scarcity; with the ultimate objective of providing tools which could be used in the multi-stakeholder settings coming from the WEF partnership work stream.

In November 2009, 2030 WRG published its ground-breaking report "Charting our Water Future: Economic Frameworks to Inform Decision-Making". The report was something very new in the sense that it put cost benefit analysis at the heart of a decision-making framework for prioritising water interventions. But it also crystallised the global challenge of water scarcity; that we are already withdrawing a volume of blue water which is close to a planetary boundary; that to satisfy the demand for water in 2030 will require us to do things differently. This report was followed in January 2010 by the WEF paper on the principles of partnership using specific case studies: "Innovative Water Partnerships: Experiences, Lessons Learned and Proposed Way Forward".

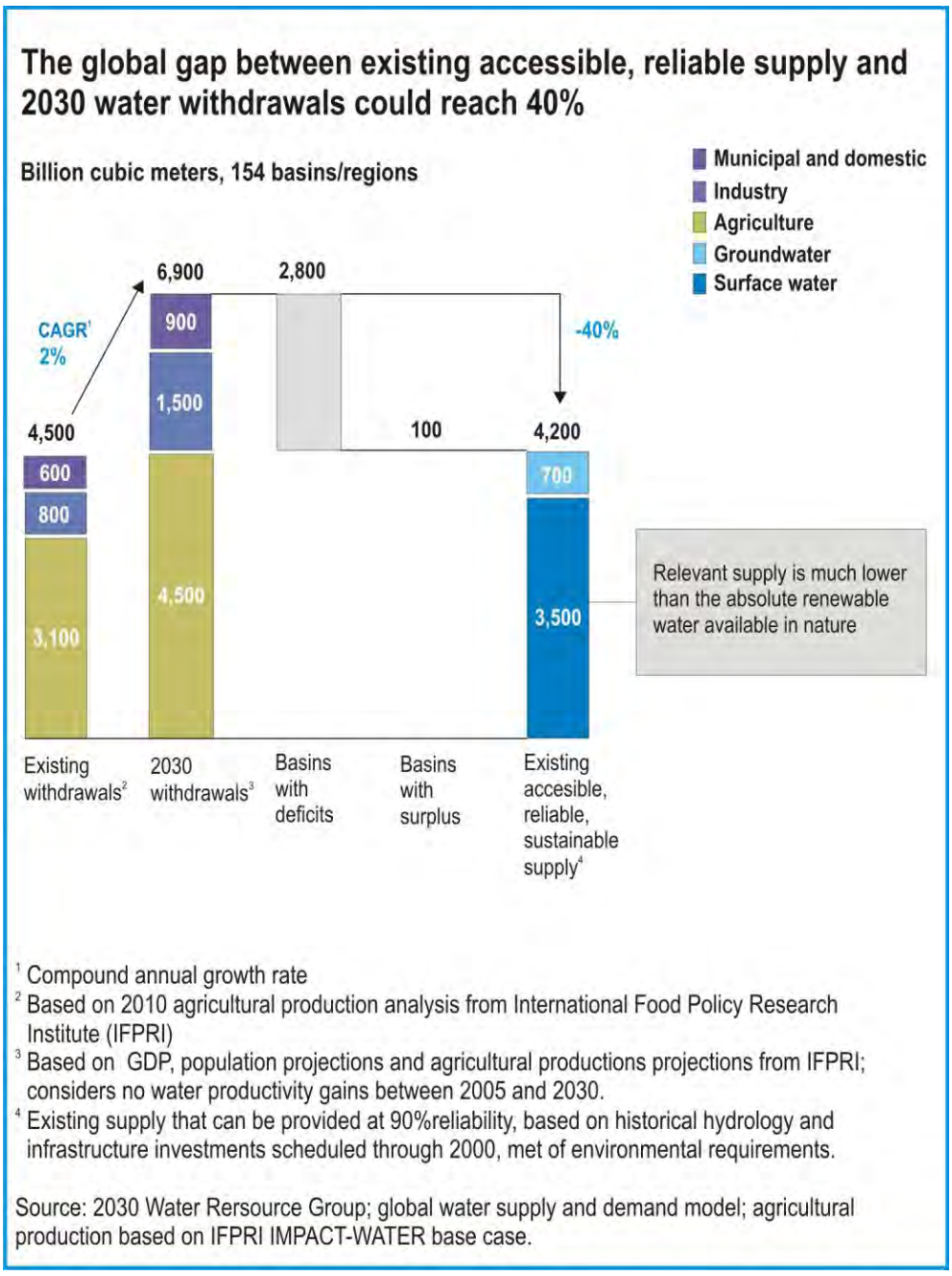
Against this background, Water Resources Group Phase 2 was launched in 2010 as a formal alignment of WEF WI and 2030 WRG. Phase 2 led to Phase 3 with the formal establishment of the 2030 WRG, with its secretariat housed in the offices of the IFC in Washington. 2030 WRG works as a public-private-civil society partnership, using a three step approach which brings together the Analyse, Convene, Transform principles developed by WEF and 2030 WRG. At the WEF meeting in Davos in January 2014, the founders of 2030 WRG committed to supporting 2030 WRG for three further years from July 2014.

2030 WRG has been working with a number of governments, which in broad chronological order are:

- South Africa
- Jordan
- India (Karnataka)
- Mexico
- Tanzania
- Mongolia
- India (Maharashtra)
- Peru
- Bangladesh
- Kenya

The ACT process is at differing stages in each country, with South Africa having reached "T" with a number of innovative partnerships now in operation.

Figure 1-1: Global gap between access and supply



[1] Compound annual growth rate
[2] Based on 2010 agricultural production analysis from International Food Policy Research Institute (IFPRI)
[3] Based on GDP, population projections and agricultural productions projections from IFPRI; considers no water productivity gains between 2005 and 2030.
[4] Existing supply that can be provided at 90%reliability, based on historical hydrology and infrastructure investments scheduled through 2000, met of environmental requirements.

Source: 2030 Water Rersource Group; global water supply and demand model; agricultural production based on IFPRI IMPACT-WATER base case.

1.2 WRG Peru Initiative

2030 WRG first engaged with the Government of Peru in 2012 and the initial discussions led to the signing of a Memorandum of Understanding (MoU) at the WEF Latin America Summit in Lima in April 2013.

Since then 2030 WRG has been working with the Ministry of Agriculture (MINAG), the National Water Authority (ANA) and the Global Green Growth Initiative (GGGI) to initiate a multi-stakeholder platform that will guide the work streams and priorities. Other public sector partners include the Ministry of Mines, the Ministry of Environment and the Ministry of Finance.

Discussions between 2030 WRG and ANA led to an agreement to carry out an analysis of the National Water Plan, River Basin Water Management Plans and other related plans to determine cost effectiveness of interventions, to understand their political, social and environmental impacts and thereby prioritize investments. The analysis is intended to inform the multi-stakeholder platform and help guide the focus of public-private dialogue. This report describes the procedures and results of the analytical work agreed upon between 2030 WRG and ANA.

In May 2014, 2030 WRG issued a Terms of Reference (ToR) for the analysis to its panel of consultants and awarded a Task Order to AMEC to carry out the work over the period July to October 2014.

1.3 Project Objectives and Scope

The purpose of this work is to provide an important value-add of the 2030 WRG Peru partnership with the Global Green Growth Initiative (GGGI) to raise awareness, and mobilise 'new actors' from the private sector to engage in water activities and the partnership. The Work Plan of the partnership is summarised as:

- Institutional setup; creation of a Steering Committee and a public-private multi-stakeholder platform (MSP)
- Mapping of current initiatives and actors
- Analysis of financial instruments to promote private sector investment in the water sector
- Identification of gaps in current initiatives and roadmap for future work
- Promotion of investments to potential MSP partners
- Support integrated water resources management plans in key basins
- Capacity building

The ToR for the analytical work is summarised as follows:

- Review of the proposed interventions and associated investments identified in the coastal catchments of the National Water Plan and the Coastal Water Resources Management Plans (see **Figure 1-2**);

- Application of hydro-economic analysis to identify priority interventions from a cost benefit perspective;
- Review the political, environmental and social impacts of the priority investments;
- The ToR require that each of these tasks be the subject of reports and presentations, together with supporting documentation on datasets and evidence of stakeholder and literature research;
- In carrying out these tasks and arriving at our conclusions, we have considered five cross-cutting themes;
- The scale and urgency of the water resources challenge in the context of development and growth;
- The role of water quality improvement as a key factor in closing the supply demand gap and in improving environmental conditions;
- The potential role of the private sector in technological, financial and managerial resources to implement projects;
- The importance to 2030 WRG and GOP of applying Best Practice and Sustainable techniques; and
- The impact of El Niño and Climate Change on water resource availability and water demand.

The ToR for this project were developed between 2030 WRG and ANA to help build upon existing planning documents, and advance efforts toward stimulating private investment in Peruvian water resource infrastructure.

To achieve the elements called for in the ToR, the work was carried out in a series of tasks between July and October 2014. We submitted to 2030 WRG our report on "Review of Proposed Interventions" on 2nd September 2014. A Draft Final Report that brought together that report with reports on the application of the Hydro-Economic tool and on review of political, social and environmental impacts was submitted on 22nd September 2014. The next step in our work was to invite comments and suggestions regarding our initial findings at the Stakeholder Workshop on 25th September 2014; the outputs of that workshop as well as Draft Report review comments by 2030 WRG have been incorporated into this Final Report. ANA was involved throughout the project, from inception to the final workshop.

Figure 1-2: Coastal basins in Peru considered in this report

2.0 Review of Interventions

This section summarizes activities and results related to reviewing existing water resources management plans to identify projects and interventions which have not yet been implemented. Specific objectives were to:

- Review and synthesise existing water sector plans, and compile a list of water resource development interventions;
- Investigate to what extent supply and demand management solutions have been adequately addressed in the plans;
- A diagnostic which will assess the water availability demand situation and whether the proposed interventions to close the gap are realistic;
- Identify whether green and indigenous practices have been covered;
- A review of global best practices for closing the water supply-demand gap in Peru; and
- Recommended projects for inclusion in 2030 WRG Case Studies.

In performing this, a preliminary screening analysis of the plans is undertaken and a subset selected for Hydro-Economic analysis and subsequent investment prioritization.

2.1 Compilation of Projects from a Review of Existing Plans

The overall objective of this task was to make a review and synthesis of the existing and current water sector plans, and subsequently compile a list of water resource development actions identified in those plans to yield a set of actions which may be considered attractive for investment by the private sector. In particular, those plans promoted after the passage of the Water Resources Act (Law 29338) in 2009:

- The National Water Resources Plan or NWRP (ANA Memoria 2013, also designated as the PNRH for the initials in Spanish *Plan Nacional de Recursos Hídricos*);
- The 6 completed pilot WRMPs[3] for the coastal zones of Tumbes, Chira-Piura, Chancay-Lambayeque, Chancay-Huaral, Quilca-Chili and Tacna (Tacna) – overall covering 9 coastal catchments out of 62. These plans provided the overwhelming majority of information available. These six WRMP were recently concluded, with funding provided by the World Bank and the Inter-American Development Bank under the Project for Modernization of Water Resources Management (PMGRH, *Programa de Modernización de la Gestión Integrada de los Recursos Hídricos*) program in those institutions. An exhaustive coverage of all 62 watersheds is not feasible given the absence of planning documents (or even of planning processes), but we have

[3] Also alternatively referred to as River Basin Management Plans (RBMPs), or in Spanish as Planes de Gestion de Recursos Hidricos de Cuencas (PGRHC)

managed to obtain information also for the Acarí, Atico, Chala, Ica, Moquegua, Santa and Chillón-Rímac-Lurín[4].

Other sources of information reviewed to identify projects and interventions relevant to this study were the online databases maintained by the Peruvian government: National Public investment System (SNIP –Sistema Nacional de Inversion Pública) and Proinversión (the public entity attached to the Ministry of Economy and Finance that is responsible for national policies to promote private investment). These Sources are summarized in **Table 2-1** below:

Table 2-1: Sources of information utilized to develop the list of potential investments.

Information sources	Responsible entity	Remarks
Plan Nacional de Recursos Hídricos (PNRH)	ANA, National Water Authority	Provided by ANA in digital editable version (MS Word).
Planes de Gestión de Recursos Hídricos de Cuenca (PGRHC)	ANA and in particular, Consejos de Recursos Hídricos de Cuenca **(CRHC) –** basin **c**ouncils	Provided by ANA in digital editable version (MS Word).
Database of projects for investment at sectorial level	ProInversión agency of the Peruvian Government	Accessible on the web link: http://www.proyectosapp.pe/default.aspx
Database of projects in the Sistema Nacional de Inversión Pública (SNIP)	Ministry of Economy and Finance (MEF)	Accessible on the web link: http://www.mef.gob.pe/contenidos/inv_publica/ new- bp/operaciones-bp.php

2.1.1 National Water Challenges Hierarchical Structure

It is important to note that taking into account all sources of information, investments in water resources can be structured and disaggregated according to different levels, as shown in **Table 2-2**[5] Each of these levels of water resource actions can be generally described as follows:

Policy or *Lines of action*, which correspond to the 5 major themes / challenges considered by the National Water Resource Plan and would be the first level of disaggregation of the Plan into five Policies related to: water quantity management, water quality management, opportunity management (including institutional and socio-economic development of poor areas), management of water culture, and eventually adapting to climate change and extreme events;

[4] There will be additional plans (such as Chillón-Rímac-Lurín) but not within our study, given the status of the tendering processes according to information provided by the ANA.

[5] These different categories are neither the hierarchical structure of the RBMPs nor that of the NWRP, but rather an attempt to match the logical sequence of the former (action lines, programmes, sub-programmes, interventions, and projects) and the logical framework of the NWRP, based on 5 national policies, 11 strategies, and 30 so-called programmes of measures (see Table 4.1, page 168 of the NWRP, or Table 6.1, page 217, for the same structure with associated investments.

Strategies, that correspond to "sub-lines of action;" for example, under the "quantity management" Policy there are various Strategies including "improving water use efficiency and demand management" and "increasing available water supply";

Programmes, a third level of disaggregation that are strategic elements leading to planning horizons aiming at achieving strategic objectives that represent a grouping of projects; for example, under the "improving water use efficiency and demand management" Strategy there are various Programmes, including "control and demand measurement" and "improving water distribution systems";

Sub-programmes, a fourth level of disaggregation available in the NWRMP, linked to specific strategic objectives and included within programmes. They gather the next level (interventions); and

Interventions and *Projects*, which represent the fifth and sixth levels of disaggregation. Continuing with the above example, under the "control and demand measurement" Programme there is a goal to undertake 2,061 water supply system control and measurement projects in the next 20 years. The Intervention could be a grouping of such projects on a regional basis, or by type of system improvement.

2.1.2 Database of Interventions

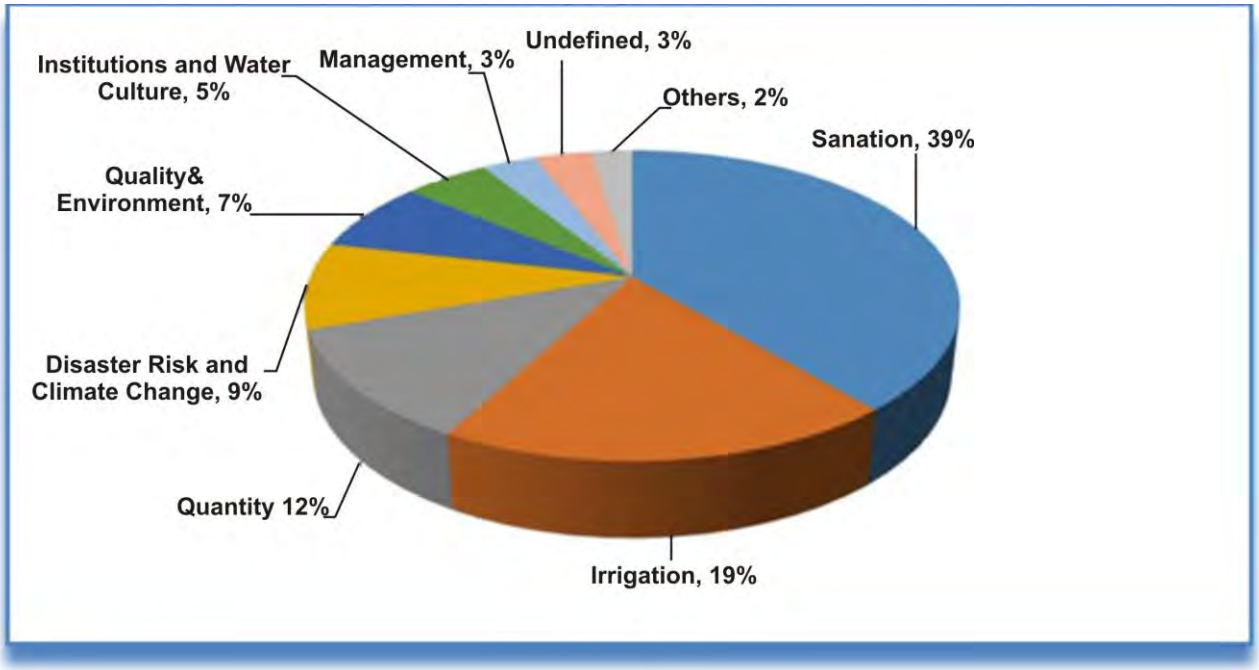
Based on the review of the above-cited data sources, a database of 2,303 interventions was developed in an Excel spreadsheet. The Excel database was structured to capture specific characteristics of each interventions organised into nine major categories: identification characteristics; location characteristics; technical and social parameters; typology and duration of project; other data from the SNIP database; other data and information from the basin water plans; category of project within the national water plan; and other supporting data.

Figure 2-1 provides a breakdown of the projects by thematic area that can be related back to the NWRP Policies and Strategies; **Appendix A** defines in detail the types of data and information sought for each intervention.

Table 2-2: Hierarchical structure of the actions related to water security in Peru (source: National Water Resource Plan, Table 4.1)

Policy		Strategy		Programme	
1	Quantity Management	1	Improving knowledge of water resources and demands	1	National Hydro meteorological net implementation
				2	Increase the knowledge of groundwater
				3	Implementation of the National System Information of water quantity
		2	Improving efficiency of water use and demand management	4	Demand control and measure
				5	Improving conduction system and water distribution
				6	Irrigation technification
				7	Sustainable amplification of agricultural frontier
		3	Increase of the resource availability	8	Increment of the surface regulation of WR and inter-basin WR transfer
				9	Upper land basin reforestation
				10	Elimination of aquifer over exploitation
				11	Reuse of treated wastewater and sea water desalinization
2	Quality Management	4	Improving knowledge of water quality	12	Improving knowledge of surface water quality
				13	Improving knowledge of groundwater quality
				14	Supervision of wastewater discharge
				15	Normative regulation of water quality and best practices
		5	Improvement and extension of the sanitation coverage	16	Increase potable water coverage
				17	Increase sewer coverage
				18	Increase wastewater treatment coverage
3	Opportunity Management	6	Implementation of the Integrated Management of Water Resources (IMWR)	19	Institutional strengthening of the IMWR
				20	Administrative strengthening of the IMWR
				21	Implementation of the IMWR on the trans border basin
		7	Develop irrigation and sanitation in poverty areas	22	Develop of the irrigation and sanitation on poverty areas
4	Management of water culture	8	Institutional coordination and hydric governance	23	IMWR consolidation
				24	Hydro solidarity and hydric governance
		9	Environmental education and water culture	25	Water culture consolidation
				26	Communication, sensitization and awareness of IMWR
5	Climate change and extreme events adaptation	10	Climate change adaptation	27	Improving knowledge of climate change effects
				28	Climate change adaptation measures
		11	Irrigation management in extreme events	29	Irrigation management of inundation and sliding
				30	Performance in a situation of drought alert

Figure 2-1: Percentage Distribution of the 2,303 Interventions by Thematic Area[6]



2.1.3 Data Availability

A detailed review of the each of the interventions in the database was made. For the 2,303 projects listed, data for the vast majority of the characteristics remained empty for a variety of reasons:

- For many records, some of the information is not available at all;
- Some information is available but not easily accessible (analogue rather than digital format for large datasets);
- Some information is available and reasonably accessible but it's difficult to trust – doubts arise as per the way it was obtained; and
- Some information is available and accessible but there are challenges in terms of internal consistency.

Filling these data gaps for all 2,303 potential investments was outside the scope of this project, however the information available did provide a good starting point for prioritisation, and gaps were filled later for projects which remained after a pre-screening process described in **Section 3**. **Section 3.1** of this report provides a detailed summary of the availability of data to perform a robust HE analysis. To facilitate the diagnostic analysis, a screening process was applied to the original database

[6] At the Figure 2-1, Sanitation includes domestic water supply and sanitation.

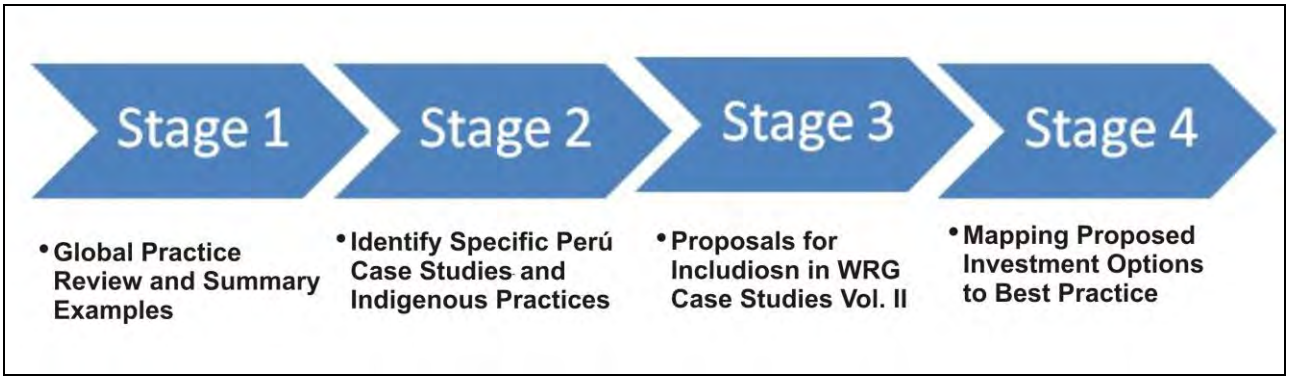
to reduce the number of projects that would subsequently be subject to the hydro-economic and PESIA analysis (the screening process and its results are summarised in **Section 2.3**, and a detailed description is provided in **Section 3.3).**

2.2 Best Practice / Green + Indigenous Practice

The objective of this task was to identify the best and innovative global practices in water resources management, related to measures which are effective for reducing the supply/demand gap in Peru. Furthermore, suitable Peruvian initiatives concerning water conservation measures have been proposed for inclusion in an updated online version of 2030 WRG's "Catalogue of Case Studies" for managing water use in scarce environments (as is the coastal region of Peru). The best practices specifically include "green" practices, as well as indigenous practices, where found to be water-efficient and environmental-friendly.

A four-stage process was implemented to tackle the best practices review. This process is graphically illustrated in **Figure 2-2**, and each of the four stages is briefly described in separate subsections below.

Figure 2-2: Four stage process employed to evaluate existing and potential use of Best Practices in Peru



2.2.1 Stage 1: Global Best Practice Review and Summary Examples

It is useful to consider what is meant by 'Best' or 'Innovative' practices in Water Management and the United Nations 'Water for Life' UN-Water Best Practices Award[7] provides a useful classification in this respect. The UN 'checklist' has been provided below as a reminder of the range of factors that need to be considered in helping to assess if any planned investment measure in the catchments in Peru can be termed 'Best' or 'Innovative' practice. The best practice must have substantially contributed to the

[7] http://www.un.org/waterforlifedecade/waterforlifeaward.shtml

improvement of the living environment on a sustainable basis, especially to the living conditions of the poorest and most disadvantaged groups of society, and demonstrate a positive impact.

The best practice must have made an outstanding contribution to the **sustainable management of water**. Contributions to be considered include but are not limited to:

Integrated Water Resource Management (IWRM);

- Adaptation to climate change;
- Improvement in water quality, decrease in water pollution;
- Increase in water efficiency;
- Improvement in water governance; and

Protection and conservation of natural resources and of the environment, e.g. establishment and management of protected areas of special importance for the water cycle.

The best practice must have made an outstanding contribution to **social and other impacts**:

- Improvement of health conditions;
- Improvements in disaster prevention, preparedness and mitigation;
- More effective and efficient administrative, management and information systems;
- Social integration and reduction of exclusion;
- Gender equality and equity in decision-making, resource-allocation and programme design and implementation; and
- Community participation in decision making and resource allocation.

The best practice results in **lasting changes** in at least one of the following areas:

- Legislation, regulatory frameworks, by-laws or standards formally recognising the issues and problems that have been addressed;
- Institutional frameworks and decision-making processes that assign clear roles and responsibilities to various levels and groups of actors, such as central and local governmental organisations and community-based organisations; and
- Efficient, transparent and accountable management systems that make more effective use of human, technical, financial and natural resources.

The best practice should be based on a **partnership** between at least two of the following actors:

- Government organisation or agency, including bilateral aid agencies;
- City, local authority;
- Non-governmental organisation (NGOs);
- Community-based organisation (CBOs);
- Private Sector (e.g. water operators);

- Research and academic institution;
- Media;
- Public or private foundation; and
- Educational institution.

The best practice includes social policies and/or sectorial strategies that have the ability to be up scaled.

Additional criteria:

- Empowerment of the community to maintain water services and infrastructures;
- How others have learnt or benefited from the initiative;
- Means used for sharing or transferring knowledge, expertise and lessons learned.

The principal reference material used in the identification of global best practices has been the following:

1. 2030 WRG Charting our Water Future
2. 2030 WRG Managing Water Use in Scarce Environments (A Catalogue of Case Studies)
3. Global Water Partnership Web Site[8]
4. Water Conservation in Irrigated Agriculture, US Dept. Of Agriculture Economic Information Bulletin No. 99

In addition to the above source material our assessment of Best Practice has been based on the experience and judgement of the team taking into account the challenges and knowledge of the Peru catchments.

Appendix B presents 5 tables that provide a summary of projects and measures by key sectors that have been applied and can be considered representative of Best Practices in water-scarce environments and are considered appropriate for application in the catchments and key sectors in Peru. Each case study or project has been given:

- a reference number,
- a brief summary of the measure, and
- where available an indication of the water saving potential or other key metric.

[8] WWW.GWP.ORG

We have also highlighted specifically any 'green' or the more sustainable techniques in italics. The numbers in brackets correspond to the 'bullet' number of the two reference documents above.

2.2.2 Stage 2: Peru Best Practices Case Studies

This section provides selected examples of best practice measures and initiatives that have been applied in Peru **(Table 2-3)** to give an indication of the 'indigenous' approaches (both projects and 'non structural' measures) that exist or are in development. As with the global practice review these can be used when reviewing the planned interventions to help in the assessment of the feasibility and likely success of the planned investment options.

Table 2-3: Selected Peruvian Best Practice Examples

Example	Scheme Summary	Problem	Benefit
Improving Transectorial Interaction to generate Resilience to climate change and water security. Global Water Partnership South America.	The initiative will test the trans sectorial cooperation to generate climate resilience and water security in the Santa Eulalia sub-basin	Santa Eulalia sub-basin produces 50% of water and 70% of energy used in Lima. However the region has high poverty levels and water, food and energy insecurity. This is further aggravated by increasing vulnerability to the effects of climate change.	Water Security, investment to improve water management; implementation of green and innovative solutions to face the challenges of water security to confront the climate change
SAB Miller Water Footprint at Breweries and assessment of water efficiency for Backus (SABMiller's Peruvian Subsidiary). Global Water Partnership South America.	Water Footprint assessment and water audits to target efficiency improvements; planned investigation of feasibility of water reuse within the non beer production processes; planned assessment of rainwater harvesting in locations where precipitation more abundant	7% improvement on average in water efficiency between 2008 and 2010	Improved resilience to climate change and water scarcity
Tinajones Reservoir. Special Project Olmos-Tinajones (peot.gob.pe)	Located in Lambayeque, this is one of the major projects in the country to store water during the wet season to be used during the dry season for agriculture irrigation	Shortage of water in the north coast for 6 months, which did not allow the development of agriculture.	Water security to irrigate crop fields during the whole year, increased tourism due the artificial lagoon, generation of employment for the local people.
Water Desalinization for mining process. Cerro Lindo Mine	The Cerro Lindo Mine (Chincha - Ica) started in 2008 and included a desalination plant. The intake is near to Jahuay beach (Pacific Ocean), about 60 km from the mine site. Approximately 98% of the desalinated water is used for mineral processing the other 2% is for human consumption.	The mine operation needs a constant water supply, whether to mineral process, human consumption, or any other requirement. This mine is located in the Ica Coast where rainfall is low and infrequent. The storage of surface water is therefore not an option.	The water saving using water from the sea is avoiding use the groundwater from the Ica aquifer which is already over exploited

Example	Scheme Summary	Problem	Benefit
Wastewater Treatment Plant. Municipal District of San Miguel – Lima.	The Municipality of San Miguel (Lima District) has a wastewater plant which treats 250 m^3 per day of wastewater coming from San Miguel district. The amount is enough to water approximately 10 hectares of urban parks and gardens, including the Costa Verde cliffs.	Lima is in the dry coast and its gardens and parks need constant and abundant watering. It was usual practice to do this with clean water; however this means a large consumption of water where this resource is not sufficient.	Water saving using recycled water, which reduce the cost of park maintenance and allows a redistribution of potable water among disadvantaged segments of the population.
Wastewater treatment to improving water availability for irrigation (San Jose – Lambayeque). *Global Water Partnership South America*.	Due the absence of another water source, farmers irrigate crops with wastewater, which was used as a natural fertilizer. Because of the sanitation risk of this practice the farmers proposed to the regional authorities the implementation of wastewater treatment in order to promote agricultural development.	Rural migrant families were settled in an area call "Pampa de Perros" (part of San Jose farmer community), around the main collector leading wastewater from Chiclayo into Pacific Ocean. Farmers irrigate crops with this wastewater, however this brought sanitation risks and problems.	Investment in treatment pools for wastewater then used in agriculture production. Employment benefits and income to local farmers
Water Desalinization for mining process. Pampa de Pongo Mine Project	Pampa de Pongo Mine Project (Bella Unión – Arequipa) is located in the desert south coast of Perú, it will have two water supplies: sea water and groundwater. The 6% required for potable water is desalinated water, the balance needed for mine process water will come from salt water direct from the sea (29%) and groundwater drainage from the open pit (66%).	Due to the location, sources of water are very scarce. Furthermore, the groundwater drained from the pit is not sufficient for the mine requirements.	Water supply using this sea water as a complement, and considering its final quality as potable water.
Wastewater Treatment Plant (Metropolitan Municipality of Lima)	In 2011 the Municipality of Lima had 5 wastewater treatment plants with a combined capacity of 339,085 m^3 per year for parks and gardens irrigation. In 2013 another 3 plants were constructed.	Lima's many gardens and parks need constant watering. It was usual to do this with fresh water; however this means large municipal consumption and cost of water where this resource is not sufficient.	Water saving using recycled water, which reduces the cost of parks maintenance. The last 3 plants constructed will save 909,540 m^3 per year of potable water, which is equivalent to 15,000 person's annual consumption.
Wastewater Treatment Plant. San Jeronimo District – Cusco.	San Jerónimo wastewater treatment plant processes the 85% of Cusco wastewater and discharge to Huatanay river.	Wastewater of 4 Cusco districts (Santiago, Wanchaq, San Sebastian and San Jeronimo), apart from industrial and commercial waste was discharged directly to the Huatanay river.	Improve water quality, stopping contamination of the water of Huatanay river and benefiting 386 thousand people of Cusco.

Also included in this section is a summary of water management techniques that are unique to Peru including some Inca examples which could have potential application in some of the planned smaller scale interventions **(Table 2-4).**

As with the global Best Practice review, we have highlighted examples considered to be 'green' approaches.

Table 2-4: Selected Peruvian Green and Indigenous Practice Examples

	Examples of Benefit/Case Study
Forestation of Upper River Basins	Huachos District (Castrovirreyna - Huancavelica). The upper slopes of the catchments are forested or with vegetal cover, there is evidence of complete forest of quinuales and other native species. This has helped stabilise the ground and prevention of landslides caused by heavy rains
Amunas Hydraulic Systems	Huarochiri (Lima highlands). This is an ancient practice of aquifer recharge and this is a good example of water harvesting. This method is still use by the Tupicocha community
Andean Dams	Ricococha Dam (Pamparomas district, Huaylas province, Ancash). This is an example of one of the hundreds of Andean dams. The purpose of these dams was for storage water to be used in the dry season. Historically, these dams were never located on the river mainstem, and as a result, were not affected as severely from siltation which can significantly reduce their operating capacity.
Irrigation Channels	Numerous Inca and pre-Inca irrigation channels. One of the greatest is the hydraulic channels system built in Machu Picchu. The system had the purpose of conveying water to several fountain for consumption water and slope stabilization.
Andenes Terrace Systems	Terracing of the steeply sloped mountainsides and canyons was a common practice of the Incas and pre Incas. There are innumerable such terraces in the Andes, many of these are still used today. They generally have a high permeability, providing good drainage for the plant root zone and recharging underlying aquifers. The terraces provide flat agricultural area, also soil stabilization. Today there are several efforts to reconstruct and revitalize some of the Andenes Terrace systems for efficient water use by indigenous communities, including in the Colca Valley[9] and Andean highlands in the department of Lima[10]

[9] http://organicwellnessnews.com/en/perus-colca-valley-revives-ancient-agricultural-terraces/
[10] http://www.peruthisweek.com/news-perus-government-looks-to-rebuild-ancient-andean-terraces-13500

2.2.3 Stage 3: Proposals for Inclusion in 2030 WRG Case Studies

Table 2-5 proposes some Peruvian projects considered appropriate for inclusion in an update to the 2030 WRG Case Study report.

Table 2-5: Proposals for Inclusion in 2030 WRG Case Studies

Sector	Project Summary	Water Security Impact	Best Practice Features	Why this would make a good example for inclusion in 2030 WRG Case Study Catalogue
Municipal Water	Wastewater Treatment Plant (Municipal) San Miguel (Lima)	250 m^3 /day not used from the municipal fresh water supply	Recycling wastewater for irrigation of parks Reduced consumption of municipal water allowing more available for local population Drip Irrigation making evaporative losses lower	Lima is the second largest desert city in the world, with 9 million people living in an area that receives less than 5 cm of rainfall per year, yet this green practice allows many of the business and residential districts of Lima to have numerous green parks and tree-lined boulevards
Mining	Pampa de Pongo Mine Project (Bella Unión – Arequipa) is located in the desert south coast of Perú, it will have two water supplies: sea water and groundwater.	Of the total water demand, the 6% required for potable water is desalinated water, the balance needed for mine process water will come from salt water direct from the sea (29%) and groundwater drainage from the open pit (66%).	Desalinization of an abundant water sources i.e. seawater for potable supply, utilization of non-potable water to supply demands not requiring fresh water	Mining represents one of the principal economic engines of the Peruvian economy. While groundwater resources generally exist along the arid coastal plain, utilizing such supplies for mining activities that do not require potable water would reduce the availability of that resource for domestic and industrial uses requiring fresh water.
Other – Indigenous techniques	Revitalization of ancient Andenes Agricultural Terraces Systems	Reconstruct and revitalization of ancient terrace infrastructure that has fallen into disrepair allows for improved water management and poverty reduction in indigenous communities in the Peruvian highlands	Land levelling for efficient irrigation, improved utilization of sparse rainfall during the dry season and improved drainage management during the wet season	Revival of ancient water management practices to improve water use efficiency and reduce poverty of indigenous communities. Potentially applicable in other impoverished indigenous communities around the world

2.2.4 Stage 4: Mapping Proposed Investment Opportunities onto Best Practice

The aim of this section is to map the proposed investment opportunities in the six coastal basins which were benefitted from pilot plans, to the Global Best practice examples provided in Stage 2 and where possible identify any key gaps in the planned approaches. This has been done at 2 levels: firstly a review of the NWRMP generic proposals and secondly on the type of projects being proposed in the WRMP. In **Section 2.3** below, we undertake an assessment of specific projects in each of the six coastal basins which were the subject to pilot-plans.

2.2.4.1 Assessment of NWRMP Programmes of Measures and opportunities for the 2030 WRG

The National Water Resources Management Plan identifies the policies, strategies and measures that are planned for Peru from now until 2035 and are summarised in **Table 2-6**. Almost all of these programs will have elements of global best practice, but here we have updated **Table 2-2** by highlighting the programs that are considered very significant in the context of this study for 2030 WRG and in particular the potential investment opportunities.

Table 2-6: Applicability of BMPs to Policies, Strategies, and Programs in the Peru NWRMP to 2035 (from Table 4.1 of the National Water Plan, ANA, 2014)

Policy		Strategy		Program		Key measures / opportunities for the 2030 WRG Project
1	Quantity Management	1	Improving knowledge of water resource availability and demand	1	National Hydro meteorological net implementation	Y
				2	Increase the knowledge of groundwater	
				3	Implementation of the National System Information of water quantity	
		2	Improving efficiency of water use and demand management	4	Demand control and measure	Y
				5	Improving conduction system and water distribution	Y
				6	Irrigation technification	Y
				7	Sustainable amplification of the agricultural frontier	Y
		3	Increase of the resource availability	8	Increment of the surface regulation of WR and inter basin WR transfer	Y
				9	Upper land basin reforestation	
				10	Elimination of aquifer over exploitation	Y
				11	Reuse of treated wastewater and sea water desalinization	Y

Policy		Strategy		Program		Key measures / opportunities for the 2030 WRG Project
2	Quality Management	4	Improving knowledge of water quality	12	Improving knowledge of surface water quality	
				13	Improving knowledge of groundwater quality	
				14	Supervision and supervision of wastewater discharge	
				15	Normative regulation of water quality and best practices	
		5	Improvement and extension of the sanitation coverage	16	Increase potable water coverage	Y
				17	Increase sewer coverage	Y
				18	Increase wastewater treatment coverage	Y
3	Opportunity Management	6	Implementation of the Integrated Management of Water Resources (IMWR)	19	Institutional strengthening of the IMWR	
				20	Administrative strengthening of the IMWR	
				21	Implementation of the IMWR on trans boundary basins	
		7	Develop of irrigation and sanitation in poverty areas	22	Develop of the irrigation and sanitation in poverty areas	Y
4	Management of water culture	8	Institutional coordination and hydric governance	23	IMWR consolidation	
				24	Hydro solidarity and hydro governance	
		9	Environmental education and water culture	25	Water culture consolidation	
				26	Communication, sensitization and awareness of IMWR	
5	Climate change and extreme events adaptation	10	Climate change adaptation	27	Improving knowledge of climate change effects	
				28	Climate change adaptation measures	Y
		11	Irrigation management of extreme events	29	Irrigation management of inundation and sliding	Y
				30	Performance in a situation of drought alert	

2.2.4.2 Assessment of Planned Interventions and Global Best Practice

In this section, we consider the generic list of investments that have been identified from **Section 2.1** and specifically those aimed at improving water security through closing the supply demand gap. It is also recognised that other substantial investments including wastewater treatment, management of flood risk, and delivering hydromorphology and ecosystem services such a Natural Water retention are

also planned and will impact on the supply-demand gap, but for the purpose of this section we have focussed specifically on the water resources investment measures.

The following **Table 2-7** illustrates how the current generic list of investment measures aligns with examples of global best practice and where possible we have identified any that are specific to Peru and represent 'green' or sustainable approaches.

Table 2-7: Assessment of Best Practice Measures in the Investment Proposals in the 6 key Catchments

Project Type	Best Practice Example (reference numbers in Appendix B)	Measures unique to Peru	Green Measure
Construction of dams, reservoirs and other impoundments - *Poechos (Chira-Piura), Purapa (Vichaycocha), Quiles, Cáraca, Añasmayo, Huataya, Montero (Ayabaca, Piura), Canoas de Punta Sal (Contralmirante Villar, Tumbes), Sullana (Piura), Tunashirca, Calientes (Tacna), Cerro Blanco (Tacna), El Aliso, Quipacaca, Yaco Coyonca, Nasca (Ica), Chimbote (Santa, Ancash), Frías (Ayabaca, Piura).*	MS1, A12		
Expansion of reservoir and dam capacity	MS1, A12		
Improvement of reservoirs and other large to medium impoundments	MS1		
Mini-reservoirs and retention ponds	MS1, A15	Potential to apply some of the techniques identified in Appendix B	
Improvement of groundwater abstraction points	MS4		
Expansion and improvement of distribution networks (incl. control of leakages)	MD1		
Construction of irrigation canals	A12/A13	Potential to apply some of the techniques identified in Appendix B	
Construction of desalination plants – *La Yarada (Tacna)*	MS2, MS9		
Construction of wastewater reuse plants	A19, MS8		
Gauging stations, to monitor water availability or meteorological stations and instalment of telemetry for real-time data transmission to server-based databases or monitoring of water allocation for irrigation through satellite images (remote sensing)	A20, A17		Y
Leakage reduction - repair and maintenance of water mains	MD1, MD2, MD13		

Project Type	Best Practice Example (reference numbers in Appendix B)	Measures unique to Peru	Green Measure
Lining of irrigation canals	A1	Potential to apply some of the techniques identified in Appendix B	
Metering in irrigation districts for groundwater or surface water	A16		Y
More advanced irrigation systems (i.e. drip irrigation) for increased water use efficiency in agriculture	A2, A17, A21		Y

2.2.5 Summary and Recommendations Related to BMPs and Green/ Indigenous Techniques

As shown in this review, a wide range of projects / interventions are likely to be relevant to addressing different water policy challenges including water scarcity and closing the supply/demand gap. Many global and local Best Practices have been included. Identification of the relevant investment opportunities should take into account other water policy challenges in addition to closing anticipated water supply and demand gaps, and projects and interventions aimed at water quality improvement, climate change adaptation, restoration of aquatic ecosystems could also provide a viable investment opportunity.

Some of the key Best Practice 'headlines' emerging from this review are:

- Interventions and Incentives that reduce consumptive use are very prevalent;
- Interventions which include decision making based on wider context and knowledge of details local Catchment and Water Resources Management Plans;
- Implementation of data collection and monitoring that allows effectiveness of measures to be monitored and quantified;
- Interventions that deliver benefit at the catchment scale at lowest cost;
- Committed partnerships including private and public sector partnerships that maximise water security for multiple stakeholders.

There are many examples of global Best Practice in water management already in existence in Peru and given the significant challenges presented, considerable opportunity exists to embed many of these practices and local measures in the investment proposals. We believe that there are projects which would merit inclusion in the update to the 2030 WRG Case Studies and these have been included for consideration in this review. This will also serve to illustrate the potential for future projects in the country to be innovative and deliver considerable water security benefits.

In terms of key gaps, from the summary of the generic investment measures reviewed for the six coastal basins which were the subject to pilot-plans, there would appear to be some gaps in measures

proposed through water reuse and demand management interventions in the Municipal, Industrial and Mining sectors and their potential to address overall supply-demand shortfalls. (More information on these and confirmation of these 'gaps' may emerge from a more detailed review of specific catchment measures). Aquifer recharge also appears to be a gap in the supply measures but this may be due to specific catchment hydrogeology. Given the significance of these sectors in Peru we have highlighted some examples of Best Practice involving Public-Private Sector collaboration in these sectors (**Table 2-8**) as examples of the opportunities that may be available with an emphasis in demand management processes compared to water supply schemes.

Table 2-8: Best Practice Examples from Public-Private Sector Partnerships

Type of Intervention	Private Entity	Key Best Practice Features
Municipal Leakage	SASOL	Reduces business risk whilst simultaneously reducing municipality's costs and increases water supply security. Combination of innovative public-private sector collaboration on funding on water saving measures including pressure management, network leakage reduction and domestic leakage management; reduced water stress risk to municipality and local energy company (SASOL)
Water Recycling in the Food Sector	UNILEVER	Reuse of process water and greywater via treatment; harvesting rainwater from roofs. Negligible use of municipal water supply. Under normal circumstances these measures have made 12000m3 available for the local community per year.
Water Use Reduction in the Food Sector	NESTLE	Installation of water measurement to record water use; recovery and use of condensate; low flow plumbing and staff awareness. Water use reduced by 50% leaving more water in the dam and for downstream uses.
Mine water Recycling	RIO TINTO	Rainwater harvesting and wash water recovery; reduction in abstraction from lake allowing more water available for local community and hydropower plant
Low cost irrigation scheduling	PEPSICO	Use of tensiometers to measure soil moisture and guide irrigation scheduling. Water withdrawals reduced by 19%

2.3 Project Screening for Diagnostic Evaluation

The diagnostic analysis summarised in **Section 2.4** was not applied to all 2,303 projects in the original list. Rather, the original list was reduced through a "filtering" process to reduce the list to a much smaller number of projects that exhibit positive characteristics for investment and that will subsequently be applied to hydro-economic and PESIA analysis. The pre-screening criteria that were applied to provide a small number of projects for the diagnostic were as follows (a more detailed explanation of the screening process is available in **Section 3** and **Appendix E** of this report):

- Removal of duplicate entries. As many as 64 duplicate entries were encountered in the original 'master list,' and each duplicate was consolidated into one before advancing;
- Exclusion of projects already completed and/or that have already begun;

- Removal of projects for projects / interventions that are irrelevant to the prioritization of investments in principle such as a) legislative measures b) administrative measures (incl. the ongoing securitization of informal water use rights), c) discharge controls, d) codes of good practice, and e) abstraction controls or pollution monitoring activities.

The pre-screening criteria described above were applied to the list of interventions developed in **Section 2.1.** The final list of pre-screening results yielded 423 potential investments worth a total estimated cost of investment of 24.86 billion New Peruvian Soles (or $8.88 billion dollars).

All the projects from the National Water Plan and from the SNIP and Proinversión database that passed through the pre-screening process were not disaggregated by investment classification.

- The National Water Plan provided 19 projects to the list, which included an intervention comprised of 73 disinfection systems for wastewater treatment plants across the country, reforestation of 333,000 hectares within the basins on the Pacific slopes of the Andes, a national long-term water quality monitoring program, discharge control programs, studies related to climate change effects and vulnerability, a program to reduce the vulnerability of threatened species and fragile ecosystems, and integrated flood control programs.
- The Proinversión database provided two projects. One involves the construction of civil works in the headwater catchments of the basins that provide potable water for Lima, and the other is for the Majes –Siguas large-scale irrigation project.

2.4 Project Diagnosis

The objective of this section was firstly to provide a summary of the key challenges, drivers, and pressures on water security in each catchment. Secondly, it summarises a diagnosis of the proposed interventions and investments as outcomes of the pre-screening in **Section 2.3**. The aim was to examine and identify whether or not the pre-screened projects contribute to closing the water gap between projected water demand and sustainable supply. Thirdly, the diagnosis also sought to verify or promote the implementation of best practices, and sustainable techniques and technologies. The diagnosis is summarized by geographical areas or river basins, relevant best practice, type of project (i.e. irrigation, sanitation, etc.), and finally by the water policy challenges faced by Peru.

2.4.1 Diagnosis Methodology

The previous subsection described the pre-screening “filtering” approach to reduce the number of projects from a catalogue of more than 2,300 to a shorter list which could be subject to a diagnostic analysis on a per catchment basis. The diagnosis took the following approach:

- Firstly, the catchment characteristics and sustainable water supply and demand were estimated[11]. Key challenges, drivers and pressures on water security in these catchments were summarised.
- Secondly, following the pre screening, the projects were assessed to see whether they can contribute to closing the water gap between estimated water demand and sustainable supply. A quantitative summary was not able to be undertaken as little or no hard data was available on water yield or demand reduction for each of the projects. Therefore, a simple approach was taken whereby for each intervention a 'Yes' was assigned if the project leads to increased reliable supply (e.g., new, improved, strengthened reservoirs, new groundwater wells as part of conjunctive water supply scheme), or decreased demand (irrigation canal improvements and lining, improvement and leak repairs to existing water supply distribution network). A "No" was assigned for those interventions which do not target these goals. In those cases where a project was for system improvements which included expansion of service areas, it was deemed to likely increase demand and therefore a "No" was assigned.
- Thirdly, an evaluation of whether the interventions implement *best practices as well as sustainable green and/or indigenous techniques* were assessed based on professional judgement.

2.4.2 Results of the Diagnostic

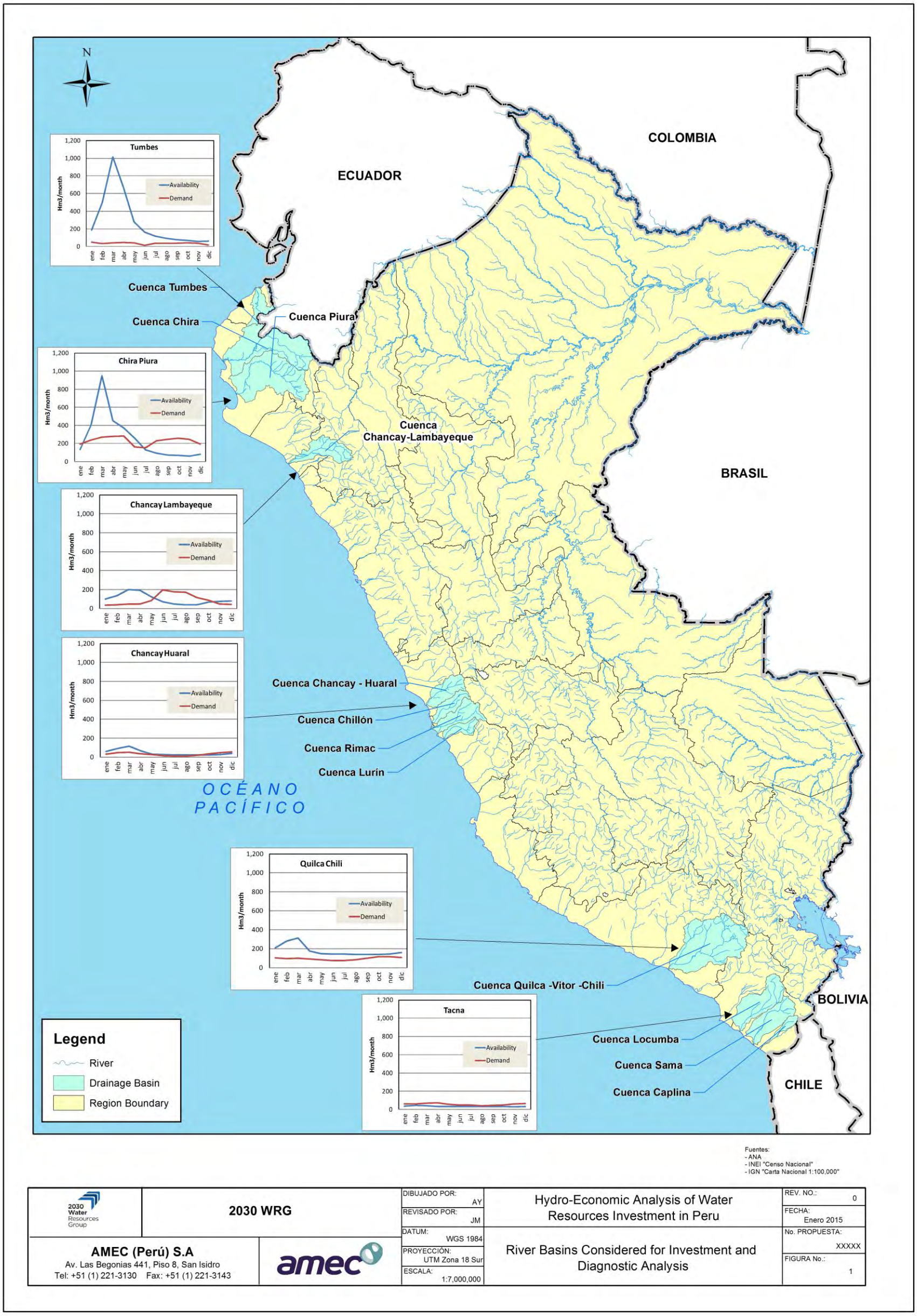
A summary map showing the location of each of the coastal basins considered in this report is presented in **Figure 2-3**. The results are organised by basin from north to south and are presented below, with more detailed information relating to the challenges in each of the basins provided in **Appendix C**.

The **supply-demand charts** presented for each basin provide the reader a broad appreciation of water stress. Water availability is expressed as current monthly average flows and was derived by others using a continuous modelling series of rainfall-runoff calibrated using available stream flow data. Demands were estimated by others based on data provided by water users in the area and estimates of agricultural water demands and per capita use rates for domestic, commercial, and industrial uses. So far as we are aware, neither water availability nor demand makes an allowance for environmental flow

[11] The available supply was calculated using a continuous modelling series of rainfall-runoff calibrated using available stream flow data, and the demands were estimated based on data provided by water users in the area and estimates of agricultural water demands and per capita use rates for domestic, commercial, and industrial uses (INCLAM, 2013).The need to rely on model results to estimate water availability is due to the fact that hydro-meteorological data are not continuous and poor in quality. Similarly much of the demand data is estimated due to the lack of accurate long-term measurement of water use. Despite the fact that this data is estimated, we feel it provides a reasonable representation of water availability and water demand, and is thus suitable for use in this project.

The **ratio of annual demand to water availability** ranges from 13% (Tumbes) to 167% (Tacna). The Water Resources Vulnerability Index (Raskin *et al*, *Water Futures: Assessment of Long-range Patterns and Prospects.* Stockholm, Sweden: Stockholm Environment Institute, 1997) suggests that water stress is experienced when water withdrawals exceed 20% of available water; moving to severe water stress for withdrawals greater than 40%. On this basis, all basins except Tumbes, are in severe water stress.

Figure 2-3: Coastal catchments in Peru considered in this report



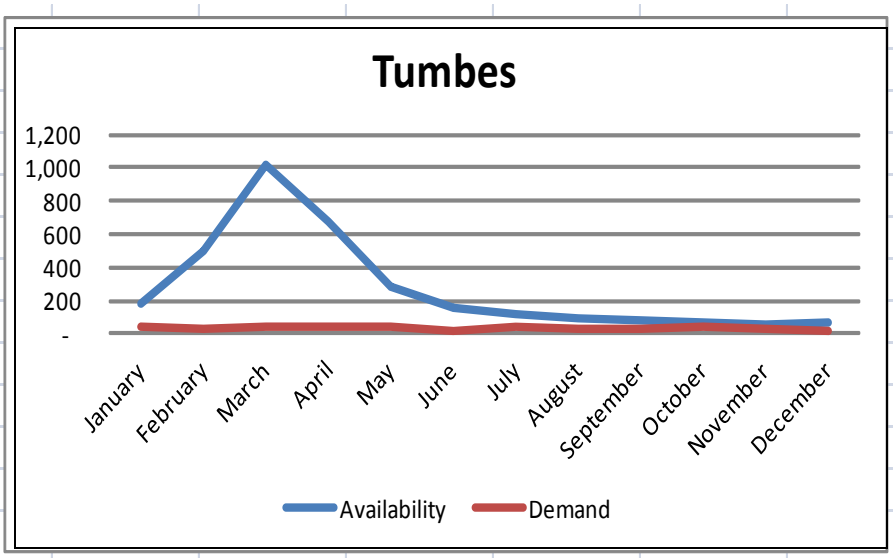
2.4.2.1 Tumbes Basin

Located along Peru's northern coast near the national border with Ecuador, the Tumbes Region is bordered by the Ecuadorian provinces of El Oro and Loja on the east; Peru's Piura Region on the south; and by the Pacific Ocean on the north and west. The principal hydrographic figure in the region is the Tumbes River, which drains a watershed of approximately 4,850 km^2, of which 1,806 lies within Peru. The Rio Tumbes originates in the Cordillera Chilla and Cerro Negro of Ecuador. With a population of just over 230,000[12], the principal city is Tumbes near the coast, and there is significant agricultural development along the Tumbes River upstream of the city.

The current average monthly hydrologic balance is presented in **Figure 2-4** and shows that under current average conditions the basin does not exhibit a significant shortage in any months, although in dry years there likely will be water stress in the period between September and November.

Figure 2-4: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Tumbes Basin (hm^3 is equal to m^3 x10^6).

Availability	Demand
187	49
495	35
1,014	42
670	46
280	40
163	15
119	40
94	37
76	37
69	43
60	36
63	19
3,291	439



The key water challenges in the catchment are summarized below with further detail available in **Appendix C.**

[12] Peruvian Instituto Nacional de Estadistica e Informatica, http://www.inei.gob.pe/

Water quantity challenges

- Water infrastructures in this river basin district are obsolete or deteriorating.
- Almost no use of new technologies and best practices in irrigation.
- Low efficiency in the systems for abstraction and conveyance of water.
- Riverbed silting is one of the major concerns in the area.

Water quality challenges

- Major discharges of wastewater and inadequate drainage
- Solid waste dumping at river bank sites.
- Discharge of agrochemical waste, a major source of diffuse pollution.
- One of the main sources of pollution is mining in the upper catchment.
- Due to overexploitation of coastal aquifers, there is evidence of saline intrusion.

The basin water resources management plan (INCLAM, 2013) identified 392 projects in the study area, and the pre-screening process described above yielded a shorter list of 117 projects of potential interest for investment. The first table in **Appendix D** provides a listing of the projects that passed through the first level screening process. Of those:

- Nineteen are for agricultural irrigation projects worth a total estimated value of 1.98 billion Peruvian Nuevo Soles, or PEN (current conversion is approximately 2.85 PEN per US dollar). Fifteen of the projects involve improvement of existing infrastructure, and these improvements were assumed to improve the system efficiency (thus earning positive marks from a Best Practice perspective) and therefore impart a positive effect on the hydrologic balance. Two involved construction of new dams which also were deemed to exert a positive influence on the hydrologic balance. The largest single agricultural project is the 1.4 billion PEN project to open a new area for irrigation along the right-hand margin of the Rio Tumbes. This project will increase demands significantly and therefore lead to a negative effect on the hydrologic balance.
- Forty of the projects involved expanding and improving potable water supplies and water treatment facilities, with the costs for these projects ranging from approximately 1 million PEN up to nearly 100 million PEN. In general, such improvements will certainly lead to improved social wellbeing and quality of life, and in cases of replacing old leaky lines with new lines may be expected to lead to demand reduction. But essentially all of the projects appear to also have a component of expanding the system, delivering more water to existing customers and adding new water users to the system, so they may also be expected to have a negative influence on the hydrologic balance.
- Fifty-three projects are related to flood control and storm water management. Again, these projects will certainly be valuable from a social health and security perspective, but the vast majority are unlikely to affect the hydrologic balance nor was it obvious from any of the descriptions that they would merit Best Practice points. For example, one storm water management practice widely applied in the western US involves utilizing storm water management for artificial recharge projects, and often this is done in conjunction with urban greenways and nature parks that also provide additional social and environmental amenities.

None of the storm water management project descriptions for the Tumbes area explicitly cited those types of projects, thus Best Practice and Green Practice points were not awarded.

- The remaining 5 were non-structural projects related to reforestation and environmental conservation, and one project related to training for agricultural producers.

2.4.2.2 Chira-Piura Basin

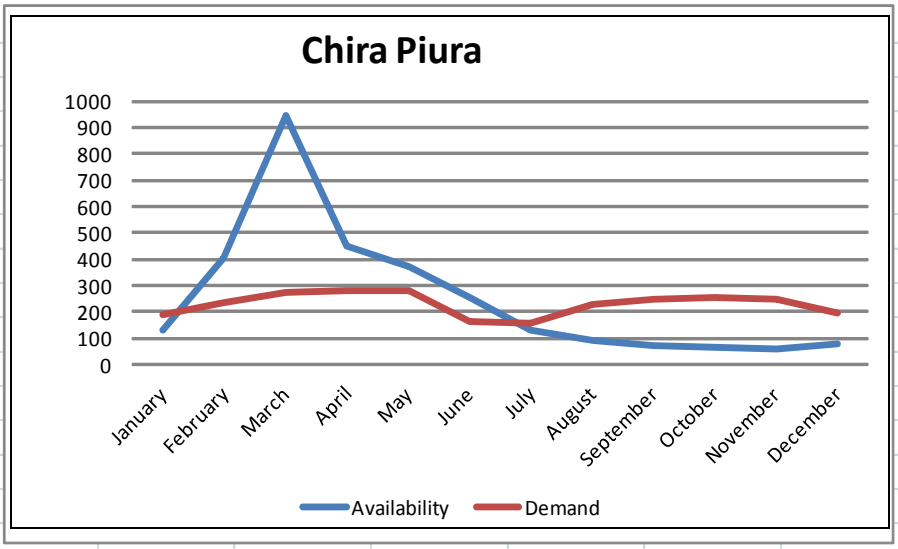
Also located in northern Peru, just south of the Tumbes Basin, the Chira-Piura is drained by two large river basins, the Piura Basin and the bi-national Chira Basin. With an area of 29,853 km^2, these two river basins comprise 87.5% of the land area of the Department of Piura. The population is more than 1 million, with the principal water uses for agricultural, domestic uses, aquaculture and industrial.

The current average monthly hydrologic balance is presented in **Figure 2-5**. In contrast to the Tumbes Basin, **Figure 2-5** shows that under current average conditions the Chira Piura Basin experiences a significant supply shortage in the months between July and January. By any measure this basin is under severe water stress.

In the future, the Alto Piura project (currently under development) is expected to add 315 hm^3 to the supply annually, although the demands are expected to increase on the order of 200 hm^3 by the time that project is delivering water to the basins, thus a significant supply-demand gap is expected to remain a threat without new water supply or demand reduction projects. The supply hydrograph does show a large surplus from February through April, so projects which can capture and store that surplus (reservoir, large scale aquifer storage and recovery projects) can greatly help fill the supply-demand breach.

Figure 2-5: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Chira Piura Basin (hm^3 is equal to m^3 x10^6)

	Availability	Demand
ry	135	192
ary	405	236
	947	272
	451	278
	373	282
	256	162
	130	154
t	94	231
mber	73	248
er	68	258
mber	61	246
nber	82	194
tal	**3,074**	**2,751**



The key water challenges in the catchment are summarized below with further detail available in **Appendix C.**

Water quantity challenges

- Lack of adequate infrastructure for water regulation.
- Aging water and sanitation infrastructure.
- Water scarcity affecting some urban areas.
- Lack of response to extreme events.

Water quality challenges

- Discharge of raw sewage resulting in surface and groundwater pollution.
- Lack of wastewater treatment infrastructure or rather operational problems (due to undersized capacity and lack of maintenance).
- In the city of Piura there are major discharges of industrial wastewater.
- In the middle and lower course of the watershed, there is lack of maintenance of aerobic lagoons.
- In the coastal are (Paita and Sechura seas), there is untreated wastewater discharge from manufacturing.

The Chira-Piura Basin had by far the most individual projects identified (1,196) among all the six coastal basin studies. Of that large number, 135 projects passed through the pre-screen process. The second table in **Appendix D** summarizes the results of the diagnostic analysis for the Chira-Piura Basin. Of those projects that passed the initial screening exercise:

- Twenty-six are for agricultural irrigation projects worth a total estimated value of 490 million PEN. The majority of the projects involve improvement to existing infrastructure, and these improvements were assumed to improve the system efficiency (thus earning positive marks from a Best Practice perspective) and therefore impart a positive effect on the hydrologic balance. One involved expanding the Poechos reservoir system (this single project with an estimated cost of 298 million PEN accounted for 60% of the total cost of all the agricultural system improvements) involved construction of new dams which also were deemed to exert a positive influence on the hydrologic balance. The only two projects not expected to exert a positive influence on the hydrologic deficit were the construction of a new canal (under the assumption that a new canal will open up new lands for irrigation, thus a demand increase) and a new water intake structure (under the assumption that it will allow increased river diversions).
- Eighty-nine of the projects involved expanding and improving potable water supplies and water treatment facilities, with a total cost exceeding 1.926 billion PEN costs for these projects ranging from approximately 1 million PEN up to nearly 100 million PEN. In general, such improvements will certainly lead to improved social wellbeing and quality of life, but the act of improving the system to deliver more water to existing users and adding new users to the system may also be expected to have a negative influence on the hydrologic balance.

- Eleven projects are related to flood control and storm water management. Again, these projects will certainly be valuable from a social health and security perspective, but the vast majority are unlikely to affect the hydrologic balance nor was it obvious from any of the descriptions that they would merit Best Practice points.
- The Chira-Piura plan involved two additional infrastructure projects worth a total of 99 million PEN, one of which involved artificial recharge of alluvial aquifers, which earn points from both the hydrologic balance perspective as well as from the Best Practice perspective.
- The remaining 7 were non-structural projects related to reforestation and environmental conservation, one related to management of alpine lakes and glacier management, another related to a feasibility study for a desalinization plant to provide potable supplies, and one project related to implementing National Water Plan initiatives.

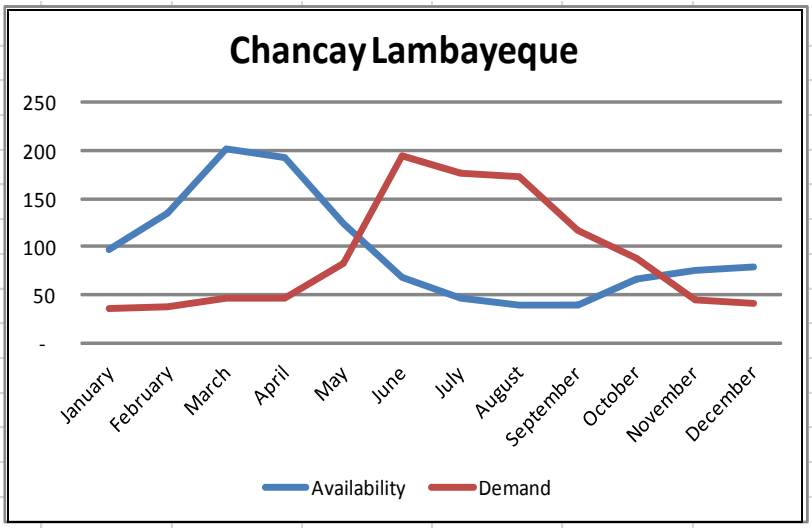
2.4.2.3 Chancay – Lambayeque Basin

The Chancay-Lambayeque river rises in the Andes in the Department de Lambayeque at an altitude of 3,800 m, running its course from the east to the west. Subsequently, they take on the names of "Chico" and "Llantén" Rivers, being known as the Chancay-Lambayeque River from its confluence with the Rio San Juan until it reaches La Puntilla as it enters the Pacific coastal plain. From this point the river is divided into three courses: Taymi Canal (north), Rio Reque (south), and between those two the Lambayeque River continues to run in its original channel. Only Reque River empties into the Pacific Ocean, north of Puerto Eten, while the other two branches, the Lambayeque and Taymi do not reach the sea because theirs waters are used for irrigation until exhausted (obviously suggesting a water budget deficit). In this arid coastal plain, irrigation is needed to support farming. The fertile river valleys produce half of the sugar cane crop of Peru. The major urban centre in this area is Chiclayo.

The current average monthly hydrologic balance is presented in **Figure 2-6** The Chancay Lambayeque monthly water availability – demand hydrographs exhibit an even more extreme supply shortage than that of the Chira Piura Basin. **Figure 2-6** shows that the water users experience a significant supply shortage in the months between May and October. The basin has severe water stress. In the future, increased agricultural harvest is expected with completion of the Olmos Transandino Project. The water supply project will transfer up to 2 billion m^3 annually of water from the Huancabamba River in the Cajamarca Region east of Lambayeque (currently under development). While this interbasin transfer project will add significant water to the basin in the future, it is actually part of the original plans for the Olmos project. As such, it will be delivering water to as many as 38,000 hectares for that project, thus the existing significant supply-demand gap is expected to remain a threat in the absence of any new water supply or demand reduction projects. Again, the supply hydrograph does show a large surplus from February through April, so projects which can capture and store that surplus (reservoir, large scale aquifer storage and recovery projects) can greatly help fill the availability-demand breach.

Figure 2-6: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Chancay Lambayeque Basin (hm^3 is equal to m^3 x10^6)

Availability	Demand
97	36
134	38
201	46
192	46
123	82
69	194
47	176
39	173
40	116
66	88
75	46
79	41
1,162	1,082



The key water challenges in the catchment are summarized below with further detail available in **Appendix C**.

Water quantity challenges

- Lack of clarity regarding available long-term renewable resources.
- Water storage infrastructure is both insufficient and deteriorating.
- Prevalence of highly water-demanding crops.
- Lack of enforcement (and securitization) of water use rights, affecting both surface and groundwater.
- Lack of official estimation of irrigation efficiencies.
- Preference for surface vs. groundwater (for irrigation).
- Low coverage of water services.
- Soil degradation and loss in the middle and lower basin.

Water quality challenges

- Pollution derives from untreated domestic, municipal and industrial wastewater, solid waste disposal, and agro-chemicals.
- In the upper river basin, there is evidence of inorganic pollution (i.e. metals) and low pH levels (which may have a natural origin).

The Chancay Lambayeque Basin had 230 individual projects identified in the basin water management study basin studies, and 56 projects passed through the pre-screen process. The third table in **Appendix D** summarizes the results of the diagnostic analysis for the Chancay Lambayeque Basin. Of those projects that passed the initial screening exercise:

- Twenty-seven are for agricultural irrigation projects worth a total estimated value of 305 million PEN. Again, the majority of the projects involve improvement to existing infrastructure, and these improvements were assumed to improve the system efficiency (thus earning positive marks from a Best Practice perspective) and therefore impart a positive effect on the hydrologic balance. Interestingly, while not a single new water storage project is noted on this list (which would certainly help fill the supply gap), there are several which involve expansion /installation of new irrigated lands. It is possible that they may be expecting to receive supplies from the Olmos project for these lands.
- Sixteen of the projects involve expanding and improving potable water supplies and water treatment facilities valued at 141 million PEN. Based on their descriptions, none of these projects are particularly notable from a filling-the-water-gap perspective, nor from a Best Practice perspective.
- Nine projects are related to flood control and storm water management. Again, it was not obvious from any of the descriptions that they would merit Best Practice points.
- There are three projects in the "Other Infrastructure" category, two of which are projects that involve the construction and/or strengthening of reservoirs worth over 560 million PEN; obviously these will help fill the supply – demand deficit.
- The remaining one non-structural project is related to reforestation in the rural Tongod district.

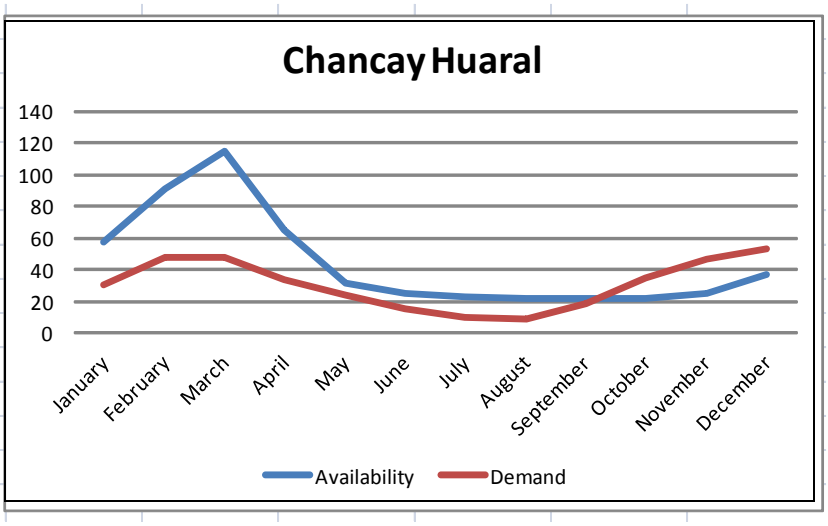
2.4.2.4 Chancay – Huaral Basin

Located in the Department of Lima, the Chancay Huaral Basin supplies water resources to this fertile agricultural valley just north of Lima. The Chancay-Huaral flows off the western slope of the Andes, rising from the glaciers of Puajuanca at an altitude greater than 5,000m, originating as the Rio Baños, flowing through a series of alpine lakes at the foot of the Alcay Glacier, before dropping through a complex of steep quebradas, merging with other streams, eventually taking on the name Rio Chancay Huaral at the confluence of the Rio Vichaycocha and Rio Chicrín. From that point the river continues on its way to the Pacific, receiving flows from several tributaries before discharging into the broad fertile fields of the Huaral valley, eventually discharging into the Pacific Ocean some 60 km north of Lima. The catchment area for the Rio Chancay Huaral is 3,040 km^2.

The current average monthly hydrologic balance is presented in **Figure 2-7**. The Chancay Huaral monthly availability – demand hydrographs indicate only a moderate supply shortage in the months of October through December. **Figure 2-7** shows experiences a significant supply shortage in the months between June and October. Again, the supply hydrograph does show a large surplus from February through April, so projects which can capture and store that surplus (reservoir, large scale aquifer storage and recovery projects) can greatly help fill the supply-demand breach.

Figure 2-7: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Chancay Huaral Basin (hm^3 is equal to m^3 x10^6)

Availability	Demand
58	30
91	48
115	49
65	34
32	25
26	15
23	10
22	9
22	19
22	35
25	47
38	54
539	375



The key water challenges in the catchment are summarized below with further detail available in **Appendix C.**

Water quantity challenges

- Population density increase (in certain areas) leading to supply problems.
- Agricultural expansion in the Añasmayo, Cárac and Huataya sub-catchments (middle stretch of the watershed).
- Low water use efficiency in irrigation.
- Insufficient water storage infrastructure for water resources exploitation and regulation in the main course of Chancay-Huaral River and in the middle-stretch sub-catchments.
- Additional pressures in the headwaters though regulated and unregulated mining activities leading to environmental liabilities.

Water quality challenges

- Main pollution sources in the basin are mining material heaps, untreated domestic / industrial wastewater, raw sewage and agrochemicals.
- Low sanitation coverage rates.
- WWTPs of Huaral and Chancay are obsolete.
- Organic pollution (pathogens) due to untreated domestic wastewater discharges.
- Inorganic pollution (metals: aluminium, manganese, iron).

The Chancay Huaral Basin had 104 individual projects identified in the basin water management study basin studies. Of those, 31 projects passed through the pre-screening process. The fourth table in **Appendix D** summarizes the results of the diagnostic analysis for the Chancay Huaral Basin. Of those projects that passed the initial screening exercise:

- Twenty are for agricultural irrigation projects worth a total estimated value of 232 million PEN. Again, the majority of the projects involve improvement to existing infrastructure, and these improvements were assumed to improve the system efficiency (thus earning positive marks from a Best Practice perspective) and therefore impart a positive effect on the hydrologic balance. There are a number of small reservoir projects, strengthening and rehabilitating existing small reservoirs, as well as a few larger reservoir projects. A particularly interesting project listed here is a large scale conjunctive use project involving the installation of 20 to 25 wells; when properly planned, such a program can be an alternative means to capture the part of February through April runoff peak as a means to augment water supplies in dry periods.
- Eight of the projects involved expanding and improving potable water supplies and water treatment facilities. In this basin there appears to be more of an emphasis on treatment. There is also an interesting description of a project that plans to implement a series of measures based on the results of other studies, potentially without structural measures.
- There is one, relatively small, intervention related to flood control and stormwater management.
- There are two projects in the "Non-Infrastructure" category one related to reforestation in the upper watershed, and the other a very interesting project related to artificial recharge using "amunas," an ancient recharge method practice by the Incas, capturing flow off of hillslopes and directing it to recharge basins.

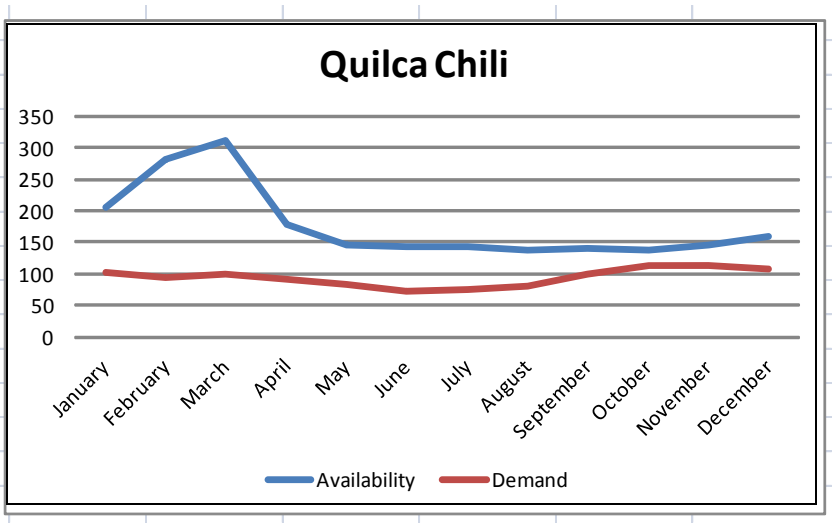
2.4.2.5 Quilca – Chili

The Chili Quilca basin is located on the western slope of the Andes, draining into the Pacific Ocean. It covers virtually all of the province of Arequipa. Occupying a total area of 13,817 km^2, the Chili Quilca basin is comprised of eleven sub-basins, six of which are tributaries and five that make up the main channel. The city of Arequipa, the second largest in Peru, lies near the centre of the basin. The main economic activities are in the basin are livestock, agriculture, industry and mining. However, as described in the basin water management plan, the regional government is striving to diversify the economy into other activities, trade and other services. The basin is also distinguished by having protected natural areas, including two national reserves (Salinas and Aguada Blanca and Punta Plates) and three regional protected areas: the Queñua forests Nevado del Rayo and Pichu-Pichu, and the Colca Valley - Snowy Ampato), plus the proposed Chapi-Churajón protected area.

The current average monthly hydrologic balance is presented in **Figure 2-8** and shows that under current average conditions the basin is does not exhibit a significant shortage in any months, although certainly in dry years there may be water stress in the period between September and November. Furthermore, it is likely that in certain local areas supply constraints may be felt in the October – November time frame.

Figure 2-8: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Quilca Chili Basin (hm^3 is equal to m^3 x10^6).

Availability	Demand
206	103
280	94
313	99
177	93
146	85
143	73
143	75
139	81
141	99
138	114
145	114
158	108
2,128	1,138



The key water challenges in the catchment are summarized below with further detail available in **Appendix C.**

Water quantity challenges

- Water sources inventories are either outdated or incomplete, including groundwater resources, which are widely used in the basin.
- Infrastructural deficit and major losses.
- Expected demand increase for household demand given current low levels of coverage.
- Lack of metering and informal water use rights.
- Expected increase of irrigation demand.
- Insufficient regulation of hydropower generation.

Water quality challenges

- The Arequipa WWTP installed capacity is clearly insufficient.
- Heavy metals concentrations from human activity in the middle and lower basin.
- Organic pollution from domestic wastewater is widespread.
- Mining activities are also a significant driver in terms of pollution.
- The Chili River is also affected by domestic wastewater discharges (organic pollution: pathogens), and untreated effluents from farms and industries.

The Quilca Chili Basin had 131 individual projects identified in the basin water management study basin studies. Of that number, 27 projects passed through the pre-screen process. The fifth table in **Appendix D** summarizes the results of the diagnostic analysis for the Quilca Chili Basin. Of those projects that passed the initial screening exercise, the water resource management plan and screening process for the basin yielded a project profile far different than the other basins to the north:

- No projects specifically related to improving and expanding canals and irrigation systems made it on to this pre-screened list.
- Furthermore, no projects relating to water supply and water treatment made it on to the pre-screened list.
- Four relatively small projects related to flood control and storm water management.

In the "Other Infrastructure" category are 12 projects valued at 1.09 million PEN, most of which involve improved management and regulation of existing systems, as well as a few projects with significant water supply augmentation characteristics. Indeed, the largest single project a large dam and reservoir for the Rio Sumbay valued at 800 million PEN.

- There are eleven projects in the "Non-Infrastructure" category some related to improvement of the "water culture," several others related to planning studies, both for water supply and for wastewater management.

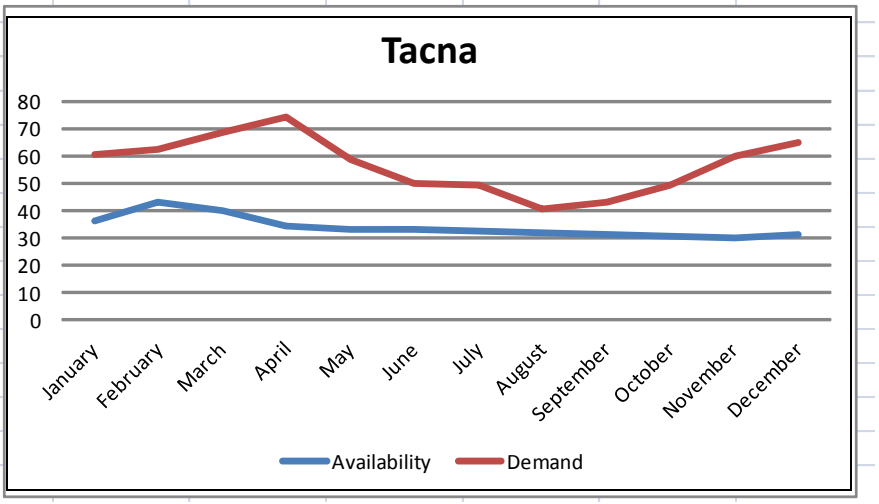
2.4.2.6 Tacna Basin

Finally, the southernmost province in the country (approximately 2,000 km from the Tumbes Basin on the north), the Tacna Region is bordered by the Pacific Ocean on the west, the Moquegua Region on the north, the Puno Region on the northeast, the Bolivian La Paz Department on the east, and the Arica-Parinacota Region of Chile on the south. The border between the Tacna Region and Chile is known as La Línea de la Concordia. The region is located below the Titicaca plateau, and has a diverse geography, including volcanoes, deserts and mountainous zones, from which arise rivers that go over the punas and the plateaus, thus forming the hydrographical system of this zone, drained by the Caplina, Sama, Locumba, and Maure-Uchusuma rivers. The region is small in size, but has a great mining and agriculture potential. It has various climates and diverse agriculture production.

The current average monthly hydrologic balance is presented in **Figure 2-9**. In contrast to all other regions studied, Tacna exhibits by far the more extreme water deficit compared the other basins studied. The Tacna monthly supply – demand hydrographs indicate a supply shortage every month, with the extreme shortages occurring in the months of April and December. The Tacna region can clearly benefit from the implementation of measures to help fill the water gap.

Figure 2-9: Average monthly water resource availability and demand in the basin over the course of the year under current conditions for the Tacna Basin (hm^3 is equal to m^3 x10^6).

	Availability	Demand
	36	61
y	43	62
	40	69
	34	75
	33	59
	33	50
	33	49
	32	40
per	31	43
	31	50
per	30	60
er	32	65
	408	681



The key water challenges in the catchment are summarized below with further detail available in **Appendix C.**

Water quantity challenges

- Planning weaknesses have led to a relevant mismatch between infrastructure availability and actual needs.
- Transfer of water resources from Puno is the source of interregional conflicts between Tacna region and the regional governments of Moquegua and Puno.
- Expansion of irrigated land.
- Groundwater sources in La Yarada irrigation district, whose aquifer is overexploited mostly due to outlawed abstractions.

Water quality challenges

- There are concerns regarding salinity in the Locumba sub-catchment.
- In the Lower Caplina, there are major problems of bacterial pollution due to household and industrial waste.
- In Sama and Locumba there are records of contamination due to chemical by-products or residues.
- Large-scale mining activity is a driver of pollution in some spots of the river basin as well as in the river mouth (Ite Bay).
- In La Yarada aquifer, due to lowering of phreatic levels, there is evidence of saltwater intrusion.

The Tacna Basin had 81 individual projects identified in the basin water management study basin studies. Of that number, 33 projects passed through the pre-screen process. The sixth table in **Appendix D** summarizes the results of the diagnostic analysis for the Tacna Basin. Of those projects that passed the initial screening exercise, the project profile developed in the Tacna Basin studies is quite consistent with the severe supply-demand gap that exists in the region:

- Nine are for agricultural irrigation projects worth a total estimated value of 659 million PEN. Again, the majority of the projects involve improvement to existing infrastructure, and these improvements were assumed to improve the system efficiency (thus earning positive marks from a Best Practice perspective) and therefore impart a positive effect on the hydrologic balance.
- Fourteen of the projects involve expanding and improving potable water supplies and water treatment facilities, as well as the construction of new waste water treatment plants. The total budget for the 14 projects in water supply and sanitation exceeds 821 million PEN.
- There are four intervention related to flood control and storm water management.
- In the "Other Infrastructure" category are some very interesting projects to increase the water supply for the water short Tacna region, including an inter-basin transfer (Deriviacion del Rio Desaguadero) and another to desalinate seawater to provide drinking water for the city of Tacna.
- There is one project in the "Non-Infrastructure" category one related to reforestation in the upper watershed of the Locumba River.

3.0 Application of the Hydro-Economic Tool

This section describes the application of the hydro-economic (HE) tool to the potential investments. It is a condensation of a detailed report on the topic; the complete report is attached as **Appendix E.**

3.1 Overview of Hydro-Economic Tool

The hydro-economic tool developed for the prioritisation of investments in the coastal catchments of Peru can basically be considered as a weighed sum of a series of factors. A hydro-economic tool, by definition, integrates hydrological and economic information. Yet, this tool goes beyond that. Within a multi-criteria analysis framework, economic benefits and cost effectiveness (financial expenditures to achieve a technical water resource outcome) are integrated with environmental and social criteria for the assessment of investment options. In a very simplified sense, the final "score" of each investment alternative is computed as:

$$Score = w_{economic}F_{economic} + w_{cost\ eff.}F_{cost\ eff.} + w_{environ}F_{environ} + w_{social}F_{social}$$

Where w_i represents the weight applied to factor F_i. This section of the report describes in detail the economic considerations and cost effectiveness factors considered, while **Section 4** summarizes the social and environmental criteria utilized in the HE tool.

Transparency in this multi-criteria analysis is achieved not only by explicitly stating and weighting assessment criteria, but also through the design of the tool, which combines pre-screening and screening tiers (log files are available for all projects discarded in the prioritisation process), with the prioritisation of investments. The tool was subject to public consultation with a wide array of stakeholders as described in **Section 4**. All parties were required to explicitly state their preferences through a structured and facilitated process and the hydro-economic tool allowed to identify areas of agreement and disagreement, thereby providing a good framework for managing conflicts around water management.

Evidence and knowledge stemming from HE analysis will inform decisions rather than replacing decision makers' deliberations. The conclusions of this report can help public, private and civil society decision makers to compare their investment options in a systematic, rigorous, and transparent way. However, decisions are made in a continuously changing environment. It is therefore critical to provide rational, transparent, and replicable pre-screening, screening, assessment, and prioritisation criteria so that the outcomes of this study can be updated when and if required. The following subsections describe issues of data availability for application of the tool, and a description of the objective investment screening approach employed

3.2 Review of data availability

A wide range of water investment alternatives has been identified in the course of the execution of the review of interventions as described in **Section 2**. Critical review of data availability aimed:

- to establish comprehensiveness of the list of investment alternatives identified so as to ensure that no potential investment alternative, according to the information made available when delivering this report, is not considered in the analysis;
- to assess availability and quality of information associated with investment alternatives on the list, as part of a quality assurance (QA) procedure so as to provide the 2030 WRG with such a solid evidence base as data quality permits;
- to inform development of the prioritisation approach as part of the application of a tool that combines, further to other criteria (see below), hydrological and economic variables.

3.2.1 Data for Cost-Benefit Analysis

Information collated for the identified investment opportunities was assessed in the context of the data requirements for application of the HE tool. Key issues regarding data availability for hydro-economic assessment were:

Overall, 71% of the records relate to very specific small projects (largely drawn from the SNIP database). The remaining entries represent either interventions with a different degree of aggregation and concreteness or just project idea notes (PIN) with some data. The diversity is also reflected in the capital costs of different investment opportunities. These range from few thousand new Peruvian soles (PEN) to more than PEN 1 billion (350 million US$).

Reasonable information is available on financial parameters albeit at a detailed, project level and includes data on total upfront capital costs, operational and maintenance costs – in both cases at market and social prices – as well as on implementation time and lifetime of assets.

To enable a cost-effectiveness analysis, any measure on the technical effectiveness of the different investment alternatives (i.e. mostly volumes of water, given that our alternatives are assessed against water policy objectives) and reliable capital investment costs ("CAPEX" for CAPital EXpense) and operational and maintenance costs ("OPEX" for OPerations EXpense) estimates were required. Critically, less than 1% of records contain relevant information on technical hydrological parameters such as water quantity saved, etc. Obtaining (better quality) information on the pre-screened list of investment opportunities for appraisal in different catchments was critical to the feasibility of the investment prioritisation. Thus, a major effort was required to obtain technical effectiveness (hydrological) parameters, for instance using outputs from the hydrological models used in some of the WRMPs (WEAP, Water Evaluation and Planning System, www.weap21.org) or pre-feasibility and feasibility documents available from the SNIP database that also include this information.

Similarly, the list of investment opportunities did not contain information on other environmental outcomes, either positive or negative, or social conflicts and other social outcomes. The Hydro-economic tool developed was aiming to explicitly include social and environmental indicators (albeit in qualitative/ semi-quantitative terms) and to use these for investment portfolio optimisation. **Section 4** addresses how the social and environmental issues were considered in the prioritization modelling.

Regarding the typology of projects according to relevant sector or type of technique, different criteria are used across different information sources. However, sanitation and irrigation account for circa 60% of records. Details of the critical review of information collated for all identified investment opportunities are presented in **Appendix E**.

3.2.2 Peruvian Water Investment Context

Peru has a rapidly changing economy and society. Its macroeconomic performance is amongst the best in Latin America, mostly on the basis of current commodity prices and some structural reforms that have provided additional stability to the country, albeit facing a 5% external deficit. Peru will grow by 5.2% and 5.6% in 2014 and 2015, despite the less favourable external environment (a slowdown in the Chinese economy being the main risk factor for Peru's growth) and lower income from mining. In addition, demographic change is to be a major driver of pressures on natural resources, not so much in terms of the overall population growth rate (slightly above 1%) but because of intense urbanization processes or more accelerated growth in some areas of the country, particularly the most arid areas.

3.3 Summary of Investment Screening Process for HE Analysis

As described in Section 2, information available on the comprehensive list of projects and interventions identified (2,303) was used to carry out the pre-screening of potential investment alternatives (IAs) based on a set of transparent filtering criteria and clear rationale. The project pre-screening described in **Section 2.3** was undertaken at a preliminary stage (before development of the HE tool) to allow for a diagnostic analysis of potential investment alternatives. For investment alternative prioritization using the HE tool, an analogous transparent and objective screening process was employed as described below.

A multi-tiered, logical process was followed for this purpose (see **Figures 3-1** and **3-2**):

Tier 1. Identification of potential investment alternatives as part of WP2 to review the breadth and comprehensiveness of proposed investments in the coastal catchments of Peru. As part of task 3.1, the database was not only debugged but also criteria for identification were made explicit.

Tier 2. How to get from the comprehensive list of potential investment alternatives to a shorter list of potential investment alternatives. This is what we call pre-screening for the purposes of this report and the design of the hydro-economic tool. At this stage, alternatives are not assessed.

Tier 3. How to get from a shorter list to a more relevant list of priority investment alternatives subject to a more in-depth analysis. At this stage, alternatives are already subject to some assessment criteria as part of the hydro-economic tool. This screening process is therefore part of a first stage of prioritization of investments. The output is the final list of alternatives to be prioritised.

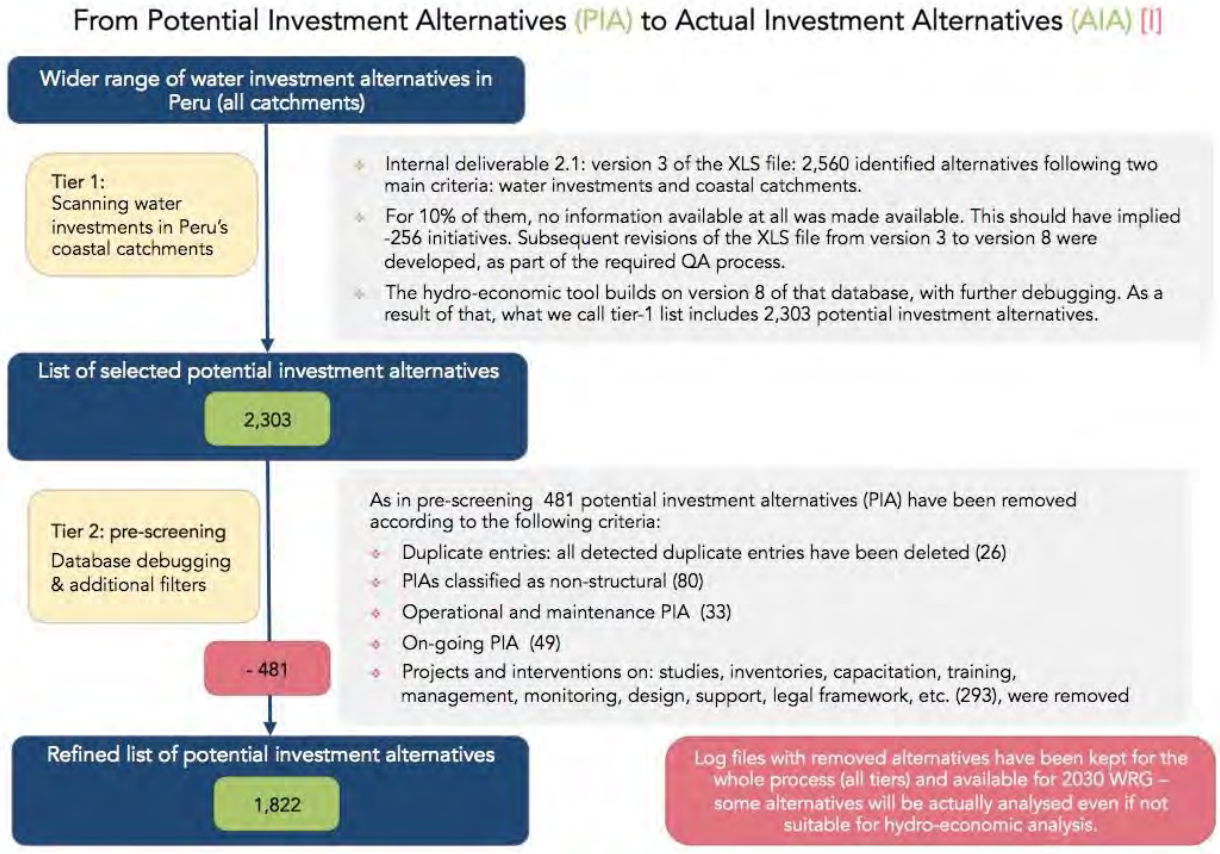
Tier 4. The prioritization of investments itself (a second level of prioritization, indeed) – through collecting as much information as possible for a targeted set of alternatives to provide a deeper analysis of them.

In particular, pre-screening of the comprehensive list of all investment opportunities identified resulted in removal of 481 potential investment alternatives (PIAs) resulting in 1,822 entries remaining based on removal of duplicate entries, projects and interventions associated with routine operation and maintenance as well as non-structural PIAs. Furthermore, ongoing investment projects were removed. While such projects are important, they do not constitute potential investment alternatives to the 2030 WRG.

Finally, it was recognised that some types of projects and interventions would intrinsically fall within public responsibility and would not be financed privately. Such relevant projects and interventions include legislative and administrative measures, emission and abstraction controls, monitoring activities, codes of good practice, studies, assessments and planning among others.

It is important to note that all potential investment alternatives removed after applying pre-screening filters are recorded and can be retrieved if required. In other words, whatever decision by the project team working on the hydro-economic assessment of these alternatives and prioritisation of investments, can actually be explained and reverted, if required.

Figure 3-1: From Potential Investment Alternatives (PIA) to Actual Investment Alternatives (AIA), Tier 1 and Tier 2 screening



3.4 Application of HE Tool to Prioritise Initiatives: Building Hydro-Economic Evidence

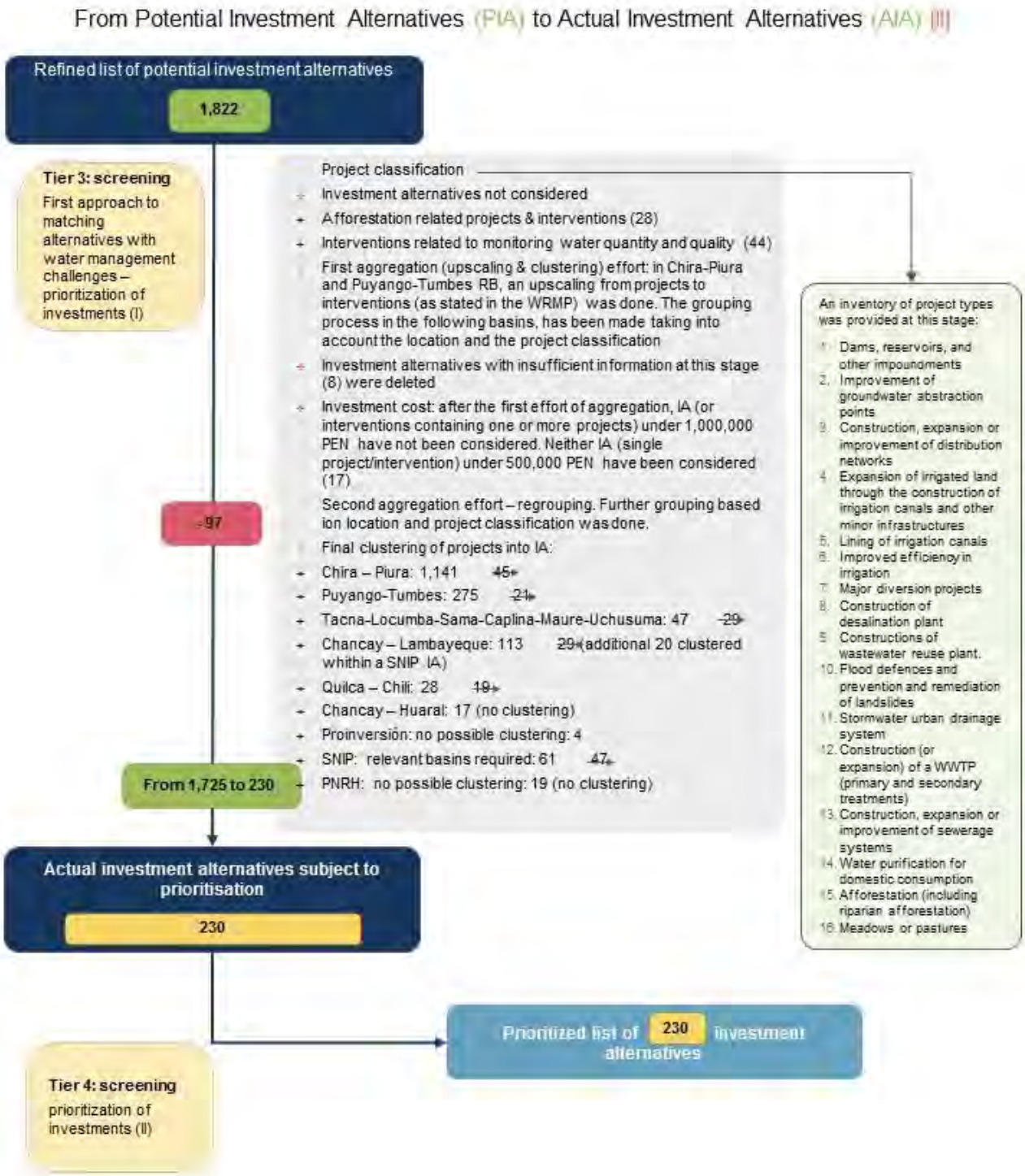
The Tier 1 and Tier 2 screening approach summarized in **Figure 3.1** reduced the total number of investments to 1,822, and this section describes how the Tier 3 screening proceeded to ultimately arrive at a much shorter list of alternatives to be analysed using the HE tool and subject to PESIA analysis for PIA prioritization.

Despite the fact that a fully-fledged cost-benefit analysis (CBA) is infeasible, due to time constraints and lack of information, CBA nevertheless provides the conceptual and methodological framework for the analysis of investment opportunities. With the right information inputs, CBA would actually be a robust analytical framework for three different purposes: the financial appraisal of the different IAs, their economic evaluation, and the assessment of some distributional impacts.

The results of prioritisation of investment opportunities identified (included in the following sections) allow potential investors to understand the scale, effectiveness, timeline and social and environmental consequences related to each IA. In addition, the investment prioritisation process takes into account environmental outcomes (i.e. contribution towards closing the gap as well as other environmental externalities, positive and negative), economic and social impacts in addition to financial consideration.

Building on the work carried out as described in **Section 2**, a critical review of the data collated has informed the development of the approach to the prioritisation of investment alternatives for water management in Peru.

Figure 3-2: From Potential Investment Alternatives (PIA) to Actual Investment Alternatives (AIA), Tier 3 and Tier 4 screening



3.5 Prioritisation of Investment Alternatives – Hydro-Economic Considerations

Further to the pre-screening exercise described in **Section 2**, a more in-depth screening procedure (Tier 3 and Tier 4) was followed to shortlist, in a first prioritisation of investments, a set of 230 investment alternatives. For that purpose, *ad-hoc* classification criteria were developed whereby each intervention was classified against each of the following:

a) **Key economic sector** (agriculture; environmental flows; household, commercial, public; hydropower; manufacturing; mining; and multipurpose reservoirs);

b) **Water policy/management challenge**: Climate change adaptation (CCA); CCA/flood; Development; ecosystem services enhancement (ESS); Flood; closing the water gap (GAP); GAP/flood; GAP/quality; Quality; Quality/Flood;

c) **River basin district / catchment**; and

d) **Type of Project**: dams and reservoirs (D+R); D+R/FMR (for flood risk management); D+R/WS/WWT (for water supply and sanitation); D+R/WT (linked to a water transfer); drainage (DRAIN); DRAIN/S (and sanitation); FMR; irrigation (IRR); IRR/D+R; sanitation (S); water and sanitation (S/WS); desalination plant (WDP); (water purification plant) WPTP; WS; WS/WWT; WT; and wastewater treatment (WWT). Includes further codes for irrigation projects (type specification and use – on/off-site investments for storage, delivery, and application).

As a result of these classification criteria and through a transparent process of clustering and upscaling of projects to initiatives, the list of potential investment alternatives (PIAs) was further reduced to 230 (as illustrated in **Figure 3-2**). For the remaining 230 alternatives, the hydro-economic tool was applied at two levels:

- As part of an analysis integrating hydrological information and financial information, the cost-effectiveness analysis of the different alternatives was developed (see cost curves in **Section 5**);
- In addition, some key economic benefits were estimated for the two main groups of projects (irrigation and sanitation), as detailed in the following two subsections.

3.5.1 Irrigation – Estimating benefits derived from productivity increases

On the basis of information from a US$10+M loan from the World Bank to Peru for the so-called Irrigation Subsector Project PSI II project (irrigation subsector supplemental project), a factor was derived to estimate the value of productivity increases that may occur with irrigation system improvements[13]. Information from the World Bank irrigation project for Peru covers in a very comprehensive way catchments and irrigation districts that are within the scope of our analysis. As a result of the assessment (World Bank, 2009), the following results are of use:

- Average increase in beneficiaries' annual production value per ha (US$/family): 5% and 153% respectively (depending on whether off-site or on-site improvements).
- Average increase in beneficiaries' annual production value per ha (US$ / ha): 3.5% and 155% respectively.
- Average increase in yield of main crops: traditional crops (0-5%, 28%), vegetables (0-3%, 28-57%), fruit trees (0-5%, 14-33%).
- Average income of farmers' households increased by 5% in real terms (US$183 per year); at baseline the average farmers household income was US$3,647 per year.
- Average productivity of land increased by 4% in real terms (US$ 54 / ha) (at baseline, the average productivity of the farm was US$ 1,530 per ha and per year).

As an outcome of the hydro-economic tool, quantified IA benefits reflect the increase value of agricultural production resulting from either increased yields and / or shift to the production of higher value crops. Information on the hydrological impact of these alternatives (in hm^3) was then used to estimate the economic benefits of these productivity increases as a result of improved efficiency (PEN / hm^3).

As part of an improved functionality of the tool, more detailed assessment of benefits could be developed if there were information on the relevant crops for each planned investment. This could be done on the basis of available data on changes in yields and cropped areas as a result of improved irrigation in traditional crops (rice, sugarcane, cotton, maize, beans, yucca, sweet potatoes, potatoes, and basic crops); vegetables (paprika pepper, water melon, pumpkin, asparagus, garlic, onion); fruits (avocado, mandarin, mango, apple, grape) and pasture (alfalfa).

[13] An important remark is that in the coastal catchments there is almost no rainfed agriculture at all, which has implications in terms of baseline. The area with irrigation infrastructure is roughly 1.2 million hectares.

3.5.2 Sanitation and Improved Water Supply – Estimating health benefits stemming from decreased morbidity and premature mortality rates

According to a World Bank report[14] that provides relevant information on benefits from diarrheal morbidity and mortality in rural Peru as a result of improved sanitation facilities or improved water supply, the reduction in diarrheal illness per person is 32% for sanitation and 25% for water supply. This implies a number of diarrheal cases averted per year of 1.3 million (sanitation) and 1m (water supply). More specifically, deaths in children averted per year are 180 (sanitation) and 135 (water supply).

There are also data on annual health benefits of improved services (million PEN), annual value of time savings from improved services (million PEN) and annualized costs of service provision (million PEN). On the grounds of transparency and legitimacy of data sources, these benefits are derived from a range of studies (including epidemiological surveys) and are calculated separately for different categories of individuals in rural Peru. The key assumptions in deriving these benefits relate to the costs of morbidity and mortality and to the value of time saved. For example, morbidity costs, based on the costs of treatment and value of lost time, are PEN 50 per case of diarrhoea. Premature mortality costs are calculated based on the 'Human Capital Approach' (HCA), which actually provides an underestimate of the value of a lost life (i.e. numbers provided are lower bounds, which is the sort of conservative approach that one should follow in a CBA).

In addition, these investment alternatives generate savings in time. These are based on data for households who are more than 15-min walk from a water source (approximately 210,000 households are in this category). Time saved is valued at 75% of the average rural wage (PEN 20 / day).

Furthermore, Hutton (2012) for the WHO provides additional evidence for Peru on global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. These data are relevant but too aggregated for this study. A workable approach though, at the necessary scale for this project, builds on benefit-cost ratios (BCR) 5.84 for sanitation projects in Peru and 1.9 for water supply. This is used in combination with information available on costs to yield health benefits for each relevant IA (drinking water supply and sanitation, mostly).

[14] World Bank (2007) Environmental sustainability: a key to poverty reduction in Peru.

4.0 Political, Environmental and Social Impact Assessment (PESIA)

In **Section 3**, the hydro-economic analysis tool was developed and applied to evaluate and prioritize the investment opportunities considered in this study. The hydro-economic analysis and project ranking is based on quantitative financial data, as well as hydrologic water supply and water demand data and information. This **Section 4** presents the approach to factoring into the analysis an assessment of political, environmental, and social considerations. These considerations are inherently more qualitative, especially social and political factors. In many cases, however, it can be social factors (such as relations with nearby and other affected communities) that determine whether or not a project can be implemented. In the following subsections, we present an approach to develop quantitative valuations and weights for key Political, Environmental, and Social factors that can affect the viability of a project.

4.1 Social / Political Evaluation of projects

Our assessment and quantification of Political and Social factors is based on three independent sources of data:

- The wide experience of our project social impacts team in studying and evaluating social and economic impacts of natural resource development projects across South America in general, and in Peru in particular.
- Peruvian government Social Conflict Databases from Presidential Cabinet of Ministers, ANA, and the national Ombudsman Office.
- Over 25 interviews with representatives of a broad range of stakeholders involved with, or affected by, water resource development projects. The interviews were undertaken specifically for the purpose of this study, and were held with representatives from the private, public, and NGO sectors.

Section 4.1.1 below describes the stakeholder interview process and summarizes the responses of the stakeholders to questions on water resource scarcity and water sustainability issues faced by Peru, including an identification of their perspectives on opportunities and threats related to water investments. **Section 4.1.2** explains how these interviews and other experience in evaluating social impacts of development projects in Peru are utilized to provide a quantitative assessment of the social impacts of the water resource investments considered in this study.

4.1.1 Evaluation of Stakeholder Interviews: Process and Results Summary

A detailed report on the stakeholder engagement process, and important outcomes of that process to consider in the PESIA analysis, is included is provided in an internal project report. This section provides a summary of the stakeholder interview process and results.

As a part of this project, multiple stakeholders from both the public and the private sector have been interviewed. The interviews with stakeholders pertaining to the private sector with previous experience or with the intention of investing in important projects have been prioritised. Moreover, some stakeholders of the public sector with a project portfolio mainly in Private-Public-Associations have been interviewed. These interviews have been carried out from 8th August 2014 to 8th September 2014 in the city of Lima. The criteria to choose the people to be interviewed as well as the institutions that they represent have been determined following the methodology and mapping of the stakeholder engagement plan.

4.1.1.1 Objectives of Stakeholder Engagement Process

The interviews with stakeholders from the public and private sector have been conducted with the purpose of obtaining information in relation to understanding how to improve private sector investment in the economy in the country:

- **Interest in Projects related to the Water Resources**

  The expectations from the projects motivated by the Ministry of Economy and Finance (MEF); the interest in participating in projects that the government is promoting, such as “My Watering”, “National Programme of Urban Sanitation”, “National Programme of Rural Sanitation”, etc.; the social and political constraints that the projects imply and the amount of the investment; and the degree of success that we expect from these programmes and the indicators obtained in terms of technical and social benefits.

- **Strategies and Funding Systems**

  A series of questions during each interview involved exploring the ways in which the projects are funded, the weak and the strong parts of the funding system, the experience obtained in profitability, the possible suggestions to improve in relation to the organizational and funding aspects of the system and, finally which would be the strategy to improve the social image of the sector.

- **Key Projects of the Sector**

  Another part of the interview process sought to clarify which would be the projects of interest for short, medium and long term periods of time as well as to decide which would be the amounts of money to fund these projects, the projects not viable for public funding, the risks and threats to develop new projects, the possibility to consider these projects with some IP or IPP solutions

and, finally, which would be the strengths and opportunities that may ensure the success of the projects.

- **Factors to be taken into Account**

  The final part of the interviews investigated the collaboration or association to make up consortiums for the new projects, the possibility to add new stakeholders who have not been taken into account, the suggestions to public institutions to change the roles of national or regional programmes to improve funding and the level of impact in the water sector.

Particularly useful to support the PESIA analysis were the notes taken during the interview, and these notes were reviewed and considered in how much weight to place on social factors in the combined HE and PESIA analysis from the interview process. Other parts of the information gathered during this process was particularly useful for understanding various vehicles through which the private sector could make investments in the public section (water projects in particular), but not necessarily relevant for the PESIA analysis that is the topic of this chapter. Therefore, those aspects, which are particularly relevant for helping in the "T" phase of 2030 WRG's Analyse-Convene-Transform paradigm, are described separately in **Section 6**.

4.1.1.2 Stakeholder Interviewee Profiles

Stakeholder interviews were undertaken with 29 individuals from 27 institutions, from which 8 were public institutions and 19 were from the private sector. A breakdown of the stakeholders represented in the consultation (in the interviews and/or the final stakeholder workshop) is shown in **Figure 4-1**. In the public sector, 1 belonged to the sanitation sector, 2 to the environmental sector, each one with two interviews, 2 to the financial sector and 1 to the agricultural sector. **Table 4-1** provides a summary of the individuals and their respective institution that were approached for the interviews. The last column highlights whether the meeting actually took place. In some cases the individual who attended the interview was another representative. A summary of the results of the interviews are provided below in **Table 4-2**, and English-language summaries of the interviews are included as **Appendix F**.

Figure 4-1: Breakdown of stakeholders consulted

SECTOR	Sanitation	Enviromental	Financing	Mining and Construction	Energy	Food	Cooperation	Cement	Agriculture
PRIVATE	Dialogo y Soluciones		IDB Inter-American Development Bank IFC International Finance Corporation WORLD BANK GROUP	SOUTHERN COPPER SOUTHERN PERÚ ANDRADE GUTIERREZ Sociedad Nacional de MINERIA PETROLEO Y ENERGIA ANTAMINA Compañía de Minas Buenaventura	DUKE ENERGY	Coca-Cola	COSUDE	UNACEM CONSTRUYENDO OPORTUNIDADES	INNOVA RURAL INSTITUTO PERUANO DE TECNOLOGÍA INNOVACIÓN Y GESTIÓN
CIVIL SOCIETY	agualimpia WWF Ciudad Saludable The Nature Conservancy				Futuro Sostenible creando puentes para el desarrollo AVINA				
PUBLIC	Vivienda Ministerio de Vivienda, Construcción y Saneamiento ANA Autoridad Nacional del Agua		PERÚ Ministerio de Economía y Finanzas ProInversión						PERÚ Ministerio de Agricultura y Riego

Table 4-1: Stakeholder institutions, and names and positions of individuals interviewed.

Institution	Name	Position	Meeting
Agua Limpia	Mercedes Castro García	CEO	Yes
Antamina	Roberto Manrique	Environmental Manager	Yes
Autoridad Nacional del Agua	Juan Carlos Sevilla Gildemeister	Director	Yes
Autoridad Nacional del Agua (ANA)	Miguel Ángel Beretta Cisneros	Deputy Director for International Cooperation	Yes
Banco Interamericano de Desarrollo - BID	Edgar Orellana Arévalo	Water and Sanitation Team Leader	Yes
CIA. De Minas Buenaventura S.A.A.	Raúl Benavides	Deputy director for Business Development	No
Coca-Cola	Julia Sobrevilla	Communication Manager	Yes
COSUDE	Carla Toranzo	Country Manager	Yes
Diálogo y Soluciones	Jorge del Castillo Gálvez	CEO	Yes
Duke Energy Perú	Guillermo Fajardo Cama	Country Manager for Corporate Social Responsibility	Yes
Fundación Avina	Zoraida Sánchez Morales	Program Coordinator	Yes
Fundación UNACEM	Armando Casis	CEO	Yes
Futuro Sostenible	Antonio Bernales Alvarado	CEO	Yes
Grupo Ciudad Saludable	Albina Ruiz Ríos	Chairman and Founder	No
IFC Corporación Financiera Internacional	Álvaro Quijandría	Country Manager for Investments	Yes
Innova Rural	Ismael Benavides Ferreyros	CEO	Yes
Ministerio de Agricultura	Jorge Luís Montenegro Chavesta	Deputy Minister for Infrastructures and Irrigation Development	Yes
Ministerio del Ambiente	Alessandra G. Herrera Jara	Assessor	No
Ministerio del Ambiente	Mariano Castro S. M.	Deputy Minister for Environmental Management	No
Ministerio de Economía y Finanzas	Eloy Durand Cervantes	General Director for Public Investments	No
Ministerio de Energía y Minas	Guillermo Shinno	Deputy Minister for Mining	Yes
Ministerio de Vivienda	Francisco Dumler Cuya	Deputy Minister for Building and Water Sanitation	Yes
Newmont Perú S.R.L.	Javier Velarde Zapater	CEO	No
Proinversión	Carlos Herrera	Chief for Investors Assessment	Yes
Sociedad Nacional de Minería Petróleo y Energía	Guido Bocchio Carbajal	Legal Assessor for Mining Sector	Yes
The Nature Conservancy	Luís Alberto González	Country Manager	No
Unión de Cervecerías Peruanas Backus y Johnston S. A. A.	Felipe Cantuarias Salaverry	Deputy President for Planning and Corporate Affairs	No
Water and Sanitation Program	Ivo Imparato	Principal Regional Team Leader	No
WWF Perú	Cecilia Álvarez Vega	Coordinator of Unit for Conservation Sciences	No

4.1.1.3 Opportunities and Threats Identified by Stakeholders

The attractiveness of individual project investments to the private and public sector will differ. **Table 4-2** provides stakeholders' perspectives on the opportunities and threats related to water project investments.

Our HE+PESIA methodology, analysis and prioritisation is based largely on 7 basins which have Water Management Councils (WMC) and an approved Water Resources Management Plan approved by ANA and the WMC. This means that the political risk for potential, investors is minimised because:

- There is strong institutional presence in the basin. ANA is present in the largest city (represented by AAA) and also with local offices in the micro-watersheds (ALAs).
- The WMC has wide participation from Regional Government, municipalities, universities, professional associations, NGOs, etc.
- The participatory system used for approving the Water Resources Management Plan confers social legitimacy of the technical process and the consensus outcome.
- The Water Resources Management Plan has also a PPP Financial Program, where different types of financing schemes are included.

Whilst this is the case for the 7 basins which are the focus of this study, there are other works and/or interesting programs for private investment in other basins and in the basins that provide Lima's water supply, and in those cases there may be varying levels of political risk.

Table 4-2: Stakeholder perspectives on opportunities and threats in water project investments in Peru

Sector	Opportunity	Threat
Agriculture	- Different directions of the sector (agriculture) maximise the fund management to settle agricultural operations aimed at making the most of water resources management.	- Negative effects of climate change in the investments in this sector.
Food	- Become a major stakeholder in the field of water resources, detecting how to articulate the projects implemented by the public sector and the community creating a greater impact on water issues, which are a priority to the government.	- The stakeholders involved (GoRe, GoLo, etc.) ignore the existance of the water compensation system as a result of the lack of project proposals submitted in order to allow the recovery of water resources in nature or society.
Enviroment		- Problems for the private sector that doesn't want the supervision of the APP operations are performed by GoRe according to the law, but that the monitoring is undertaken by a national agency (ANA or other).
Cooperation	- Future alliances between the public and private sector with regard to water resources use and management in the country, encouraging other associations to become a part of them (the alliances).	
Energy	- Evaluate the mechanisms of standarised contributions of the institution in the energetic plan of the country that are intended for implementing plans of catchments or pre-plans of catchements, being these ones participatory with presence of ANA and other agents. - Through their tax obligations strengthen ANA and other agents of the catchement.	- Vulnerability in the operational level of basic water management bodies due to political disagreements.
Funding	- Investments shared between the IDB and the Government intended to renew the PMGRH for 5 more years, such actions would be focused on issues of sewage and recovery of the environmental status. - Investments with IFC for irrigation projects.	- Conflicts with the inhabitants of the catchements areas or regions.
Mining	- Ensuring the supply of secure water to the lower parts of the valleys thanks to the assets generated by the mining industry. - Major project implementation in relation to water resources by the sector through "Works forTax" because it is the most active mechanism and keeps direct contact with the water problems in the operational area of the sector. - Possibility of introducing public-private partnerships in non-classical issues, not only for the execution of physical works, but also the possibility to research resources such as the Technological Institute for Water. - Greater involvement of private institutions in the mining sector in public investment through incentives such as tax benefits, exemptions or any other compensations under a special tributary regulation. - When it comes to water, investiments at urban level for the support of cleaning and other services; in the higher parts of the catchement area, the support would be intended for the livestock development.	- The programmes on water intended for irrigation do not usually allow private investment go along with public investment, not as in the case of the Programme "Water for All" in terms of sanitation.
Sanitation	- The Government encourages entrepreneurs to fund public projects under public guidelines and plans. - Accelerating investment through private investment on the basis of public resources "Works for Taxes". - Policy of integration and identification of the beneficiaries with their works, looking for the evaluation of such works by the beneficiaries. - Mining companies interested in the sanitation sector to manage co-funding with PNSR and PNSU programmes.	- Inestability of the teams capable of managing and organizing people who belong to public bodies (GoRe, GoLo). - Poor management capacity of the GoRe to drive the projects implemented by the public sector. - Lack of initiative of the Government to provide detailed visibility of the PGRH in companies and associations, which would generate the co-funding of works prioritised in the plans.
Social	- Strengthening social vision through programmes which are complementary to the existing ones that may contribute to close the gap of water. - Incorporation of management models for operation and maintenance.	- Methodological problems between different institutions involved that do not allow the integration of information coming from different media (PROCOES, JAICA, PNSR, etc.). There is no methodological unification.

4.1.2 Social Impact Valuations and Weights

To account for social factors in the evaluation and prioritization of the investment opportunities, a method was developed to assign numerical values and quantitative weights to six key social impact factors. The values assigned to each of the factors varied by project type and hydrological basin. The following subsections describe the process carried out for the quantification of social factors and their application to the project prioritisation process.

4.1.2.1 Generic social impact valuation by project typology

The Social Impacts Assessment utilizes six key factors, which were deemed to capture highly relevant measures of social impacts which the projects will impact on nearby communities:

- Social Conflicts: Referred to potential, dormant, or resolved conflicts that may influence in the development of the projects.
- Access to Water: Referred to the improvement in the access to water for consumption or irrigation in both urban and rural sectors.
- Human Health: Referred to impacts on human health.
- Social Equity: Referred to impacts on affordability of water, as a result of possible increases in water services tariffs.
- Reduced Exposure to Natural Disasters: Referred to impacts from natural disasters such as floods, pollution, droughts, on population and properties.
- Organizational structure: Referred to impacts on local or regional organizational structures for institutions, local customs or social organizations.

Firstly, each factor was assigned a weight according to its relative importance, as shown in **Table 4-3** below. For simplicity, the sum of the weights added up to 1.0, which allows one to readily understand the relative importance assigned to each factor. For example, referring to **Table 4-3**, Social Conflict, Social Equity, and Organizational Structure have the highest weights, or greatest importance, whereas Reduction in Exposure to Natural Disasters was assigned the lowest weight. This weighting scheme was developed based on the decades of practical experience by the project social impact team and the Peruvian government social conflict databases previously cited.

Table 4-3: Relative weights assigned to each of the six key social factors

	Social conflicts	Access to water	Human health	Social equity	Reduced exposure to natural disasters	Organizational structure
Weights (within social criteria)	Social conflicts	Impact of improved access to water on communities (other than health)	Impact on human health	Impact on affordability (as a result of increases in water services tariffs)	Impact of natural disasters (floods, droughts etc.) on population and properties	Impact on local organizational structure or local customs
	0.2	0.15	0.15	0.2	0.1	0.2

Next, these six factors were considered within the context of each of the global project types discussed in **Section 3** of the report:

For each type of project, each factor was assigned a scale value. The scale value ranged from 1 to 5, where 1 and 2 are negative impacts, 3 is neutral and, 4 and 5 are positive impacts. **Table 4-4** below presents the values for each factor by project type. Both the weights (**Table 4-3**) and the type (negative or positive) and value of impact quantification (**Table 4-4**), were developed based on an exhaustive analysis from the catchments plans, social conflict databases, and other relevant information and team experience.

Table 4-4: Social factor impacts valuation by project type (Green=direct impact, Orange= indirect impact) and valuation (1=strongly negative, 2=somewhat negative, 3=neutral, 4= somewhat positive, and 5=strongly positive; N and P signify negative and positive) for each type of project

Types of projects / interventions	Key affected water users / sectors	Social conflicts	Impact on Access to Water	Impact on Human health	Social equity, Impact on water affordability	Reduced exposure to natural disasters (floods, droughts, ...)	Impact on Local Organisational Structures
Dams, reservoirs, and other impoundments	WS&S,IRHP, MIN	N / 1-2	P / 4-5	3	P / 4-5	3	N/P / 1-5
Improvement of groundwater abstraction points	WS&S, IRR, HP, MIN, MAN	3	N/P / 1-5	3	3	N / 1-2	3
Construction, expansion or improvement of distribution networks (including reduction of leakages)	WS&S, MAN	P / 4-5	P / 4-5	P / 4-5	N / 1-2	3	N/P / 1-5
Expansion of irrigated land through the construction of irrigation canals and other minor infrastructures	IRR	N / 1-2	P / 4-5	3	N/P / 1-5	3	3
Lining of irrigation canals	IRR	P / 4-5	P / 4-5	3	N/P / 1-5	3	3
Improved efficiency in irrigation	IRR	N / 1-2	P / 4-5	3	P / 4-5	P / 4-5	3
Major diversion projects	WS&S, IRR, HP	N / 1-2	N/P / 1-5	3	N/P / 1-5	3	3
Construction of desalination plants	WS&S, IRR, MIN	N / 1-2	P / 4-5	3	N/P / 1-5	3	3
Constructions of wastewater reuse plants	WS&S, IRR	N / 1-2	P / 4-5	P / 4-5	P / 4-5	3	3
Flood defences	RES, AGR, MAN	3	3	3	3	P / 4-5	3
Prevention and remediation of landslides	RES, AGR, MAN	3	3	3	3	P / 4-5	3
Stormwater urban drainage system	WS&S	3	P / 4-5	P / 4-5	P / 4-5	P / 4-5	3
Construction (or expansion) of a WWTP (primary and secondary treatments)	WS&S, AGR, REC, ENV	3	P / 4-5	P / 4-5	P / 4-5	3	3
Construction, expansion or improvement of sewerage systems	WS&S, AGR, REC, ENV	P / 4-5	P / 4-5	P / 4-5	P / 4-5	3	3
Water purification for domestic consumption	RES	3	P / 4-5	P / 4-5	N/P / 1-5	3	N/P / 1-5
Afforestation (including riparian afforestation)	WS&S, ENV	N / 1-2	3	3	3	P / 4-5	N / 1-2
Establishment of meadows or pastures	RES, ENV	N / 1-2	3	3	3	3	N / 1-2

WS&S: Water supply and sanitation (Urban and Rural), IRR: Irrigation, MAN: Manufacturing, AGR: Agriculture, HP: Hydropower, MIN: Mining, REC: Recreation, RES: Residential, ENV: Environment

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4.1.2.2 Refined social impact valuation by river basin and sector

As shown in **Table 4-4**, some impacts were easily identified as positive, such as Human Health parameter. However, there were some other impacts that could be identified as positive or negative, depending on the type of project and specific basin and sector. For example, the project type "Improvement of Groundwater Abstraction Points" under the social factor "Access to Water" can have either a very positive or very negative social impact:

- In those situations where there are abundant relatively untapped groundwater supplies, such a project type would generally be considered to have a positive social impact, however
- In those situations in which groundwater supplies are scarce and already overexploited, such a project type would have negative social impacts on the overall community.

These types of issues were addressed when we reviewed all 230 projects considered in the HE assessment. In this step, for each project we thoroughly reviewed the associated Catchment Plans, as well as Peruvian government Social Conflict Databases from Presidential Cabinet Office, ANA, and the national Ombudsman Office.

As a result, some of the 230 projects have changed their values and weights according to specific characteristics of the basins and sectors. For example, for the Caplina Basin, Project "Improvement of groundwater collection points to supply Tacna's population", despite of the apparent absence of social conflict parameter at the general matrix (**Table 4-4**), we've considered necessary indicate the negative impact on social conflicts for this specific project, due to the current, widely recognized over exploitation of groundwater in Tacna. Each change of the valuation of social impacts helped to refine the assessment for the prioritisation of projects.

4.2 Environmental impact evaluation of projects

To account for environmental factors in the evaluation and prioritization of the investment opportunities, a method was developed to assign numerical values and quantitative weights to six key environmental factors. The values for each of the environmental factors varied by project type and hydrologic basin. The following subsections describe the process employed for the quantification of environmental factors and their application to the environmental assessment for the 230 potential investments subject to HE analysis.

4.2.1 Key Environmental Issues in Peru

Ecologically, Peru is a very diverse country, with many ecological and climate variations across its territory that result in a wide range of environmental challenges to address. Most of the environmental concerns can however be grouped into a handful of key issues, which may be summarised as follows:

Water quantity: Water resources distribution in Peru shows wide variation between the Pacific basins and the Atlantic (Amazon) basins. The Pacific coast is extremely arid, with cities such as Lima

receiving of the order of 2 cm precipitation annually, while the Amazon Basin has abundant rainfall and run-off. Most of the water demand, however, is focussed within the coastal region of Peru in the Pacific basin. How water projects such as those considered here may impact on the available water resources is a key environmental concern that must always be addressed in EIA studies and permit applications.

Water quality: Expanded and improved waste water management is a key goal for Peru because surface and underground water quality is affected by untreated sewage, agricultural, industrial and mining effluents. Bearing in mind that most of the population is located in the cities in the coast, the pressure on the water resources associated with wastewater is both a challenge and an opportunity, given that water reuse projects have the potential to increase water resource availability.

Hydro-morphology: Given that river water quantity and quality will be affected by any changes made to a river basin, this issue is related to basin management, the hydro-morphology of the river, and consideration of ecological and environmental flows.

Biodiversity: A key issue for Peru is the extent and magnitude of project impacts on the vegetation, fauna, and hydrobiology related to any development project. Water projects could change water quantity, quality and river integrity, affecting local biodiversity, leading to the need for mitigation, compensation and monitoring plans.

Soils: The quality and quantity of Peru's soils are suffering changes because of the expansion of cities, and agricultural expansion and overexploitation. It is important therefore to ensure actions that preserve the quality of the soils and also to prevent desertification, soil salinization and soil loss.

Waste management: As one of the main environmental challenges to urban development, waste management is an important issue to address. Cities have recently started implementing waste management programs and infrastructure that will partially address this historical problem.

Climate change: Peru has high vulnerability to the impacts of climate change. Glacier retreat is changing hydrological dynamics and will impact water security in the future. These impacts may require the implementation of mitigation measures to prevent soil loss, water and air pollution, and programs to increase water use efficiency. See also **Section 4.2.2.**

From this list, five were selected as the main key issues to consider when evaluating environmental impact of the potential investments:

- water quantity,
- water quality,
- hydro-morphology
- biodiversity, and
- climate change.

4.2.1.1 Generic environmental impact valuations by project typology

Given that the five key environmental factors will be impacted in a positive or negative way by each project development, it is important to have an estimate of how positive or negative the impact could be for each of the 230 investments considered in the HE analysis.

As defined in **Section 3** and utilized again in the social assessment (**Section 4.1.2**), the projects considered in the analysis were grouped in 17 generic types of projects for evaluation of the environmental benefit and cost. The generic environmental valuation was assigned as follows:

- The water quantity, water quality and hydro-morphology factors were assigned either positive or negative impact;
- The biodiversity factor was considered only for positive impacts; and
- The climate change factor was considered only for negative impacts.

Using the same approach as in the social impact assessment, the valuation used an absolute assignment of number from 1 (high negative impact) to 5 (high positive impact), considering 3 as a neutral impact. **Table 4-5** shows the result of the generic valuation.

Table 4-5. Environmental impacts type (Green=direct impact, Orange= indirect impact) and valuation (1=strongly negative, 2=somewhat negative, 3=neutral, 4= somewhat positive, and 5=strongly positive) for each type of project

Types of projects / interventions	Key affected water users / sectors	Environmental impacts							
		Direct environmental benefits (environmental outcome)				Environmental costs (externalities associated with investment opportunities)			
		Water quantity	Water quality	Hydro-morphology	Biodiversity	Water quantity	Water quality	Hydro-morphology	Climate change mitigation
		Avoided external costs (water supply)	Avoided external costs (water quality)	Hydromorphological improvements	Enhanced biodiversity and ESS delivery (incl E-flows)	Aggravating water scarcity and drought risk (overexploitation)	Disposal of wastewater / brackish water	Adverse hydromorphological changes	Damages from atmospheric pollution (GHG and others)
Dams, reservoirs, and other impoundments	D+R	5	4	4	3	3	2	1	3
Improvement of groundwater abstraction points	GW	5	3	3	3	2	3	2	3
Construction, expansion or improvement of distribution networks (including reduction of leakages)	WS	5	4	3	3	3	3	2	3
Expansion of irrigated land through the construction of irrigation canals and other minor infrastructures	IRR	4	3	3	3	2	2	2	2
Lining of irrigation canals	CL	4	3	3	3	3	3	3	3
Improved efficiency in irrigation	IRR*	5	4	3	4	3	3	3	2
Major diversion projects	WT	5	3	3	3	2	3	1	2
Construction of desalination plants	DESAL	5	3	3	3	3	2	3	2
Constructions of wastewater reuse plants	REUSE	4	5	3	4	3	2	3	2
Flood defences	FD	3	3	3	3	3	3	1	3
Prevention and remediation of landslides	LS	3	5	5	5	3	3	3	2
Stormwater urban drainage system	DRAIN	4	5	3	4	3	2	3	3
Construction (or expansion) of a WWTP (primary and secondary treatments)	WWTP	5	5	3	5	3	2	3	3
Construction, expansion or improvement of sewerage systems	S	3	5	3	4	3	2	3	3
Water purification for domestic consumption	WPP AND WPP*	3	5	3	3	3	3	3	3
Afforestation (including riparian afforestation)	AFF	5	5	5	5	2	3	3	3
Establishment of meadows or pastures	M&P	4	4	4	4	2	3	3	3

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Specific environmental impact valuation by basin and sector

After the generic types of projects were evaluated, the next step was to analyse the specific list of projects, assigning each of them a score from 1 to 5, based on the generic valuation. In the cases where the projects were multi-purpose, it was necessary to have a refined and more detailed valuation.

The refined valuation takes into account the specific basin conditions, the application area and the population that will benefit from (or be negatively impacted by) the project. The impact valuation considered the project types involved and adjusting the generic impact values for the specific kind of project and geographical location.

4.2.2 Climate Change and El Niño / La Niña Considerations

The topics of El Nino and Climate Change carry great importance for the future of water resources management in Peru. The following subsections discuss these two climate phenomena and their implications for water resource management.

4.2.2.1 Analysis of Climate Change and Impacts

Peru is highly vulnerable to climate change impacts, with seven of the nine vulnerability characteristics recognized in the 1992 United Nations Framework Convention on Climate Change (UNFCCC). Those seven characteristics are (MINAM 2010):

- low coastal zones;
- arid and semi-arid areas;
- exposure to floods, droughts, and desertification;
- zones prone to natural disasters;
- areas of high urban pollution;
- fragile mountain ecosystems; and
- significant economic dependence on the production and export of fossil fuels.

With regard to the water resource situation in Peru, the water production and storage capacity in the high mountain snowfields and glaciers are particularly vulnerable to a warming global climate. In addition to the loss of glaciers that can be viewed to serve as water storage reservoirs historically, as highland temperatures increase and precipitation becomes more erratic, highland pastures, wetlands, and prairies are losing their capacity to provide their usual sponge like regulation and filtration of water flows and groundwater recharge. The observed micro-climate changes include prolonged droughts, more intense and shorter precipitation periods, and more intense frosts.

The National Water Resource Plan (ANA, 2014, Section 2.12) provides a quantitative projection of climate change in Peru through 2030, and that projection is based on a study by SENAMHI (2009).

AMEC undertook a review of the methods employed to develop these climate change forecasts for Peru. As described by SENAMHI (2009), the Peruvian forecasts were based on seven GCM (Global Climate Model, or General Circulation Model) model runs with 2 scenarios defined in the "Emissions Scenario Special Report" (IPC, 2007). The two scenarios are: A2 high increase of CO_2, and B2 low increase of CO_2, yielding an ensemble of 14 model runs for projecting large scale changes across Peru. To detect and account for bias the models were compared to the observed data from the Climate Research Unit (CRU) of the University of East Anglia for the period 1961 – 1990. The average of these 14 scenarios was used to project large-scale temperature and precipitation changes. Because the resolution of the GCMs is too coarse to resolve local changes, they use dynamical downscaling to project local changes in precipitation and runoff.

GCM Model Predictions of Changes in Precipitation

The dynamical downscaling process was made with the regional model RAMS, which were forced by the single NCAR (from the US agency National Center for Atmospheric Research) global model. The RAMS model was initialized with the NCAR-PCM T42, because this model did the best job of capturing the observed intense rainfall on the northern coast during ENSO events. Based on our experience in application of GCMs and dynamical downscaling for predicting refined, local forecasts for future precipitation and hydrology (Harding *et al.*, 2012), *such a single model approach should have no role in planning*. Only ensemble-based studies are an acceptable basis for planning, accordingly, we will not address the single-model RCM study further.

With regard to the fact that the SENHAMI study appears to have used a 14-member ensemble from the SRES A2 and B1 emissions scenarios, we have fewer reservations, but a number of questions remain. The choice of emissions scenario is probably not significant to estimates of future precipitation, and is thus not a shortcoming of the study. However, a 14-member ensemble may only be marginally acceptable as the basis for planning. At a minimum, the choice of ensemble size should be supported with an assessment of the statistical significance of changes in mean precipitation. This will provide no information about how well the selected ensemble approximates the full range of GCM projections. A better approach would be to place the selected ensemble in context of the full ensemble of CMIP3 projections, which is approximately 112 model runs. The best approach would be to evaluate the full CMIP3 ensemble. In addition to ensemble selection, there are outstanding questions regarding the methods used to simulate hydrology, including the methods used to develop forcings for the hydrology models. Nor could we find a description of how from the ensemble study they generated the **Figures 51, 52** and **54**, which imply a resolution much, much finer than 200, 300 or 500 km (presumably they used some sort of statistical downscaling approach). Finally, there are outstanding questions about how model biases (in the GCM and hydrology model) were addressed when estimating changes in precipitation and hydrologic conditions.

In summary, the future climate analysis of precipitation scenarios presented in the national water plan (based on the SENAMHI, 2009 report) carries with it a number of uncertainties, and project planning based upon these scenarios should be considered preliminary. That said, this should not affect our recommendations related to investment prioritization.

GCM Model Predictions and Observations of Changes in Temperature

In contrast with our reservations in using the GCM model predictions of precipitation as a basis for water investment prioritisation, the model predictions for temperature are quite consistent with observed temperature trends and carry with them important messages on water resource availability in the future. Specifically, the temperature model predictions and observations suggest that some of the glaciers found in the high Andes may melt away in decades (e.g., Fraser, 2012; Thompson *et al*., 2013). Such a scenario poses significant implications for water supplies and availability for communities dependent on stream flows that carry glacial meltwater (Vergara *et al*., 2007; Fraser, 2012).

Vergara *et al.* (2007) show that up to 50% of the streamflow for tributaries to major rivers that feed populations and irrigation projects are fed by glacial melt. In the short-term, stream flows fed by rapidly retreating glaciers will increase, but as the glaciers disappear, such stream flows would be dramatically reduced. In a sense, one can view the glaciers as providing natural regulation to stream flows, akin to man-made reservoirs, storing water from wet season precipitation and releasing water during the subsequent dry season. With this perspective in mind, projects that involve increasing water storage (be it reservoirs or artificial recharge) in those basins with significant glacial meltwater contributions will help provide resiliency against climate change, and thus should be considered to have a higher priority. The Hydro-Economic model developed for this project did not include a “glacial melt” factor, however, since the more detailed hydrologic analysis which would be required to identify those specific glacier-sensitive stream flows was beyond the scope of this study.

4.2.2.2 Impact of El Niño Southern Oscillation

Peru is also one of the country’s most directly affected by the El Niño Southern Oscillation (ENSO), experiencing increased temperatures from El Niño every four to five years, as well as periodic colder temperatures associated with La Niña. In Peru, the El Nino – La Nina cycle is often accompanied by unusually wet periods (El Nino) and unusually dry periods or droughts (La Nina). The magnitude of the El Niño and La Niña events is measured by the “Indice Costero El Niño (ICEN)”, or the El Niño Coastal Index in English, which is a running average of three months of the monthly sea temperature anomalies off the northern Peruvian coast. The identification of events (El Niño, La Niña) is undertaken using the following criteria:

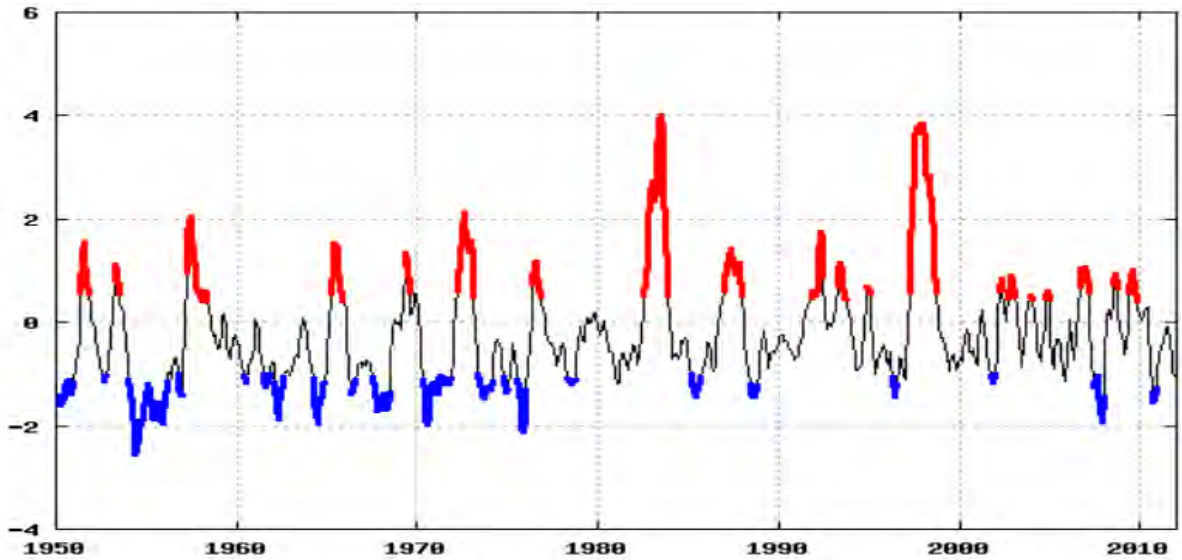
- A “La Niña event in the Peruvian coastal region” corresponds to a period of “cold conditions” (indicated by large negative ICEN) during at least 3 consecutive months.
- An “El Niño event in the Peruvian coastal region” corresponds to a period of “warm conditions” (indicated by a large positive ICEN) during at least 3 consecutive months.

Figure 4-2 presents the ICEN from 1950 through 2011 with El Niño corresponding to the positive peaks in red and La Niña events corresponding to the negative peaks in blue.

The hydrologic impact of El Niño and La Niña events is extreme rainfall. For example, in 1924-1925, the city of Lima, which typically receives less than 5 cm precipitation annually, received flooding rains in one of the first recognized El Niño events, and the city of Piura on the northern coastal plain, which typically receives 6 cm of precipitation annually experienced 28.1cm, 180.2cm, and 25.5 cm in El Niño events in 1992, 1998, and 2002 (Takahashi, 2004). These variations often have significant disruptive effects on agriculture and other productive activities, and the El Niño effect is expected to increase in frequency as a result of climate change (Obregón *et al*. 2009).

According to the "Plan de Gestión de los Recursos Hídricos de la cuenca Chira – Piura" the anomalies of the hydric demands will be positive in that basin, that will increase the evapotranspiration and therefore the water balance deficit, those effects would be more intense in the Bajo Piura and the low part of the sub basins San Francisco and Yapatera. Part of the El Niño effects is the increased flooding, due to the intense precipitation, which can cause localized disasters. Besides, it's been observed that after El Niño event, adverse drought effects may occur during La Niña events. In general, El Niño has bigger implications to the north of Peru, most of the studies and climate models has been done for this part of the country. Thus, the basin management plans for the south parts of the country do not present much information of the El Niño effects.

Figure 4-2: El Niño Coastal Index from 1950 through 2011



Note: Red line: El Niño Blue line: La Niña.

In relation to future conditions, the SENAMHI (2009) publication "Escenarios Climaticos en el Peru para el año 2030", has been made an extensive analysis of the climate evolution in Peru. To do this, observed trends in daily precipitation, maximum and minimum temperature were used, for a data record of 42 years (1965 – 2006) from 64 pluviometric stations and 29 maximum and minimum temperature stations were used. This analysis yielded the following conclusions:

- Annual precipitation shows a strong increase over the north coast of the country, also the temperature is affected by the strong events of ENSO, the tendency of maximum and seasonal temperature shown positive values prevalence about +0.2ºC/decade. The tendency of minimum and seasonal temperature were mostly positive (0.1 – 0.2 ºC/decade).
- The future climate study described above predicts an annual maximum temperature is expected to increase 1ºC by 2030 and up to 2ºC to the end of 2050. The average increase of minimum temperature is similar to the maximum.
- For precipitation, the future climate study described above predicts changes by 2030, showing a decrease in precipitation of 10 to 30% between La Libertad southward to Tacna (south), and increase up to 20% over Tumbes and Piura in the northern parts of the country.

Again, due to the uncertainties in these studies described above, project planning based upon these precipitation scenarios should be considered preliminary. That said, this does not affect our recommendations related to investment prioritization presented in **Section 5** below.

5.0 Prioritised Investments by Basin

In each of the following sections we describe the current challenges in each catchment, summarising the information from **Section 2**. We then present an overview of investment priorities which have been derived from the project listing which was subsequently taken into the hydro-economic and PESIA analysis (described in **Section 3**). Finally we present the results of the prioritisation; firstly in terms of effectiveness in closing the water gap and then in terms of an integrated analysis of cost effectiveness, economic benefit, social impact, and environmental impact.

In each of the sections that follow:

- The **supply-demand charts** are those shown in **Section 2** and presented here again to give the reader a broad appreciation of water stress. Water availability is expressed as current monthly average and was derived using a continuous modelling series of rainfall-runoff calibrated from available stream flow data, and includes impact of regulation infrastructure if it exists. Demands were estimated by others based on data provided by water users in the area and estimates of agricultural water demands and per capita use rates for domestic, commercial, and industrial uses. The water gap is based on the difference between the estimated availability and demand. So far as we are aware, neither water availability nor demand makes an allowance for environmental flow.
- The **ratio of annual demand to water availability** ranges from 13% (Tumbes) to 167% (Tacna). The Water Resources Vulnerability Index (Raskin *et al*, *Water Futures: Assessment of Long-range Patterns and Prospects.* Stockholm, Sweden: Stockholm Environment Institute, 1997) suggests that water stress is experienced when water withdrawals exceed 20% of available water; moving to severe water stress for withdrawals greater than 40%. On this basis all catchments except Tumbes are in severe water stress. In many basins water demand is already met through imports from neighbouring Amazonian basins
- The **water quantity and water quality challenges** are summarised from those described in Section 2.
- The **investment priorities overview** is a commentary on the responses to the water quantity and water quality of the overall palette of investment alternatives that we have reviewed.
- In the **prioritised investment analysis** we have firstly presented cost curves to illustrate cost effectiveness of investments in closing the water gap. We go on to present a ranked table of the 10 projects with highest priority arising from the integrated analysis. In these tables there are projects which do not close the supply demand gap but which derive economic, environmental or social benefit.
- Whilst the **costs shown on the cost curves are the Equivalent Annual Cost (**estimated on the basis of capital and O&M costs, timelines and a discount rate), the costs shown in tables are the initial capital investment.
- The reader should note that **some of the investments** shown in the tables **are alternatives**, and that some **are constituent elements of a planned programme**. This means that care must be taken when making conclusions about the priority of individual projects.

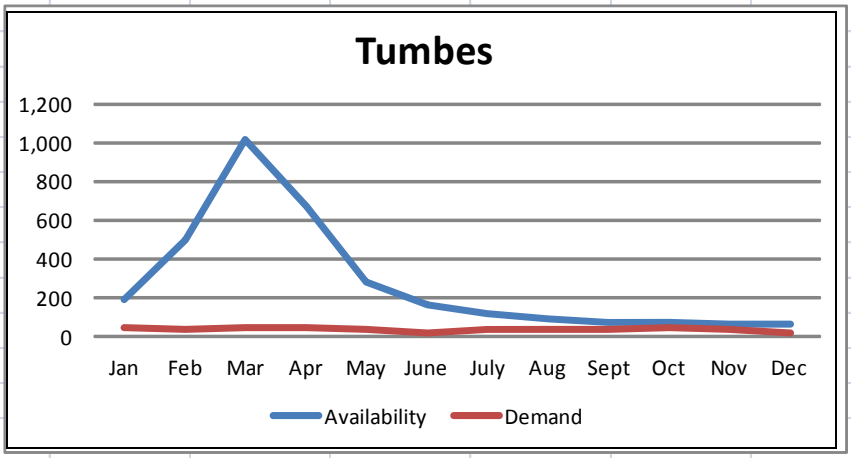
5.1 Tumbes

5.1.1 Challenges

Under current average conditions the basin does not exhibit a significant shortage in the period January to June but in dry years there is water stress in the period between September and December.

Figure 5-1: Current water resource supply and demand (hm³/month) in the Tumbes catchment

Availability	Demand
187	49
495	35
1,014	42
670	46
280	40
163	15
119	40
94	37
76	37
69	43
60	36
63	19
3,291	439



A crucial element of the challenges in the Tumbes catchment relate to the bi-national management of shared water with Ecuador. Many of the water quality problems are related to suspended solids from mining activity in the Ecuadorian territory.

Another challenge which we are aware of is the high-growth tourist zone (the largest coastal development in the country) without safe drinking water and sanitation systems, impacting the coastal communities from Tumbes south to Chira. Here, lack of water is limiting urban growth and intervention measures are being prioritized for urban use rather than irrigation.

5.1.1.1 Water quantity challenges

- Water supply infrastructure is obsolete or deteriorating.
- Little use of new technologies and best practices in irrigation.
- Low efficiency in the systems for abstraction and conveyance of water.
- Riverbed silting is a major concern.

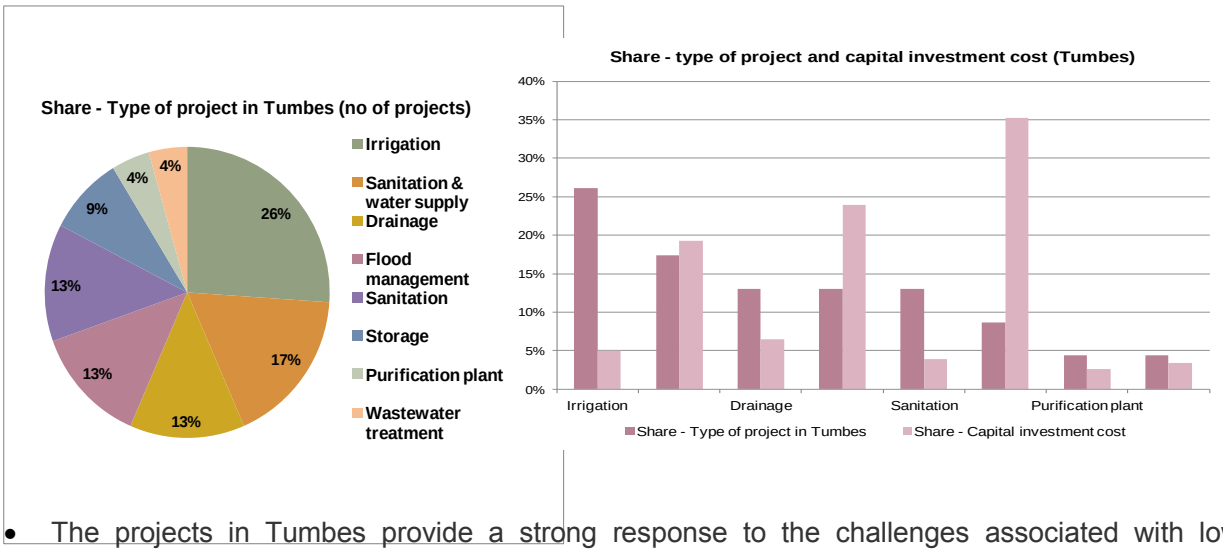
5.1.1.2 Water quality challenges

- Major discharges of wastewater and inadequate drainage.
- Solid waste at dumping river bank sites.
- Discharge of agrochemical waste, a major source of diffuse pollution.
- One of the main sources of pollution is mining in the upper catchment.
- Due to overexploitation of coastal aquifers, there is evidence of saline intrusion.

5.1.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Tumbes catchment is estimated at PEN 1,310 million; including those that reduce the supply demand gap by an estimated 97 hm^3/year. **Figure 5-2** summarises the types of project and their share in total number and total cost. Irrigation projects are prominent but storage and flood defence projects account for the highest investment.

Figure 5-2: Summary of investment projects in Tumbes catchment



- The projects in Tumbes provide a strong response to the challenges associated with low efficiency in water abstraction and conveyance systems, lack of adequate infrastructure and almost non-existent application of best practices in irrigation. The diversity reflected in the prioritised list of investments include **irrigation efficiency measures**, such as lining of irrigation canals, improving irrigation water abstraction and conveyance systems in Tumbes and Brujas Alta y Fundo Las Palomas and carrying out improvements of minor irrigation infrastructure in Tumbes. Furthermore, prioritised investment projects include a range of **water supply investments** including both construction of dams and construction of groundwater abstraction with associated distribution systems.
- A range of prioritised investment projects will contribute to addressing the persistent challenge of the lack of adequate infrastructure for water supply and low efficiency in abstraction and distribution systems in the catchment. However, the prioritised list of investment does not seem

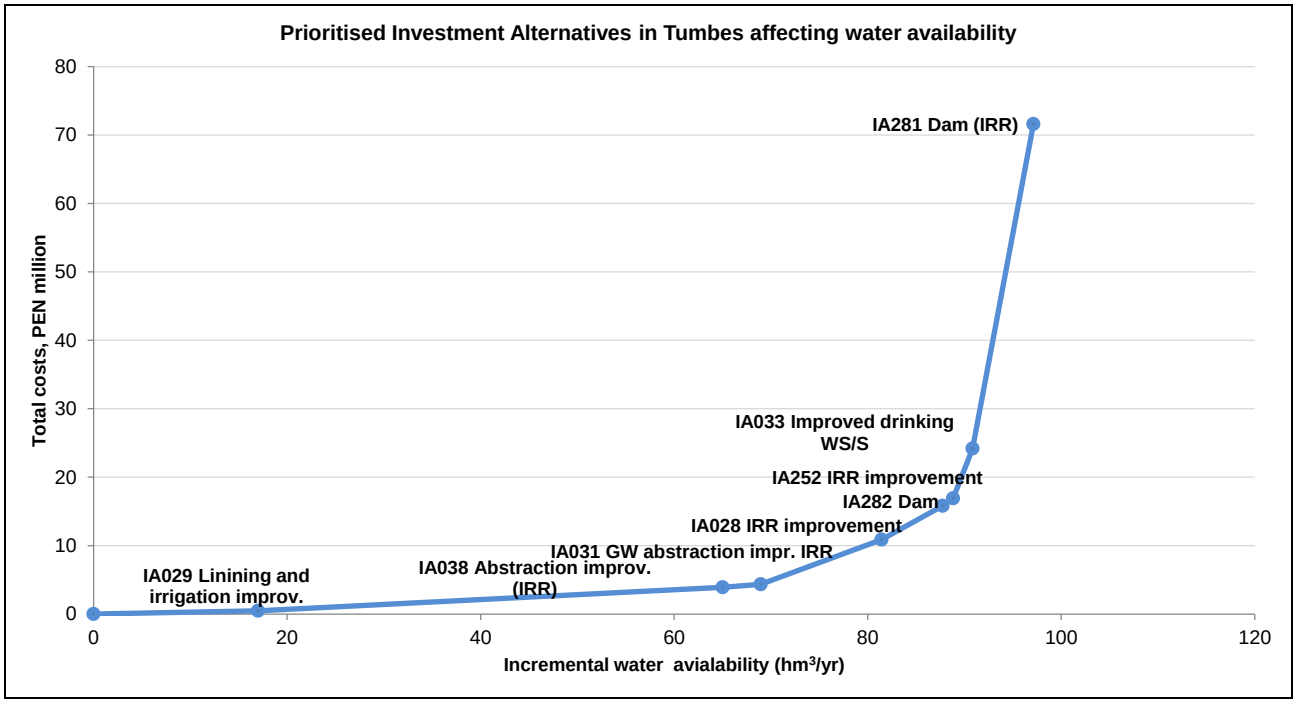
to offer a full diversity of potential solutions and is primarily focused on **improving existing drinking water supply networks** and **construction of WPP** as part of joint water supply and sanitation projects. For instance, improvement of drinking water supply systems, distribution networks and sewerage systems would save 2.0 hm^3 of water per year. Numerous prioritised investment projects are focused on **construction, improvement and expansion of drinking water supply and sewage networks in rural and urban areas** of the Tumbes catchment. While improvements in existing water supply networks are expected to have a positive impact on increased water availability, construction of new or expansion of existing drinking water supply networks may result in a relative increase in water demand. Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reduction measures), water demand reduction measures and/or exploration of new water supply sources. Expansion and improvement of drinking water and sewerage network in urban and rural areas would also play an important role in tackling water quality challenges as well as serving social and health policy objectives.

- **Construction of a municipal WWTP** at Tumbes will contribute to tackling reduced water quality as a result of direct untreated discharges of domestic sewage into rivers and associated resulting environmental damage. Development of sewerage systems, particularly in rural areas as well as WWTP construction will also serve social policy objectives while resulting in health benefits associated with provision of sanitation services to catchment inhabitants. Furthermore, construction and improvement of urban drainage systems for storm water will contribute to pollution reduction.
- Prioritised investments in flood defence systems will contribute to addressing the major **flood risk management** challenge in the catchment that is associated with riverbed silting. Prioritised investment projects are diverse in nature, recognising the need for preventative as well as disaster response actions and include flood defence construction in riparian areas, control and mitigation of erosion and sedimentation processes as well as cleaning and de-silting riverbeds after flood events.
- Prioritised investments also include projects aimed to tackle **solid waste management** issues, such as improvement of urban waste management systems that would also positively contribute to solving water quality challenges in the catchment.
- However, prioritised investments in Tumbes catchment do not reflect the critical need to tackle **major pollution loads from transboundary mining** activities (including mercury loads) or discharges of agrochemical waste (including fertilisers, pesticides, and insecticides).

5.1.3 Prioritised Investment Analysis

The cost curve in **Figure 5.3** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Tumbes catchment in terms of increasing water availability and closing the supply and demand gap. The curve exhibits an elastic section up to around 80 hm^3/year followed by a swift transition to an inelastic section, which includes two dam projects.

Figure 5-3: Cost curve for investment alternatives in Tumbes catchment



The investments included in the cost curve are listed below in **Table 5.1**. They represent a range of different projects including canal lining, new abstractions for irrigation, water supply systems and dams.

Table 5-1: Cost effective investment alternatives in Tumbes catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³/yr)
IA029	Lining and improvement of irrigation canals – Tumbes	3.35	17.00
IA038	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas – Tumbes	23.33	48.00
IA031	Improvement and construction of groundwater abstraction points and related infrastructure for irrigation – Tumbes	1.91	3.94
IA028	Improvement of irrigation minor infrastructure (surface and groundwater) – Tumbes	25.86	12.50
IA282	Construction of Quebrada Fernández Dam	43.42	6.30
IA252	Improvement of irrigation water services (abstraction and conveyance) – Tumbes, Tumbes	9.31	1.09
IA033	Improvement of drinking water supply systems, distribution networks and sewerage systems	51.81	2.00
IA281	Construction of a dam in Puyango-Tumbes River and the associated distribution network for irrigation	419.10	6.30

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5.2**.

Table 5-2 Top 10 prioritised investment alternatives in Tumbes catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA038	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas – Tumbes	23.33	48.00	5.00	1.50	2.40	4.00	3.45
IA029	Lining and improvement of irrigation canals – Tumbes	3.35	17.00	5.00	1.00	1.75	3.70	3.12
IA031	Improvement and construction of groundwater abstraction points and related infrastructure for irrigation – Tumbes	1.91	3.94	5.00	1.00	1.70	3.30	3.00
IA028	Improvement of irrigation minor infrastructure (surface and groundwater) – Tumbes	25.86	12.50	3.00	0.83	1.75	4.00	2.57
IA044	Waste Water Treatment Plant	45.00	0.18	1.00	2.83	2.60	4.00	2.56
IA033	Improvement of drinking water supply systems, distribution networks and sewerage systems	51.81	2.00	1.00	2.17	1.88	4.00	2.27
IA040	Improvement of integrated urban solid waste management	44.86	0.00	0.00	2.50	2.15	4.20	2.15
IA034	Construction and improvement of rural drinking water supply infrastructure and sewerage systems in rural areas	15.29	0.00	1.00	2.00	1.88	3.60	2.12

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA035	Water Purification Treatment Plant and Waste Water Treatment Plant	34.77	0.00	0.00	2.17	2.15	4.00	2.03
IA045	Sewerage systems in rural areas (development of sanitation projects)	4.55	0.00	0.00	2.33	2.15	3.80	2.00

The impact of the integrated analysis over that of cost effectiveness is to raise the priority of investments which have positive economic, social and environmental benefit such as sewerage systems, wastewater treatment and solid waste management. Such investments will improve water quality and thus increase the potential availability of water that can enter the supply system. These ten projects represent a total investment of PEN 250 million and include 6 projects which would reduce the water gap by 83 Hm^3/yr.

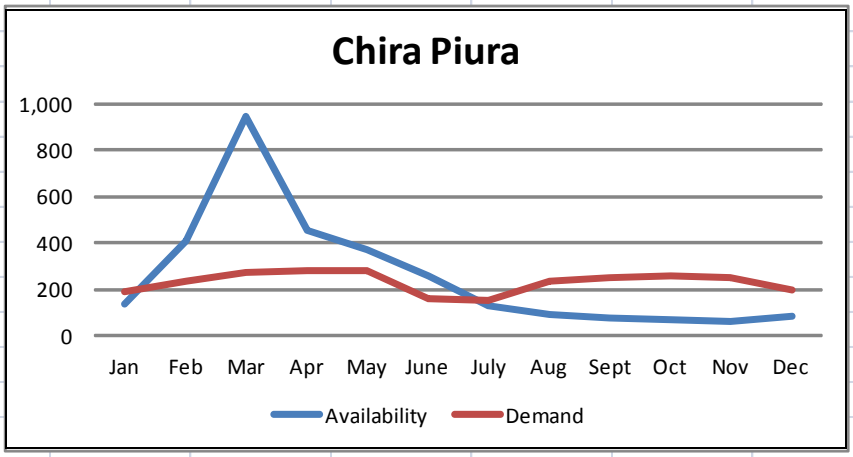
5.2 Chira Piura

5.2.1 Challenges

Under current average conditions the Chira Piura Basin experiences a significant supply shortage in the months between July and January. By any measure this catchment is under severe water stress.

Figure 5-4: Current water resource supply and demand (hm³/month) in the Chira Piura catchment

Availability	Demand
135	192
405	236
947	272
451	278
373	282
256	162
130	154
94	231
73	248
68	258
61	246
82	194
3,074	2,751



The same phenomenon that occurs in the Chira Piura catchment as in Tumbes catchment and relate to the bi-national management of shared water with Ecuador. Sediment problems (soil-erosion) and pollution are partly rooted in Ecuadorian territory.

5.2.1.1 Water quantity challenges

- Lack of adequate infrastructure for water regulation.
- Aging water and sanitation infrastructure.
- Water scarcity affecting some urban areas.
- Lack of response to extreme events.
- Lack of regulation capacity (up to 500 hm³) due to siltation of the Poechos dam.

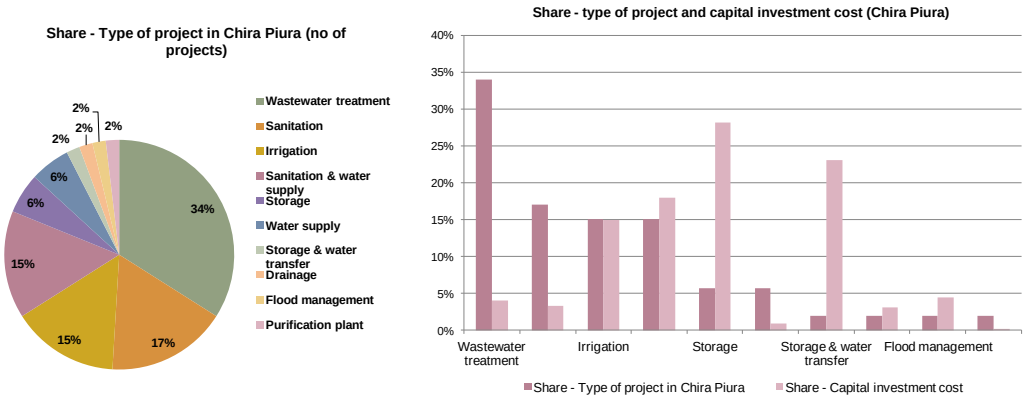
5.2.1.2 Water quality challenges

- Discharge of raw sewage resulting in surface and groundwater pollution.
- Lack of wastewater treatment infrastructure or rather operational problems (due to undersized capacity and lack of maintenance).
- In the city of Piura there are major discharges of industrial wastewater.
- In the middle and lower course of the watershed, there is lack of maintenance of aerobic wastewater treatment lagoons.
- In the coastal area (Paita and Sechura seas), there is untreated wastewater discharge from manufacturing industries.
- In the lower valleys there is salinization of agricultural soils as a result of poor irrigation practices.

5.2.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Chira Piura catchment is estimated at PEN 5,038 million; including those that reduce the supply demand gap by an estimated 1,250 hm^3/year. **Figure 5-5** summarises the types of project and their share in total number and total cost. Wastewater treatment projects are prominent, but storage projects account for the highest investment.

Figure 5-5: Summary of investment projects in Chira Piura catchment



- A range of investment projects prioritised will contribute to addressing the ***persistent challenge of the lack of adequate infrastructure for water supply and regulation*** in the catchment. Prioritised investments addressing this challenge are diverse in the nature and range from major diversion and storage projects (e.g. Alto Piura project entailing a water transfer and the construction of Las Peñitas dam on the Piura River) to small-scale solutions such as development of new dams and small reservoirs for surface run-off exploitation. More importantly, prioritised investment projects in Chira Piura reflect a wide range of ***irrigation***

efficiency measures, including installation of technified irrigation (mostly drip irrigation), lining of irrigation canals, improving water distribution networks used for irrigation water supply, repairing and improving superficial irrigation systems such as dams, water intakes, piping, distribution and introducing metering systems. Investment projects aimed at developing additional water supply sources and at improving current irrigation efficiency will provide a substantial contribution to tackling water scarcity challenges in the catchment. However, expansion or construction of additional major and minor irrigation infrastructure would result in increased water demand and use unless coupled with water efficiency measures (e.g. expansion and improvement of irrigation water service canals in Piura aiming to mitigate potential adverse impacts on water availability).

- Investment in expansion and improvement of flood defences (in riparian areas) will contribute to addressing pressing ***climate change adaptation challenges*** in the catchment particularly manifesting in the lack of response to extreme events. In the context of the agricultural sector and its *exposure to* ***extreme events***, investments in securing necessary water supply and distribution infrastructure coupled with investments in improved irrigation efficiency and introduction of technified irrigation techniques will contribute to climate proofing of agricultural activities.
- A lack of ***adequately maintained and sufficient municipal water supply infrastructure*** combined with high water demand thereby leading to water scarcity in urban areas (particularly pronounced in Talara and Paita cities) constitutes one of the key water supply challenges in the catchment. Prioritised list of investment offers a range of potential solutions including exploration of additional water sources (e.g. Santa Rosa dam at Quiroz River, additional surface and groundwater abstraction) and improving existing drinking water supply networks (e.g. Piura, Talara) including construction of WPP. Numerous prioritised investment projects are focused on expansion and/or construction of drinking water supply and sewage networks (in combination or separately). While improvements in existing water supply networks are expected to have a positive impact on increased water availability, construction of new or expansion of existing drinking water supply networks may result in a relative increase in water demand. Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reductions measures), water demand reduction measures and/or exploration of new water supply sources. In addition to the Santa Rosa dam, the multi-purpose Alto Piura project and the Las Peñitas dam will also augment available water supply.
- ***Construction of multiple municipal WWTPs*** across the catchment will contribute to tackling the issue of direct untreated discharges of domestic sewerage in the upper and middle parts of the catchment and the associated environmental damage caused. Construction of a number of WWTPs will also serve social policy objectives while resulting in health benefits associated with provision of clean drinking water and sanitation services to catchment inhabitants. Expansion and improvement of sewerage network in urban areas (e.g. in Piura) and provision of rural sanitation systems would also play an important role in tackling water quality challenges as well as serving social and health policy objectives.
- Prioritised investments also include projects that will contribute to tackling ***untreated wastewater discharges from manufacturing sector*** causing water quality problems in the coastal areas, Sullana and in the city of Piura, in particular. Expansion and improvements in the sewerage systems in the industrial area in Sullana, expansion and improvement of San Martin WWTP as well as expansion of drinking water and sewerage services in Piura are few

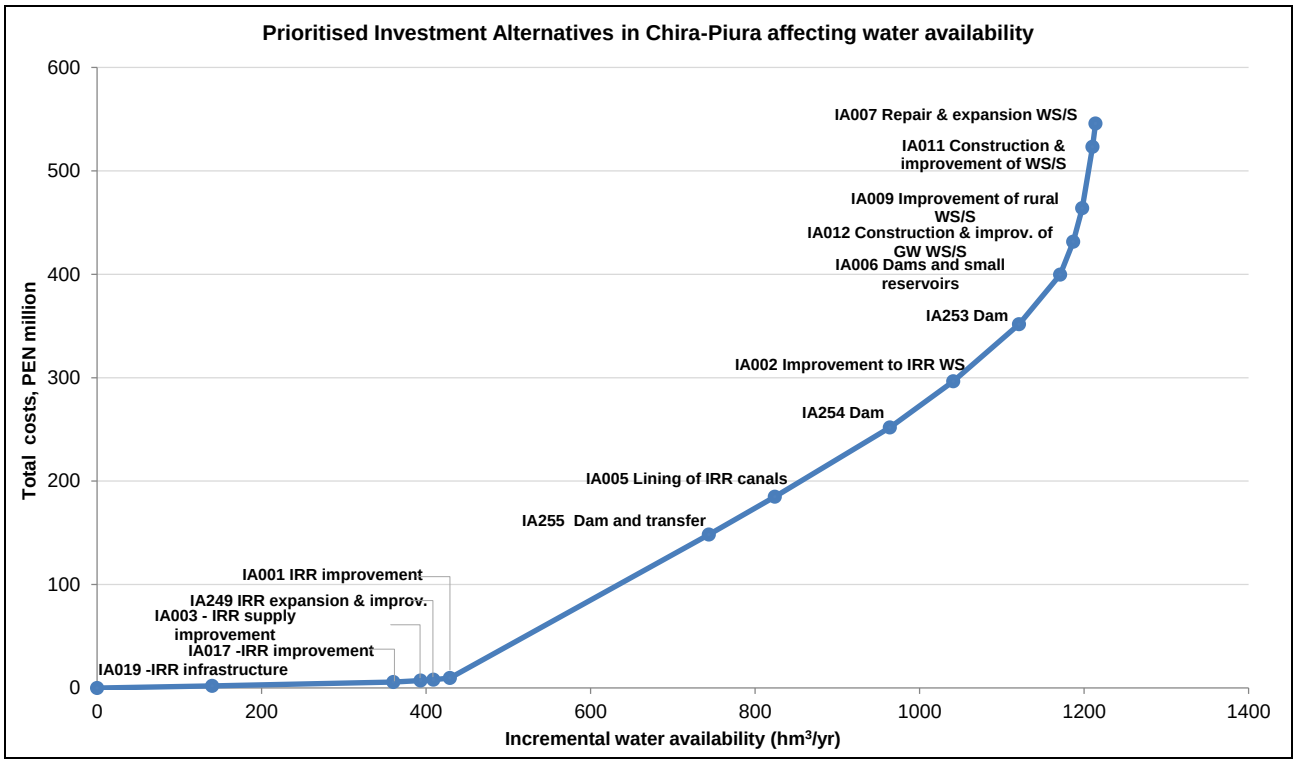
examples of relevant investment alternatives that will contribute to addressing some of the key pressures in the catchments.

- Prioritised investments aimed to tackle ***solid waste management*** issues, such as improvement of solid waste management systems in Talara as well as investments in construction and improvement of landfill sites would also positively contribute to solving water quality challenges in the catchment.

5.2.3 Prioritised Investment Analysis

The cost curve in **Figure 5.6** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Chira Piura catchment in terms of increasing water availability and closing the supply and demand gap. The curve exhibits an elastic section up to 400 hm^3/year followed by a less elastic section to 1,100 hm^3/year, and then a transition to an inelastic section, which includes dam and water/sanitation projects.

Figure 5-6: Cost curve for investment alternatives in Chira Piura catchment



The investments (as far as IA 006) included in the cost curve are listed below in **Table 5-3**. They represent a range of different infrastructure including canal lining, irrigation improvement, wastewater treatment plants, water supply systems and dams.

Table 5-3: Cost effective investment alternatives in Chira Piura catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)
IA019	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13.62	140.00
IA017	Efficiency improvement through technified irrigation - mostly drip irrigation	25.81	220.20
IA003	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10.30	33.00
IA249	Expansion and improvement of irrigation water service (canals) - Piura Piura	4.96	15.76
IA258	Waste Water Treatment Plant San Martin	6.50	17.41
IA001	Repairing and improvement of superficial irrigation systems (dams, water intakes, piping, distribution) and metering systems	11.54	20.00
IA261	Waste Water Treatment Plant Chulucanas	3.66	1.58
IA272	Waste Water Treatment Plant - Catacos, Piura, Piura	13.04	4.60
IA255	Alto Piura project (water transfer, Tronera Sur dam, valley improvement and pumping plants)	1,163.42	315.00
IA005	Lining of irrigation canals	296.42	80.00
IA254	Santa Rosa dam - Quiroz River	557.87	140.00
IA263	Waste Water Treatment Plant Lancones	2.44	0.63
IA002	Improvement of bulk water distribution networks for irrigation (piping, conveyance, distribution)	302.49	77.00
IA253	Las Peñitas dam - Piura river	460.00	80.00
IA257	Waste Water Treatment Plant - Los Portales, Piura, Piura	3.16	0.65
IA262	Waste Water Treatment Plant Mallaritos	1.63	0.30
IA013	Water Purification treatment Plant (WPP)	8.40	1.26
IA006	New dams and small reservoirs for (upstream) surface runoff exploitation	400.77	50.00

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-4.**

Table 5-4 Top 10 prioritised investment alternatives in Chira Piura catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA258	Waste Water Treatment Plant San Martin	6.50	17.41	5.00	2.67	2.60	3.80	3.67
IA017	Efficiency improvement through technified irrigation - mostly drip irrigation	25.81	220.20	5.00	1.67	2.40	3.60	3.37
IA261	Waste Water Treatment Plant Chulucanas	3.66	1.58	4.00	2.50	2.60	3.80	3.34
IA019	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13.62	140.00	5.00	2.00	2.40	3.05	3.28
IA003	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10.30	33.00	5.00	1.17	2.00	3.60	3.18
IA001	Repairing and improvement of superficial irrigation systems (dams, water intakes, piping, distribution) and metering systems	11.54	20.00	5.00	1.83	1.88	2.90	3.09
IA272	Waste Water Treatment Plant - Catacos, Piura, Piura	13.04	4.60	3.00	2.67	2.60	3.80	3.07
IA249	Expansion and improvement of irrigation water service (canals) - Piura Piura	4.96	15.76	5.00	1.00	1.75	2.90	2.90
IA254	Santa Rosa dam - Quiroz River	557.87	140.00	3.00	1.83	2.48	3.35	2.75
IA005	Lining of irrigation canals	296.42	80.00	3.00	1.17	2.25	3.70	2.66

The impact of the integrated analysis over that of cost effectiveness has largely been to re-order the priority of investments to reflect those which have higher economic, social and environmental benefit such as wastewater treatment. It is noted that IA 254 Santa Rosa Dam (PEN 557 million) falls several places in the ranking but remains with a higher than average combined score.

These ten projects represent a total investment of PEN 943 million and reduce the water gap by 670 Hm^3/yr.

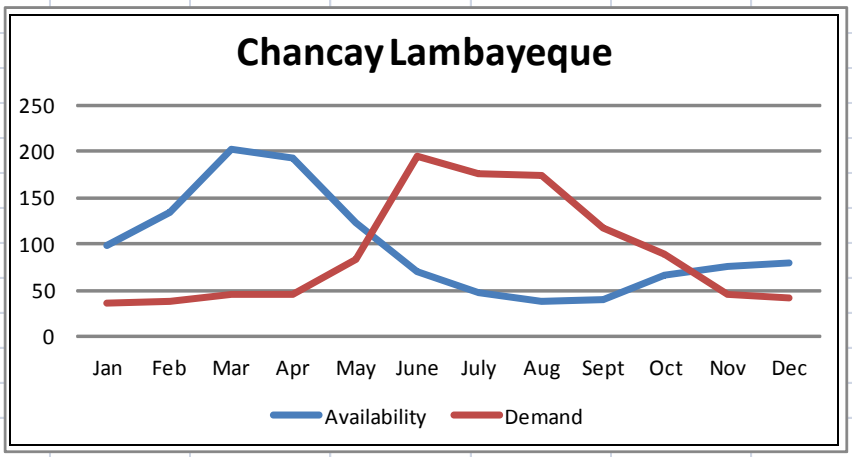
5.3 Chancay-Lambayeque

5.3.1 Challenges

Water users experience a significant supply shortage in the months between May and October. The catchment has severe water stress.

Figure 5-7: Current water resource supply and demand (hm^3/month) in the Chancay Lambayeque catchment

Availability	Demand
97	36
134	38
201	46
192	46
123	82
69	194
47	176
39	173
40	116
66	88
75	46
79	41
1,162	1,082



In this catchment, the proposed Olmos Special Project would draw water from a basin (the Huancabamba River), downstream from the intake for the High Piura Special Project, which means that both projects are competing for the same water.

5.3.1.1 Water quantity challenges

- Lack of clarity regarding available long-term renewable resources.
- Water infrastructure including storage is both insufficient and deteriorating.
- Prevalence of highly water-demanding crops.
- Lack of enforcement (and securitization) of water use rights, affecting both surface and groundwater.
- Lack of official estimation of irrigation efficiencies.
- Preference for surface vs. groundwater (for irrigation).
- Low coverage of water services.
- Soil degradation and loss in the middle and lower basin.

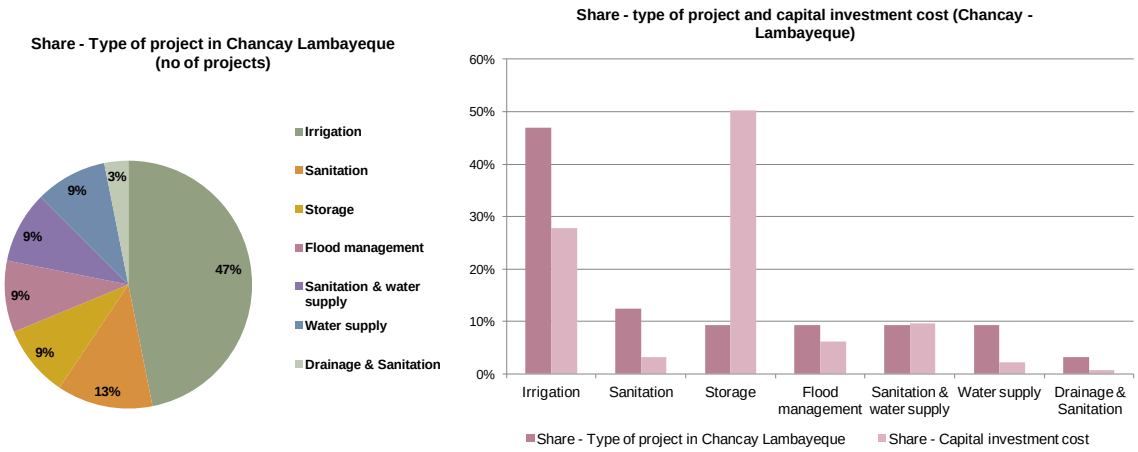
5.3.1.2 Water quality challenges

- Pollution derives from untreated domestic, municipal and industrial wastewater, solid waste disposal, and agro-chemicals.
- In the upper river basin, there is evidence of inorganic pollution (i.e. metals) and low pH levels (which may have a natural origin).

5.3.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Chancay Lambayeque catchment is estimated at PEN 1,159 million; including those that reduce the supply demand gap by an estimated 190 hm^3/year. **Figure 5-8** summarises the types of project and their share in total number and total cost. Irrigation projects are prominent, but storage projects account for the highest investment.

Figure 5-8: Summary of investment projects in Chancay Lambayeque catchment



- A range of prioritised investments will contribute to addressing the *challenge of **insufficient water storage infrastructure and regulation*** in the catchment for irrigation purposes including investments in SICAN dam system, an indigenous system (PEN 2 million offering 5 hm^3/yr) and Special Project Olmos – Tinajones project linked to an impoundment. However, prioritised investments seem lacking in diversity of potential water supply solutions. Furthermore, prioritised investments include wide range of ***irrigation efficiency measures***, such as improved irrigation channels (Carpintero, Fala and Fernandez irrigation canals), canal lining (Lambayeque and Cajamarca departments), technification of irrigation (Chugur, Hualgayoc, Cajamarca) as well as more modest measures aimed at improving agrarian productivity (San José, Lambayeque). On the other hand a range of prioritised investments foresee ***construction or expansion of irrigation infrastructure*** that would result in increased water demand (Chota, Chancay-Baños, Tocmoche - Chota irrigation system). Such expansion of irrigation systems will need to be coupled with water efficiency measures in order to mitigate any potential net adverse impact on water availability.
- Prioritised investments in flood defence systems will contribute to addressing ***flood risk management*** challenge in the catchment. Prioritised investment projects in Chancay-

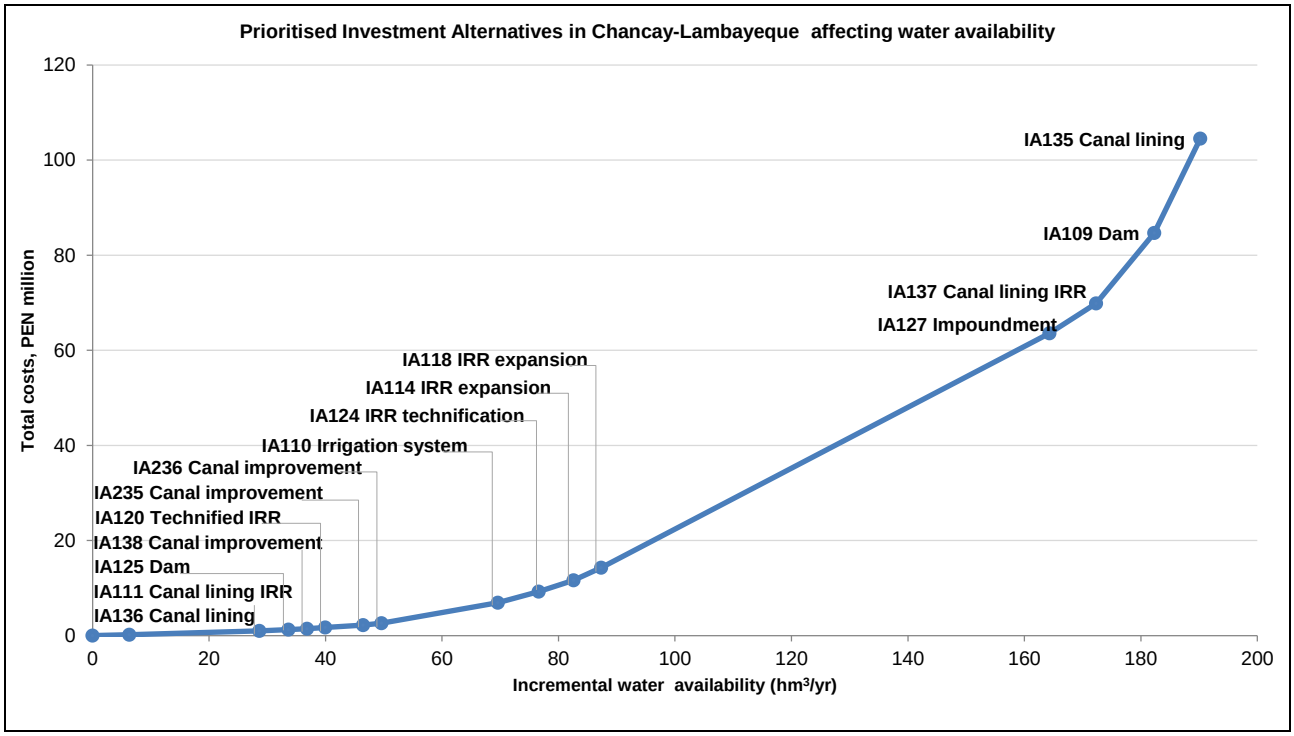
Lambayeque include flood defence construction in riparian areas (Reque river, Lambayeque river, Quebrada Pacherrez, Chiclayo and in mid-low Chancay-Lambayeque valley).

- Prioritised investments involving ***construction of urban sewerage systems*** separately (Santa Cruz, San Miguel) or jointly with storm water drainage (Pomalca, Chiclayo, Lambayeque) as well as construction of urban drainage system (Lambayque) will contribute to tackling the issue of direct untreated discharges of domestic sewerage and will to an extent mitigate environmental damage caused by the discharge of organic pollution. However, prioritised investments do not include projects involving construction of WWTPs potentially rendering construction of sewerage collection systems ineffective in the context of pollution mitigation due to the lack of primary or secondary treatment of the sewage collected.
- ***Improvements in sewerage*** (La Victoria, Chiclayo, Lambayeque) ***and drinking water supply networks*** (Tongod, San Miguel, Cajamarca, Chiclayo, Lambayeque) will also play an important role in tackling water quality challenges as well as serving social and health policy objectives. In the case of improvements in existing water supply networks, these are expected to have a positive impact on increased water availability. Construction of new or expansion of existing drinking water supply networks, on the other hand, may result in a relative increase in water demand (e.g. expansion of drinking water services in Ferreñafe, Lambayeque). Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reductions measures), water demand reduction measures and/or exploration of new water supply sources.
- Prioritised investments aimed to **tackle *solid waste management*** issues include investments in improvement and expansion of integrated municipal solid waste management (cities of Ferreñafe, Pueblo Nuevo, Manuel Antonio Mesones Muro and Santa Cruz that would also positively contribute to solving water quality challenges in the catchment.

5.3.3 Prioritised Investment Analysis

The cost curve in **Figure 5-9** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Chancay Lambayeque catchment in terms of increasing water availability and closing the supply and demand gap. The curve exhibits an elastic section up to 80 hm^3/year followed by a less elastic section to 180 hm^3/year then a transition to an inelastic section, which includes a dam and canal lining projects.

Figure 5-9: Cost curve for investment alternatives in Chancay Lambayeque catchment



The investments included in the cost curve are listed below in **Table 5-5**. They are represented wholly by irrigation-related projects.

Table 5-5: Cost effective investment alternatives in Chancay Lambayeque catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³/yr)
IA136	Improvement of irrigation canal 1 (Fala)	1.48	6.30
IA111	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5.88	22.33
IA125	SICAN dam system	1.63	5.00
IA138	Improvement of Fernandez canal -	1.72	3.18
IA120	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1.57	3.15
IA235	Improvement of Carpintero irrigation canal - Ferreñafe	4.19	6.48
IA236	Improvement of irrigation water services - Tongorrape canal - Lambayeque, Lambayeque	3.25	3.15
IA110	Chota irrigation system	30.55	20.00
IA124	Irrigation infrastructures and technified irrigation systems - Cajamarca	15.85	7.00

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³/yr)
IA114	Irrigation infraestructuras - Chancay-Baños, Santa Cruz, Cajamarca	16.10	6.00
IA118	Irrigation infrastructures in Tocmoche - Chota, Cajamarca	22.48	4.73
IA127	Special project Olmos - Tinajones (impoundment)	447.47	77.00
IA137	Improvement (lining) of irrigation canals and improvement of irrigation efficiency via technified irrigation systems in Cajamarca department	42.69	8.00
IA109	Pisit Santa Cruz Dam - Santa Cruz, Cajamarca	133.19	10.00
IA135	Improvement (lining) of canals in Lambayeque department	160.34	7.88

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-6**.

Table 5-6: Top 10 prioritised investment alternatives in Chancay Lambayeque catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm³/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA125	SICAN dam system	1.63	5.00	5.00	1.67	1.95	3.60	3.27
IA111	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5.88	22.33	5.00	1.17	2.00	3.70	3.21
IA120	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1.57	3.15	5.00	1.00	1.70	4.00	3.19
IA110	Chota irrigation system	30.55	20.00	5.00	1.17	1.75	3.30	3.04
IA235	Improvement of Carpintero irrigation canal - Ferreñafe	4.19	6.48	5.00	0.83	1.50	3.60	3.00
IA138	Improvement of Fernandez canal -	1.72	3.18	5.00	0.67	1.25	3.70	2.94
IA136	Improvement of irrigation canal 1 (Fala)	1.48	6.30	5.00	0.83	1.50	3.30	2.92
IA236	Improvement of irrigation water services - Tongorrape canal - Lambayeque, Lambayeque	3.25	3.15	5.00	0.67	1.25	3.60	2.92
IA124	Irrigation infrastructures and technified irrigation systems - Cajamarca	15.85	7.00	4.00	1.17	1.88	3.60	2.85
IA114	Irrigation infraestructuras - Chancay-Baños, Santa Cruz, Cajamarca	16.10	6.00	3.00	1.00	1.88	3.30	2.44

The impact of the integrated analysis over that of cost effectiveness has only been to re-order the priority of investments to reflect those which have higher relative economic, social and environmental benefit. Though all irrigation-related interventions remain, the Olmos Special Project (IA127) falls out of the table due to its lower overall score.

These ten projects represent a total investment of PEN 82 million and reduce the water gap by 83 Hm^3/yr.

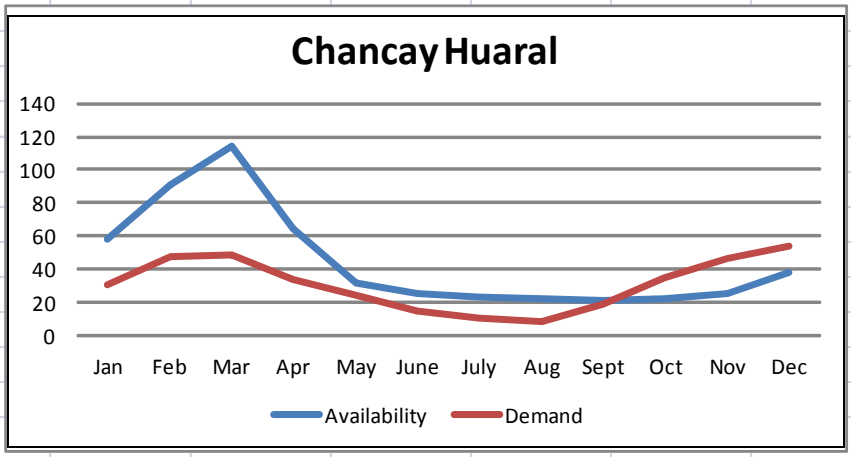
5.4 Chancay Huaral

5.4.1 Challenges

Though there is moderate water stress during the months of January to April in average years, there is water shortage for the remainder of the year, which can be severe in dry years. The catchment has severe water stress.

Figure 5-10: Current water resource supply and demand (hm³/month) in the Chancay Huaral catchment

Availability	Demand
58	30
91	48
115	49
65	34
32	25
26	15
23	10
22	9
22	19
22	35
25	47
38	54
539	375



This catchment is the largest agricultural area close to Lima. It is essential to improve the quality of drinking water, but also the low poor quality of surface water due to mining and domestic pollution impacts which affect the viability of agriculture and its produce for the local market.

5.4.1.1 Water quantity challenges

- Population density increase (in certain areas) leading to supply problems.
- Agricultural expansion in the Añasmayo, Cárac and Huataya sub-catchments (middle stretch of the watershed).
- Low water use efficiency in irrigation.
- Insufficient water storage infrastructures for water resources exploitation and regulation in the main course of Chancay Huaral River and in the middle-stretch sub-catchments.
- Additional pressures in the headwaters though regulated and unregulated mining activities leading to environmental liabilities.

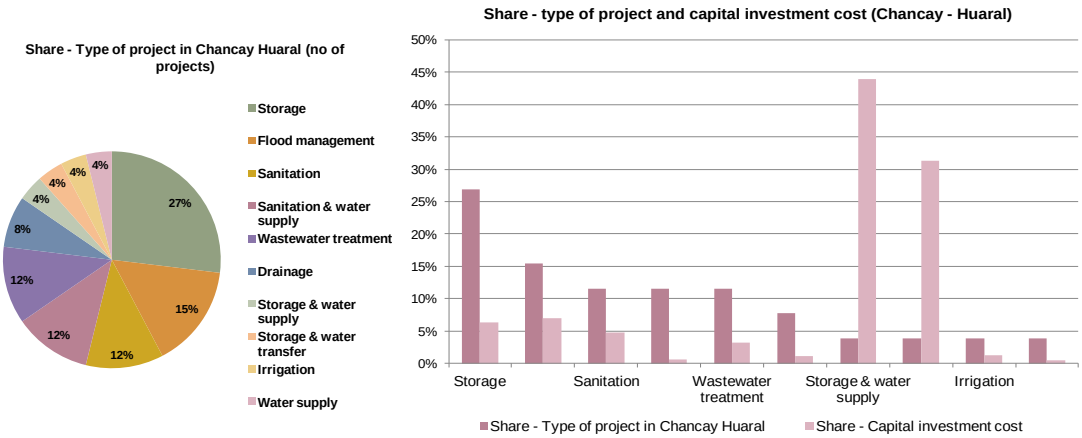
5.4.1.2 Water quality challenges

- Main pollution sources in the basin are mining material heaps, untreated domestic / industrial wastewater, raw sewage and agrochemicals.
- Low sanitation coverage rates.
- WWTPs of Huaral and Chancay are obsolete.
- Organic pollution (pathogens) due to untreated domestic wastewater discharges.
- Inorganic pollution (metals from mining leachate: aluminium, manganese, iron).

5.4.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Chancay Huaral catchment is estimated at PEN 2,555 million; including those that reduce the supply demand gap by an estimated 459 hm^3/year. **Figure 5-11** summarises the types of project and their share by total number and total cost. Storage projects are prominent, but there are also significant numbers of flood management, water supply, sanitation and wastewater treatment projects. Storage and water supply/transfer projects account for the highest investment. A single investment of PEN 1,124 million on a water supply project for Lima dominates this analysis.

Figure 5-11: Summary of investment projects in Chancay Huaral catchment



- A range of prioritised investments will contribute to addressing the *persistent challenge of* ***insufficient water storage infrastructure and regulation*** in the Chancay Huaral catchment. Prioritised investments addressing this challenge are diverse in the nature and range from multi-purpose major diversion and storage projects (e.g. Huaral river basin reservoirs and transfers) to the use of water harvesting through an indigenous practice of amunas (0.8 million US$ providing 2.4 hm^3).
- In the context of ***irrigation***, prioritised investments include construction of large reservoirs (e.g. Purapa) and other reservoirs. The diversity of investments is further augmented by investments that are aiming to stabilise and use ponds or use of groundwater wells. Most importantly,

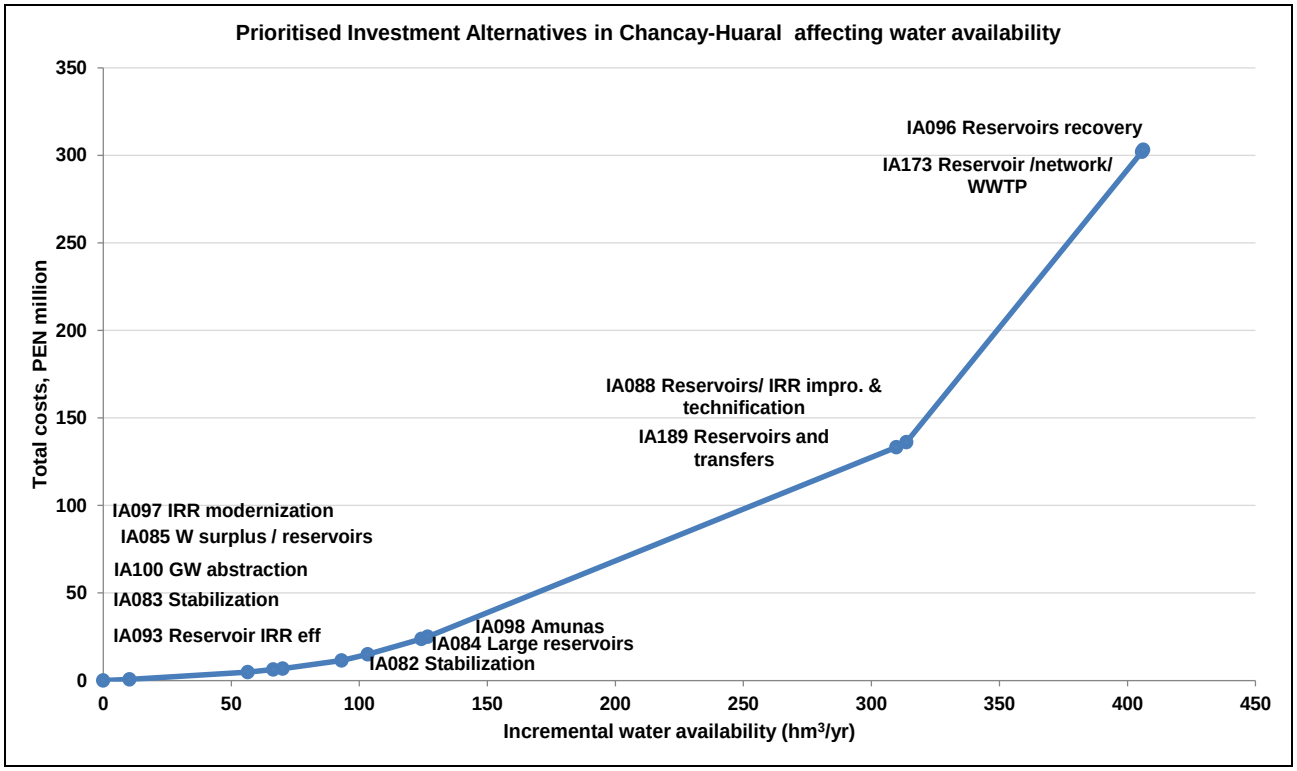
prioritised investments in Chancay Huaral include ***irrigation efficiency measures***, such as modernization of irrigation conveyance infrastructure and canal lining as well as investments in reservoirs linked to efficiency improvements and technification of irrigation (in Cárac, Añasmayo, Huataya, Quipacaca and Yaco Coyonca).

- Investment in expansion and improvement of flood defences as well as risk prevention and climate change adaptation measures will contribute to addressing ***climate change adaptation challenges*** in the catchment and to reducing inhabitants' and agricultural sector's ***exposure to extreme events***.
- Tackling ***provision of clean drinking water*** to catchment's inhabitants is of high importance due to public health concerns associated with direct consumption of water from wells that may be contaminated with agricultural pollution and untreated sewerage. The construction of several water purification plants as well as expansion of reservoirs, distribution networks coupled with construction of WPP for the city of Lima (equivalent to 393.2 million US$) are among the prioritised investment projects that are aiming to tackle the challenge. It should be, however, noted that while prioritised investments include a range of water supply projects (e.g. reservoirs) and WPP construction, very few include network expansion. While construction of new or expansion of existing drinking water supply networks may result in a relative increase in water demand, consumption of potentially contaminated water directly from wells is causing substantial public health concerns. To compensate for a potential increase in water demand, the investments would benefit from parallel implementation of efficiency measures such as leakage reductions measures, water demand reduction measures and/or exploration of new water supply sources.
- Prioritised investments involving ***construction of several municipal WWTPs*** across the Chancay Huaral catchment will contribute to tackling the issue of direct untreated discharges of domestic sewerage and will to an extent mitigate environmental damage caused by the discharge of organic pollution. Construction of WWTPs will also serve social policy objectives while resulting in health benefits associated with provision of sanitation services to the catchment inhabitants. ***Construction of urban water supply and sewerage systems*** as well as ***improvements in drinking water supply and sewerage networks*** in Humaya and Huaral will also play an important role in tackling water quality challenges as well as serving social and health policy objectives. In the case of improvements in existing water supply networks, these are expected to have a positive impact on increased water availability. Prioritised investments do not extensively or explicitly address the challenge of low sanitation rates, particularly in the rural areas, agrochemicals pollution from agriculture or pollution stemming from mining materials heaps.
- Prioritised investments aimed to tackle ***solid waste management*** issues, such as investments in construction of landfill sites (Chancay, Huaral, and Aucallama) would also positively contribute to solving water quality challenges in the catchment.

5.4.3 Prioritised Investment Analysis

The cost curve in **Figure 5-12** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Chancay Huaral catchment in terms of increasing water availability and closing the supply and demand gap. The curve exhibits an elastic section up to 120 hm^3/year followed by a less elastic section to 320 hm^3/year then a transition to an inelastic section, which includes a dam and canal lining projects.

Figure 5-12: Cost curve for investment alternatives in Chancay Huaral catchment



The investments included in the cost curve (as far as IA 088) are listed below in **Table 5-7**. The table also shows the large project for Lima (IA 173). The projects show a diversity of interventions to address water scarcity including irrigation, reservoirs, water harvesting, drainage, water supply and sanitation.

Table 5-7: Cost effective investment alternatives in Chancay Huaral catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3yr)
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5.20	10.30
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33.50	46.10
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10.92	10.00
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4.16	3.70
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24.03	18.00
IA097	Modernization of irrigation & conveyance infrastructure and canal lining.	32.76	23.00
IA202	Drainage system for agriculture in Jequetepeque Valley	27.22	35.30
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26.50	10.20
IA084	Large reservoirs – Purapa and Quiles.	62.14	21.00
IA098	Water harvesting through amunas (an indigenous practice).	2.20	2.40
IA189	Reservoirs and water transfers in Huaura river basin	801.32	183.00
IA088	New reservoirs linked to efficiency improvements and technification of irrigation – Quipacaca and Yaco Coyonca.	20.72	4.00
IA173	Expansion of reservoirs, distribution networks, and construction of a drinking water treatment plant - Drinking water supply for the city of Lima	1,124.00	92.00

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-8**.

Table 5-8 Top 10 prioritised investment alternatives in Chancay Huaral catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24.03	18.00	5.00	2.67	2.60	3.80	3.67
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33.50	46.10	5.00	1.83	2.13	3.95	3.44
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5.20	10.30	5.00	1.67	1.95	4.00	3.38
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4.16	3.70	5.00	1.67	1.95	3.95	3.37
IA202	Drainage system for agriculture in Jequetepeque Valley	27.22	35.30	5.00	1.33	1.78	4.20	3.33
IA097	Modernization of irrigation & conveyance infrastructure and canal lining.	32.76	23.00	5.00	1.17	2.00	3.70	3.21
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10.92	10.00	5.00	1.50	2.28	3.05	3.15
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26.50	10.20	4.00	1.67	1.95	3.95	3.07
IA084	Large reservoirs – Purapa and Quiles.	62.14	21.00	3.00	1.83	2.13	3.95	2.84
IA098	Water harvesting through amunas (an indigenous practice).	2.20	2.40	3.00	1.50	1.78	3.95	2.70

The impact of the integrated analysis over that of cost effectiveness has largely been to re-order the priority of investments to reflect those which have higher relative economic, social and environmental benefit. The large project for water supply to Lima (IA 173), with a total score of 2.25 does not feature in the ten projects

The ten projects represent a total investment of PEN 228 million and reduce the water gap by 180 Hm^3/yr.

5.5 Chillón-Rímac-Lurín

5.5.1 Challenges

We have no data on supply and demand gap for these three sub-catchments.

5.5.1.1 Water quantity challenges

- Very low efficiency in the systems for abstraction and conveyance of water (irrigation: 33%; domestic use: 60-70%)
- Intense soil degradation and loss leading to grave concerns about salinity and drainage.
- Very highly vulnerable river basins due to their topography and slope: severe floods and landslide problems.
- Significant water infrastructural deficit and major leakages in the installed capacity

5.5.1.2 Water quality challenges

Whilst SEDAPAL, which is the water utility company which serves Lima, focuses on improving the efficiency of the extensive network of water supply for the Lima conurbation, and on improvements to drinking water treatment (over PEN 2,500 million invested over the past 10 years), this does not resolve the pollution problems associated with the water sources, which are extremely vulnerable to:

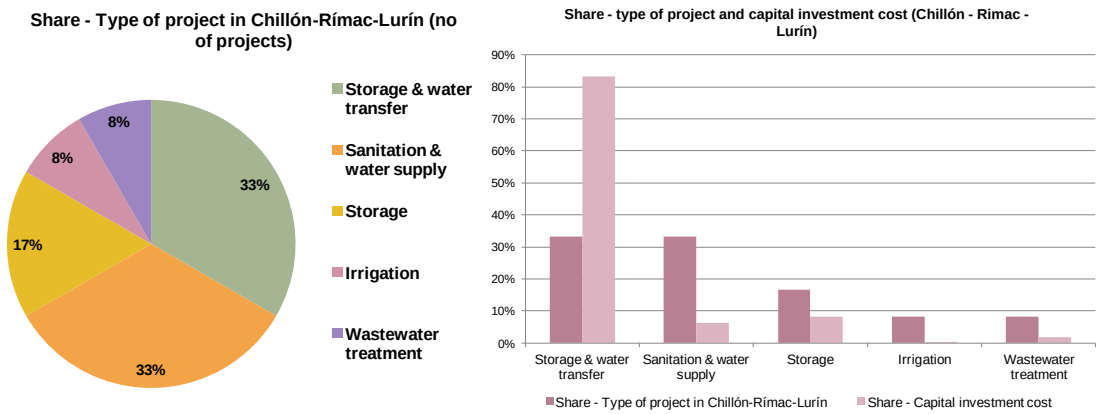
- Pollution liabilities from old mines throughout the basin with a high risk during floods or earthquakes because the majority are on river banks
- Local untreated industrial discharges (River Huaycoloro) that are discharged directly to river or to a collector operated by SEDAPAL.
- Solid waste landfills near to the rivers or on flood plains.
- Domestic solid waste from communities near and around Lima, and from holiday residences in the countryside (e.g. Chosica).
- Diffuse pollution due to leakage from the sewer network and mining/industrial/agricultural leachate.

5.5.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Chillon-Rimac-Lurín catchments is estimated at PEN 2,408 million; including those that reduce the supply demand gap by an estimated 293 hm^3/year. **Figure 5-13** summarises the types of project and their share in total number and total cost. Storage, transfer and water supply projects are prominent and they account for the highest investment.

It is important to note that these investments do not include any of the elements of the investment plan of SEDAPAL and whose plan was not included in the TOR for this study.

Figure 5.10 – Summary of investment projects in Chillon-Rimac-Lurín catchment

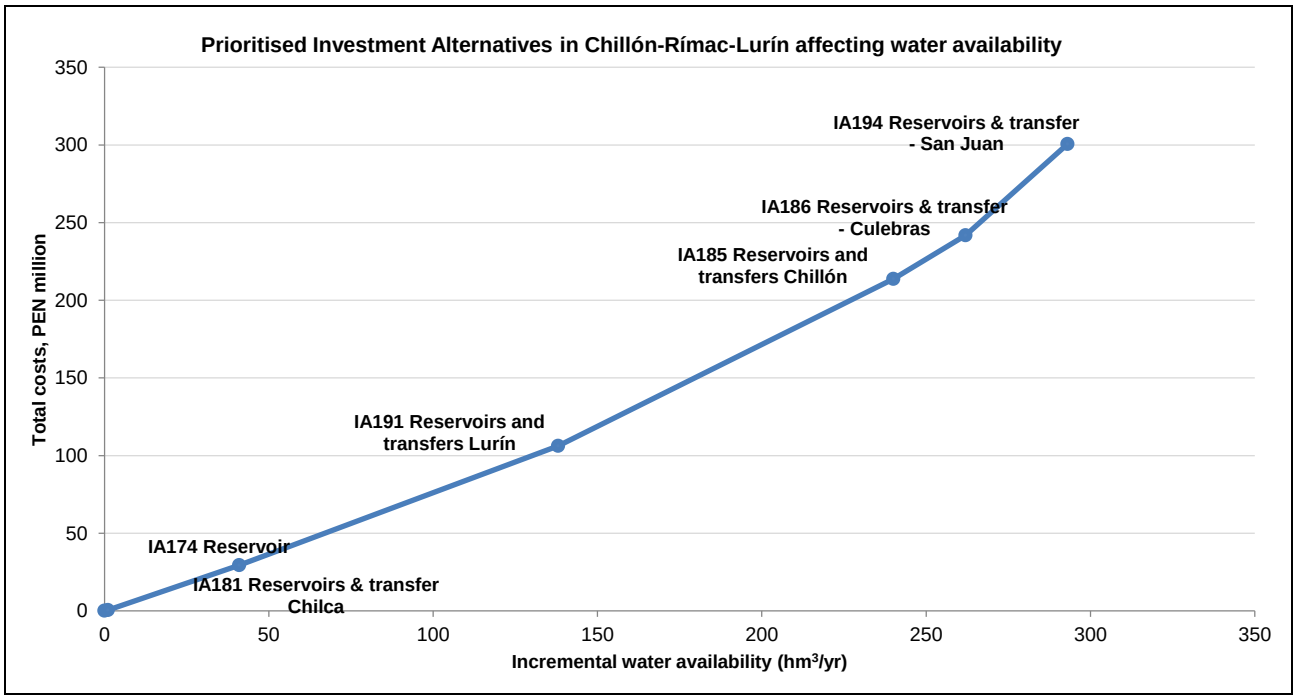


- Development of ***multi-purpose reservoirs and water transfers*** in Chillón, Culebras, Lurín, San Juan and Chilca river basins at the capital investment cost equivalent of 703 million US$ will secure additional 253 hm^3/year of water while construction of Chillón River reservoir (197 million US$) will supply **municipal water**. These investment projects, however, would not solve the issue of very low efficiency in the water abstraction and conveyance systems and should be implemented in conjunction with distribution network improvement projects. Development of abstraction infrastructure from Lurín River (9.9 million US$) will serve **agricultural users**.
- A lack of ***adequately maintained and sufficient municipal water supply infrastructure*** constitutes one of the key water supply challenges in the catchment. The prioritised list of investment offers a range of potential solutions including improvement and rehabilitation projects for drinking water supply systems contributing to the reduction of leakages (e.g. in Villa El Salvador, Cercado de Lima and San Juan de Lurigancho). Furthermore, investments including network expansion projects (e.g. in Villa El Salvador) will also serve social and health related policy objectives.
- ***Expansion and improvement of drinking water and sewerage networks*** in urban areas (e.g. in Villa El Salvador, Callao, Ventanilla, San Martín de Porres, Cercado de Lima and San Juan de Lurigancho) will play an important role in serving social and health policy objectives as well as in tackling water quality challenges.
- Significant health and social benefits will be obtained through construction of 73 ***water purification systems in drinking water treatment plants*** as farmer communities directly consume untreated water.
- A range of pressing challenges still remain outstanding in the **Chillón-Rímac-Lurín** catchment as no investments on the prioritised list entail projects that would tackle ***severe water pollution problems associated with mining*** due to the presence of mining material heaps in the catchment and with **discharge of untreated domestic and industrial wastewater**.

5.5.3 Prioritised Investment Analysis

The cost curve in **Figure 5-14** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Chillon-Rimac-Lurín catchments in terms of increasing water availability and closing the supply and demand gap. The curve is (relative to those for other catchments) of low elasticity, starting to become inelastic at 300 hm^3/year.

Figure 5-14: Cost curve for investment alternatives in Chillon-Rimac-Lurín catchments



The investments included in the cost curve are listed below in **Table 5-9**. Apart from the small project IA181, these projects are all major water storage and transfer projects.

Table 5-9: Cost effective investment alternatives in Chillon-Rimac-Lurín catchments

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)
IA181	Reservoirs in Chilca river basin	3.00	1.00
IA174	Chillón River reservoir	196.70	40.00
IA191	Reservoirs and water transfers in Chillón river basin	567.98	97.00
IA185	Reservoirs and water transfers in Culebras river basin	795.44	102.00
IA186	Reservoirs and water transfers in Lurín river basin	207.68	22.00
IA194	Reservoirs and water transfers in San Juan river basin	435.18	31.00

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-10**.

Table 5-10: Top 10 prioritised investment alternatives in Chillon-Rimac-Lurín catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA181	Reservoirs in Chilca river basin	3.00	1.00	3.00	1.67	1.95	3.35	2.60
IA177	73 water purification systems in drinking water treatment plants	41.50	-	0.00	2.83	2.60	3.80	2.20
IA174	Chillón River reservoir	196.70	40.00	1.00	1.83	2.13	3.50	2.11
IA185	Reservoirs and water transfers in Culebras river basin	795.44	102.00	1.00	1.50	2.48	3.35	2.08
IA191	Reservoirs and water transfers in Chillón river basin	567.98	97.00	1.00	1.50	2.30	3.35	2.04
IA186	Reservoirs and water transfers in Lurín river basin	207.68	22.00	1.00	1.50	2.13	3.35	2.01
IA194	Reservoirs and water transfers in San Juan river basin	435.18	31.00	1.00	1.50	2.13	3.35	2.01
IA204	Expansion of the distribution network for household water supply and sewerage system - Callao, Ventanilla, San Martín de Porres	74.79	0.00	0.00	2.17	1.88	4.00	1.97
IA201	Expansion and improvement of drinking water supply and sewerage systems in Villa El Salvador	57.09	0.00	0.00	2.17	1.88	4.00	1.97
IA287	Improvement and rehabilitation of drinking water and sewerage systems - Cercado de Lima	13.08	0.00	0.00	2.00	1.88	4.00	1.93

The impact of the integrated analysis over that of cost effectiveness has been to bring in a high (2nd) priority project for water treatment for 73 communities (IA177), and a number of other water and sewerage projects just below the group of storage and transfer projects.

The ten projects represent a total investment of PEN 2,389 million, six of which would reduce the water gap by 293 Hm^3/yr. The low cost effectiveness scores of most of these investments impact on the low overall final score.

Not considered in this review, but which occurs to us, is the potential for re-use of treated wastewater from Lima which is concentrated largely at only 2 collection points. There is a tremendous potential in the field of reuse for landscaping, industrial uses, environmental enhancement (such as the wetlands of Chosica and the area south of Lima), and even in the agricultural orchard area of Lurín close to Lima. In addition, there is the potential to use sea water for industrial and sanitation purposes as is implemented in Hong Kong.

Further it is likely that Lima is the only area of Peru that can afford the true price of desalinated water.

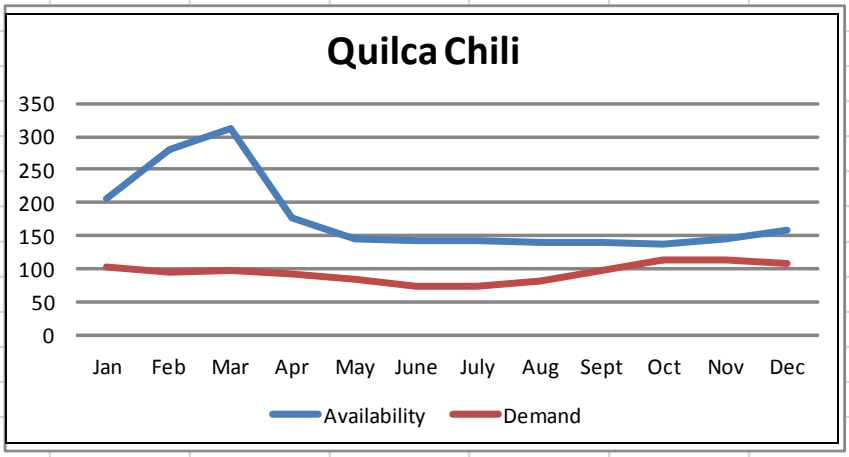
5.6 Quilca Chili

5.6.1 Challenges

Under current average conditions the basin does not exhibit a significant shortage from January to May but has water scarcity dry years in the period between September and November. It can be considered to be in water stress.

Figure 5-15: Current water resource supply and demand (hm³/month) in the Quilca Chili catchment

Availability	Demand
206	103
280	94
313	99
177	93
146	85
143	73
143	75
139	81
141	99
138	114
145	114
158	108
2,128	1,138



There are particular risks in the Quilca-Chili catchment which impact the agricultural sector because the development of the large irrigated areas of the Majes-Siguas II project depends on water from the Cuzco region. The conflict over this water transfer will continue because of the demands of the Cuzco region for the Tacna region to invest in hydraulic infrastructure development in the Cuzco region as compensation for the donation of water. There is a need to look for new mechanisms to transfer part of the economic benefits to the Cuzco area of the water transfer from the Cuzco area.

5.6.1.1 Water quantity challenges

Water sources inventories are either outdated or incomplete, including groundwater resources, which are widely used in the basin.

- Water infrastructural deficit and major losses.
- Expected demand increase for household demands given current low levels of coverage.
- Lack of metering and informal water use rights.
- Expected increase of irrigation demand.

- Insufficient regulation of hydropower generation.

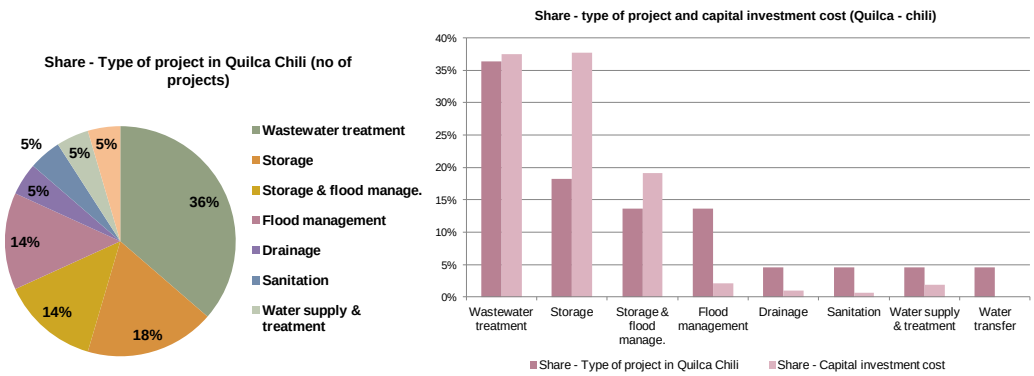
5.6.1.2 Water quality challenges

- The Arequipa WWTP installed capacity is clearly insufficient.
- Heavy metals concentrations from human activity in the middle and lower basin.
- Organic pollution from domestic wastewater is widespread.
- Mining activities are also a significant cause of pollution.
- The Chili River is also affected by domestic wastewater discharges (organic pollution: pathogens), and untreated effluents from farms and industries.

5.6.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Quilca Chili catchment is estimated at PEN 2,756 million; including those that reduce the supply demand gap by an estimated 1,655 hm^3/year. **Figure 5-16** summarises the types of project and their share in total number and total cost. Wastewater treatment and water storage projects are prominent and they account for the highest investment.

Figure 5-16: Summary of investment projects in Quilca Chili catchment



- A range of prioritised investments includes projects contributing to the mitigation of ***existing infrastructural deficit***, and, in particular, projects associated with construction of multi-purpose reservoirs and undertaking river regulation projects. In the context of water scarcity alleviation, all these projects will contribute to increasing water availability, however implementation of the Majes-Siguas II water transfer project is associated with relatively more pronounced environmental and social impacts than the construction of reservoirs (e.g. Chili reservoirs), dams (e.g. El Frayle dam) and river regulation projects (Yura River, Siguas river).
- ***Expansion and improvement of WWTPs*** in Arequipa region and Arequipa Metropolitan areas appears on the top of the list for WWTP related interventions. This is consistent with the need to tackle severe water quality problems present in the region. Furthermore, a range of highly ranking investment projects involve provision of infrastructure for primary wastewater treatment in rural areas (e.g. Añashuayco, Eastern catchment, Sumbay) as well as installation of primary

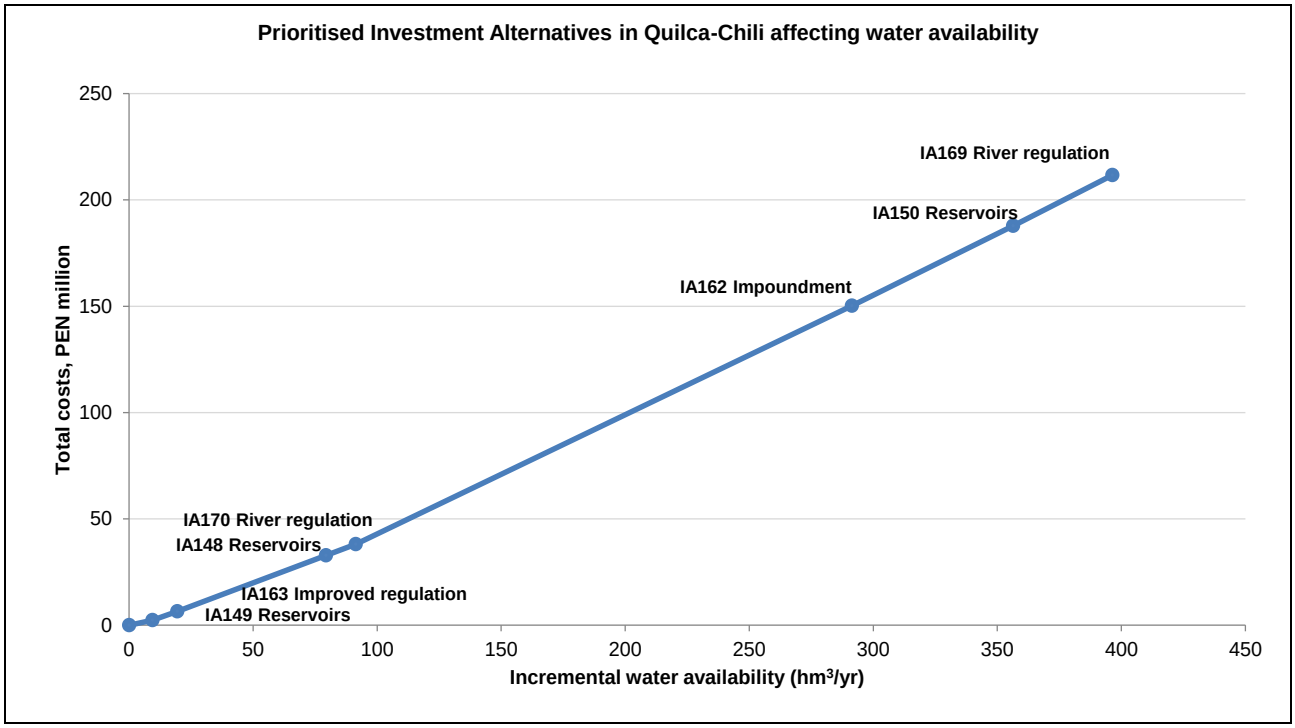
and secondary treatment in medium and lower Quilca-Vítor-Chili where environmental quality is adversely affected by discharges from human settlements.

- There is, however, a lack of planned investments on the prioritised list aiming to improve ***irrigation efficiency*** or reduce ***demand for household water consumption*** issues that were identified as some of the key challenges in the Quilca Chili catchment. In the context of expected increases in irrigation and household water demand in the catchment, consideration of efficiency improvements will be critical to ensure that demand increases do not lead to further exacerbation of water scarcity issues in the catchment.

5.6.3 Prioritised Investment Analysis

The cost curve in **Figure 5-17** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Quilca Chili catchment in terms of increasing water availability and closing the supply and demand gap. The curve is (relative to those for other catchments) of low elasticity, and does not show any movement towards inelasticity within the range plotted.

Figure 5-17: Cost curve for investment alternatives in Quilca Chili catchment



The investments included in the cost curve are listed below (up to IA169) in **Table 5-11**. The projects that head the table are related to reservoirs and flood regulation, and these are followed by a large sewerage and wastewater treatment project (IA199) for Arequipa, and a smaller water supply project.

Table 5-11: Cost effective investment alternatives in Quilca Chili catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)
IA149	Chili reservoirs – sluice repairing and reservoir impoundment (Aguada Blanca)	18.50	9.40
IA163	Improved regulation in Eastern catchment - Quilca Chili	30.00	10.00
IA148	Chili reservoirs – flood regulation, agriculture, hydropower and supply (Pillones, Capillune, Caquemayo, Asta de Venado, Sumbay) - Phase 1	210.00	60.00
IA170	Yura River regulation	38.00	12.00
IA162	Impoundment in Sumaby River	800.00	200.00
IA150	Chili reservoirs – increasing installed capacity in El Frayle dam.	300.00	65.00
IA169	Siguas River regulation	170.00	40.00
IA199	Expansion and improvement of the system of emissaries and wastewater treatment in the region of Arequipa	943.80	114.88
IA207	WWTP and improved drinking water supply system - La Joya Irrigation District (Arequipa)	52.70	3.81

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-12**.

Table 5-12: Top 10 prioritised investment alternatives in Quilca Chili catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA149	Chili reservoirs – sluice repairing and reservoir impoundment (Aguada Blanca)	18.50	9.40	4.00	1.67	1.95	3.95	3.07
IA148	Chili reservoirs – flood regulation, agriculture, hydropower and supply (Pillones, Capillune, Caquemayo, Asta de Venado, Sumbay) - Phase 1	210.00	60.00	3.00	1.83	2.30	3.95	2.88
IA163	Improved regulation in Eastern catchment - Quilca Chili	30.00	10.00	3.00	1.67	1.95	3.95	2.77
IA170	Yura River regulation	38.00	12.00	3.00	1.67	1.95	3.55	2.66
IA162	Impoundment in Sumaby River	800.00	200.00	2.00	1.83	2.48	3.95	2.62
IA207	WWTP and improved drinking water supply system - La Joya Irrigation District (Arequipa)	52.70	3.81	1.00	2.67	2.78	4.00	2.56
IA199	Expansion and improvement of the system of emissaries and wastewater treatment in the region of Arequipa	943.80	114.88	1.00	2.83	2.60	3.80	2.50

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA150	Chili reservoirs – increasing installed capacity in El Frayle dam.	300.00	65.00	1.00	1.83	2.30	3.95	2.28
IA157	Water Water Treatment Plant, primary and secondary treatment – Medium and lower Quilca-Vítor-Chili.	26.50	-	0.00	2.67	2.60	4.00	2.23
IA161	Infrastructure for wastewater treatment in rural areas – WWTP with reuse - Eastern catchment.	3.60	-	0.00	2.50	2.60	4.00	2.19

The impact of the integrated analysis over that of cost effectiveness has been to slightly re-order the ranking and to bring in at the foot of the table two water treatment projects.

The ten projects represent a total investment of PEN 2,425 million, eight of which would reduce the water gap by 475 Hm^3/yr.

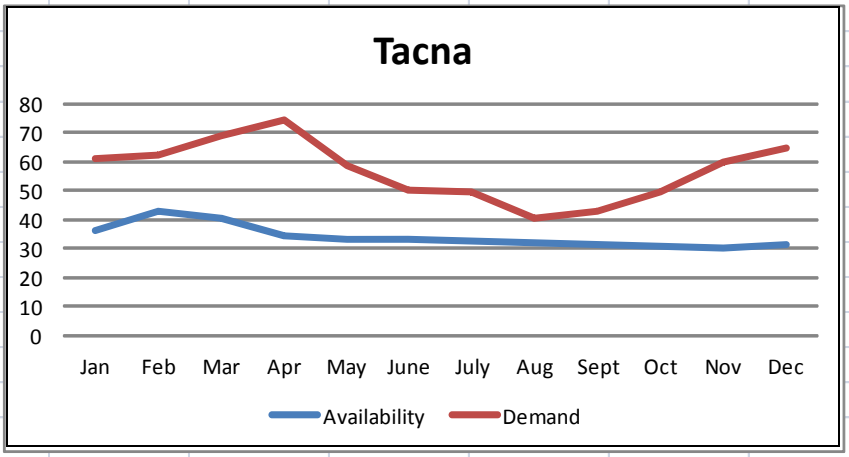
5.7 Tacna

5.7.1 Challenges

Tacna exhibits the most extreme water deficit compared the other basins studied in this report. It is by any measure in very severe water stress in average years and all year round.

Figure 5-18: Current water resource supply and demand (hm³/month) in the Tacna catchment

Availability	Demand
36	61
43	62
40	69
34	75
33	59
33	50
33	49
32	40
31	43
31	50
30	60
32	65
408	681



One of the most important challenges is the need to provide a reliable water supply to the city of Tacna. The economic development of the city is unlikely to be driven by agriculture, as evidenced by the water imbalance, and therefore, other trade-related activities (free trade zone) and tourism are vital to the city. But these industries will depend on the reliable supply of municipal water.

Most of the agricultural activity in the catchment is downstream of the city of Tacna, in particular the area of Yarada, where the aquifer is now over-exploited. Therefore, a wastewater treatment plant for re-use of wastewater would give higher security to the irrigated crops which to some degree are already irrigated with effluent from the city. Tacna needs to access private investment, so that the projects that strengthen the water supply services (including of reuse of wastewater) aimed at increasing the security of existing users, will also make it possible to develop other urban sector activates such as commerce, industry, manufacturing, etc. This would derive a true alternative to subsistence agriculture, and is likely to be economically feasible due the area's proximity to Chile and the various mining activities in the region.

This catchment is strongly affected by droughts and chronic water shortages, which makes it necessary also to invest in managing water demand.

5.7.1.1 Water quantity challenges

- Planning weaknesses have led to a mismatch between infrastructure availability and actual needs.
- Transfer of water resources from Puno is the source of interregional conflicts between Tacna region and the regional governments of Moquegua and Puno.
- Expansion of irrigated land.
- Groundwater sources in La Yarada irrigation district, whose aquifer is overexploited mostly due to illegal abstractions.

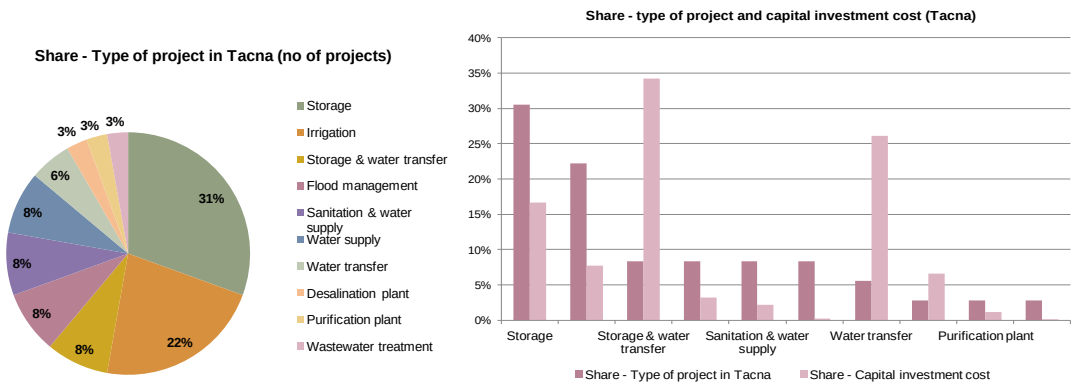
5.7.1.2 Water quality challenges

- There are concerns regarding salinity in the Locumba sub-catchment.
- In the Lower Caplina, there are major problems of bacterial pollution due to household and industrial waste.
- In Sama and Locumba there are records of contamination due to chemical by-products or residues.
- Large-scale mining activity is a cause of pollution in some parts of the river basin as well as in the river mouth (Ite Bay).
- In La Yarada aquifer, due to lower phreatic levels, there is evidence of saltwater intrusion.

5.7.2 Investment Priorities Overview

The total investment cost of prioritised projects in the Tacna catchment is estimated at PEN 6,578 million; including those that reduce the supply demand gap by an estimated 923 hm^3/year. **Figure 5-19** summarises the types of project and their share in total number and total cost. Water storage and irrigation projects are prominent but water transfer projects account for the highest investment.

Figure 5-19: Summary of investment projects in Tacna catchment

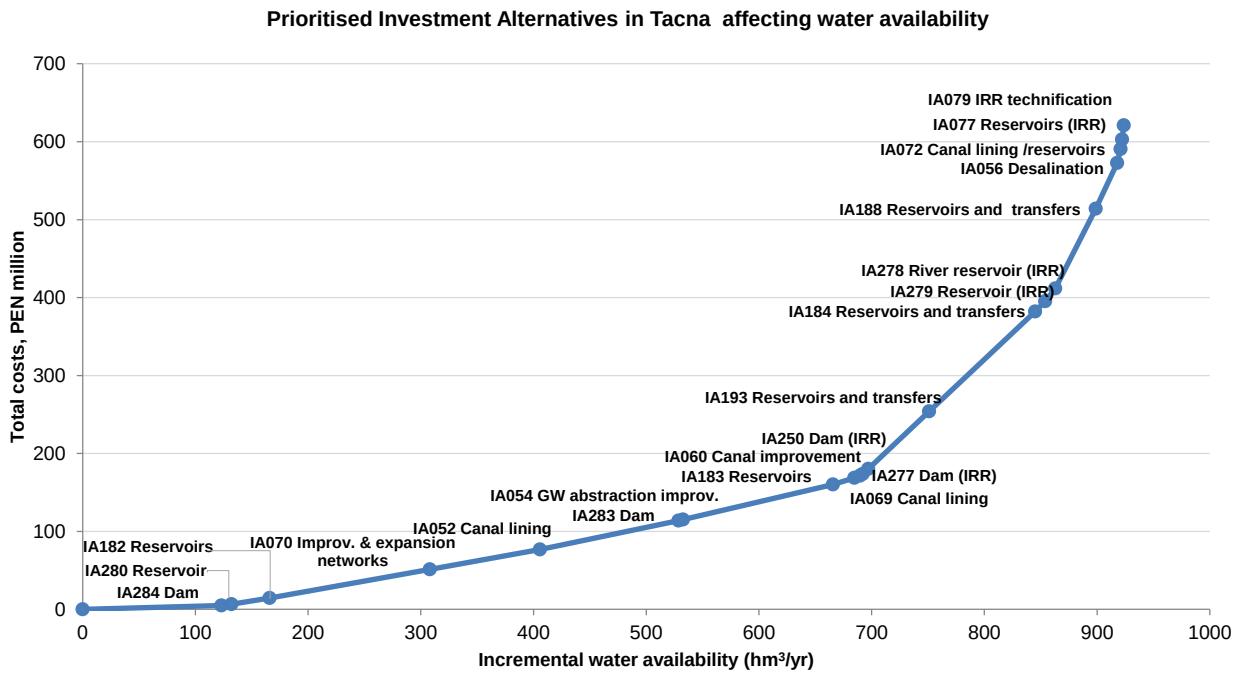


- Tacna has a significant ***mismatch between available infrastructure and current and future demands***. Major and minor infrastructures have been built over the last few decades but additional planned investments are foreseen. These include Yarascay dam and the expansion of the distribution network for agricultural development in the Vilavilani valley. There are also relevant investments in canal lining.
- Yet, all these investments refer to irrigated agriculture when, indeed there is also a major challenge in terms of ***water supply for the main settlements*** in the area, such as Tacna city. In the Tacna catchment in fact, there is a debate about the choice of a desalination plant for domestic supply (La Yarada desalination plant, 151.2 million US$, 18.9 hm^3) or the alternative of a major diversion project (El Desaguadero, 509.7 million US$), that is highly contested and leading to an interregional conflict.
- In the headwaters of the catchment cultivated land has grown. In the past, there was an explicit acknowledgement of the ***potential to expand agriculture*** towards circa 80,000 additional ha (three times the arable land by 2000), mostly in Sama Hills (object of a Special Project) and La Yarada-Hospicio. La Yarada is indeed an active irrigation district, facing increasing drought risk and vulnerability to scarcity. In La Yarada most of the water is obtained from groundwater withdrawal, very often in illegal wells. These new infrastructures should be assessed in more depth since they should actually contribute to reduce pressures over the aquifer, rather than creating perverse incentives.
- ***Flood defence*** investments have been given lower priority in current plans. Not surprisingly, it is perceived that they may not necessarily contribute to manage flood risk while adding significant hydromorphological pressures. Significant investments are foreseen in the Sama, Caplina and Locumba sub-catchments.
- In Tacna, ***deficient water quality may be related to moderate levels of salinity***. There are no major investments to improve water quality envisaged though. In Tacna (as well as in other catchments as Moquegua), the extraction of water for mining is claimed to have depleted natural sources, with severe environmental and social outcomes.

5.7.3 Prioritised Investment Analysis

The cost curve in **Figure 5-20** illustrates the relative cost effectiveness of the prioritised investment alternatives in the Tacna catchment in terms of increasing water availability and closing the supply and demand gap. The curve is elastic in the range up to 700 hm^3/year, and then transitions quickly to inelasticity above 900 hm^3/year.

Figure 5-20: Cost curve for investment alternatives in Tacna catchment



The investments included in the cost curve are listed below (up to IA056) in **Table 5-13**. The projects are largely irrigation-related reservoirs, abstractions and infrastructure improvements. There is only one domestic water supply project (IA280). The La Yarada desalination plant (IA056) is at the foot of the table due to its relatively low cost effectiveness in closing the supply demand gap.

Table 5-13: Cost effective investment alternatives in Tacna catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)
IA284	Jarumas dam - Sama river basin	37.18	123.00
IA280	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11.10	8.94
IA182	Reservoirs in Fortaleza river basin	60.43	34.00
IA070	Improvement and expansion of the distribution network for agricultural development - Tacna-Vilavilani valley	262.00	142.00
IA052	Improvement of irrigation canals - Caplina River	181.85	97.69
IA283	Yarascay dam - Sama river basin	284.93	123.00
IA054	Improvement of groundwater abstraction points (improve domestic water security)	9.58	4.00
IA183	Reservoirs in Yauca river basin	332.47	133.00
IA069	Lining of Patapujo irrigation canal	57.96	19.00
IA277	Improvement of irrigation water supply [dam construction] - Calacala irrigation community - Cairani, Candarave	19.71	4.96
IA060	Improvement of irrigation canals and distribution networks - Locumba River	16.99	2.50
IA250	Calientes River dam for irrigation - Santa Cruz - Candarave	58.14	4.96
IA193	Reservoirs and water transfers in Sama river basin	544.50	54.00
IA184	Reservoirs and water transfers in Caplina river basin	947.97	94.00
IA279	Cerro Blanco regulation reservoir for irrigation water supply (impoundment of transferred waters from Uchusuma)	90.00	8.94
IA278	Calientes river regulation reservoir for irrigation water supply - Tacna	112.00	8.94
IA188	Reservoirs and water transfers in Hospicio river basin	757.24	36.00
IA056	La Yarada desalination plan for domestic water supply	432.13	18.90

After taking into account the integrated hydro-economic (HE) and PESIA factors, the ten highest ranked investment projects are as shown in **Table 5-14**.

Table 5-14 Top 10 prioritised investment alternatives in Tacna catchment

ID	Project title	Capital investment cost (at market prices, million PEN)	Effectiveness (water saving potential, hm^3/yr)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA280	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11.10	8.94	5.00	1.67	1.95	3.90	3.35
IA182	Reservoirs in Fortaleza river basin	60.43	34.00	5.00	1.83	2.13	3.35	3.27
IA284	Jarumas dam - Sama river basin	37.18	123.00	5.00	1.83	2.48	2.95	3.24
IA183	Reservoirs in Yauca river basin	332.47	133.00	4.00	1.83	2.48	3.35	3.05
IA052	Improvement of irrigation canals - Caplina River	181.85	97.69	4.00	1.17	2.25	3.70	2.96
IA283	Yarascay dam - Sama river basin	284.93	123.00	4.00	1.83	2.48	2.95	2.94
IA070	Improvement and expansion of the distribution network for agricultural development - Tacna-Vilavilani valley	262.00	142.00	4.00	0.83	1.20	3.90	2.72
IA054	Improvement of groundwater abstraction points (improve domestic water security)	9.58	4.00	4.00	1.50	2.08	2.50	2.66
IA069	Lining of Patapujo irrigation canal	57.96	19.00	3.00	1.00	1.75	3.70	2.52
IA277	Improvement of irrigation water supply [dam construction] - Calacala irrigation community - Cairani, Candarave	19.71	4.96	2.00	1.67	1.95	3.75	2.41

The impact of the integrated analysis over that of cost effectiveness has been to re-order the ranking (IA280 Arunta reservoir for domestic water supply - moves to top position) but has not brought in any more domestic water supply and sewerage projects.

The ten projects represent a total investment of PEN 1,257 million and would reduce the water gap by 690 Hm^3/yr.

5.8 Information on Current Level of Investment

Based on our review, there is little unequivocal information on the actual level of investment. For those projects with a SNIP code, there is some inaccurate metadata on the status of each planned investment in the project cycle: pre-investment, investment, post-investment. Yet, this information is rather imprecise (and potentially outdated in some cases) and not available for all registries in our dataset. In addition, for some other projects (namely those implemented through Proinversión), information is much more accurate but these projects represent only a very small number of those in the dataset.

It is also important to recall that investment options are either the so-called interventions or individual projects. Interventions are sometimes a bundle of internally consistent projects aiming at similar objectives in a specific water basin or mere windows of opportunities for the future identification of individual projects.

In late 2014, the UN Economic Commission for Latin America and the Caribbean (ECLAC) published the database on investment in economic infrastructure in LAC, 1980-2012[15]. Information on investment in water is not complete for 2030 WRG studies since it refers only to water and sanitation infrastructure, which is only a part of all investment in water management, the actual scope of our analysis.

Apart from these uncertainties on investment in infrastructure, it is worth noting investment by the World Bank in economic research and strengthening water management institutions in Peru. In fact, the basin water management plans that were reviewed and part of the source of projects lists for this report were underwritten by World Bank funding through its Water Resources Management Modernization Program for Peru. That program has had a number of positive outcomes:

- The creation of a River Basin Council (RBC) in each of the three pilot river basins whose main responsibility is the formulation of the river basin plans and the coordination of their implementation.
- Another significant Project achievement to date is the definition of the methodology for water use and pollution charges, approved in December 2012. Today, those charges account for 75 per cent of ANA's revenues, far more than its share from the national budget. They finance part of the administrative costs of the National Water Authority in Lima, as well as the newly created Autoridades Administrativas de Agua (AAA, river basin organizations) and the technical secretariats of the River Basin Councils.
- Activities related to the formalization of water rights for irrigation were advanced. Water users organizations recognized by ANA, but not necessarily legally established as civil society (very few of them are), will be able to have their water use formalized[16].

[15] http://www.cepal.org/Transporte/noticias/noticias/3/53923/EII-LAC-DB1980-2012.pdf
[16] Decreto Supremo No 011-2013-MINAGRI.

Finally, there has also been investment in projects that contribute to water resource sustainability in Peru by Non-Government Organizations (NGOs), the Peruvian Government, and private agricultural development organizations. Some examples include:

- Aquafondo, an NGO associated with the Nature Conservancy, has projects focussed in irrigation system improvement and artificial recharge in the Andes watersheds above Lima.
- Another project that will rehabilitate terraces in eleven regions of the country, from Tacna in the south to Amazonas in the north, which is expected to cost $35 million, funded by the Inter-American Development Bank, the federal government and the local communities.
- In the Colca Valley near Arequipa, the is an ongoing project rebuilding agricultural terraces and raised fields (also known as "Andenes" as described in **Section 2.2**), a pre-Hispanic farming practice adapted to difficult mountain topography, with plans to revitalize agriculture on stepped terraces to the valley not just for subsistence, but for market too. In a public-private partnership, 650 local agricultural producers from sixteen villages, the Chivay City Council and the export firm Peru World Wide SAC are currently growing organic certified quinoa in the valley, as part of the Poverty Reduction and Alleviation Project (PRA). This is an initiative of the U.S. Agency for International Development (USAID) in Peru (USAID-PERU) that aims to contribute to poverty reduction via sustainable job in the Peruvian Andes and revenue creation in poor areas, with an entrepreneurial and demand-driven approach."

6.0 Programme and Project Funding Mechanisms Overview

6.1 Background

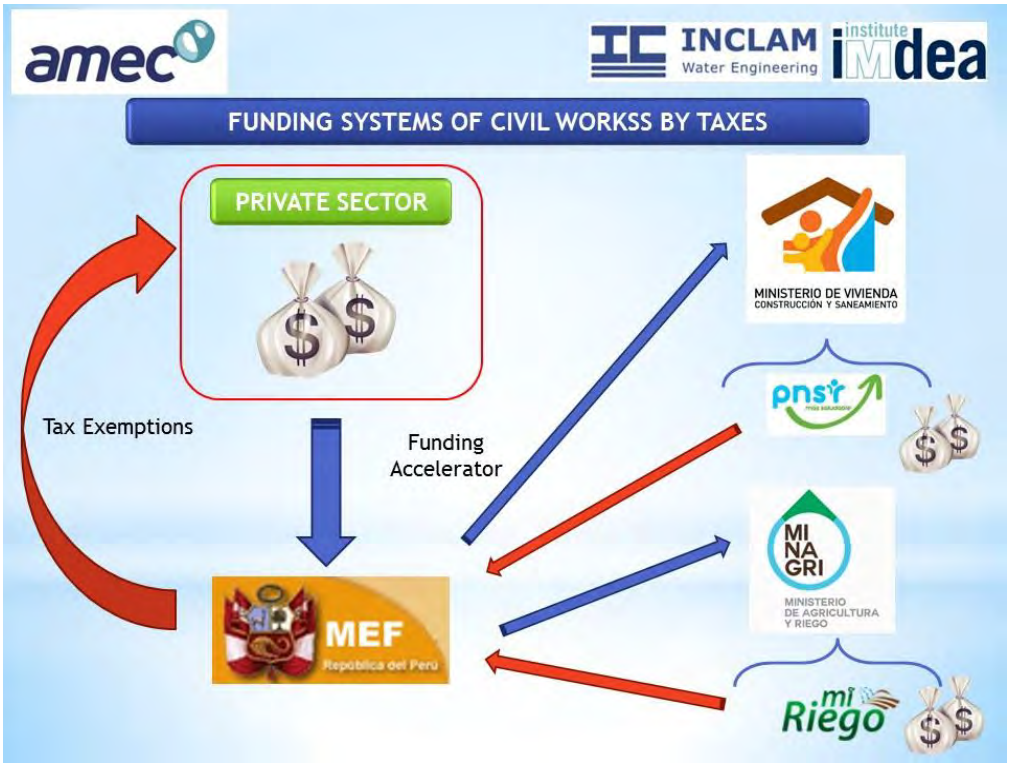
As a part of the tasks to be carried out within the study many stakeholders from the public, private and NGO sectors were interviewed. We gave high priority to the interviews with stakeholders from the private sector who have current or previous experience of investing in important projects. Further, some stakeholders from the public sector with a project portfolio in Private-Public-Associations have been interviewed. Whilst the principal objective of the stakeholder engagement process was for us to verify the assumptions made in our integrated HE and PESIA evaluation and prioritisation of interventions, the engagement also enabled us to gain further knowledge of funding mechanisms in Peru which would and could apply to water interventions. In this section we will describe some of these mechanisms.

6.2 Funding system for Civil Works through corporate tax credit

Act No. 29230, known as “Obras por Impuestos” (translated “projects for taxes”) is a mechanism that is based on compensating private companies that have made investments in public works via credits against the corporate taxes that they must pay to the Peruvian government. The investment is recognized if the works and studies are already identified public projects at the national, regional or local level. In other words, this is a method of payment of corporate taxes on their profits, in which the companies may choose to pay their taxes through the carrying out of civil works, thereby obviating the need of the regional government, local government or public body to raise the initial capital from public funds.

In this way, the private company funding the work today can reduce their taxes on profit to be paid to the SUNAT by the beginning following year by up to 50%. In turn, regional governments, local governments and public bodies that benefit from the project are funded by the national government and start paying back the costs one year after the work is completed and up until ten years with no interest.

Figure 6-1: Funding of civil works through corporate tax credit



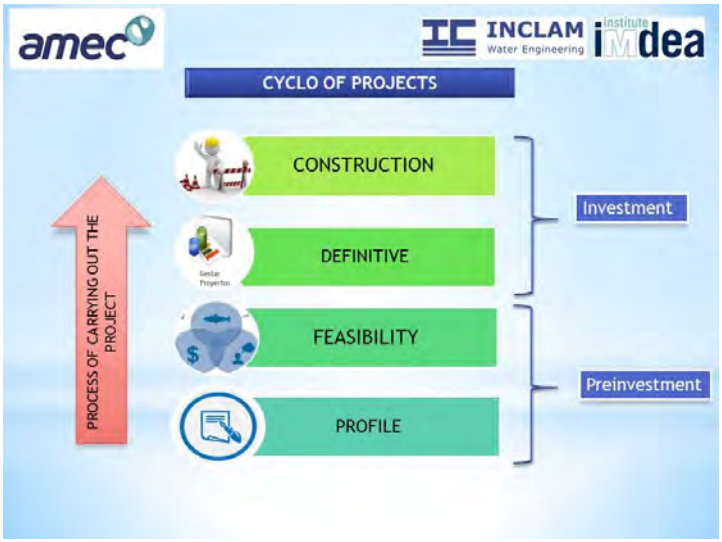
The mechanism allows the funding of all type of projects of public investment provided that they obey the policy and plans of the national, regional or local development authorities and have a statement of viability under the National System of Public Investment (SNIP). The private institutions fund the projects of their interest, which can be chosen from the prioritised list of the regional, local government or public bodies.

As of 2014, the law has not passed into regulation. However, since July 2013, the Law allows the regional, local government and public bodies to include the costs the maintenance of civil works and not only the construction or rehabilitation of the infrastructure.

6.2.1 Funding of the Cycle of Projects

According to Law 29230 it is possible to fund the whole project life cycle, which includes the pre-investment stage with the profile and feasibility studies, and the investment stage with the definitive study and the construction of the civil work.

Figure 6-2: Project life cycle

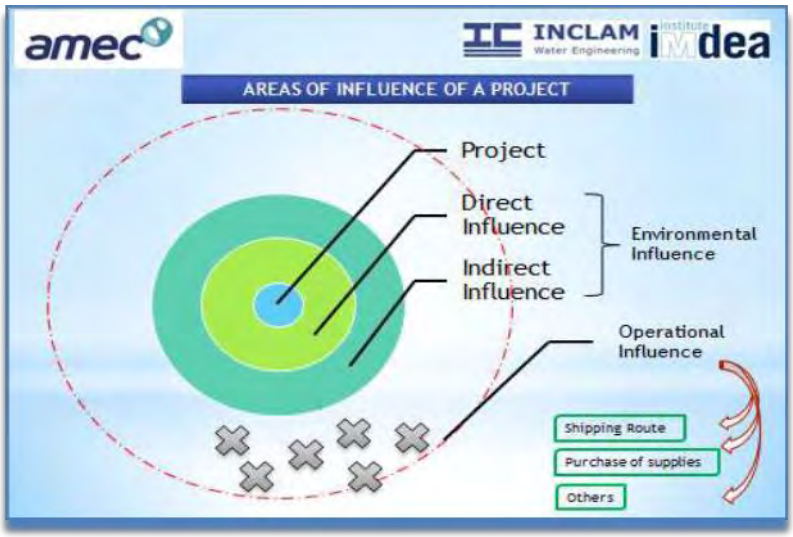


6.2.2 Area of Influence of the Project

The direct influence area (AID) is the territory where the impacts of the project are directly seen. The indirect influence area (AII) is defined as the physical space where the impacts have an environmental factor and have affected others not directly related to the project.

Additionally, there is the operational area, which is the zone of interest and which may be very wide because it is where the equipment or materials of the civil works are stored and moved.

Figure 6-3: Area of influence of projects



6.3 Public-Private Associations

The Ministry of Agriculture and Irrigation (MINAGRI) has planned to carry out a series of water projects through Private-Public Associations (PPAs), also known as “Concessions”, which are of regional and national interest. These projects are listed in **Table 6-1**, providing information on their locations, hydric benefit, and costs.

Table 6-1: Public-Private Association Water Projects

N°	PROJECTS	REGION	CODE SNIP N°	HYDRIC AVAILABLE (Hm^3)	AREAS (ha)	BENEFICIARY POPULATION (ha)	INVESTMENT (Millions)	STATE
1	Construción canal colector Ingahuasi	Ica	1899	18	12,000	89,332	105	Feasibility in modification
2	Afianzamiento Hídrico del río Pisco	Ica	95493	200	28,000	137,948	1,063	Profile Approved
3	Canal Lanchas	Ica	169574	3.2	5,556	22,734	15	Profile Approved
4	Construcción de la presa tambo	Ica	112017	55	28,315	96,400	272	Feasibility in modification
5	Construcción de presa "Las Delicias"- río Zaña	Lambayeque	246726	80	16,500	25,000	338	Profile Appoved
6	Construcción de presa "Cruz de Colaya" - río Chiniama,Motupe	Lambayeque	211861	6	3,500	1,000	42	Profile Approved
7	Construcción de presa "Montería"-río Chancay Lambayeque	Lambayeque	242860	77	30,000	25,486	432	Profile Approved
8	Construcción sistemas de presa "La Calzada"- río La Leche	Lambayeque	S/C	70	15,000	10,000	322	Profile in formulation
9	Sistema Nacional de Monitoreo de Recursos Hídricos	NACIONAL	S/C			País	25	Profile in formulation
10	Trasvase Este – Oeste Perú							Preliminar Idea
	Ruta Sur	Ayacucho, Ica y Arequipa	S/C		218,000		73	
	Ruta Norte	Huanuco,San Martín, La Libertad y Ancash.	S/C		500,000		109	
11	Alto Piura	Piura	S/C	640	31,000		1,181	Project in formulation
12	Chinecas	Ancash	S/C		20,154	600,000	1,400	Project in formulation
13	II Fase etapa I Olmos	Lambayeque	S/C	479	56,000		476	Project in formulation
14	Proyecto Vilcazán	Piura	S/C	120	13,000	10,000	360	Project in formulation

6.4 Programmes at a National Level in the Region of Interest

Currently, the Government is implementing three very important programmes of high social impact in the basins of focus in this report, one of which belongs to the agricultural sector and the rest to the sanitation sector. These programmes are shown on **Figure 6-4**.

6.4.1 "My Watering" Programme

According to Law 29951 (Public Sector Budget of 2013), funds for this programme has been approved. Its purpose is to help close gaps in the provision of infrastructure for water resources for agricultural purposes. The mechanism is through the funding and implementation of public investment projects, including pre-investment studies, which have an impact on the reduction of poverty and extreme poverty in the country, the improvement of the efficiency of water use and the increasing of agricultural production and productivity in locations above 1,500 meters elevation.

6.4.2 National Programme of Urban Sanitation (PNSU)

The programme is based in urban zones of over 2,000 inhabitants and where there is a very old and obsolete infrastructure, which requires renovation, and improvement of the transmission and distribution systems, as well as the storage of water with the purpose of supplying drinking water.

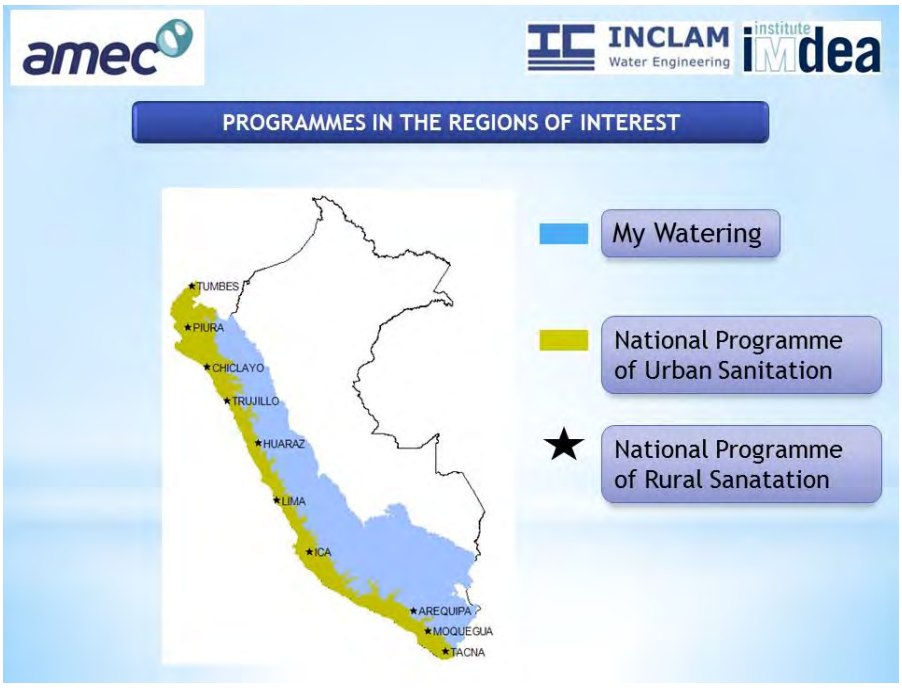
6.4.3 National Programme of Rural Sanitation (PNSR)

The programme is focused on intervention in rural areas, such as villages (200 to 2,000 inhabitants), depending on the level of poverty and the existence of acute diarrhoea diseases (EDA) in children under 5, with the purpose of reverting the situation and the improvement of their living conditions.

6.4.4 National Plan of Investments

There is a projected investment of PEN 53,400 million for the next 7 years (2014-2021) in drinking water and sewage at a national level in order to reduce the coverage gap between the urban and rural areas.

Figure 6-4: Programmes in the regions of interest



6.5 Opportunities and Threats

All sectors, both private and public, have different needs in terms of investment in the water resources field. The characteristics of the projects can be attractive from different points of views. Nevertheless, it is important to know which would be the main opportunities and threats in the region of interest. **Table 4-2** (which was initially presented in **Section 4**) summarises our views on those risks and opportunities, by sector.

6.6 Key findings relating to funding and implementation

We believe that the **funding system of civil works through tax credit has been very successful** in several private institutions, with the profit shared with the Government, beneficiaries and other private institutions. This system can fund pre-investment and investment studies; and given that the Government often has limitations to carry them out, the private sector gets an opportunity to participate at an early stage.

The programmes at a national level of the **Public-Private Associations are a good opportunity** for the private sector to invest.

The investments made in the water and sanitation sector have grown 3.3 times during the period 2007-2013 and will require 15 more years of investment to reach the goal of universal coverage. The water and sanitation sector has identified an investment need of PEN 53 billion for the period 2014-2021,

weighed towards sewerage and wastewater treatment over drinking water. In the data bank of the SNIP, **there are viable projects still without budget**, which may be accelerated by the private sector's investment in the water and sanitation sector.

Whilst there are many risks and constraints to the participation of the private sector, experience in Peru, and as demonstrated by case studies in the 2030 WRG catalogue, shows that these may be mitigated through dialogue and mutual understanding of stakeholder goals.

7.0 Summary and Key Messages

This report presents an integrated hydro-economic and PESIA analytical approach to evaluate and prioritize water resource investment opportunities that have already been identified and investigated in various levels of detail. In this Section we:

- summarize the challenges faced for water resource investment in Peru (from **Sections 2 and 5**)
- summarise the priority investment opportunities (from **Sections 3, 4 and 5**)
- postulate some potentially overlooked opportunities
- set out what we see as key messages in the context of 2030 WRG objectives
- propose a potential implementation roadmap for water resource interventions (from **Section 6**)

7.1 Closing the gap and beyond

7.1.1 Challenges

Peru is in the process of harnessing the potential of water for economic development through agriculture, hydropower, mining, and urban development. The most competitive areas of this emerging and thriving economy have been high international commodity prices and these are heavily dependent on the provision of water services. Freshwater sources are intensively used, especially in the most water scarce areas of the country where population and the most water intensive activities tend to concentrate.

The spatiotemporal rainfall and runoff variability, particularly pronounced in some areas of the Pacific region, shapes the particularities of the coastal catchments in terms of water resources availability and distribution. Coastal rivers have large periodic floods, transporting significant amounts of sediments, shaping braided channels, while many streams are even intermittent or ephemeral downstream. Overall, these rainfall and runoff patterns coincide with the intensive use of water resources, mostly in agriculture. Due to the upstream reservoirs and diversion projects, downstream reaches of the Pacific rivers are commonly deprived of high flows, and it is those flows that carry sediments, modify channel morphology, and maintain habitat complexity.

This context has resulted in water withdrawals and discharges that are already in excess of the sustainable capacity of long-term natural resources and infrastructures to meet current and future demand even in normal years, especially in the southern basins, exemplified in this study by the Locumba-Sama-Caplina-Tacna and Quilca Chili catchments.

The projected impacts on water availability of climate change will mean that some areas have more run-off and others less; a situation made more complex due to the melting of glaciers which results in short term increase in run-off. More extreme events – drought and flood – are projected.

Given the very limited decoupling between water use and economic growth trends, growing water demand has led to increasing water scarcity and related risk. In some cases, this is also the result of the lack of coordination of sectorial policies that may potentially lead to oversized infrastructures and idle facilities This is a major risk that needs to be factored in when promoting grey infrastructure, such as major diversion projects as Majes-Siguas II in the Quilca Chili, or the Desaguadero interbasin water transfer to supply the city of Tacna and the expansion of irrigated land in La Yarada district, or the Alto Piura special project in Chira Piura. Additionally, it is common to find weak enforcement (and inadequate structure) of water use rights, mostly regarding groundwater resources, and over-allocation of surface water use rights, leading to potential overexploitation.

The climate change and El Nino analysis (**Section 4**) suggests that droughts may become more frequent in the coastal catchments. Given that all catchments except Tumbes are already in varying degrees of water stress, the situation is set to become more acute in projections to 2021 and 2035. These critical issues call for improved adaptation mechanisms and strengthened resilience, both in terms of demand reduction (e.g. repair leaking water supply systems) and increase on the supply side, also via alternative sources such as desalination (as in La Yarada, Tacna catchment), and the re-use of treated wastewater (no examples of this were found in the plans reviewed).

Further, and where the impacts of climate change are to increase flood risk, the interventions which will be required will need to consider changed flow regime and consideration will need to be made of the impact of climate change on interventions which are designed to close the supply demand gap. Examples include dam spillways, sacrificial zones near reservoirs, early warning systems, and flood risk insurance.

7.1.2 Water for agriculture

Not surprisingly, most of the projects ranking higher in the prioritisation of investments are programmes to increase water use efficiency in irrigation at different levels. Examples include:

- Off-farm irrigation system investments to increase distribution and conveyance efficiency, such as those lining canal lining in the Chira Piura, the Tumbes or the Chancay Huaral basins; the Patapujo irrigation canal in Tacna; the upstream irrigation system Churgur-Hualgayoc in Cajamarca (Chancay Lambayeque); the improvement of irrigation canals in the Caplina and Locumba Rivers (Tacna catchment);
- On-farm investments to increase water use efficiency in the application to crops through technified systems, in the Chira-Piura; Jorge Basadre irrigation district in Locumba (Tacna); Tacamache-Chugur-Hualgayoc in Cajamarca (Chancay-Lambayeque); or the Caplina River (Tacna).

We have also noted the prevalence of major water storage and inter basin transfer projects, some of which are for irrigation only, while others are multipurpose.

In most water scarce areas, competitiveness of both the urban and rural economy is heavily dependent on the availability of a sufficient and secure provision of water services in particular for agriculture, agro-

food industries, and urban demands. Opportunities can be identified to reduce water use (e.g. by increasing irrigation efficiency, as in the above-mentioned examples) or to enhance availability. Increasing the water stored in aquifers through recharge facilities such as ponds, temporary delay of runoff by low retention dykes, and similar infrastructure provides infiltration opportunities (including infiltration of treated effluent into aquifers for pumping in the summer and re-use for irrigation) which contribute to increasing water availability (at key times). However, not many investment alternatives have actually been identified in this area and we return to this theme in **Section 7.3** below.

7.1.3 Water Quality

Yet, not everything is about scarcity and droughts in the Peruvian coastal regions. A major concern is surface and ground water quality degradation. Improvement in the quality of natural water assets can lead to remarkable economic benefits. In turn, increases in natural water flows might can improve the natural assimilation capacity for discharges, as well as resulting in a reduced cost of treating effluents in order to guarantee a pre-determined quality standard. This partly explains the major effort foreseen in the country to expand or build wastewater treatment plants (WWTP) such as in Tumbes or Chira Piura (Los Portales, Noroeste, Aypate, Chulucanas, Mallaritos, Lancrones, Salitral, Morropón, Pueblo Nuevo, Viviate, Miramar, La Juaca, Vichayal, Catacos, Paita, etc., and the treatment plants with joint primary and secondary treatment in Chancay Huaral, Medium and Lower Quilca-Vítor-Chili). Our review and analysis has identified a clear lack of water quality data being collected across the basins and has highlighted a key need going forward.

Any sanitation and drinking water supply project, such as the expansion and concentration of the system of outfalls and wastewater treatment in the metropolitan area of Arequipa or the San Martín WWTP in Piura, is aimed, among other things, at reducing morbidity and premature mortality. This is of paramount importance in rural areas of Peru, which explains the foreseen investments in separate sewerage systems in the Lower and Medium Quilca-Vítor-Chili and in Sumbay, also in the Quilca Chili catchment, and the installation of oxidation ponds in Chalcahuana, in the same catchment.

Conventional practice is to coordinate the public effort required to encompass economic growth by supplying water services demanded as a result of rapid progress in many areas of the economy including demographic change, urban sprawl, irrigation development, manufacturing activities, and mining, in an *ad hoc* non-integrated fashion.

Path-dependency is powerful. In economic goals, the main objective of water policy has consisted of and very often consists in finding inexpensive and reliable means to meet water demands. However, this supply-biased approach, which is clearly evident in the wide array of planned investments, will necessarily need to be compatible with one aimed at making all water services used by the Peruvian economy consistent with the preservation and adequate protection of the status of water bodies. This means that, rather than an engine for the expansion of the economy, water policy should be designed to decouple growth from increases in water services demand, to reverse scarcity trends, to mitigate

drought risk, and to manage all economic water uses within the range of the water bodies resources to deliver them sustainably.

7.1.4 Civil Defence Against Flooding

Torrential rains are common in some areas, mostly those in the north, which lead to hazards of flash floods, stream flooding, and landslides – some investment alternatives to tackle landslides have been singled out in the Quilca Chili. In the Tumbes and Chira Piura basins, managing flood risk is a common challenge. Based on the project descriptions in the database is difficult to know if the planned flood defence infrastructure incorporates green practices which can result in increased recharge and riparian area restoration.

7.1.5 Integrated Water Resource Planning and Investment

Economic progress has made evident the need to enhance sectorial policy coordination, on the one hand, and to overcome the subsidiary role of water management as an add-on instrument of sectorial and regional expansions towards a real mainstreaming element of economic policy on the other. Decoupling economic growth from increasing water demand remains an important challenge.

As part of the hydro-economic analysis developed, direct benefits of the different investment alternatives have been measured in terms of their contribution to the above-mentioned water policy challenges. Some of those alternatives, though, have been designed either with other non-water policy objectives in mind or to bring about benefits in other policy areas.

Irrigation expansion, for instance, may well contribute to productivity gains that may in turn increase farmers' income at a microeconomic level or exports and economic growth at a macroeconomic level. Any project aimed at expanding irrigation may not necessarily pursue a water policy objective but an agricultural production development, social cohesion or economic policy one. As a matter of fact, wider macroeconomic impacts of water policy (i.e. induced investment, employment, GDP increases, fiscal balance, etc.) have been prioritised in Peru.

Likewise, similar applies to hydropower generation, as that planned for the Sumbay River (Quilca Chili) or Moquegua I and Moquegua III (Tambo-Pasto Grande). A successful project may contribute to energy policy but the contribution to water policy should be explicitly intended (and proved).

Except for Tumbes, all the basins in this study meet their water demand to a greater or lesser extent through water transfers from the Amazonian basin. This results in water security uncertainty and can result in conflicts as new water projects are developed in either donor or recipient basins.

7.2 Prioritised investment responses to challenges

7.2.1 Overview findings by basin

The figures and tables in landscape format over the following four pages serve to illustrate and summarise the findings reported in Section 5:

Table 7.2 Challenges and Investment Summary

Figure 7.1 Summary of investment responses by basin, sector and project type

Figure 7.2 Summary of responses to close the supply demand gap

Table 7.3 Top 20 investment alternatives

The 230 investment alternatives which were subjected to the integrated HE and PESIA analysis have a total investment cost of some PEN 22 billion, and include projects which would reduce the supply demand gap by some 4,900 Hm^3/year.

When looking at the ten most highly ranked projects in each catchment, the resulting 70 projects have an investment cost of some PEN 7.6 billion (~35% of Tier 4) and would reduce the supply demand gap by some 2,500 Hm^3/year (~45% of Tier 4). In other words, the highest priority projects taking into account social and environmental factors have high leverage to reduce the supply demand gap.

Table 7-1: Top 20 Rank projects and their value in PEN

Basin	Nr of projects	PEN total M
Chancay Huaral	7	125
Chira Piura	5	60
Chancay Lambayeque	3	10
Tacna	3	108
Tumbes	1	23

The inset illustrates where the top 20 projects (those with the highest ranking) are located. It is interesting to note that although the Chancay Huaral basin does not constitute one of the highest in terms of overall investment among the 230 alternatives, the projects there have a high ranking due to their effectiveness in closing the supply demand gap and strong scores on social and environmental factors. It is also of interest that in this catchment, the project types vary more than in other catchments.

Table 7-2: Challenges and Investment Summary

		Tumbes	Chira Piura	Chancay-Lambayeque	Chancay-Huaral	Chillón - Rímac - Lurín	Quilca Chili	Tacna	Total
Hydrological data (water balance)	**Water availability (Hm^3/yr)**	3290	3074	1161	538	N/A	2128	406	
	Water demand (Hm^3/yr)	439	2751	1082	374	N/A	1138	681	
Water Policy Challenges		Low-tech irrigation	Infrastructural deficit - regulation	High crop demand	Increase in population	Soil degradation	Infrastructural deficit	Mismatch: water availability & needs	
		Flood risk	Water scarcity	Soil degradation	Low-tech irrigation	Flood risk	Increased demand	Social conflict - transfer	
		Silting	Extreme events risk	Pollution	Infrastructural deficit - Storage	Infrastructural deficit	Pollution	Groundwater overexploitation	
		Pollution (mining)	Pollution – low water treatment	Low coverage of water services	Mining	Pollution		Irrigated land expansion	
			Industry discharges	Infrastructural deficit	Pollution (mining)			Soil salinization	
					Low sanitation & wastewater treatment			Saline water intrusion - aquifer	
								Coverage	
								Pollution	
Results from the total list of 230 prioritised IAs	**Total investment cost (million PEN)**	1310	5038	1159	2555	2408	2756	6578	21804
	Technical effectiveness (Hm^3/yr)	97	1250	190	459	293	1655	923	4867
Results from top 10 of prioritised IAs	**Top 10 projects (general typology plus important projects)**	Irrigation	Irrigation	Irrigation	Irrigation	Reservoirs	Reservoirs	Irrigation	
		Tumbes WWTP	Piura WWTP		Conjunctive use	Water transfers	Arequipa WWTP	Reservoirs	
					Drinking water	Water treatment	Yura river regulation		
					Reservoirs				
	Total investment cost (million PEN)	250	943	82	228	2385	2425	1257	7570
	Technical effectiveness (Hm^3/yr)	83	670	83	180	293	475	690	2474

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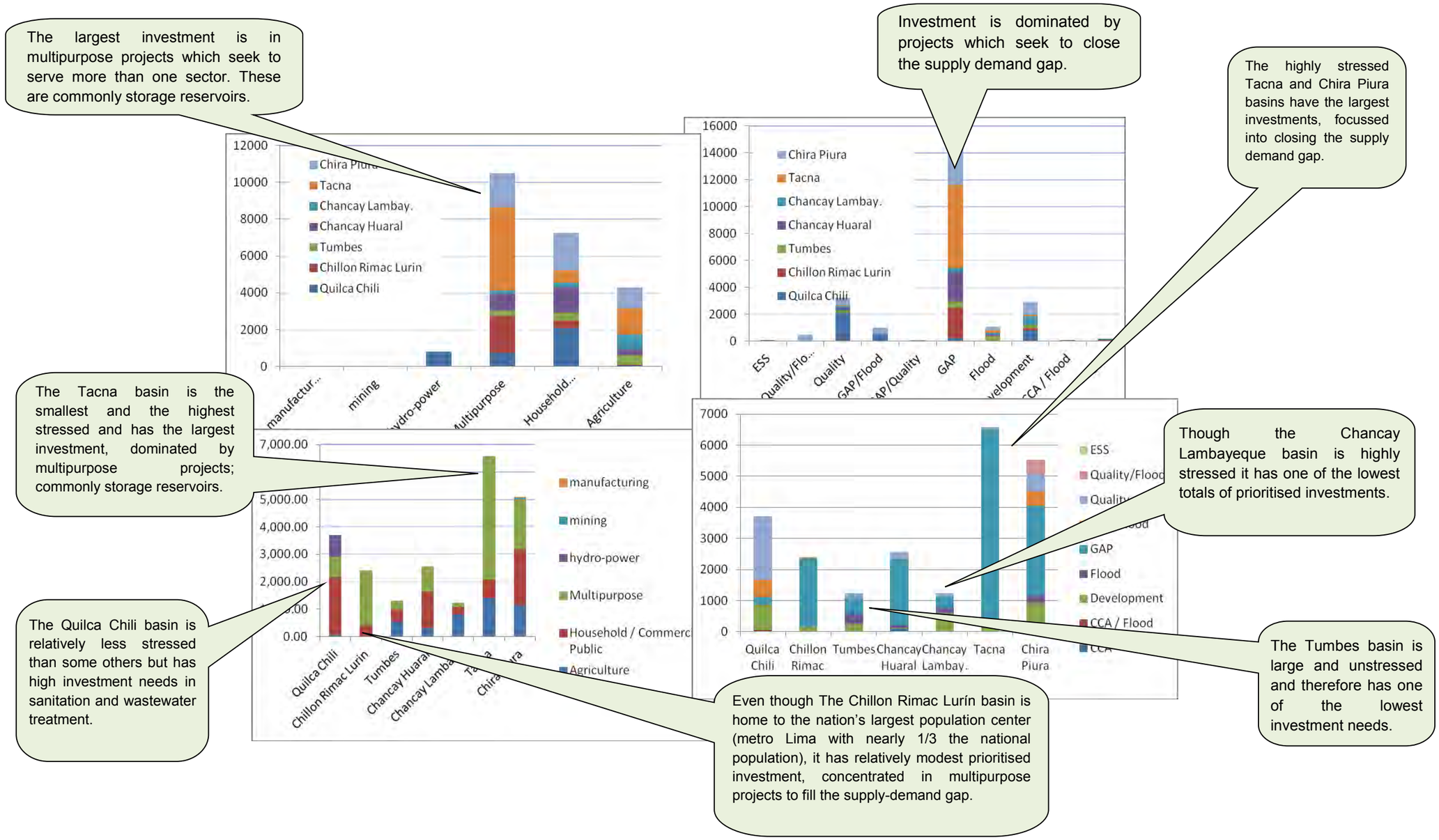
Figure 7-1: Summary of investments by basin, sector and project category



Notes: The investment totals represent 230 projects from the total of 2300.
Projects which address Training, Restoration, Forestation and Hydrometrics are not included here but are included in Appendix G. Chillon-Rimac-Lurín investments do not include those proposed by SEDAPAL.

Figure 7-2 Summary of responses to close the supply demand gap

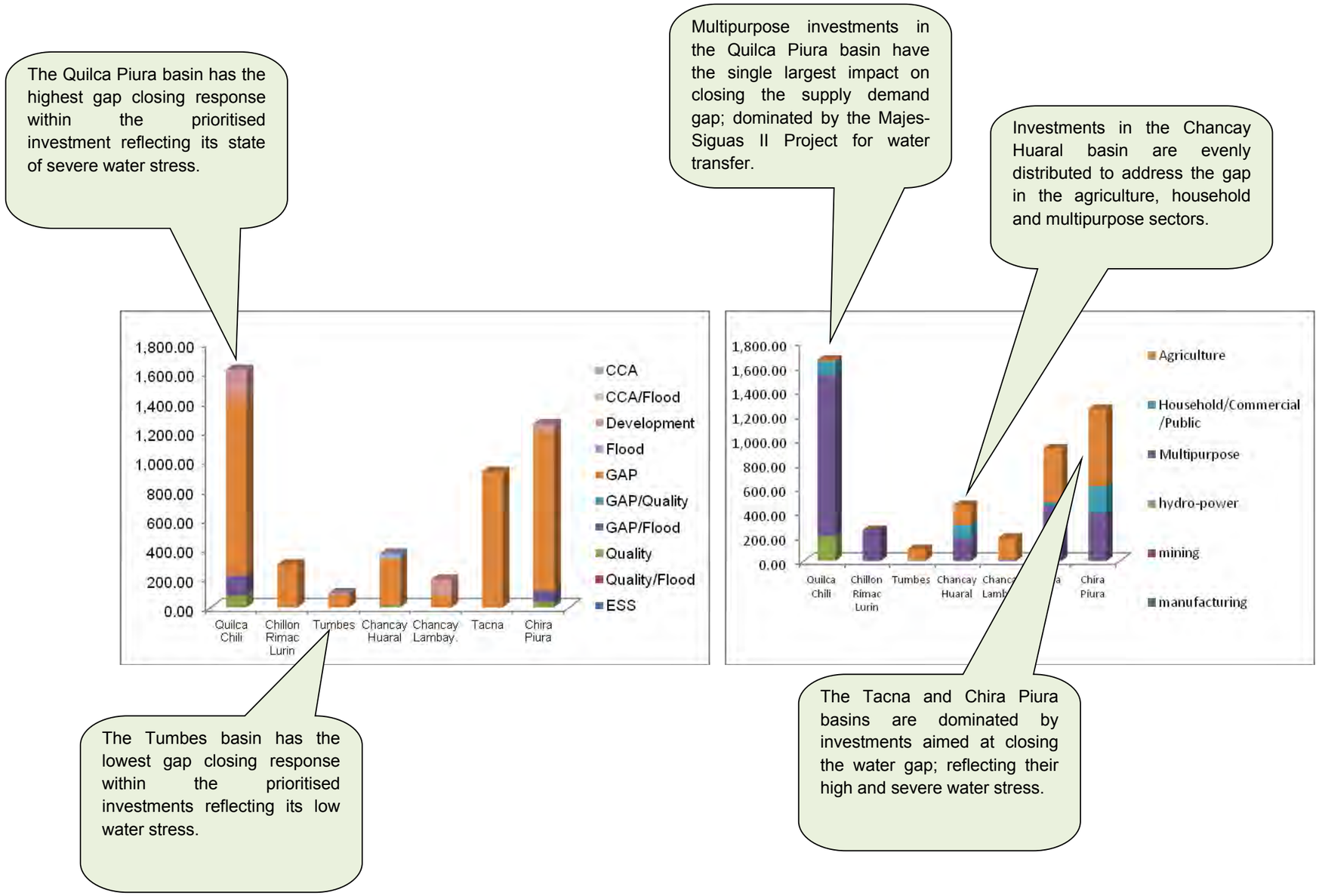


Table 7-3 The 20 highest ranked investment alternatives

IA ID (Final)	Key economic sector	Water policy / management challenge	River basin district / catchment	Type of project	Title of the project / intervention	Capital investment cost (@ market prices in PEN)	Total Score
IA195	Household / Commercial / Public	Quality	Chancay-Huaral	WWT	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage systems for treated waters	24,030,000	3.67
IA258	Household / Commercial / Public	Quality	Chira-Piura	WWT	Waste Water Treatment Plant San Martin	6,500,000	3.67
IA038	Agriculture	GAP	Tumbes	IRR	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas - Tumbes	23,325,700	3.45
IA083	Agriculture	GAP	Chancay-Huaral	D+R	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33,500,000	3.44
IA093	Agriculture	GAP	Chancay-Huaral	D+R	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5,200,000	3.38
IA017	Agriculture	GAP	Chira-Piura	IRR	Efficiency improvement through technified irrigation - mostly drip irrigation	25,805,948	3.37
IA085	Agriculture	GAP	Chancay-Huaral	D+R	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4,159,000	3.37
IA280	Household / Commercial / Public	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11,100,000	3.35
IA261	Household / Commercial / Public	Quality	Chira-Piura	WWT	Waste Water Treatment Plant Chulucanas	3,656,250	3.34
IA202	Agriculture	Flood	Chancay-Huaral	DRAIN	Drainage system for agriculture in Jequetepeque Valley	27,222,804	3.33
IA221	Agriculture	Flood	Santa	DRAIN	Improvement of drainage system in Huancaco sector - Viru, Libertad	8,613,944	3.33
IA019	Agriculture	GAP	Chira-Piura	IRR	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13,617,324	3.28
IA182	Multipurpose	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Reservoirs in Fortaleza river basin	60,430,000	3.27
IA125	Agriculture	GAP	Chancay-Lambayeque	D+R	SICAN dam system	1,630,000	3.27
IA284	Agriculture	GAP	Tacna (Locumba-Sama-Caplina-Tacna-Maure-Uchusuma)	D+R	Jarumas dam - Sama river basin	37,175,100	3.24
IA097	Agriculture	GAP	Chancay-Huaral	IRR	Modernization of irrigation conveyance infrastructure and canal lining.	32,760,000	3.21
IA111	Agriculture	GAP	Chancay-Lambayeque	IRR	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5,880,000	3.21
IA120	Agriculture	GAP	Chancay-Lambayeque	IRR	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1,570,000	3.19
IA003	Agriculture	GAP	Chira-Piura	IRR	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10,301,669	3.18
IA100	Agriculture	GAP	Chancay-Huaral	WS	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10,920,000	3.15

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7.2.2 Overview findings by economic sector and project type

The inset **Table 7.4** illustrates in which sectors the top 20 projects (those with the highest ranking) are located. Agriculture is by a big margin the sector where the most highly ranked investments are directed.

Table 7-4 Sectorial distribution of the Top 20 ranked projects

Sectors	No. of projects	PEN total M
Agriculture	15	250
Household	4	45
Multipurpose	1	60

In close correlation with the sectorial focus, the project types most dominant in the top 20 projects are for irrigation (largely efficiency improvements) and dams/reservoirs. These types are followed by municipal wastewater treatment. Of note, the top 2 highest ranking projects are related to improving water quality via waste water treatment.

Table 7-5 Typology of the Top 20 ranked projects

Project Types	No. of projects	PEN total M
Irrigation	7	125
Storage	7	150
Waste Water Treatment	3	35
Water Supply	1	11
Drainage	2	35

The trade-off to be faced by Peruvian policy makers and private investors in the country is not unique, but it is a major challenge: how to reconcile the need to substantially reduce the infrastructural deficit in the country and, at the same time, avoid severe indebtedness, major environmental liabilities, social conflicts, and to provide effective responses to close the water gap. And the water gaps may be even wider by 2021 and 2035 than today.

One of the main institutional challenges is to avoid a sector specific approach. When judged separately and according to their intended technical objectives (in terms of incremental water availability), each of the responses to water challenges in the Peruvian coastal catchments could appear to be a clear success.

Nevertheless, with major infrastructural investments planned for irrigated agriculture, household supply, wastewater treatment (for different sectors), and mining (the latter with a relevant private share in investments), one may expect the infrastructural deficit to be reduced in the next few decades. Such new infrastructure would then allow for a flexible adaptation to water supply, convey and apply water both in rural and urban uses, increase water use efficiency, expand installed capacity of non-conventional of water sources (desalination, reuse). These measures, though, may not necessarily result in a real contribution to curb the existing negative trends towards increased scarcity and higher drought risk.

One basic reason behind that insight is the need to analyse in more depth incentives behind water demand and supply, and in particular to adapt all individual decisions to collective water policy objectives. Integrated water resources management and a contemporary approach to water planning in an emerging economy like Peru is not so much about replacing supply-side with demand-side alternatives but rather to combine them in an integrated approach. The analysis of alternatives in isolation and only from a sectorial perspective is somewhat misleading because synergies between different investment alternatives and trade-offs are of paramount importance. What is more effective and important is the policy mix to manage a water resources portfolio at a basin or catchment level.

In sectorial terms, three major groups can be identified in the prioritised list of investments:

- **Agriculture**, with planned investments in efficiency improvement through technified irrigation (mostly drip irrigation); improved off-site infrastructure – such as in Brujas Alta and Fundo Las Palomas, Tumbes; implementation of major and minor infrastructures for groundwater irrigation; and canal lining.
- **Household, commercial and public** uses, with planned investments in dams and reservoirs, improvement of groundwater abstraction points for household supply or major investments in WWTPs (with the challenge to tackle energy inputs to ensure feasibility).
- Significant investments are also planned for **multipurpose infrastructures**, such as the Chili reservoirs, or those in the Fortaleza sub-catchment, or the combined system of reservoirs and water transfer in the Pisco river basin.

7.3 Potential for other types of intervention

During the course of this study we have observed a remarkable range of interventions to address water scarcity, water quality, flood risk, and environmental enhancement amongst others. In **Section 2** we have reported on our observations in relation to “best practice”, and green and indigenous practices.

In this section we have gathered together their views on the potential for types of intervention which we believe are not included in the reports that we have studied. This is not to say that we believe that such measures are unknown in Peru or have indeed not been assessed. Rather that we list such measures in this report and if they are already being promoted by other agencies then they can be ignored.

7.3.1 Interventions to increase directly water availability

7.3.1.1 Managed aquifer recharge (MAR)

This technique is seeing a rapid uptake in countries with water scarcity. Its technical basis is to use aquifers to store water by recharging them with surplus river water or treated wastewater. Aquifer recharge has an advantage (when compared to surface reservoirs) as evaporation losses are minimised, especially in hot climates. This may be one of the major overlooked investment opportunities:

An example could be an aggressive MAR program using the **sedimentary aquifers that underlie the Lima metropolitan area**. Every year, the Rio Rimac discharges surplus volumes of water to the ocean (equivalent to many times the annual Lima water demand), while at the same time part of Lima's water supply is derived from well fields that are experiencing dropping groundwater levels. Capturing part of that runoff which discharges to the sea and recharging it to those parts of the aquifer experiencing dropping water levels may provide a cost-effective means to turn those groundwater resources into a sustainable renewable resource for the long term.

7.3.1.2 Indirect re-use of treated wastewater

Also a feature of plans in other countries to combat water scarcity is a move towards the indirect use of treated wastewater in domestic (IPR), agricultural and industrial settings. The technical basis involves adding two or more further stages of treatment (e.g. reverse osmosis, advanced oxidation, granular activated carbon) to conventional wastewater treatment, and discharging to river, reservoir or aquifer from which water is withdrawn for its intended use, possibly involving passage through a conventional drinking water treatment process. Where the treated wastewater is currently being discharged to the ocean, this technique adds "new" water to the water cycle. An oft-quoted disadvantage of this technique is the high energy (and associated carbon) cost of advanced treatment. On the other hand such processes can source energy from solar power or from the energy liberated from digestion of wastewater sludge. This technique offers advantages over sea water desalination due to the much lower concentration of minerals in treated wastewater.

Except in the Quilca Chili basin, and as can be seen from our diagnosis, the importance of water quality is generally much lower than that of water quantity, which means that there is lower awareness of the problem of inadequate sanitation. This means that the potential solution of re-use of treated wastewater now has more opportunity to enter the discussion on ways to close the gap.

There is potential for **re-use of treated wastewater from Lima** which is concentrated largely at only 2 collection points. There is a tremendous potential for reuse for landscaping, industrial uses, environmental enhancement (such as the wetlands of Chosica and the area south of Lima), and even in the agricultural orchard area of Lurín close to Lima. The same advantages could be seen for other coastal cities of Peru.

In the Tacna basin, most of the agricultural activity in the catchment is downstream of the city of Tacna, in particular the area of Yarada, where the aquifer is now over-exploited. Therefore, a wastewater treatment plant for re-use of wastewater would give higher water security to the irrigated crops which to some degree are already irrigated with effluent from the city. Tacna needs to access private investment, so that the projects that strengthen the water supply services (including of reuse of wastewater) aimed at increasing the security of existing users, will also make it possible to develop other urban sector activates such as commerce, industry, manufacturing, etc. This would derive a true alternative to subsistence agriculture, and likely to be economically feasible due the area's proximity to Chile and the various mining activities in the region.

7.3.1.3 Desalination of sea water

Though sea water desalination (sometimes combined with thermal power generation) is a feature of cities in the Gulf region of the Middle East, it remains an expensive option for generation of "new" water. The technique involves taking sea water through a multi-stage process, commonly based on reverse osmosis using membranes. There is a bi-product to dispose of – a very concentrated brine solution.

It is likely that **Lima is the only area of Peru that could afford** the true price of desalinated water. On the face of it, MAR or IPR (separately or combined) would seem to offer less expensive options for Lima, and even they may prove more expensive than transfer of water from the Andean region to Lima. There may be specific locations such as the coastal resorts in the northern areas, where due to tourism or industrial water demands, desalinated water may be affordable. Even in those cases, IPR or even direct potable re-use (DPR) would likely be a less costly alternative.

7.3.1.4 Conjunctive use

Conjunctive use of water resources can yield more "new" water by optimising the combined access to two or more sources; and may be combinations of surface water with surface water (e.g., fresh water for potable use and untreated seawater for toilet flushing in coastal communities) or surface water with groundwater (e.g., groundwater well located near streambeds for irrigation supply during the dry season will result in cones of depression that can be readily recharged by surface flows in subsequent runoff season). The potential of this technique can only be assessed through a detailed study of hydrology, hydrogeology, the system architecture, and the demand profile. More often than not the additional yield is more than expected, especially where the resources are within different ownership. A key constraint can be lack of alignment of the objectives of the owners of each source.

7.3.2 Interventions to improve indirectly water availability

7.3.2.1 Water utility operational efficiency

Drinking water and wastewater treatment is not associated by a large part of the Peruvian society (nor politically) with quality of life and security of health. As a result, attention and budget to ensure the **efficient performance of treatment plants is lacking**. We believe that this represents an opportunity to improve water quality and thereby, indirectly, water quantity.

In particular, and as capital of the nation, Peruvian society expects Lima to set an example for the entire country. In any case, and for all water utilities, other opportunities include:

- improvement of the **efficiency of the water and sewerage networks**; in terms of operational costs and leakage or infiltration (already underway in Lima),
- construction of **separate sewerage networks** (foul and storm water) to reduce sewage overflows, reduce flows into wastewater treatment works and aid recovery of waste water,
- where catchments are strongly affected by droughts and chronic water shortages, investment in **managing water demand** through distribution zoning, leakage management, pressure management, metering etc. (already underway in some locations).

7.3.2.2 Land use planning and management

We note a need to improve the planning, regulation and management of **land use**, especially where there are bi-national agreements or commissions (e.g., Puyango-Tumbes and Catamayo-Chira). Further, there are problems with **solid waste management** on the flood plains and **residues from informal or historical abandoned mining** (in most of the basins of the north). These three diffuse vectors alter runoff regimes and degrade surface water quality. Their better management offers potential to have positive direct impacts on water quality and indirect impacts on water quantity.

7.3.2.3 Public-private collaboration

Whilst we recognise that water interventions have been studied and assessed for most of the basins of Peru, we believe that the six basins which are the prime subject of this study represent relatively high institutional strength in the field of water. We therefore believe that there is a great opportunity in these basins to instigate a process of definition and prioritization of projects in a participatory way that can **facilitate the entry of private investment**.

In section 6 we have mentioned a number of mechanisms which can stimulate such collaboration, and they include:

- **The Funding Systems of Civil Works by Tax Credits** offers an advantageous tax position for private sector investment in what are traditionally public sector projects, and

- **The Public-Private Associations** already in place in Peru mean that the principles of private-public-civic society collaboration are already established.

7.3.3 Interventions by the mining, manufacturing and agriculture sectors

Public sector funded studies of water demand (and water infrastructure) in Peru rarely take into account the needs of mining and manufacturing, which means that the demands of those sectors can become a subject of conflict and controversy. However, and as shown in the 2030 WRG catalogue of case studies, there exists great potential for the public sector (water utilities and water regulators) **to work in collaboration with the mining and manufacturing** industries to develop water interventions which are "win-win". One example of this type of project is the investment by Freeport McMoRan's Cerro Verde Mine in a new wastewater treatment plant for the city of Arequipa. Treated wastewater from that plant is subsequently used by the mine for process water and mine operations.

In the agriculture sector, the challenge of on-farm "technification" is not being addressed by the public sector. This modernising of the field systems is a clear complement to the projects to provide linings to canals and pressurization of water distribution systems, all under the title of "improving the efficiency of the irrigation." Here exists great potential for public and private sector to collaborate to maximise benefits of each other's interventions. The key to ensuring that the public and private sector interventions are complementary is dialogue, in which the private sector describes market-led field-level interventions and the public sector describes its basin-level water resource management plans.

These three sectors already understand the need to invest in the area of their impact on water resources and the environment. They generally know of the need to better manage Peruvian society's perception of them and the need to work directly with the communities that they work in and around. Water is often the vector for conflict, so that the solutions to the challenges of water quantity and quality for these communities, and for the sectors, represent an enormous opportunity for collaboration.

7.4 Key messages in the context of the 2030 Water Resources Group objectives

The integrated HE and PESIA analysis has yielded a prioritised list of investments which would involve a total investment cost of some PEN 22 billion and which together would reduce the supply demand imbalance in the area studied by some 4,900 Hm^3/year. By taking the 10 highest ranked projects in each of the 7 coastal catchments, the costs reduce to PEN 7.6 billion and the reduction in gap by 2,500 Hm^3/year. We believe that in these group of projects there are a number of possible foci for 2030 WRG's objectives in Peru.

Before we describe these potential foci, and the initial framework of a roadmap for implementation, we would like to re-iterate some of the boundary conditions to our study:

Our review started with over 2300 investment alternatives from 6 basins, the National Plan and the Chillon-Rimac-Lurín area. It is therefore important to note that these sources together do not represent all proposed water investment in Peru.

The functionality of the integrated HE and PESIA analysis tool could be much improved with more and better data, especially for the household sector interventions. We are not saying that this needs to be done before 2030 WRG moves ahead but rather that the tool could be of wide benefit to a broad range of Peruvian stakeholders if it were made more robust with better data.

We have not analysed projects for training, restoration, re-forestation, and hydrometric stations but we believe that many of these may be of interest to private sector stakeholders. Details of these projects are in **Appendix G**.

Putting these comments aside and recognising that this Analysis "A" is the first step in 2030 WRG's ACT Analyse, Convene, Transform process, we have formulated the following key messages.

7.4.1 A basin perspective

The Tacna catchment has severe water stress which the 10 highest priority projects would go a long way to resolving by generating some 690 Hm^3/year of water for an investment of PEN 1,257 m. These projects are dominated by irrigation efficiency and reservoirs.

The Chancay Huaral catchment also has severe water stress and within its 10 highest ranked projects are 7 which are within the 20 highest ranked across all catchments studied. They would generate some 180 Hm^3/year of water for an investment of PEN 228 m and make a significant move toward more water security in the basin. The projects include irrigation, reservoirs and municipal water supply/sanitation.

The Chira Piura catchment is one of the largest and also has severe water stress. The 10 highest ranked projects would generate some 670 Hm^3/year of water for an investment of PEN 943 m and make a significant move toward more water security in the basin. The projects are dominated by irrigation efficiency and municipal wastewater treatment.

The remaining catchments have varying degrees of water stress and volumes of investment, but have less favourable ratios of investment to generating more water (a basic tenet of 2030 WRG) or have a relatively low investment need.

7.4.2 Sector and project type perspectives

a) **The agriculture sector** is by a significant margin that which features mostly in the top 10 projects in the catchments and in the overall top 20 projects, where they account for PEN 225 m (some 70%) of investment.

b) **Irrigation improvement and efficiency projects** feature highly in most of the catchments and in the overall top 20 they account for PEN 125 m of investment.

c) **Dams and reservoir projects** rate highly in most of the catchments and in the overall top 20 they account for PEN 150 m of investment.

d) **Municipal wastewater treatment projects** feature in several of the catchments and in the overall top 20, including the top highest ranking projects, and they account for PEN 35 m of investment.

7.4.3 Implementation routes

a) **The Funding Systems of Civil Works by Tax Credits** offers an advantageous tax position for private sector investment in what are traditionally public sector projects.

b) **The Public-Private Associations** already in place in Peru mean that the principles of private-public-civic society collaboration are already established.

7.4.4 Potential private sector comparative advantages

a) The most beneficial project types identified in this study (irrigation efficiency, dams and reservoirs, wastewater treatment) lend themselves to **application of private sector technological, financial and project management resources**. Verification of this conclusion is evident in the 2030 WRG catalogue of case studies.

b) Further, the experience of the private sector (potentially in other territories) in some of **the potential intervention opportunities** (managed aquifer recharge, re-use of treated wastewater, utility operations) may be source of "win-win" collaboration. Examples of such interventions can be found in the 2030 WRG Catalogue of Case Studies, and include:

- **Procter and Gamble** financed a wastewater re-use facility at their Planta Milenio manufacturing plant in Mexico, which brought them a secure source of cooling water and addressed water scarcity in the Lerma river basin.
- **Acwa Power** and **Suez Environment** funded and implemented a leakage reduction programme for the city of Jeddah in Saudi Arabia; and Sasol supported a similar programme in Emfuleni in South Africa.
- **Rio Tinto** funded and implemented a number of water conservation measures including rainwater harvesting and wastewater re-use at the Argyle Mine in Western Australia, which reduced their water demand from the river basin.

7.4.5 An initial roadmap

Whilst we note that the TOR for this study mentions a “roadmap towards the actual implementation of projects to close the water gap”, we do not feel that it is appropriate to propose such an important concept without a review of the key messages with 2030 WRG.

Purely as a starting point for discussion we suggest that the following matrix could be used as a framework to convene stakeholder groups to commence discussion around key messages. Groups could be convened based on either axis of the table, and stakeholders could be represented in Groups on either axis depending upon their interest.

Table 7-6: Initial convening framework

				Basin Groups		
				Tacna	Chancay Huaral	Chira Piura
Sector and Project type Groups	Agriculture and Multipurpose		Irrigation improvement and efficiency			
		Household	Dams and reservoirs			
			Municipal wastewater treatment projects (inc. re-use)			
			Other potential interventions			

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Appendices

Appendix A Project Characteristics Captured in the Database

Appendix B Best Practice Example Tables

Appendix C Challenges and Pressures on Water Security in Key Catchments

Appendix D Diagnostic of Basin Results

Appendix E Development and Application of HE Tool

Appendix F Summary of Interviews

Appendix G Prioritisation Analysis Investment Alternatives

Appendix H Workshop Report

Appendix A
Project Characteristics Captured in the Database

1. Project Characteristics Captured in the Database

For each of the 2,303 spreadsheet rows there are numerous columns that are included to provide characteristics and data for each included projects. The project characteristic columns are organized into 6 major categories:

1. **Identification characteristics**, which lists a number of identifying characteristics including the name of the source document from which the project was identified, the level of aggregation (project or intervention, which is a group of related projects), a qualifier of the level of data availability and accessibility about the project (low, medium, or high), and the name of the project or intervention;
2. **Situation / Location characteristics**, which includes the name of the basin which the project is located in, the administrative-geographic location of the project (Departmento, Provincia, and Distrito), the spatial scope of the project ("ámbito"), and the AAA (Autoridades Administrativas de Agua, or the regional administration water authority) district within which the project is located;
3. **Financial parameters and characteristics**, which includes the estimated upfront capital cost of the project or intervention, the annual operating and maintenance cost, as well as several financial parameters and criteria;
4. **Technical and social parameters**, including the number of people benefiting from the project or intervention, the volume of water that the project will develop, the number of hectares to be irrigated (for agricultural irrigation projects), and the length of canals or flood protection levees to be developed under the project. Unfortunately, this information is not available for most of the entries in the initial database, and efforts will be made to acquire this data for the projects ultimately subject to hydro-economic analysis;
5. **Typology and duration of project**, including the **current status** of the project (feasibility, pre- feasibility, or idea), the time frame for the project, the length of time to payback the investment, a measure of the useful life of the project, the type of project (structural or non-structural), and a qualitative evaluation of the necessity for the project (low, medium, and high).

6. **Other Secondary Data**, including **data from SNIP database**, which includes the SNIP project description, the overall objective of the project, the funding mechanism, and several others; **Other data and information presented in the basin water plans**, including the project code, line of action line, program, and subprogram identifiers, as well as qualitative and quantitative observations about the projects provided in the basin plans; **Category of the project within the national water plan**, whether it is a nationally important plan, if the project is consistent with water management strategies described in the plan, and which national program the project may be part of; **Other data to support diagnosis and hydro-economic analysis**, including its overlap and synergies with other projects and interventions, whether the project utilizes Peruvian and/or global best practices, and an index to note whether it is a water quantity or water quality project.

Appendix B
Best Practice Example Tables

1. Introduction

Below are five tables that provide a summary of projects and measures by key sectors that have been applied in scarce water environments and are considered appropriate for consideration in the catchments and key sectors in Peru. Each of these can be considered to represent a Best Practice. Each case study or project has been given a reference number, a brief summary of the measure and where available an indication of the water saving potential or other key metric. We have also highlighted specifically any 'green' or the more sustainable techniques in italics. The numbers in brackets correspond to the 'bullet' number of the two reference documents above.

2. Information by Sectors

2.1 Mining Sector

Table B-1: Mining Sector Examples

Reference	Measure	Country/Example	Description/Summary	Water Saving Potential
M1	Better Housekeeping – Water Management Plan with increased monitoring (1)	BRA	Better monitoring and management measures at sites	15% reduction in consumption
M2	Dust Suppression on Haul Roads (1)	RSA	Addition of chemical to aid suppression	80% reduction in water use
M3	Mine Water Treatment Reuse (1)	RSA	Pump and treat unused water and reuse in operations	N/A
M4	Recycling of Treated Service Water (1)	RSA	Optimisation of in plant wastewater reuse for low quality demand uses	8% reduction in Potable water spend
M5	Paste Tailings (1)	RSA	Thickening of tailings to higher solids concentration and recycle water	Water loss reduction from 40% to 26%

Reference	Measure	Country/Example	Description/Summary	Water Saving Potential
M6	Water Optimisation in the Mining Sector (2)	Lomas Bayas Copper Mine, Chile	Using a drop system to replace sprinkler application to the leach pad	Evaporation rate in leaching reduced by 54%
M7	*Mine Water Recycling (2)*	*Kimberley, AUS*	*Dams constructed to collect lower quality water; water recycling in the washing process*	*96% reduction in water abstracted from a lake and 40% of mine water is recycled*

2.2 Agricultural Sector

Table B-2: Agricultural Sector Examples

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
A1	Canal Lining (1)	CHN/IND/RSA	Lining on farm canals to reduce seepage	
A2	Drip Irrigation(1)	BRA/CHN/IND/RSA	Application of water through low pressure tubing as opposed to flooding	20% - 60% gross water savings
A3	*Irrigation Scheduling (1)*	*BRA/IND/CHN/RSA/USA*	*Prevent over-irrigating*	*10% - 15% gross water savings*
A4	Precision Farming (Irrigated) (1)	BRA/RSA	Use of GPS to optimise sowing density, fertilizer and other needs	13% to 30% in Brazil
A5	Genetic Crop Development (Irrigated) (1)	BRA/CHN/IND/RSA	Development and adoption of crop varieties to attain higher yields	N/A
A6	*Sprinkler Irrigation (1)*	*BRA/CHN/ND/RSA*	*Increase yield and irrigation efficiency (e.g. through reduced evaporation)*	*10% to 40% (Brazil)*
A7	*Trashing Stubble (1)*	*BRA/RSA*	*Alternative to burning improves water retention and increases moisture levels*	*N/A*
A8	System of Rice Intensification (SRI) (1)	CHN/IND	Improve rice planting, irrigation and production practices	15% in India
A9	*Sprinkler Conversion (1)*	*RSA*	*Use microsprayers where practical as they consume less water than sprinklers*	*10%*
A10	Piped Water Conveyance (1)	CHN	Use of pipes to transfer and reduce evaporative losses	10% - 40%
A11	Drainage Construction (Irrigation) (1)	IND, RSA	Construction of adequate drainage to reduce need for irrigation	10% - 30% gross water savings
A12	Large scale irrigation infrastructure (1)	IND	Use of stream dams and reservoirs	N/A
A13	Large scale	IND	Renovation, desilting,	N/A

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
	irrigation rehabilitation (1)		maintenance planning and management systems	
A14	Last mile irrigation (1)	IND	Bridging the gap between the irrigation created and irrigation potential with last mile delivery infrastructure and associated management systems	N/A
A15	Small scale infrastructure (1)	IND	Small dams built closet to communities; water used in dry spells or to augment rainfall	N/A
A16	*Irrigation Management (2)*	*Orange – Senqu RSA*	*Improved metering; scheduling; sprinkler systems; water allocation rules*	*7% annual irrigation demand reduction*
A17	*Low cost irrigation scheduling (2)*	*Punjab, IND*	*Use of sensors to guide scheduling;*	*19% reduction in withdrawals*
A18	Water reclamation for reuse and groundwater recharge (2)	Orange County, USA	Treatment of wastewater for irrigation and groundwater recharge; Infiltration basins; non potable water distribution systems	60% reclaimed used in irrigation; 40% used to recharge groundwater
A19	Improving Water availability through wastewater treatment (2)	Segura River, SPAIN	Capture and treatment of wastewater and return for direct and indirect reuse in irrigation	Meet 6% of irrigation demand but considerable water quality improvements in Segura
A20	*Irrigation network renewal (2)*	*Victoria, AUS*	*Real time flow monitoring; lining of channels; replacement with pipe systems; sprinkler and drip applications*	*Improve channel water supply efficiency from 79% to 92%*
A21	Improving flood irrigation efficiency via laser levelling of fields (4)	New Mexico, USA	*Prevent over-irrigating*	*20% - 40% gross water savings*

2.3 Municipal Water Supply Sector

Table B-3: Municipal Water (Supply) Sector Examples

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
MS1	Small & Large Dams and Reservoirs including Raising (1)	BRA/CHN/RSA	Dam construction, raising	Variable depending on yield; sedimentation known issue in Peru in reducing yield so needs associated catchment management. Potentially high capex
MS2	Desalination SWRO (1)	BRA/CHN/RSA	Reverse osmosis process for Seawater	Depends on design
MS3	Interbasin Transfers Surplus to 'deficit' catchments (1)	CHN	Interlinking surplus to deficit areas to improve overall yields. Can be effective when utilising gravity as much as possible; conjunctive use of surface and groundwater sources fall into this category	Depends on design
MS4	Groundwater Pumping (1)	BRA/IND/RSA	Shallow and Deepwater extraction	Depends on design
MS5	*Local Water Conveyance (1)*	*CHN*	*Conveyance of surface water using local channels over short distances – similar to INCA techniques*	*Depends on design*
MS6	Aquifer recharge (1)	BRA/IND/RSA	Collection of rainwater and artificial recharge with collected water	Can achieve high (75%) recharge efficiencies – the percentage of water that reaches the aquifer from the recharge structure.
MS7	Aquifer Recharge with Stormwater (2)	Adelaide, AUS Phoenix, AZ, USA	Treatment and reuse of non-potable water and untreated stormwater for groundwater recharge	
MS8	Improving Water Availability through Wastewater Treatment (2)	Segura, ESP	Wastewater reuse and treatment investment	90% reuse of treated volumes in irrigation
MS9	Use of Seawater in dual municipal water supply (2)	Hong Kong, CHN	Use of seawater for toilet flushing and evaporative cooling; city has a dual reticulated network	Seawater accounts for 22% of domestic demand

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
MS10	Wastewater Reclamation to meet Potable Demand (2)	Windhoek, NAM	Multibarrier approach to treatment and blending with freshwater	26% of Windhoek demand from reclaimed water

2.4 Municipal Water Demand Sector

Table B-4: Municipal Water (Demand Management) Sector Examples

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
MD1	Municipal Leakage (1)	BRA, CHN, IND, RSA	Leak detection and repair in distribution networks	Various 5% - 16% quoted
MD2	Household Leakage (1)	BRA, RSA	Reduction in leaks on households	5% quoted in RSA
MD3	Commercial Leakage (1)	BRA, CHN	Reduction of leaks on commercial and public premises	5% - 10% quoted in CHN
MD4	Wastewater Reuse (municipal) (1)	BRA, CHN	Reuse of treated municipal water and use in cooling etc	Depends on design
MD5	Wastewater Reuse (buildings) (1)	CHN	Use of biotreatment to recycle wastewater for use in toilets in commercial buildings	30% reduced water use quoted
MD6	*Dual Flush Toilets (new and retrofit) (1)*	*BRA, CHN, RSA*	*Installation of water saving dual flush toilets*	*70% saving in water consumption quoted*
MD7	Pressure Management in Distribution (1)	RSA	Improved pressure management in distribution system	3% - 20% quoted
MD8	*More efficient household goods – Washing Machines & Showerheads (1)*	*BRA, CHN, RSA*	*Water efficient goods*	*Varies with appliance*
MD9	*Rainwater Harvesting (1)*	*BRA, IND, RSA*	*Collection of rainwater from rooftops for domestic use*	*N/A*

Reference	Measure	Country Example	Description/Summary	Water Saving Potential
MD10	Reducing Business Risk through Municipal Leakage (2)	Emfulani, RSA	Combination of innovative public-private sector collaboration on funding on water saving measures including pressure management, network leakage reduction and domestic leakage management; reduced water stress risk to municipality and local energy company	12000m3 per year by June 2014
MD11	*Water Loss Management Programme & Water Authority Conservation Programme(2)*	*NSW, AUS* *Nevada, USA*	*Demand reduction through policy measures, water rates and new building codes*	*30% reduction per capita daily use*
MD12	Advanced Pressure Management (2)	Cape Town, RSA	Measurement of night time flows and investment in advanced control based on flow and time	40% saving on original water use
MD13	Leakage Reduction in a City * 2 (2)	Jeddah, KSA. Johannesburg, RSA	Network modifications; pressure management; active and passive leakage management	12% in Jeddah; 10% in Johannesburg
MD14	*Demand Management Strategy (2)*	*Singapore*	*Public engagement; pricing and metering; legislation on building codes*	*PCC reduced by 8% between 2003 and 2013*
MD15	*Domestic and Business Retrofit (2)*	*Sydney, AUS*	*Promoting use of water efficient devices; education; leakage detection; water audits and smarty metering*	*Total Water use reduced from 2001 to 2012 by 30%*
MD16	*Behavourial Change (2)*	*Zaragoza, ESP*	*Engagement and education and good practice promotion; financial incentives on purchase of water efficient products*	*25% reduction in daily water use between 1997 and 2008*

2.5 Industrial Water Sector

Table B-5: Industrial Water (Supply & Demand) Sector Examples

Measure	Measure	Country Example	Description/Summary	Water Saving Potential
IW1	Condensed Water cooling (1)	CHN	Power sector – raising concentration and reduction of wastewater discharge and freshwater withdrawals	33% reduction in consumption
IW2	Industrial Leakage (1)	RSA	Leakage reduction at facilities	30% reduction in leakage
IW3	*Water Efficient Washing (1)*	*RSA*	*Installation of spring valves on hoses in washing*	*10% reduction in consumption*
IW4	Recycling/re-use of treated water (1)	BRA	Optimisation of in plant water for low quality demand uses	20% reduction in consumption
IW5	*Sensitivity sensors (1)*	*BRA*	*Automation of water processes through improved monitoring*	*25% reduction in consumption*
IW6	Wastewater Reuse (Textile) (1)	CHN	Install treatment and recycling of wastewater internally	33% - 50% consumption savings
IW7	*Managing water towards zero discharge (2)*	*Lerma Chapala Basin, MEXICO*	*Recycling of wastewater for use as cooling water; Rainwater Harvesting on site; low water use fittings*	*47% reduction in groundwater abstraction; 50% reduction in volume use by staff*
IW8	Water reuse in the textile sector (2)	Tiruppur, IND	Upgrade of effluent treatment; sale of reclaimed water	Water Demand from river reduced by 75%
IW9	*Water use reduction strategy in the food sector to reduce business risk(2)*	*Mossel Bay, RSA*	*Installation of water measurement to record water use; recovery and use of condensate; low flow plumbing and staff awareness*	*Water use reduced by 50% at the factor and reduced water withdrawal leaving more available in Mossel Bay*
IW10	Water recycling in the food sector (2)	Durban, RSA	Reuse of process water and greywater via treatment; harvesting rainwater from roofs. Negligible use of municipal water supply	80% demand met by on site recycling; 20% by harvested rainwater and condensate capture leaving more water for local community

Appendix C
Challenges and Pressures on Water Security in Key Catchments

CHALLENGES AND PRESSURES ON WATER SECURITY IN KEY CATCHMENTS, EXTRACTED FROM THE SIX CATCHMENT BASIN WATER RESOURCE MANAGEMENT PLANS

Catchment	Major drivers, pressures and needs
Tumbes	**Water quantity challenges** • (On the supply side) Lack of infrastructure. Water infrastructures in this river basin district are obsolete or deteriorating. Capital asset replacement is almost non-existent. Furthermore, the design of infrastructures can be said to be ill-defined since it does not seem to take account of major drivers such as climate change or silting patterns due to intense deforestation in the area: i.e. sediment flows). • (On the demand side) Almost no use of new technologies and best practices in irrigation. Irrigation systems are mostly gravity-fed, flood or furrow irrigation, and use of ponds. In addition, some widespread crops are rice or banana trees, highly water-intensive. • (On the supply side) Overall, there is low efficiency in the systems for abstraction and conveyance of water. • (Flood risk management) The riverbed silting is one of the major concerns in the area. Sediment loads have dramatically increased due to deforestation of riparian areas and floodplains and intensive herding. River flows have been drastically altered, with hydromorphological alterations all over the place. In addition, drainage works or flood defences have been largely placed in inadequate locations, which leads to a deficient management of floods, water logging and flood risk management. **Water quality challenges** • Further to the geochemical composition upstream, there are major discharges of wastewater and several lacks in terms of drainage, which have led to an overall increase in the concentration of coliforms and nutrients (nitrogen, phosphorous), in the lower stretch of the basin, where most human settlements concentrate. • There is also disposal of solid waste in dumping sites throughout the riverbank. • In addition, there is discharge of agrochemical waste, a major source of diffuse pollution. This is clearly linked to the use of fertilisers, pesticides, or insecticides, further to pollution loads from cattle breeding (purines, etc.). • One of the main sources of pollution (and this problem is more critical in the Tumbes than in any other catchments) is mining in the upper catchment. Tailing basins contain sulphurs. Besides, the inadequate management of mercury when burning the amalgamate in the purification process of gold may also lead to major pollution loads. This is a critical problem, since most of the mining activity is in the neighbouring country of Ecuador. • Due to overexploitation of coastal aquifers, there is evidence of saline intrusion. This is especially clear in the Zarumilla basin or the gullies of Bocapán, Seca and Fernández.

Catchment	Major drivers, pressures and needs
Chira-Piura	**Water quantity challenges** • (On the supply side) Lack of adequate infrastructures for water regulation. With 2012 data, there seems to be a positive hydrological balance. Yet, the lack of adequate infrastructures (i.e. dams and reservoirs) partly prevents the use of those water resources. This lack of infrastructure is not an absolute one: Poechos rock-fill dam (built 1972, operating since 1976 with a useful life of 50 years) had an installed capacity of 1,000 hm3 (actual capacity due to silting is 885 hm3). • (On the supply side) Aging water and sanitation infrastructure. There is neither systematic nor major replacement of capital assets in those areas in which there is W&S infrastructure. In others this infrastructure is lacking. • (Combined outcome of supply and demand) Water scarcity affecting some urban areas. The joint effect of lack of water supply infrastructures and high electricity costs leads to severe scarcity in cities such as Talara and Paita. • (Climate change adaptation) Lack of response to extreme events. Chira-Piura is highly vulnerable to climate change and climate extremes; this is mainly so for agriculture and critical infrastructures. **Water quality challenges** • Discharge of raw sewage (e.g. at Sullana) resulting in surface and groundwater pollution due to waste and wastewater disposal (the latter from agriculture, manufacturing and mining). • In the upper and middle course of the Chira-Piura watershed, direct discharge of untreated domestic sewage can be explained by the lack of wastewater treatment infrastructure or rather operational problems (due to undersized capacity and lack of maintenance). In the city of Piura there are major discharges of industrial wastewater. • In the middle and lower course of the watershed, there is lack of maintenance of aerobic lagoons (the prevalent wastewater treatment systems) thus resulting in pollution. Furthermore, there is diffuse source pollution from unregulated mining and agricultural activities. • In the coastal are (Paita and Sechura seas), there is untreated wastewater discharge from manufacturing. • As per groundwater, there is lack of evidence (i.e. time series).
Chancy-Huaral	**Water quantity challenges** • (On the demand side) Population density increase (in certain areas) leading to supply problems. The population growth rate in the most populated districts of the basin district (Huaral, Chancay, and Aucallama) is around 10-20% (spreading towards the North of Greater Lima). This is linked to an expected water demand growth for domestic uses of 6-7 hm3 in the medium term, for an expected demand of 22+ hm^3.

Catchment	Major drivers, pressures and needs

- (On the demand side) Agricultural expansion. In the Añasmayo, Cárac and Huataya sub-catchments (middle stretch of the watershed), there are roughly 5,000 ha of agricultural land, in an area relatively close to Lima, growing highly profitable crops (fresh fruit). This implies a demand of some 27 hm3. Several features of this agriculture production contribute to water shortages: type of culture (prevalence of orchard instead of seasonal crops; decrease in productivity during wet period); and deteriorated Irrigation networks; and technified irrigation systems and soil and water conservation practices rarely in place.
- (On the demand side) Low water use efficiency in irrigation. Agriculture in the basin (21,165 ha; 337 hm3 of legal water rights for irrigation) is based on poor irrigation systems (intakes and canals either unlined or with deteriorated lining) based on inefficient irrigation techniques (i.e. flood irrigation), with an efficiency rate lower than 40%, and linked problems in terms of pollution and salinity. Return flows are widely used downstream (also for domestic uses). The main source for irrigation (and rural domestic supply) in the Chancay-Huaral valley, though, is groundwater (80-100 hm3), mostly through natural upwelling.
- (On the supply side) Insufficient water storage infrastructures for water resources exploitation and regulation in the main course of Chancay-Huaral River and in the middle-stretch sub-catchments. More than 50% of the non-exploited water surplus is generated in the upper basin of Chancay-Huaral River (potential storage volume during the wet period: 100 hm3). The upper Chancay-Huaral natural reservoirs, ponds and lakes and the Puajanca group of lakes could supply 75 hm3 during the dry period but many of them either are not currently under exploitation – they have not been prepared as artificial reservoirs – or structural damages have been detected in some of the exploited ones.
- (On the supply side) Additional pressures in the headwaters. In the upper and middle Chancay-Huaral catchment, which is relevant in terms of its contribution of long-term renewable water resources to the whole catchment, there is a good quality status and a negative population growth rate between 15 and 30%. These well-preserved areas are threatened though by regulated and unregulated mining activities leading to environmental liabilities, as well as by non-consumptive uses (i.e. hydropower leading to major hydromorphological alterations), or point and diffuse pollution (i.e. domestic sewage, wastewater from mining, etc.).

Water quality challenges

- Main pollution sources in the basin are mining material heaps, untreated domestic / industrial wastewater, raw sewage and agrochemicals. Data are scarce and therefore it is not easy to go beyond this. Problems mainly arise in rural areas (valley area: Aucallama and Chancay districts).
- Low sanitation coverage rates. Furthermore, WWTPs of Huaral and Chancay (both owned by the water utility EMAPA) are obsolete.
- Organic pollution (pathogens) due to untreated domestic wastewater discharges. Mainly in the middle and lower basin (Chancay river: downstream Acos and Añasmayo river, downstream La Perla).
- Inorganic pollution (metals: aluminium, manganese, iron).

Catchment	Major drivers, pressures and needs
	• As per groundwater pollution, knowledge gaps are a limiting factor. Presumably there is pollution from agriculture (return flows and agrochemicals) and wastewater infiltration, but no in-depth study has been carried out so far. There are public health concerns given direct consumption of water from wells.
Chancay-Lambayeque	**Water quantity challenges** • (On the supply side) There is not clarity regarding available long-term renewable resources. Besides, water infrastructure is both insufficient and deteriorating. Storage capacity is also insufficient. Estimated water surplus during the wet season that is not being used accounts for 200 hm3. Tinajones regulation system (lower basin) has an installed capacity of 1,000 hm3. Roughly 170 hm3 are not consumed as a result of low application technologies, lack of formal property rights, and insufficient and damaged drainage system. Furthermore, the aquifer has not been studied but estimations on the basis of monitored wells show a good potential (1,000 hm3). • (On the demand side) Prevalence of highly water-demanding crops (sugarcane, rice, corn, cotton and vegetables). Sugarcane and rice actually account for 75% of the irrigated area. The predominant irrigation system is gravity-fed schemes – only 0.7% of irrigated area, 650 ha, applies localized irrigation techniques. • (On the demand side) Lack of enforcement (and securitization) of water use rights, affecting both surface and groundwater. As an example, in the Taymi irrigation canal (900 intakes, 50-60 hm3 in dry years, 60-70 hm3 in an average year), despite the effort for formalization of rights, a majority of users still lack formal water rights. • (On the demand side) Lack of official estimation of irrigation efficiencies. There are global estimated values for the Tinajones regulated system (38%), where the expected theoretical efficiency was 70%. • (On the demand side) Preference for surface vs. groundwater (for irrigation). Surface water is available at a lower cost and there is lack of policies promoting conjunctive use. Use of reclaimed wastewater has not been confirmed in Tinajones. In certain areas, though, such as the agricultural district of San José (500 ha), sewage is directly used for irrigation with potential public health concerns. • (On the supply side) Low coverage of water services. In the upper and middle stretches of the catchment (i.e. Santa Cruz region), coverage for drinking water services is circa 30%. In the lower basin, in the area supplied by EPSEL, rates are 65% for drinking water and roughly 59% for sanitation. In rural areas (< 2,000 inhabitants), JAAS provide services but water supplied not always meets drinking standards. • (On the demand side) Soil degradation and loss in the middle and lower basin. This is probably the main challenge in the Tinajones system, due to salinity (middle and lower basin; roughly 48,000 ha, 50% of the irrigated area) and erosion processes (middle basin).

Catchment	Major drivers, pressures and needs
Chillón-Rímac-Lurín	**Water quality challenges** • Pollution sources in the Chancay-Lambayeque are not that different as compared to other basins. Pollution derives from untreated domestic, municipal and industrial wastewater, solid waste disposal, and agro-chemicals. According to ANA sampling there is no evidence of water pollution from mining activities. Pollution impacts are more severe due to the lack of appropriate purification and wastewater treatment infrastructures. • In the upper river basin, there is evidence of inorganic pollution (i.e. metals) and low pH levels (which may have a natural origin). • In what is actually a widespread problem in the country, there is no evidence of groundwater pollution due to the lack of information. According to some samples, though, there may be pollution due to agricultural activities (i.e. leachate of agro-chemicals) and wastewater infiltration, but no in-depth study has been carried out to date, according to information made available. **Water quantity challenges** • (On the demand side) Very low efficiency in the systems for abstraction and conveyance of water (irrigation: 33%; domestic use: 60-70%) • (On the supply side) There is an intense soil degradation and loss, leading, as in other catchments, to severe concerns about salinity and drainage. • (On the supply side) Very highly vulnerable river basins due to their topography and slope: severe floods and landslide problems (the so-callled 'huyacos'; aggravated by El Niño and land-use change and uncontrolled urban sprawl, including or mainly in Greater Lima, for more than three decades). Within this context, the priority locations to implement control and mitigation projects are micro-watersheds located in the Rímac and Santa Eulalia Rivers (Quirio, Pedregal, Paihua, Río Seco, Carosio, Cashahuacra, Corrales, Viso California, Santa María-Quirio, La Ronda, Cantuta-La Ronda, Pedregal-Carosio, La Cantuta and Cuchimachay,Chucumayo micro-watersheds). • (On the supply side) In what is a major challenge all over Peru, there is a significant infrastructural deficit and major leakages in the installed capacity. It should be taken into account that this multi-regional basin involves three regional government authorities: Regional Government of Callao, Regional Government of Greater Lima, and Regional Government of Lima), occasionally posing co-ordination challenges. **Water quality challenges** • There is evidence of severe surface / groundwater pollution problems (heavy metals: upper basin; organic: middle and low river basin; solid waste) due to mining, untreated domestic, industrial, and energy wastewater. a) Mining: mining material heaps in the Chillón Upper basin (affecting Chillón River headwaters: Lagunas Aguascocha, Verde Cocha, Chuchom, Chuchúm, León Cocha, Azulcocha, Cullhuay and Rihuancocha –Huaros District-, and lagunas Huiso, Yarcan, Huayhuinca y Tambillo –Arahuay-; laguna Quechaa o Quespe and Antacocha San Antonio, Huarochiri); Rímac River (20 out of 27 non

Catchment	Major drivers, pressures and needs
	operational concessions); and Lurín (abandoned mine land in Antioquia). b) Untreated domestic/industrial wastewater entails high treatment costs downstream (bulk water resources) for SEDAPAL, the water service operator. Farmer communities in the upper and medium basin directly consume bulk water (without previous purification). Wastewater treatment priority areas are in districts located in the upper Rímac River, such as Chicla, Casapalca, San Mateo, Surco, and Matucana.
Quilca-Chili	**Water quantity challenges** • (On the supply side) Critical information gaps. As in other catchments in the country, hydrological information is improvable, both on water availability and quality. It is not only that there are no sufficient monitoring stations; it is also that they are mostly inaccurate. Water sources inventories are either outdated or incomplete, including groundwater resources, which are widely used in the basin. Information gaps also refer to irrigation infrastructure and the potential for further exploitation in the Chili valley. • (On the supply side) Infrastructural deficit and major losses. Deteriorating when not lacking infrastructure (i.e. reservoirs and canals) is a limiting factor. There are major losses in storage, conveyance and distribution. • (On the demand side) Expected demand increase for household demand given current low levels of coverage. Further to the lack of infrastructure or the pollution of bulk water, household demand is expected to increase since coverage is still far from being universal (i.e. maximum coverage: SEDAPAR: 88.9%; lower coverage levels: 40% in Sabandía and Uchumayo, 20% ein Characato and Yura). • (On the demand side) Lack of metering and informal water use rights. Demand metering systems are clearly insufficient. Furthermore, user lacking formal water rights account for an estimated demand of 80 hm3, against the 68 hm3 of formal users. • (On the demand side) Expected increase of irrigation demand. Currently there is a significant water deficit for irrigation in some sectors of the Mollebaya (Pocsi, Placa, Mollebaya and Santa Ana) or Yarabamba (Quequeña) sub-catchments, as well as in the Yura sub-catchment (Yuramayo) or the Siguas river (Huanca Lluta, Querque, Taya, San Basilio, and Murco). In agriculture, gravity-fed systems are prevalent. • (On the demand side) Insufficient regulation of hydropower generation. Charcani (stations I, II and III) hydropower generation is limited to the flow level of the Chili regulated system. Regulations on consumptive vs. non-consumptive uses are not clear enough, although limitations to take advantage of the surplus (in wet years) may limit windfall profits. **Water quality challenges** • The Arequipa WWTP has an installed capacity for wastewater treatment that is clearly insufficient. This explains severe quality problems in Arequipa's metropolitan area (according to legal standards ECA1 A2): evidence of coliforms, heavy metals, BOD5 problems, and

Catchment	Major drivers, pressures and needs
	nitrates. • Heavy metals concentrations can be explained due to the upper basin geological features but also to human activities in the middle and lower basin: Sumbay River (Al); Chili River (Al, Mn, Fe); Zamácola Canal (Al); Tomilla purification plant inlet (Al, Mn, Fe); Añashayco Quebrada (Fe); Tingo Grande River (Fe, Mn). • In turn, BOD5 values in the Upper Quilca-Vitor-Chili are rather due to wastewater discharge from human settlements of less than 400 inhabitants, whereas in the Middle Quilca-Vitor-Chili this is explained by the concentration of settlements. Major problems might be expected in the lower catchment as well given the expected growth of high value-added agriculture and demographic change. • In addition, there are drainage and salinity challenges in the Vítor Valley, and specifically at La Joya irrigation district. In the Quilca River, salinity affects the lower stretch of the catchment, until its river mouth, due to adjacent irrigated areas in the Siguas grasslands. • Mining activities are also a significant driver in terms of pollution. As per formal mining, Sociedad Minera Cerro Verde will increase (from 2016 onwards) the amount of processes copper from 120,000 to 360,000 tons), given the current juncture in the international commodity markets. This may entail and increase of 1 m3/s of wastewater to be treated (potentially in the ongoing Enlozada WWTP). Informal mining has led to conflicts (mining-agriculture) at the Yarambamba sub-catchments. In addition, there 55 mining material heaps leading to severe environmental liabilities close to the Chili's riverbank. • The Chili River is also affected by domestic wastewater discharges (organic pollution: pathogens), and untreated effluents from farms and industries. • Regarding groundwater pollution, there is no information about it, besides some samples from wells supplying Arequipa city.
Tacna	**Water quantity challenges** • (On the supply side) Planning weaknesses have led to a relevant mismatch between infrastructure availability and actual needs. In the Tacna watershed, major and minor infrastructures have been built over the last few decades. It cannot be said to be an unregulated basin at all but this is compatible with infrastructural deficit. Major infrastructures include 2 small hydropower plants (Aricota 1 and 2, with an installed capacity of 35 MW) or the Jarumas Dam (12.5 hm3). In addition, the province of Tacna is mainly supplied from Paucarani dam (8 hm3). Two main challenges are to be faced: drought and drought risk management in irrigated agriculture and water supply for the main human settlements of the area (such as Tacna city). • (On the supply side) Interregional conflict. Transfer of water resources from Puno is the source of interregional conflicts between Tacna region and the regional governments of Moquegua and Puno. • (On the demand side) Expansion of irrigated land. In the upwaters of the catchment there is a relevant progress of cultivated land. In the past, there was an explicit acknowledgement of the potential to expand agriculture towards circa 80,000 additional ha (three times the arable land by 2000), mostly in Sama Hills (object of a Special Project) and La Yarada-Hospicio. Agricultural production in Tacna is mostly specialized in fodder crops (around 60% of irrigated area), which do not necessarily correspond to the productive features of the

Catchment	Major drivers, pressures and needs
	region, since these crops are highly water-intensive in a water scarce area. • (On the supply side) Water is mostly obtained from surface irrigation in the sub-catchments of Caplina, Uchusuma, Sama and Locumba, and from groundwater sources (i.e. 2.38 m^3/s) in La Yarada irrigation district, whose aquifer is clearly overexploited mostly due to outlawed abstractions. **Water quality challenges** • Despite the deficient quality of water, salinity does not seem to be a major problem due to the light texture of soils in the Tacna valley. In other words, salinity is not explained so much by soil composition but rather by the use of bad practices in irrigation. • There are concerns regarding salinity, though, in the Locumba sub-catchment and specifically in the lower stretch of the river and downstream Locumba and area adjacent to River Salado. • In the Lower Caplina, there are major problems of bacterial pollution due to household and industrial waste. Furthermore, in Sama and Locumba there are records of contamination due to chemical by-products or residues. • Large-scale mining activity is a driver of pollution in some spots of the river basin as well as in the river mouth (Ite Bay). • In La Yarada aquifer, due to lower phreatic levels, there is evidence of saltwater intrusion.

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Appendix D
Diagnoistc of Basin Results

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1. Diagnostic of Pre-screened Invesments per Basin

The following tables present the pre-screened investment alternatives (IA) per basin.

1.1 Tumbes Basin

See Table 1.1-1.

Table 1.1-1: Pre-screened IA Tumbes Basin

Investment Classification	Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practice Code
Infrastructure - Irrigation	1,980,498,353 S/.	1194	Rehabilitación y mejora de la infraestructura hidráulica menor (superficial y subterránea)	41,583,915 S/.	1	6	A14
		1203	Implementación de sistemas de riego tecnificado	23,325,700 S/.	1	15	A16
		1290	Construccion De Dique Y Descolmatacion De Caja Hidraulica Del Rio Zarumilla - Sector Lechugal; Distrito De Papayal	3,482,169 S/.	1	4	A15
		1357	Mejoramiento De La Irrigacion Hualtacal Sector Peña Blanca, Distrito De San Jacinto, Provincia De Tumbes	92,892 S/.	1	6	A14
		1364	Mejoramiento Del Canal Averias, Distrito Casitas - Contralmirante Villar Tumbes	111,798 S/.	1	6	A14
		1365	Mejoramiento Del Sistema De Riego Del Sector Oidor Alto, San Jacinto, Provincia De Tumbes	157,502 S/.	1	6	A14
		1373	Irrigacion Binacional Obras Hidrologicas Del Rio Puyango Tumbes	419,101,572 S/.	1	7	A12
		1388	Mejoramiento Del Sistema De Captacion De La Irrigacion Sector Urcos-Malval, Distrito De Corrales - Tumbes - Tumbes	175,395 S/.	1	6	A14
		1400	Construccion Presa Quebrada Fernandez - Tumbes	43,418,281 S/.	1	1	A12
		1412	Reposición De Caja Hidráulica De Canales Aductores De La Margen Izquierda, Sectores Rica Playa, Oidor Y Vaquería, Distrito De San Jacinto, Provincia Y Departamneto De	80,553 S/.	0	6	
		1417	Mejoramiento De Los Sistemas De Riego De Las Irrigaciones El Prado Bajo Y Área La Palma- El Prado Alto. Distrito Pampas De Hospital - Tumbes	1,724,455 S/.	1	6	A14
		1433	Mejoramiento De La Infraestructura Hidraulica Para Riego Agricola Del Sector Cerro Blanco - Distrito San Juan De La Virgen - Provincia Tumbes	1,567,844 S/.	1	6	A14
		1439	Mejoramiento Del Sistema De Riego Irrigacion Brujas Alta E Instalacion De Un Sistema De Riego En El Sector Fundo Las Palomas, Distrito De San Juan De La Virgen,	5,292,012 S/.	1	6	A14
		1488	Mejoramiento Del Canal De La Margen Izquierda Del Rio Tumbes Y Bocatoma La Peña - Region Tumbes	9,177,911 S/.	1	6	A14
		1493	Mejoramiento Del Canal Principal Del Sector De Riego Pampa Grande Progresiva 1+000-2+720 Distrito, Provincia Y Departamento De Tumbes	1,416,663 S/.	1	6	A14
		1513	Mejoramiento Del Sistema De Riego Sector El Algarrobal Parte Baja - Distrito De Matapalo Provincia De Zarumilla Departamento De Tumbes	1,245,856 S/.	1	6	A14
		1518	Instalacion De Toma Directa Y Obras De Protección, Grúa Puente De La Sala De Maquinas, Linea De Bombeo N 4 Y Equipo Complementario, En El Sistema De Captacion	8,750,557 S/.	0	7, 16	
		1580	Mejoramiento Del Servicio De Agua Para Riego De La Irrigacion Becerra-Belen Cabuyal Distrito De Pampas De Hospital, Provincia Y Departamento De Tumbes	9,309,266 S/.	1	6	A14
		1583	Irrigación De La Margen Derecha Del Río Tumbes	1,410,484,012 S/.	0	1, 7	A12,A13,A14
Infrastructure - Potable Water Supply and Sanitation	541,543,107 S/.	1191	Operación, mantenimiento y desarrollo de las infraestructuras de captación, transporte, drenaje y medición de agua de los operadores de infraestructura hidráulica	23,569,067 S/.	1	3	MS1
		1197	Operación, mantenimiento y desarrollo de la infraestructura de captación, transporte, tratamiento, medición y distribución de agua para uso poblacional y/u otros usos	96,294,000 S/.	1	3	MS1
		1199	Mejora de los sistemas e infraestructura hidráulica de abastecimiento de agua en áreas rurales	15,288,135 S/.	1	12	
		1200	Construcción de nuevas plantas de tratamiento y potabilización de agua para uso poblacional y/u otros usos	34,765,565 S/.	0	21	MS8
		1201	Ampliación de la red de suministro de agua para uso poblacional	27,445,344 S/.	0	12	MD1
		1223	Operación y mantenimiento de las Plantas de Tratamiento de las Aguas Residuales (PTAR)	7,035,000 S/.	1	22	A19
		1225	Operación y mantenimiento de las redes de alcantarillado	30,639,000 S/.	0	28	MD1
		1231	Construcción de PTAR con capacidad de tratamiento para el vertimiento a la calidad exigida	45,000,000 S/.	0	21	MD4
		1292	Mejoramiento Y Rehabilitacion Del Sistema De Saneamiento Basico Del Sector Nuevo Tumbes, Provincia De Tumbes - Tumbes	12,170,494 S/.	0	12	MD1
		1316	Mejoramiento Y Rehabilitacion Del Sistema De Agua Potable Del Sector Sur Del Distrito Canoas De Punta Sal, Provincia De Contralmirante Villar - Tumbes	5,986,912 S/.	0	12	MD1
		1317	Mejoramiento Y Ampliacion Del Sistema De Abastecimiento De Agua Potable Para Las Localidades De Cañaveral,Casitas,La Rinconada,Huaquilas,Tamarino,Averias Y Trigal	5,845,689 S/.	0	12	MD1
		1327	Ampliacion Del Sistema De Agua Potable De Los Caseríos De Cristales, Malval, Urcos Y San Francisco, Distrito De Corrales - Tumbes - Tumbes	1,139,400 S/.	0	12	MD1
		1333	Mejoramiento Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado De La Localidad De Matapalo Y Anexos , Distrito De Matapalo - Zarumilla - Tumbes	3,299,815 S/.	0	12	MD1
		1334	Mejoramiento Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado De La Localidad De Papayal Y Anexos , Distrito De Papayal - Zarumilla - Tumbes	5,612,842 S/.	0	12	MD1
		1344	Mejoramiento Y Ampliacion De Los Sistemas De Agua Potable Y Desague De La Localidad De Aguas Verdes Y Aa.Hh. , Distrito De Aguas Verdes - Zarumilla - Tumbes	15,879,937 S/.	0	12	MD1
		1375	Construccion De Laguna De Oxidacion, Linea De Impulsion, Sistema De Media Tension Y Equipamiento De Camaras De Bombeo Del Centro Poblado De Puerto Pizarro,	3,602,901 S/.	0	26	MS1
		1382	Mejoramiento Y Ampliacion Del Sistema De Agua Potable Y Alcantarillado De Los Centros Poblados Del Eje Costero Sur Comprendido Entre Las Localidades De Acapulco Al	10,109,610 S/.	0	12	
		1419	Instalacion Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado En El Aa. Hh. Los Claveles Del Sector Pampa Grande, Provincia De Tumbes - Tumbes	1,727,948 S/.	0	24	
		1420	Instalacion Del Sistema De Agua Potable Y Alcantarillado En El Aa. Hh. Las Flores Ii Etapa Del Sector Pampa Grande, Provincia De Tumbes - Tumbes	1,179,053 S/.	0	24	
		1431	Construccion Del Sistema De Drenaje Pluvial En El Casco Urbano De Zarumilla, Provincia De Zarumilla - Tumbes	6,531,749 S/.	0	20	
		1447	Ampliacion Y Mejoramiento Del Sistema De Agua Potable, Red De Alcantarillado, Tratamiento De Aguas Servidas En El Balneario De Punta Sal, Provincia De	4,518,825 S/.	0	12	MD1
		1462	Mejoramiento Y Ampliacion Del Sistema De Agua Potable Y Alcantarillado Del Sector La Garita Oeste, Buenos Aires, El Triunfo Y Cercado De Corrales Del Distrito De	2,028,947 S/.	0	12	MD1
		1466	Mejoramiento Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado De Las Localidades De San Juan De La Virgen Y Garbanzal , Distrito De San Juan De La Virgen	5,188,868 S/.	0	12	MD1
		1467	Mejoramiento Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado De La Localidad De Corrales Y Anexos - Corrales - Tumbes	19,619,545 S/.	0	12	MD1
		1481	Mejoramiento Del Sistema De Agua Y Alcantarillado En El Sector Parte Alta Del Barrio Las Delicias, Leoncio Prado Y Los Pinos Norte Del Distrito De Zorritos, Provincia De	1,060,250 S/.	0	12	MD1
		1485	Mejoramiento Del Sistema De Saneamiento Y Vial En El Barrio Jose F. Sanchez Carrion, Provincia De Contralmirante Villar - Tumbes	1,850,626 S/.	0	12	MD1
		1487	Mejoramiento Y Ampliación Del Sistema De Agua Potable Y Alcantarillado Zona De Expansión Urbana Del Sector Nuevo Tumbes, Provincia De Tumbes - Tumbes	36,836,044 S/.	0	12	MD1
		1492	Instalacion Del Servicio De Alcantarillado Y Disposicion Final De Aguas Servidas En El Distrito De Matapalo, Provincia De Zarumilla - Tumbes	3,955,410 S/.	0	28	
		1516	Instalacion Del Sistema De Alcantarillado Y Disposicion Final De Aguas Residuales Del Centro Poblado De Cañaveral Del Distrito De Casitas, Provincia De Contralmirante	3,025,138 S/.	0	28	
		1520	Construccion Del Sistema De Alcantarillado Y Planta De Tratamiento De Aguas Residuales De Las Localidades De Oidor, Casa Blanqueada Y Carretas , Distrito De San	4,885,932 S/.	0	21	
		1524	Mejoramiento Y Ampliacion Del Sistema De Alcantarillado Y Construccion De La Planta De Tratamiento De Aguas Residuales Para Las Localidades De Pechichal, San	13,825,491 S/.	0	28	MD1
		1525	Rehabilitacion Y Mejoramiento Del Sistema De Agua Potable Y Saneamiento De La Calle 28 De Julio Tramo Entre La Calle Arica Y Tarapaca Del Cercado De Zarumilla Del	1,126,171 S/.	0	12	MD1
		1526	Rehabilitacion Y Mejoramiento Del Sistema De Agua Potable Y Saneamiento Del C.P. Uña De Gato Del Distrito De Papayal, Provincia De Zarumilla - Tumbes	3,421,108 S/.	0	12	MD1
		1533	Mejoramiento Del Servicio De Agua Potable Y Saneamiento Del Aa.Hh Las Malvinas Del Distrito De Zarumilla, Provincia De Zarumilla - Tumbes	4,101,362 S/.	0	12	MD1
		1535	Instalacion Del Servicio De Alcantarillado Y Planta De Tratamiento De Aguas Residuales Del Caserio El Tablazo De Rica Playa Del Distrito De San Jacinto, Provincia De	4,701,605 S/.	0	21	MS8
		1538	Mejoramiento Del Servicio De Agua Potable Y Saneamiento Del Aa.Hh Edmundo Romero Del Distrito De Zarumilla, Provincia De Zarumilla - Tumbes	4,229,291 S/.	0	12	MD1
		1541	Mejoramiento Del Sistema De Captacion E Impulsion Para El Almacenamiento De Agua Potable En El Aa.Hh. Campo Amor Del Distrito De Zarumilla, Provincia De Zarumilla	1,199,288 S/.	0	12	MD1
		1546	Instalacion Del Servicio De Alcantarillado Del Caserio Tacural, Del Distrito De San Juan De La Virgen, Provincia De Tumbes - Tumbes	2,092,423 S/.	0	28	
		1542	Mejoramiento Del Abastecimiento De Agua Potable, Alcantarillado Y Construccion De La Planta De Tratamiento De Aguas Residuales, Para La Facultad De Ciencias Agrarias	2,973,850 S/.	0	12	MD1
		1555	Mejoramiento Y Ampliación De La Red Principal De Agua Y Alcantarillado Del Sector Nor Este Y Nor Oeste Del Aa Hh Los Claveles Pampa Grande Distrito De Tumbes,	7,033,676 S/.	0	12	MD1
		1557	Mejoramiento Y Ampliación De La Red Principal De Agua Y Alcantarillado Del Sector Sur Este Y Nor Oeste Del Aa Hh Las Flores Pampa Grande Distrito De Tumbes,	3,520,289 S/.	0	12	MD1
		1562	Creacion Sistema De Abastecimieto De Agua Potable Y Alcantarillado Del Aa.Hh Nueva Esperanza, Distrito De Aguas Verdes - Zarumilla - Tumbes	1,194,643 S/.	0	24	MD1
		1565	Instalacion De Los Servicios De Agua Potable Y Alcantarillado En El Barrio Jose Carlos Mariategui, Miraflores Y El Cc.Pp Cabuyal, Distrito De Pampas De Hospital, Provincia	9,913,365 S/.	0	24	
		1583	Rehabilitación y mejora de las infraestructuras de captación de agua para uso poblacional y/u otros usos	46,118,500 S/.	0	35	

		1229	Ampliación y construcción de nuevas redes de alcantarillado	55,169,944 S/.	0	28	
		1245	Protección y mejora de los puntos críticos ante fenómenos de riesgo hidrológico. Implementación de defensas ribereñas	90,731,931 S/.	0	16	
		1294	Construccion De Muro De Defensa Y Nivelacion De Calles Del Aa.Hh Tomas Arizola Del Distrito De Aguas Verdes De La Provincia De Zarumilla - Tumbes	1,120,487 S/.	0	16	
		1300	Defensa Ribereña En El Rio Tumbes Sector Huaquillas - Tumbes, Provincia Y Departamento De Tumbes	3,545,284 S/.	0	16	
		1318	Construccion De Defensa Ribereña En El Rio Tumbes Sector El Naranjo De La Comision De Regantes Casa Blanqueada, Distrito De San Jacinto, Provincia Y Region Tumbes	1,299,598 S/.	0	16	
		1332	Encimado De Ribera, Enrocado Y Descolmatación Del Rio, Sector El Palmar-Provincia De Tumbes	1,105,869 S/.	0	16	
		1346	Proteccion De Ribera Sector Prado Bajo	1,198,857 S/.	0	16	
		1349	Proteccion De Ribera Sector Papayal	1,167,015 S/.	0	16	
		1353	Mejoramiento De La Infraestructura Vial Urbana Y Drenaje Pluvial Del Asentamiento Humano Ampliacion Salamanca. , Provincia De Tumbes - Tumbes	2,424,184 S/.	0	20	
		1408	Recuperación Del Sistema De Protección De Áreas De Cultivo Del Sector Malval, Provincia Y Departamento De Tumbes	77,911 S/.	0	35	
		1432	Construccion De Defensas Ribereñas En Las Jurisdicciones De Cerro Blanco Y Santa Rosa Distrito De San Juan De La Virgen Y San Jacinto, Provincia Y Departamento De Tum	4,579,169 S/.	0	16	
		1448	Construccion De Defensa Ribereña Sector Pampa Grande, Distrito, Provincia Y Departamento De Tumbes	3,133,970 S/.	0	16	
		1450	Recuperacion Del Servicio De Proteccion De Areas Agricolas En La Margen Izquierda Del Rio Tumbes Sector Higueron, Distrito De San Jacinto, Provincia Y Departamento De	2,830,129 S/.	0	35	
		1452	Mejoramiento De La Infraestructura Vial Urbana Y Drenaje Pluvial Del Asentamiento Humano Alan Garcia Ii. , Provincia De Tumbes - Tumbes	3,314,470 S/.	0	20	
		1453	Mejoramiento De La Infraestructura Vial Urbana Y Drenaje Pluvial Del Asentamiento Humano Los Jardines. , Provincia De Tumbes - Tumbes	5,265,779 S/.	0	20	
		1454	Protección De Orilla Derecha De Quebrada Angostura Sector Colegio Horacio Zevallos - Canal Rusto La Inverna Distrito De Pampas De Hospital. Provincia Y Departamento D	1,198,031 S/.	0	16	
		1457	Construcción De Escollera Longitudinal En La Margen Izquierda Del Río Tumbes, Tramo San Jacinto - Plateros, Distrito De San Jacinto, Provincia Y Departamento De Tumbes	1,192,873 S/.	0	16	
		1459	Protección De Ribera Izquierda Del Río Tumbes, Sector Santa Rosa - La Peña, Distrito San Jacinto, Provincia Y Departamento De Tumbes.	1,105,803 S/.	0	16	
		1460	Defensa Ribereña En El Rio Tumbes Sector Pampagrande	1,429,669 S/.	0	16	
		1475	Mejoramiento De La Infraestructura Vial Urbana-Drenaje Pluvial Del Sector Noreste Del Barrio Pampa Grande Del Distrito De Tumbes , Provincia De Tumbes - Tumbes	7,504,281 S/.	0	20	
		1482	Mejoramiento De La Infraestructura Vial Urbana Y Drenaje Pluvial De La Calle Prolongacion 09 De Octubre Y Pasaje Gitano Del Distrito De Zarumilla, Provincia De Zarumilla	1,052,799 S/.	0	20	
		1486	Mejoramiento De Las Capacidades Del Sector Público Y De La Sociedad Civil Para La Gestion De La Conservación De Bosques Para Mitigar El Cambio Climático En 5 Regione	36,509,453 S/.	0	37	
		1489	Mejoramiento Del Drenaje Pluvial Del Ingreso Principal Del I.E.S.T.P Cap.Fap.Jose Abelardo Quiñones De La Provincia De Tumbes - Region Tumbes	2,342,167 S/.	0	20	
Infrastructure - Stormwater and Flood Risk Management	911,599,766 S/.	1503	Instalacion De Los Servicios De Protección En El Sector Quebrada Miraflores, En La Localidad De Oidor, Distrito De San Jacinto, Provincia De Tumbes, Región Tumbes	1,084,891 S/.	0	16	
		1509	Mejoramiento De La Infraestructura Vial,Peatonal Y De Drenaje Pluvial Del Sector La Rocana Del Aa.Hh. Campo Amor Del Distrito De Zarumilla, Provincia De Zarumilla - Tu	8,775,375 S/.	0	20	
		1510	Mejoramiento De La Infraestructura Vial, Peatonal Y De Drenaje Pluvial Del Sector 30 De Diciembre Del Aa.Hh. Campo Amor Del Distrito De Zarumilla, Provincia De Zarumil	4,259,577 S/.	0	20	
		1514	Instalacion De Servicio De Protección De Rivera En El Sector Margen Derecha Del Rio Tumbes Localidad Cabeza De Lagarto Distrito De Pampas De Hospital Provincia Y Depa	9,805,608 S/.	0	16	
		1516	Instalacion Del Servicio De Protección Contra La Erosión En El Sector El Progreso Romero, Margen Derecha Del Rio Tumbes, En El Distrito, Provincia Y Región Tumbes	3,099,020 S/.	0	16	
		1517	Creacion Defensa Ribereña Margen Izquierda Del Rio Zarumilla - Tramo Comprendido Entre Pueblo Nuevo Y La Bocatoma La Palma - Papayal - Zarumilla - Tumbes	37,868,149 S/.	0	16	
		1536	Instalación Del Servicio De Protección Contra Las Inundaciones En Las Localidades De La Palma - Canario Ii, Margen Izquierda Del Rio Zarumilla (Progresiva 0+120 -	35,196,287 S/.	0	16	
		1553	Instalacion Del Drenaje Pluvial De La Ciudad De Tumbes, Provincia De Tumbes - Tumbes	80,025,088 S/.	0	20	
		1543	Mejoramiento Del Servicio De Infraestructura Vial-Peatonal Y Drenaje Pluvial En Villa San Isidro, Distrito De Corrales - Tumbes - Tumbes	3,806,858 S/.	0	20	
		1547	Ampliacion Del Servicio De Proteccion Contra Inundacion En El Sector El Naranjo - Casablanqueada Del Distrito De San Jacinto, Provincia De Tumbes Y Departamento De T	8,144,160 S/.	0	16	
		1552	Mejoramiento Y Proteccion De La Infraestructura De Evacuacion De Las Aguas Pluviales De La Quebrada Piedritas Y Disminucin De La Vulnerabilidad , Distrito De Aguas Ver	1,108,721 S/.	0	20	
		1556	Instalacion De Los Servicios De Proteccion Margen Izquierda Del Río Tumbes Sector Vista Hermosa - Distrito De Corrales, Provincia Y Departamento De Tumbes.	2,622,853 S/.	0	16	
		1560	Creacion De Los Servicios De Proteccion En La Margen Izquierda De La Quebrada San Juan, En El Sector Del Camal, Del Distrito De San Juan De La Virgen, Provincia De Tum	1,369,651 S/.	0	16	
		1564	Mejoramiento Del Servicio De Proteccion De La Captacion Bocatoma La Peña, Sector Puente Francos - Bocatoma La Peña - Distrito De Pampas De Hospital, Provincia, Depa	6,700,749 S/.	0	16	
		1566	Instalacion Del Servicio De Proteccion Contra Inundacion En El Sector Tamarindo, El Peligro Margen Izquierda Del Rio Tumbes Distrito De San Jacinto, Provincia Y Departam	6,818,661 S/.	0	16	
		1567	Instalacion Del Servicio De Protección Contra La Erosión En El Sector El Progreso Romero, Margen Derecha Del Rio Tumbes, En El Distrito, Provincia Y Región Tumbes	3,769,383 S/.	0	17	
		1568	Instalacion De Los Servicios De Proteccion A Zona De Produccion En El Sector Las Palmeras, Distrito De San Juan De La Virgen, Provincia Y Departamento De Tumbes	7,399,528 S/.	0	16	
		1570	Instalacion De Los Servicios De Proteccion Margen Derecha Del Rio Tumbes Sector Capatacion Puerto El Cura-Pampa Grande Del Distrito, Provincia Y Region Tumbes	8,535,282 S/.	0	16	
		1571	Instalacion Del Servicio De Proteccion Contra Inundaciones En El Sector La Rinconada Con Dique Enrrocado Margen Derecha Del Rio Tumbes Progresiva 0+00 A La 1+838 Di	8,920,291 S/.	0	16	
		1572	Instalacion Del Servicio De Protección De Las Estaciones De Bombeo En El Sector Brujas Alta Y Brujas Baja, Margen Derecha Del Rio Tumbes, En El Distrito San Juan De La	3,907,372 S/.	0	16	
		1573	Instalacion De Los Servicios De Proteccion De La Margen Derecha Del Rio Tumbes Sector La Inverna - Distrito De Pampas De Hospital, Provincia Y Departamento De Tumbe	9,028,900 S/.	0	16	
		1576	Instalacion Servicio De Proteccion Contra Inundacion En El Rio Tumbes Margen Derecha Sector Romero - Huaquillas En El Distrito, Provincia Y Departamento De Tumbes	9,167,902 S/.	0	16	
		1577	Instalacion Del Servicio De Protección De Las Estaciones De Bombeo En El Sector Brujas Alta Y Brujas Baja, Margen Derecha Del Rio Tumbes, En El Distrito San Juan De La V	3,237,009 S/.	0	16	
		1579	Mejoramiento Del Dren Pluvial La Rocana Del Sector La Rocana Del Aa.Hh. Campo Amor Del Distrito De Zarumilla, Provincia De Zarumilla - Tumbes	2,054,787 S/.	0	20	
		1580	Instalacion Del Servicio De Proteccion Contra Inundacion En El Rio Tumbes Margen Izquierda Sector Vaquería - Distrito De San Jacinto, Provincia De Tumbes Y Departame	9,202,086 S/.	0	16	
		1248	Recuperación, limpieza y descolmatación de los cauces y drenes tras fenómenos de crecidas	1,164,214 S/.	0	16	
		1249	Detección y control de la deforestación	1,000,000 S/.	0	35	A16
Non-Infrastructure Investments	22,075,259 S/.	1387	Reforestación de la cuenca con especies autóctonas	9,838,169 S/.	0	30	
		1569	Mejoramiento De La Conservacion De Los Ecosistemas Del Distrito De Matapalo, Provincia De Zarumilla - Tumbes	4,284,279 S/.	0	33	
		1574	Mejoramiento De Las Capacidades De Conservacion Del Ecosistema Y Recuperacion De Biodiversidad De Los Centros Poblados La Coja, Lechugal Y Pueblo Nuevo Del Distrit	2,592,696 S/.	0	33	
		1577	Mejoramiento De La Calidad De Servicio De Capacitacion Y Asistencia Tecnica De La Direccion De Competitividad Agraria De La Direccion Regional De Agricultura Tumbes Z	3,195,901 S/.	1	12	A15

1.2 Chira Piura Basin

Table 1.2-1: Pre-screened IA Chira-Piura Basin

Investment Classification	Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practice Code
Infrastructure - Irrigation	490,107,165 S/.	83	Construccion De Canal Norte Km39+200 Al Km55+842 - Valle Del Chira	33,506,017 S/.	0	7	A14
		105	Entrenamiento En Riego Tecnificado Y Asistencia Técnica-Perat 2009	4,602,356 S/.	1	15	A14
		107	Construccion Sistema De Drenaje Norte Dren Nd8 - Valle Del Chira	4,230,375 S/.	1	7	A14
		113	Mejoramiento Del Canal Lateral San Fernando C.P. La Golondrina Marcavelica, Distrito De Marcavelica - Sullana - Piura	3,728,330 S/.	1	6	A14
		197	Mejoramiento Del Sistema De Riego Del Sub Sector Pabur, En El Distrito De La Matanza, Provincia De Morropon	8,839,630 S/.	1	6	A14
		205	Construccion De Bocatoma Y Mejoramiento Del Canal Huerequeque Km. 0 Al 6+040 De La Subcuenca Charanal -Distrito De Chulucanas, Provincia De Morropon - Piura	5,382,699 S/.	0	6	A14
		209	Mejoramiento Del Servicio De Agua Para Riego De Los Sectores El Ingenio, La Pilca Y Tamarindo Buenos Aires, Provincia De Morropon - Piura	3,565,576 S/.	1	6	A14
		214	Mejoramiento Del Servicio De Agua Para Riego Agricola Del Canal La Tercera En La Localidad De Paccha Ciudad De Chulucanas, Provincia De Morropon - Piura	3,125,652 S/.	1	6	A14
		318	Instalacion Del Sistema De Riego Tecnificado La Matanza-Palturan-El Chorro Del Caserio El Milagro, Distrito De Huarmaca - Huancabamba - Piura	2,522,100 S/.	1	15	A14
		381	Mejoramiento Del Servicio De Agua En El Sistema De Riego De La Microcuenca San Lorenzo Distrito Lalaquiz, Provincia De Huancabamba - Piura	6,033,653 S/.	1	6	A14
		482	Instalacion De La Minirepresa Y Creacion Del Sistema De Riego Del Sector Palo Blanco, Distrito De Pacaipampa - Ayabaca - Piura	9,664,837 S/.	1	4	A15
		484	Mejoramiento Del Sistema De Conduccion Del Agua Para Riego En El Sector Espindola , Cc Samanga Del Distrito De Ayabaca, Provincia De Ayabaca - Piura	7,342,665 S/.	1	6	A14
		649	Mejoramiento De La Infraestructura De Riego Del Canal Ramal Nuevo - El Arenal, Distrito De Colán, Provincia De Paita, Piura	8,133,558 S/.	1	6	A14
		654	Mejoramiento De La Infraestructura De Riego Sector Santa Elena - San Francisco, Distrito De Colan - Paita - Piura	6,584,414 S/.	1	6	A14
		656	Mejoramiento De La Infraestructura De Riego Del Canal Principal Pueblo Nuevo - Distrito Colan, Provincia De Paita - Piura	5,991,290 S/.	1	6	A14
		734	Mejoramiento Del Servicio De Agua Del Sistema De Riego De Los Canales De Ii Orden - Ii Etapa Del Distrito De Rinconada Llicuar, Provincia De Sechura - Piura	6,113,025 S/.	1	6	A14
		738	Mejoramiento Del Sistema De Riego Menor De Segundo Orden, Canal La Antonia: Toma San Andrés Prog. 0+00 Km. A Prog. 5+500 Km. C.P San Clemente Distrito De Bellavista	3,591,407 S/.	1	6	A14
		766	Mejoramiento Del Servicio De Agua Del Sistema De Riego Del Canal 10.4 En La Localidad C.P. 10, Caserio Las Monicas - San Lorenzo, Distrito De Tambogrande, Provincia De Piu	17,695,846 S/.	1	6	A14
		767	Mejoramiento Del Servicio De Agua Del Sistema De Riego Del Canal Tg-Malingas Del , Distrito De Tambo Grande - Piura - Piura	11,962,037 S/.	1	6	A14
		768	Mejoramiento Del Servicio De Agua Del Sistema De Riego Del Canal Lateral M-19,9 - El Inca , Zona De Malingas Del , Distrito De Tambo Grande - Piura - Piura	10,218,094 S/.	1	6	A14
		769	Mejoramiento Del Sistema De Riego Canal Lateral 22-5 - Valle De Los Incas Del, Distrito De Tambo Grande - Piura - Piura	9,324,787 S/.	1	6	A14
		771	Mejoramiento Del Sistema De Riego Del Canal Lateral T-50, Sector Algarrobo - Zona La Peñita Del, Distrito De Tambo Grande - Piura - Piura	7,255,372 S/.	1	6	A14
		773	Mejoramiento Y Revestimiento Del Canal Marañon Distrito De La Union, Provincia De Piura - Piura	4,895,415 S/.	1	13	A14
		775	Mejoramiento Del Canal Castillo - Potrero, Tramo 3.00 Km En La Progresiva (0+000 - 2+000) Canal Castillo; Progresiva (0+000 - 1+000) Canal Potrero En El Distrito El Tallan	4,203,902 S/.	1	6	A14
		778	Mejoramiento Canal De Riego Monteviejo Tramo Km 2+040-7+100 La Union,Piura,Piura	3,236,454 S/.	1	6	A14
		1172	Afianzamiento Del Reservorio Poechos - Sistema Hidraulico Chira - Piura	298,357,674 S/.	1	3	A15
		1	Mejoramiento Y Ampliación De Los Sistemas De Agua Potable, Alcantarillado Y Tratamiento De Aguas Residuales De La Ciudad De Talara - Distrito De Pariñas, Provincia De Talar	267,540,107 S/.	0	21	
		2	Mejoramiento Y Ampliación De Los Sistemas De Agua Potable Y Alcantarillado En El Distrito De Mancora - Talara	38,315,333 S/.	0	21	
		3	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado En La Urb. Felipe Santiago Salaverry I Y Ii Etapa E Instalacion De Planta De Tratamiento De Aguas Residuales Y Reu	27,252,857 S/.	0	24, 28, 21	
		4	Mejoramiento Y Ampliación Del Sistema De Agua Potable Y Alcantarillado Del Distrito De Los Órganos, Provincia De Talara - Piura	12,594,171 S/.	0	24, 28	
		5	Ampliacion, Mejoramiento Del Sistema De Agua Potable Y Saneamiento Básico De Negritos, Distrito De La Brea - Talara - Piura	10,714,120 S/.	0	12, 24, 28	
		10	Mejoramiento De Las Redes De Agua Potable A Nivel De Eps Grau S.A. - Departamento De Piura	5,913,873 S/.	0	12	
		11	Mejoramiento, Ampliacion Del Sistema De Agua Potable Y Alcantarillado En Los Barrios Bellavista, Primavera, Centro Y Nueva Ciudad De Lobitos Lobitos, Distrito De Lobitos - Tala	6,282,564 S/.	0	24, 28	
		13	Instalacion De Nueva Planta De Tratamiento De Aguas Residuales Del Distrito De Los Organos, Provincia De Talara - Piura	4,586,369 S/.	0	21	
		29	Rehabilitacion De La Red De Agua Potable Y Alcantarillado En Los Parques 43 Al 57, Distrito De Pariñas, Provincia De Talara - Piura	3,070,223 S/.	0	12	
		81	Instalacion Del Sistema De Agua Potable Y Alcantarilladó De La Habilitacion Urbana Asociacion Para El Desarrollo Urbano Del Distrito De Sullana Ii Etapa - Provincia Sullana - Dep	59,069,086 S/.	0	24, 28	
		82	Construccion Del Sistema De Agua Potable Y Letrinizacion En Cieneguillo Sur Y Centro - Sullana, Provincia De Sullana - Piura	34,628,748 S/.	0	24	
		84	Instalación de 3 sistemas de desinfección en las cuencas de la RH Pacífico con déficits hídricos, con su correspondiente sistema de conducción y almacenamiento de aguas residua	24,030,000 S/.	0	21	
		85	Mejoramiento Del Servicio De Agua Potable En Loma De Teodomiro Y Nueva Esperanza Del Distrito De Sullana, Provincia De Sullana - Piura	19,591,463 S/.	0	12	
		86	Mejoramiento Del Sistema De Agua Potable Y Saneamiento De Los Centros Poblados Del Distrito De Querecotillo, Provincia De Sullana - Piura	16,005,241 S/.	0	12, 24	
		88	Mejoramiento Del Servicio De Agua Potable E Instalación Del Servicio De Alcantarillado De La Villa Huangalá Distrito De Sullana, Provincia De Sullana - Piura	11,347,857 S/.	0	12, 24	
		89	Mejoramiento Y Rehabilitacion Del Servicio De Agua Potable Y Alcantarillado De La Avenida Jose De Lama Del Distrito De Sullana, Provincia De Sullana - Piura	10,955,918 S/.	0	12, 24	
		90	Instalacion Del Servicio De Agua Potable Y Alcantarillado En Los A.H. Jesus Maria, Villa La Paz, Los Olivos, Nueva Esperanza, Villa Maria Y 15 De Marzo De Sullana Provincia De S	9,984,910 S/.	0	12, 24	
		91	Mejoramiento Del Servicio De Agua Potable En La Zonal Sullana De La Eps Grau S.A.	9,939,947 S/.	0	12	
		92	Mejoramiento Del Colector San Miguel Desde La Calle Felix Jaramillo Hasta La Camara De Bombeo Del Distrito De Sullana, Provincia De Sullana - Piura	11,775,261 S/.	0	24, 28	
		93	Construccion Del Sistema De Agua Potable Y Alcantarillado De La Asociacion Para El Desarrollo Urbano Del Distrito De Sullana, Provincia De Sullana, Departamento De Piura	9,765,357 S/.	0	24, 28	
		95	Ampliacion Y Mejoramiento Del Sistema De Agua Potable Y Alcantarillado En El Centro Poblado San Juan De La Virgen Del Distrito De Ignacio Escudero, Provincia De Sullana - Pi	8,399,687 S/.	0	24, 28	
		101	Mejoramiento Del Sistema De Agua Y Alcantarillado Del Caserio Santa Cruz Del Distrito De Querecotillo, Provincia De Sullana- Piura, Provincia De Sullana - Piura	6,190,948 S/.	0	24, 28	
		114	Mejoramiento Del Dren Pluvial Y Calles Colectoras Del Barrio Sur Del Distrito De Salitral, Provincia De Sullana - Piura	3,708,834 S/.	0	20	
		193	Instalacion Del Sistema De Abastecimiento De Agua Potable Y Recoleccion De Aguas Servidas Para La Habilitacion Urbana Valle Camila Del Distrito De Chulucanas - Provincia De	27,445,389 S/.	0	12, 24, 28	
		194	Mejoramiento Y Ampliacion Del Sistema De Agua Potable Y Construccion Del Sistema De Alcantarillado En El Centro Poblado Laynas, En El Distrito De La Matanza, Provincia De M	9,961,551 S/.	0	12, 24, 28	
		196	Mejoramiento Del Sistema De Agua Potable E Instalacion Del Sistema De Alcantarillado Del Caserio Carrasquillo - Distrito De Buenos Aires, Provincia De Morropon - Piura	8,940,184 S/.	0	12, 24, 28	
		198	Mejoramiento Del Sistema De Agua Potable Y Alcantarillado En La Localidad De Santo Domingo -Distrito De Santo Domingo, Provincia De Morropon - Piura	8,312,957 S/.	0	12, 24, 28	
		199	Mejoramiento Y Ampliación Y Sistema De Agua Potable Y Alcantarillado En La Localidad De Yamango Y Anexos Flor De Agua, Victor Raúl, Alto San José, La Laguna, La Loma, Alto	8,151,464 S/.	0	12, 24, 28	
		399	Mejoramiento Del Servicio De Agua Potable E Instalacion Del Servicio De Alcantarillado En La Localidad De Tunal, En El Distrito De Lalaquiz, Provincia De Huancabamba , Distrito I	6,309,340 S/.	0	12, 24, 28	
		400	Ampliacion Del Sistema Integral De Agua Potable Y Alcantarillado-Letrinizacion De Las Localidades De Las Huacas, Chanrro, Piedra Azul, Loma Larga Baja, Loma Larga Alta, Distri	8,300,373 S/.	0	12, 24, 28	
		476	Ampliacion Y Mejoramiento Del Sistema De Abastecimiento De Agua Potable Y Alcantarillado Y Tratamiento De Aguas Residuales De La Ciudad De Huancabamba, Distrito De Hua	38,056,234 S/.	0	12, 24, 28	
		646	Instalacion Del Servicio De Agua Potable Y Alcantarillado De Los Centros Poblados Yacila, La Islilla Y La Tortuga Del Distrito De Paita, Provincia De Paita - Piura	20,832,425 S/.	0	12, 24, 28	

Infrastructure - Potable Water Supply and Sanitation	1,926,868,601 S/.	647	Instalacion De Los Servicios De Agua Potable Y Alcantarillado En Los Anexos Comunales De Villa Los Algarrobos,Nuevo Jerusalen,Villa Hermosa,Ignacio De Loyola,Nuevo Paraiso	14,727,361 S/.	0	12, 24, 28
		648	Instalacion Del Servicio De Agua Potable Y Alcantarillado En Los A.H. De Miramar, Consuelo De Velasco, Maria Parado Bellido, Ampliacion 2 De Agosto, Los Laureles Del Distrito D	9,981,692 S/.	0	12, 24, 28
		650	Mejoramiento Del Servicio De Agua Potable En La Zonal Paita De La Eps Grau S.A.	8,062,944 S/.	0	12
		652	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado De Los Aa.Hh. El Tablazo, El Tablazo San Francisco Y Tablazo San Francisco Del Distrito, Provincia De Paita - Piura	7,340,798 S/.	0	12, 24, 28
		653	Construccion Del Sistema De Agua Potable Y Saneamiento En Centro Poblado La Islilla, Provincia De Paita - Piura	6,935,721 S/.	0	12, 24, 28
		655	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado De La Ciudad Blanca Sector 3 - Distrito De Paita, Provincia De Paita - Piura	6,048,276 S/.	0	12, 24, 28
		657	Mejoramiento Y Ampliación Del Sistema De Agua Y Alcantarillado Tamarindo , Distrito De Tamarindo - Paita - Piura	7,408,376 S/.	0	12, 24, 28
		661	Mejoramiento De Las Redes De Alcantarillado En La Urbanizacion Isabel Barreto Ii Etapa, Provincia De Paita - Piura	3,732,515 S/.	0	24, 28
		662	Rehabilitacion De La Captacion Y Estacion De Bombeo Del Arenal Eje Paita Talara	3,214,820 S/.	0	5
		725	Ampliacion Y Mejoramiento De Los Servicios De Agua Potable Y Alcantarillado De La Ciudad De Sechura, Provincia De Sechura - Piura	42,640,999 S/.	0	12, 24, 28
		732	Mejoramiento Del Sistema De Agua Potable Y Alcantarillado En El Distrito De Bernal, Provincia De Sechura - Piura	10,239,303 S/.	0	12, 24, 28
		766	Mejoramiento De Las Redes De Agua Potable Y Alcantarillado De La I, Ii, Iii, Iv Etapa De La Urb. Piura, A.H Los Ficus I, Ii Etapa Y Las Malvinas Del Distrito De Piura - Piura	18,345,467 S/.	0	12, 24, 28
		869	Mejoramiento Y Ampliación Del Servicio De Agua Potable Y Saneamiento En El Sector Medio Piura, Distrito De Castilla - Piura - Piura	16,946,980 S/.	0	12, 24, 28
		871	Mejoramiento Ampliacion Del Sistema De Agua Potable E Instalacion De Alcantarillado En Los Caserios Dos Altos, Nuevo Tamarindo, Santa Cruz, Tunape Y Arroyo Mío En El Dis	15,936,218 S/.	0	12, 24, 28
		872	Ampliacion Y Mejoramiento Del Sistema De Agua Potable Y Alcantarillado En El A.H. San Martin Del Distrito De Piura, Provincia De Piura - Piura	14,712,988 S/.	0	12, 24, 28
		873	Construcción De Nueva Planta De Tratamiento De Aguas Residuales Del Distrito De Catacaos, Provincia De Piura- Piura	13,040,812 S/.	0	12, 24, 28
		874	Construccion Del Sistema De Agua Potable Y Alcantarillado Del Conjunto Habitacional Aypate, Distrito De Piura, Provincia De Piura - Piura	10,778,634 S/.	0	12, 24, 28
		875	Mejoramiento Del Servicio De Agua Potable En La Zonal Piura Catacaos Las Lomas De La Eps Grau Sa.	9,895,149 S/.	0	12
		876	Ampliacion Y Mejoramiento De Sistema De Agua Potable Y Alcantarillado En El Centro Poblado La Cruceta Del, Distrito De Tambo Grande - Piura - Piura	9,993,343 S/.	0	12, 24, 28
		877	Instalacion Del Sistema De Agua Potable Y Alcantarillado De La Iii Etapa Del Boulevard Park Plaza Miraflores Country Club Castilla-Piura	9,988,388 S/.	0	12, 24, 28
		878	Instalacion Del Sistema De Agua Potable Y Alcantarillado De La Urbanizacion Residencial Magisterial Del Distrito, Provincia Y Departamento De Piura	9,979,751 S/.	0	12, 24, 28
		879	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado En La Urbanizacion Miraflores, Distrito De Castilla - Piura - Piura	9,967,328 S/.	0	12, 24, 28
		880	Ampliación, Rehabilitación Y Mejoramiento Del Servicio De Agua Potable Y Alcantarillado De Las Intersecciones: Prolongación Av. Grau, Av. Chulucanas, Av. Circunvalación, Av. M	9,964,404 S/.	0	12, 24, 28
		880	Mejoramiento Y Ampliacion Del Sistema De Agua Potable Y Alcantarillado En La Ciudad De Morropon, Caserios El Chorro Y Zapotal, Distrito De Morropon, Provincia De Morropon,	9,964,901 S/.	0	12, 24, 28
		881	Ampliacion Y Mejoramiento Del Sistema De Agua Y Alcantarillado Del Centro Poblado De Cucungara, Distrito De Cura Mori, Provincia De Piura - Piura	9,964,389 S/.	0	12, 24, 28
		882	Mejoramiento Del Sistema De Agua Potable E Instalacion De Alcantarillado En El Sector Noreste Del Distrito De La Union, Provincia De Piura - Piura	10,588,712 S/.	0	12, 24, 28
		883	Instalacion Del Sistema De Agua Potable Y Alcantarillado De La Ii Etapa De La Habilitacion Urbana Boulevard Park Plaza Miraflores Country Club - Distrito De Castilla - Departamer	9,893,270 S/.	0	12, 24, 28
		884	Instalacion Del Servicio De Agua Potable Y Letrinas En Los Caserios Puerta Pulache-Nuevo Maray-Nueva Santa Rosa-Nueva Esperanza -Nueva Esperanza Baja-Barrio Libre-Santa	9,823,625 S/.	0	12, 24, 28
		885	Instalacion Del Sistema Integral De Los Servicios De Agua Potable Y Alcantarillado De La Urbanización Miraflores Country Club Del Distrito De Castilla - Piura - Piura	9,497,465 S/.	0	12, 24, 28
		886	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado En La Av. Juan Bosco Tramo Prolongacion Tacna - Mario Galan Piura - Piura	9,449,364 S/.	0	12, 24, 28
		887	Instalacion Del Sistema De Agua Potable Y Alcantarillado De La 1Era Etapa Del Boulevard Park Plaza Miraflore - Castilla - Piura	9,027,555 S/.	0	12, 24, 28
		888	Mejoramiento Del Sistema De Agua Potable E Instalacion Del Sistema De Alcantarillado Y Planta De Tratamiento En Los Caserios De Loma Negra Y Santa Elena Del Distrito De L	8,623,347 S/.	0	12, 24, 28
		890	Rehabilitacion De Redes De Agua Potable Y Alcantarillado En El A.H. Almirante Miguel Grau I Y Ii Etapa Del Distrito De Piura, Provincia De Piura - Piura	7,501,912 S/.	0	12, 24, 28
		891	Rehabilitacion Del Sistema De Agua Potable Y Alcantarillado En El A.H Tupac Amaru I Y Ii Etapa, En El Distrito De Piura, Provincia De Piura - Piura	6,798,699 S/.	0	12, 24, 28
		892	Rehabilitacion De Las Redes De Agua Potable Y Alcantarillado En La Av. Grau En El Tramo Comprendido Entre Av. Cesar Vallejo Y Av. Chulucanas Y La Av. Chulucanas Tramo Co	6,717,536 S/.	0	12, 24, 28
		893	Instalacion Del Sistema De Agua Potable Y Alcantarillado De La 1Era Etapa De La Habilitacion Urbana Urbanizacion Las Palmeras - Distrito Castilla - Provincia Piura - Departament	6,572,016 S/.	0	12, 24, 28
		898	Mejoramiento Del Servicio De Agua Potable Y Alcantarillado Del Aa.Hh. Santa Rosa, Sectores 1, 2, 4 Y 5 Distrito De Piura, Provincia De Piura - Piura	5,947,044 S/.	0	12, 24, 28
		899	Rehabilitacion De Redes De Agua Potable Y Alcantarillado En El A.H. San Pedro, Distrito De Piura, Provincia De Piura - Piura	5,937,719 S/.	0	12, 24, 28
		904	Instalacion Del Sistema De Agua Potable Y Letrinas En Los Caserios De San Pedrillo, Nuevo San Pedro, Charancoposo, La Pala, Cp - 10 - Zona Curvan Del, Distrito De Tambo Gr	6,602,029 S/.	0	12, 24, 28
		906	Instalacion De Redes De Agua Potable Y Alcantarillado En La Habilitacion Urbana Santa Margarita Distrito De Piura, Provincia De Piura	5,673,296 S/.	0	12, 24, 28
		909	Construccion De Pozo Tubular Y Mejoramiento De Reservorio Elevado En La Urbanizacion Piura - Distrito De Piura - Provincia Piura - Departamento De Piura	4,649,062 S/.	0	12, 24, 28
		913	Construccion De Sistema De Agua Potable Y Eliminacion De Excretas En El Centro Poblado De Palominos Y Cruce De Vega - Zona Curvan Del, Distrito De Tambo Grande - Piura -	5,441,319 S/.	0	12, 24, 28
		915	Instalacion Del Sistema De Abastecimiento De Agua Potable Y Recoleccion De Las Aguas Servidas En La Habilitacion Urbana Montebello - I Y Ii Etapa Del Distrito De Piura - Piura	4,251,433 S/.	0	12, 24, 28
		919	Instalacion Del Servicio De Agua Potable Y Saneamiento En El Caserio Cruz De Caña Y Anexos, Distrito De Castilla - Piura - Piura	3,981,694 S/.	0	12, 24, 28
		920	Mejoramiento Del Abastecimiento De Agua Potable Y Evacuación De Las Aguas Residuales En La Habilitacion Urbana Las Casuarinas, Distrito De Piura - Piura - Piura	3,971,183 S/.	0	12, 24, 28
		925	Instalacion Del Servicio De Agua Potable Y Eliminación De Excretas En Los Caseríos De Monteverde Alto, Monteverde Bajo Y La Salinas De La Zona De Malingas Del, Distrito De	3,711,875 S/.	0	12, 24, 28
		930	Rehabilitacion Y Construcción De Redes De Agua Y Alcantarillado De La Av. B Desde La Mz. H De I Merino-Calle Gladiolos-Avifap, Av. D, Av. Algarrobos, Calle 5 - Av S.Cerro, Call	3,164,715 S/.	0	12, 24, 28
		931	Instalacion Del Sistema De Tratamiento De Aguas Servidas En La Habilitacion Urbana Los Portales -Piura-Piura	3,158,954 S/.	0	12, 24, 28
		932	Mejoramiento Del Colector Principal De Alcantarillado En La Av. Chulucanas Entre Las Avenidas Circunvalacion Y El Tallan Y Desde El Dren Petro Peru Hacia La Camara San Mar	3,136,491 S/.	0	12, 24, 28
		1190	Instalación de sistemas de desinfección	520,760,000 S/.	0	29
		2136	Ampliacion Y Mejoramiento De La Planta De Tratamiento De Aguas Residuales Domesticas San Martin - Region Piura	123,683,335 S/.	0	22
		2139	Instalacion Y Ampliacion De Los Sistemas De Agua Potable Y Alcantarillado En Los Aa.Hh.Villa Maria,Nueva Esperanza,Los Olivos,Villa La Paz,Pilar Nores,Jesus Maria Y 15 De Ma	21,531,106 S/.	0	12, 24, 28
		2144	Instalacion Del Servicio De Agua Potable Y Alcantarillado Para La Habilitacion Urbana Parque Industrial De Piura, En El Distrito,Provincia Y Departamento De Piura	7,704,690 S/.	0	12, 24, 28
		2145	Mejoramiento De La Linea De Conduccion De Agua Potable De Diametro 600 Mm Tramo Desde La Ptap El Arenal Hasta La Camara De Valvulas T-5 Del Eje Paita-Talara Distrito Y	6,891,348 S/.	0	12, 24, 28
		2146	Instalacion De Redes De Agua Potable Y Alcantarillado En La Habilitacion Urbana Santa Margarita - Ii Etapa,Del Distrito,Provincia Y Departamento De Piura	5,565,797 S/.	0	12, 24, 28
		2149	Mejoramiento Del Sistema De Abastecimiento De Agua Potable De Las Habilitaciones Urbanas Las Casuarinas, Sol De Piura, Villas Del Sol De Piura Y La Planicie Del Distrito De P	3,203,737 S/.	0	12, 24, 28
		2192	Ampliacion De Los Servicios De Agua Potable Y Alcantarillado En El Asentamiento Humano Las Dalias De La Ii Y Iii Etapa, Distrito, Provincia Y Departamento De Piura	4,023,925 S/.	0	12, 24, 28
Infrastructure - Stormwater and Flood Risk	126,296,864 S/.	6	Mejoramiento Del Sistema De Evacuacion De Las Aguas Servidas De La Camara Central Talara - Talara - Piura	11,432,457 S/.	0	20
		94	Creacion Del Sistema De Drenaje Pluvial De Las Calles Jose Galvez, 03 De Mayo, Panamericana, Calle E, Sanchez Cerro Y San Martin Anexo Monte Lima Del Distrito De Ignacio E	8,828,399 S/.	0	20
		96	Mejoramiento Del Sistema De Drenaje Pluvial Del Sector San Pedro Alto Del Anexo De San Pedro Del Distrito De Ignacio Escudero, Provincia De Sullana - Piura	8,316,682 S/.	0	20
		98	Creacion Del Sistema De Drenaje Pluvial De Los Sectores San Martin, Belén Y Primavera Del Anexo San Jacinto Del Distrito De Ignacio Escudero, Provincia De Sullana - Piura	7,416,540 S/.	0	20
		102	Construccion De Defensa Ribereña Rio Chira Sectores Santa Cruz - La Margarita - Distrito De Querecotillo - Sullana - Piura	5,590,789 S/.	0	16
		109	Mejoramiento Del Sistema De Drenaje Pluvial De Las Calles Jerusalen Entre La Calle 28 De Julio Y El Porton Santa Rosa Del Anexo De San Miguel Distrito De Ignacio Escudero, P	4,198,785 S/.	0	20

Management		658	Construccion Del Sistema De Drenaje Pluvial Del Centro Poblado Vichayal, Distrito De Vichayal, Provincia De Paita - Piura	6,062,816 S/.	0	20	
		660	Sistema De Evacuación Por Bombeo Dren El Litoral - Pueblo Nuevo De Colan - Distrito De Colán	3,736,037 S/.	0	20	
		726	Creacion Del Sistema De Drenaje Pluvial En La Villa Becara, Distrito De Vice - Sechura - Piura	6,518,198 S/.	0	20	
		739	Defensa Ribereña Río Piura Margen Derecha Sector Cordillera - Poso Oscuro Alto, Distrito Bernal, Provincia Sechura - Piura	3,461,052 S/.	0	16	
		1168	Instalacion Del Sistema De Drenaje Pluvial En La Expansion Urbana Coscomba - Sector Los Polvorines De La Ciudad De Piura, Provincia De Piura - Piura	60,735,109 S/.	0	20	
Other Infrastucture	98,800,000 S/.	2	Recarga artificial en 5 acuíferos aluviales.	41,300,000 S/.	1	33	MS7
		725	Control vertimientos procedentes de las EPS	57,500,000 S/.	0	28	
Non-Infrastructure Investments	205,509,412 S/.	80	Gestión de glaciares y lagunas andinas	158,000,000 S/.	1	36	
		200	Ampliacion De La Cobertura Forestal Para Mejorar Los Servcios Ambientales En La Subcuenca Chalaco, Distrito De Chalaco, Provincia De Morropon, Region Piura.	7,324,688 S/.	0	30	
		494	Mejoramiento De Los Servicios Hídricos En Los Bosques De Las Comunidades De Mostazas, Samanga, Tapal, Yanta, Cujaca, Tacalpo, San Bartolomè De Los Olleros, Suyupampa	2,184,724 S/.	1	31	
		2267	Estudio efectos cambio climático en recursos hídricos	10,000,000 S/.	0	36	
		1765	Restauración hidrológica-forestal de la cuenca. Recuperación de la vegetación de ribera.	10,000,000 S/.	0	33	
		2219	Estudios de potencial de desalinización de aguas de mar para consumo humano en unidades hidrográficas con ciudades costeras importantes y/o riego de zonas agrícolas de expor	10,000,000 S/.	1	9	
		2249	Implementar y evaluar el PNRH	8,000,000 S/.	0	36	

1.3 Chancay – Lambayeque Basin

Table 1.3-1: Pre-screened IA Chancay - Lambayeque Basin

Investment Classification	Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practice Code
Infrastructure - Irrigation	305,842,745 S/.	1913	Construcción de Sistema de Irrigación Chota	30,550,000 S/.	0	7	A14
		1926	Mejoramiento del canal de riego San José distrito de San José-La mbayeque	8,646,286 S/.	1	6	A14
		1962	Mejoramiento de Canal de Riego Morrope	24,000,000 S/.	1	6	A14
		1963	Mejoramiento del servicio de agua para riego del canal Zanjón, distrito de Mochumi-Lambayeque-La mbayeque	6,634,256 S/.	1	6	A14
		1970	Mejoramiento del Canal de Riego Chuchicol-Ferreñafe	3,580,000 S/.	1	6	A14
		1972	Mejoramiento del Canal de Riego Carpintero Tramo 0+000 Km al 5+000 Km-Ferreñafe	3,210,000 S/.	1	6	A14
		2080	Mejoramiento del cauce del Canal Taymi Antiguo	60,000,000 S/.	1	16	
		1974	Mejoramiento del servicio de agua para riego en el canal el Padre en el sector de Capote, Distrito de Picsi, Provincia de Chiclayo, Departamento	4,331,674 S/.	1	6	A14
		1975	Mejoramiento del canal de riego El Padre del distrito de Mochumi, provincia de La mbayeque-La mbayeque	4,294,186 S/.	1	6	A14
		1976	Mejoramiento del servicio de agua para riego en el canal Chiclayo distrito y provincia de Chiclayo, departamento de Lambayeque	13,816,347 S/.	1	6	A14
		1977	Mejoramiento del servicio de agua de riego del canal Huaca Blanca del subsector de riego Chongoyape	4,144,903 S/.	1	6	A14
		1978	Mejoramiento del servicio de agua para riego del canal Mirador subsector de riego Chongoyape	3,465,964 S/.	1	6	A14
		1981	Mejoramiento del servicio de agua para riego agrícola en el canal Tocnope en el subsector de riego Chiclayo, distrito La Victoria, provincia	9,890,000 S/.	1	6	A14
		1983	Mejoramiento del servicio de agua para riego en las localidades de Santa Rosa, Achiramayo y El Hualte, distrito de Ninabamba-Santa Cruz-	5,070,000 S/.	1	6	A14
		1984	Instalación del servicio de irrigación parte alta de Chugur-Distrito de Chugur-Hualgayoc-Cajama rea	13,490,000 S/.	0	7	A14
		1984	Instalación de irrigación en la parte alta de Chugur, distrito de Chugur-Hualgayoc-Cajama rea.	13,490,000 S/.	0	7	A14
		1986	Instalación del sistema de riego en la localidad de Perla mayo, Tres Lagunas y Anexos, distrito de Chugur-Hualgayoc-Cajama rea.	3,630,000 S/.	0	7	A14
		1987	Construcción del sistema integral de riego de la localidad de Tindibamba, distrito de Chancay Baños-Santa Cruz-Caja marca.	6,540,000 S/.	0	7	A14
		1988	Mejoramiento del canal de riego El Sinchau-Tambillo Bajo, distrito de Chugur-Hualgayoc-Cajama rea	4,980,000 S/.	0	6	A14
		1997	Mejoramiento de los canales de riego Pi cuy-Mu na na-El Tingo e instalación del sistema de riego tecnificado caserío Mu na na, distrito de Cata	3,190,000 S/.	0	6,15	A14
		2000	Mejoramiento de los sistemas de riego de los caseríos de Tres Ríos, Chuclapampa, Rupahuasi, Llamapampa, El Milagro, Baños de Quilcatey	9,520,000 S/.	0	6	A14
		2001	Mejoramiento de los si temas de riego de los caseríos Nuevo Progreso, Quilcate, San Mateo, distrito de Catilluc-San Miguel-ea ja marca.	9,470,000 S/.	0	6	A14
		2003	Instalación del sistema de riego tecnificado en localidades rurales deTongod, distrito de Tongod-San Miguel-Caja marca.	11,600,000 S/.	0	15	A14
		2005	Construcción del sistema integral de riego de los caseríos de Chiriconga, Cusich, Chupanyo y el Molino, distrito de Chancay-Baños Santa Cruz-	9,560,000 S/.	0	7	A14
		2009	Instalación de los servicios de agua para riego en la Comunidad Campesina deTocmoche, distrito de Tocmoche, provincia de Chota, región	22,480,000 S/.	0	7	A14
		2011	Mejoramiento y ampliación del servicio de agua para riego en la localidad de San Juan de Licupis, distrito de San Juan de Licupis, 0.73 provincia	3,020,000 S/.	1	6	A14
		2067	Instalación del sistema de drenaje agrícola en el sector Mórrope-Sasape, valle Chancay Lambayeque, departamento Lambayeque	13,239,129 S/.	1	7	A11
Infrastructure - Potable Water Supply and Sanitation	141,032,269 S/.	1900	Proyecto alternativo de captación de agua para abastecimiento poblacional de la provincia de Chiclayo	18,200,000 S/.	0	24	
		1926	Mejoramiento del sistema de agua potable e instalación del sistema de alcantarillado del centro poblado Pacherres, distrito de Pucalá -Chiclayo -	8,646,286 S/.	0	24, 28	
		1930	Mejoramiento de las redes de agua potable y alcantarillado con conexiones domiciliarias de las calles comprendidas dentro del perímetro Av.	8,338,521 S/.	0	24, 28	
		1930	Mejoramiento de las redes de agua potable y alcantarillado con conexiones domiciliarias de las calles comprendidas dentro del perímetro Av.	8,338,521 S/.	0	24, 28	
		1931	Mejoramiento de las redes de agua potable y alcantarillado con conexiones domiciliarias de las calles comprendidas dentro del perímetro	4,053,545 S/.	0	24, 28	
		1938	Mejoramiento e instalación del servicio de agua potable y alcantarillado en los caseríos Punto Cuatro, Los Coronados La Piedra, Palo Parado y	4,296,941 S/.	0	24, 28	
		1938	Mejoramiento e instalación del servicio de agua potable y alcantarillado en los caseríos Punto Cuatro, Los Coronados La Piedra, Palo	4,296,941 S/.	0	24, 28	
		1939	Ampliación, mejoramiento de los servcios de agua potable y saneamiento de la ciudad de Chongoyape, distrito de Chongoyape-Chiclayo-	19,248,300 S/.	0	24	
		1940	Mejoramiento, ampliación del servicio de agua potable y alcantarillado de las localidades de La Laguna, El Potrero, Romero Circa,	9,327,543 S/.	0	24, 28	
		1941	Mejoramiento del sistema de agua y letrinización de los caseríos de El Huate, La Laguna, Cercado de Ninabamba, distrito de Ninabamba -Santa	6,680,000 S/.	0	24	
		1942	Mejoramiento y ampliación del sistema de agua potable y saneamiento básico con biodigestores en los caseríos de Chugur, distrito de	3,070,000 S/.	0	24	
		2047	Mejoramiento, ampliación del servicio de agua potable y alcantarillado de las localidades de La Laguna, El Potrero, Romero Circa,	3,360,000 S/.	0	24, 28	
		2050	Mejoramiento, ampliación del servicio de agua potable, tratamiento de agua residuales con biogestores en caseríos del distrito de Pulan, distrito	3,280,000 S/.	0	24, 21	
		2051	Mejoramiento, instalación de la red colectora de aguas servidas y drenaje pluvial de la localidad de Pomalca, distrito de Pomalca-Chiclayo-	7,879,462 S/.	0	28, 20	
		2052	Mejoramiento del emisor sur La Victoria, distrito de La Victoria-Ch i el ayo-La mbayeque	26,136,209 S/.	0	24	
		1973	Construcción del Revestimiento del Canal San José de la Ciudad de Lambayeque, Provincia de Lambayeque-Lambayeque	5,880,000 S/.	1	1	A1
Infrastructure - Stormwater and Flood Risk Management	184,305,321 S/.	2075	Construcción de defensas ribereñas en el río Chancay-Lambayeque en los tramos de riesgo identificados por la ALA	43,760,000 S/.	0	16	
		2077	Construcción de defensas ribereñas en las márgenes del río Reque en los distritos de Ciudad Eten y Monsefú, provincia de Chiclayo y	13,279,704 S/.	0	16	
		2076	Encauzamiento y protección río Chancay sector canal El Pueblo y sector Santa Rosa-Huaca Blanca-distrito Chongoyape, provincia de Chiclayo y	3,221,923 S/.	0	16	
		2084	Implantación de una red de alerta temprana integrada en un sistema automático de información hidrológica (SAIH)	7,850,000 S/.	0	11	
		2078	Instalación del servicio de protección en la quebrada Pacherrez sector Pacherrez-Caballo Blanco, distrito de Pucalá, provincia de Chiclayo.	4,829,475 S/.	0	16	
		2082	Instalación del sistema de drenaje pluvial en el área urbana, distrito de Mochumi-Lambayeque-Lambayeque	4,642,243 S/.	0	20	
		2081	Instalación del sistema de drenaje pluvial urbano en la ciudad de La Victoria, distrito de La Victoria-Chiclayo-Lambayeque	60,151,976 S/.	0	20	
		2066	Afianzamiento del mantenimiento del sistema de drenaje	24,250,000 S/.	0	20	
		2079	Obras de control integral de inundaciones en la cuenca media y baja del valle Chancay Lambayeque, provincia de Chiclayo, región y	22,320,000 S/.	0	16	
Other Infrastructure	568,816,721 S/.	1904	Afianzamiento de mantenimiento de la infraestructura hidráulica	4,500,000 S/.	1	12	
		1916	Construcción de la Represa Pisit Santa Cruz, Provincia de Santa Cruz Cajamarca	133,187,389 S/.	1	1	
		1914	Instalación de la presa de Embalse Montería y Obras conexas, distrito de Chongoyape, provincia de Chiclayo, Departamento de Lambayeque.	431,129,332 S/.	1	1	
Non-Infrastructure	4,240,000 S/.	2069	Recuperación de áreas degradadas, mediante la forestación y reforestación de la zona rural de Tongod, distrito de Tongod-San Miguel -	4,240,000 S/.	0	30	

1.4 Chancay – Huaral Basin

Table 1.4-1: Pre-screened IA Chancay - Huaral Basin

Investment Classification	Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practice Code
Infrastructure - Irrigation	232,268,314 S/.	1666	Construccion De La Represa De La Laguna Yacoco Yunca	1,643,268 S/	1	1	A15
		1668	Construccion De La Represa De Quipacaca	4,258,208 S/	1	1	A12
		1670	Mejoramiento Y Ampliación Del Servicio De Almacenamiento De Agua Para Uso Agrícola-Presa Caccray-Santa Cruz De Andamarca-Huaral-Lima	3,846,812 S/	1	2	A15
		1671	Mejoramiento Y Ampliacion De Los Reservorios De Tuctucancha Y Huayrupampa En La Comunidad Campesina De Sumbilca, Distrito De Sumbilca,	3,279,511 S/	1	2	A15
		1675	Mejoramiento Del Canal Yanamachay De Coto, Distrito De 27 De Noviembre - Provincia De Huaral - Lima	2,031,550 S/	1	6	A14
		1677	Mejoramiento De La Infraestructura De Riego Canal Palpa Bajo	1,328,783 S/	1	6	A14
		1683	Mejoramiento Del Canal De Riego La Concevida En La Comunidad Campesina Y Distrito De Santa Cruz De Andamarca, Provincia De Huaral - Lima	2,033,870 S/	1	6	A14
		1684	Mejoramiento Del Canal Caqui, Valle Chancay, Provincia De Huaral	1,148,077 S/	1	6	A14
		1685	Canal Matriz Huaralica - Tutumo	2,612,801 S/	0	7	A14
		1697	Aprovechamiento y reserva distribuida mediante reservorios en parcelas y agrupaciones de parcelas: Cárac 0.6MMC; Añasmayo 1.3MMC; Huataya	4,159,000 S/	1	4	A15
		1698	Represamiento De Las Lagunas Callauparac Y Chucuni - Yancao, Distrito De Ihuari - Huaral - Lima	2,391,434 S/	1	2	A14
		1700	Afianzamiento de Lagunas mediante la construcción y rehabilitación de mini presas en la cuenca Chancay-Huaral	33,500,000 S/	1	4	A12
		1701	Recuperación 11 reservorios de regulación diaria abandonados en el valle: Candelaria, Galeano, Las Salinas, Laure, Huando, Huarangal, Las Mercedes,	7,900,000 S/	1	4	A15
		1702	Mejora de distribución (construcción de medidores e instalación de compuertas) y capacitación en el uso de estos a la Junta de Usuarios	3,900,000 S/	1	6	A14, A16
		1749	Desarrollo de nuevos reservorios asociados a la mejora en eficiencia y tecnificación del riego. Quipacaca (en Añasmayo, 1-2MMC) y Yaco Coyonca (en	20,715,000 S/	1	4 y15	A20
		1750	Mejora de eficiencia y tecnificación de riego (Cárac 2.3MMC; Añasmayo 3.3 MMC; Huataya 4.7MMC)	5,200,000 S/	1	2	A20
		1752	Afianzamiento de Lagunas Largo Plazo. Las lagunas y el incremento de volumen : Rahuite (rehabilitación, 2MMC), Uchumachay (rehabilitación, 1.6MMC)	26,500,000 S/	1	4	A12
		1753	Aprovechamiento de excedentes mediante la construcción de grandes reservorios: Reservorio Purapa (en Vichaycocha, 6 -12MMC) y reservorio en	62,140,000 S/	1	4	A12
		1754	Regadíos en el Valle. Modernización de estructura de distribución. Recubrimiento de canales de derivación (133km) de primer orden (228km) y de	32,760,000 S/	1	13	A14
		1755	Sistema de uso conjuntivo racionalizado de aguas superficiales y subterráneas mediante la perforación de 20-25 pozos para la inclusión áreas	10,920,000 S/	1	2, 5	A14
Infrastructure - Potable Water Supply and Sanitation	235,648,797 S/.	1687	Instalación De Los Servicios De Agua Potable Y Saneamiento En Los Sectores 4, 5 Y 6 Del Pueblo Joven 03 De Octubre Del Distrito De Huaral	4,245,441 S/	0	24	
		1690	Instalacion De Redes Agua Potable Y Alcantarillado En San Graciano , Distrito De Aucallama - Huaral - Lima	1,573,356 S/	0	28	
		1709	Tratamiento Primario. PTAR urbana para la cuenca Chancay-Huaral	26,330,000 S/	0	21	
		1710	Construcción de sistemas parciales de alcantarillado urbano en la cuenca Chancay-Huaral	80,000,000 S/	0	21, 27	
		1722	Sobre la base de los resultados de los estudios anteriores se desarrollará un programa de intervenciones, con medidas estructurales y no estructurales.	45,500,000 S/	0	30	
		1758	Lagunas de oxidación en poblaciones rurales de la Cuenca Baja	23,000,000 S/	0	26	
		1759	Tratamiento secundario PTAR urbana	30,000,000 S/	0	21	
		1760	Sistema completo alcantarillado urbano	25,000,000 S/	0	21, 28	
Other Infrastructure	5,000,000 S/.	1764	Intervenciones de Protección	5,000,000 S/	0	16	
Non-Infrastructure	12,200,000 S/.	1698	Siembra de agua y mejoramiento de la capacidad de retención y filtración -AMUNAS	2,200,000 S/	1	31	MS6
		1765	Restauración hidrológica-forestal de la cuenca. Recuperación de la vegetación de ribera	10,000,000 S/	0	30	

1.5 Quilca – Chili Basin

Table 1.5-1: Pre-screened IA Quilca - Chili Basin

Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practice Code
NA			NA	NA	NA	
NA			NA	NA	NA	
44,200,000 S/.	1829	Infraestructura de defensa de zonas pobladas	25,000,000 S/.	0	16	
	1830	Mejora de la infraestructura de drenaje deficitario	5,000,000 S/.	0	16, 20	
	1888	Mantenimiento y limpieza de cauces y torrenteras	11,700,000 S/.	0	16	
	1897	Sistema de prevención y contingencia ante inundaciones. Sistema de alerta temprana	2,500,000 S/.	0	16	
1,093,600,003 S/.	1771	Mejoramiento de los sistemas de medición. Implementación de hidrometría de aguas de retorno.	4,000,000 S/.	0	11	
	1777	Regulación del río Yura	38,000,000 S/.	1	3	
	1779	Drenaje integral en La Joya y Vítor.	14,000,000 S/.	0	20	A11
	1795	Operación y mantenimiento de la red de aguas superficiales	9,600,000 S/.	0	11, 25	
	1796	Operación y mantenimiento de la red de aguas subterráneas	2,400,001 S/.	1	11, 25	
	1844	Incremento de la regulación en el río Chili. Represamiento del río Sumbay	800,000,000 S/.	1	3	
	1845	Regulación del río Siguas	170,000,000 S/.	1	3	
	1846	Incremento de la regulación en la cuenca oriental	30,000,000 S/.	1	3	
	1850	Mejoramiento de infraestructura de captación, conducción y distribución	1,000,000 S/.	0	3	
	1854	Implementación de infraestructura de regulación y fomento del reuso de aguas tratadas en zonas rurales. PTAR con reúso cuenca oriental	3,600,000 S/.	1	3, 10	MS7
	1855	Operación y mantenimiento de la red de aguas superficiales	16,800,000 S/.	1	11, 25	
	1856	Operación y mantenimiento de la red de aguas subterráneas	4,200,002 S/.	1	11, 25	
650,200,009 S/.	1776	Programa integral de seguridad de presas e infraestructura mayor	10,000,001 S/.	0	36	
	1813	Promoción de inversiones para el desarrollo de infraestructura hidráulica	20,000,000 S/.	1	38	
	1814	Plan de abastecimiento a centros poblados	100,000,001 S/.	0	38	
	1815	Plan de saneamiento a centros poblados	100,000,002 S/.	0	38	
	1824	Sensibilización para la valoración del agua, la corresponsabilidad y participación en la GIRH	2,000,000 S/.	1	39	
	1826	Recuperación, innovación, desarrollo de prácticas de uso y conservación de recursos hídricos	1,600,000 S/.	1	39	
	1827	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	2,400,002 S/.	1	39	
	1870	Promoción de inversiones para el desarrollo de infraestructura hidráulica	10,000,002 S/.	1	38	
	1871	Plan de abastecimiento a centros poblados	200,000,000 S/.	0	38	
	1872	Plan de saneamiento a centros poblados	200,000,000 S/.	0	38	
	1884	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	4,200,001 S/.	1	39	

1.6 Tacna Basin

Table 1.6-1: Pre-screened IA Tacna Basin

Investment Classification	Total Investment	Investment Code in Original Database	Brief Description of Investment / Project	Capital Investment	cuenca	Contributes to Closing Water Balance Gap (1=Yes, 2=No)	Typology of Investment	Best Practi Code
Infrastructure - Irrigation	659,412,286 S/.	1589	Agrupación De Proyectos Relacionados Con La Mejora General De Algunos Riegos Agrícolas En La Región Tacna	144,034,259 S/.	Tacna	1	3	A14
		1594	Mejoramiento Del Canal Uchusuma Bajo	32,640,000 S/.	Caplina	1	6	A14
		1595	Mejoramiento Del Canal Caplina, Tramo Challata-Para En La Cc.Rr. Bajo Caplina	40,300,228 S/.	Caplina	1	6	A14
		1591	Mejoramiento Del Canal Chiquitoma-Calleraco-Centro Poblado Totora-Candarave-Tacna	3,811,832 S/.	Locumba	1	6	A14
		1600	Entubado De Laterales Y Riego Tecnificado En Las Comisiones De Regantes De Uchusuma Y Magollo	4,861,752 S/.	Caplina	1	12	A12
		1599	Construcción De Reservorios De Regulación En Cerro Blanco (Región De Tacna)	90,000,000 S/.	Caplina	1	1	A12
		1598	Construcción De Reservorios De Regulación En Calientes (Región De Tacna)	112,000,000 S/.	Caplina	1	1	A12
		1596	Entubado Canal De Riego Copare	9,500,000 S/.	Caplina	1	12	A14
		1660	Mejoramiento Del Servicio De Agua Para Riego En La C.R. Calacala (Cairani-Candarave)	19,712,785 S/.	Locumba	1	12	A14
Infrastructure - Potable Water Supply and Sanitation	821,038,562 S/.	1663	Proyectos De Reducción De Consumos, Tratamiento De Residuos Y Reutilización De Aguas	252,000,000 S/.	Tacna	1	10, 12	
		1656	Proyectos De Potabilización De Aguas Para Suministro Poblacional, Mejora De Redes Y Reservorios De Distribución Y Depuración De Aguas Residuales Previo Al Reúso O Retorno A Fuentes Naturales En	38,556,045 S/.	Locumba	0	29 Y 28 Y 10	
		1606	Agrupación De Actuaciones De Mejora De Redes De Distribución En Baja Para El Suministro A La Población De Tacna	67,187,587 S/.	Caplina	0	12	
		1658	Proyectos De Potabilización De Aguas Para Suministro Poblacional, Mejora De Redes Y Reservorios De Distribución Y Depuración De Aguas Residuales Previo Al Reúso O Retorno A Fuentes Naturales En	68,636,180 S/.	Tacna	0	16	
		1597	Mejoramiento De La Infraestructura De Captación De Las Comunidades De Vilavilani E Higuerani	10,560,000 S/.	Caplina	0	8	
		1632	Mejoramiento Y Ampliación De Los Servicios De Agua Potable Y Saneamiento En El Centro Poblado De Cambaya, Distrito De Ilabaya, Jorge Basadre	1,519,523 S/.	Locumba	0	31	
		1654	Mejoramiento Del Servicio De Almacenamiento Y Regulación De Agua Potable Para Villa Locumba, Jorge Basadre	1,668,074 S/.	Locumba	0	12	
		2174	Mejoramiento Del Servicio De Agua Potable En El Subsector 23 Y 26 Del Sector VII Con El Caudal Excedente De La Estacion De Bombeo Eb-03 Mediante La Impulsion De Este Caudal Por La Estacion De Bc	3,250,945 S/.	Tacna	0	29	
		1609	Construcción De Una Planta De Tratamiento De Aguas Residuales En Locumba	2,068,000 S/.	Locumba	0	21	
		1588	Construcción De Una Planta De Tratamiento De Aguas Residuales En Locumba	84,264,828 S/.	Locumba	0	21	
		1605	Agrupación De Actuaciones De Mejora Y Entubado De Conducciones De Transporte Del Recurso Hídrico En Alta Para El Suministro A La Población De Tacna	88,845,217 S/.	Tacna	0	12	
		1608	Mejoramiento Del Servicio De Agua Potable De Locumba	9,728,600 S/.	Locumba	0	12	
		1602	Agrupación De Actuaciones De Mejora Y Ampliación Del Tratamiento De Las Aguas Para Consumo Poblacional De La Ciudad De Tacna Y Entorno	73,304,152 S/.	Caplina	0	12	
		1607	Ampliación De La Planta De Tratamiento De Aguas Residuales Magollo En Tacna	46,145,260 S/.	Caplina	0	22	
Infrastructure - Stormwater and Flood Risk Management	188,792,240 S/.	1631	Instalación De Muro De Protección En Tramos Críticos De Las Riberas Del Río Ilabaya, Distrito De Ilabaya, Jorge Basadre	9,841,531 S/.	Locumba	0	16	
		1626	Instalación De Muro De Protección En El Río Colocaya De La Localidad De Ilabaya, Distrito De Ilabaya, Jorge Basadre	18,158,630 S/.	Locumba	0	16	
		1628	Instalación De Los Servicios De Protección Contra Avenidas En Las Quebradas De Incidencia Al Centro Poblado De Mirave, Distrito De Ilabaya, Jorge Basadre	25,792,079 S/.	Locumba	0	16	
		1646	Reducción Del Riesgo De Inundación Con Mejora De Protección En Puntos Críticos. Implementación De Defensas Ribereñas En Cuencas Sama, Caplina Y Locumba	135,000,000 S/.	Tacna	0	16	
Other Infrastucture	2,859,383,835 S/.	1614	Desalinización De Agua En La Yarada Para Consumo Poblacional De Tacna	432,132,167 S/.	Caplina	1	9	M52
		2223	Estructuras de embalse y trasvase para la cuenca Caplina	947,970,000 S/.	Caplina	1	1	
		1613	Derivación Del Río Desaguadero A La Ciudad Y Valle De Tacna	1,457,000,000 S/.	Caplina	1	1	
		1616	Cosecha De Agua Para Adaptación Al Cambio Climático	9,100,000 S/.	Tacna	0	38	
		1590	Mejoramiento Del Sistema De Conducción Del Tramo Vizcachas Quebrada Matazas Provincia De Candarave-Tacna	13,181,668 S/.	Locumba	0	1	
Non-Infrastructure	3,547,108 S/.	1650	Mejoramiento Y Ampliación De La Forestación Para La Disminución De La Contaminación Del Medio Ambiente En Pampa Sitana, Provincia De Jorge Basadre	1,721,692 S/.	Locumba	0	30	

Appendix E
Development and Application of HE Tool

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ANNEXES

Annex A: Results of the critical data review

1. Introduction the Hydro-Economic Tool

This Appendix describes the application of the hydro-economic (HE) tool to the potential invesments.

1.1 Overview of Hydro-Economic Tool

The hydro-economic tool developed for the prioritisation of investments in the coastal catchments of Peru can basically be considered as a weighed sum of a series of factors. A hydro-economic tool, by definition, integrates hydrological and economic information. Yet, this tool goes beyond that. Within a multicriteria analysis framework, economic benefits and cost effectiveness (financial expenditures to achieve a technical water resource outcome), are integrated with environmental, and social criteria for the assessment of investment options. In a very simplified sense, the final "Score" of each investment alternative is computed as:

Score = weconomicFeconomic + wcost eff.Fcost eff. + wenvironFenviron + wsocialFsocial

Where w_i represents the weight applied to factor F_i. This section of the report describes in detail the economic considerations and cost effectiveness factors considered, while **Section 4** summarizes the social and environmental criteria utilized in the HE tool.

Transparency in this multicriteria analysis is achieved not only by explicitly stating and weighting assessment criteria, but also through the design of the tool, which combines prescreening and screening tiers (log files are available for all projects discarded in the prioritisation process), with the prioritisation of investments. The tool was subject to public consultation with a wide array of stakeholders as described in Section 4. All parties were required to explicitly state their preferences through a structured and facilitated process and the hydro-economic tool allowed to identify areas of agreement and disagreement, thereby providing a good framework for managing conflicts around water management.

1.2 Review of Data Availability

A wide range of water investment alternatives has been identified in the course of the execution of Work Package 2. The inventory of water investment alternatives associated with the coastal catchments of Peru was composed building on a number of major information sources, including WRMPs (6 Plans covering 9 catchments on the Pacific coast), NWRP, SNIP, and Proinversión.

Private investment initiatives identified during the interviews with stakeholders as well as additional sources of information (ANA, Aquafondo etc.) constituted further sources of

information. This was particularly relevant for Chillón-Rímac-Lurín catchments for which no WRMPs were available at the time of the study (i.e. the tendering process is ongoing). The information obtained was then used to compliment the inventory of investment opportunities identified as part of WP2.

The critical review of data availability carried out as part of task 3.1 aimed at:

Establishing comprehensiveness of the list of investment alternatives identified, so as to ensure that no potential investment alternative, according to the information made available when delivering this report, is not considered in the analysis;

Assessing availability and quality of information associated with investment alternatives on the list, as part of a quality assurance (QA) procedure so as to provide the 2030 WRG with such a solid evidence base as data quality permits;

Informing the development of a prioritisation approach as part of the application of a tool that combines, further to other criteria (see below), hydrological and economic variables.

Out a total universe of water related investment opportunities in Peru, the ones proposed in the coastal catchments were identified using the sources listed above and totalling to 2,560 projects and interventions. For some of these projects no data was available resulting in 2,295 identified investment proposals to be included in the inventory. Further extensive QA work involved identification of additional projects and culminated in a version of the database (WP2.T1-InitiativesData-v8.XLS) containing 2,303 potential investment alternatives for further screening and appraisal.

Overall, 74% of records relate to specific and, in many cases, small projects (largely drawn from the SNIP database). The remaining entries (26%) represent either interventions with a different degree of aggregation and concreteness or just project idea notes (PIN) with some data. The diversity is also reflected in the capital costs of different investment opportunities. These range from a few thousand Peruvian new soles (PEN) to more than PEN 1 billion (350 million US$).

Reasonable information is available on financial parameters albeit at a detailed, project level and include data on total upfront capital costs, operational and maintenance costs – in both cases at market and social prices – as well as on implementation time and lifetime of assets.

Critically, less than 1% of records contain relevant information on technical hydrological parameters such as water quantity saved, etc. Obtaining (better quality) information on the pre-screened list of investment opportunities for appraisal in different catchments was critical to the feasibility of the investment prioritisation. In particular, to enable a cost-effectiveness analysis, any measure on the technical effectiveness of the different investment alternatives (i.e. mostly volumes of water, given that our alternatives are assessed against water policy

objectives) and reliable capital investment costs (CAPEX) and operational and maintenance costs (OPEX) estimates were required. A major effort was required to obtain technical effectiveness (hydrological) parameters, for instance using outputs from the hydrological models used in some of the WRMPs (through WEAP) or pre-feasibility and feasibility documents available from the SNIP database that also include this information. Finally, to put prioritisation of investment alternatives in context, reliable information on catchment hydrological balances was needed to establish current or anticipated water supply and demand gap.

Similarly, the list of investment opportunities did not contain information on other environmental outcomes, either positive or negative or social conflicts and other related outcomes. The hydro-economic tool developed explicitly includes social and environmental indicators (albeit in qualitative/ semi-quantitative terms) and to use these for investment optimisation, as part of the integration of PESIA results in the hydro-economic tool.

Regarding the typology of projects according to relevant sector or type of technique, different criteria are used across different information sources. However, sanitation and irrigation account for circa 60% of records.

The summary of the key results of the critical review of information collated for all identified investment opportunities are presented in Appendix F. Data collated is then further assessed in terms of its relevance for investment prioritisation and implications of the availability and/or quality of information for the investment prioritisation approach and tool.

The Government of Peru will be investing billions of dollars annually in long-term projects for water resources management (according to the National Water Resources Plan US$45.7 bn of investments by 2035 are required). Yet, deep uncertainties (on the feasibility of some investments, information and knowledge gaps, the institutional setup, social acceptance of some investments, etc.) pose relevant challenges to make decisions in the present that make sense in the longer term. Methods to inform robust decision-making are available but, as any analyst would acknowledge, their outcomes are highly contingent on data availability and quality. As a matter of fact, it is not only about dealing with uncertainty about possible futures but also about tackling uncertainty stemming from inaccurate (when available at all) information about the past and the present.

Furthermore, evidence and knowledge stemming from it (as the actual cornerstone of this project) will inform decisions rather than replacing decision makers' deliberations. The conclusions of this report can help public, private and civil society decision makers to compare their investment options in a systematic, rigorous, and transparent way and single out one (or a set of them) that is robust. However, decisions are made in a continuously changing environment. It is therefore critical to provide rational, transparent, and replicable

pre-screening, screening, assessment, and prioritisation criteria so that the outcomes of this study can be updated when and if required.

- Peru has a rapidly changing economy and society. Its macroeconomic performance is amongst the best in Latin America, mostly on the basis of current commodity prices and some structural reforms that have provided additional stability to the country, albeit facing a 5% external deficit. Peru will grow by 5.2% and 5.6% in 2014 and 2015, despite the less favourable external environment (a stronger slowdown in the Chinese economy being the main risk factor for Peru's growth) and a lower support from mining. In addition, demographic change is to be a major driver of pressures on natural resources, not so much in terms of the overall population growth rate (slightly above 1%) but because of intense urbanization processes or more accelerated growth in some areas of the country.
- Within this context, the key question for this project is not so much which set of investment alternatives best meets the goals of the Peruvian society, but rather which set of investment alternatives meets current and future water policy objectives in uncertain scenarios. Further, disagreements about the future can lead to gridlock or even worse: investments tailored to one set of assumptions on the basis of uncertain data and facing an uncertain future may prove inadequate or even detrimental if another future happen.
- Information available on the comprehensive list of projects and interventions identified (2,303) was then used to carry out the pre-screening of potential investment alternatives based on a set of transparent filtering criteria and clear rationale.

A multi-tiered, logical process was followed for this purpose (see Figure 1.1):

- **Tier 1.** Identification of potential investment alternatives as part of WP2 to review the breadth and comprehensiveness of proposed investments in the coastal catchments of Peru. As part of task 3.1, the database was not only debugged but also criteria for identification were made explicit.
- **Tier 2.** How to get from the comprehensive list of potential investment alternatives to a shorter list of potential investment alternatives. This is what we call pre-screening for the purposes of this report and the design of the hydro-economic tool. At this stage, alternatives are not assessed.
- **Tier 3.** How to get from a shorter list to a more relevant list of priority investment alternatives subject to a more in-depth analysis. At this stage, alternatives are already subject to some assessment criteria as part of the hydro-economic tool. This screening process is therefore part of a first stage of prioritization of investments. The output is the final list of alternatives to be prioritised.

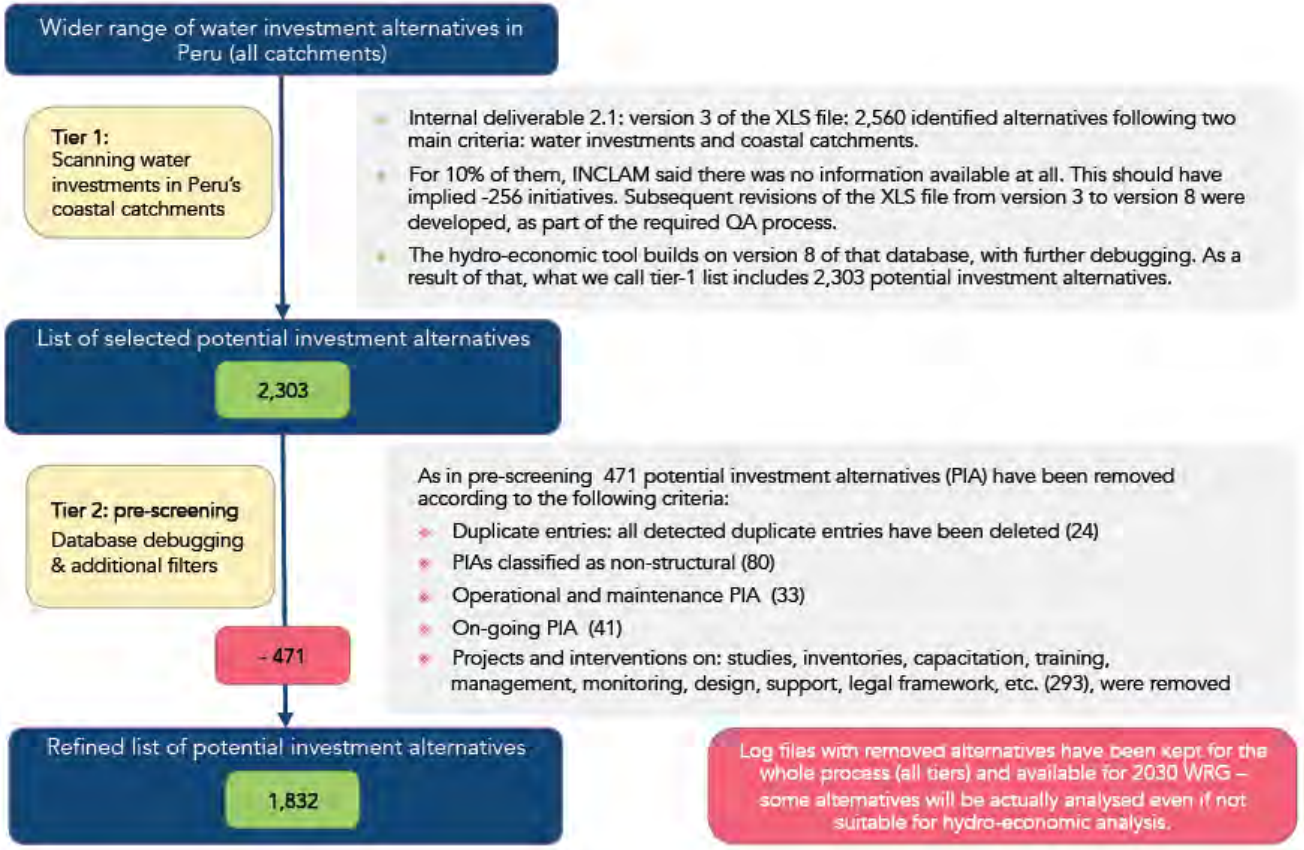
- **Tier 4.** The prioritization of investments itself (a second level of prioritization, indeed) – through collecting as much information as possible for a targeted set of alternatives to provide a deeper analysis of them.
- In particular, pre-screening of the comprehensive list of all investment opportunities identified resulted in removal of 471 potential investment alternatives (PIAs) resulting in 1,832 entries remaining based on removal of duplicate entries, projects and interventions associated with routine operation and maintenance as well as non-structural PIAs. While only 11% of records include the information on [Project classification], most of the relevant projects and interventions are easily identified (studies, legal initiatives etc.). Conversely, some of the projects and interventions caught by the filter genuinely represent a non-structural project and are removed from the hydro-economic assessment, although available anyway in log files for further transparency. For instance, afforestation or major infrastructure projects were kept.
- Furthermore, ongoing investment projects were removed using the [Status] filter1 due to obsolete need for prioritisation. While such projects are important these do not constitute potential investment alternatives to the 2030 WRG. Should any of these ongoing projects remain, it would just be as part of wrong information provided to the project team.
- Finally, it was recognised that some types of projects and interventions would intrinsically fall within public responsibility and would not be financed privately. Such relevant projects and interventions include legislative and administrative measures, emission and abstraction controls, monitoring activities, codes of good practice, studies, assessments and planning among others.
- It's clear that many of these investment alternatives, if not all, are very relevant for the purposes of water policy in Peru and this needs to be said, but no private engagement can be envisaged in principle. This is not to say that, through procurement, some of those initiatives cannot lead to private participation (i.e. providing equipment for pollution control activities or consultancy services for codes of good practice). However, in principle these initiatives were not assessed through the hydro-economic tool.
- Educational and awareness-raising projects as well as R&D projects were excluded from investment prioritisation as well, due to the characteristics of those potential investments and information on them. It is important to bear in mind, though, that PepsiCo and The Coca-Cola Company, currently supporting 2030 WRG activities in Peru, and also other private companies might be interested in supporting this kind of

[1] Filters for 'inversión' and 'inversión en ejecución'

measures on the grounds of corporate social responsibility (CSR). Similarly, one may wish to explore private engagement in innovation or demonstration projects.

- Overall, all potential investment alternatives removed after applying pre-screening filters are recorded and can be retrieved if required. In other words, whatever decision by the project team working on the hydro-economic assessment of these alternatives and prioritisation of investments, can actually be explained and reverted, if required.

Figure 1.1 From Potential Investment Alternatives (PIA) to Actual Investment Alternatives (AIA)



2. Development and Application of Hydro-Economic Tool to Prioritise Investment Opportunities

2.1 Building Hydro-Economic Evidence

- Despite the fact that a fully-fledged cost-benefit analysis (CBA) is unfeasible, time and information wise, within the context of this project, CBA does provide the conceptual and methodological framework for the analysis of investment opportunities. With the right information inputs a full CBA would actually be a robust analytical framework for three different purposes: the financial appraisal of the different investment alternatives, their economic evaluation, and the assessment of some distributional impacts.
- The results of prioritisation of investment opportunities identified (included in the following sections) allow potential investors to understand the scale, effectiveness, timeline and social and environmental consequences related to each IA.
- In other words, the investment prioritisation process takes into account environmental outcomes (i.e. contribution towards closing the gap as well as other environmental externalities, positive and negative), economic and social impacts in addition to financial consideration.
- Building on the work carried out as part of WP1 and WP2, the critical review of the data collated (WP3.1) has informed the development of the approach to the prioritisation of investment alternatives for water management in Peru. The approach developed to prioritise investment alternatives is reflecting a number of key dimensions.

2.1.1 Diversity of Water Management Challenges

- Investment opportunities identified are tackling a diverse set of water management challenges across different catchments and affecting a wide range of sectors. Some investment opportunities are directly associated with closing the gap challenge while others are addressing other critical issues, such as flood protection or safe drinking water and sanitation services that may be of high interest for the public sector and civil society.
- Conventionally, water management challenges against which to assess investment alternatives identified include:

- Closing the water gap, which mostly refers to balancing present and future demands to long-term renewable resources. In other words, contributing to reduce water scarcity in the short term and increasing water security (which also entails reducing drought risk) in the medium and longer term.
- Managing floods and flood risk.
- Tackling water pollution and improving water quality.
- Adapting to future pressures, including climate change.
- Enhancing biodiversity levels and ecosystem services delivery (e.g. through aquatic ecosystem restoration).
- Strengthening the catchment approach to water management
- Closing the gap between water demand and water supply is one of the most important issues in water policy in Peru, with a number of relevant synergies and trade-offs with others, and one of the key areas of focus for investment opportunities prioritisation. However, projects and interventions aimed at water quality improvement, climate change adaptation, restoration of aquatic ecosystems could also provide a viable investment opportunity and inclusion of investment alternatives that provide other environmental, social and economic benefits in the appraisal is highly relevant. On one hand it reflects a recognition of the contribution that different investment opportunities make to the diverse set of water policy objectives, but on the other hand it prevents exclusion of alternatives that may be of potential interest for private investors simply because their primary aim is not to tackle closing the gap issue. Finally, such approach also allows recognising instances where an investment opportunity aimed at closing water supply demand gap simultaneously provides ancillary benefits (such as those derived from sanitation).
- For instance, the construction of new WWTPs – such as those planned for Catacos or Talara (Piura), Puerto Pizarro or San Jacinto (Tumbes), Locumba, and La Joya (Arequipa), will have a positive impact on water quality as well as on water availability where previously water was too polluted for abstraction purposes. At the same time, such projects will aim to reduce morbidity and premature mortality rates as well as to provide basic access to sanitation – a critical social objective, thereby contributing to environmental quality, public health and social policies.
- A construction of a dam or a reservoir, such as Poechos (Chira-Piura), Purapa (Vichaycocha), Quiles, Cáraca, Añasmayo, Huataya, Montero (Ayabaca, Piura), Canoas de Punta Sal (Contralmirante Villar, Tumbes), Sullana (Piura), Tunashirca, Calientes (Tacna), Cerro Blanco (Tacna), El Aliso, Quipacaca, Yaco Coyonca, Nasca (Ica), Chimbote (Santa, Ancash), or Frías (Ayabaca, Piura) would offer additional water supply as well as may provide hydropower production opportunities (e.g. Sumbay River).

- Some investment opportunities identified, such as the expansion of irrigation systems (such as those in Chancay-Lambayeque or Chira-Piura), the provision of water supply and sanitation services to rural population (i.e. in the Quilca-Vítor-Chili and Sumbay, Quilca-Chili catchment), whilst being associated with essential development objectives may actually result in contributing to water scarcity through the increase of water demand.
- The WRMPs for pilot catchments themselves include a range of irrigation expansion projects resulting in additional pressure on water resources and potentially exacerbating water scarcity issues. It is of paramount importance to stop and think of this specific example since there are many alternatives in the database linked to the expansion of irrigation systems or the improvement of current ones. Whereas the former may clearly respond to legitimate economic development aspirations (although not necessarily leading to positive environmental outcomes), the latter may rather be seen as a water conservation measure. Under certain circumstances, this may actually be the case but in others the actual outcomes may rather make things more difficult in terms of closing the water gap.
- Paradoxically, the success of water efficiency measures, as the desired outcome of these investments (either public or not), could actually mean an actual saving at a plot level, but not necessarily at a higher spatial scale (catchment, basin).
- In economic theory, part of these effects is conceptualized under the proposition of the so-called Jevons' paradox or rebound effect. Unlike common wisdom, technological progress (introduction of low-pressure irrigation systems, for instance), that increases the efficiency with which water is used, tends to lead to higher growth rates of consumption at a certain scale. Efficiency measures do actually reduce the amount of water demanded for a given use. However, in addition, improved efficiency lowers the relative cost of using water (making water a more productive input), which in fact is an incentive to use more, potentially outweighing any savings from increased efficiency.
- Further to this paradox, water depletion may increase through an overall rise in consumptive use and, therefore, reduced physical return flows (and water supply downstream) and lost aquifer seepage. In addition, there may be an increase in energy consumption and energy dependency brought about by the generalized mechanization of irrigation systems.

2.1.2 Diversity of response

- A wide range of investment opportunities identified are relevant to addressing different water policy challenges including water scarcity and closing water supply and water demand gap. Global best practices alone include measures like inter-basin

water transfers, wastewater reuse, canal lining, improved irrigation efficiency (drip irrigation, etc.), dams and reservoirs, gravity transfers, improved distribution networks (including leakage reduction) and wastewater reuse, among others.

- A range of measures is available to water managers and private investors to deal with water scarcity and drought risk for Peru (GAP) including:

• Construction of dams, reservoirs, and other impoundments (i.e. rock-fill dams, retention ponds, etc.) – this may also include the expansion of reservoir and dam capacity or the improvement of reservoirs and other large to medium impoundments. This may also include the restoration and consolidation of ponds. (D+R)
• Improvement of groundwater abstraction points. (GW)
• Construction, expansion or improvement of distribution networks (including control or reduction of leakages as a result of repairing and maintaining water mains). (WS)
• Expansion of irrigated land through the construction of irrigation canals and other minor infrastructures. (IRR)
• Lining of irrigation canals (CL)
• Improved efficiency in irrigation via technified irrigation systems (i.e. drip irrigation). (IRR)
• Major diversion projects (i.e. inter-basin transfer). (WT)
• Construction of desalination plant. (DESAL)
• Constructions of wastewater reuse plant. (REUSE)

- While flooding (FLOOD) can never be completely prevented, its impacts can be significantly mitigated through investment in water infrastructure such as dams, levies, flood defences, drainage systems, and stormwater management systems.
- The following are examples of measures to manage floods and flood risk in Peru:

• Flood defences (in riparian areas) and other (unspecified) flood protection measures. (FD)
• Prevention and remediation of landslides (including prevention of erosion and soil loss). (LS)
• Stormwater urban drainage system – unclear whether it is rainwater harvesting, swales, channels and rills, soakaways or retention ponds (or all of the above) (DRAIN)

- Internationally, water quality (QUALITY) has been managed through direct regulatory instruments such as setting ambient water quality standards, technology requirements, controls on polluter's emissions into sewer systems and water courses, and bans on discharges into water sources used for drinking or irrigation. Peru, through a pollution fee in the 2009 Water Act, seems to be exploring a shift towards the use of economic instruments but this is way underdeveloped as yet. In addition, major infrastructure investments in wastewater treatment and sanitation are also required.
- The examples of measures aimed at managing water quality in Peru include:

• Construction (or expansion) of a WWTP (primary and secondary treatments) – this may also include specific elements such as oxidation ponds. (WWTP (NEW) and WWTP* (improvement, expansion, etc.).
• Construction, expansion or improvement of sewerage systems (sewer pipes and sewerage systems), both in urban areas (i.e. separate sewerage systems) and in rural areas (rural sanitation projects including latrines, septic tanks and Imhoff tanks) – linked to this, some investment alternatives refer to landfill sites (S)
• Water purification for domestic consumption. (WPP (NEW) AND WPP* (improvement, expansion, etc.).

- Last but not least and although this has not yet been widely explored in Peru, there are some hydromorphological measures or measures intended at enhancing, preserving or restoring the ability of aquatic ecosystems to deliver ecosystem services and functions, including natural water provision and assimilation of pollutants, as part of aquatic ecosystem restoration projects. Some of these practices may essentially be aiming at water quality objectives.

• Afforestation (including riparian afforestation). (AFF)
• Meadows or pastures. (M&P)

- As part of measures that primarily contribute to managing water quantity and security (either water scarcity and drought or flooding and waterlogging), evidence is found in Peru of water supply and water demand approaches.
- Within water supply approaches, water infrastructure to deal with issues of water scarcity has historically been the focus of many countries' approach (including Peru) to managing water security. Large-scale water infrastructure can capture and store surface water runoff through dams or reservoirs, or augment natural freshwater resources (from alternative sources), such as with desalination plants. In other words, any infrastructure aimed at capturing and storing surface or groundwater, to divert water from one place to another (i.e. intra-basin and inter-basin transfers) or to apply water to different end-uses (i.e. distribution network for drinking water and sanitation services or irrigation canals), could actually be part of this first category. In addition, one may add alternatives sources such as wastewater reuse or desalination.
- It is important to note that water supply control can either be achieved through grey or green infrastructures, plus some indigenous practices, such as amunas in Chancay-Huaral (a pre-Hispanic of water harvesting) or Sican hydraulic systems in Chancay-Lambayeque.

2.1.3 Diversity of Locations

- As above, overall the overwhelming majority of available information is derived from the 6 pilot basins with a WRMP covering 9 costal catchments out of 62 (6 WRMPs - PGRHC2). Further information on projects and interventions was obtained from SNIP, Proinversión, the NWRP (to be approved within 2014), and stakeholder consultation (as part of WP2).

[2] Chira-Piura, Puyango-Tumbes, Locumba-Sama-Caplina-Tacna (delivered by the consortium INCLAM-Alternativa); Chancay-Huaral, Chancay-Lambayeque and Quilca-Chili (delivered by TYPSA-TECNOMA-ENGECORPS).

- An exhaustive coverage of all 62 watersheds is not feasible given the absence of planning documents (or even of planning processes), but we have managed to obtain information also for the Acarí, Atico, Chala, Ica, Moquegua, Santa and, of course, Chillón-Rímac-Lurín3.
- The so-called programs of measures presented in the NWRP (30) while addressing the country as a whole are too aggregated for the purpose of investment prioritisation. Availability of information at the required level of detail is one of the key pre-screening criteria across different catchments.

2.1.4 Diversity of sectors

- The hydro-economic assessment of investment opportunities is, therefore, able to present investment prioritisation results by water policy challenge (or water policy objective linked to the NWRP), by catchment (or other geographic scale), by key economic sector or water user (distinguishing between agriculture – including irrigation and cattle breeding; manufacturing; mining; household, commercial and public; hydropower; e-flows, and multi-purpose reservoirs) and by type of investment alternative. Investment prioritisation is not, therefore, limited exclusively to prioritising the investment opportunities aiming to address the water supply and demand gap.
- This is possible by explicit matching of potential investment alternatives and actual water policy challenges through defining additional fields, including water management challenge. Similarly, understanding key pressures across the catchments as well as water supply and demand balances in these catchments allow drawing conclusions regarding the extent investment priorities identified are likely to contribute to alleviating key pressures in the catchments. Review of key references such as diagnostics from the WRMPs, WB and IDB project documents, NWRP, etc. helped building this appreciation.
- Relevant economic sector and/or water end user (i.e. domestic, irrigation, mining, manufacturing, etc.) and types of the investment alternatives presented above constitute additional fields (to be used for filtering of investment alternatives prioritised).

[3] There will be additional plans (such as Chillón-Rímac-Lurín) but not within our study, given the status of the tendering processes according to information provided by the ANA.

2.2 Approach to Investment Prioritisation

2.2.1 Outcomes of Investment Alternatives – the Actual Benefits

- Water policy is about making economic development and social welfare enhancement compatible with the improvement and protection of water resources. Water and aquatic ecosystems provide the economy with flows of water services or inputs for the delivery of many valuable goods and services such as drinking water, biomass production (either for food, fodder or bioenergy), electricity, manufactured goods, recreational services, etc. Quantity and quality of all these water services, as well as its stable or secure provision, depend on the conservation status of all those aquatic ecosystems. All water resources management measures should thus be defined according to their environmental outcomes.
- A basic difference should be established between the demand for water services by end users (households, farmers, industries, mining companies, etc.), and water service supply (which includes everything related to adapting bulk water resources to those end uses: quality, location, gradient, etc.).
- These water services, from a supply-side standpoint, are mostly provided in Peru by the public sector (large dams, abstraction facilities, conveyance infrastructure, etc.); in other cases, they are rather provided by utilities (purification, delivery of drinking water, etc.), and include water provision, wastewater treatment and re-use, sanitation and sewerage services.
- Arguably, we may say that whatever socially responsible investment alternative should aim at improving the ecological status of water bodies but not only – quite often, they will also be able to foster production and employment increases or poverty mitigation or social cohesion or any other developmental objective, within current and future pressures on water. One may then accept that there is a water policy objective in strict sense (improving the status of aquatic ecosystems to deliver a wide array of services and functions) and an economic development objective of these water investments (i.e. making water accessible for a wider array of services to the economy and society in an efficient, equitable and sustainable way).
- The improvement in the status of water bodies can be obtained through (1) increasing water availability (increasing supply, reducing demand or both); (2) improving water quality; and (3) enhancing, maintaining or restoring hydromorphological features.
- Positive outcomes of the different investment alternatives to provide water services and contribute to other water management challenges thus do necessarily have to be linked to the outcomes resulting from their implementation:

1. Quantifiable reductions of water services demand by different water users or economic activities.
    a. Reduction of water demand for irrigation.
    b. Reduction of the demand for drinking water and sanitation services.
    c. Reduction of water demand for mining.
    d. Reduction of water demand for manufacturing activities.
    e. Reduction of the demand for water-cooling of thermal power stations (mostly non-consumptive use).
    f. Reduction of the demand for water to be turbined for hydropower generation (mostly non-consumptive use).
    g. Reduction of water demand for aquaculture (mostly non-consumptive use).
    h. Reduction of water demand for recreational activities (mostly non-consumptive use).
2. Increases in the efficiency with which these water services are provided. This is the case of all water investment alternatives designed to abate quantitative and qualitative pressures on water bodies stemming from the need to meet a given demand of water services.
    a. Efficiency improvement in irrigation systems.
    b. Improvement of water distribution networks.
    c. Improvement of major water conveyance infrastructures.
    d. Increased use of reclaimed wastewater in manufacturing processes.
    e. Improved efficiency in wastewater treatment.
    f. Construction of WWTP.

3. Replacing water supply sources to reduce pressures on water bodies linked to the provision of a given set of water services both to production and consumption activities. In other words moving away from some traditional sources to others with lower negative impacts.
    a. Expansions of capacity for water re-use.
    b. Construction of desalination plants.
    c. Construction, expansion or improvement of infrastructures to harness conventional water sources (surface runoff, groundwater, water transfers, etc.).
4. Reduced impacts of specific economic activities on the structure and functional activity of aquatic ecosystems.
    a. Soil conservation (prevention of erosion, including nutrient loss).
    b. Reduction of deforestation in riparian areas.
    c. Minimization of floodplain occupation.
    d. Improved natural water retention capacity.
5. Reduction in risk exposure and vulnerability (or increased resilience) to climate and weather extreme events, or in other words an increased ability to reduce disaster risk and adapt to climate change.
    a. Improved resilience to drought risk.
    b. Improved resilience to flood risk.
    c. Improved resilience to other climate and weather extremes (i.e. heat waves, flash floods, cut-off lows etc.).

- On these grounds, for instance a reduction in water demand in a given place should not to be judged as a success for water policy before assessing the true impact on the status of affected water sources. In that case, the reduction in water demand will then need to be linked with lower pressures on surface and groundwater and these, in turn, with a better status of conservation as indicated, for example, by increased runoff flows or phreatic strata.
- Assessing the benefits of water investment alternatives thus requires a certain understanding of (and good information about):
- The links between the economy and the environment, in particular to understand how meeting this demand is connected with different pressures on those water bodies delivering ecosystem services.
- The fact that saving water is not always equivalent to using less water or leaving more for the in-stream ecological flows.

- The need of hydrological models at a catchment level to assess the effect on the different interconnected water bodies (modeled in WEAP at least for those catchments analyzed by INCLAM but unavailable for other catchments).
- The above-mentioned positive impacts link to the benefits of the water investments that have been assessed as part of this assignment, at least in those cases in which hydrological information is available:
- Avoided opportunity costs of achieving a pre-determined target – probably the most straightforward potential benefit of these investment alternatives is the avoided cost of the best feasible alternative (i.e. improved water use efficiency in a given irrigation district entails the avoidance of the cost of withdrawing groundwater). An example of that is the situation in the Taymi irrigation canal (900 intakes, 50-60 hm^3 in dry years, 60-70 hm^3 in an average year), where despite the effort for formalization of rights, a majority of users still lack formal water rights. An alternative water source may divert some water users away from groundwater sources in risk of overexploitation.
- Natural capital can substitute human-made capital in providing some water services. This is why the improvement in the quality of water assets might lead to remarkable economic benefits. The increase in water flows might also soar the natural assimilation capacity of a water flow as well as coming out with a reduced cost of treating effluents in order to guarantee a pre-determined quality standard, whatever that is. Planned water sanitation projects, for instance, though their contribution to water quality improvements will result in avoided treatment costs in WTTPs.
- Avoided costs of meeting the demand of water services in the economy to obtain a given output (i.e. pumping cost-savings resulting from higher phreatic strata in the Ica valley; reduced pre-treatment costs for drinking water provision or for manufacturing purposes due to upstream quality improvements; increased biological potential for fishing production; etc.).
- Ecosystem services linked to a better conservation status of water resources. These services include:
    a. Reduced drought risk, as the likelihood of a severe deficit in water availability over water demands is reduced, and higher drought resilience as buffer stocks are improved and water allocation is contingent to water supply.
    b. Improved flood protection should floodplains be better protected, and disaster risk reduction as a result of lower vulnerability for people and real estate, and wise management of land and the environment.
    c. Reduced health risk, as the likelihood of a decrease in morbidity or premature mortality rates, derived from exposure levels to water pollution and as a result of the natural assimilation capacity of aquatic ecosystems.

d. Recreation and other amenities, as the consumptive (i.e., angling) or non-consumptive values (i.e., bird spotting) related to leisure opportunities linked to a good ecological status of water bodies and ecosystems.

- In the context of environmental impacts, improvements or adverse impacts on water quality, water quantity or hydro-morphology of water bodies associated with implementation of different investment alternatives would also result in an impact on biodiversity and ESS delivery (including E-flows). Furthermore, some of the IAs under consideration are associated with substantial carbon emissions and would adversely impact climate change mitigation.

2.2.2 Assessment Criteria Included in the Hydro-Economic Prioritisation Tool

- The hydro-economic (HE) tool developed uses a wide range of financial, economic, technical (to reflect effectiveness of investment opportunities), environmental, and social assessment criteria and reflects qualitative, quantitative, and monetary information.

2.2.2.1 General criteria for water investment portfolio optimisation

The HE tool uses a range of identification and support data for the analysis with key relevant fields including:

- ID numbers (including *ad-hoc* ID numbers for all Investment Alternatives identified to account for clustering some specific projects under an Investment Alternative)
- Project name and description
- SNIP/ WRMP IDs
- Level of aggregation (projects, interventions)
- Status
- Sub-programme

Needless to say that readiness for implementation and compliance with national legislation is, in principle, assumed (i.e. taken as a fact) for the purposes of this project, although some information has already been provided that allows to include caveats for the 2030 WRG where relevant. For instance, for the Chira-Piura catchment, some projects such as Santa Rosa are mere Project Idea Notes (PIN) and can actually be considered, in principle, as a investment alternative for the purposes of the hydro-economic analysis. In turn, the Tronera Sur dam, part of a Special Project, is contingent on water imports from a major diversion project (inter-basin transfer from the Amazon), which has not been yet executed.

2.2.2.2 Financial Parameters

- Financial feasibility is clearly a critical criterion for the assessment and prioritization of investment opportunities identified, and one that is very relevant for private investors. Available financial information is by far the most abundant. Key indicators that are included in the HE prioritisation tool include investment (upfront capital investment cost, at market prices in PEN) and O&M costs, asset lifetime, investment length, NPV, and IRR.
- In order to carry out a financial cost-effectiveness analysis and develop cost curves in the main catchments capturing investment alternatives that are expected to contribute to closing the water gap, key hydrological data were required. Such data were two-fold and included a technical effectiveness measure to express the contribution of the each identified investment alternative towards closing the gap. In practice, million cubic meters (hm3) added or saved per measure represents a suitable technical effectiveness indicator. Furthermore, current and projected water demand and supply gap for the catchments under consideration was needed to assess whether any investment in water scarcity measures would be required at all or conversely, whether implementation of all identified investment opportunities would not be sufficient to close the gap.

2.2.2.3 Economic Parameters (including environmental externalities)

- Economic feasibility is rather assessed on the basis of the overall impact of the different investment alternatives on the welfare of society as a whole. What is at stake is not whether the investment alternative yields a positive cash-flow throughout time but rather whether each project positively contributes to social welfare.
- Within this context, an economic cost is the sacrifice associated to the use of available water resources for one end-use instead of another (so that any economic cost is indeed an opportunity cost) or to follow one course of action instead of the best alternative. Hence, it refers to the negative impacts in terms of welfare, either direct or indirect, that may be linked to the implementation of any water investment alternative.
- Indirect costs can actually be considered as external costs, as they are not part of explicit implementation costs but rather brought about as a result of the implementation of any alternative. At the micro-economic level, indirect costs include, for example, opportunity costs in strict sense (i.e. foregone benefits, additional costs); at the macro-economic level they are linked to possible income losses (e.g. a loss in agriculture production or revenue or gross value added).
- Assessment of economic costs of investment opportunities also allowed for explicit inclusion of some PESIA outcomes (from WP4) within this CBA framework, including

some environmental and social criteria. For instance, any environmental external impact (a unilateral and uncompensated welfare loss for any third party as a result of the implementation of the water investment project) could virtually be measured in monetary terms. The limiting factor is information available at an investment alternative level. This analysis would actually require data at least on the impact (In physical units) and some unit value (either directly estimated or extrapolated) to translate each impact into an economic cost.

- Further to financial costs (see section 2.2.2.2), which include investment, operation and maintenance costs, dealing in particular with land requirement (acquisition and compensation), construction and rehabilitation, additional costs need to be considered: indirect sectoral economic costs (such as the potential loss of agricultural production in some river restoration projects) or indirect wider socio-economic costs (e.g. shift in economic activities for economic "downstream" and "upstream" sectors producing farm input or transforming agricultural output).
- As per economic benefits the HE tool includes direct benefits (i.e. all market and non-market benefits that are a direct consequence of the implementation of the investment alternatives). These economic benefits are measured against the expected technical effectiveness of the different investment opportunities to attain water policy goals.
- Direct benefits entail, for example, the avoided costs of treating water (when a WWTP is implemented or from improved water purification installed capacity); avoided flood damages as a result of flood and flood risk management measures; increased and/or more stable water supply from increased water retention capacity; avoided health care costs associated with a reduction of waterborne disease instances; avoided or reduced costs to sectors dependent on good water quality (e.g. aquaculture and shellfisheries); improved productivity; increased revenue from water related recreation etc. In other words, direct benefits can be said to represent the micro-economic dimension of the overall benefits of these projects, as they represent both the direct economic value of aquatic ecosystem goods and services and economic services provided by water bodies.
- Indirect benefits are the wider socio-economic benefits derived from the implementation of these projects. They are integrated under the so-called multiplier effect of investing in water projects, and represent the macro-economic dimension of these benefits: under this category, we may find in fact induced increases in income, employment and investment, as well as economic growth in certain economic sectors or even poverty alleviation. Of course, direct benefits are directly related to indirect benefits: for example, the reduction of flood risk and its related avoided damage costs may involve, for example, an avoided loss of GDP for Peru; the averted public expenditures on mitigating / restoring the damages in the Rímac catchment can be

allocated to other uses / sectors, with likely macro-economic effects; private companies (e.g. water utilities) would not need to allocate part of their capital to restore the damage (i.e. to preserve or enhance natural water sources) and would then have more investment capacity (for asset replacement or improved service delivery or network expansion, etc.).

- Some water projects, in addition, may come along with other important ancillary benefits such as biodiversity (and ecosystem services delivery) or amenity, etc. These might be almost exclusive of natural preservation (as in green infrastructures) and not easily attainable via alternative water policy measures (i.e. several grey infrastructures). These ancillary benefits, however, are clearly non-measurable with available information.

There is a wide array of economic costs and benefits including:

- A number of projects may incur a significant cost in terms of energy consumption (i.e. wastewater treatment, groundwater pumping, major diversion projects such as inter-basin transfers, desalination, etc.). **Energy consumption** (kWh per cubic meter of supplied water or treated water or desalinated water or pumped water, etc.), in turn, would also be coupled to (carbon-dioxide equivalent emissions (CO_2e). GHG emissions estimates could be derived based on the data on energy consumption linked to the different IAs, should this information be available. Needless to say that if a project saves energy (and thus emissions), this would be accounted for as an economic benefit.
- Irrigation and sanitation projects account for roughly 60% of all projects and interventions identified as part of WP2. For irrigation projects (i.e. increased water use efficiency in agriculture), a significant economic benefit might be linked to **productivity increases** at plot level (increase in kg per ha) or **water productivity increases** (more Peruvian new soles per cubic meter applied to agricultural production). The factor used in this CBA (expressed in PEN/hm^3) to obtain the increased productivity in agriculture is based on data from the Wold Bank (2009) of average productivity increase in Peru (US$ 54 /ha) and the average demand of water per hectare and per year (10,400 m^3/ha·yr) (H2Olmos Project, 2010). More precise information at a crop level could be provided but information on representative crops per catchment at a project level has not been made available.
- For sanitation projects, it is well known that one of the most evident impacts is in terms of reductions of **morbidity and premature mortality rates**. Estimates of the economic benefits of these projects were made by applying unit values available (from epidemiological studies, for instance). Benefits on reduced health risk in the hydro-economic tool were calculated using the Equivalent Annual Cost (total) or each relevant alternative and Benefit Cost Ratios (BCR) for water supply and sanitation

projects in Peru: 1.9 for water supply, and 5.84 for sanitation projects (Hutton, 2012, pp. 59 and 63).

- For the estimation of potential macro-economic effects, linked to specific projects, just validated information on **employment generation, induced investment or potential impact on GDP** would actually be of use. This information is available but only at very aggregated levels (i.e. symmetric input-output tables, etc.) and not linked to water investments at all.
- Investment alternatives in the Peruvian coastal catchments also entail environmental externalities (either positive or not). These unintended environmental outcomes are also taken into account in a semi-qualitative way. For instance, the implementation of inter-basin water transfers (i.e. Desaguadero) or construction of water desalination plants (i.e. La Yarada) would be associated with high energy consumption and associated carbon emissions. While the HE prioritisation tool considers the relevant indicators (on water quantity, water quality, hydro-morphology, biodiversity and ESS delivery, including E-flows) detailed data on anticipated energy consumption (that could then be translated into carbon emissions and monetised) is scarcely available.

2.2.2.4 Social Parameters

Implementation of investment alternatives may also be associated with a range of social impacts, related to:

- The stated objective of selected water sector IAs (where investment has a social development, poverty mitigation, social cohesion or civil protection objective). Therefore, this includes providing equitable and affordable access to water & sanitation services to population, building civil infrastructure projects (e.g. flood protection), aiming at providing access to water (increasing coverage in urban and rural areas of Peru), improving human health and reduced exposure to flood events and other natural disasters. Some of the positive impacts will manifest as reduced health-care costs, avoided costs associated with property losses and damages as well as avoided costs of alternative water supply, as in section 2.2.2.3. However, benefits of flood protection and human health improvements are not limited to avoided or reduced direct costs of treatment or property repairs. Similarly, access to drinking water improves quality of life and impacts are not limited to (potentially) reduced costs of water services provisions.
- (Often) unintended consequences of water sector IAs that can be stemming from IA per se (e.g. a reservoir for mining) or its format (e.g. inter-basin transfer vs. desalination plant in Tacna). IAs under consideration, therefore, have a potential to cause, exacerbate or alleviate social conflicts and impact local customs.

- On a strictly qualitative level, information on social conflicts per catchment is very relevant. In addition to social equity and conflicts data, some of the investment alternatives are also associated with potential positive social impacts, such as improved access to safe drinking water and basic sanitation, reduced health hazards and reduced exposure to natural disasters (for instance, reduced flood risk would not also have economic benefits but also will provide social security and non-tangible benefits to affected population). Impact on local organisational structure is another criterion for assessing social impacts of IAs.
- From a quantitative perspective, information on social equity impacts (distributional impacts) is valuable. This is to say, information on disproportionate costs for different groups of water users or any information on affordability of water services (i.e. for households facing domestic water bills) may be helpful but to date it is mostly lacking. A key social impact has to do with the contribution of water investments to social equity, in the sense of the impact on the distribution of wealth and income.

2.2.2.5 Bringing Financial, Economic, Environmental and Social Indicators Together

- Ideally, prioritisation of investment opportunities would be based on a comprehensive identification, quantification and monetisation of financial, economic (inclusive of environmental externalities) and social costs and benefits. In practice, the hydro-economic investment prioritisation tool relies on a mixture of monetary, quantitative and qualitative information.

- The design of the prioritisation tool, however, allows such functionality. Once better information becomes available more sophisticated analysis can be performed within the remit of the CBA approach. The tool has been designed in such a way that allows expansion and replicability.
- On one hand investment portfolio optimisation at a catchment scale focuses on choosing IAs aimed at tackling a range of water policy challenges present in the catchment. On the other hand, it allows considering particular water policy challenge, sector, type of investment opportunity (e.g. water supply, water demand measures, etc.) and present prioritised investment opportunities against these different types of criteria.
- A catchment wide investment prioritisation is based on the assessment criteria, associated indicators, values and weights that will be subject to stakeholder validation, both through the consultation process and a dedicated workshop on September 25th, 2014.
- Information obtained on technical effectiveness of the IAs across the catchments allows derivation of cost-effectiveness ratios and construction of cost curves (see section 2.4.2). In particular, the cost curves depict different investment opportunities (such as, for instance, wastewater reuse, inter-basin transfers, development of new water sources, desalination, as well as demand management measures, such as leakage reduction, irrigation efficiency improvement etc.) along the X-axis while presenting costs on the Y-axis. Needless to say that the necessary provisions will need to be made to account for mutually exclusive investment opportunities or instances where implementation of one option would reduce efficiency of subsequent investment opportunities moving along the curve.
- The HE investment prioritisation tool, therefore, accounts for key ancillary benefits of investment opportunities aimed primarily at closing the gap between water supply and demand and includes investment opportunities addressing other water policy challenges in the appraisal.
- Investments in irrigation expansion represent a special case as while such actions may well contribute to productivity gains that may increase in turn farmers' income at a microeconomic level or exports and economic growth at a macroeconomic level, such projects are likely to negatively impact water supply and demand gap in the catchment (and potentially result in a situation where a catchment not experiencing the gap at present would be faced with one in a medium or long-term if such expansion were to be implemented). Any project aimed at expanding irrigation is likely to pursue an agricultural, development, or economic rather than water policy objectives, as explained above (section 2.1.1). In the context of investment prioritisation exercise, one approach would be to account for the impact of such expansion on the water supply demand gap. Alternatively, the impact of such

investment opportunities on water scarcity may be expressed as a negative value (for the indicator of hm3 saved/ added) as it would be aggravating water scarcity rather than alleviating the challenge.

- As a result of this integration, the hydro-economic analysis entails cost-effectiveness analysis for water quantity measures (based on financial and technical effectiveness parameters), and cost-benefit analysis mostly for irrigation and water supply and sanitation projects contributing to water quality (via economic benefits of agricultural productivity increases and reduction in morbidity and premature mortality rates). In addition, elements from the PESIA (environmental and social risk factors) are included.

2.3 Prioritisation of investment alternatives – application of the hydro-economic tool

Further to the pre-screening exercise described in section 1, a more in-depth screening procedure (tier 3) was followed to shortlist, in a first prioritisation of investments, a set of investment alternatives that are presented (237). For that purpose, ad-hoc classification criteria (linked to the different levels of analysis and the discussion of results, as reflected in section 2.5) were developed:

a) **Key economic sector** (agriculture; e-flows; household, commercial, public; hydropower; manufacturing; mining; and multipurpose reservoirs).

b) **Water policy/management challenge**: Climate change adaptation (CCA); CCA/flood; Development; ecosystem services enhancement (ESS); Flood; closing the water gap (GAP); GAP/flood; GAP/quality; Quality; Quality/Flood.

c) **River basin district / catchment**.

d) **Type of Project**: dams and reservoirs (D+R); D+R/FMR (for flood risk management); D+R/WS/WWT (for water supply and sanitation); D+R/WT (linked to a water transfer); drainage (DRAIN); DRAIN/S (and sanitation); FMR; irrigation (IRR); IRR/D+R; sanitation (S); water and sanitation (S/WS); desalination plant (WDP); (water purification plant) WPTP; WS; WS/WWT; WT; and wastewater treatment (WWT). Includes further codes for irrigation projects (type specification and use – on/off-site investments for storage, delivery, and application).

As a result of these classification criteria and through a transparent process of clustering and upscaling of projects to initiatives, the list of potential investment alternatives (PIAs) was further reduced (see figure 2.1).

For the remaining 237 alternatives, the hydro-economic tool was applied at two levels, as described above: as part of an analysis integrating hydrological information and financial

information, the cost-effectiveness analysis of the different alternatives was developed (see cost curves in section 2.4.2); in addition, some key economic benefits were estimated for the two main groups of projects (irrigation and sanitation).

2.3.1 Irrigation – Benefits Derived from Productivity Increases

On the basis of information from a US$10+m loan from the World Bank to Peru for the so-called PSI II project (irrigation subsector supplemental project), a factor was derived to estimate the value of productivity increases.

Water conveyance efficiency as a result of irrigation system improvements may increase on average from 55% to 68% whereas application efficiency would go from 60% to 70%. However, overall information is not available at a project level, which calls for an alternative approach.

Irrigation efficiency programmes may adopt the form of irrigation technification (as in many of the 'irrigation' investment alternatives assessed). In those cases efficiency would increase from 55% to 85%. Yet, it may also be part of more conventional projects, benefitting from gravity-fed schemes (i.e. efficiency increase from 55% to 63%).

The rehabilitation of irrigation and drainage infrastructure can be broken down into three types of works: intakes, canals, and wells. Aside from increases in farm income due to higher availability of water, one can observe increased regularity in the provision of water and a reduction in damaging effects from floods. In some other cases, a significant expansion of a secondary crop takes place due to the installation of the infrastructure. Sometimes (i.e. in primarily rice growing areas) the introduction of a secondary crop (i.e. legumes) aids in reversing severe salinization problems.

An important remark is that in the coastal catchments there is almost no rainfed agriculture at all, which has implications in terms of baseline. The area with irrigation infrastructure is roughly 1.2 million hectares.

Since there is enough information for that (although project descriptions are sometimes unclear), two types of projects were considered: rehabilitation and modernization of off-farm (collective) irrigation systems, and on-farm irrigation technology improvement (drip, sprinkler, improved gravity).

Information from the World Bank irrigation project for Peru covers in a very comprehensive way catchments and irrigation districts that are within the scope of our analysis. Almost any relevant productive unit has been considered. As a result of the assessment (World Bank, 2009), the following results are of use:

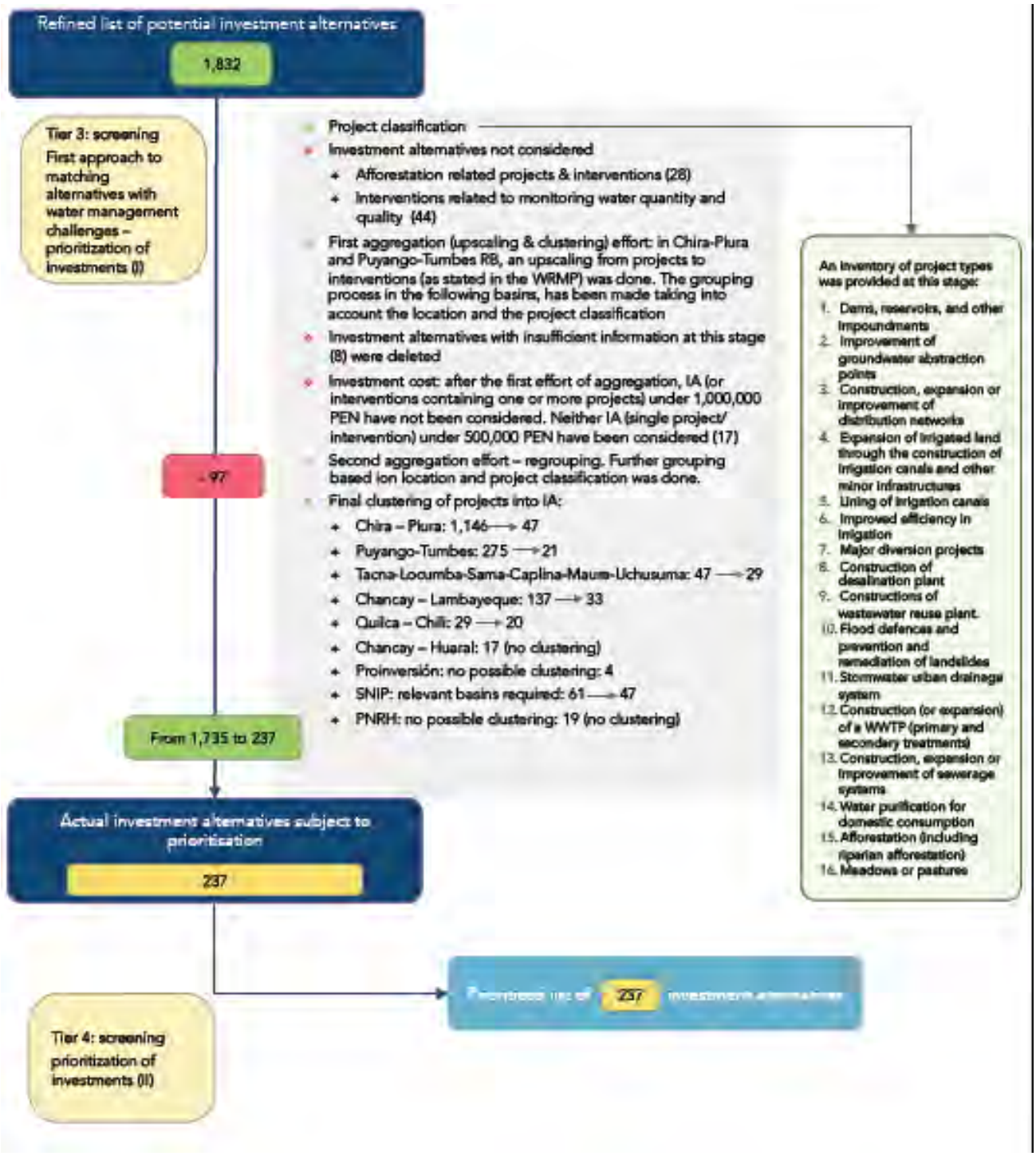
- Average increase in beneficiaries' annual production value per ha (US$/family): 5% and 153% respectively (depending on whether off-site or on-site improvements).
- Average increase in beneficiaries' annual production value per ha (US$ / ha): 3.5% and 155% respectively.
- Average increase in yield of main crops: traditional crops (0-5%, 28%), vegetables (0-3%, 28-57%), fruit trees (0-5%, 14-33%).
- Average income of farmers' households increased by 5% in real terms (US$183 per year); at baseline the average farmers household income was US$3,647 per year.
- Average productivity of land increased by 4% in real terms (US$ 54 / ha) (at baseline, the average productivity of the farm was US$ 1,530 per ha and per year).

Increased household income and land productivity are explained by (a) a moderate shift to higher value crops (the cropped area under traditional crops decreased by 1%, while the area under vegetables increased by 14% and the area under fruit trees increased by 1%); (b) increases in yields (vegetables: 0 to 3%, fruit trees, 0 to 5%; traditional crops, o to 5% with the exception of rice and sugarcane whose yields decreased by 8% and 3% respectively).

As an outcome of the hydro-economic tool, quantified IA benefits reflect the increase value of agricultural production resulting from either increased yields and / or shift to the production of higher value crops. Information on the hydrological impact of these alternatives (in hm^3) was then used to estimate the economic benefits of these productivity increases as a result of improved efficiency (PEN / hm^3).

As part of an improved functionality of the tool, more detailed assessment of benefits could be developed if there were information on the relevant crops for each planned investment. This could be done on the basis of available data on changes in yields and cropped areas as a result of improved irrigation in traditional crops (rice, sugarcane, cotton, maize, beans, yucca, sweet potatoes, potatoes, and basic crops); vegetables (paprika pepper, water melon, pumpkin, asparagus, garlic, onion); fruits (avocado, mandarin, mango, apple, grape) and pasture (alfalfa).

Figure 2.1 From Potential Investment Alternatives (PIA) to Actual Investment Alternatives (AIA)



2.3.2 Sanitation – Health Benefits Stemming from Decreased Morbidity and Premature Mortality Rates

According to World Bank (2007)[4], that provides relevant information on benefits from diarrheal morbidity and mortality in rural Peru as a result of improved sanitation facilities or improved water supply, the reduction in diarrheal illness per person hits 32% for sanitation and 25% for water supply.

This implies a number of diarrheal cases averted per year of 1.3 million (sanitation) and 1m (water supply). More specifically, deaths in children averted per year are 180 (sanitation) and 135 (water supply).

There are also data on annual health benefits of improved services (million PEN), annual value of timesavings from improved services (million PEN) and annualized costs of service provision (million PEN). Furthermore, there is information on benefit-cost rations (health benefits only and health benefits plus timesavings) but again this information is, in principle, of little use because of the high level of aggregation: 1.10 and 2.26 for sanitation and 1.14 and 2.69 for water supply.

On the grounds of transparency and legitimacy of data sources, these benefits are derived from a range of studies (including epidemiological surveys) are calculated separately for different categories of individuals in rural Peru. The key assumptions in deriving these benefits relate to the costs of morbidity and mortality and to the value of time saved. Morbidity costs, based on the costs of treatment and value of lost time, are PEN 50 per case of diarrhoea. Premature mortality costs are calculated based on the 'Human Capital Approach' (HCA), which actually provides an underestimate of the value of a lost life (i.e. numbers provided are lower bounds, which is the sort of conservative approach that one should follow in CBA).

In addition, these investment alternatives generate savings in time. These are based on data for households who are more than 15-min walk from a water source (approximately 210,000 households are in this category). Time saved is valued at 75% of the average rural wage (PEN 20 / day).

Furthermore, Hutton (2012) for the WHO provides additional evidence for Peru on global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. These data are relevant but including too aggregated information on annual capital cost and annual recurrent cost, for urban and rural areas. Information is presented by house connection or well, septic tank or pit latrines, and sewerage connection, some of the investment alternatives envisaged for the coastal catchments in Peru.

[4] World Bank (2007) Environmental sustainability: a key to poverty reduction in Peru

A workable approach though, at the necessary scale for this project, builds on benefit-cost ratios (BCR): 5.84 for sanitation projects in Peru; 1.9 for water supply. This is used in combination with information available on costs to yield health benefits for each relevant IA (drinking water supply and sanitation, mostly).

A major issue about health benefits (avoided costs) in Peru is that of children and the relationship between diarrhoeal diseases and malnutrition. It is clear that malnourished children suffer more frequent episodes of diarrhoeal disease, while a child's nutritional status is affected following a diarrhoeal episode. Malnutrition and stunting can lead to poorer school performance, early school dropout and, as a result, increased poverty and social exclusion. Extended exposure to faecal pathogens may, in part, cause environmental enteropathy, a postulated condition characterised by malabsorption, villus atrophy, crypt hyperplasia, T-cell infiltration and general inflammation of the jejunum. This chronic infection of the small intestine could explain why sanitation may have a stronger correlation with gains in growth than with reductions in diarrhoea incidence. A study in Peru (Checkley et al., 2004) showed that diarrhoea could explain 16% of stunting, while access to sanitation and water services could explain 40%. However, information at this level is not available at a project scale.

2.4 Take-Away Messages

2.4.1 Water Management Challenges – Closing the Water Gap and Beyond

Peru is still in the process of being able to harness the potential of water for economic development mostly for agriculture, hydropower, mining, and urban development. The other side of the story is that the most competitive areas of this emerging and thriving economy (such as mining and export-oriented agriculture, both driven by the current context of high international commodity prices) are heavily dependent on the provision of water services.

Freshwater sources are intensively used, especially in the most water scarce areas of the country (such as the coastal catchments that have been assessed as part of this assignment) where population and the most water intensive activities tend to concentrate (agriculture, urban development, tourism). With an area of 21.67% of the Peruvian continental areas (1,285,215.6 km^2) and 62 catchments (out of 159 in the country), the coastal area of Peru gathers 62.53% of the population (for a total of 30,067,181 inhabitants).

Just 1.76% of Peruvian water resources (out of a total of 1,935,621 hm^3 per annum) are available in the coastal area. This implies 0.12 $hm^3/yr \cdot km^2$ – 1.51 in the whole country) and 1,815.61 $m^3/inhab \cdot yr$ (as compared to 64,376.54 on average in the country).

This context has resulted in water withdrawals and discharges that are already in excess over the sustainable capacity of long-term natural resources and infrastructures to meet current and future demand even in normal years, especially in the Locuma-Sama-Caplina-Tacna and Quilca-Chili catchments. Furthermore, available evidence about climate change shows that water flows might decrease in the near future.

There is major infrastructure for storage in some catchments: Poechos (1,000 hm^3) and San Lorenzo (258 hm^3) in the Chira-Piura; Tinajones (320 hm^3) in the Reque catchment (Chancay-Lambayeque), or Gallito Ciego (571 hm^3) in the Jequetepeque river basin. Within this study, in addition, several other investment alternatives have been identified and assessed: the special project Olmos-Tinajones (Chancay-Lambayeque); reservoirs linked to efficiency improvements via technification of irrigation (Cárac, Añasmayo and Huataya, or Quipacaca and Yaco Coyonca in Chancay-Lambayeque); micro-reservoirs for fodder irrigation (Tacna); large reservoirs (Purapa and Quiles, in Chancay-Huaral), or a large dam in Puyango-Tumbes and the associated distribution network for irrigation.

In terms of demand, consumptive water use in the Pacific accounts for 86.97% of total consumptive water use in the country, and 38.11% of total non-consumptive water use.

The spatiotemporal rainfall and runoff variability, particularly pronounced in some areas of the Pacific region, shapes the particularities of the coastal catchments in terms of water resources availability and distribution. Peruvian coastal rivers have large periodic floods, transporting significant amounts of sediments, shaping braided channels, while many streams are even intermittent or ephemeral downstream.

Overall, these rainfall and runoff patterns concur with the intensive use of water resources, mostly in agriculture. Downstream reaches are commonly deprived of high flows, which carry sediments, modify channel morphology, and maintain habitat complexity.

Given the very limited decoupling between water use and economic growth trends, growing water demand has led to increasing water scarcity and related risk. In some cases, this is also the result of the lack of coordination of sectoral policies that may potentially lead to oversized infrastructures and idle facilities, a major risk that needs to be factored in when fostering grey infrastructure, such as major diversion projects as Majes-Siguas II in the Quilca-Chilli, or the Desaguadero water transfer to supply the city of Tacna and the expansion of irrigated land in La Yarada district, or even the Alto Piura special project in Chira-Piura. Additionally, it is common to find flawed enforcement (and inadequate structure) of water use rights, mostly regarding groundwater resources (when the lack of information concurs), and over-allocation of surface water use rights, leading to potential overexploitation.

The fact that drought events are becoming more frequent in the coastal catchments, where the average annual demand of water is not necessarily higher than long-term renewable resources (i.e. water supply), according to available information, but may be so in projections to 2021 and 2035, has led to an increased uncertainty about the reliability of water supply exacerbated, as above, by climate change. These critical issues call for improved adaptation mechanisms and strengthened resilience, both in terms of demand reduction and increase on the supply side, also via alternative sources such as desalination (as in La Yarada, Tacna catchment).

Not surprisingly, most of the projects ranking higher in the prioritisation of investments are programmes to increase water use efficiency in irrigation at different levels:

Off-site investments to increase distribution and conveyance efficiency, such as those on canal lining in the Chira-Piura, the Tumbes or the Chancay-Huaral; the Patapujo irrigation canal in Tacna; the upstream irrigation system Churgur-Hualgayoc in Cajamarca (Chancay-Lambayeque); the improvement of irrigation canals in the Caplina and Locumba Rivers (Tacna catchment);

On-site investments to increase water use efficiency in the application to crops through technified systems, in the Chira-Piura; Jorge Basadre irrigation district in Locumba (Tacna); Tacamache-Chugur-HUalgayoc in Cajamarca (Chancay-Lambayeque); or the Caplina River (Tacna).

In most water scarce areas, competitiveness of both the urban and rural economy is heavily dependent on the availability of a sufficient and secure provision of water services in particular for agriculture, agro-food industries, and urban demand. Opportunities can be identified to reduce water use (e.g. by increasing irrigation efficiency, as in the above-mentioned examples) or to enhance availability. Increasing the water stored in aquifers through recharge facilities such as ponds, temporary delay of runoff by low retention dykes etc., provides infiltration opportunities (including infiltration of treated effluent into aquifers for pumping in the summer and re-use for irrigation) which contribute to increasing water availability (or reallocating time wise) and are measures of particular interest in the area. However, not many investment alternatives have actually been identified in this area.

Yet, not everything is about scarcity and droughts in the Peruvian coastal regions. A major concern has to do with water quality degradation. The improvement in the quality of water assets might actually lead to remarkable economic benefits. In turn, increase in water flows might also soar the natural assimilation capacity of water flows as well as coming out with a reduced cost of treating effluents in order to guarantee a pre-determined quality standard. This partly explains the major effort foreseen in the country to expand or build wastewater treatment plants (WWTP) such as in Tumbes or Chira-Piura (Los Portales, Noroeste, Aypate, Chulucanas, Mallaritos, Lancrones, Salitral, Morropón, Pueblo Nuevo, Viviate,

Miramar, La Juaca, Vichayal, Catacos, Paita, etc.), or even the treatment plants with joint primary and secondary treatment in Chancay-Huaral, Medium and Lower Quilca-Vítor-Chili).

Furthermore, torrential rains are common in some gullies, which lead to hazards of flash floods, stream flooding, and landslides – some investment alternatives to tackle landslides have been singled out in the Quilca-Chili.

Conventional practice has consisted in coordinating the public effort required to encompass economic growth by supplying water services demanded as a result of rapid progress in many areas of the economy including demographic change, urban sprawl, irrigation development, manufacturing activities, mining, etc.

Path-dependency is powerful. Regarding economic goals the main objective of water policy has consisted and very often consists in finding inexpensive and reliable means to meet water demands. However, this supply-biased approach, which is clearly evident in the wide array of planned investments, will necessarily need to be compatible with one aimed at making all water services used by the Peruvian economy consistent with the preservation and adequate protection of the status of water bodies. This means that, rather than an engine for the expansion of the economy, water policy should be designed to decouple growth from increases in water services demand, to revert scarcity trends, to mitigate drought risk, and to coordinate all economic water uses within the range of the ability of water bodies to deliver them sustainably.

The simultaneous economic progress has made evident the need to enhance (sectoral) policy coordination, on the one hand, and to overcome the subsidiary role of water management as an add-on instrument of sectoral and regional expansions towards a real mainstreaming element of economic policy on the other. Decoupling economic growth from increasing water demand remains an important challenge.

As part of the hydro-economic analysis developed, direct benefits of the different investment alternatives have been measured in terms of their contribution to the above-mentioned water policy challenges. Some of those alternatives, though, have been designed either with other non-water policy objectives in mind or to bring about benefits in other policy areas.

Irrigation expansion, for instance, may well contribute to productivity gains that may increase in turn farmers' income at a microeconomic level or exports and economic growth at a macroeconomic level. Any project aimed at expanding irrigation may not necessarily pursue a water policy objective but an agricultural, development, social cohesion or economic policy one. As a matter of fact, wider macroeconomic impacts of water policy (i.e. induced investment, employment, GDP increases, fiscal balance, etc.) have taken centre stage in Peru nowadays.

Something similar applies to hydropower generation, as that planned for the Sumbay River (Quilca-Chili) or Moquegua I and Moquegua III (Tambo-Pasto Grande). A successful project may contribute to energy policy but the contribution to water policy should be explicitly intended (and proved).

Any sanitation and drinking water supply project, such as the expansion and concentration of the system of emissaries and wastewater treatment in the metropolitan are of Arequipa or the San Martín WWTP in Piura, is aimed, among other things, at reducing morbidity and premature mortality rates – a critical social objective but one on the grounds of public health and social policy, and not only within the context of water policy. This is of paramount importance in rural areas of Peru, which explains foreseen investments in separate sewerage system in the Lower and Medium Quilca-Vítor-Chili or in Sumbay, also in the Quilca-Chili catchment, or even the installation of oxidation ponds in Chalcahuana, in the same catchment.

In other words, there are ancillary benefits of water investments that need to be factored in. As it is well known, though, available information to estimate these benefits is especially weak. Despite these information lacks, though, some of these benefits have been estimated as part of the analysis (see Annex A).

2.4.2 Zooming in Catchments

In Chira-Piura catchment:

A range of investment projects prioritised will contribute to addressing the ***persistent challenge of the lack of adequate infrastructure for water supply and regulation*** in the catchment. Prioritised investments addressing this challenge are diverse in the nature and range from major diversion and storage projects (e.g. Alto Piura project entailing a water transfer and the construction of Las Peñitas dam on the Piura river) to small-scale solutions such as development of new dams and small reservoirs for surface run-off exploitation. More importantly, prioritised investment projects in Chira-Piura reflect a wide range of ***irrigation efficiency measures***, including installation of technified irrigation (mostly drip irrigation), lining of irrigation canals, improving water distribution networks used for irrigation water supply, repairing and improving superficial irrigation systems such as dams, water intakes, piping, distribution and introducing metering systems. Investment projects aimed at developing additional water supply sources and at improving current irrigation efficiency will provide substantial contribution to tackling water scarcity challenges in the catchment. However, expansion or construction of additional major and minor irrigation infrastructure would result in increased water demand and use unless coupled with water efficiency measures (e.g. expansion and improvement of irrigation water service (canals) in Piura aiming to mitigate potential adverse impacts on water availability.

Investment in expansion and improvement of flood defences (in riparian areas) will contribute to addressing pressing ***climate change adaptation challenges*** in the catchment particularly manifesting in the lack of response to extreme events. In the context of the agricultural sector and its *exposure to* ***extreme events***, investments in securing necessary water supply and distribution infrastructure coupled with investments in improved irrigation efficiency and introduction of technified irrigation techniques will contribute to climate proofing of agricultural activities.

A lack of ***adequately maintained and sufficient municipal water supply infrastructure*** combined with high water demand thereby leading to water scarcity in urban areas (particularly pronounced in Talara and Paita cities) constitutes one of the key water supply challenges in the catchment. Prioritised list of investment offers a range of potential solutions including exploration of additional water sources (e.g. Santa Rosa dam at Quiroz River, additional surface and groundwater abstraction) and improving existing drinking water supply networks (e.g. Piura, Talara) including construction of WPP. Numerous prioritised investment projects are focused on expansion and/or construction of drinking water supply and sewage networks (in combination or separately). While improvements in existing water supply networks are expected to have a positive impact on increased water availability, construction of new or expansion of existing drinking water supply networks may result in a

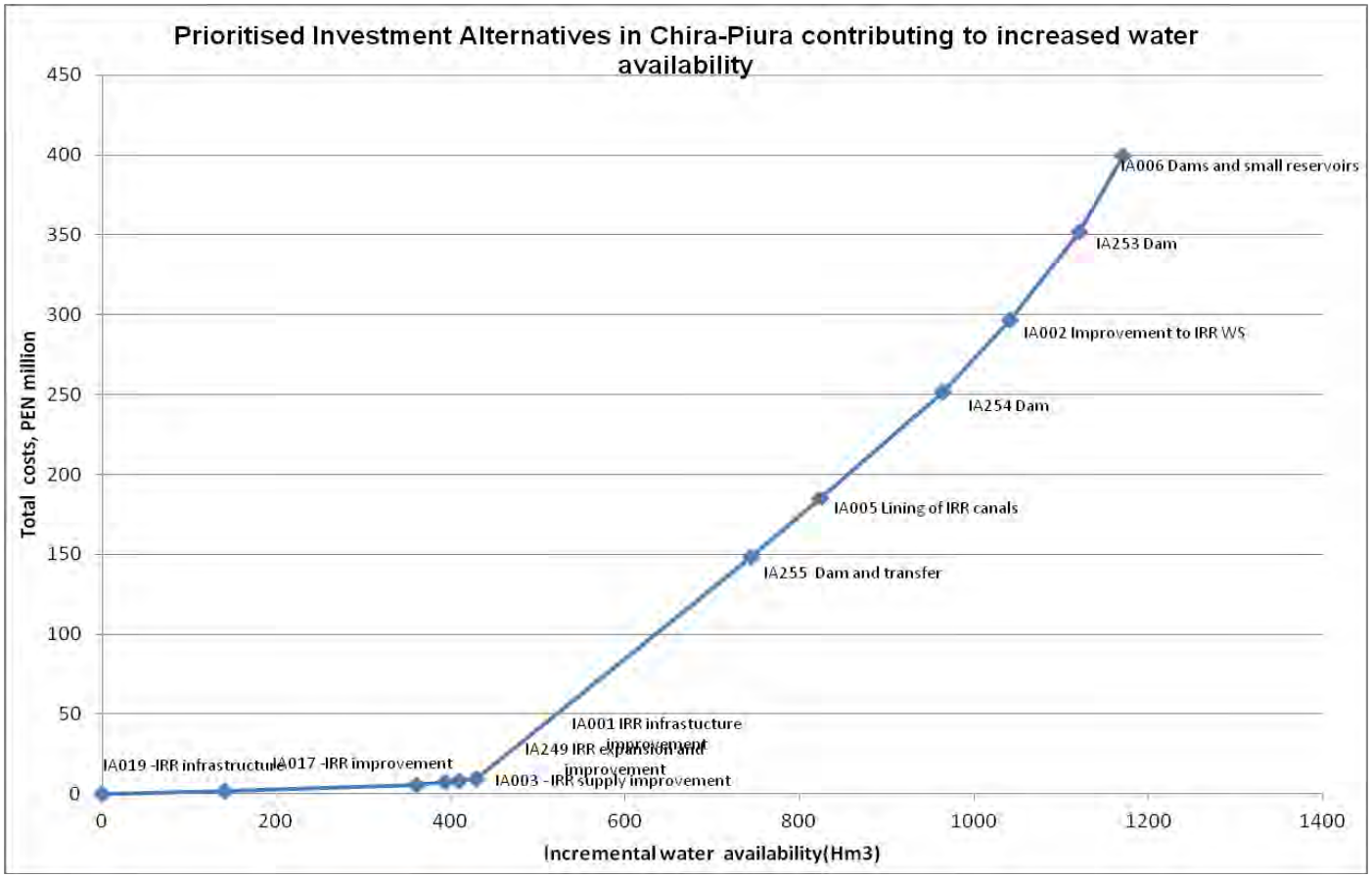
relative increase in water demand. Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reductions measures), water demand reduction measures and/or exploration of new water supply sources. In addition to Santa Rosa dam, multi-purpose Alto Piura project and Las Peñitas dam will also augment available water supply.

Construction of multiple municipal WWTPs across the catchment will contribute to tackling the issue of direct untreated discharges of domestic sewerage in the upper and middle parts of the catchment and associated environmental damage caused. Construction of a number of WWTPs will also serve social policy objectives while resulting in health benefits associated with provision of clean drinking water and sanitation services to catchment inhabitants. Expansion and improvement of sewerage network in urban areas (e.g. in Piura) and provision of rural sanitation systems would also play an important role in tackling water quality challenges as well as serving social and health policy objectives.

Prioritised investments also include projects that will contribute to tackling ***untreated wastewater discharges from manufacturing sector*** causing water quality problems in the coastal areas, Sullana and in the city of Piura, in particular. Expansion and improvements in the sewerage systems in the industrial area in Sullana, expansion and improvement of San Martin WWTP as well as expansion of drinking water and sewerage services in Piura are few examples of relevant investment alternatives that will contribute to addressing some of the key pressures in the catchments.

Prioritised investments aimed to tackle ***solid waste management*** issues, such as improvement of solid waste management systems in Talara as well as investments in construction and improvement of landfill sites would also positively contribute to solving water quality challenges in the catchment.

Figure 2.2 Prioritised Investment Alternatives in Chira-Piura contributing to increased water availability



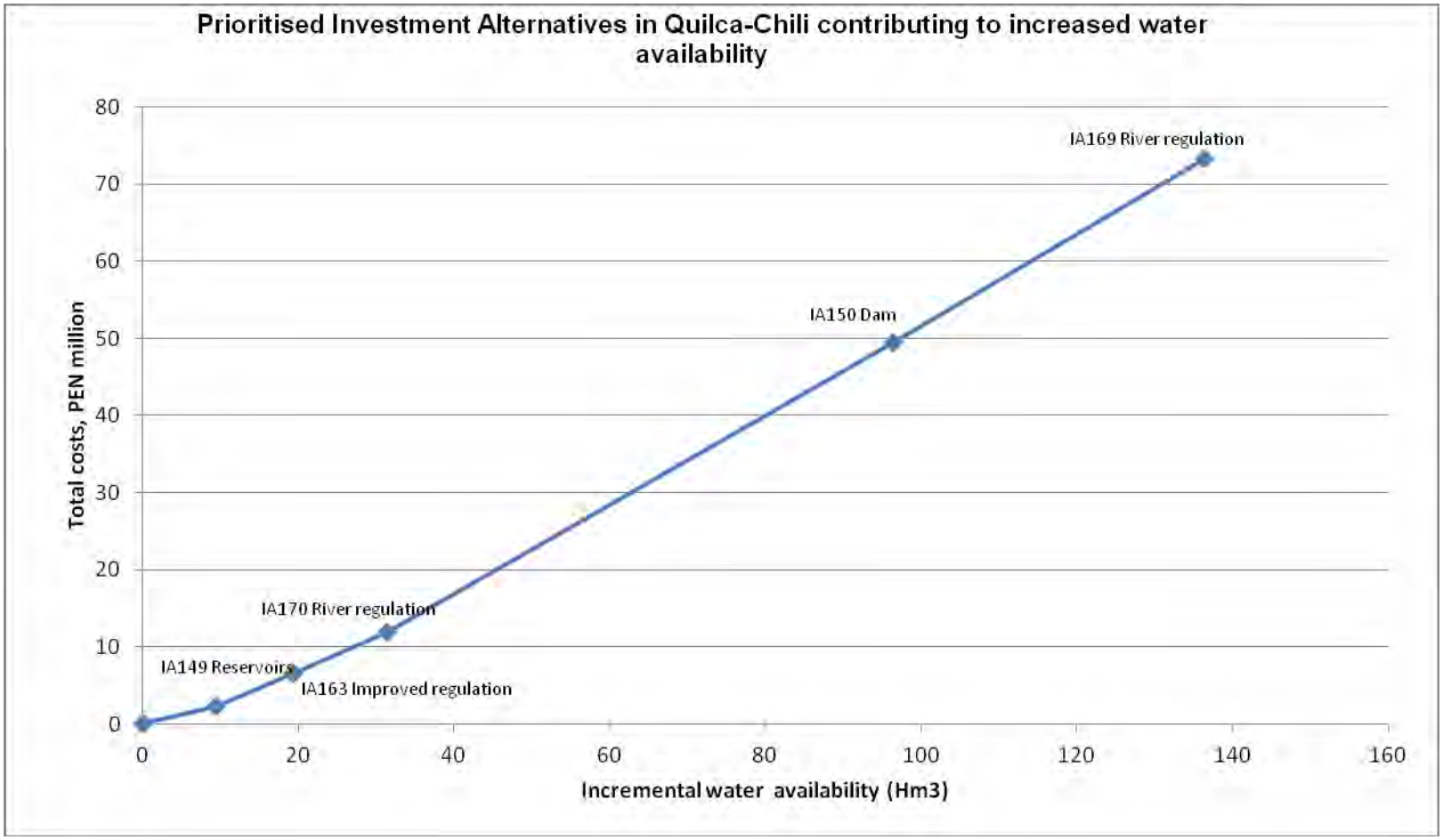
In **Quilca-Chili** catchment:

A range of prioritised investments includes projects contributing to the mitigation of ***existing infrastructural deficit***, and, in particular, projects associated with construction of multi-purpose reservoirs and undertaking river regulation projects. In the context of water scarcity alleviation, all these projects will contribute to increasing water availability, however implementation of the Majes-Sigus II water transfer project is associated with relatively more pronounced environmental and social impacts than the construction of reservoirs (e.g. Chili reservoirs), dams (e.g. El Frayle dam) and river regulation projects (Yura River, Siguas river).

Expansion and improvement of WWTPs in Arequipa region and Arequipa Metropolitan areas appears on the top of the list for WWTP related IAs. This is consistent with the need to tackle severe quality problems present in the region. Furthermore, a range of highly ranking investment projects involve provision of infrastructure for primary wastewater treatment in rural areas (e.g. Añashuayco, Eastern catchment, Sumbay) as well as installation of primary and secondary treatment in medium and lower Quilca-Vítor-Chili where environmental quality is adversely affected by discharges from human settlements.

There is, however, an obvious lack of planned investments on the prioritised list aiming to improve ***irrigation efficiency*** or reduce ***demand for household water consumption*** identified as some of the key challenges and issues in Quilca-Chili catchment. In the context of expected increases in irrigation and household water demand in the catchment, consideration of efficiency improvements will be critical to ensure that demand increases do not lead to further exacerbation of water scarcity issues in the catchment.

Figure 2.3 Prioritised Investment Alternatives in Quilca-Chili contributing to increased water availability



In **Chillón-Rímac**-Lurín catchments:

Development of ***multi-purpose reservoirs and water transfers*** in Chillón, Culebras, Lurín, San Juan and Chilca river basins at the capital investment cost (at market prices) of 703 million US$ will secure additional 253 hm^3 of water while construction of Chillón River reservoir (197 million US$) will serve **municipal water supply**. These investment projects, however, would not solve the issue of very low efficiency in the water abstraction and conveyance systems and should be implemented in conjunction with distribution network improvement projects. Development of abstraction infrastructure from Lurín River (9.9 million US$) will serve **agricultural users**.

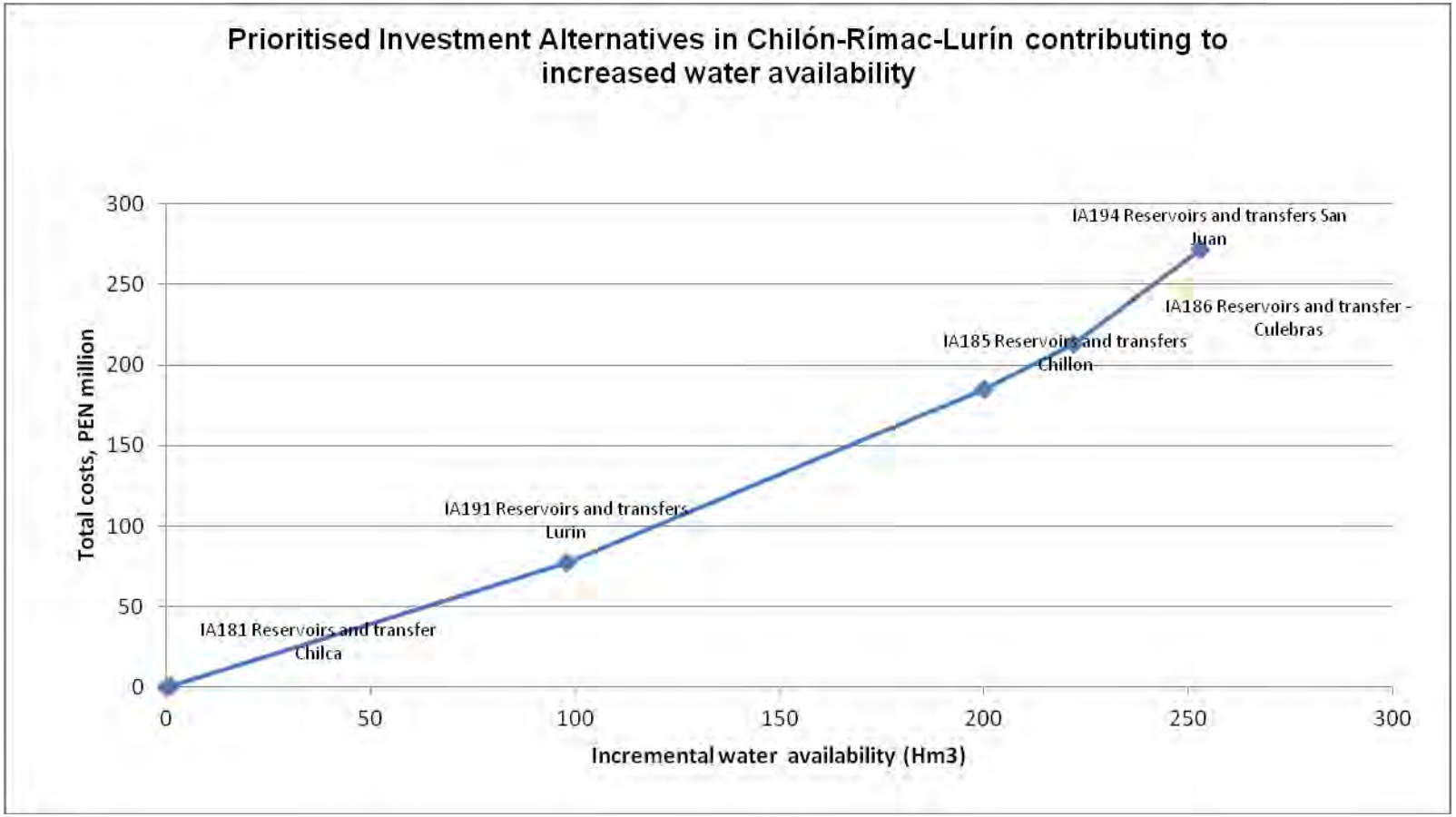
A lack of ***adequately maintained and sufficient municipal water supply infrastructure*** constitutes one of the key water supply challenges in the catchment. Prioritised list of investment offers a range of potential solutions including improvement and rehabilitation projects of drinking water supply systems contributing to the reduction of leakages (e.g. in Villa El Salvador (20.0 million US$); Cercado de Lima (4.6 million US$) and San Juan de Lurigancho (2.0 million US$)). Furthermore, investments including network expansion projects (e.g. in Villa El Salvador) will also serve social and health related policy objectives.

Expansion and improvement of drinking water and sewerage networks in urban areas (e.g. in Villa El Salvador (20.0 million US$); Callao, Ventanilla, San Martín de Porres (26.2 million US$); Cercado de Lima (4.6 million US$) and San Juan de Lurigancho (2.0 million US$)) will play an important role in serving social and health policy objectives as well as in tackling water quality challenges.

Significant health and social benefits will be obtained through construction of 73 ***water purification systems in drinking water treatment plants*** (14.5 million US$) as farmer communities directly consume untreated water.

A range of pressing challenges still remain outstanding in the **Chillón-Rímac-Lurín** catchment as no investments on the prioritised list entail projects that would tackle ***severe water pollution problems associated with mining*** due to the presence of mining material heaps in the catchment and with **discharge of untreated domestic and industrial wastewater**.

Figure 2.4 Prioritised Investment Alternatives in Chillón-Rímac-Lurín contributing to increased water availability



In **Tumbes** catchment:

Prioritised investment projects in Tumbes provide a strong response to the challenges associated with low efficiency in water abstraction and conveyance systems, lack of adequate infrastructure and almost non-existent application of best practices in irrigation. The diversity reflected in the prioritised list of investments include **irrigation efficiency measures**, such as lining of irrigation canals (1.2 million US$ securing 17 hm^3 of water), improving irrigation water abstraction and conveyance systems in Tumbes and Brujas Alta y Fundo Las Palomas (11.4 million US$ securing 49.1 hm^3 of water) and carrying out improvements of minor irrigation infrastructure in Tumbes (9.1 million US$ securing 12.5 hm^3 of water). Furthermore, prioritised investment projects include a range of **water supply investments** including both construction of dams (Puyango-Tumbes River, 146.6 million US$ providing 6.3 hm^3 of water; Quebrada Fernández Dam 15.2 million US$ providing 6.3 hm^3 of water) and construction of groundwater abstraction (0.7 million US$ providing 3.9 hm^3) with associated distribution systems.

A range of prioritised investment projects will contribute to addressing the persistent challenge of the *lack of adequate infrastructure for water supply and low efficiency in abstraction and distribution systems* in the catchment. However, the prioritised list of investment does not seem to offer a full diversity of potential solutions and is primarily focused on ***improving existing drinking water supply networks*** and ***construction of WPP*** as part of joint water supply and sanitation projects. For instance, improvement of drinking water supply systems, distribution networks and sewerage systems at the capital cost of 18.1 million US$ would save 2.0 hm^3 of water per year. Numerous prioritised investment projects are focused on ***construction, improvement and expansion of drinking water supply and sewage networks in rural and urban areas*** of the Tumbes catchment (70.7 million US$). While improvements in existing water supply networks are expected to have a positive impact on increased water availability, construction of new or expansion of existing drinking water supply networks may result in a relative increase in water demand. Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reductions measures), water demand reduction measures and/or exploration of new water supply sources. Expansion and improvement of drinking water and sewerage network in urban and rural areas would also play an important role in tackling water quality challenges as well as serving social and health policy objectives.

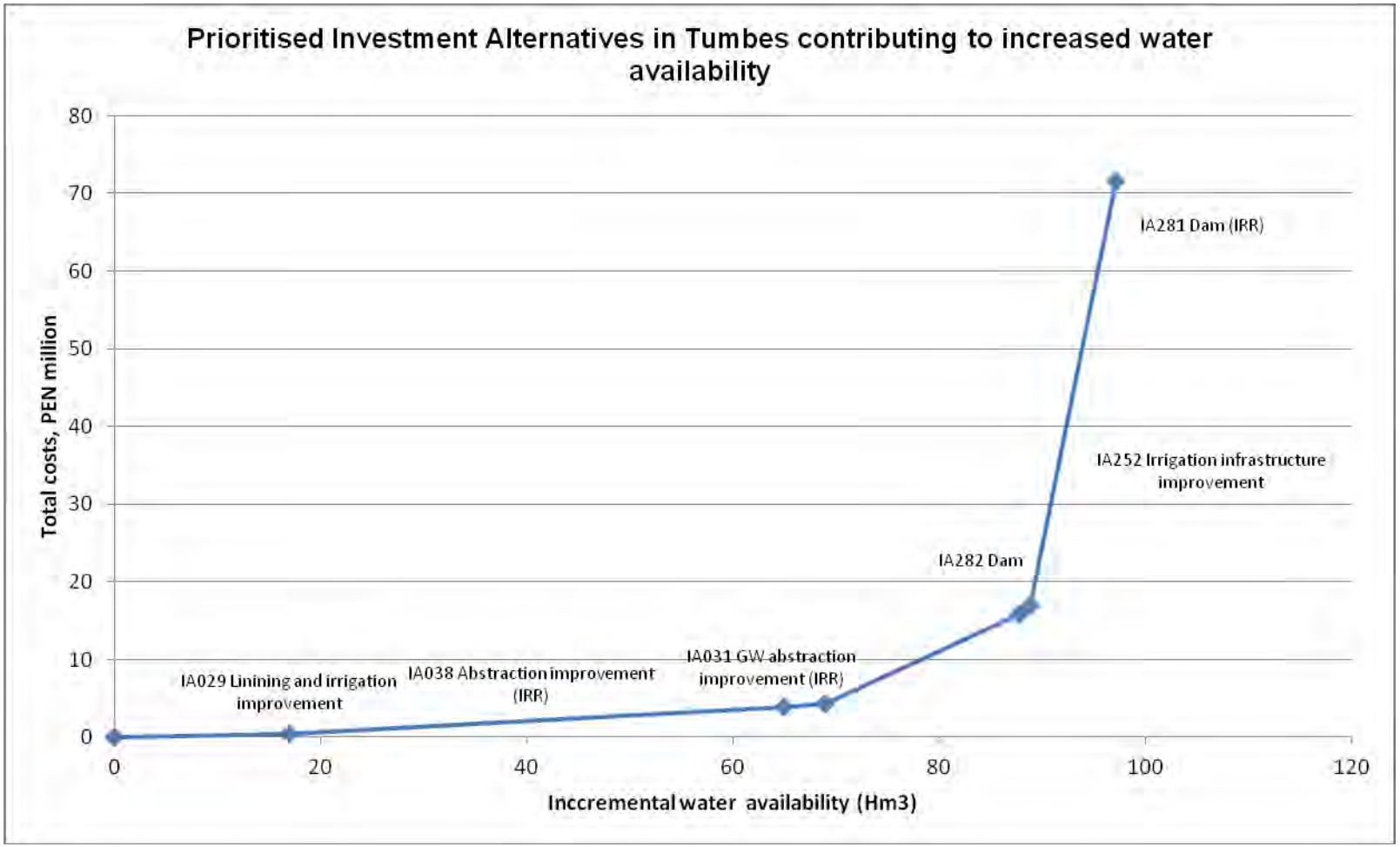
Construction of municipal WWTP in the Tumbes catchment (15.8 million US$) will contribute to tackling the issue of direct untreated discharges of domestic sewerage and associated environmental damage. Development of sewerage systems, particularly in rural areas (1.6 million US$) as well as WWTP construction will also serve social policy objectives while resulting in health benefits associated with provision of sanitation services to catchment inhabitants. Furthermore, construction and improvement of urban drainage systems for stormwater (23 million US$) will contribute to pollution reduction.

Prioritised investments in flood defence systems will contribute to addressing major ***flood risk management*** *challenge* in the catchment that is associated with riverbed silting. Prioritised investment projects in Tumbes are diverse in nature, recognising the need for preventative as well as disaster response actions and include flood defence construction in riparian areas (106.8 million US$), control and mitigation of erosion and sedimentation processes (1.9 million US$) as well as cleaning and desilting riverbeds after flood events (1.4 million US$)

Prioritised investments also include projects aimed to tackle ***solid waste management*** issues, such as improvement of urban waste management systems (15.7 million US$) that would also positively contribute to solving water quality challenges in the catchment.

However, prioritised investments in Tumbes catchment do not reflect the critical need to tackle major pollution loads from transboundary mining activities (including mercury loads)) or discharges of agrochemical waste (including fertilisers, pesticides, and insecticides).

Figure 2.5 Prioritised Investment Alternatives in Tumbes contributing to increased water availability



In Chancay- Huaral catchment:

A range of prioritised investments will contribute to addressing the *persistent challenge of* ***insufficient water storage infrastructure and regulation*** in the Chancay-Huaral catchment. Prioritised investments addressing this challenge are diverse in the nature and range from multi-purpose major diversion and storage projects (e.g. Huaral river basin reservoirs and transfers, 280.3 million US$ that will secure 183 hm^3 of water) to the use of water harvesting through an indigenous practice of amunas (0.8 million US$ providing 2.4 hm^3).

In the context of ***irrigation***, prioritised investments include construction of large reservoirs (Purapa, Quiles – 21.7 million US$ providing 21 hm^3 of water) and other reservoirs (4.3 million US$ providing 4.2 hm^3 of water). The diversity of investments is further augmented by investments that are aiming to stabilise and use ponds (21.0 million US$ providing 56.3 hm^3 of water) or use of groundwater wells (3.8 million US$ providing 10 hm^3 of water). Most importantly, prioritised investments in Chancay-Huaral include ***irrigation efficiency measures***, such as modernization of irrigation conveyance infrastructure and canal lining (11.5 million US$ providing 23 hm3 of water) as well as investments in reservoirs linked to efficiency improvements and technification of irrigation (in Cárac, Añasmayo, Huataya., Quipacaca and Yaco Coyonca; 9.1 million US$ offering 14.3 hm3 of water)

Investment in expansion and improvement of flood defences (25.8 million US$) as well as risk prevention and climate change adaptation measures (34.5 million US$) will contribute to addressing ***climate change adaptation challenges*** in the catchment and to reducing inhabitants' and agricultural sector's ***exposure to extreme events***.

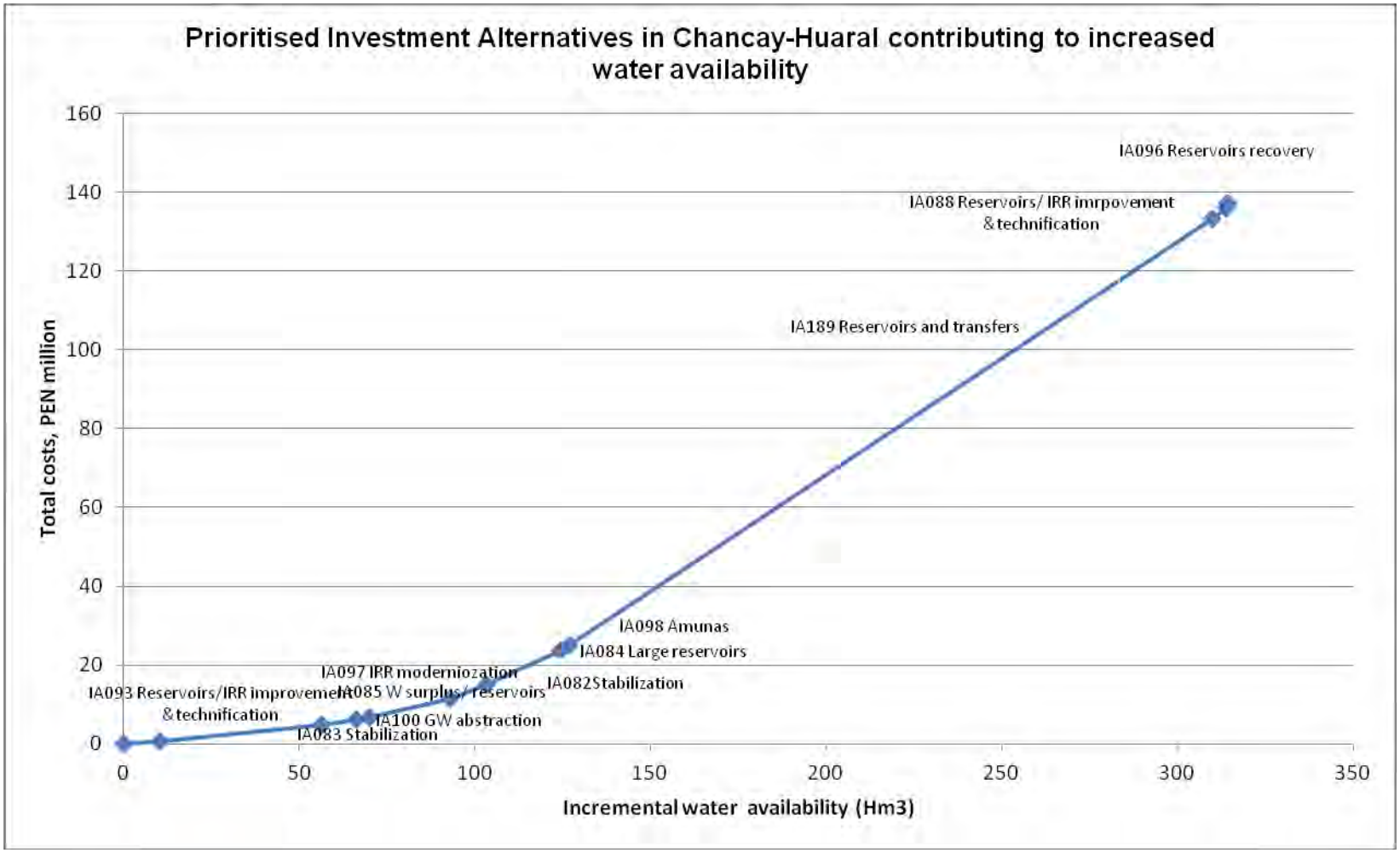
Tackling ***provision of clean drinking water*** to catchment's inhabitants is of high importance due to public health concerns associated with direct consumption of water from wells that may be contaminated with agricultural pollution and untreated sewerage. Construction of several water purification plants (8.4 million US$) as well as expansion of reservoirs, distribution networks coupled with construction of WPP for the city of Lima (393.2 million US$) are among prioritised investment projects that are aiming to tackle the challenge. It should be, however, noted that while prioritised investments include a range of water supply projects (e.g. reservoirs) and WPP construction, very few include network expansion.

While construction of new or expansion of existing drinking water supply networks may result in a relative increase in water demand, consumption of potentially contaminated water directly from wells is causing substantial public health concerns. To compensate for a potential increase in water demand, the investments would benefit from parallel implementation of efficiency measures such as leakage reductions measures, water demand reduction measures and/or exploration of new water supply sources.

Prioritised investments involving ***construction of several municipal WWTPs*** (19.7 million US$) across the Chancay-Huaral catchment will contribute to tackling the issue of direct untreated discharges of domestic sewerage and will to an extent mitigate environmental damage caused by the discharge of organic pollution. Construction of WWTPs will also serve social policy objectives while resulting in health benefits associated with provision of sanitation services to the catchment inhabitants. ***Construction of urban water supply and sewerage systems*** separately (urban sewerage system - 8.8 million US$) or jointly (2.3 million US$)m installation of on-site sewage management (28.0 million US$) as well as ***improvements in drinking water supply and sewerage networks*** in Humaya and Huaral (2.8 million US$) will also play an important role in tackling water quality challenges as well as serving social and health policy objectives. In the case of improvements in existing water supply networks, these are expected to have a positive impact on increased water availability. Prioritised investments do not extensively or explicitly address the challenge of low sanitation rates, particularly in the rural areas, agrochemicals pollution from agriculture or pollution stemming from mining materials heaps.

Prioritised investments aimed to tackle ***solid waste management*** issues, such as investments in construction of landfill sites (Chancay, Huaral, Aucallama, 6.2 million US$) would also positively contribute to solving water quality challenges in the catchment.

Figure 2.6 Prioritised Investment Alternatives in Chancay-Huaral contributing to increased water availability



In Chancay-Lambayeque catchment:

A range of prioritised investments will contribute to addressing the *challenge of* ***insufficient water storage infrastructure and regulation*** in the catchment for irrigation purposes including investments in SICAN dam system, an indigenous system (0.6 million US$ offering 5 hm^3 of water) and Special Project Olmos – Tinajones project linked to an impoundment (151.9 million US$). However, prioritised investments seem lacking in diversity of potential water supply solutions. Furthermore, prioritised investments include wide range of ***irrigation efficiency measures***, such as improved irrigation channels (Carpintero, Fala and Fernandez irrigation canals; 2.6 million US$ providing 16 hm^3 of water), canal lining (Lambayeque and Cajamarca departments; 73.1 million US$ providing 38.2 hm^3 of water), technification of irrigation (Chugur, Hualgayoc, Cajamarca; 6.1 million US$ providing 10.2 hm^3 of water) as well as more modest measures aimed at improving agrarian productivity (San José, Lambayeque; 0.2 million US$). On the other hand a range of prioritised investments foresee ***construction or expansion of irrigation infrastructure*** that would result in increased water demand (Chota, Chancay-Baños, Tocmoche - Chota irrigation system; 24.2 million US$ offering 30.7 hm^3 of water). Such expansion of irrigation systems will need to be coupled with water efficiency measures in order to mitigate any potential net adverse impact on water availability.

Prioritised investments in flood defence systems will contribute to addressing ***flood risk management*** challenge in the catchment. Prioritised investment projects in Chancay-Lambayeque include flood defence construction in riparian areas (Reque river, Lambayeque river, Quebrada Pacherrez, Chiclayo and in mid-low Chancay-Lambayeque valley; 29.5 million US$).

Prioritised investments involving ***construction of urban sewerage systems*** separately (Santa Cruz, San Miguel – 0.9 million US$) or jointly with stormwater drainage (Pomalca, Chiclayo, Lambayeque, 2.8 million US$) as well as construction of urban drainage system (Lambayque, 22.7 million US$) will contribute to tackling the issue of direct untreated discharges of domestic sewerage and will to an extent mitigate environmental damage caused by the discharge of organic pollution. However, prioritised investments do not include projects involving construction of WWTPs potentially rendering construction of sewerage collection systems ineffective in the context of pollution mitigation due to the lack of primary or secondary treatment of the sewage collected.

Improvements in sewerage (La Victoria, Chiclayo, Lambayeque, 9.1 million US$) ***and drinking water supply networks*** (Tongod, San Miguel, Cajamarca, Chiclayo, Lambayeque – 39.2 million US$) will also play an important role in tackling water quality challenges as well as serving social and health policy objectives. In the case of improvements in existing water supply networks, these are expected to have a positive impact on increased water availability. Construction of new or expansion of existing drinking water supply networks, on

the other hand, may result in a relative increase in water demand (e.g. expansion of drinking water services in Ferreñafe, Lambayeque; 0.3 million US$). Such projects, therefore, would need to be combined with investment projects aiming to improve the efficiency of current networks (e.g. leakage reductions measures), water demand reduction measures and/or exploration of new water supply sources. For instance, alternative domestic water supply project in Chiclayo would cost 6.4 million US$ while multi-purpose Pisit Santa Cruz Dam (Santa Cruz, Cajamarca) would result in additional water availability of 10 hm^3 at a cost of 46.6 million US$.

Prioritised investments aimed to tackle ***solid waste management*** issues include investments in improvement and expansion of integrated municipal solid waste management (cities of Ferreñafe, Pueblo Nuevo, Manuel Antonio Mesones Muro and Santa Cruz, 3.2 million US$) that would also positively contribute to solving water quality challenges in the catchment.

Figure 2.7 Prioritised Investment Alternatives in Chancay- Lambayeque contributing to increased water availability

In **Tacna** catchment:

Tacna is a very good example of a significant ***mismatch between available infrastructure and current and future demands***. Major and minor infrastructures have been built over the last few decades but additional planned investments are foreseen. These include Yarascay dam (adding 123 hm^3 at circa 100 million US$) or the expansion of the distribution network for agricultural development in the Vilavilani valley (142 hm^3, 92.7 million US$). There are also relevant investments in canal lining.

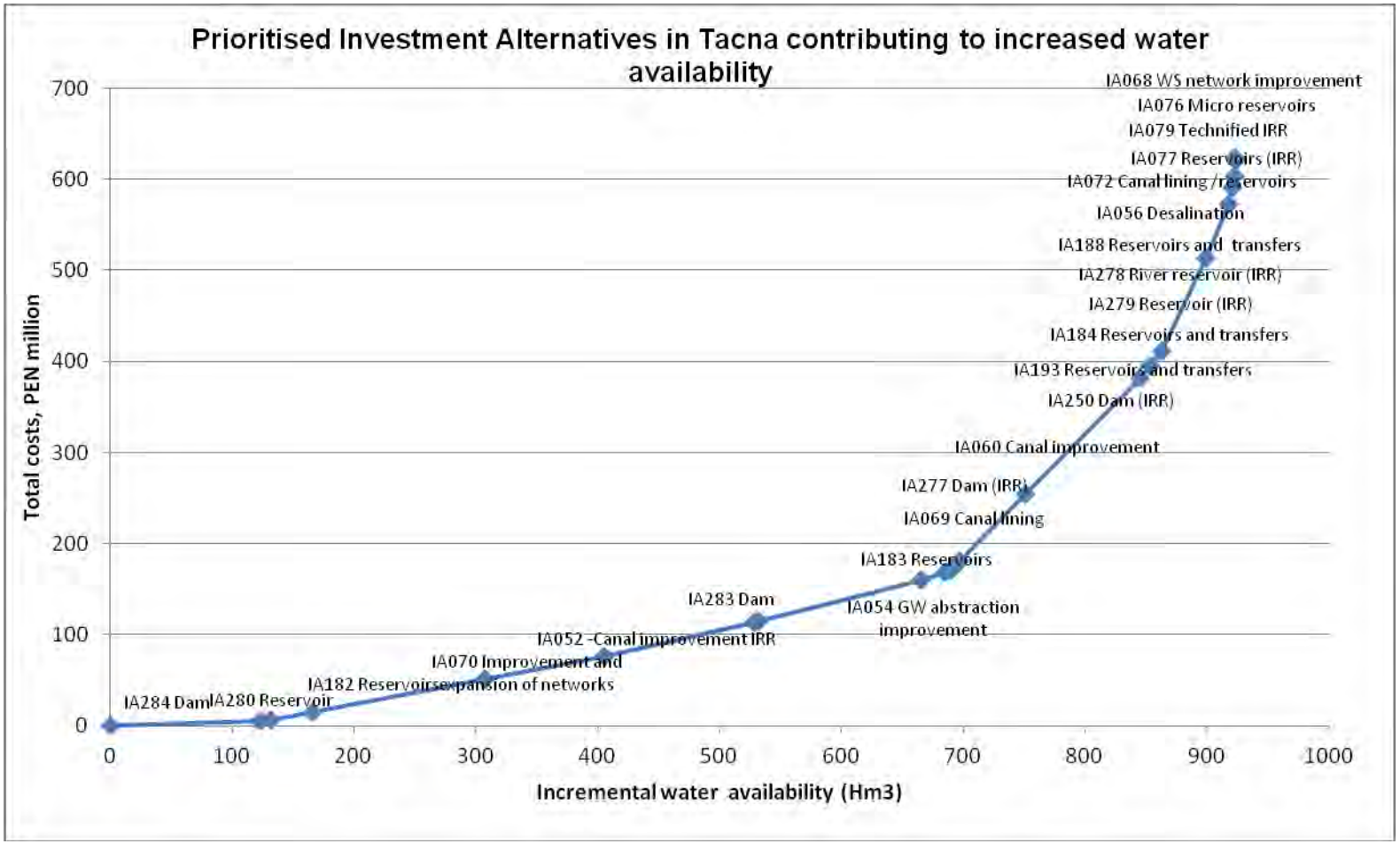
Yet, all these investments refer to irrigated agriculture when, indeed there is also a major challenge in terms of ***water supply for the main human settlements*** in the area, such as Tacna city. In the Tacna catchment in fact, there is a relevant controversy between the choice of a desalination plant for domestic supply (La Yarada desalination plant, 151.2 million US$, 18.9 hm^3) or the alternative of a major diversion project (El Desaguadero, 509.7 million US$), already highly contested and leading to an interregional conflict.

In the upwaters of the catchment cultivated land has grown. In the past, there was an explicit acknowledgement of the ***potential to expand agriculture*** towards circa 80,000 additional ha (three times the arable land by 2000), mostly in Sama Hills (object of a Special Project) and La Yarada-Hospicio. La Yarada is indeed an active irrigation district, facing increasing drought risk and vulnerability to scarcity. In La Yarada most of the water is obtained from groundwater withdrawal, very often in outlawed wells. These new infrastructures should be assessed in more depth since they should actually contribute to reduce pressures over the aquifer, rather than creating perverse incentives.

Flood defences have been ranked low. Not surprisingly, it is perceived that they may not necessarily contribute to manage flood risk while adding significant hydromorphological pressures. Significant investments are foreseen in the Sama, Caplina and Locuma sub-catchments.

In Tacna, ***deficient water quality seems compatible with moderate levels of salinity***. There are no major investments to improve water quality envisaged though. In Tacna (as well as in other catchments as Moquegua), the extraction of water for mining is claimed to have depleted natural sources, with severe environmental and social outcomes.

Figure 2.8 Prioritised Investment Alternatives in Tacna contributing to increased water availability



2.4.3 Findings per economic sector and project type

Traditional policy responses to mitigate structural water scarcity and to reduce drought risk, thus increasing the resilience of the Peruvian economy to react to these extreme events and policy challenges, not only have failed overall to provide an adequate solution; sometimes they have even brought unwanted results. The trade-off to be faced by Peruvian policy makers and private investors in the country is not a major one: how to reconcile the need to substantially reduce the infrastructural deficit in the country and, at the same time, avoid severe indebtedness, major environmental liabilities, social conflicts, and to provide effective responses to close the water gap, which seems more evident for 2031 and 2035 than today, with some clear exceptions (Quilca-Chili, Tacna, etc.).

One of the main institutional challenges is precisely to avoid a sector-biased approach. When judged separately and according to their intended technical objectives (in terms of incremental water availability), each of the responses to water challenges in the Peruvian coastal catchments could become a clear success.

Nevertheless, with major infrastructural investments planned for irrigated agriculture, household supply, wastewater treatment (for different sectors), and mining, the latter with a relevant private share in investments, one may expect the infrastructural deficit to be reduced in the next few decades. Infrastructures would then allow for a flexible adaptation to water supply, convey and apply water both in rural and urban uses, increase water use efficiency, expand installed capacity of non-conventional of water sources (desalination, reuse)… These measures, though, may not result in a real contribution to curb down the existing negative trends towards increased scarcity and higher drought risk.

One basic reason behind that insight is the need to analyse in more depth incentives behind water demand and supply and in particular to adapt all individual decisions to collective water policy objectives. Unlike common wisdom, integrated water resources management and a contemporary approach to water planning in an emerging economy like Peru is not so much about replacing supply-side with demand-side alternatives but rather to combine them in a sensible way. As a matter of fact, the analysis of alternatives in isolation and from a sectoral perspective is somewhat misleading – synergies between different investment alternatives and trade-offs are of paramount importance. What actually matters is the policy mix to manage a water resources portfolio at a catchment level.

In sectoral terms, three major groups can be identified in the prioritised list of investments:

Agriculture, with planned investments in efficiency improvement through technified irrigation (mostly drip irrigation); improved off-site infrastructure – such as in Brujas Alta and Fundo

Las Palomas, Tumbes; implementation of major and minor infrastructures for groundwater irrigation; and canal lining.

Household, commercial and public uses, with planned investments in dams and reservoirs, improvement of groundwater abstraction points for household supply or major investments in WWTPs (with the challenge to tackle energy inputs to ensure feasibility).

Significant investments are also planned for multipurpose infrastructures, such as the Chili reservoirs, or those in the Fortaleza sub-catchment, or the combined system of reservoirs and water transfer in the Pisco river basin.

Annex A: Results of the critical data review

Table 1. Results of the critical review of the data provided and its relevance for the Hydro-economic tool

Type	Element	Description	Comments for WP3	Field relevant to WP3
Identification	ID code	Unique identification code	Required for referencing. Highly useful for the identification of investment alternatives (projects and interventions)	Yes
	Information source	Sources of information including: - Water Resources Management Plans (WRMPs) for Chancay-Huaral, Chira-Piura, Chancay-Lambayeque, Quilca-Chili, Tacna, Tumbes - NWRP (PNRH)[5] - Proinversión - NSPI[6] (SNIP)	The inventory covers all the major sources of information –WRMPs, NWRP, SNIP and Proinversión Total number of entries (interventions and projects) - 2,303 covering Chira-Piura, Tumbes, Tacna, Chancay-Huaral, Chancay-Lambayeque and Quilca-Chili. There are also some entries for Caplina, Locumba, Marañón, Maure-Uchusuma, and Sama, all sub-catchments of the above-mentioned watersheds. Quality assurance work entailing inclusion of additional investment alternatives etc. culminated in 2,303 identified investment alternatives for screening and investment prioritisation. We assume that the coverage of the inventory (2,303 entries) is comprehensive.	Yes
	Aggregation level	Project Intervention	Action lines, programmes and, potentially, sub-programmes would be to generic scale for investment assessment, therefore the inventory contains projects and interventions. The scale of the projects (~1,700) was originally considered too detailed for the assessment. At the same time data on interventions was not provided at the required level of detail to be able to assess its potential relevance as an investment opportunity and (linked) projects needed to be reviewed. The key objective of the task was, therefore, to derive a list of investment alternatives in water management per catchment based on the review of both recorded interventions and projects.	Yes
	Information	High	The indicator actually represents information	No

[5] PNRH stands for Plan Nacional de Recursos Hidricos – National Water Resources Plan (NWRP). It is meant to be approved in 2014 (potentially within the time boundaries of the project). The document that is currently available is in Spanish only and while it is quite useful for an overview of water management in Peru, it does not offer sufficient details required to identify investment opportunities

[6] The SNIP is the National System of Public Investment. It has quite a reputation in Latin America (together with the Chilean or the Colombian ones). This does not imply that their appraisals are good enough, rather that they are better than average in Latin America.

Type	Element	Description	Comments for WP3	Field relevant to WP3
	quality	Average Low	availability and quantity rather than quality (using purely quantitative metrics based on the number of cells completed). Critical review of the information as part of the WP3.1 was focusing on validation and quality checking of the data relevant to WP3 rather than just on availability.	
	Project name	Title of the project	Unique project or intervention name	Yes
	Catchment	Name of the catchment	The data is available on the 9 catchments (from 6 WRMPs) including: 1. Chira-Piura (INCLAM-ALTERNATIVA). 2. Tumbes (also by INCLAM-ALTERNATIVA) 3. Chancay-Huaral (by TYPSA) 4. Quilca-Chili (by TYPSA) 5. Chancay-Lambayeque (by TYPSA). 6. Tacna (by INCLAM-ALTERNATIVA) In the best plans in terms of detail and quality of information (Chira-Piura, Tumbes etc.) there are three planning documents: diagnostic report, assessment of alternatives, and WRMP itself. Some of these planning documents have already been validated as part of a multi-stakeholder process through the so-called Consejos de Cuenca (Basin Committees, an embryo of a river basin authority). It is the case of the Chancay-Huaral, Chira-Piura, Chancay-Lambayeque, Quilca-Chili. There are 3 additional RBDs (the so-called "Lima basins"): Chillón, Rímac and Lurín for which these plans have not yet been tendered. They are treated as an interregional basin. For most of the 62 coastal river basins (Pacific hydrographic regions) there is no plan, which virtually means that there is no information. The review highlighted that 95% of available data relate to 6 river basins only.	Yes
	Region		Peru is divided into 25 regions (or 'departamentos') and the Lima Province, which does not belong to any of them. The regions, in turn, are sub-divided into provinces (195), which are composed of districts (1,840). The field [Region] is relevant since information from the SNIP is provided at a 'departamento' level. [Provinces and districts are not useful for the WP3.	Yes
Location	Province	Province	Geographical location	No
	District	District	Geographical location	No

Type	Element	Description	Comments for WP3	Field relevant to WP3
	Geographical scope	Geographical scope	This is a reference to whether the project can be deemed as local, regional or national which is potentially useful.	Yes
	AAA	Administrative Water Authorities	This is a reference to the AAA which is useful to include.	Yes
	Investment cost (at market prices)	Investment costs	Investment cost at market prices were defined as all costs assumed in the investment phase, including risk reduction costs and the costs of mitigating negative environmental impacts, studies, licences, certificates, and authorizations (if applicable). It is, however, unclear what the costs of mitigation of negative environmental impacts stand for and how these are calculated. Nonetheless, data on investment costs offered the opportunity to calculate **Equivalent Annual Cost (EAC) for investment alternatives under consideration.** With the right information (i.e. more or less reliable data on investment and technical effectiveness in cubic hectometres), annual equivalent cost of different investment alternatives could be compared as part of a cost-effectiveness analytical framework and cost curves constructed. The EAC approach allows comparing and appraising investments with different lifetimes, which was critical given the weakness of the information base.	Yes
Financial / economic parameters	Investment cost (at social prices)	Investment cost (at social prices)	These are investment costs at market prices uplifted using correction factors published in the SNIP Annex #10. These include the social costs not accounted for in costs expressed at market prices, such as potential negative externalities or disaster risk management costs (avoided costs or foregone benefits) including those linked to negative environmental impacts (as required in Annex 7, page 5, of the SNIP). These are meant to be incremental costs (as a result of comparing the project against a baseline scenario. This information is clearly unreliable (and missing for the majority of entries). Obtaining cost data e.g. on mitigation costs, externality costs would be valuable but does not seem to be available. Furthermore, there seem to be some overlap with the investment costs at market prices, as these also refer to the costs of environmental impacts (unless here they are referring to non-internalised environmental costs). In terms of the approach the project would greatly benefit from having a monetary metric that covers both direct financial costs (capital and O&M), as well as environmental and social costs, but unless the data is	Yes?

Type	Element	Description	Comments for WP3	Field relevant to WP3
			consistently available for all entries and all assumptions and approach to how the values have been calculated are spelled out, the (patchy and unreliable) estimates are not very helpful for the purpose of investment prioritisation. The issue of *incremental costs* poses another challenge since the definition of scenarios seems to refer to with/without the project situation with no details on how baselines were defined available. For a sound CBA, what needs to be compared is the scenario defined by the project (foreseen outcomes) against a baseline scenario, which does not reflect at all the situation before the project was implemented but rather how things would evolve (i.e. trends) in the absence of such a project.	
	O&M cost	Operational and maintenance costs	This is an estimate of the operating and maintenance incremental costs, comparing with/without project scenarios. They seem to describe assumptions and parameters employed and present incremental cost flows at market prices.	Yes
	Remarks on costs	Field to record comments and references	Since available information comes from different sources (WRMPs, NWRP, SNIP, PROINVERSION, etc.), this field helps to record some information on metadata.	Yes
	Foreseen private participation	Yes or No	Information on private investment foreseen.	Yes
	NPV	Net Present Value	Data seem to have been calculated at social prices but there is contradictory information since in some passages social NPV is defined as NPV over beneficiaries. Furthermore, in many instances where NPV data is available, no investment costs at social prices are presented raising a question how these have been calculated and whether the values presented are derived based on the investment costs at market prices. Data on the appraisal period lengths and discount rates used would be required to validate the numbers (for instance, a discount rate of 10% was used in Tumbes River Basin). In light of uncovered errors in investment/ O&M costs (the number of erroneous entries is not yet known) <u>financial indicators (e.g. EAC) for the investment opportunities selected for appraisal would need to be recalculated or checked</u>. Overall, NPV and EAC form one of the key financial indicators for investment opportunities prioritisation from financial point of view.	Yes
	IRR	Internal Rate of Return	Data seem to have been calculated at social prices. Same comments as above apply. Furthermore, for the indicator to be meaningful, details on the discount rates used are required (whereas the NPV is compared to 0, the IRR is compared to the discount rate and without	Yes

Type	Element	Description	Comments for WP3	Field relevant to WP3
			this basic information of reference, it is essentially meaningless for the purpose of investment prioritisation)	
	CE ratio	Cost-effectiveness ratio	SNIP tends to include this ratio when CBA is not applicable. It reflects the present value of total costs over the total beneficiaries, in order to determine the average cost per beneficiary. This represents an unusual effectiveness metric. The projects and interventions are linked through to sub-programmes, programmes and action lines. Different projects and interventions are effectively addressing a wide range of water resources challenges including quantity, quality, climate change and disaster management (e.g. flood protection). For the purposes of the investment opportunities prioritisation, development of cost-curves for a subset of technical investment opportunities aimed at closing the water gap based on the technical effectiveness Hm3 added/ saved and financial costs (expressed as EAC) can be carried out. However, in order to reflect contribution of investment alternatives to other water management objectives, i.e. not exclusively limited to closing the gap options, wider set of economic, social and environmental criteria will need to be considered in the HE tool.	Yes
	CE unit	Cost-effectiveness unit	This is not a cost-effectiveness unit (such as PEN/ m3 of water or PEN/ ha of irrigated land etc.) The field is used by INCLAM to record ad-hoc indicators on effectiveness (in the absence of monetary information). Not available for the majority of records and not useful for the purposes of WP3 other than expressed as PEN/ person	No
	Funding	Records on funding	Sources of funding. Useful as an indicator, but given the lack of data, not critical for the WP3	Yes
Technical and social parameters	Direct beneficiaries	Number of people affected	Number of beneficiaries seems to be calculated in terms of households and then translated into number of people affected using 1 household equals 5 people conversion factor. May not be appropriate as a cost-effectiveness indicator, but a useful social indicator. Strictly descriptive and more useful to have an idea of the project scale than for analytical purposes.	Yes
	Water volume (added or conserved) [hm3]	New added or recovered volume of water in annual terms (Hm3)	Potentially one of the most relevant technical effectiveness indicators (in the context of water quantity measures. Coupled with the data on costs and asset lifetimes allows derivation of EAC and construction of cost-curves (based on financial costs and water scarcity considerations). Other prioritisation criteria will be needed to assess how effective different investment opportunities are in responding to other	Yes

Type	Element	Description	Comments for WP3	Field relevant to WP3
			water resources challenges in Peru. The list of investment opportunities provided the data for less than 20 entries (out of 2,303) and obtaining the information for identified investment opportunities was critical.	
	Irrigated area [ha]	Irrigated area	No data provided. Not relevant directly, but indirectly may be used for calculations of other indicators, such as water saved or to estimate productivity increases.	Yes (indirectly)
	Length of channels [km]	Length of channels	No data provided. Not relevant directly, but indirectly may be used for calculations of other indicators, such as water saved.	Yes (indirectly)
	Length of defences [km]	Length of flood defences	No data provided. Not relevant directly, but indirectly may be used for calculations of other indicators, such as water saved or to estimate the number of properties protected.	Yes (indirectly)
	WTP to avoid risks [S/.]	Willingness to Pay to avoid risks	No data provided. The indicator is defined as an economic estimate of avoided risks (in the project implementation scenario), however, no details provided on what kind of risks. Not useful for the WP3 given no estimates and uncertainty over what this indicator actually represent	No
	DRR measures	Yes or No	No data provided. The indicator is defined as actions to reduce damages and losses that could be caused by the occurrence of a disaster during the project. Not useful for the WP3 given no estimates and uncertainty over how these would be estimated	No
Typology and project length	Status	Feasibility, investment, project profile, pre-feasibility, project idea note, unknown	No data available for all the entries (projects/ interventions). For the purposes of identification of investment opportunities for appraisal, projects and interventions already at implementation stage should be excluded (as ongoing investments). Some of records seem to indicate the status of investment or investment and implementation.	Yes
	Temporal scale	Short-term (less than 5 years) Medium-term (5 to 10) Long-term (10+)	No data available for all the entries (projects/ interventions). As discussed above, some of the entries are marked as "ongoing". None of these entries features the status entry. If these particular projects and interventions are already ongoing, these need to be excluded from the investment prioritization appraisal. Furthermore, the temporal scale among different catchments is not even (suggesting the need to convert the costs in EAC to allow for comparison of investment opportunities occurring over different lifetimes)	Yes

Type	Element	Description	Comments for WP3	Field relevant to WP3
	Investment duration	Length of investment	No data available for all the entries (projects/ interventions), but useful indicator in conjunction with the asset lives.	Yes
	Investment lifespan	Useful life of assets	No data available for all the entries (projects/ interventions), but will be critical for financial appraisal of identified investment opportunities across the catchments.	Yes
	Type of project	Structural Non-structural Maintenance	No data available for all the entries (projects/ interventions), but will be critical for identifying investment opportunities across the catchments. In particular, a wide range of structural projects will be relevant to closing the gap objective (such as irrigation optimization, green and water efficient buildings, infiltration trenches that recharge aquifers, afforestation, culture of reduced domestic water use, wastewater treatment and reuse, mine water treatment and reuse, evapotranspiration reduction, dry cooling in power generation, etc.). Conversely, some of the projects and interventions listed are of purely public/ institutional and administrative nature that would not constitute a viable investment opportunity. Type of project, therefore, constitutes an important analytical filtering criterion.	Yes
	Actual need	Indispensable, needed, populist	No data available but not critical for the WP3	No
Additional data from SNIP	SNIP ID	SNIP ID	Relevant information allowing to link the projects/ interventions from WRMPs to SNIP database (in order to obtain further technical information) as well as gaining appreciation of the type of the project and sectors affected in order to identify investment opportunities for the appraisal	Yes
	Project description	Project description		
	Project aim	Project aim		
	Project alternative description	Project alternative description		
	Project formulating unit	Project formulating unit	Not critical for the WP3	No
	Implementing body	Implementing body	Not critical for the WP3	No
	Financing mechanism (implementation)	Financing mechanism (implementation)	Relevant information allowing to link the projects/ interventions from WRMPs to SNIP database (in order to obtain further technical information) as well as gaining appreciation of the potential financing sources and sectors affected in order to identify investment	Yes
	Financing	Financing		

Type	Element	Description	Comments for WP3	Field relevant to WP3
	mechanism (maintenance)	mechanism (maintenance)	opportunities for the appraisal	
	Relevant economic sector	Relevant economic sector		
	Function	Function	Unclear indicator but seemingly referring to sectors and water uses.	No
	Programme	Programme	Relevant information allowing to link the projects/ interventions to sub-programs and programs	Yes
	Sub-programme	Sub-programme		
Additional data (from planning documents)	WRMP ID Action line	WRMP ID Action line	Information on sub-programmes, programmes and action lines is not available for all entries, but is quite relevant anyway.	Yes
	Programme	Programme	First of all it makes it easier to match information stemming from the catchment plans with the logical structure of the NWRP, and it provides an idea of the project type.	
	Sub-programme	Sub-programme		
	Intervention	Intervention	The WRMPs consist of action line, programme, sub-programme, initiative and project. • An action line is a set of programmes (6). They are equivalent to the so-called policies (5) of the National Water Resources Plan. • Each programme is a strategic element to set planning horizons aiming at meeting the Peruvian water policy strategic objectives. • Sub-programmes are specific elements within each programme. These are strictly linked to strategic objectives. • Each sub-programme, in turn, contains a number of interventions dealing with the same aspect. • Interventions are actually clusters of projects targeting the same (or similar) objective.	
	Funding	Funding sources	Relevant information but not provided for all entries.	Yes
	Remarks	Comments	NA	No
Link to the NWRP –	National policy [5]	National policy [5]	Relevant information providing links to the logical framework set out in the NWRP (tables 4.1 & 6.1): • 5 national policies: quantity management; quality management; opportunity management – bear in mind what I told you about the political context; water culture management; climate change and extreme event adaptation. • 11 national strategies: improved knowledge	Yes
	Strategy [11]	Strategy [11]		
	Programme [30]	Programme [30]		

Type	Element	Description	Comments for WP3	Field relevant to WP3
			on resources and demands, water use efficiency and demand management, increased supply (as part of policy 1); improved knowledge on quality, improved and expanded sanitation services (policy 2); IWRM implementation, development of irrigation and sanitation in poor areas (policy 3); institutional coordination and water governance, environmental education and water culture (policy 4); and climate change adaptation, extreme event risk management (policy 5). • 30 programmes of measures. These are too vague to be investment opportunities, but potentially useful to structure our conclusions and, also, to build the typology of investment alternatives so as to reduce the level of entropy between different information sources	
Other data	Overlaps			
	Peruvian best practices for the 2030 WRG catalogue	Best practice	Relevant information, as identifies a particular project or intervention as a best practice. Should be completed for all investment opportunities under consideration.	Yes
	Global best practices			
	WRG typology	Link to water policy challenges	Relevant information, as links different projects and interventions to water policy challenges (quantity, quality, opportunity, water security, climate change, etc.). Should be completed for all investment opportunities under consideration.	Yes
	Important projects	Important projects	Relevant information, aiming to mark relevant investment alternatives that might be linked to minor investment or low financial profitability but implementation of which may be relevant for other (water policy) reasons	Yes
	Project classification	Project classification	Relevant information. Represents an attempt to provide a label / key word associated with project types (irrigation, sanitation, etc.) to allow for filtering if required.	Yes

There is a number of purely descriptive fields that while not relevant for investment prioritisation, have been used for the pre-screening exercise including the following fields: project classification, status, SNIP programme, SNIP sub-programme, WRMP action line, WRMP programme, WRMP sub-programme, WRMP intervention, funding, NWRP national

policy, NWRP strategy, and NWRP programme. Rather than having them scattered, these are grouped in the HE tool.

Appendix F
Summary of Interviews

1. Summary of Interviews

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Agua Limpia**			ID	**1**
Tipo (Público / Privado)	**Privado**	Sector	**Saneamiento**		
Nombre Persona contactada por carta	**Mercedes Castro García**				
Cargo Persona contactada por carta	**Gerente general**				
Fecha de Reunión	12/08/2014	Lugar de Reunión	**INCLAM**		
Persona Entrevistada	**Mercedes Castro García**				
Cargo Persona Entrevistada	**Gerente General**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
- Es una ONG que se gestiona como una institución y trabajan con el BID, en concreto, con el FONIM que les financia. Otras empresas que se unieron a este fondo fueron: Barrick, Yanacocha, Asociación CerroVerde, SPCC, Avina, ScotiaBank, Resources Foundation de NY y Ariel Foundation de Tokio, donde el proyecto era brindar ayuda a los GoLo para orientarlos a mejorar la gestión de proyectos. - Saneamiento en rurales y periurbanas (en Sur Arequipa). Trabajaron mucho en Libertad, Cajamarca y Ancash. - El problema es que los GoLo son los que proveen de agua potable y sistema de saneamiento a su población rural. El proyecto les ayudaba en ingeniería: perfiles, F, ExpeTec. y se les complementaba con capacitación a las JAS para la operación y mantenimiento. Esto fue del 2009 al mediados del 2013. - En diciembre de 2013 BID les encarga un nuevo proyecto para zonas periurbanas, donde llegan las EPS poco a poco, pero deben complementar esa llegada de agua potable y saneamiento para que haya microcréditos a las familias para que complementen con adecuaciones en su vivienda, con lavadero, baño, etc. AguaLimpia además lo guía técnicamente, no solo a los afectados, sino a las entidades financieras para que orienten correctamente los créditos. Con eso quieren acabar con la financiación por medio de sistemas tipo usura. Ellos también tienen programas de capacitación a gasfiteros y técnicos, para que haya un colectivo técnico capacitado propio en la zona. La zona elegida es Lima, Norte de Trujillo y sur de Arequipa; están en el piloto del cono norte y cono sur de Lima. Trabajan con la financiera Edificar. - Otro proyecto es el de COSUDE (cooperación suiza) y AguaLimpia aplica Swissagua. COSUDE trabaja con ANA para medir la huella hídrica del Perú y AguaLimpia lo hace en las empresas privadas, les están calculando la huella y las medidas de reducción para 1,5 años. - Hay 5 pilotos: Unasem, Nestlé, DukeEnergy, Camposol, etc. Otros proyectos que les financia Fundación Avina de capacitación de la sociedad civil. - RALCEA es una red virtual de todos los países americanos en gestión del agua a todos los niveles. El proyecto depende de la UE y en concreto de JRC, comenzó en 2011 y concluye ahora. Ellos son el instituto de referencia y ANA el organismo focal. - - Para el BM fueron contratados por 2 meses en un servicio para el WSP, para Cuzco, Lambayeque, etc. y para elaborar su plan regional de saneamiento rural. - El expertise es generar las alianzas. La ONG está soportada por AguaLimpia Consultores.					

2) Estrategias y mecanismos de financiación que lleven a cabo
No information
3) Proyectos clave para el sector
Los proyectos del PNSR son básicos para que funcione la nutrición y por ende la educación, la no emigración y los problemas de las familias de los conos.
4) Otros agentes a incorporar/visitar
Que den estabilidad a los equipos con capacidad de gestión y formar gente. Que recepcionen más información de las instituciones como AguaLimpia para que tengan lecciones aprendidas sin cobrar. Potenciar los ingenieros sanitarios porque sólo se forman en UNI y en Santiago Antunez de Mayolo en Huaraz - Ancash. El estado debe llamar al empresariado para que no se financien proyectos atomizados, sino que los probados estén organizados bajo unas directrices públicas y planes para que inviertan. Hacer algún piloto con un GoRe que quiera hacer esta política de coordinación en la inversión de agua de las mineras o empresariado. Las nuevas ventanas de oportunidad serían con los nuevos tras las elecciones y tras la limpieza de los equipos actuales. PNSR es un gran programa y bien pensado, aunque los procesos son mejorables. Necesitan ver actos en el territorio porque no se ve el efecto.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Autoridad Nacional del Agua (ANA)**			ID	**2**
Tipo (Público / Privado)	**Público**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Juan Carlos Sevilla Gildemeister**				
Cargo Persona contactada por carta	**Jefe**				
Fecha de Reunión	15/08/2014	Lugar de Reunión	**Calle 17, 355, urb. Palomar, San Borja**		
Persona Entrevistada	**Yuri Pinto**				
Cargo Persona Entrevistada	**Secretario general**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
- Con el MinAGRI han trabajado un mapa para definir las inversiones PP. Son las mismas que las que nos habló con Vicemin. - Se nos entrega un mapa de las actuaciones con los proyectos, las inversiones y los beneficios. - El MEF les va remitiendo los proyectos estratégicos, como APP, y les monitorean (MEF monitorea a ANA) para ver que seguimiento se le está dando. En los APP, ANA está como ente de vigilancia (especialmente con el tema tarifas…) - ANA ya firma los contratos de concesión porque tienen esos contratos una opinión de ANA (es la norma 28029 que gestiona los modelos de concesión). - Hay dos modelos de gestión de agua, los de inversión publica o los de 28019 (En APP) que es donde se emite el informe d e ANA.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
APP: hay interés de ambos y puede ser el público el promotor - Opl: les parece mejor porque eso promociona a los privados puros y en cambio el otro caso es más complejo porque muchas veces se necesita más cofinanciación porque no es rentable al no aañdir - Ellos directamente no están o no tienen a nadie para ver inversores privados, sino que los					
3) Proyectos clave para el sector					
Nos dan la lista de 10 - Nos vuelven ha remarcar el caso de Ica, ya que los afectados son mayormente del sector privado (Agroexportadores). Están planteando una regeneración de la EDAR para hacer una substitución de recursos por el del acuífero. - No existe un mach entre la lista de las actuaciones y los interesados.					

4) Otros agentes a incorporar/visitar
Se plantean que Willy tenga un equipo que busque financiamiento privado - PMGRH es una Uej de obras de prevención - En las reuniones que se han tenido el sector privado no quiere que la supervisión de las operaciones APP sean los GoRe, cosa que es así por ley ahora. ANA o alguien nacional debería haber tenido esa supervisión. - Creen que lo mejor las soluciones APP clásicas como un Majes-Siguas - Pero creen que las mineras podrían salir de su ámbito - Están trabajando en mejorar los trámites de licencias de agua, etc., pero no les compete totalmente, porque debería ser vía MEF o GoRe o GoLo por el tema tributario. - Constituir una agenda e irse viendo para ver los temas hacia delante - Conversar con Ingol para poder ver lo de glaciología.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Autoridad Nacional del Agua (ANA)**			ID	**3**
Tipo (Público / Privado)	**Público**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Miguel Ángel Beretta Cisneros**				
Cargo Persona contactada por carta	**Subdirector unidad de cooperación internacional**				
Fecha de Reunión	14/08/2014	Lugar de Reunión	**Incluida en la Reunión 3**		
Persona Entrevistada					
Cargo Persona Entrevistada					
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information **2) Estrategias y mecanismos de financiación que lleven a cabo**					
No information **3) Proyectos clave para el sector**					
No information **4) Otros agentes a incorporar/visitar**					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Banco Interamericano de Desarrollo - BID**			ID	**4**
Tipo (Público / Privado)	**Privado**	Sector	**Financiero**		
Nombre Persona contactada por carta	**Edgar Orellana Arévalo**				
Cargo Persona contactada por carta	**Especialista líder en agua y saneamiento**				
Fecha de Reunión	19/08/2014	Lugar de Reunión	**Calle Dean Valdivia, 148, San Isidro**		
Persona Entrevistada	**Edgar Orellana Arévalo**				
Cargo Persona Entrevistada	**Especialista líder en agua y saneamiento**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
- Tienen el proyecto de PMGRH que finaliza el año 2015. - Del proyecto actual han desembolsado un 83% de las 10 millones que estaban previstos, pero la parte de compromiso del Banco es sólo de 1,3 millón ya. Está agotado. - La unidad ejecutora tiene poca agilidad, y no tiene definido todo lo que tienen que hacer. - Tienen experiencia en temas de cooperación privada, por ejemplo en procesos de concesión de servicios de agua potable y saneamiento: Guayaquil es un caso, estuvieron también en el caso de Tumbes, etc. - Tienen un proyecto de 100 millones en temas de sanemiento rural (BID, fondo AECID no reembolsable y el propoio MInViv). El problema es la sostenibilidad. - Exigen que los proyectos lleven incorporada una línea de fortalecimiento social para la parte de capacitación de las juntas, del acompañamiento a las obras, etc.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
Todos los formatos que están usando son bilaterales con garantía soberana. - Existe una ventanilla del banco que trabaja con el sector privado. En Perú no está funcionando en materia de agua.					
3) Proyectos clave para el sector					
EL interés es renovar el proyecto del PMGRH para 5 años más, pero estará centrado más en la línea de tratamiento de aguas residuales, residuos sólidos, etc. - No hay cuencas definidas, pero ellos estarían dispuestos a incorporar cuencas con intereses provados para que fuera en formato APP, sino es así, sería en el formato común de 100% público: con MinViv, Minam, Minagri y MiNEM. Sería focalizado a aguas servidas y recuperar el estado ambiental. En el formato de 2-3 cuencas piloto, 2016-2021 - Sería con el PMGRH como unidad ejecutora pero no con BM. El aporte de BID sería 100 millones, esperando una parte igual o superior por parte del estado. - Están coordinando con BCP para entrar en proyectos con Sedapal y para los proyectos nuevos. -					

4) Otros agentes a incorporar/visitar
Están apoyando al MinViv en iniciar la estrategia de concesionar servicios de EPS. Tienen un producto que, de forma objetiva, las empresas puedan valorar su estado para que se las analice. Programa Acorating, donde hay software pero también tema de capacitación, etc. Están acabando el producto en Perú para iniciar a aplicarlo. Es un instrumento que no solamente suma los indicadores empresariales y económicos sino que evalua las prácticas de gestión de las empresaras. - Eribelto Lima, es el especialista en temas de recursos naturales y riego del BID en Perú. - Enrique Rodríguez es el especialista en Energía - Alfred Grunwald, es el especialista en CC. -

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru

Consult stakeholders and identify policies and practices - WP4 - T1

Stakeholder questionnaires and interviews

Datos de Referencia

Entidad entrevistada	**CIA. de minas Buenaventura S.A.A.**			ID	**5**
Tipo (Público / Privado)	**Privado**	Sector	**Minería**		
Nombre Persona contactada por carta	**Alejandro Hermoza**				
Cargo Persona contactada por carta	**Vicepresidente asuntos sociales y ambientales**				
Fecha de Reunión	22/08/2014	Lugar de Reunión	**Calle Begonias, 415, piso 21**		
Persona Entrevistada	**Raúl Benavides**				
Cargo Persona Entrevistada	**Vicepresidente de desarrollo de negocios**				

Contenido de la entrevista

1) Intereses y Proyectos actuales en Materia de Agua

- Nos hablan de Cerro Verde.
- La Zanja, en 2004 los subversivos queman el campamento. A raíz de eso se hicieron 3 cosas:
(1) Llevar energía eléctrica a unos pueblos del entorno de la mina -4 MUSD-;
(2) A los jóvenes disponibles de San Miguel y Santa Cruz les dieron cursos de capacitación con escuela técnica CETEMIN y tienen unos 80 trabajando en la mina hoy día y otros en otros lugares -1 MUSD.-;
(3) Hicieron 1 presa de 0,6 hm3 para regular la quebrada -10 MUSD-.
- En Coimolache: han hecho algo similar y en Tambomayo lo van a hacer igual.
- Yanacocha: están trabajando en la ETAP de Cajamarca (10 MUSD); pero están haciendo reservorios, conducciones, etc…

2) Estrategias y mecanismos de financiación que lleven a cabo

La ETAP fue de arequipa fue aporte puro de Cerro Verde - Las cosas realizadas en La Zanja se hizo por aporte puro, pero hoy sería por obras por impuestos. - Los presupuestos de esas actuaciones salen de los proyectos, no de RRCC (que son presupuestos más de gastos de gestión). Entonces en proyecto se van a cargar los activos sociales generados: plan de desarrollo, compra de tierras, infraestructuras… - No existen estudios de % de inversión en esas medidas respecto al monto global de las inversiones. No hay tampoco una regla general, depende de cada caso. - Han usado Obras por Impuestos en Arequipa y en Cajamarca (Yaurucán, donde han realizado el asfaltado de una vía de la ciudad) y en Arequipa (Orocopampa). Hay 3 o 4 más en marcha.

3) Proyectos clave para el sector
Deben pensar en una industria minera generadora de activos (y no pasivos) y que estos activos sean una garantía del abastecimiento de agua segura para las partes bajas de los valles (represamiento, forestación, etc…). Es una oportunidad minera. La industria minera debe trabajar en el manejo de cuenca y la limpieza de las aguas, tanto en abastecimiento como saneamiento. - Van a plantear varias represas, canales de regadío y abastecimiento por OP -
4) Otros agentes a incorporar/visitar
- Obras por impuestos va ser el mecanismo más activo, incluso se guarda para época que tengas IR con intereses. - Hablar con Alejandro Hermoza para los documentos que expliquen los casos de Buenaventura - Hablar con la gente de ALAC (Guido Castillo) -

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Diálogo y Soluciones**			ID	**6**
Tipo (Público / Privado)	**Privado**	Sector	**Saneamiento**		
Nombre Persona contactada por carta	**Jorge del Castillo Gálvez**				
Cargo Persona contactada por carta	**Gerente general**				
Fecha de Reunión	12/08/2014	Lugar de Reunión	**Leónidas Calderón 179, Magdalena**		
Persona Entrevistada	**Jorge del Castillo Gálvez**				
Cargo Persona Entrevistada	**Gerente general**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Nos habla de la Política 33RH y la 34 Ord. Territorial - El nicho apareció acunado las empresas privadas que no atendían los temas de MA y agua, vieron que se bloqueaban operaciones. Además de ellos hay otras empresas y lo mejor es que las propias, energéticas mineras, etc… incorporan a sus cuadros para equipos de gestión socioambiental - Se necesita que el estado acompañe las operaciones de los privados para evitar las tensiones sociales que sean demasiado tarde para arreglar; si se generan anticuerpos no hay anada hacer. - Ha habido conflictos sociales que se han podido gestionar por estudios de RH. Hay una gran falta de información de los recursos disponibles y aparecen mitos. - Están trabajando en el río Ocoña, en Arequipa, en una central y trabajan la idea de no afección de la calidad ni de los hábitats del camarón. - Se llama proyecto camarón, donde el tramo de 20 km de afección de la traza del canal, haya obras que permitan que el caudal ecológico que manteniene sea efectivo, con represas a mano de piedras, control de las votaderos de los centros poblados y de la minería informal para que sea efectivo. - La inversión de la central del río Ocoña (CH Oco2010) de 400 MUSD, el programa camarón es muy poco en relación. Las empresas extractivas (y energéticas) están por debajo del 1-2% de la inversión. - El caso de Arequipa que resolvió la minera Cerro Verde el abastecimiento urbano y finalmente también está trabajando ahora por el tema de la depuración de residuales, donde además de asumir el tratamiento van a reutilizar el agua en refrigeración; arregla además la calidad del agua agrícola aguas abajo y, por tanto, resolvió los problemas de exportación de esos agricultores. Esto no fue canon, fue aportación voluntaria adicional - El caso en Arequipa de Tia María es totalmente diferente porque no ha habido comunicación, esta llegó tarde y luego no sostienen el proceso de diálogo continuamente, entonces hay paronos, etc.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
Proyecto de abastecimiento de Tacna es un proyecto estrella por su urgencia - Arequipa necesita afianzar sus fuentes - Lima necesita ser más eficiente para no perder tanta agua y mejorar el sistema - Agua en la selva para las comunidades. - Comunidades emblemáticas con la minería por su tradición, como Cerro de Pasco no tienen agua potable aún. - Proyecto de Concón-Topará desde la central del Platanar en cuenca del Cañete podría ser una nueva APP - Seguir potenciando Olmos y Alto-Piura					

4) Otros agentes a incorporar/visitar
Se necesita fortalecer la autoridad en las cuencas en todo lugar. - Los PE no deberían haber pasado a lo GoRes por la falta de capacidad de gestión - Utilizar mejor el sistema de obras por impuestos (también capacitación y estudios) detectando las empresas prioritarias en cada región, para acelarar los procesos. - Plantear acelerar la inversión mediante la inversión privada sobre la base de recusrsos públicos, como la obra por impuestos. - Política de hacer partícipe a la gente de las obras, hacerlas "sus obras" para que las valoren, no regalarlas sin más.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru						
Consult stakeholders and identify policies and practices - WP4 - T1						
Stakeholder questionnaires and interviews						
Datos de Referencia						
Entidad entrevistada	**Duke Energy Perú**				ID	**7**
Tipo (Público / Privado)	**Privado**	Sector	**Energía**			
Nombre Persona contactada por carta	**Guillermo Fajardo Cama**					
Cargo Persona contactada por carta	**Gerente nacional de responsabilidad social**					
Fecha de Reunión	12/08/2014	Lugar de Reunión	**Ca. Dionisio Derteano 144, Piso 19, San Isidro**			
Persona Entrevistada	**Guillermo Fajardo Cama**					
Cargo Persona Entrevistada	**Gerente nacional de responsabilidad social**					
Contenido de la entrevista						
1) Intereses y Proyectos actuales en Materia de Agua						
Duke genera el 60% por hidro y el resto es térmico - Se han fusionada Duke con ProgressEnergy y son ahora son los mayores productores de energía del mundo ¿? - Pertenecen al área internacional de USA. La región sudamérica se gestiona desde Lima - Aportan >600 MW en el sistema interconectado internacional (8 millones de familias dependen de ellos) - El 60% hidro y 40% térmicas (en la zona de la selva de Huatilla, de gas, siendo propietarios desde los pozos de gas, llevan ya 25 años allí). Les dan a la zona de la selva energía eléctrica, GLP y combustibles líquidos. - Su origen hidro es la privatización de Electro, en Cañon del Pato (Santa) y Carruaquero (Lambayeque). Están presnetes en la gestión de cuencas, han participado en el PGRH de Chacay-Lambayeque y activos en el CRHC a través del eno-consuntivo - Tienen una mala experiencia en una laguna que abastece a Cañón del Pato que ha bloqueado su producción y eso le hace pensar que la GRH por cuenca es fundamental - 57 años de operación de Cañón del Pato y ellos la tienen desde el 1998. Está repotenciada hasta 263 MW. Está vinculado al afianzamiento de 4 lagunas de las 86 que hay en la cordillera Blanca. Ese afianzamiento vino también por los temas de seguridad tras el desastre del 70 (Paron Rajucolca, Aguascocha y Rajucocha). - En estos momentos se están planteando la regulación de lagunas para ver si pueden amortiguar el CC sobre los glaciares (petición ANA) y ellos podrían tener más regulación. Hay 14 lagunas de interés 5 inminente. - Han tenido problemas con las comunidades locales por la regulación de la laguna Parón (Caraz), que recién se desatora. Han tenido ausencia de trabajo social. - Los proyectos Chavimochic y Chinecas dependen de su agua y por tanto el mensaje de la cuenca baja hacia la cuenca alta funcionó para desencayar el tema. - Les apoyó la ALA de Huaraz para equilibrar el efecto de las Comunidades, las JAS, etc. con ellos. - No hay CRHC en Santa pero lo están apoyando la conformación del grupo impulsor - Los fenónemos de deshielo se dieron tambien en 212, laguna 513, y ahora le sintresa afinanzar Palcacocha. - La IPP que se presenta entre Duke y la unidad de glaciología de ANA. - CH Carruaquero, está en Cajamarca, cuenca Chancay-Lambayeque. Allá si están en el CRHC, tienen actividad con PEOT, y financian parte de la O&M de la infraestructura hídrica mayor y fortalemcimiento institucional y capacitación, a través del PEOT y la JUA. Tienen una represa Sirati y entregan agua con su bocatoma en el olmos Tinajones. - No hay nuevos proyectos de centrales en la zona hasta la fecha, aunque sí están yendo un plan de negocio para todo el país a partir de la fusión. Lo que están viendo es temas de optimización, repotenciación, turbinas de paso, etc. - Hay un desaliento de las grandes hidro por el sector mini, porque el precio asegurado no alienta, ya que el gas es muy barato. Si hay interés de en las grandes pero no más que lo que está en marcha - Está muy preocupados por CC, a nivel corporativo, y a nivel local participan de todas las actividades que se generan. Incluso el interés está por la capacitación para prepararse para la resilencia.						

Proyecto Pucará, que era un proyecto de asociación entre usuarios agro e hidrenergético en Cuzco. Está en la lista de proyectos de MINEM pero no sale. - El proyecto de huella hídrica en Chilca y Huatilla salió muy bien por temas internos para mejoramiento y optimización (indicadores, buenas prácticas…) y por otro lado a nivel externo con la imagen con comunidades, etc. Están valorando generalizarlo al resto de latinoamérica. Es un mecanismo de buenas prácticas que te acredita social y ambientalmente con un costo contenido ya que había costo compartido con CONSUDE. - El financiamiento es clásico (bancario) pero están viendo con buenos ojos la IPP de las lagunas de Ancash. - No están usando obras por impuestos, en parte porque las autoridades locales no lo quieren por dos motivos: no pueden manejar la plata del proyecto y compromete presupuesto del año siguiente. Lo han intentado y no lo han conseguido.
3) Proyectos clave para el sector
No information
4) Otros agentes a incorporar/visitar
Opinión sobre la política del mix energético en el plan energético del país. Se debe promocionar más la hidrología como un tema estratégico a medio y largo plazo ya que los trámites desalientan, hay que promover más esto, con vistas a venta, no sólo a asegurar el mercado local. - A nivel operativo debería fortalecer más los órganos básicos de gestión del agua para hacerlos menos vulnerables a los vaivenes políticos y mejorar la gestión de los RRHH. - Podrían valorar a través de sus obligaciones tributarias el fortalecimiento de la ANA y otros agentes de las de cuenca. Pueden valorar muy positivamente que haya un mecanismo para que aporten regladamente en un planes de cuencas o preplanes de cuenca. Las condiciones es que sean participativos, con presencia de todos y ANA para que no se estigme el plan por ser de Duke u otro.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Fundación Avina**			ID	**8**
Tipo (Público / Privado)	**Privado**	Sector	**Social**		
Nombre Persona contactada por carta	**Zoraida Sánchez Morales**				
Cargo Persona contactada por carta	**Coordinadora programática**				
Fecha de Reunión	13/08/2014	Lugar de Reunión	**Avina**		
Persona Entrevistada	**Zoraida Sánchez Morales**				
Cargo Persona Entrevistada	**Coordinadora programática**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
AVINA vive de un fideicomiso privado de empresas Suizas que ya lleva más de 10 años en sudamérica. - Tiene presupuesto operativa y un % de presupuesto a coinversiones, sin cargo de planilla que ya está financiada. La coinversión con coorperación suiza, con fundaciones (pej. Gates, Good Enerhies, Portico…), sin reembolso posterior, sino en temas agua a fondo perdido - AVINA tiene 9 agendas, una de ellas es el agua. - No está centrados en gran infraestructuras, sino en inversión social asociado a los expedientes técnicos. Le llaman expedinete social, y se basa en la capacitación de los que se hacen el servicio, las JAS están en 10 millones de peruanos y en saneamiento 11 millores (en América latina se valora en 40 millones de habitantes) - Lo hacen por capacitación técnica, fortalecimiento de capacidades, exploración de tecnología que se aplique allá… no tratan la parte de la financiación O&M - COSUDE dan soporte en la redacción de los expedientes técnicos, etc. y ellos complementan con capacitación a las juntas de agua, temas de sistemas de infomración de agua y saneamiento y detectar las brechas y ver como orientarlos en las líneas de inversión que existen y donde deben tramitar sus proyectos. - El estudio de abogados Torres y Torres Lara ha hecho un estudio de cómo financiar la empresa privada en estos temas, también empresas medianas no solmente las grandes. - Están viendo como la empresa privada puede ayudar a preservar la calidad del recursos en microcuencas, en fuentes de agua, etc… La metodología sería por donación. ¿Qué ganan? Lo hacen vinculado a huella hídrica y por compensación voluntaria, valotrando los m3 preservados en las zona siempre asociado a abastecmiento urbano - Tienen una buena base de datos de JAS - No saben que monto o % representan sus acciones sobre los montos totales de las inversiones en infraestructuras - Existe un informe "Plan de Inversiones en Agua y Saneamiento en Perú" recién presnetado en el MinViv que presenta los datos de la foto de hoy de agua y saneamiento en Perú y definición de la brecha y necesidades, a partir de fuentes secundarias. Lo han financiado las cooperaciones.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
La experiencia de la inversión de mineras y extractivas es que no hay un discurso armado claro, sino que juegan a las medias tintas. La inversión no habla de modelo de desarrollo sino de obras y montos invertidos. El modelo es un modelo de renta al programa del alcalde que no tiene la capacidad de montar o definir un modelo de desarrollo. - Las empresas mineras se fraccionan, en la fundación, la responsbailidad social y las relaciones comunitarias, que no tienen porque responder a la misma lógica de desarrollo.					
3) Proyectos clave para el sector					
Hay un grupo Red Ge que analizan a las empresas y ellos proponen que apareza una renta que vaya sustituyendo la renta minera - El reto es migrar este modelo de inversión actual a que ya la minera financie el proceso de un modelo territorial que no va a depender en el futuro de la minería.					
4) Otros agentes a incorporar/visitar Falta mirada social, como programas que acompañen a los que se han de conectar en las redes de las EPS y que hacen la diferencia en cerrar la brecha del agua, y que hagan exitisa la obra, que si no no consigue esufragar el costo de O&M - Tienen problemas metodológicos: PROCOES, JAICA, PNSR, etc… no hay una integración hasta el punto que un alcalde puede hacer lo que quiera para financiarse, cualquier fondo o incluso un privado por obra por impuestos. Se debe controlar en un sistema centralizado, que no sea sólo el PNSR, sino que sume la info de la sONGs, de otros programas, etc.. y que unifique metodología. - Hace falta incorporar el modelo de gestión para operación y mantenimiento. - La inversión privada más fácil de entrar por obras por impuestos.					

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Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Futuro Sostenible**			ID	**9**
Tipo (Público / Privado)	**Privado**	Sector	**Social**		
Nombre Persona contactada por carta	**Antonio Bernales Alvarado**				
Cargo Persona contactada por carta	**Director ejecutivo**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada					
Cargo Persona Entrevistada					
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Grupo Ciudad Saludable**			ID	**10**
Tipo (Público / Privado)	**Privado**		Sector	**Saneamiento**	
Nombre Persona contactada por carta	**Albina Ruiz Ríos**				
Cargo Persona contactada por carta	**Fundadora y Presidenta**				
Fecha de Reunión	-		Lugar de Reunión	**NO REALIZADA**	
Persona Entrevistada					
Cargo Persona Entrevistada					
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**IFC Corporación Financiera Internacional**			ID	**11**
Tipo (Público / Privado)	**Privado**	Sector	**Financiero**		
Nombre Persona contactada por carta	**Álvaro Quijandría**				
Cargo Persona contactada por carta	**Gerente regional – Clima de Inversiones**				
Fecha de Reunión	08/08/2014	Lugar de Reunión	**Calle Miguel Dasso 104, Piso 5 San Isidro**		
Persona Entrevistada	**Álvaro Quijandría**				
Cargo Persona Entrevistada	**GerenterRegional – Clima de Inversiones**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
BM puede entrar en financiamiento en Policies y en Financiero de Infraestructura de agua para gobiernos - Además hay un Programa especifico de Water Sanitation Program - IFC: que cubre asesoramiento, consultoría de gestión de infra y organización de las EPS, etc... sin entrar en construcción. - IFC tiene servicios de asesoría que incluye prácticas, cumplimiento de estándares de performancia que les permite trabajar o recibir financiamiento del IFC, y eso cubre de todo: temas de gobernabilidad, sostenibilidad (entre agua por ahí), relaciones con comunidades, para empresas. - IFC financia consultoría en temas de gestión pero también el capital de trabajo, inversión en infraestraestructuras, etc... pueden entrar en Project Finance con privados. - BM financia Público y IFC financia en general a privados, pero puede financiar las públicas con derecho privado, como SEDAPAL - IFC puede financiar a subnacionales, donde puede entrar en gobiernos subnacionales como por ejemplo EPS. Hubo alguna histórico, pero ahora no. - 2030 WRG es un programa funcionalmente dependen de IFC, pero no depende jerárquicamente, sino de un consejo, donde está y preside el IFC, pero hay usuarios también, bancos, etc.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
¿Por qué financiarte con IFC? Porque los filtros y sello que consiguen les permite llegar a más financiamiento. Ellos no son baratos, tienen las tasas de mercado, pero acaban sumando los costos de los análisis y la aplicación de condicionse, con lo que se acaban convirtiendo en más costosos. Pero ellos pueden sindicar los créditos con otros bancos y hacerlo más grande. También utilizan banca local para trasladar su crédito, por ejemplo con BBVA tiene una línea "Sostenibilidad" pero el dinero viene del IFC y BBVA administra. - Tiene una asesoría para estructurar operaciones APP complejas peor no hay casos en Perú. - También hay actividades de promoción, como el premio de sostenibilidad anual, entre IFC y el Financial Times, en todo el globo, entre otras cosas hacen workshops para el fomento de nuevas ideas, etc... Convinient Services. - Sus condicionantes ambientales y con comunidades son limitantes a operaciones de alto impacto. - Los montos no limitan, limitan los posibles conflictos. Los proyectos salen entre 50 y 200 millones USD. Menos de 50 es difícil por los efectos de las condicionantes.					
3) Proyectos clave para el sector IFC puede entrar en irrigación, pero lo normal ha sido entrar sólo en infraestructuras de saneamiento (p.ej. planta de Huaicoloro), y también en hidroproducción, Chévez (CH) que está en proceso. - Han trabajado en agroexportadores, por ejemplo, con Agrocasa en Ica que es la primera del mundo en espárragos, que financió su riego tecnificado; Agro Laredo, en Chavimochic, para su constitución de caña y plata etanol (siempre como capital trabajo); Agro Industrial Virú; pero hace 3-4 años que no hay porque los proyectos no salen en las evaluaciones de perfil por los problemas de falta de agua y competencia entre usuarios. Les analizan todo, tipo DD con expertos, también en temas de disponibilidad hídrica. - Operaciones tipo Chavimochic no están en ninguna de las actuales pero pueden estar evaluando las nuevas. Pero muchas veces no están en el inicio y aparecen cuando ya está estructurada y aparece el operador y comienza actividad. Norvial fue así.					
4) Otros agentes a incorporar/visitar					

Recomienda hablar con Yanina Núñez, Gerente del sector Infraestructura. Ella tiene los proyectos antiguos, los actuales y los que están estudiando. Además tiene los mecanismos de financiación novedosos.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru

Consult stakeholders and identify policies and practices - WP4 - T1

Stakeholder questionnaires and interviews

Datos de Referencia

Entidad entrevistada	**Innova Rural**			ID	**12**
Tipo (Público / Privado)	**Privado**	Sector	**Saneamiento**		
Nombre Persona contactada por carta	**Ismael Benavides Ferreyros**				
Cargo Persona contactada por carta	**Presidente ejecutivo**				
Fecha de Reunión	14/08/2014	Lugar de Reunión	**Ca. Halcones 250, San Isidro**		
Persona Entrevistada	**Otilia Caro**				
Cargo Persona Entrevistada	**Directora ejecutiva adjunta**				

Contenido de la entrevista

1) Intereses y Proyectos actuales en Materia de Agua

ONG dirigida por grupo de empresarios con objetivo de promover desarrollo productivo del sector agrario. Formado por personal que ha estado en MEF y MINAGRI - Hacen proyectos y estudios de agro, riego y forestales. Los principales clientes son Mineras que les contratan para diagnosticar las comunidades afectadas y les proponen las acciones. Esas inversiones, históricamente privadas, ahora buscan fondos públicos. En el Sector APP está como complemento a ellos los de Agroideas que busca mejorar la competitividad de pequeños agricultores que pueden dar el salto hacia un desarrollo mayor, formalización, etc. Financian asistencia técnica, capacitación, proyectos. Ejemplos pueden ser como a unos agricultores en zona de influencia de mina, se les armó en BP para pasar a cultivo de café orgánico, se hicieron los estudios de suelo para sustentar, los documentos exigidos por Agroideas para financiar el proceso tanto en asistencia técnica, la certificación orgánica, la compra de planteles, etc... Cofinancian a cada acción del proyecto, cofinanciando (del 80 al 60% en función del tamaño con máximo de 4 UIT por beneficiario) con organización es de 40 a 100 socios por montos por cooperativa de 400.000 a 1 M. S/ - Hay 200M. USD con USA y Agroideas ha dispuesto de 70-80 M. S/ al año. Los procesos de Agroideas duran de 7 a 9 meses y no solía ser atractivo para las mineras por el tiempo, pero desde la crisis de los metales. - Agroideas también financia tecnificación de riego en paltas en Moquegua y Arequipa, en parcela de 1 ha. Exige la asociación de los campesinos, en colectivos, empresa, cooperativa… - Agrorural lleva la financiación de los de subsistencia (menos de 1 ha) y tipo subsidio, microreservorios, ayuda a la lucha contra plagas, etc. - Mi Riego es un programa que financia pública de infraestructura mayor y riego en parcelas por encima de 1500 m. En los últimos tiempo han visto que pueden ir al modelo APP a través de inversiones mineras. Inicialmente mineras pagaban expedientes y estudios para que fueran a financiar la obra por SNIP, pero ahora las empresas están cofinanciando parte de las obras. También lo están complementando con fondos de obras por impuestos, vía convenio empresa-MINAGRI donde se fija las responsabilidades de cada parte, en general minera hace todos los estudios hasta exp. Técnico y Mi Riego la obra, a veces incluso dejando claro que un % de la obra la paga la mina). - Por ej., han hecho un estudio de 1,600 ha y 120 M S/ en provincia de Santa Cruz en Cajamarca, y las condiciones de la obra no entraban exactamente en las condiciones de Mi Riego. Entonces se está valorando fraccionar, pasar ya el mejoramiento del canal por Mi Riego, pero a través de Obras Por Impuestos financiar el estudio de la represa. Otro ej., en Ancash, la minera Antamina, ha hecho un caso de riego en Haurocurán, donde la mina ha financiado un % de la obra. No existe política general ni del sector minero ni de los programas buscando iniciativas mineras y tampoco existe valoración de las participaciones privadas ni en monto ni en % en estos programas. Antes (2008) había una unidad minera en el ministerio que buscaba la cofinanciación de proyectos. Hubo reuniones y se identificaron proyectos y comunidades. El MINAGRI podría hacer los talleres e iniciar los estudios y programas en las comunidades sin que participara la minera para no tener que vencer las reticencias a hablar con Mineras. Luego esa unidad exponía los proyectos a las mineras en la zona para ver que podían financiar con ellas. Tras la selección esa unidad iba a exponer que exista la posibilidad de cofinanciamiento y que se firmaban los convenios. Innova Rural fue a visitar a MinVivienda para explicar estas fórmulas de cofianciamiento de MINAGRI para avanzar estudios por privado en zonas de influencia minera. Hasta el momento no se abrió. Consecuencia: no se ha pasado de estudios en el

primer año
2) Estrategias y mecanismos de financiación que lleven a cabo
Vía convenio para cofinanciar con Agroideas y MiRiego y vía obra por impuestos es lo más común. - Las mineras tienen un gran interés en entrar en el sector saneamiento pero no hay coordinación para poder gestionar cofinanciamiento con los programas PNSR o PNSU.
3) Proyectos clave para el sector
SPCC tiene interés en Paltuture para las áreas agrícolas para poder compensar la tensión en Arequipa - La obra de La Joya en Arequipa, regaba de las servidas que ahora se quedará CerroVerde… con lo que ahora habrá conflicto. Portanto CerroVerde debe generar un programa de gestión social que trabaje la idea de la calidad, la certificación agroexportadora, etc... para que no se les vuelva en contra una operación tan importante como la EDAR y reutilización de Arequipa.
4) Otros agentes a incorporar/visitar
Falta de marketing y de presentación de los programas de MINAGRI Agroideas, Agrorural y Mi Riego para que se conozcan y se usen. - Nos propone hablar con Freddy Kleiman para poder explicarnos la relación Agro-Mina y está en Antamina - Debería realizarse una exposición de las obras priorizadas en las cuencas piloto para poder ver que podrían invertir las mineras (tipo taller). Debe darse visibilidad detallada de los PGRH en las empresas y asociaciones. - La iniciativa debe tomarla el estado para poder cofinanciar obras, y también para no financiar obras que no están en los planes o no están priorizadas.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Ministerio de Agricultura**			ID	**13**
Tipo (Público / Privado)	**Público**	Sector	**Agricultura**		
Nombre Persona contactada por carta	**Jorge Luís Montenegro Chavesta**				
Cargo Persona contactada por carta	**Viceministro de desarrollo e infraestructura agraria y riego**				
Fecha de Reunión	11/08/2014	Lugar de Reunión	**Av. La Universidad N°200 - La Molina - Lima**		
Persona Entrevistada	**Jorge Luís Montenegro Chavesta**				
Cargo Persona Entrevistada	**Viceministro de desarrollo e infraestructura agraria y riego**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Hay unas fichas en Ica que nos dan la idea de los costos, áreas, etc. - Ica: 650 MPEN es la parte financiable por GoRe (270) y MINAGRI (380) - Ica: Incahuasi; - IP Lambayeque; (1) Perfil de Las Delicias (80hm3) en Zaña, Cruz de Colaya en Motupe (6 hm3) y (2) La Calzada (120 hm3) y Montería (--) - IP Piura: Vilcasanz (perfilillo…) y Santa Rosa; no hay datos más allá de lo que ya tenemos de SNIP - Alto Piura: están valorando pasarlo a IP o, según quien gane, se caiga. 20.000 ha nuevas y mejoramiento de valle viejo… pero creen que sería mejor anularlos y que la demanda sea desde Olmos y con regulación (5 presas en laterales) - Chinecas: tienen problemas por la invasión en las tierras que tendrían que ser productivas. - Majes: ya se está. Pero hay algo que no se está mirando: PR. Prado-Esperanza en Espinar, con el PE Meriss-Inka. Prevé mejoramiento de pastos de 10000 ha con una presa nueva. En Yauri, en puente Rosario, sobre Apurímac, hacer una regulación de 800 hm3 e hidroproductivo. - Pasto-Grande, estaría arrancando lomas de Ilo (minera Cayaveco podría financiar) - IP Tacna: son 2 obras independientes: Vilachauyani y Copapujo que sumarían un 1-1,5 m3/s que permita una central y se compratiría EPS Tacna y 2500 ha. Información del PET, estudio. Nos pasan datos y podría unirse con la suma de la propia planta. Hay que sumar el acuífero, porque eso aumenta cofinanciación al ser ambiental-social. Más Recarga Caplina. - Tumbes: reformular la IP, pero depende de nosotros. Esperar al nuevo Presidente Regional - MI Riego: 1200 + 450 MPEN en estudios y obras. Van a hacerlo por ratios de impacto mayores. Van a intentar acoger 200 MPEN proyectos) por obras por impuestos que ya han pasado al sector Minero. Lo están haciendo por obras por impuestos que no atacan a los presupuestos GoRe o GoLo.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
Todo lo que están pensando es concesión - Excepto en obras por impuestos que en este caso podría entrar el privado - DG de Comercio Agrario sería el que gestiona fondos para apalancar operaciones agropecuarias asociadas a mi riego, a través de Agroideas (20%privado y 80%público) y AgroBanco y Sierra Exportadora está por unirse al Minagri - Están viendo si el exportador (inversor) puede apalancar y financiar las operaciones de tecnificación en parcela incluyendo la reparcelación, vía el asocitivismo. - Agroideas da beneficios y financiación a través de asociativismo, no vale el individual. - Están incluso fomentando subsidios para reconversión de agricultores pequeños en caso que se apruebe BP y apliquen las propuestas para plantar frutales, etc… que han de esperar. Ese subsidio solamente será si están en ese plan de reconversión. Los cultivos son reconvertir las parcelas de algodón (Pisco) por debajo de 4 ha en la zona sur, en el caso de arroz en el norte (Piura), trabajan para pasar a otro cultivo que les permita con la misma dotación multiplicar por 2 ó 3 la superficie de riego. - Están potenciando todo lo que es comercialización y gestión de mercados internacionales. - Están planteando que costa sea agroexportación (monocultivos) y cultivos en sierra sean para mercado local					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
Queda pendiente					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru

Consult stakeholders and identify policies and practices - WP4 - T1

Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Ministerio de Economía y Finanzas**			ID	**14**
Tipo (Público / Privado)	**Público**	Sector	**Financiero**		
Nombre Persona contactada por carta	**Eloy Durand Cervantes**				
Cargo Persona contactada por carta	**Director general de inversión pública**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Eloy Durand Cervantes**				
Cargo Persona Entrevistada	**Director general de inversión pública**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Ministerio de Vivienda**			ID	**15**
Tipo (Público / Privado)	**Público**	Sector	**Saneamiento**		
Nombre Persona contactada por carta	**Francisco Dumler Cuya**				
Cargo Persona contactada por carta	**Viceministro de construcción y saneamiento**				
Fecha de Reunión	06/08/2014	Lugar de Reunión	**Westin Rte. Market**		
Persona Entrevistada	**Francisco Dumler Cuya**				
Cargo Persona Entrevistada	**Viceministro de construcción y saneamiento**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Máximo responsable de los programas de saneamiento Rural y Urbano, EPS Sedapal y normatividad en la materia					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Ministerio del Ambiente**			ID	**16**
Tipo (Público / Privado)	**Público**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Alessandra G. Herrera Jara**				
Cargo Persona contactada por carta	**Asesora**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Alessandra G. Herrera Jara**				
Cargo Persona Entrevistada	**Asesora**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Ministerio del Ambiente**			ID	**17**
Tipo (Público / Privado)	**Público**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Mariano Castro S. M.**				
Cargo Persona contactada por carta	**Viceministro de gestión ambiental**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Mariano Castro S. M.**				
Cargo Persona Entrevistada	**Viceministro de gestión ambiental**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Newmont Perú S.R.L.**			ID	**18**
Tipo (Público / Privado)	**Privado**	Sector	**Minería**		
Nombre Persona contactada por carta	**Javier Velarde Zapater**				
Cargo Persona contactada por carta	**Gerente general**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Javier Velarde Zapater**				
Cargo Persona Entrevistada	**Gerente general**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru						
Consult stakeholders and identify policies and practices - WP4 - T1						
Stakeholder questionnaires and interviews						
Datos de Referencia						
Entidad entrevistada	**Proinversión**				ID	**19**
Tipo (Público / Privado)	**Público**		Sector	**Financiero**		
Nombre Persona contactada por carta	**Carlos Herrera**					
Cargo Persona contactada por carta	**Director de servicios a los inversionistas**					
Fecha de Reunión	21/08/2014		Lugar de Reunión	**Edificio Petroperu**		
Persona Entrevistada	**Luis Pita**					
Cargo Persona Entrevistada	**Jefe de proyectos de saneamiento**					
Contenido de la entrevista						
1) Intereses y Proyectos actuales en Materia de Agua						
Hasta la fecha se han invertido 20-25000 Millones de USD con efectos muy pobres - La primera promoción fue el Proyecto Olmos. EL concesionario Hidroeléctrico. Va por fases. - La concesióin Majes-Siguas pero por los problemas con Cuzco, la concesión está suspendida. Preveen que se reactive a fines del 2014. Son 38.000 ha nuevas y tiene hidros por 500 MW. El Concesionario actual es en tema de implementación de infraestructuras hidráulicas mayores y prestación de agua a las ha. El hidrop es otro proceso que sale después. - Proyecto Chavimochic, 18.000 ha nuevas que ya venían de la fase 1 y 2. Ahora se desarrolla la 3a incorporando 63.000 ha nueva y 47.000 ha mejoradas en Chicama. - En caso Chavimochic, en cuanto al INV son 700 MUSD, pero el estado pone hoy 373 MUSD; Las inversiones privadas se valoran en más de 1000 MUSD por la preparación de tierras, tecnificación, fábricas, semillas, etc. En producción, se valora que la producción de Chavimochic sean de 1200 MUSD/año; Pero además los 373 MUSD se recuperan, son un crédito: primero con la venta de tierras y luego con el retorno del importe de la veta de agua a partir del año 15 hasta el 25. - Dos proyectos de Agua Potable: Huascacocha (2,5 m3/s adicionales para Lima vía la regulación, conectándose al actual Marca 3 y llegando a la cuenca del Rímac) ya concesionado y Marca 2 (que incluye planta de tratamiento y ramal nuevo que prevee +5 m3/s adicionales).Está lanzada la convocatoria de Marca 2. Hay un tercero que es la regulación del río Chillón (en estudio). El concedente en estos casos es el MINVI siendo Sedapal será el beneficiario de las obras y el supervisor. EL tema hidro no es muy destacable pero el vertido en Rímac representa una mejora a la producción a las hidro actuales y SEDAPAL les cobrará. El concesionario no puede vender el agua a nadie que no sea SEDAPAL. - Existe un proyecto en el sur de Lima de desalinización (Provisur) que está concesionado; Mismo esquema que Marca. Se comienza a construir en este año.						

2) Estrategias y mecanismos de financiación que lleven a cabo
Los contratos de concesión son de los GoRe a través de los PPEE, es decir el concedente en representación del estado peruano. PE es un supervisor del contrato por encima del supervisor especialidao que también depende el PE. - El mecanismo actual es un apalancamiento financiero temporal con visión a más de los 25 años de concesión, mal llamado cofinanciación. Tal y como se plantea el cofinanciamiento parece un subsidio. - En caso de Chavimochic el precio nuevo es 0,06 USD/m3 y en Olmos es 0,07; Pero en el caso de Chavimochic hay desde la antigua o sea 0 (Antiguos), agroexpordaroes antiguos (0,025) para el agua que ya percibían y por agua mayor para 2 campaña se cobra más), tierras adquiridas per sin agua otra y los nuevos el 0,06 (hay 9 tipos de ususrios, hay que sumar a los poblacionales y a los hidro. Existe un objetivo cuando todo esté desarrollado, es de 13.000 m3/ha/año - La regulación es la ley 28019 y su reglamento y crea un marco especial para esto. - En caso de una actividad de regulación de avenidas, se debe pagar igual, pero en ese caso sería el GoRe y que vea como lo repercute o si lo subvenciona por presupuesto. - Si hay un proyecto nuevo verán los números y de qué entidad pública lo tendría que introducir. Si hay o no hay PE existente o adscribible. No existen límites de financiación al alza, si a la baja, pues si son pequeños se restringen al GoRe (lim= 15 MUSD). Los tiempos dependen del estado de madurez anterior. Chavimochic entró en Proinversión en 2011 y se ha adjudicado en 2013 (2 años). Majes Siguas se complicó y que no tenía una serie de cambios ni conceptos que complicaron la declaratoria de viabilidad. - En caso de una promoción privada, el promotor tiene derecho a tanteo sobre el ganador y en caso de no poder igualar recuperar el costo de los estudios (declarados previamente) - Existen mecanismos de recuperar la concesión. Quien sustituye a un concesionarioo que falle debe asumir todo, pero además el accionista estratégico (que está deifnido en cada caso) debe estar hasta 5 años de la operación. -
3) Proyectos clave para el sector
EL proyecto Olmos tiene un potencial de 150.000 ha pero solo incorpora 38.000 en la fase actual concedida. EN este caso están planteando una segunda etapa para incorporar 100.000 ha adicionales. - Están los de Ica. El canal Ingahuasi, añadiendo plan presa Tambo, pero no tienen SNIP para llegar a tener acceptación de las comunidades. Ante esto se han ido al modelo de potenciar el canal de Caruancho y luego un nuevo embalse den el cauce del río Ica, con doble uso, regulación para riego y laminación de avenidas. Se reactivaría para el nuevo GoRe. También se están planteando ampliar la captación al río Pampas, con 600 hm3 de aporte, y añadir 25.000 ha nuevas con hidro. Ambos casos son por propia iniciativa, poder apoyaros para llegar a viabilidad para que estén exceptos para poderlos desarrollar. En este caso el concesionario debe estar en la parte alta para animar a la iniciativa privada. - En el caso de Ica opción 1 las dificultades son mayores por el proceso de apalancamiento temporal porque no hay tierras nuevas y en este caso lo que se propondría es que los antiguos paguen lo que tengan que pagar y el GoRe u otro, les subsidie fuera del contrato concesional. - Posibles proyectos nuevos: Alto Piura, Chinecas, se plantean un proyecto de trasvase del Desaguadero hacia Tacna.
4) Otros agentes a incorporar/visitar
En el caso de los conflictos con partes de cuenca o regiones, ellos exigen o median para que haya acuerdos, peor lo ideal es que estos proyectos son de carácter nacional y no de carácter regional. En esto están trabajando para que avance la siguiente etapa de Olmos porque Cajamarca se opondrá. - Si surge una idea que no está en los PPEE existentes, se puede evaluar pero no iría por la GoRe si es bi o más regional. - Pampas Verdes, es un proyecto de 3 regiones y 100% privado (promoción). Pero si hay 200.000 ha y 3 regiones se debe ir a Proinversión para poder avanzarlo y etsructurar una solución.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Sociedad Nacional de Minería Petróleo y Energía**			ID	**20**
Tipo (Público / Privado)	**Privado**	Sector	**Min ería**		
Nombre Persona contactada por carta	**Jacqueline Villanueva Vargas**				
Cargo Persona contactada por carta	**Asesora legal del sector minero**				
Fecha de Reunión	15/08/201 4	Lugar de Reunión	**SNMPE**		
Persona Entrevistada	**Jacqueline Villanueva Vargas**				
Cargo Persona Entrevistada	**Asesora legal del sector minero**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Interesan los proyectos que tienen que ver con las actividades extractivas y los proyectos que tienen que ver con su responsabilidad social; aunque haya denominadores comunes de eficiencia, costo, t, resultados, pero los dos ámbitos son tratados diferentemente. - Como evitar tomar el agua que otros usuarios están usando o quieren usar (caso Tia María) y lucha contra el dogma y la politización - Nos recuerda en el caso de Cerro Verde, un caso de éxito. Se consiguió una reserva de uso de agua para el proyecto, pero en este caso la reserva no fue sólo para el proyecto, sino que fue multipropósito: Energético, Minero (Cerro Verde), Agrícola(mayor disponibilidad) y Poblacional (aumento de las horas de servicio) todo con la presa Quiones; tras ello a petición del GoRe Arequipa se financiaron proyectos del SNIP por mercanismo de obras por impuestos (y uno anterior, fondo de solidaridad con el pueblo, tipo fideicomiso). - SPCC+Backus+BCP... va a financiar el puente que une los dos lados del Arequipa, puente Chilina, para las buenas relaciones sociales y mejor beneficio de la actividad productiva. Se está haciendo por obras por impuestos… pero a cambio debería haber algún premio - No existe un informe que evalúe las inversiones privadas en agua desde el sector minero o energético.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
Agua para todos es un programa que sí permite la inversión privada acompañando la pública en temas de saneamiento, pero en riego no hay esa visión					
3) Proyectos clave para el sector					
Graves problemas de los estudios de recursos - Tia María					

4) Otros agentes a incorporar/visitar
En los casos multipropósito en los que no hay un beneficio directo para la minera, porque no consigue el agua, hay siempre beneciios de tipo infrecto (social, imagen, tranquiliadad, etc…) - Pero en los casos de responsabilidad social corporativa, debe ser cofinaciada, porque el interés es de las comunidades y por tanto del estado. - El premio que ganan las empresas privadas en involucrarse en las inversiones públicas, deberían darles beneficios fiscales o excepciones, o alguna compesación. Esto debría ir a una norma tributaria especial, o de trámite,… es una norma adhoc. O la propia facilidad para hacerlo, o sea un acompañamiento con alguna compensación - Están muy importante tramitar la eficiencia también en la tramitología para no barar l ainversión. Esisten muchas incógintas o riesgos para poder entrar parte social o para parar los proyectos. - José Luis Escarfil fue el que estuvo en el BP del Insituto Tecnológico del Agua - Hay que introducir las APP en temas no clásico, el caso del Instituto encaja en esto. - Entrevistarse por Julia Torreblanca de Cerro Verde - Responsable del consejo de competitividad: Angelica Matzuda -

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Southern Perú Copper Corporation**			ID	**21**
Tipo (Público / Privado)	**Privado**	Sector	**Minería**		
Nombre Persona contactada por carta	**Guido Bocchio Carbajal**				
Cargo Persona contactada por carta	**Gerente legal y recursos naturales**				
Fecha de Reunión	15/08/2014	Lugar de Reunión			
Persona Entrevistada	**Guido Bocchio Carbajal**				
Cargo Persona Entrevistada	**Gerente legal y recursos naturales**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**The Nature Conservancy**			ID	**22**
Tipo (Público / Privado)	**Privado**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Luís Alberto Gonzáles**				
Cargo Persona contactada por carta	**Representante en el Perú**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Luís Alberto Gonzáles**				
Cargo Persona Entrevistada	**Representante en el Perú**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Unión de Cervecerías Peruanas Backus y Johnston S. A. A.**			ID	**23**
Tipo (Público / Privado)	**Privado**	Sector	**Alimentación**		
Nombre Persona contactada por carta	**Felipe Cantuarias Salaverry**				
Cargo Persona contactada por carta	**Vicepresidente planeamiento y asuntos corporativos**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Felipe Cantuarias Salaverry**				
Cargo Persona Entrevistada	**Vicepresidente planeamiento y asuntos corporativos**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru

Consult stakeholders and identify policies and practices - WP4 - T1

Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Water and Sanitation Program**			ID	**24**
Tipo (Público / Privado)	**Privado**	Sector	**Saneamiento**		
Nombre Persona contactada por carta	**Ivo Imparato**				
Cargo Persona contactada por carta	**Principal regional team leader**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Ivo Imparato**				
Cargo Persona Entrevistada	**Principal regional team leader**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**WWF Perú**			ID	**25**
Tipo (Público / Privado)	**Privado**	Sector	**Ambiente**		
Nombre Persona contactada por carta	**Cecilia Álvarez Vega**				
Cargo Persona contactada por carta	**Coordinadora unidad de ciencias para la conservación**				
Fecha de Reunión	-	Lugar de Reunión	**NO REALIZADA**		
Persona Entrevistada	**Cecilia Álvarez Vega**				
Cargo Persona Entrevistada	**Coordinadora unidad de ciencias para la conservación**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**ANTAMINA**			ID	**26**
Tipo (Público / Privado)	**Privado**	Sector	**Minería**		
Nombre Persona contactada por carta	**Ricardo Morel**				
Cargo Persona contactada por carta	**Vicepresidente de asuntos corporativos**				
Fecha de Reunión	26/08/2014	Lugar de Reunión	**-**		
Persona Entrevistada	**Roberto Manrique**				
Cargo Persona Entrevistada	**Gerente de medio ambiente**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Grupo CADE: 13 empresas, sistematizar Caplina, Huatanae y Chancay-Lambayeque. Mineras + SNMPE + PUCP; el coordinador es Ignacio Bustamante es el responsable y Antamina lo está liderando con la Católica del Manejo de Agua; en ese proyecto se ve de determinar detalles de los planes y aterrizarlos en instrumentos de gestión a nivel local en cuenca alta, media y baja, 1 cuenca por año y acaban de empezar. Que tengan un instrumento de gestión. ANA colabora dando al info. - En Infraestructura están lanzando proyectos con mi riego apalancando proyectos en las realiadades sociales de su zona de operación, financian los estudios para poder acometer las obras, expedientes hasta ahora han ido por fondos directos o canon y las obras, por impuestos. Están llevando los proyectos a Foniprel para iniciar los trámites. - Un caso es Presa de Hualcocura, en cofinanciamiento con Mi Riego, en Prov. De Bolognesi hay 8 más, del estilo de canales de riego… los % de cofinanciamiento han superado el 50% y en monto están de 17 MPEN (valle de Fortaleza) - En la agenda de responsabilidad Social de la Minera, el agua es clave. - Una APP orientado a saneamiento a Huarmey hará pasar la disponibilidad del agua de 6h a dotación global - Están usando el área de influencia operativa que es mayor que área influencia ambiental directa o indirecta, que es donde la gente sigue viendo a Antamina, por ejemplo por el ducto de transporte, los camiones de operarios, etc… - Como actúan: tienen un mecanismo interno de detección de proyectos, desbloqueo, desarrollo de estudios e implementación - Agua como vector para construir acción social. - Desarrollan a los gobiernos locales a plantear sus proyectos (en estudios y expedientes gastan un 10% de las inversiones en las construcciones) - Es un mecanismos de distribución más justo que la ley de distribución del cánon. Se dan casos que en mismo ámbito de influencia, un distrito recibe 100 millones y otro 300.000. Ese tema de OpI tengan un mecanismo de compensación a las desigualdades del cánon. Hay el Mi Riego, el beca 18, Caliwaurma, etc... Y es importante que los GoRe estén en ellos implicados, pero los que dirigen deben ser los GoLo. En esa parte también tiene una agenda de fortalecimiento de capacidades, para poder encontrar fondos de coorperación internacional para poder generar espacios para que la municipalidad sepa desarrollarse e interactuar con los principales actores, defina necesidades y detecte fondos públicos para poder financiarse. - También están desarrollando una visión de Proceso de desarrollo para que el valor de los inversiones esté en el procceso productivo posterior, comercio, cadenas de valor, etc… Lo están haciendo con cooperación internacional. Muy importante para hacer sostenible las inversiones de las presas, riegos, etc. En el caso de Valle de Fortaleza para los cinco tipos de cadenas productivas -durazno, espárrago...- están movilizando entre Antamina y la coorperación canadiense, más de 20 millones de soles; se trabaja con las mancomunidades, no con los alcaldes, aunque están incorporados, porque las mancomunidades superan a la fugacidad de los responsables políticos. - Su gestión se basa en Inversiones en activos; fortalecimiento de capacidades; fortalecimiento de instituciones de forma que la opinión, la decisión, la representación					

sea más colegiada no tan personalista y eso genera capital social comunitario; eso genera una apropiación de los proyectos y la existencia de la minera en el futuro ya no es imprescindible, se construye la sostenibilidad de las infraestructuras en el futuro.
2) Estrategias y mecanismos de financiación que lleven a cabo
En el cambio de políticas de inversión social, han hecho encuestas y han detectado que a nivel urbano el soporte que desean es en limpieza, delincuencia y servicios, donde entra el agua. - En las mesas de desarrollo en las partes altas, viene más hacia desarrollo ganadero.
3) Proyectos clave para el sector
2014 y 2015 van a ir más a proceso de apalancamiento por OpI y direccionar elimpuesto, no hacer inversiones directas por el fondo minero que ya no existe.
4) Otros agentes a incorporar/visitar
En Mi Riego se podría consultar el conjunto de casos que están impulsando a través de los probados - Milton Alva está desarrollando una estrategia de agrouindustrial en el valle - Mejoras: la disponibilidad de los fondos es importante. Por ejemplo la parte de fondos regionales a los cuales pueden acceder vía OpI no pueden acceder por los casos de corrupción. Si se mantienen esos fondos vía gobierno central serían mucho más eficientes. - El planeamiento debe ser la clave que genera la cartera de proyectos y su legitimación, y hay muy pocos.

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru					
Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**COSUDE**			ID	**27**
Tipo (Público / Privado)	**Privado**	Sector	**Cooperación**		
Nombre Persona contactada por carta	**Karla**				
Cargo Persona contactada por carta	**Country manager**				
Fecha de Reunión	01/09/2014	Lugar de Reunión	**-**		
Persona Entrevistada	**Karla**				
Cargo Persona Entrevistada	**Country manager**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Están en una empresa cementera con varias industrias. Tienen una central en Yuris, en Cañete river, con más de 200 MW de producción. - Con esa central queda positivo el balance de consumos energéticos y venta en Sinterconectado - ISO 14046 sobre determinación de huella hídrica, para que la reduzcan y desarrollar acciones de responsabilidad coorporativa en la idea de mejorar sistemas de agua y compensar tu huella hídrica. - El ejemplo en un pueblo joven al sur de Lima, han hecho un proyecto de captura de niebla, y están haciendo tres reservorios, 32 m3 cada uno, para 120 famlias, cerca de 1000 personas y también riegan sus parcelas de lúmuca y sábila. - Quieren que esto sea un modelo a nivel privado. Hay docs y ficha. - Van a lanzar en la COP 20 la ayuda suiza para determinar la huella hídrica de Perú. -					
2) Estrategias y mecanismos de financiación que lleven a cabo					
Este proyecto se cofinan, 500.000PEN por empresa (5 empresas) + 1,5MPEN la cooperación suiza (COSUDE) a fondo perdido; lo que hace COSUDE es contratar al consultor (Agua Limpia) que se ha capacitado en hacer la huella y hacerla en estos casos. - La parte empresarial se ha hecho a través de fondo de la empresa como fondos para gestión corporativa, no son fondos de OpI o así - Ellos (COSUDE) montan comités de Stakeholders, lo hacen con académicos, pej. Están viendo de entrar la currícula de las carreras, con la PUCP.					
3) Proyectos clave para el sector					
Están por extender a más empresas del grupo empresarial: todo el sector segmento, concreto y energía; además de sumar más actores y ver como se compensa el consumo con las producciones de agua. Euieren que la extensión no sólo sea por empresas, sino también para otros territorios. - A COSUDE Perú21 le está pidiendo generalizar al sector privado en general (scaling up), a través de las experiencias de las mismas empresas que ya han hecho el paso. -					
4) Otros agentes a incorporar/visitar					
Buscar más alianzas, entre Priv-Publ También quieren invitar a los gremios, asociaciones para generalizar.					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Fundación UNACEM**			ID	**28**
Tipo (Público / Privado)	**Privado**	Sector	**Cementeras**		
Nombre Persona contactada por carta	**Armando Casis**				
Cargo Persona contactada por carta	**Gerente general**				
Fecha de Reunión	01/09/2014	Lugar de Reunión	**-**		
Persona Entrevistada	**Armando Casis**				
Cargo Persona Entrevistada	**Gerente general**				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
No information					
2) Estrategias y mecanismos de financiación que lleven a cabo					
No information					
3) Proyectos clave para el sector					
No information					
4) Otros agentes a incorporar/visitar					
No information					

Hydro-Economical Analysis and Prioritisation of Water Resource Initiatives in Peru Consult stakeholders and identify policies and practices - WP4 - T1					
Stakeholder questionnaires and interviews					
Datos de Referencia					
Entidad entrevistada	**Coca Cola**			ID	**29**
Tipo (Público / Privado)	**Privado**	Sector	**Alimentación**		
Nombre Persona contactada por carta	**Julia Sobrevilla**				
Cargo Persona contactada por carta	-				
Fecha de Reunión	08/09/2014	Lugar de Reunión	-		
Persona Entrevistada	-				
Cargo Persona Entrevistada	-				
Contenido de la entrevista					
1) Intereses y Proyectos actuales en Materia de Agua					
Proyecto en Oxapampa y lo hacen con Avina y el Instituto del Bien Común: reforestación y conservación; Acceso a Agua en Chincha Alta y Baja y Ancash. Están iniciando otro en Pucusana: acceso a agua potable por pozos comunitarios. Internamente también hacen reuso, mejora del agua de planta, mejoras tecnológicas, etc... Los proyectos pueden estar de 100-150kUSD para los proyectos en 1 año.					
2) Estrategias y mecanismos de financiación que lleven a cabo					
Proyecto Replenish: El mandato de CocaCola es recuparar en la naturaleza o sociedad el 102% del agua que consumen: en proyectos grandes (Agua Naturaleza… por ejemplo recuperación, irrigación…) y en pequeños proyectos comunitarios (Tipo alcantarillado y potable…) Miden muchas veces los impactos de comunicación que son muy distintos en cada caso.					
3) Proyectos clave para el sector					
Para llevar algo adelante lo llevan a Atlanta y se la aprueban. Buscan mayor impacto en el triángulo dorado que sume estado-social-empresa y que midan el impacto, los intereses, el costo, los m3 de replenish, etc… Nos pasan un documento al respecto. Ellos no quieren identificar proyectos, quieren que les vengan con ellos.					
4) Otros agentes a incorporar/visitar					
Necesitan detectar como articular estos proyectos con lo público y lo comunitario. Quieren ser un actor relevante dentro del sector del agua. Mayor impacto en las prioridades del gobierno en temas de agua.					

Appendix G
Prioritisation Analysis Investment Alternatives

1. Prioritisation Analysis

The following Tables present the results of investment alternatives (IA) per river basin, water policy challenge and sector, of each catchment identify at the hidroeconomic analysis.

1.1 Chancay – Lambayeque

The following tables presents the results for IA per river basin, water policy challenge and sector, for Chancay Lambayeque.

Table G-1: IA per River Basin – Chancay Lambayeque

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA125	SICAN dam system	1,63	0,57	0,23	0,08	5,00	5,00	1,67	1,95	3,60	3,27
IA111	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5,88	2,06	0,82	0,29	22,33	5,00	1,17	2,00	3,70	3,21
IA120	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1,57	0,55	0,23	0,08	3,15	5,00	1,00	1,70	4,00	3,19
IA110	Chota irrigation system	30,55	10,69	4,28	1,50	20,00	5,00	1,17	1,75	3,30	3,04
IA235	Improvement of Carpintero irrigation canal - Ferreñafe	4,19	1,46	0,53	0,19	6,48	5,00	0,83	1,50	3,60	3,00
IA138	Improvement of Fernandez canal -	1,72	0,60	0,22	0,08	3,18	5,00	0,67	1,25	3,70	2,94
IA136	Improvement of irrigation canal 1 (Fala)	1,48	0,52	0,19	0,07	6,30	5,00	0,83	1,50	3,30	2,92
IA236	Improvement of irrigation water services - Tongorrape canal - Lambayeque, Lambayaque	3,25	1,14	0,40	0,14	3,15	5,00	0,67	1,25	3,60	2,92
IA124	Irrigation infraestructures and technified irrigation systems - Cajamarca	15,85	5,54	2,34	0,82	7,00	4,00	1,17	1,88	3,60	2,85
IA114	Irrigation infraestructures - Chancay-Baños, Santa Cruz, Cajamarca	16,10	5,63	2,37	0,83	6,00	3,00	1,00	1,88	3,30	2,44
IA141	Improvement and expansion of integrated municipal solid waste management in the cities of Ferreñafe, Pueblo Nuevo and Manuel Antonio Mesones Muro - Ferreñafe, Lambayeque	5,25	1,84	1,75	0,61	-	0,00	2,33	2,15	4,20	2,12
IA133	Improvement of integrated municipal solid waste management in the city of Santa Cruz - Santa Cruz, Cajamarca	4,12	1,44	1,09	0,38	0,00	0,00	2,33	2,15	4,20	2,12
IA139	Improvement of sewerage systems - La Victoria, Chiclayo, Lambayeque	26,14	9,14	3,76	1,31	-	0,00	2,50	2,15	3,80	2,04
IA127	Special project Olmos - Tinajones (impoundment)	447,47	156,54	49,30	17,25	77,00	1,00	1,83	2,30	2,95	2,00
IA126	Construction and improvement of drinking water distribution network and sewerage systems - Tongod, San Miguel, Cajamarca	2,50	0,87	0,29	0,10	0,00	0,00	2,17	1,88	4,00	1,97
IA140	Improvement and expansion of drinking water supply systems and construction of sewerage systems- Cajamarca	32,47	11,36	3,81	1,33	0,00	0,00	2,17	1,88	4,00	1,97
IA288	Construction, expansion and improvement of drinking water supply and sewerage services - Chiclayo, Lambayeque	77,02	26,94	9,05	3,16	0,00	0,00	2,17	1,88	4,00	1,97
IA118	Irrigation infraestructures in Tocmoche - Chota, Cajamarca	22,48	7,86	2,64	0,92	4,73	2,00	0,83	1,25	3,30	1,97
IA112	Sewerage systems - Santa Cruz, San Miguel - Cajamarca	2,50	0,87	0,29	0,10	0,00	0,00	2,00	2,15	3,85	1,95
IA137	Improvement (lining) of irrigation canals and improvement of irrigation efficiency via technified irrigation systems in Cajamarca department	42,69	14,93	6,30	2,20	8,00	1,00	1,00	1,88	3,60	1,92
IA109	Pisit Santa Cruz Dam - Santa Cruz, Cajamarca	133,19	46,59	14,82	5,19	10,00	1,00	1,67	1,95	2,95	1,89
IA145	Alternative project for domestic water supply in Chiclayo	18,20	6,37	2,14	0,75	0,00	0,00	1,67	1,88	4,00	1,87
IA135	Improvement (lining) of canals in Lambayeque department	160,34	56,09	19,83	6,94	7,88	1,00	0,83	1,50	3,60	1,80
IA104	Construction, expansion and improvement of drinking water supply - Cajamarca	6,23	2,18	0,73	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA143	Construction and improvement of sewerage system and stormwater drainag system - Pomalca, Chiclayo, Lambayque	7,88	2,76	0,95	0,33	-	0,00	1,83	2,15	3,35	1,78
IA103	Expansion of drinking water services - Ferreñafe, Lambayeque	0,95	0,33	0,11	0,04	0,00	0,00	1,17	1,88	4,00	1,77
IA142	Construction and improvement of irrigation systems in San Juan de Licupis - Chota, Cajamarca	3,02	1,06	0,35	0,12	0,00	1,00	0,67	1,25	3,60	1,72

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (0-5)	Eco. Benefits Score (0-5)	Env. Score (0-5)	Social Score (0-5)	Final Score
IA116	Irrigation system upstream Churgur - Hualgayoc, Cajamarca	13,49	4,72	1,61	0,56	0,00	1,00	0,67	1,25	3,30	1,63
IA134	Improvement of agrarian productivity in Gatillo - San José, Lambayeque	0,54	0,19	0,06	0,02	0,00	0,00	1,00	1,70	3,30	1,50
IA121	Flood and erotion defences - Quebrada Pacherrez, Chiclayo	4,83	1,69	0,75	0,26	0,00	0,00	0,83	0,23	4,00	1,34
IA107	Flood defences in riparian areas of the Chancay - Lambayeque river	43,76	15,31	4,82	1,69	0,00	0,00	0,83	0,23	4,00	1,34
IA144	Flood protection measures in mid-low Chancay-Lambayeque valley - Chiclayo, Lambayeque	22,32	7,81	2,62	0,92	0,00	0,00	0,83	0,23	4,00	1,34
		1.159,60	**405,67**	**-**	**-**	**190,20**	**-**	**42,83**	**-**	**-**	**-**

Table G-2: IA per Policy Challenge – Chancay Lambayeque

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**593,46**	**207,61**	**51,18%**			**107,73**					
IA110	Chota irrigation system	30,55	10,69	2,63%	4,28	1,50	20,00	5,00	1,17	1,75	3,30	3,04
IA114	Irrigation infraestructures - Chancay-Baños, Santa Cruz, Cajamarca	16,10	5,63	1,39%	2,37	0,83	6,00	3,00	1,00	1,88	3,30	2,44
IA127	Special project Olmos - Tinajones (impoundment)	447,47	156,54	38,59%	49,30	17,25	77,00	1,00	1,83	2,30	2,95	2,00
IA126	Construction and improvement of drinking water distribution network and sewerage systems - Tongod, San Miguel, Cajamarca	2,50	0,87	0,22%	0,29	0,10	0,00	0,00	2,17	1,88	4,00	1,97
IA140	Improvement and expansion of drinking water supply systems and construction of sewerage systems- Cajamarca	32,47	11,36	2,80%	3,81	1,33	0,00	0,00	2,17	1,88	4,00	1,97
IA118	Irrigation infraestructures in Tocmoche - Chota, Cajamarca	22,48	7,86	1,94%	2,64	0,92	4,73	2,00	0,83	1,25	3,30	1,97
IA145	Alternative project for domestic water supply in Chiclayo	18,20	6,37	1,57%	2,14	0,75	0,00	0,00	1,67	1,88	4,00	1,87
IA104	Construction, expansion and improvement of drinking water supply - Cajamarca	6,23	2,18	0,54%	0,73	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA103	Expansion of drinking water services - Ferreñafe, Lambayeque	0,95	0,33	0,08%	0,11	0,04	0,00	0,00	1,17	1,88	4,00	1,77
IA142	Construction and improvement of irrigation systems in San Juan de Licupis - Chota, Cajamarca	3,02	1,06	0,26%	0,35	0,12	0,00	1,00	0,67	1,25	3,60	1,72
IA116	Irrigation system upstream Churgur - Hualgayoc, Cajamarca	13,49	4,72	1,16%	1,61	0,56	0,00	1,00	0,67	1,25	3,30	1,63
	Flood	**70,91**	**24,81**	**6,11%**								
IA121	Flood and erotion defences - Quebrada Pacherrez, Chiclayo	4,83	1,69	0,42%	0,75	0,26	0,00	0,00	0,83	0,23	4,00	1,34
IA107	Flood defences in riparian areas of the Chancay - Lambayeque river	43,76	15,31	3,77%	4,82	1,69	0,00	0,00	0,83	0,23	4,00	1,34
IA144	Flood protection measures in mid-low Chancay-Lambayeque valley - Chiclayo, Lambayeque	22,32	7,81	1,92%	2,62	0,92	0,00	0,00	0,83	0,23	4,00	1,34
	GAP	**372,33**	**130,25**	**32,11%**			**82,47**					
IA125	SICAN dam system	1,63	0,57	0,14%	0,23	0,08	5,00	5,00	1,67	1,95	3,60	3,27
IA111	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5,88	2,06	0,51%	0,82	0,29	22,33	5,00	1,17	2,00	3,70	3,21
IA120	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1,57	0,55	0,14%	0,23	0,08	3,15	5,00	1,00	1,70	4,00	3,19
IA235	Improvement of Carpintero irrigation canal - Ferreñafe	4,19	1,46	0,36%	0,53	0,19	6,48	5,00	0,83	1,50	3,60	3,00
IA138	Improvement of Fernandez canal -	1,72	0,60	0,15%	0,22	0,08	3,18	5,00	0,67	1,25	3,70	2,94
IA136	Improvement of irrigation canal 1 (Fala)	1,48	0,52	0,13%	0,19	0,07	6,30	5,00	0,83	1,50	3,30	2,92
IA236	Improvement of irrigation water services - Tongorrape canal - Lambayeque, Lambayaque	3,25	1,14	0,28%	0,40	0,14	3,15	5,00	0,67	1,25	3,60	2,92
IA124	Irrigation infraestructures and technified irrigation systems - Cajamarca	15,85	5,54	1,37%	2,34	0,82	7,00	4,00	1,17	1,88	3,60	2,85

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA137	Improvement (lining) of irrigation canals and improvement of irrigation efficiency via technified irrigation systems in Cajamarca department	42,69	14,93	3,68%	6,30	2,20	8,00	1,00	1,00	1,88	3,60	1,92
IA109	Pisit Santa Cruz Dam - Santa Cruz, Cajamarca	133,19	46,59	11,49%	14,82	5,19	10,00	1,00	1,67	1,95	2,95	1,89
IA135	Improvement (lining) of canals in Lambayeque department	160,34	56,09	13,83%	19,83	6,94	7,88	1,00	0,83	1,50	3,60	1,80
IA134	Improvement of agrarian productivity in Gatillo - San José, Lambayeque	0,54	0,19	0,05%	0,06	0,02	0,00	0,00	1,00	1,70	3,30	1,50
	Quality	**122,91**	**43,00**	**10,60%**								
IA141	Improvement and expansion of integrated municipal solid waste management in the cities of Ferreñafe, Pueblo Nuevo and Manuel Antonio Mesones Muro - Ferreñafe, Lambayeque	5,25	1,84	0,45%	1,75	0,61	-	0,00	2,33	2,15	4,20	2,12
IA133	Improvement of integrated municipal solid waste management in the city of Santa Cruz - Santa Cruz, Cajamarca	4,12	1,44	0,36%	1,09	0,38	0,00	0,00	2,33	2,15	4,20	2,12
IA139	Improvement of sewerage systems - La Victoria, Chiclayo, Lambayeque	26,14	9,14	2,25%	3,76	1,31	-	0,00	2,50	2,15	3,80	2,04
IA288	Construction, expansion and improvement of drinking water supply and sewerage services - Chiclayo, Lambayeque	77,02	26,94	6,64%	9,05	3,16	0,00	0,00	2,17	1,88	4,00	1,97
IA112	Sewerage systems - Santa Cruz, San Miguel - Cajamarca	2,50	0,87	0,22%	0,29	0,10	0,00	0,00	2,00	2,15	3,85	1,95
IA143	Construction and improvement of sewerage system and stormwater drainag system - Pomalca, Chiclayo, Lambayque	7,88	2,76	0,68%	0,95	0,33	-	0,00	1,83	2,15	3,35	1,78
		1.159,60	**405,67**	**100,00%**	**-**	**-**	**190,20**	**-**	**-**	**-**	**-**	**-**

Table G-3: IA per Sector – Chancay Lambayeque

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**799,40**	**279,66**	**68,94%**			**180,20**					
IA125	SICAN dam system	1,63	0,57	0,14%	0,23	0,08	5,00	5,00	1,67	1,95	3,60	3,27
IA111	Lining of San José canal in the city of Lambayeque - Lambayeque, Lambayeque	5,88	2,06	0,51%	0,82	0,29	22,33	5,00	1,17	2,00	3,70	3,21
IA120	Technified irrigation systems in Tacamache - Chugur, Hualgayoc, Cajamarca	1,57	0,55	0,14%	0,23	0,08	3,15	5,00	1,00	1,70	4,00	3,19
IA110	Chota irrigation system	30,55	10,69	2,63%	4,28	1,50	20,00	5,00	1,17	1,75	3,30	3,04
IA235	Improvement of Carpintero irrigation canal - Ferreñafe	4,19	1,46	0,36%	0,53	0,19	6,48	5,00	0,83	1,50	3,60	3,00
IA138	Improvement of Fernandez canal -	1,72	0,60	0,15%	0,22	0,08	3,18	5,00	0,67	1,25	3,70	2,94
IA136	Improvement of irrigation canal 1 (Fala)	1,48	0,52	0,13%	0,19	0,07	6,30	5,00	0,83	1,50	3,30	2,92
IA236	Improvement of irrigation water services - Tongorrape canal - Lambayeque, Lambayaque	3,25	1,14	0,28%	0,40	0,14	3,15	5,00	0,67	1,25	3,60	2,92
IA124	Irrigation infraestructures and technified irrigation systems - Cajamarca	15,85	5,54	1,37%	2,34	0,82	7,00	4,00	1,17	1,88	3,60	2,85
IA114	Irrigation infraestructures - Chancay-Baños, Santa Cruz, Cajamarca	16,10	5,63	1,39%	2,37	0,83	6,00	3,00	1,00	1,88	3,30	2,44
IA127	Special project Olmos - Tinajones (impoundment)	447,47	156,54	38,59%	49,30	17,25	77,00	1,00	1,83	2,30	2,95	2,00
IA118	Irrigation infraestructures in Tocmoche - Chota, Cajamarca	22,48	7,86	1,94%	2,64	0,92	4,73	2,00	0,83	1,25	3,30	1,97
IA137	Improvement (lining) of irrigation canals and improvement of irrigation efficiency via technified irrigation systems in Cajamarca department	42,69	14,93	3,68%	6,30	2,20	8,00	1,00	1,00	1,88	3,60	1,92
IA135	Improvement (lining) of canals in Lambayeque department	160,34	56,09	13,83%	19,83	6,94	7,88	1,00	0,83	1,50	3,60	1,80
IA142	Construction and improvement of irrigation systems in San Juan de Licupis - Chota, Cajamarca	3,02	1,06	0,26%	0,35	0,12	0,00	1,00	0,67	1,25	3,60	1,72
IA116	Irrigation system upstream Churgur - Hualgayoc, Cajamarca	13,49	4,72	1,16%	1,61	0,56	0,00	1,00	0,67	1,25	3,30	1,63
IA134	Improvement of agrarian productivity in Gatillo - San José, Lambayeque	0,54	0,19	0,05%	0,06	0,02	0,00	0,00	1,00	1,70	3,30	1,50
IA121	Flood and erotion defences - Quebrada Pacherrez, Chiclayo	4,83	1,69	0,42%	0,75	0,26	0,00	0,00	0,83	0,23	4,00	1,34
IA144	Flood protection measures in mid-low Chancay-Lambayeque valley - Chiclayo, Lambayeque	22,32	7,81	1,92%	2,62	0,92	0,00	0,00	0,83	0,23	4,00	1,34
	Household / Commercial / Public	**183,26**	**64,11**	**15,80%**			**0,00**					
IA141	Improvement and expansion of integrated municipal solid waste management in the cities of Ferreñafe, Pueblo Nuevo and Manuel Antonio Mesones Muro - Ferreñafe, Lambayeque	5,25	1,84	0,45%	1,75	0,61	-	0,00	2,33	2,15	4,20	2,12
IA133	Improvement of integrated municipal solid waste management in the city of Santa Cruz - Santa Cruz, Cajamarca	4,12	1,44	0,36%	1,09	0,38	0,00	0,00	2,33	2,15	4,20	2,12

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA139	Improvement of sewerage systems - La Victoria, Chiclayo, Lambayeque	26,14	9,14	2,25%	3,76	1,31	-	0,00	2,50	2,15	3,80	2,04
IA126	Construction and improvement of drinking water distribution network and sewerage systems - Tongod, San Miguel, Cajamarca	2,50	0,87	0,22%	0,29	0,10	0,00	0,00	2,17	1,88	4,00	1,97
IA140	Improvement and expansion of drinking water supply systems and construction of sewerage systems- Cajamarca	32,47	11,36	2,80%	3,81	1,33	0,00	0,00	2,17	1,88	4,00	1,97
IA288	Construction, expansion and improvement of drinking water supply and sewerage services - Chiclayo, Lambayeque	77,02	26,94	6,64%	9,05	3,16	0,00	0,00	2,17	1,88	4,00	1,97
IA112	Sewerage systems - Santa Cruz, San Miguel - Cajamarca	2,50	0,87	0,22%	0,29	0,10	0,00	0,00	2,00	2,15	3,85	1,95
IA145	Alternative project for domestic water supply in Chiclayo	18,20	6,37	1,57%	2,14	0,75	0,00	0,00	1,67	1,88	4,00	1,87
IA104	Construction, expansion and improvement of drinking water supply - Cajamarca	6,23	2,18	0,54%	0,73	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA143	Construction and improvement of sewerage system and stormwater drainag system - Pomalca, Chiclayo, Lambayque	7,88	2,76	0,68%	0,95	0,33	-	0,00	1,83	2,15	3,35	1,78
IA103	Expansion of drinking water services - Ferreñafe, Lambayeque	0,95	0,33	0,08%	0,11	0,04	0,00	0,00	1,17	1,88	4,00	1,77
	Multipurpose	**176,95**	**61,90**	**15,26%**			**10,00**		**0,00**			
IA109	Pisit Santa Cruz Dam - Santa Cruz, Cajamarca	133,19	46,59	11,49%	14,82	5,19	10,00	1,00	1,67	1,95	2,95	1,89
IA107	Flood defences in riparian areas of the Chancay - Lambayeque river	43,76	15,31	3,77%	4,82	1,69	0,00	0,00	0,83	0,23	4,00	1,34
		1.159,60	**405,67**	**100,00%**	**-**	**-**	**190,20**	**-**	**-**	**-**	**-**	**-**

1.2 Chancay Huaral

The following tables presents the results of IA per river basin, water policy challenges and sector, for Chancay Huaral

Table G-4: IA per River Basin – Chancay Huaral

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage sistems for treated waters	24,03	8,41	3,54	1,24	18,00	5,00	2,67	2,60	3,80	3,67
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33,50	11,72	4,19	1,47	46,10	5,00	1,83	2,13	3,95	3,44
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5,20	1,82	0,57	0,20	10,30	5,00	1,67	1,95	4,00	3,38
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4,16	1,45	0,58	0,20	3,70	5,00	1,67	1,95	3,95	3,37
IA202	Drainage system for agriculture in Jequetepeque Valley	27,22	9,52	7,24	2,53	35,30	5,00	1,33	1,78	4,20	3,33
IA097	Modernization of irrigation conveyance infrastructure and canal lining.	32,76	11,46	4,59	1,61	23,00	5,00	1,17	2,00	3,70	3,21
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10,92	3,82	1,48	0,52	10,00	5,00	1,50	2,28	3,05	3,15
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26,50	9,27	3,58	1,25	10,20	4,00	1,67	1,95	3,95	3,07
IA084	Large reservoirs – Purapa and Quiles.	62,14	21,74	8,71	3,05	21,00	3,00	1,83	2,13	3,95	2,84
IA098	Water harvesting through amunas (indigenous practice).	2,20	0,77	1,27	0,44	2,40	3,00	1,50	1,78	3,95	2,70
IA173	Expansion of reservoirs, distribution networks, and construction of a drinking water treatment plant - Drinking water supply for the city of Lima	1.124,00	393,21	165,74	57,98	92,00	1,00	1,67	2,30	3,95	2,25
IA102	Water Water Treatment Plant (secondary treatment).	30,00	10,49	4,42	1,55	-	0,00	2,83	2,60	3,80	2,20
IA101	Waste Water Treatment Plant (primary treatment).	26,33	9,21	3,88	1,36	-	0,00	2,67	2,60	3,80	2,17
IA088	New reservoirs linked to efficiency improvements and technification of irrigation – Quipacaca and Yaco Coyonca.	20,72	7,25	2,80	0,98	4,00	1,00	1,67	1,95	3,95	2,17
IA096	Recovery of 11 reservoirs – Candelaria, Galeano, Las Salinas, Laure, Huando, Huarangal, Las Mercedes, Palpa, Miraflores Norte, La Virgen, San Cayetano	7,90	2,76	1,07	0,37	0,50	1,00	1,67	1,95	3,95	2,17
IA086	Landfill construction – Chancay, Huaral, Aucallama.	17,60	6,16	4,64	1,62	0,00	0,00	2,50	2,15	4,20	2,15
IA189	Reservoirs and water transfers in Huaura river basin	801,32	280,33	108,31	37,89	183,00	1,00	1,50	2,48	3,35	2,08
IA087	Partial systems for on-site sewage management.	80,00	27,99	9,40	3,29	0,00	0,00	2,50	2,15	3,85	2,05

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA099	Urban sewerage system.	25,00	8,75	2,94	1,03	0,00	0,00	2,33	2,15	3,85	2,02
IA212	Drinking water supply and sewerage systems in Cañete (Lima)	6,60	2,31	0,77	0,27	0,00	0,00	2,00	1,88	4,00	1,93
IA222	Improvement of drinking water supply and sewerage systems in Humaya - Huaura, Lima	4,96	1,74	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA218	Improvement of drinking water distribution networks and sewerage systems - Huaura, Lima	3,11	1,09	0,39	0,14	0,00	0,00	1,83	1,88	4,00	1,90
IA205	Flood defences - Cañete (Lima)	37,78	13,22	4,35	1,52	0,00	0,00	0,83	0,23	4,00	1,34
IA210	Flood defences in critical stretches of the Jequetepeque River	36,00	12,60	4,07	1,42	0,00	0,00	0,83	0,23	4,00	1,34
IA095	Risk prevention and climate change adaptation.	100,00	34,98	-	-	0,00	0,00	0,67	0,23	4,00	1,30
IA090	Short term bofedal wetlands in the medium and upper catchment / preservation measures	5,00	1,75	-	-	0,00	0,00	0,67	0,23	4,00	1,30
		2.554,95	**893,81**	**-**	**-**	**459,50**	**-**	**-**	**-**	**-**	**-**

Table G-5: IA per Water Policy Challenge – Chancay Huaral

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	CCA	**100,00**	**34,98**	**3,91%**								
IA095	Risk prevention and climate change adaptation.	100,00	34,98	3,91%	-	-	0,00	0,00	0,67	0,23	4,00	1,30
	Development	**14,67**	**5,13**	**0,57%**								
IA212	Drinking water supply and sewerage systems in Cañete (Lima)	6,60	2,31	0,26%	0,77	0,27	0,00	0,00	2,00	1,88	4,00	1,93
IA222	Improvement of drinking water supply and sewerage systems in Humaya - Huaura, Lima	4,96	1,74	0,19%	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA218	Improvement of drinking water distribution networks and sewerage systems - Huaura, Lima	3,11	1,09	0,12%	0,39	0,14	0,00	0,00	1,83	1,88	4,00	1,90
	ESS	**5,00**	**1,75**	**0,20%**								
IA090	Short term bofedal wetlands in the medium and upper catchment / preservation measures	5,00	1,75	0,20%	-	-	0,00	0,00	0,67	0,23	4,00	1,30
	Flood	**101,01**	**35,34**	**3,95%**			**35,30**					
IA202	Drainage system for agriculture in Jequetepeque Valley	27,22	9,52	1,07%	7,24	2,53	35,30	5,00	1,33	1,78	4,20	3,33
IA205	Flood defences - Cañete (Lima)	37,78	13,22	1,48%	4,35	1,52	0,00	0,00	0,83	0,23	4,00	1,34
IA210	Flood defences in critical stretches of the Jequetepeque River	36,00	12,60	1,41%	4,07	1,42	0,00	0,00	0,83	0,23	4,00	1,34
	GAP	**2.131,31**	**745,60**	**83,42%**			**314,20**					
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33,50	11,72	1,31%	4,19	1,47	46,10	5,00	1,83	2,13	3,95	3,44
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5,20	1,82	0,20%	0,57	0,20	10,30	5,00	1,67	1,95	4,00	3,38
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4,16	1,45	0,16%	0,58	0,20	3,70	5,00	1,67	1,95	3,95	3,37
IA097	Modernization of irrigation conveyance infrastructure and canal lining.	32,76	11,46	1,28%	4,59	1,61	23,00	5,00	1,17	2,00	3,70	3,21
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10,92	3,82	0,43%	1,48	0,52	10,00	5,00	1,50	2,28	3,05	3,15
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26,50	9,27	1,04%	3,58	1,25	10,20	4,00	1,67	1,95	3,95	3,07
IA084	Large reservoirs – Purapa and Quiles.	62,14	21,74	2,43%	8,71	3,05	21,00	3,00	1,83	2,13	3,95	2,84
IA098	Water harvesting through amunas (indigenous practice).	2,20	0,77	0,09%	1,27	0,44	2,40	3,00	1,50	1,78	3,95	2,70
IA173	Expansion of reservoirs, distribution networks, and construction of a drinking water treatment plant - Drinking water supply for the city of Lima	1.124,00	393,21	43,99%	165,74	57,98	92,00	1,00	1,67	2,30	3,95	2,25

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA088	New reservoirs linked to efficiency improvements and technification of irrigation – Quipacaca and Yaco Coyonca.	20,72	7,25	0,81%	2,80	0,98	4,00	1,00	1,67	1,95	3,95	2,17
IA096	Recovery of 11 reservoirs – Candelaria, Galeano, Las Salinas, Laure, Huando, Huarangal, Las Mercedes, Palpa, Miraflores Norte, La Virgen, San Cayetano	7,90	2,76	0,31%	1,07	0,37	0,50	1,00	1,67	1,95	3,95	2,17
IA189	Reservoirs and water transfers in Huaura river basin	801,32	280,33	31,36%	108,31	37,89	183,00	1,00	1,50	2,48	3,35	2,08
	Quality	**202,96**	**71,00**	**7,94%**			**18,00**					
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage sistems for treated waters	24,03	8,41	0,94%	3,54	1,24	18,00	5,00	2,67	2,60	3,80	3,67
IA102	Water Water Treatment Plant (secondary treatment).	30,00	10,49	1,17%	4,42	1,55	-	0,00	2,83	2,60	3,80	2,20
IA101	Waste Water Treatment Plant (primary treatment).	26,33	9,21	1,03%	3,88	1,36	-	0,00	2,67	2,60	3,80	2,17
IA086	Landfill construction – Chancay, Huaral, Aucallama.	17,60	6,16	0,69%	4,64	1,62	0,00	0,00	2,50	2,15	4,20	2,15
IA087	Partial systems for on-site sewage management.	80,00	27,99	3,13%	9,40	3,29	0,00	0,00	2,50	2,15	3,85	2,05
IA099	Urban sewerage system.	25,00	8,75	0,98%	2,94	1,03	0,00	0,00	2,33	2,15	3,85	2,02
		2.554,95	**893,81**	**100,00%**	**-**	**-**	**367,50**	**-**		**-**	**-**	**-**

Table G-6: IA per Sector – Chancay Huaral

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**304,81**	**106,63**	**11,93%**			**164,10**					
IA083	Stabilization of ponds through the construction and rehabilitation of mini-dams or barrages	33,50	11,72	1,31%	4,19	1,47	46,10	5,00	1,83	2,13	3,95	3,44
IA093	Reservoirs linked to efficiency improvement and technification of irrigation – Cárac, Añasmayo, Huataya.	5,20	1,82	0,20%	0,57	0,20	10,30	5,00	1,67	1,95	4,00	3,38
IA085	Water surplus exploitation and distributed reserve through reservoirs in plots and replotting areas – Cárac, Añasmayo, Huataya.	4,16	1,45	0,16%	0,58	0,20	3,70	5,00	1,67	1,95	3,95	3,37
IA202	Drainage system for agriculture in Jequetepeque Valley	27,22	9,52	1,07%	7,24	2,53	35,30	5,00	1,33	1,78	4,20	3,33
IA097	Modernization of irrigation conveyance infrastructure and canal lining.	32,76	11,46	1,28%	4,59	1,61	23,00	5,00	1,17	2,00	3,70	3,21
IA100	Conjunctive-use through boring 20-25 wells to integrate the aquifer's marginal areas.	10,92	3,82	0,43%	1,48	0,52	10,00	5,00	1,50	2,28	3,05	3,15
IA082	Long-term stabilization, creation and expansion of ponds – Rahuite, Uchumachay, Quisha (restoration); Parcasch Alto, Barrosococha, and Culacancha (new ponds).	26,50	9,27	1,04%	3,58	1,25	10,20	4,00	1,67	1,95	3,95	3,07
IA084	Large reservoirs – Purapa and Quiles.	62,14	21,74	2,43%	8,71	3,05	21,00	3,00	1,83	2,13	3,95	2,84
IA088	New reservoirs linked to efficiency improvements and technification of irrigation – Quipacaca and Yaco Coyonca.	20,72	7,25	0,81%	2,80	0,98	4,00	1,00	1,67	1,95	3,95	2,17
IA096	Recovery of 11 reservoirs – Candelaria, Galeano, Las Salinas, Laure, Huando, Huarangal, Las Mercedes, Palpa, Miraflores Norte, La Virgen, San Cayetano	7,90	2,76	0,31%	1,07	0,37	0,50	1,00	1,67	1,95	3,95	2,17
IA205	Flood defences - Cañete (Lima)	37,78	13,22	1,48%	4,35	1,52	0,00	0,00	0,83	0,23	4,00	1,34
IA210	Flood defences in critical stretches of the Jequetepeque River	36,00	12,60	1,41%	4,07	1,42	0,00	0,00	0,83	0,23	4,00	1,34
	E-Flow	**5,00**	**1,75**	**0,20%**								
IA090	Short term bofedal wetlands in the medium and upper catchment / preservation measures	5,00	1,75	0,20%	-	-	0,00	0,00	0,67	0,23	4,00	1,30
	Household / Commercial / Public	**1.341,63**	**469,34**	**52,51%**			**110,00**					
IA087	Partial systems for on-site sewage management.	80,00	27,99	3,13%	9,40	3,29	0,00	0,00	2,50	2,15	3,85	2,05
IA102	Water Water Treatment Plant (secondary treatment).	30,00	10,49	1,17%	4,42	1,55	-	0,00	2,83	2,60	3,80	2,20
IA195	Construction of 3 water treatment plants in Pacific river basins, including conveyance and storage sistems for treated waters	24,03	8,41	0,94%	3,54	1,24	18,00	5,00	2,67	2,60	3,80	3,67
IA099	Urban sewerage system.	25,00	8,75	0,98%	2,94	1,03	0,00	0,00	2,33	2,15	3,85	2,02
IA101	Waste Water Treatment Plant (primary treatment).	26,33	9,21	1,03%	3,88	1,36	-	0,00	2,67	2,60	3,80	2,17
IA212	Drinking water supply and sewerage systems in Cañete (Lima)	6,60	2,31	0,26%	0,77	0,27	0,00	0,00	2,00	1,88	4,00	1,93

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA222	Improvement of drinking water supply and sewerage systems in Humaya - Huaura, Lima	4,96	1,74	0,19%	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA218	Improvement of drinking water distribution networks and sewerage systems - Huaura, Lima	3,11	1,09	0,12%	0,39	0,14	0,00	0,00	1,83	1,88	4,00	1,90
IA173	Expansion of reservoirs, distribution networks, and construction of a drinking water treatment plant - Drinking water supply for the city of Lima	1.124,00	393,21	43,99%	165,74	57,98	92,00	1,00	1,67	2,30	3,95	2,25
IA086	Landfill construction – Chancay, Huaral, Aucallama.	17,60	6,16	0,69%	4,64	1,62	0,00	0,00	2,50	2,15	4,20	2,15
	Multipurpose	**903,52**	**316,08**	**35,36%**			**185,40**					
IA098	Water harvesting through amunas (indigenous practice).	2,20	0,77	0,09%	1,27	0,44	2,40	3,00	1,50	1,78	3,95	2,70
IA189	Reservoirs and water transfers in Huaura river basin	801,32	280,33	31,36%	108,31	37,89	183,00	1,00	1,50	2,48	3,35	2,08
IA095	Risk prevention and climate change adaptation.	100,00	34,98	3,91%	-	-	0,00	0,00	0,67	0,23	4,00	1,30
		2.554,95	**893,81**	**100,00%**	**-**	**-**	**459,50**	**-**		**-**	**-**	**-**

1.3 Ica

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Ica.

Table G-7: IA per River Basin – Ica

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA192	Reservoirs and water transfers in Pisco river basin	890,29	311,45	120,34	42,10	336,00	3,00	1,50	2,65	3,35	2,72
IA190	Reservoirs and water transfers in Ica river basin	3.443,69	1.204,72	465,48	162,84	866,00	2,00	1,50	2,65	3,35	2,42
IA198	Expansion and improvement of drinking water supply system in Ica city	105,05	36,75	13,44	4,70	9,96	1,00	1,83	2,28	4,00	2,29
IA211	Elevated steel reservoir in Nasca (Ica)	3,88	1,36	0,90	0,31	0,00	1,00	1,67	1,95	3,95	2,17
IA187	Reservoirs and water transfers in Grande river basin	617,98	216,19	83,53	29,22	148,00	1,00	1,50	2,48	3,35	2,08
IA230	Improvement and renovation of sewer pipe - Los Aquijes, Ica - Ica	6,44	2,25	0,77	0,27	0,00	0,00	2,33	2,15	3,80	2,00
IA197	Stabilization of the Grande River basin	255,37	89,34	28,57	10,00	18,50	1,00	1,67	1,95	3,35	2,00
IA227	Improvement and expansion of drinking water and sewerage services - Pisco, Ica	9,98	3,49	6,57	2,30	0,00	0,00	2,17	1,88	4,00	1,97
IA231	Drinking water supply for La Galería - Pisco, Ica	8,40	2,94	1,42	0,50	0,00	0,00	1,50	1,88	4,20	1,89
IA216	Water network sectorization - Pisco (Ica)	6,67	2,33	2,50	0,87	0,00	0,00	1,67	1,88	4,00	1,87
IA206	Flood defences - Ica	148,27	51,87	16,33	5,71	0,00	0,00	0,83	0,23	4,00	1,34
		5.496,03	**1.922,69**	**-**	**-**	**1.378,46**	**-**	**-**	**-**	**-**	**-**

Table G-8: IA per Water Policy Challenge – Ica

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**130,10**	**45,51**	**2,37%**			**9,96**					
IA198	Expansion and improvement of drinking water supply system in Ica city	105,05	36,75	1,91%	13,44	4,70	9,96	1,00	1,83	2,28	4,00	2,29
IA227	Improvement and expansion of drinking water and sewerage services - Pisco, Ica	9,98	3,49	0,18%	6,57	2,30	0,00	0,00	2,17	1,88	4,00	1,97
IA231	Drinking water supply for La Galería - Pisco, Ica	8,40	2,94	0,15%	1,42	0,50	0,00	0,00	1,50	1,88	4,20	1,89
IA216	Water network sectorization - Pisco (Ica)	6,67	2,33	0,12%	2,50	0,87	0,00	0,00	1,67	1,88	4,00	1,87
	Flood	**148,27**	**51,87**	**2,70%**								
IA206	Flood defences - Ica	148,27	51,87	2,70%	16,33	5,71	0,00	0,00	0,83	0,23	4,00	1,34
	GAP	**5.211,22**	**1.823,05**	**94,82%**			**1.368,50**					
IA192	Reservoirs and water transfers in Pisco river basin	890,29	311,45	16,20%	120,34	42,10	336,00	3,00	1,50	2,65	3,35	2,72
IA190	Reservoirs and water transfers in Ica river basin	3.443,69	1.204,72	62,66%	465,48	162,84	866,00	2,00	1,50	2,65	3,35	2,42
IA211	Elevated steel reservoir in Nasca (Ica)	3,88	1,36	0,07%	0,90	0,31	0,00	1,00	1,67	1,95	3,95	2,17
IA187	Reservoirs and water transfers in Grande river basin	617,98	216,19	11,24%	83,53	29,22	148,00	1,00	1,50	2,48	3,35	2,08
IA197	Stabilization of the Grande River basin	255,37	89,34	4,65%	28,57	10,00	18,50	1,00	1,67	1,95	3,35	2,00
	Quality	**6,44**	**2,25**	**0,12%**								
IA230	Improvement and renovation of sewer pipe - Los Aquijes, Ica - Ica	6,44	2,25	0,12%	0,77	0,27	0,00	0,00	2,33	2,15	3,80	2,00
		5.496,03	**1.922,69**	**100,00%**	**-**	**-**	**1.378,46**	**-**		**-**	**-**	**-**

Table G-9: IA per Sector – Ica

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**403,64**	**141,21**	**7,34%**			**18,50**					
IA197	Stabilization of the Grande River basin	255,37	89,34	4,65%	28,57	10,00	18,50	1,00	1,67	1,95	3,35	2,00
IA206	Flood defences - Ica	148,27	51,87	2,70%	16,33	5,71	0,00	0,00	0,83	0,23	4,00	1,34
	Household / Commercial / Public	**140,43**	**49,13**	**2,56%**			**9,96**					
IA198	Expansion and improvement of drinking water supply system in Ica city	105,05	36,75	1,91%	13,44	4,70	9,96	1,00	1,83	2,28	4,00	2,29
IA211	Elevated steel reservoir in Nasca (Ica)	3,88	1,36	0,07%	0,90	0,31	0,00	1,00	1,67	1,95	3,95	2,17
IA230	Improvement and renovation of sewer pipe - Los Aquijes, Ica - Ica	6,44	2,25	0,12%	0,77	0,27	0,00	0,00	2,33	2,15	3,80	2,00
IA227	Improvement and expansion of drinking water and sewerage services - Pisco, Ica	9,98	3,49	0,18%	6,57	2,30	0,00	0,00	2,17	1,88	4,00	1,97
IA231	Drinking water supply for La Galería - Pisco, Ica	8,40	2,94	0,15%	1,42	0,50	0,00	0,00	1,50	1,88	4,20	1,89
IA216	Water network sectorization - Pisco (Ica)	6,67	2,33	0,12%	2,50	0,87	0,00	0,00	1,67	1,88	4,00	1,87
	Multipurpose	**4.951,96**	**1.732,36**	**90,10%**			**1.350,00**					
IA192	Reservoirs and water transfers in Pisco river basin	890,29	311,45	16,20%	120,34	42,10	336,00	3,00	1,50	2,65	3,35	2,72
IA190	Reservoirs and water transfers in Ica river basin	3.443,69	1.204,72	62,66%	465,48	162,84	866,00	2,00	1,50	2,65	3,35	2,42
IA187	Reservoirs and water transfers in Grande river basin	617,98	216,19	11,24%	83,53	29,22	148,00	1,00	1,50	2,48	3,35	2,08
		5.496,03	**1.922,69**	**100,00%**	**-**	**-**	**1.378,46**	**-**		**-**	**-**	**-**

1.4 Chillon-Rimac-Lurin

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Chillon-Rimac-Lurin.

Table G-10: IA per River Basin – Chillon-Rimac-Lurin

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA181	Reservoirs in Chilca river basin	3,00	1,05	0,41	0,14	1,00	3,00	1,67	1,95	3,35	2,60
IA177	73 water purification systems in drinking water treatment plants	41,50	14,52	6,12	2,14	-	0,00	2,83	2,60	3,80	2,20
IA174	Chillón River reservoir	196,70	68,81	29,01	10,15	40,00	1,00	1,83	2,13	3,50	2,11
IA185	Reservoirs and water transfers in Culebras river basin	795,44	278,27	107,52	37,61	102,00	1,00	1,50	2,48	3,35	2,08
IA191	Reservoirs and water transfers in Chillón river basin	567,98	198,70	76,77	26,86	97,00	1,00	1,50	2,30	3,35	2,04
IA186	Reservoirs and water transfers in Lurín river basin	207,68	72,65	28,07	9,82	22,00	1,00	1,50	2,13	3,35	2,01
IA194	Reservoirs and water transfers in San Juan river basin	435,18	152,24	58,82	20,58	31,00	1,00	1,50	2,13	3,35	2,01
IA204	Expansion of the distribution network for household water supply and sewerage system - Callao, Ventanilla, San Martín de Porres	74,79	26,16	11,28	3,95	0,00	0,00	2,17	1,88	4,00	1,97
IA201	Expansion and improvement of drinking water supply and sewerage systems in Villa El Salvador	57,09	19,97	7,84	2,74	0,00	0,00	2,17	1,88	4,00	1,97
IA287	Improvement and rehabilitation of drinking water and sewerage systems - Cercado de Lima	13,08	4,57	1,54	0,54	0,00	0,00	2,00	1,88	4,00	1,93
IA223	Improvement of drinking water supply and sewerage systems - San Juan de Lurigancho	5,67	1,98	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA209	Abstraction infrastructure (canals) - Lurín River	9,93	3,47	1,14	0,40	0,00	0,00	0,67	1,25	4,00	1,53
		2.408,04	**842,41**	**-**	**-**	**293,00**	**-**	**-**	**-**	**-**	**-**

Table G-11: IA per Water Policy Challenge – Chillon-Rimac-Lurin

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**160,56**	**56,17**	**6,67%**								
IA204	Expansion of the distribution network for household water supply and sewerage system - Callao, Ventanilla, San Martín de Porres	74,79	26,16	3,11%	11,28	3,95	0,00	0,00	2,17	1,88	4,00	1,97
IA201	Expansion and improvement of drinking water supply and sewerage systems in Villa El Salvador	57,09	19,97	2,37%	7,84	2,74	0,00	0,00	2,17	1,88	4,00	1,97
IA287	Improvement and rehabilitation of drinking water and sewerage systems - Cercado de Lima	13,08	4,57	0,54%	1,54	0,54	0,00	0,00	2,00	1,88	4,00	1,93
IA223	Improvement of drinking water supply and sewerage systems - San Juan de Lurigancho	5,67	1,98	0,24%	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA209	Abstraction infrastructure (canals) - Lurín River	9,93	3,47	0,41%	1,14	0,40	0,00	0,00	0,67	1,25	4,00	1,53
	GAP	**2.205,98**	**771,72**	**91,61%**			**293,00**					
IA181	Reservoirs in Chilca river basin	3,00	1,05	0,12%	0,41	0,14	1,00	3,00	1,67	1,95	3,35	2,60
IA174	Chillón River reservoir	196,70	68,81	8,17%	29,01	10,15	40,00	1,00	1,83	2,13	3,50	2,11
IA185	Reservoirs and water transfers in Chillón river basin	795,44	278,27	33,03%	107,52	37,61	102,00	1,00	1,50	2,48	3,35	2,08
IA191	Reservoirs and water transfers in Lurín river basin	567,98	198,70	23,59%	76,77	26,86	97,00	1,00	1,50	2,30	3,35	2,04
IA186	Reservoirs and water transfers in Culebras river basin	207,68	72,65	8,62%	28,07	9,82	22,00	1,00	1,50	2,13	3,35	2,01
IA194	Reservoirs and water transfers in San Juan river basin	435,18	152,24	18,07%	58,82	20,58	31,00	1,00	1,50	2,13	3,35	2,01
	Quality	**41,50**	**14,52**	**1,72%**								
IA177	73 water purification systems in drinking water treatment plants	41,50	14,52	1,72%	6,12	2,14	-	0,00	2,83	2,60	3,80	2,20
		2.408,04	**842,41**	**100,00%**	**-**	**-**	**293,00**	**-**	**-**	**-**	**-**	**-**

Table G-12: IA per Sector – Chillon-Rimac-Lurin

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**9,93**	**3,47**	**0,41%**								
IA209	Abstraction infrastructure (canals) - Lurín River	9,93	3,47	0,41%	1,14	0,40	0,00	0,00	0,67	1,25	4,00	1,53
	Household / Commercial / Public	**388,82**	**136,02**	**16,15%**			**40,00**					
IA177	73 water purification systems in drinking water treatment plants	41,50	14,52	1,72%	6,12	2,14	-	0,00	2,83	2,60	3,80	2,20
IA204	Expansion of the distribution network for household water supply and sewerage system - Callao, Ventanilla, San Martín de Porres	74,79	26,16	3,11%	11,28	3,95	0,00	0,00	2,17	1,88	4,00	1,97
IA201	Expansion and improvement of drinking water supply and sewerage systems in Villa El Salvador	57,09	19,97	2,37%	7,84	2,74	0,00	0,00	2,17	1,88	4,00	1,97
IA287	Improvement and rehabilitation of drinking water and sewerage systems - Cercado de Lima	13,08	4,57	0,54%	1,54	0,54	0,00	0,00	2,00	1,88	4,00	1,93
IA223	Improvement of drinking water supply and sewerage systems - San Juan de Lurigancho	5,67	1,98	0,24%	0,68	0,24	0,00	0,00	2,00	1,88	4,00	1,93
IA174	Chillón River reservoir	196,70	68,81	8,17%	29,01	10,15	40,00	1,00	1,83	2,13	3,50	2,11
	Multipurpose	**2.009,28**	**702,91**	**83,44%**			**253,00**					
IA181	Reservoirs in Chilca river basin	3,00	1,05	0,12%	0,41	0,14	1,00	3,00	1,67	1,95	3,35	2,60
IA185	Reservoirs and water transfers in Chillón river basin	795,44	278,27	33,03%	107,52	37,61	102,00	1,00	1,50	2,48	3,35	2,08
IA186	Reservoirs and water transfers in Culebras river basin	207,68	72,65	8,62%	28,07	9,82	22,00	1,00	1,50	2,13	3,35	2,01
IA191	Reservoirs and water transfers in Lurín river basin	567,98	198,70	23,59%	76,77	26,86	97,00	1,00	1,50	2,30	3,35	2,04
IA194	Reservoirs and water transfers in San Juan river basin	435,18	152,24	18,07%	58,82	20,58	31,00	1,00	1,50	2,13	3,35	2,01
		2.408,04	**842,41**	**100,00%**	**-**	**-**	**253,00**	**-**	**-**	**-**	**-**	**-**

1.5 Quilca Chili

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Quilca- Chili.

Table G-13: IA per River Basin – Quilca-Chili

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA149	Chili reservoirs – sluice repairing and reservoir impoundment (Aguada Blanca)	18,50	6,47	2,32	0,81	9,40	4,00	1,67	1,95	3,95	3,07
IA148	Chili reservoirs – flood regulation, agriculture, hydropower and supply (Pillones, Capillune, Caquemayo, Asta de Venado, Sumbay) - Phase 1	210,00	73,46	26,29	9,20	60,00	3,00	1,83	2,30	3,95	2,88
IA163	Improved regulation in Eastern catchment - Quilca Chili	30,00	10,49	4,21	1,47	10,00	3,00	1,67	1,95	3,95	2,77
IA170	Yura River regulation	38,00	13,29	5,33	1,86	12,00	3,00	1,67	1,95	3,55	2,66
IA162	Impoundment in Sumaby River	800,00	279,87	112,13	39,23	200,00	2,00	1,83	2,48	3,95	2,62
IA207	WWTP and improved drinking water supply system - La Joya Irrigation District (Arequipa)	52,70	18,44	6,55	2,29	3,81	1,00	2,67	2,78	4,00	2,56
IA199	Expansion and improvement of the system of emissaries and wastewater treatment in the region of Arequipa	943,80	330,17	136,05	47,60	114,88	1,00	2,83	2,60	3,80	2,50
IA150	Chili reservoirs – increasing installed capacity in El Frayle dam.	300,00	104,95	37,55	13,14	65,00	1,00	1,83	2,30	3,95	2,28
IA157	Water Water Treatment Plant, primary and secondary treatment – Medium and lower Quilca-Vítor-Chili.	26,50	9,27	3,91	1,37	-	0,00	2,67	2,60	4,00	2,23
IA161	Infrastructure for wastewater treatment in rural areas – WWTP with reuse - Eastern catchment.	3,60	1,26	0,53	0,19	-	0,00	2,50	2,60	4,00	2,19
IA286	Landfill site - Sumbay, Chili and Tingo Grande	19,23	6,73	5,07	1,77	0,00	0,00	2,50	2,15	4,20	2,15
IA169	Siguas River regulation	170,00	59,47	23,83	8,34	40,00	1,00	1,83	2,13	3,55	2,13
IA152	Infrastructure for wastewater treatment in rural areas – separate sewerage system - Eastern catchment, Lower and Medium Quilca-Vítor-Chili. and Sumbay	36,00	12,59	5,31	1,86	-	0,00	2,83	2,60	3,40	2,09
IA156	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Eastern catchment.	14,00	4,90	2,06	0,72	-	0,00	2,67	2,60	3,40	2,06
IA158	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Sumbay.	3,00	1,05	0,44	0,15	-	0,00	2,50	2,60	3,40	2,02
IA155	Infrastructure for wastewater treatment in rural areas – oxidation ponds – Chalhuanca.	4,00	1,40	0,59	0,21	-	0,00	2,50	2,60	3,40	2,02
IA159	Infrastructure for wastewater treatment in rural areas – WWTP (secondary treatment) – Añashuayco.	1,00	0,35	0,15	0,05	-	0,00	2,17	2,60	3,40	1,96

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA160	Integral drainage – La Joya irrigation district, Vítor valley.	28,00	9,80	7,39	2,58	-	0,00	1,33	1,78	3,70	1,69
IA176	Majes-Siguas II Project: water transfer	0,00	0,00	-	-	1.140,00	0,00	1,00	1,38	3,60	1,51
IA165	Flood defences in human settlements	50,00	17,49	5,87	2,05	0,00	0,00	0,83	0,23	4,00	1,34
IA168	Landslide prevention	5,00	1,75	0,55	0,19	0,00	0,00	0,67	0,23	4,00	1,30
IA147	Prevention and remediation of landslides	3,00	1,05	0,33	0,12	0,00	0,00	0,67	0,23	4,00	1,30
		2.756,33	**964,25**	**-**	**-**	**1.655,09**	**-**	**-**	**-**	**-**	**-**

Table G-14: IA per Water Policy Challenge – Quilca-Chili

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	CCA / Flood	**58,00**	**20,29**	2,10%								
IA165	Flood defences in human settlements	50,00	17,49	1,81%	5,87	2,05	0,00	0,00	0,83	0,23	4,00	1,34
IA168	Landslide prevention	5,00	1,75	0,18%	0,55	0,19	0,00	0,00	0,67	0,23	4,00	1,30
IA147	Prevention and remediation of landslides	3,00	1,05	0,11%	0,33	0,12	0,00	0,00	0,67	0,23	4,00	1,30
	Development	**800,00**	**279,87**	29,02%			**200,00**					
IA162	Impoundment in Sumaby River	800,00	279,87	29,02%	112,13	39,23	200,00	2,00	1,83	2,48	3,95	2,62
	Flood	**28,00**	**9,80**	1,02%								
IA160	Integral drainage – La Joya irrigation district, Vítor valley.	28,00	9,80	1,02%	7,39	2,58	-	0,00	1,33	1,78	3,70	1,69
	GAP	**238,00**	**83,26**	8,63%			**1.202,00**					
IA163	Improved regulation in Eastern catchment - Quilca Chili	30,00	10,49	1,09%	4,21	1,47	10,00	3,00	1,67	1,95	3,95	2,77
IA170	Yura River regulation	38,00	13,29	1,38%	5,33	1,86	12,00	3,00	1,67	1,95	3,55	2,66
IA169	Siguas River regulation	170,00	59,47	6,17%	23,83	8,34	40,00	1,00	1,83	2,13	3,55	2,13
IA176	Majes-Siguas II Project: water transfer	0,00	0,00	0,00%	-	-	1.140,00	0,00	1,00	1,38	3,60	1,51
	GAP / Flood	**528,50**	**184,89**	19,17%			**134,40**					
IA149	Chili reservoirs – sluice repairing and reservoir impoundment (Aguada Blanca)	18,50	6,47	0,67%	2,32	0,81	9,40	4,00	1,67	1,95	3,95	3,07
IA148	Chili reservoirs – flood regulation, agriculture, hydropower and supply (Pillones, Capillune, Caquemayo, Asta de Venado, Sumbay) - Phase 1	210,00	73,46	7,62%	26,29	9,20	60,00	3,00	1,83	2,30	3,95	2,88
IA150	Chili reservoirs – increasing installed capacity in El Frayle dam.	300,00	104,95	10,88%	37,55	13,14	65,00	1,00	1,83	2,30	3,95	2,28
	Quality	**1.103,83**	**386,16**	40,05%			**118,69**					
IA207	WWTP and improved drinking water supply system - La Joya Irrigation District (Arequipa)	52,70	18,44	1,91%	6,55	2,29	3,81	1,00	2,67	2,78	4,00	2,56
IA199	Expansion and improvement of the system of emissaries and wastewater treatment in the region of Arequipa	943,80	330,17	34,24%	136,05	47,60	114,88	1,00	2,83	2,60	3,80	2,50
IA157	Water Water Treatment Plant, primary and secondary treatment – Medium and lower Quilca-Vítor-Chili.	26,50	9,27	0,96%	3,91	1,37	-	0,00	2,67	2,60	4,00	2,23
IA161	Infrastructure for wastewater treatment in rural areas – WWTP with reuse - Eastern catchment.	3,60	1,26	0,13%	0,53	0,19	-	0,00	2,50	2,60	4,00	2,19
IA286	Landfill site - Sumbay, Chili and Tingo Grande	19,23	6,73	0,70%	5,07	1,77	0,00	0,00	2,50	2,15	4,20	2,15
IA152	Infrastructure for wastewater treatment in rural areas – separate sewerage system - Eastern catchment, Lower and Medium Quilca-Vítor-Chili. and Sumbay	36,00	12,59	1,31%	5,31	1,86	-	0,00	2,83	2,60	3,40	2,09

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA156	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Eastern catchment.	14,00	4,90	0,51%	2,06	0,72	-	0,00	2,67	2,60	3,40	2,06
IA158	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Sumbay.	3,00	1,05	0,11%	0,44	0,15	-	0,00	2,50	2,60	3,40	2,02
IA155	Infrastructure for wastewater treatment in rural areas – oxidation ponds – Chalhuanca.	4,00	1,40	0,15%	0,59	0,21	-	0,00	2,50	2,60	3,40	2,02
IA159	Infrastructure for wastewater treatment in rural areas – WWTP (secondary treatment) – Añashuayco.	1,00	0,35	0,04%	0,15	0,05	-	0,00	2,17	2,60	3,40	1,96
		2.756,33	**1.295,90**	**100,00%**	**-**	**-**	**1.655,09**	**-**	**-**	**-**	**-**	**-**

Table G-15: IA per Sector – Quilca-Chili

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**66,00**	**23,09**	1,78%			**12,00**					
IA170	Yura River regulation	38,00	13,29	3102,46%	5,33	1,86	12,00	3,00	1,67	1,95	3,55	2,66
IA160	Integral drainage – La Joya irrigation district, Vítor valley.	28,00	9,80	3202,46%	7,39	2,58	-	0,00	1,33	1,78	3,70	1,69
	Household / Commercial / Public	**1.153,83**	**403,65**	56,74%			**118,69**					
IA199	Expansion and improvement of the system of emissaries and wastewater treatment in the region of Arequipa	943,80	330,17	3102,46%	136,05	47,60	114,88	1,00	2,83	2,60	3,80	2,50
IA152	Infrastructure for wastewater treatment in rural areas – separate sewerage system - Eastern catchment, Lower and Medium Quilca-Vítor-Chili. and Sumbay	36,00	12,59	3202,46%	5,31	1,86	-	0,00	2,83	2,60	3,40	2,09
IA157	Water Water Treatment Plant, primary and secondary treatment – Medium and lower Quilca-Vítor-Chili.	26,50	9,27	3302,46%	3,91	1,37	-	0,00	2,67	2,60	4,00	2,23
IA156	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Eastern catchment.	14,00	4,90	3402,46%	2,06	0,72	-	0,00	2,67	2,60	3,40	2,06
IA161	Infrastructure for wastewater treatment in rural areas – WWTP with reuse - Eastern catchment.	3,60	1,26	3502,46%	0,53	0,19	-	0,00	2,50	2,60	4,00	2,19
IA158	Infrastructure for wastewater treatment in rural areas – WWTP (primary treatment) – Sumbay.	3,00	1,05	3602,46%	0,44	0,15	-	0,00	2,50	2,60	3,40	2,02
IA155	Infrastructure for wastewater treatment in rural areas – oxidation ponds – Chalhuanca.	4,00	1,40	3702,46%	0,59	0,21	-	0,00	2,50	2,60	3,40	2,02
IA207	WWTP and improved drinking water supply system - La Joya Irrigation District (Arequipa)	52,70	18,44	3802,46%	6,55	2,29	3,81	1,00	2,67	2,78	4,00	2,56
IA159	Infrastructure for wastewater treatment in rural areas – WWTP (secondary treatment) – Añashuayco.	1,00	0,35	3902,46%	0,15	0,05	-	0,00	2,17	2,60	3,40	1,96
IA286	Landfill site - Sumbay, Chili and Tingo Grande	19,23	6,73	4002,46%	5,07	1,77	0,00	0,00	2,50	2,15	4,20	2,15
IA165	Flood defences in human settlements	50,00	17,49	4102,46%	5,87	2,05	0,00	0,00	0,83	0,23	4,00	1,34
	Hydropower	**800,00**	**279,87**	21,60%			**200,00**					
IA162	Impoundment in Sumaby River	800,00	279,87	3902,46%	112,13	39,23	200,00	2,00	1,83	2,48	3,95	2,62
	Multipurpose	**736,50**	**257,65**	19,88%			**1.324,40**					
IA149	Chili reservoirs – sluice repairing and reservoir impoundment (Aguada Blanca)	18,50	6,47	3902,46%	2,32	0,81	9,40	4,00	1,67	1,95	3,95	3,07
IA163	Improved regulation in Eastern catchment - Quilca Chili	30,00	10,49	4002,46%	4,21	1,47	10,00	3,00	1,67	1,95	3,95	2,77
IA150	Chili reservoirs – increasing installed capacity in El Frayle dam.	300,00	104,95	4102,46%	37,55	13,14	65,00	1,00	1,83	2,30	3,95	2,28
IA169	Siguas River regulation	170,00	59,47	4202,46%	23,83	8,34	40,00	1,00	1,83	2,13	3,55	2,13
IA168	Landslide prevention	5,00	1,75	4302,46%	0,55	0,19	0,00	0,00	0,67	0,23	4,00	1,30

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA147	Prevention and remediation of landslides	3,00	1,05	4402,46%	0,33	0,12	0,00	0,00	0,67	0,23	4,00	1,30
IA148	Chili reservoirs – flood regulation, agriculture, hydropower and supply (Pillones, Capillune, Caquemayo, Asta de Venado, Sumbay) - Phase 1	210,00	73,46	4502,46%	26,29	9,20	60,00	3,00	1,83	2,30	3,95	2,88
IA176	Majes-Siguas II Project: water transfer	0,00	0,00	4602,46%	-	-	1.140,00	0,00	1,00	1,38	3,60	1,51
		2.756,33	**964,25**	**100,00%**	**-**	**-**	**1.655,09**	**-**	**-**	**-**	**-**	**-**

1.6 Santa

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Santa.

Table G-16: IA per River Basin – Santa

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA221	Improvement of drainage system in Huancaco sector - Viru, Libertad	8,61	3,01	1,25	0,44	58,70	5,00	1,33	1,78	4,20	3,33
IA219	Improvement of irrigation water supply - San José Alto and Concordia Canals - Ascope, Libertad	6,56	2,30	0,98	0,34	21,00	5,00	0,83	2,00	3,60	3,11
IA220	Improvement of irrigation water services - Tambo and El Molino - Pacasmayo, Libertad	3,63	1,27	0,55	0,19	5,30	5,00	0,83	1,50	3,60	3,00
IA214	Groundwater exploitation - Ascope (La Libertad region)	9,95	3,48	1,29	0,45	15,13	5,00	1,17	1,88	2,75	2,92
IA224	Improvement of irrigation systems - Cosque, Ñampol, Teniente, Loquete, Los Piales, and Frijol canals - Pacasmayo, Libertad	8,06	2,82	1,18	0,41	3,15	3,00	0,67	1,25	3,60	2,32
IA203	Piping system for WWTP Las Gaviotas (Ancash)	24,43	8,55	2,91	1,02	0,00	0,00	2,33	2,15	4,00	2,06
IA225	Sewerage network improvement - La Esperanza, Trujillo	9,84	3,44	1,38	0,48	0,00	0,00	2,33	2,15	3,85	2,02
IA200	Expansion and improvement of drinking water supply and sewerage systems in Trujillo	10,34	3,62	1,28	0,45	0,00	0,00	2,00	1,88	4,00	1,93
IA217	Improvement of drinking water supply and sewerage systems - Trujillo, Libertad	16,40	5,74	2,46	0,86	0,00	0,00	2,00	1,88	4,00	1,93
IA215	Integral drinking water supply and sanitaton system - Santa (Ancash)	17,19	6,01	2,89	1,01	0,00	0,00	2,00	1,88	4,00	1,93
IA226	Improvement of secondary networks for drinking water supply and sewerage systems - Trujillo	3,15	1,10	0,42	0,15	0,00	0,00	1,83	1,88	4,00	1,90
		118,15	41,33	-	-	103,28	-	-	-	-	-

Table G-17: IA per Water Policy Challenge – Santa

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**47,07**	**16,47**	39,84%								
IA200	Expansion and improvement of drinking water supply and sewerage systems in Trujillo	10,34	3,62	8,75%	1,28	0,45	0,00	0,00	2,00	1,88	4,00	1,93
IA217	Improvement of drinking water supply and sewerage systems - Trujillo, Libertad	16,40	5,74	13,88%	2,46	0,86	0,00	0,00	2,00	1,88	4,00	1,93
IA226	Integral drinking water supply and sanitaton system - Santa (Ancash)	3,15	1,10	14,55%	0,42	0,15	0,00	0,00	1,83	1,88	4,00	1,90
IA215	Improvement of secondary networks for drinking water supply and sewerage systems - Trujillo	17,19	6,01	2,67%	2,89	1,01	0,00	0,00	2,00	1,88	4,00	1,93
	Flood	**8,61**	**3,01**	7,29%			**58,70**					
IA221	Improvement of drainage system in Huancaco sector - Viru, Libertad	8,61	3,01	7,29%	1,25	0,44	58,70	5,00	1,33	1,78	4,20	3,33
	GAP	**28,19**	**9,86**	23,86%			**44,58**					
IA220	Improvement of irrigation water supply - San José Alto and Concordia Canals - Ascope, Libertad	3,63	1,27	5,56%	0,55	0,19	5,30	5,00	0,83	1,50	3,60	3,00
IA219	Improvement of irrigation water services - Tambo and El Molino - Pacasmayo, Libertad	6,56	2,30	3,07%	0,98	0,34	21,00	5,00	0,83	2,00	3,60	3,11
IA214	Groundwater exploitation - Ascope (La Libertad region)	9,95	3,48	8,42%	1,29	0,45	15,13	5,00	1,17	1,88	2,75	2,92
IA224	Improvement of irrigation systems - Cosque, Ñampol, Teniente, Loquete, Los Piales, and Frijol canals - Pacasmayo, Libertad	8,06	2,82	6,82%	1,18	0,41	3,15	3,00	0,67	1,25	3,60	2,32
	Quality	**34,27**	**11,99**	29,00%								
IA203	Piping system for WWTP Las Gaviotas (Ancash)	24,43	8,55	20,68%	2,91	1,02	0,00	0,00	2,33	2,15	4,00	2,06
IA225	Sewerage network improvement - La Esperanza, Trujillo	9,84	3,44	8,33%	1,38	0,48	0,00	0,00	2,33	2,15	3,85	2,02
		118,15	**41,33**	**100,00%**	**-**	**-**	**103,28**	**-**	**-**	**-**	**-**	**-**

Table G-18: IA per Sector – Santa

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**36,81**	**12,88**	31,15%			**103,28**					
IA220	Improvement of drainage system in Huancaco sector - Viru, Libertad	3,63	1,27	7,29%	0,55	0,19	5,30	5,00	0,83	1,50	3,60	3,00
IA219	Improvement of irrigation water supply - San José Alto and Concordia Canals - Ascope, Libertad	6,56	2,30	5,56%	0,98	0,34	21,00	5,00	0,83	2,00	3,60	3,11
IA214	Improvement of irrigation water services - Tambo and El Molino - Pacasmayo, Libertad	9,95	3,48	3,07%	1,29	0,45	15,13	5,00	1,17	1,88	2,75	2,92
IA224	Groundwater exploitation - Ascope (La Libertad region)	8,06	2,82	8,42%	1,18	0,41	3,15	3,00	0,67	1,25	3,60	2,32
IA221	Improvement of irrigation systems - Cosque, Ñampol, Teniente, Loquete, Los Piales, and Frijol canals - Pacasmayo, Libertad	8,61	3,01	6,82%	1,25	0,44	58,70	5,00	1,33	1,78	4,20	3,33
	Household / Commercial / Public	**81,34**	**28,46**	68,85%								
IA203	Piping system for WWTP Las Gaviotas (Ancash)	24,43	8,55	20,68%	2,91	1,02	0,00	0,00	2,33	2,15	4,00	2,06
IA225	Sewerage network improvement - La Esperanza, Trujillo	9,84	3,44	8,33%	1,38	0,48	0,00	0,00	2,33	2,15	3,85	2,02
IA200	Expansion and improvement of drinking water supply and sewerage systems in Trujillo	10,34	3,62	8,75%	1,28	0,45	0,00	0,00	2,00	1,88	4,00	1,93
IA217	Improvement of drinking water supply and sewerage systems - Trujillo, Libertad	16,40	5,74	13,88%	2,46	0,86	0,00	0,00	2,00	1,88	4,00	1,93
IA226	Integral drinking water supply and sanitaton system - Santa (Ancash)	3,15	1,10	14,55%	0,42	0,15	0,00	0,00	1,83	1,88	4,00	1,90
IA215	Improvement of secondary networks for drinking water supply and sewerage systems - Trujillo	17,19	6,01	2,67%	2,89	1,01	0,00	0,00	2,00	1,88	4,00	1,93
		118,15	**41,33**	**100,00%**	**-**	**-**	**103,28**	**-**	**-**	**-**	**-**	**-**

1.7 Tacna

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Tacna.

Table G-19: IA per River Basin – Tacna

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA280	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11,10	3,88	1,63	0,57	8,94	5,00	1,67	1,95	3,90	3,35
IA182	Reservoirs in Fortaleza river basin	60,43	21,14	8,17	2,86	34,00	5,00	1,83	2,13	3,35	3,27
IA284	Jarumas dam - Sama river basin	37,18	13,01	4,84	1,69	123,00	5,00	1,83	2,48	2,95	3,24
IA183	Reservoirs in Yauca river basin	332,47	116,31	44,94	15,72	133,00	4,00	1,83	2,48	3,35	3,05
IA052	Improvement of irrigation canals - Caplina River	181,85	63,62	25,49	8,92	97,69	4,00	1,17	2,25	3,70	2,96
IA283	Yarascay dam - Sama river basin	284,93	99,68	37,11	12,98	123,00	4,00	1,83	2,48	2,95	2,94
IA070	Improvement and expansion of the distribution network for agricultural development - Tacna-Vilavilani valley	262,00	91,66	36,56	12,79	142,00	4,00	0,83	1,20	3,90	2,72
IA054	Improvement of groundwater abstraction points (improve domestic water security)	9,58	3,35	1,34	0,47	4,00	4,00	1,50	2,08	2,50	2,66
IA069	Lining of Patapujo irrigation canal	57,96	20,28	8,51	2,98	19,00	3,00	1,00	1,75	3,70	2,52
IA277	Improvement of irrigation water supply [dam construction] - Calacala irrigation community - Cairani, Candarave	19,71	6,90	2,75	0,96	4,96	2,00	1,67	1,95	3,75	2,41
IA076	Water harvesting for climate change adaptation - micro-reservoirs for fodder irrigation	9,10	3,18	1,75	0,61	0,01	1,00	1,67	1,95	4,05	2,20
IA077	Reservoirs for irrigation water supply - agricultural areas in Tacna region	84,26	29,48	12,37	4,33	1,47	1,00	1,67	1,95	3,95	2,17
IA067	Waste water treatment plant - oxidation pond - Locumba	2,07	0,72	0,30	0,11	-	0,00	2,33	2,60	4,00	2,16
IA068	Improvement of domestic water supply distribution networks - Jorge Basadre	1,67	0,58	0,24	0,09	0,00	1,00	1,17	1,88	4,00	2,07
IA250	Calientes River dam for irrigation - Santa Cruz - Candarave	58,14	20,34	6,59	2,30	4,96	1,00	1,67	1,95	3,55	2,06
IA184	Reservoirs and water transfers in Caplina river basin	947,97	331,63	128,14	44,83	94,00	1,00	1,50	2,30	3,35	2,04
IA193	Reservoirs and water transfers in Sama river basin	544,50	190,48	73,60	25,75	54,00	1,00	1,50	2,30	3,35	2,04
IA072	Lining and improvement of irrigation canals and construction of reservoirs - Sama river basin	128,32	44,89	17,99	6,29	3,00	1,00	1,33	1,88	3,70	2,02
IA188	Reservoirs and water transfers in Hospicio river basin	757,24	264,91	102,35	35,81	36,00	1,00	1,50	2,13	3,35	2,01
IA278	Calientes river regulation reservoir for irrigation water supply - Tacna	112,00	39,18	16,44	5,75	8,94	1,00	1,67	1,95	3,35	2,00
IA279	Cerro Blanco regulation reservoir for irrigation water supply (impoundment of trannsferred waters from Uchusuma)	90,00	31,48	13,21	4,62	8,94	1,00	1,67	1,95	3,35	2,00

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA058	Improvement and expansion of drinking water treatment plants - urban water supply for the city of Tacna and sourroundings	73,30	25,64	10,76	3,77	0,00	0,00	2,17	2,15	3,85	1,98
IA274	Improvement of retailing drinking water distribution networks and sewerage systems for Tacna	67,19	23,50	9,86	3,45	0,00	0,00	2,17	1,88	4,00	1,97
IA285	Expansion and improvement of drinking water distribution networks, drinking water treatment, construction of reservoirs for distribution, sewerage systems and waste water treatment - Candarave, Tarata, Sama, Las Yaras, Inclán, Palca Y Calientes	61,70	21,58	9,06	3,17	0,00	0,00	2,17	1,88	4,00	1,97
IA056	La Yarada desalination plan for domestic water supply	432,13	151,17	58,53	20,48	18,90	1,00	1,50	1,28	3,85	1,96
IA064	Construction and improvement of drinking water distribution network and sewerage systems - Jorge Basadre Province	11,41	3,99	1,34	0,47	0,00	0,00	2,00	1,88	4,00	1,93
IA079	Improvement of irrigation efficiency via technified irrigation systems in irrigation communities - Tacna river	154,28	53,97	18,12	6,34	1,50	1,00	1,00	1,70	3,60	1,88
IA251	Improved drinking water supply - Tacna, Tacna	3,25	1,14	0,69	0,24	0,00	0,00	1,33	1,88	4,00	1,80
IA060	Improvement of irrigation canals and distribution networks - Locumba River	16,99	5,94	2,38	0,83	2,50	1,00	0,67	1,25	3,70	1,74
IA063	Efficiency improvement and technification of irrigation - Locumba, Jorge Basadre	6,53	2,29	0,77	0,27	-	0,00	0,83	1,53	3,60	1,51
IA055	Improvement of irrigation efficiency via technified irrigation systems - Caplina river	47,17	16,50	5,54	1,94	-	0,00	0,83	1,53	3,60	1,51
IA071	Improved control of irrigation water demand, technified irrigation systems and improvement of infraestructures.	45,95	16,07	6,75	2,36	0,00	0,00	0,67	1,25	3,60	1,42
IA078	Flood defences in riparean areas in Sama, Caplina and Locumba river basins	135,00	47,23	18,84	6,59	0,00	0,00	0,83	0,23	4,00	1,34
IA074	Flood defences in riparian areas - Inclan and Sama districts, Tacna	13,56	4,74	1,59	0,56	0,00	0,00	0,83	0,23	4,00	1,34
IA062	Flood defences in riparian areas - Locumba RB / De Ilabaya distric, Jorge Basadre	60,11	21,03	7,06	2,47	0,00	0,00	0,83	0,23	4,00	1,34
IA275	Desaguadero River water transfer - urban water supply for the city of Tacna and expansion of irrigated land in la Yarada	1.457,00	509,71	203,30	71,12	-	0,00	1,00	0,50	2,70	1,07
		6.578,04	**2.301,21**	**-**	**-**	**923,81**	**-**	**-**	**-**	**-**	**-**

Table G-20: IA per Water Policy Challenge – Tacna

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**143,54**	**50,22**	**2,18%**								
IA274	Improvement of retailing drinking water distribution networks and sewerage systems for Tacna	67,19	23,50	1,02%	9,86	3,45	0,00	0,00	2,17	1,88	4,00	1,97
IA285	Expansion and improvement of drinking water distribution networks, drinking water treatment, construction of reservoirs for distribution, sewerage systems and waste water treatment - Candarave, Tarata, Sama, Las Yaras, Inclán, Palca Y Calientes	61,70	21,58	0,94%	9,06	3,17	0,00	0,00	2,17	1,88	4,00	1,97
IA064	Construction and improvement of drinking water distribution network and sewerage systems - Jorge Basadre Province	11,41	3,99	0,17%	1,34	0,47	0,00	0,00	2,00	1,88	4,00	1,93
IA251	Improved drinking water supply - Tacna, Tacna	3,25	1,14	#¡DIV/0!	0,69	0,24	0,00	0,00	1,33	1,88	4,00	1,80
	Flood	**208,67**	**73,00**	**3,17%**								
IA078	Flood defences in riparean areas in Sama, Caplina and Locumba river basins	135,00	47,23	2,05%	18,84	6,59	0,00	0,00	0,83	0,23	4,00	1,34
IA074	Flood defences in riparian areas - Inclan and Sama districts, Tacna	13,56	4,74	0,21%	1,59	0,56	0,00	0,00	0,83	0,23	4,00	1,34
IA062	Flood defences in riparian areas - Locumba RB / De Ilabaya distric, Jorge Basadre	60,11	21,03	0,91%	7,06	2,47	0,00	0,00	0,83	0,23	4,00	1,34
	GAP	**6.150,46**	**2.151,63**	**93,50%**			**923,81**					
IA280	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11,10	3,88	0,17%	1,63	0,57	8,94	5,00	1,67	1,95	3,90	3,35
IA182	Reservoirs in Fortaleza river basin	60,43	21,14	0,92%	8,17	2,86	34,00	5,00	1,83	2,13	3,35	3,27
IA284	Jarumas dam - Sama river basin	37,18	13,01	0,57%	4,84	1,69	123,00	5,00	1,83	2,48	2,95	3,24
IA183	Reservoirs in Yauca river basin	332,47	116,31	5,05%	44,94	15,72	133,00	4,00	1,83	2,48	3,35	3,05
IA052	Improvement of irrigation canals - Caplina River	181,85	63,62	2,76%	25,49	8,92	97,69	4,00	1,17	2,25	3,70	2,96
IA283	Yarascay dam - Sama river basin	284,93	99,68	4,33%	37,11	12,98	123,00	4,00	1,83	2,48	2,95	2,94
IA070	Improvement and expansion of the distribution network for agricultural development - Tacna-Vilavilani valley	262,00	91,66	3,98%	36,56	12,79	142,00	4,00	0,83	1,20	3,90	2,72
IA054	Improvement of groundwater abstraction points (improve domestic water security)	9,58	3,35	0,15%	1,34	0,47	4,00	4,00	1,50	2,08	2,50	2,66
IA069	Lining of Patapujo irrigation canal	57,96	20,28	0,88%	8,51	2,98	19,00	3,00	1,00	1,75	3,70	2,52
IA277	Improvement of irrigation water supply [dam construction] - Calacala irrigation community - Cairani, Candarave	19,71	6,90	0,30%	2,75	0,96	4,96	2,00	1,67	1,95	3,75	2,41
IA076	Water harvesting for climate change adaptation - micro-reservoirs for fodder irrigation	9,10	3,18	0,14%	1,75	0,61	0,01	1,00	1,67	1,95	4,05	2,20

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA077	Reservoirs for irrigation water supply - agricultural areas in Tacna region	84,26	29,48	1,28%	12,37	4,33	1,47	1,00	1,67	1,95	3,95	2,17
IA068	Improvement of domestic water supply distribution networks - Jorge Basadre	1,67	0,58	0,03%	0,24	0,09	0,00	1,00	1,17	1,88	4,00	2,07
IA250	Calientes River dam for irrigation - Santa Cruz - Candarave	58,14	20,34	0,88%	6,59	2,30	4,96	1,00	1,67	1,95	3,55	2,06
IA184	Reservoirs and water transfers in Caplina river basin	947,97	331,63	14,41%	128,14	44,83	94,00	1,00	1,50	2,30	3,35	2,04
IA193	Reservoirs and water transfers in Sama river basin	544,50	190,48	8,28%	73,60	25,75	54,00	1,00	1,50	2,30	3,35	2,04
IA072	Lining and improvement of irrigation canals and construction of reservoirs - Sama river basin	128,32	44,89	1,95%	17,99	6,29	3,00	1,00	1,33	1,88	3,70	2,02
IA188	Reservoirs and water transfers in Hospicio river basin	757,24	264,91	11,51%	102,35	35,81	36,00	1,00	1,50	2,13	3,35	2,01
IA278	Calientes river regulation reservoir for irrigation water supply - Tacna	112,00	39,18	1,70%	16,44	5,75	8,94	1,00	1,67	1,95	3,35	2,00
IA279	Cerro Blanco regulation reservoir for irrigation water supply (impoundment of trannsferred waters from Uchusuma)	90,00	31,48	1,37%	13,21	4,62	8,94	1,00	1,67	1,95	3,35	2,00
IA056	La Yarada desalination plan for domestic water supply	432,13	151,17	6,57%	58,53	20,48	18,90	1,00	1,50	1,28	3,85	1,96
IA079	Improvement of irrigation efficiency via technified irrigation systems in irrigation communities - Tacna river	154,28	53,97	2,35%	18,12	6,34	1,50	1,00	1,00	1,70	3,60	1,88
IA060	Improvement of irrigation canals and distribution networks - Locumba River	16,99	5,94	0,26%	2,38	0,83	2,50	1,00	0,67	1,25	3,70	1,74
IA063	Efficiency improvement and technification of irrigation - Locumba, Jorge Basadre	6,53	2,29	0,10%	0,77	0,27	-	0,00	0,83	1,53	3,60	1,51
IA055	Improvement of irrigation efficiency via technified irrigation systems - Caplina river	47,17	16,50	0,72%	5,54	1,94	-	0,00	0,83	1,53	3,60	1,51
IA071	Improved control of irrigation water demand, technified irrigation systems and improvement of infraestructures.	45,95	16,07	0,70%	6,75	2,36	0,00	0,00	0,67	1,25	3,60	1,42
IA275	Desaguadero River water transfer - urban water supply for the city of Tacna and expansion of irrigated land in la Yarada	1.457,00	509,71	22,15%	203,30	71,12	-	0,00	1,00	0,50	2,70	1,07
	Quality	**73,30**	**25,64**	**1,11%**								
IA058	Improvement and expansion of drinking water treatment plants - urban water supply for the city of Tacna and sourroundings	73,30	25,64	1,11%	10,76	3,77	0,00	0,00	2,17	2,15	3,85	1,98
	Quality	**2,07**	**0,72**	**0,03%**								
IA067	Waste water treatment plant - oxidation pond - Locumba	2,07	0,72	0,03%	0,30	0,11	-	0,00	2,33	2,60	4,00	2,16
		6.578,04	**2.301,21**	**100,00%**	**-**	**-**	**923,81**	**-**		**-**	**-**	**-**

Table G-21: IA per Water Policy Challenge – Tacna

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**1.407,99**	**492,56**	**21,40%**			**443,28**					
IA284	Jarumas dam - Sama river basin	37,18	13,01	0,57%	4,84	1,69	123,00	5,00	1,83	2,48	2,95	3,24
IA283	Yarascay dam - Sama river basin	284,93	99,68	4,33%	37,11	12,98	123,00	4,00	1,83	2,48	2,95	2,94
IA070	Improvement and expansion of the distribution network for agricultural development - Tacna-Vilavilani valley	262,00	91,66	3,98%	36,56	12,79	142,00	4,00	0,83	1,20	3,90	2,72
IA069	Lining of Patapujo irrigation canal	57,96	20,28	#¡DIV/0!	8,51	2,98	19,00	3,00	1,00	1,75	3,70	2,52
IA277	Improvement of irrigation water supply [dam construction] - Calacala irrigation community - Cairani, Candarave	19,71	6,90	0,30%	2,75	0,96	4,96	2,00	1,67	1,95	3,75	2,41
IA076	Water harvesting for climate change adaptation - micro-reservoirs for fodder irrigation	9,10	3,18	0,14%	1,75	0,61	0,01	1,00	1,67	1,95	4,05	2,20
IA077	Reservoirs for irrigation water supply - agricultural areas in Tacna region	84,26	29,48	1,28%	12,37	4,33	1,47	1,00	1,67	1,95	3,95	2,17
IA250	Calientes River dam for irrigation - Santa Cruz - Candarave	58,14	20,34	0,88%	6,59	2,30	4,96	1,00	1,67	1,95	3,55	2,06
IA072	Lining and improvement of irrigation canals and construction of reservoirs - Sama river basin	128,32	44,89	1,95%	17,99	6,29	3,00	1,00	1,33	1,88	3,70	2,02
IA278	Calientes river regulation reservoir for irrigation water supply - Tacna	112,00	39,18	1,70%	16,44	5,75	8,94	1,00	1,67	1,95	3,35	2,00
IA279	Cerro Blanco regulation reservoir for irrigation water supply (impoundment of trannsferred waters from Uchusuma)	90,00	31,48	1,37%	13,21	4,62	8,94	1,00	1,67	1,95	3,35	2,00
IA079	Improvement of irrigation efficiency via technified irrigation systems in irrigation communities - Tacna river	154,28	53,97	2,35%	18,12	6,34	1,50	1,00	1,00	1,70	3,60	1,88
IA060	Improvement of irrigation canals and distribution networks - Locumba River	16,99	5,94	0,26%	2,38	0,83	2,50	1,00	0,67	1,25	3,70	1,74
IA055	Improvement of irrigation efficiency via technified irrigation systems - Caplina river	47,17	16,50	0,72%	5,54	1,94	-	0,00	0,83	1,53	3,60	1,51
IA071	Improved control of irrigation water demand, technified irrigation systems and improvement of infraestructures.	45,95	16,07	0,70%	6,75	2,36	0,00	0,00	0,67	1,25	3,60	1,42
	Household / Commercial / Public	**673,40**	**235,58**	**10,24%**			**31,84**					
IA280	Arunta reservoir - Gregorio Albarracín district and construction of Dams 2 and 4 - Calana district for domestic water supply	11,10	3,88	0,17%	1,63	0,57	8,94	5,00	1,67	1,95	3,90	3,35
IA054	Improvement of groundwater abstraction points (improve domestic water security)	9,58	3,35	0,15%	1,34	0,47	4,00	4,00	1,50	2,08	2,50	2,66
IA067	Waste water treatment plant - oxidation pond - Locumba	2,07	0,72	0,03%	0,30	0,11	-	0,00	2,33	2,60	4,00	2,16
IA068	Improvement of domestic water supply distribution networks - Jorge Basadre	1,67	0,58	0,03%	0,24	0,09	0,00	1,00	1,17	1,88	4,00	2,07
IA058	Improvement and expansion of drinking water treatment plants - urban water supply for the city of Tacna and sourroundings	73,30	25,64	1,11%	10,76	3,77	0,00	0,00	2,17	2,15	3,85	1,98
IA274	Improvement of retailing drinking water distribution networks and sewerage systems for Tacna	67,19	23,50	1,02%	9,86	3,45	0,00	0,00	2,17	1,88	4,00	1,97
IA285	Expansion and improvement of drinking water distribution networks, drinking water treatment, construction of reservoirs for distribution,	61,70	21,58	0,94%	9,06	3,17	0,00	0,00	2,17	1,88	4,00	1,97

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	sewerage systems and waste water treatment - Candarave, Tarata, Sama, Las Yaras, Inclán, Palca Y Calientes											
IA056	La Yarada desalination plan for domestic water supply	432,13	151,17	6,57%	58,53	20,48	18,90	1,00	1,50	1,28	3,85	1,96
IA064	Construction and improvement of drinking water distribution network and sewerage systems - Jorge Basadre Province	11,41	3,99	0,17%	1,34	0,47	0,00	0,00	2,00	1,88	4,00	1,93
IA251	Improved drinking water supply - Tacna, Tacna	3,25	1,14	0,05%	0,69	0,24	0,00	0,00	1,33	1,88	4,00	1,80
	Multipurpose	**4.496,65**	**1.573,08**	**68,36%**			**448,69**					
IA182	Reservoirs in Fortaleza river basin	60,43	21,14	0,92%	8,17	2,86	34,00	5,00	1,83	2,13	3,35	3,27
IA183	Reservoirs in Yauca river basin	332,47	116,31	5,05%	44,94	15,72	133,00	4,00	1,83	2,48	3,35	3,05
IA052	Improvement of irrigation canals - Caplina River	181,85	63,62	2,76%	25,49	8,92	97,69	4,00	1,17	2,25	3,70	2,96
IA184	Reservoirs and water transfers in Caplina river basin	947,97	331,63	14,41%	128,14	44,83	94,00	1,00	1,50	2,30	3,35	2,04
IA193	Reservoirs and water transfers in Sama river basin	544,50	190,48	8,28%	73,60	25,75	54,00	1,00	1,50	2,30	3,35	2,04
IA188	Reservoirs and water transfers in Hospicio river basin	757,24	264,91	11,51%	102,35	35,81	36,00	1,00	1,50	2,13	3,35	2,01
IA063	Efficiency improvement and technification of irrigation - Locumba, Jorge Basadre	6,53	2,29	0,10%	0,77	0,27	-	0,00	0,83	1,53	3,60	1,51
IA078	Flood defences in riparean areas in Sama, Caplina and Locumba river basins	135,00	47,23	2,05%	18,84	6,59	0,00	0,00	0,83	0,23	4,00	1,34
IA074	Flood defences in riparian areas - Inclan and Sama districts, Tacna	13,56	4,74	0,21%	1,59	0,56	0,00	0,00	0,83	0,23	4,00	1,34
IA062	Flood defences in riparian areas - Locumba RB / De Ilabaya distric, Jorge Basadre	60,11	21,03	0,91%	7,06	2,47	0,00	0,00	0,83	0,23	4,00	1,34
IA275	Desaguadero River water transfer - urban water supply for the city of Tacna and expansion of irrigated land in la Yarada	1.457,00	509,71	22,15%	203,30	71,12	-	0,00	1,00	0,50	2,70	1,07
		6.578,04	**2.301,21**	**100,00%**	**-**	**-**	**923,81**	**-**	**-**	**-**	**-**	**-**

1.8 Tumbes

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Tumbes.

Table G-22: IA per River Basin – Tumbes

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA038	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas - Tumbes	23,33	8,16	3,44	1,20	48,00	5,00	1,50	2,40	4,00	3,45
IA029	Lining and improvement of irrigation canals - Tumbes	3,35	1,17	0,47	0,16	17,00	5,00	1,00	1,75	3,70	3,12
IA031	Improvement and construction of groundwater abstraction points and related infraestructure for irrigation - tumbes	1,91	0,67	0,44	0,15	3,94	5,00	1,00	1,70	3,30	3,00
IA028	Improvement of irrigation minor infrastructure (surface and groundwater) - Tumbes	25,86	9,05	6,52	2,28	12,50	3,00	0,83	1,75	4,00	2,57
IA044	Waste Water Treatment Plant	45,00	15,74	6,64	2,32	0,18	1,00	2,83	2,60	4,00	2,56
IA033	Improvement of drinking water supply systems, distribution networks and sewerage systems	51,81	18,12	7,28	2,55	2,00	1,00	2,17	1,88	4,00	2,27
IA040	Improvement of integrated urban solid waste management	44,86	15,70	15,31	5,36	0,00	0,00	2,50	2,15	4,20	2,15
IA034	Construction and improvement of rural drinking water supply infraestructure and sewerage systems in rural areas	15,29	5,35	1,80	0,63	0,00	1,00	2,00	1,88	3,60	2,12
IA035	Water Purification Treatment Plant and Waste Water Treatment Plant	34,77	12,16	4,08	1,43	0,00	0,00	2,17	2,15	4,00	2,03
IA045	Sewerage systems in rural areas (development of sanitation projects)	4,55	1,59	0,53	0,19	0,00	0,00	2,33	2,15	3,80	2,00
IA036	Expansion and construction of distribution networks for household water supply and sewerage systems (urban and rural)	27,45	9,60	3,22	1,13	0,00	0,00	2,00	1,88	4,00	1,93
IA043	Construction, expansion and improvement of water supply and sewerage systems	158,57	55,47	18,63	6,52	0,00	0,00	2,17	1,88	3,85	1,92
IA041	Improvement of sewerage systems and distribution networks - Contralmirante Villar, Tumbes	1,06	0,37	0,12	0,04	0,00	0,00	1,83	2,15	3,85	1,92
IA281	Construction of a dam in Puyango-Tumbes River and the associated distribution network for irrigation	419,10	146,62	47,40	16,58	6,30	1,00	1,67	1,95	2,95	1,89
IA282	Construction of Quebrada Fernández Dam	43,42	15,19	4,95	1,73	6,30	1,00	1,67	1,95	2,95	1,89
IA046	Construction and improvement of stormwater urban drainage system	65,60	22,95	7,71	2,70	-	0,00	1,33	1,78	4,20	1,83
IA213	Drainage system - Pampa el Toro, Tangay, San Antonio	17,64	6,17	5,76	2,02	-	0,00	1,33	1,78	4,20	1,83
IA252	Improvement of irrigation water services (abstraction and conveyance) - Tumbes, Tumbes	9,31	3,26	1,10	0,39	1,09	1,00	0,67	1,25	3,60	1,72

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA048	Improvement of stormwater urban drainage systems	2,02	0,71	0,24	0,08	-	0,00	1,33	1,78	3,50	1,64
IA047	Flood defences in riparian areas (and other protection measures agains weather extrem events - stormwater drainage)	305,19	106,77	33,62	11,76	0,00	0,00	0,83	0,63	4,00	1,42
IA050	Control and mitigation of erosion and sedimentation processes	5,28	1,85	0,87	0,30	0,00	0,00	0,83	0,53	4,00	1,40
IA049	Recovery, cleaning and desilting of riverbeds after flood periods	3,93	1,37	1,17	0,41	0,00	0,00	0,83	0,53	4,00	1,40
IA030	Improvement of major irrigation infrastructure - canals - Tumbes	1,56	0,55	0,22	0,08	0,00	0,00	0,67	1,25	3,30	1,33
		1.310,83	**458,57**	**-**	**-**	**97,31**	**-**	**-**	**-**	**-**	**-**

Table G-23: IA per Water policy Challenge – Tumbes

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**251,52**	**87,99**	**19,19%**			**14,50**					
IA028	Improvement of irrigation minor infrastructure (surface and groundwater) - Tumbes	25,86	9,05	1,97%	6,52	2,28	12,50	3,00	0,83	1,75	4,00	2,57
IA033	Improvement of drinking water supply systems, distribution networks and sewerage systems	51,81	18,12	3,95%	7,28	2,55	2,00	1,00	2,17	1,88	4,00	2,27
IA034	Construction and improvement of rural drinking water supply infraestructure and sewerage systems in rural areas	15,29	5,35	1,17%	1,80	0,63	0,00	1,00	2,00	1,88	3,60	2,12
IA043	Construction, expansion and improvement of water supply and sewerage systems	158,57	55,47	12,10%	18,63	6,52	0,00	0,00	2,17	1,88	3,85	1,92
	Flood	**314,40**	**109,99**	**23,98%**								
IA047	Flood defences in riparian areas (and other protection measures agains weather extrem events - stormwater drainage)	305,19	106,77	23,28%	33,62	11,76	0,00	0,00	0,83	0,63	4,00	1,42
IA050	Control and mitigation of erosion and sedimentation processes	5,28	1,85	0,40%	0,87	0,30	0,00	0,00	0,83	0,53	4,00	1,40
IA049	Recovery, cleaning and desilting of riverbeds after flood periods	3,93	1,37	0,30%	1,17	0,41	0,00	0,00	0,83	0,53	4,00	1,40
	GAP	**501,97**	**175,60**	**38,29%**			**82,63**					
IA038	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas - Tumbes	23,33	8,16	1,78%	3,44	1,20	48,00	5,00	1,50	2,40	4,00	3,45
IA029	Lining and improvement of irrigation canals - Tumbes	3,35	1,17	0,26%	0,47	0,16	17,00	5,00	1,00	1,75	3,70	3,12
IA031	Improvement and construction of groundwater abstraction points and related infraestructure for irrigation - tumbes	1,91	0,67	0,15%	0,44	0,15	3,94	5,00	1,00	1,70	3,30	3,00
IA281	Construction of a dam in Puyango-Tumbes River and the associated distribution network for irrigation	419,10	146,62	31,97%	47,40	16,58	6,30	1,00	1,67	1,95	2,95	1,89
IA282	Construction of Quebrada Fernández Dam	43,42	15,19	3,31%	4,95	1,73	6,30	1,00	1,67	1,95	2,95	1,89
IA252	Improvement of irrigation water services (abstraction and conveyance) - Tumbes, Tumbes	9,31	3,26	0,71%	1,10	0,39	1,09	1,00	0,67	1,25	3,60	1,72
IA030	Improvement of major irrigation infrastructure - canals - Tumbes	1,56	0,55	0,12%	0,22	0,08	0,00	0,00	0,67	1,25	3,30	1,33
	Quality	**177,34**	**62,04**	**13,53%**			**0,18**					
IA044	Waste Water Treatment Plant	45,00	15,74	3,43%	6,64	2,32	0,18	1,00	2,83	2,60	4,00	2,56
IA040	Improvement of integrated urban solid waste management	44,86	15,70	3,42%	15,31	5,36	0,00	0,00	2,50	2,15	4,20	2,15
IA035	Water Purification Treatment Plant and Waste Water Treatment Plant	34,77	12,16	2,65%	4,08	1,43	0,00	0,00	2,17	2,15	4,00	2,03

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA045	Sewerage systems in rural areas (development of sanitation projects)	4,55	1,59	0,35%	0,53	0,19	0,00	0,00	2,33	2,15	3,80	2,00
IA036	Expansion and construction of distribution networks for household water supply and sewerage systems (urban and rural)	27,45	9,60	2,09%	3,22	1,13	0,00	0,00	2,00	1,88	4,00	1,93
IA041	Improvement of sewerage systems and distribution networks - Contralmirante Villar, Tumbes	1,06	0,37	0,08%	0,12	0,04	0,00	0,00	1,83	2,15	3,85	1,92
IA213	Drainage system - Pampa el Toro, Tangay, San Antonio	17,64	6,17	1,35%	5,76	2,02	-	0,00	1,33	1,78	4,20	1,83
IA048	Improvement of stormwater urban drainage systems	2,02	0,71	0,15%	0,24	0,08	-	0,00	1,33	1,78	3,50	1,64
	Quality / Flood	**65,60**	**22,95**	**5,00%**								
IA046	Construction and improvement of stormwater urban drainage system	65,60	22,95	5,00%	7,71	2,70	-	0,00	1,33	1,78	4,20	1,83
		1.310,83	**458,57**	**100,00%**	**-**	**-**	**97,31**	**-**	**-**	**-**	**-**	**-**

Table G-24: IA per Sector – Tumbes

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**554,67**	**194,04**	**42,31%**			**95,13**					
IA038	Improvement of abstraction and delivery of irrigation water for Brujas Alta y Fundo Las Palomas - Tumbes	23,33	8,16	1,78%	3,44	1,20	48,00	5,00	1,50	2,40	4,00	3,45
IA029	Lining and improvement of irrigation canals - Tumbes	3,35	1,17	0,26%	0,47	0,16	17,00	5,00	1,00	1,75	3,70	3,12
IA031	Improvement and construction of groundwater abstraction points and related infraestructure for irrigation - tumbes	1,91	0,67	0,15%	0,44	0,15	3,94	5,00	1,00	1,70	3,30	3,00
IA028	Improvement of irrigation minor infrastructure (surface and groundwater) - Tumbes	25,86	9,05	1,97%	6,52	2,28	12,50	3,00	0,83	1,75	4,00	2,57
IA281	Construction of a dam in Puyango-Tumbes River and the associated distribution network for irrigation	419,10	146,62	31,97%	47,40	16,58	6,30	1,00	1,67	1,95	2,95	1,89
IA282	Construction of Quebrada Fernández Dam	43,42	15,19	3,31%	4,95	1,73	6,30	1,00	1,67	1,95	2,95	1,89
IA213	Drainage system - Pampa el Toro, Tangay, San Antonio	17,64	6,17	1,35%	5,76	2,02	-	0,00	1,33	1,78	4,20	1,83
IA252	Improvement of irrigation water services (abstraction and conveyance) - Tumbes, Tumbes	9,31	3,26	0,71%	1,10	0,39	1,09	1,00	0,67	1,25	3,60	1,72
IA050	Control and mitigation of erosion and sedimentation processes	5,28	1,85	0,40%	0,87	0,30	0,00	0,00	0,83	0,53	4,00	1,40
IA049	Recovery, cleaning and desilting of riverbeds after flood periods	3,93	1,37	0,30%	1,17	0,41	0,00	0,00	0,83	0,53	4,00	1,40
IA030	Improvement of major irrigation infrastructure - canals - Tumbes	1,56	0,55	0,12%	0,22	0,08	0,00	0,00	0,00	1,25	3,30	1,33
	Household / Commercial / Public	**450,97**	**157,76**	**34,40%**			**2,18**					
IA044	Waste Water Treatment Plant	45,00	15,74	3,43%	6,64	2,32	0,18	1,00	0,00	2,60	4,00	2,56
IA033	Improvement of drinking water supply systems, distribution networks and sewerage systems	51,81	18,12	3,95%	7,28	2,55	2,00	1,00	0,00	1,88	4,00	2,27
IA040	Improvement of integrated urban solid waste management	44,86	15,70	3,42%	15,31	5,36	0,00	0,00	0,00	2,15	4,20	2,15
IA034	Construction and improvement of rural drinking water supply infraestructure and sewerage systems in rural areas	15,29	5,35	1,17%	1,80	0,63	0,00	1,00	0,00	1,88	3,60	2,12
IA035	Water Purification Treatment Plant and Waste Water Treatment Plant	34,77	12,16	2,65%	4,08	1,43	0,00	0,00	0,00	2,15	4,00	2,03
IA045	Sewerage systems in rural areas (development of sanitation projects)	4,55	1,59	0,35%	0,53	0,19	0,00	0,00	0,00	2,15	3,80	2,00

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA036	Expansion and construction of distribution networks for household water supply and sewerage systems (urban and rural)	27,45	9,60	2,09%	3,22	1,13	0,00	0,00	0,00	1,88	4,00	1,93
IA043	Construction, expansion and improvement of water supply and sewerage systems	158,57	55,47	12,10%	18,63	6,52	0,00	0,00	0,00	1,88	3,85	1,92
IA041	Improvement of sewerage systems and distribution networks - Contralmirante Villar, Tumbes	1,06	0,37	0,08%	0,12	0,04	0,00	0,00	0,00	2,15	3,85	1,92
IA046	Construction and improvement of stormwater urban drainage system	65,60	22,95	5,00%	7,71	2,70	-	0,00	0,00	1,78	4,20	1,83
IA048	Improvement of stormwater urban drainage systems	2,02	0,71	0,15%	0,24	0,08	-	0,00	0,00	1,78	3,50	1,64
	Multipurpose	**305,19**	**106,77**	**23,28%**								
IA047	Flood defences in riparian areas (and other protection measures agains weather extrem events - stormwater drainage)	305,19	106,77	32,00%	33,62	11,76	0,00	0,00	0,00	0,63	4,00	1,42
		1.310,83	**458,57**	**100,00%**	**-**	**-**	**97,31**	**-**	**-**	**-**	**-**	**-**

1.9 Acari, Chala, Atico and Moquegua

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Acari, Chala, Atico and Moquegua.

Table G-25: IA per River Basin – Acari, Chala, Atico and Moquegua

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA178	Reservoirs in Acarí river basin	310,49	108,62	41,97	14,68	125,00	4,00	1,83	2,48	3,35	3,05
IA208	Hydropower plants Moquegua I and III	252,45	88,31	30,57	10,69	104,06	4,00	1,83	2,48	3,20	3,01
IA179	Reservoirs in Atico river basin	2,49	0,87	0,34	0,12	0,50	1,00	1,67	1,95	3,35	2,00
IA180	Construction of reservoirs in Chala river basin	2,49	0,87	0,34	0,12	0,40	1,00	1,67	1,95	3,35	2,00
		567,92	**198,68**	**-**	**-**	**229,96**	**-**	**-**	**-**	**-**	**-**

Table G-26: IA per Water Policy Challenge – Acari, Chala, Atico and Moquegua

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**252,45**	**88,31**	**44,45%**			**104,06**					
IA208	Hydropower plants Moquegua I and III	252,45	88,31	44,45%	30,57	10,69	104,06	4,00	1,83	2,48	3,20	3,01
	GAP	**315,47**	**110,36**	**55,55%**			**125,90**					
IA178	Reservoirs in Acarí river basin	310,49	108,62	**54,67%**	41,97	14,68	125,00	0,34	1,19	1,19	3,35	2,89
IA179	Reservoirs in Atico river basin	2,49	0,87	**0,44%**	0,34	0,12	0,50	0,67	1,22	1,22	3,35	1,87
IA180	Construction of reservoirs in Chala river basin	2,49	0,87	**0,44%**	0,34	0,12	0,40	0,84	1,19	1,19	3,35	1,84
		567,92	**198,68**	**100,00%**	**-**	**-**	**229,96**	**-**	**-**	**-**	**-**	**-**

Table G-27: IA Sector – Acari, Chala, Atico and Moquegua

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Hydropower	**252,45**	**88,31**	**44,45%**								
IA208	Hydropower plants Moquegua I and III	252,45	88,31	44,45%	30,57	10,69	104,06	4,00	1,83	2,48	3,20	3,01
	Multipurpose	**315,47**	**110,36**	**55,55%**			**104,06**					
IA178	Reservoirs in Acarí river basin	310,49	108,62	**54,67%**	41,97	14,68	125,00	4,00	1,83	2,48	3,35	3,05
IA179	Reservoirs in Atico river basin	2,49	0,87	**0,44%**	0,34	0,12	0,50	1,00	1,67	1,95	3,35	2,00
IA180	Construction of reservoirs in Chala river basin	2,49	0,87	**0,44%**	0,34	0,12	0,40	1,00	1,67	1,95	3,35	2,00
		567,92	**198,68**	**100,00%**	**-**	**-**	**229,96**	**-**	**-**	**-**	**-**	**-**

1.10 Chira-Piura

The following tables present the results per IA per river basin, wate rpolicy challenge and sector, for Chira Piura.

Table G-28: IA per River Basin – Chira-Piura

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA258	Waste Water Treatment Plant San Martin	6,50	2,27	0,96	0,34	17,41	5,00	2,67	2,60	3,80	3,67
IA017	Efficiency improvement through technified irrigation - mostly drip irrigation	25,81	9,03	3,81	1,33	220,20	5,00	1,67	2,40	3,60	3,37
IA261	Waste Water Treatment Plant Chulucanas	3,66	1,28	0,54	0,19	1,58	4,00	2,50	2,60	3,80	3,34
IA019	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13,62	4,76	1,91	0,67	140,00	5,00	2,00	2,40	3,05	3,28
IA003	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10,30	3,60	1,52	0,53	33,00	5,00	1,17	2,00	3,60	3,18
IA001	Repairing and improvement of superficial irrigation systems (dams, water intakes, piping, distribution) and metering systems	11,54	4,04	1,62	0,57	20,00	5,00	1,83	1,88	2,90	3,09
IA272	Waste Water Treatment Plant - Catacos, Piura, Piura	13,04	4,56	1,85	0,65	4,60	3,00	2,67	2,60	3,80	3,07
IA249	Expansion and improvement of irrigation water service (canals) - Piura Piura	4,96	1,74	0,82	0,29	15,76	5,00	1,00	1,75	2,90	2,90
IA254	Santa Rosa dam - Quiroz River	557,87	195,16	66,96	23,42	140,00	3,00	1,83	2,48	3,35	2,75
IA005	Lining of irrigation canals	296,42	103,70	36,49	12,76	80,00	3,00	1,17	2,25	3,70	2,66
IA255	Alto Piura project (water transfer, Tronera Sur dam, valley improvement and pumping plants)	1.163,42	407,00	138,74	48,53	315,00	3,00	1,50	2,65	2,70	2,54
IA240	Expansion and improvement of San Martin Waste Water Treatment Plant - Piura	123,68	43,27	18,68	6,54	9,45	1,00	2,83	2,60	3,80	2,50
IA257	Waste Water Treatment Plant - Los Portales, Piura, Piura	3,16	1,11	0,47	0,16	0,65	1,00	2,50	2,60	3,80	2,44
IA263	Waste Water Treatment Plant Lancones	2,44	0,85	0,36	0,13	0,63	1,00	2,33	2,60	3,80	2,40
IA262	Waste Water Treatment Plant Mallaritos	1,63	0,57	0,24	0,08	0,30	1,00	2,33	2,60	3,80	2,40
IA011	Construction and improvement of distribution networks for household supply and sewerage systems from surface water	86,95	30,42	59,31	20,75	12,60	1,00	2,17	2,68	3,60	2,33
IA007	Repairing improvement and expansion of distribution networks for household supply and sewerage systems	129,65	45,36	22,51	7,88	3,50	1,00	2,17	2,08	4,00	2,31

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA009	Rehabilitation, improvement and expansion of distribution networks for rural household supply and sewerage systems	221,30	77,42	32,42	11,34	11,00	1,00	2,17	2,48	3,60	2,29
IA010	Improvement of Waste Water Treatment Plant (WWTP) - stabilization ponds	4,00	1,40	0,58	0,20	-	0,00	2,67	2,60	4,00	2,23
IA013	Water Purification treatment Plant (WPP)	8,40	2,94	1,06	0,37	1,26	1,00	1,83	2,15	3,85	2,22
IA265	Waste Water Treatment Plant Morropon	6,50	2,27	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA259	Waste Water Treatment Plant Noroeste	16,25	5,68	2,40	0,84	-	0,00	2,67	2,60	3,80	2,17
IA267	Waste Water Treatment Plant Pueblo Nuevo	6,50	2,27	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA253	Las Peñitas dam - Piura river	460,00	160,92	55,21	19,32	80,00	1,00	1,83	2,30	3,55	2,17
IA260	Waste Water Treatment Plant Aypate	4,06	1,42	0,60	0,21	-	0,00	2,50	2,60	3,80	2,14
IA002	Improvement of bulk water distribution networks for irrigation (piping, conveyance, distribution)	302,49	105,82	44,61	15,60	77,00	1,00	1,83	1,88	3,70	2,12
IA266	Waste Water Treatment Plant Colan	2,44	0,85	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA270	Waste Water Treatment Plant La Huaca	2,44	0,85	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA264	Waste Water Treatment Plant Salitral	2,44	0,85	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA024	Improvement of integrated solid waste management - Talara - Piura	4,05	1,42	1,12	0,39	0,00	0,00	2,17	2,15	4,20	2,08
IA006	New dams and small reservoirs for (upstream) surface runoff exploitation	400,77	140,20	48,04	16,81	50,00	1,00	1,83	2,13	3,35	2,07
IA269	Waste Water Treatment Plant Miramar	0,73	0,26	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA271	Waste Water Treatment Plant Vichayal	0,73	0,26	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA268	Waste Water Treatment Plant Viviate	0,73	0,26	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA016	Sanitation systems, expansion and improvement of sewerage systems	16,68	5,83	2,45	0,86	0,00	0,00	2,33	2,15	4,00	2,06
IA022	Construction and expansion of sewerage systems	27,19	9,51	4,14	1,45	0,00	0,00	2,50	2,15	3,85	2,05
IA021	Improvement of sewerage systems - rehabilitation of sewer pipes	43,30	15,15	6,47	2,26	0,00	0,00	2,50	2,15	3,85	2,05
IA020	Integrated solid waste management	51,36	17,97	23,05	8,06	0,00	0,00	2,50	2,15	3,80	2,04
IA241	Expansion and improvement of sewerage system - Industrial area in Sullana - Piura	4,51	1,58	0,61	0,21	0,00	0,00	2,33	2,15	3,85	2,02
IA026	Construction and improvement of landfill sites	14,15	4,95	6,45	2,26	0,00	0,00	2,50	2,15	3,70	2,01
IA289	Drinking water supply and sewerage systems - Piura, Piura	39,31	13,75	4,62	1,62	0,00	0,00	2,17	1,88	4,00	1,97

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score
IA012	Construction and improvement of distribution networks for household supply and sewerage systems from groundwater	288,99	101,10	31,84	11,14	15,76	1,00	2,17	2,68	2,30	1,97
IA014	Sanitation systems - Latrines	1,11	0,39	0,22	0,08	0,00	0,00	2,00	2,15	3,85	1,95
IA239	Expansion of drinking water services and sewerage systems - Piura, Piura	4,02	1,41	0,91	0,32	0,00	0,00	2,00	1,88	4,00	1,93
IA025	Rural sanitation systems	2,94	1,03	0,40	0,14	0,00	0,00	2,17	2,15	3,60	1,91
IA246	Improvement of drinking water distribution network from El Arenal WWTP - Talara, Piura	6,89	2,41	7,02	2,46	0,00	0,00	1,67	1,88	4,00	1,87
IA015	Expansion of the distribution network for household water supply	130,80	45,76	15,36	5,37	0,00	0,00	2,17	1,88	3,60	1,85
IA290	Improvement of drinking water supply - Piura, Piura	6,41	2,24	0,75	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA175	Solutions to tackle water conflicts (household demand - irrigation - mining)	33,72	11,80	-	-	0,00	0,00	1,00	1,88	4,20	1,79
IA023	Construction of stormwater urban drainage system	157,06	54,94	20,39	7,13	0,00	0,00	1,33	1,78	3,75	1,71
IA018	Construction, expansion and improvement of irrigation systems - water intakes, canals, and reservoirs	87,10	30,47	10,23	3,58	0,00	0,00	1,33	1,88	3,60	1,69
IA004	Construction and expansion of distribution networks (for urban water supply) and sewerage systems	3,49	1,22	0,64	0,22	-	0,00	2,00	1,68	3,20	1,66
IA027	Expansion and improvement of flood defences (in riparian areas)	221,29	77,41	24,38	8,53	0,00	0,00	0,83	0,53	4,00	1,40
		5.038,77	**1.762,72**	**-**	**-**	**1.249,70**	**-**	**-**	**-**	**-**	**-**

Table G-29: IA per Water Policy Challenge – Chira-Piura

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
	Development	**922,77**	**322,81**	**18,31%**			**58,62**					
IA249	Expansion and improvement of irrigation water service (canals) - Piura Piura	4,96	1,74	0,10%	0,82	0,29	15,76	5,00	1,00	1,75	2,90	2,90
IA011	Construction and improvement of distribution networks for household supply and sewerage systems from surface water	86,95	30,42	1,73%	59,31	20,75	12,60	1,00	2,17	2,68	3,60	2,33
IA007	Repairing improvement and expansion of distribution networks for household supply and sewerage systems	129,65	45,36	2,57%	22,51	7,88	3,50	1,00	2,17	2,08	4,00	2,31
IA009	Rehabilitation, improvement and expansion of distribution networks for rural household supply and sewerage systems	221,30	77,42	4,39%	32,42	11,34	11,00	1,00	2,17	2,48	3,60	2,29
IA289	Drinking water supply and sewerage systems - Piura, Piura	39,31	13,75	0,78%	4,62	1,62	0,00	0,00	2,17	1,88	4,00	1,97
IA012	Construction and improvement of distribution networks for household supply and sewerage systems from groundwater	288,99	101,10	5,74%	31,84	11,14	15,76	1,00	2,17	2,68	2,30	1,97
IA239	Expansion of drinking water services and sewerage systems - Piura, Piura	4,02	1,41	0,08%	0,91	0,32	0,00	0,00	2,00	1,88	4,00	1,93
IA246	Improvement of drinking water distribution network from El Arenal WWTP - Talara, Piura	6,89	2,41	0,14%	7,02	2,46	0,00	0,00	1,67	1,88	4,00	1,87
IA015	Expansion of the distribution network for household water supply	130,80	45,76	2,60%	15,36	5,37	0,00	0,00	2,17	1,88	3,60	1,85
IA290	Improvement of drinking water supply - Piura, Piura	6,41	2,24	0,13%	0,75	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA004	Construction and expansion of distribution networks (for urban water supply) and sewerage systems	3,49	1,22	0,07%	0,64	0,22	-	0,00	2,00	1,68	3,20	1,66
	Flood	**221,29**	**77,41**	**4,37%**								
IA027	Expansion and improvement of flood defences (in riparian areas)	221,29	77,41	4,37%	24,38	8,53	0,00	0,00	0,83	0,53	4,00	1,40
	GAP	**2.903,04**	**1.015,58**	**57,35%**			**1.075,20**					
IA017	Efficiency improvement through technified irrigation - mostly drip irrigation	25,81	9,03	0,51%	3,81	1,33	220,20	5,00	1,67	2,40	3,60	3,37
IA019	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13,62	4,76	0,27%	1,91	0,67	140,00	5,00	2,00	2,40	3,05	3,28
IA003	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10,30	3,60	0,20%	1,52	0,53	33,00	5,00	1,17	2,00	3,60	3,18
IA001	Repairing and improvement of superficial irrigation systems (dams, water intakes, piping, distribution) and metering systems	11,54	4,04	0,23%	1,62	0,57	20,00	5,00	1,83	1,88	2,90	3,09

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA254	Santa Rosa dam - Quiroz River	557,87	195,16	11,07%	66,96	23,42	140,00	3,00	1,83	2,48	3,35	2,75
IA005	Lining of irrigation canals	296,42	103,70	5,88%	36,49	12,76	80,00	3,00	1,17	2,25	3,70	2,66
IA255	Alto Piura project (water transfer, Tronera Sur dam, valley improvement and pumping plants)	1.163,42	407,00	23,09%	138,74	48,53	315,00	3,00	1,50	2,65	2,70	2,54
IA002	Improvement of bulk water distribution networks for irrigation (piping, conveyance, distribution)	302,49	105,82	6,00%	44,61	15,60	77,00	1,00	1,83	1,88	3,70	2,12
IA006	New dams and small reservoirs for (upstream) surface runoff exploitation	400,77	140,20	7,95%	48,04	16,81	50,00	1,00	1,83	2,13	3,35	2,07
IA175	Solutions to tackle water conflicts (household demand - irrigation - mining)	33,72	11,80	0,67%	-	-	0,00	0,00	1,00	1,88	4,20	1,79
IA018	Construction, expansion and improvement of irrigation systems - water intakes, canals, and reservoirs	87,10	30,47	1,73%	10,23	3,58	0,00	0,00	1,33	1,88	3,60	1,69
	GAP / Flood	**460,00**	**160,92**	**9,09%**			**80,00**					
IA253	Las Peñitas dam - Piura river	460,00	160,92	9,09%	55,21	19,32	80,00	1,00	1,83	2,30	3,55	2,17
	GAP / Quality	**4,51**	**1,58**	0,09%								
IA241	Expansion and improvement of sewerage system - Industrial area in Sullana - Piura	4,51	1,58	0,09%	0,61	0,21	0,00	0,00	2,33	2,15	3,85	2,02
	Quality	**527,16**	**184,42**	**10,46%**			**35,88**					
IA258	Waste Water Treatment Plant San Martin	6,50	2,27	0,13%	0,96	0,34	17,41	5,00	2,67	2,60	3,80	3,67
IA261	Waste Water Treatment Plant Chulucanas	3,66	1,28	0,07%	0,54	0,19	1,58	4,00	2,50	2,60	3,80	3,34
IA272	Waste Water Treatment Plant - Catacos, Piura, Piura	13,04	4,56	0,26%	1,85	0,65	4,60	3,00	2,67	2,60	3,80	3,07
IA240	Expansion and improvement of San Martin Waste Water Treatment Plant - Piura	123,68	43,27	2,45%	18,68	6,54	9,45	1,00	2,83	2,60	3,80	2,50
IA257	Waste Water Treatment Plant - Los Portales, Piura, Piura	3,16	1,11	0,06%	0,47	0,16	0,65	1,00	2,50	2,60	3,80	2,44
IA263	Waste Water Treatment Plant Lancones	2,44	0,85	0,05%	0,36	0,13	0,63	1,00	2,33	2,60	3,80	2,40
IA262	Waste Water Treatment Plant Mallaritos	1,63	0,57	0,03%	0,24	0,08	0,30	1,00	2,33	2,60	3,80	2,40
IA010	Improvement of Waste Water Treatment Plant (WWTP) - stabilization ponds	4,00	1,40	0,08%	0,58	0,20	-	0,00	2,67	2,60	4,00	2,23
IA013	Water Purification treatment Plant (WPP)	8,40	2,94	0,17%	1,06	0,37	1,26	1,00	1,83	2,15	3,85	2,22
IA265	Waste Water Treatment Plant Morropon	6,50	2,27	0,13%	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA259	Waste Water Treatment Plant Noroeste	16,25	5,68	0,32%	2,40	0,84	-	0,00	2,67	2,60	3,80	2,17
IA267	Waste Water Treatment Plant Pueblo Nuevo	6,50	2,27	0,13%	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA260	Waste Water Treatment Plant Aypate	4,06	1,42	0,08%	0,60	0,21	-	0,00	2,50	2,60	3,80	2,14
IA266	Waste Water Treatment Plant Colan	2,44	0,85	0,05%	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA270	Waste Water Treatment Plant La Huaca	2,44	0,85	0,05%	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water policy challenge)
IA264	Waste Water Treatment Plant Salitral	2,44	0,85	0,05%	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA024	Improvement of integrated solid waste management - Talara - Piura	4,05	1,42	0,08%	1,12	0,39	0,00	0,00	2,17	2,15	4,20	2,08
IA269	Waste Water Treatment Plant Miramar	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA271	Waste Water Treatment Plant Vichayal	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA268	Waste Water Treatment Plant Viviate	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA016	Sanitation systems, expansion and improvement of sewerage systems	16,68	5,83	0,33%	2,45	0,86	0,00	0,00	2,33	2,15	4,00	2,06
IA022	Construction and expansion of sewerage systems	27,19	9,51	0,54%	4,14	1,45	0,00	0,00	2,50	2,15	3,85	2,05
IA021	Improvement of sewerage systems - rehabilitation of sewer pipes	43,30	15,15	0,86%	6,47	2,26	0,00	0,00	2,50	2,15	3,85	2,05
IA020	Integrated solid waste management	51,36	17,97	1,02%	23,05	8,06	0,00	0,00	2,50	2,15	3,80	2,04
IA026	Construction and improvement of landfill sites	14,15	4,95	0,28%	6,45	2,26	0,00	0,00	2,50	2,15	3,70	2,01
IA014	Sanitation systems - Latrines	1,11	0,39	0,02%	0,22	0,08	0,00	0,00	2,00	2,15	3,85	1,95
IA025	Rural sanitation systems	2,94	1,03	0,06%	0,40	0,14	0,00	0,00	2,17	2,15	3,60	1,91
IA023	Construction of stormwater urban drainage system	157,06	54,94	3,12%	20,39	7,13	0,00	0,00	1,33	1,78	3,75	1,71
		5.038,77	**1.762,72**	**100,00%**	**-**	**-**	**1.249,70**	**-**	**-**	**-**	**-**	**-**

Table G-30: IA per Sector – Chira-Piura

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
	Agriculture	**1.153,00**	**403,36**	**22,88%**			**635,96**					
IA017	Efficiency improvement through technified irrigation - mostly drip irrigation	25,81	9,03	0,51%	3,81	1,33	220,20	5,00	1,67	2,40	3,60	3,37
IA019	Implementation of major and minor infrastructure of irrigation systems (groundwater)	13,62	4,76	0,27%	1,91	0,67	140,00	5,00	2,00	2,40	3,05	3,28
IA003	Improvement of water delivery networks for irrigation (piping, conveyance, distribution)	10,30	3,60	0,20%	1,52	0,53	33,00	5,00	1,17	2,00	3,60	3,18
IA001	Repairing and improvement of superficial irrigation systems (dams, water intakes, piping, distribution) and metering systems	11,54	4,04	0,23%	1,62	0,57	20,00	5,00	1,83	1,88	2,90	3,09
IA249	Expansion and improvement of irrigation water service (canals) - Piura Piura	4,96	1,74	0,10%	0,82	0,29	15,76	5,00	1,00	1,75	2,90	2,90
IA005	Lining of irrigation canals	296,42	103,70	5,88%	36,49	12,76	80,00	3,00	1,17	2,25	3,70	2,66
IA002	Improvement of bulk water distribution networks for irrigation (piping, conveyance, distribution)	302,49	105,82	6,00%	44,61	15,60	77,00	1,00	1,83	1,88	3,70	2,12
IA006	New dams and small reservoirs for (upstream) surface runoff exploitation	400,77	140,20	7,95%	48,04	16,81	50,00	1,00	1,83	2,13	3,35	2,07
IA018	Construction, expansion and improvement of irrigation systems - water intakes, canals, and reservoirs	87,10	30,47	1,73%	10,23	3,58	0,00	0,00	1,33	1,88	3,60	1,69
	Household / Commercial / Public	**2.002,83**	**700,66**	**39,75%**			**218,74**					
IA258	Waste Water Treatment Plant San Martin	6,50	2,27	0,13%	0,96	0,34	17,41	5,00	2,67	2,60	3,80	3,67
IA261	Waste Water Treatment Plant Chulucanas	3,66	1,28	0,07%	0,54	0,19	1,58	4,00	2,50	2,60	3,80	3,34
IA272	Waste Water Treatment Plant - Catacos, Piura, Piura	13,04	4,56	0,26%	1,85	0,65	4,60	3,00	2,67	2,60	3,80	3,07
IA254	Santa Rosa dam - Quiroz River	557,87	195,16	11,07%	66,96	23,42	140,00	3,00	1,83	2,48	3,35	2,75
IA240	Expansion and improvement of San Martin Waste Water Treatment Plant - Piura	123,68	43,27	2,45%	18,68	6,54	9,45	1,00	2,83	2,60	3,80	2,50
IA257	Waste Water Treatment Plant - Los Portales, Piura, Piura	3,16	1,11	0,06%	0,47	0,16	0,65	1,00	2,50	2,60	3,80	2,44
IA263	Waste Water Treatment Plant Lancones	2,44	0,85	0,05%	0,36	0,13	0,63	1,00	2,33	2,60	3,80	2,40
IA262	Waste Water Treatment Plant Mallaritos	1,63	0,57	0,03%	0,24	0,08	0,30	1,00	2,33	2,60	3,80	2,40
IA011	Construction and improvement of distribution networks for household supply and sewerage systems from surface water	86,95	30,42	1,73%	59,31	20,75	12,60	1,00	2,17	2,68	3,60	2,33

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA007	Repairing improvement and expansion of distribution networks for household supply and sewerage systems	129,65	45,36	2,57%	22,51	7,88	3,50	1,00	2,17	2,08	4,00	2,31
IA009	Rehabilitation, improvement and expansion of distribution networks for rural household supply and sewerage systems	221,30	77,42	4,39%	32,42	11,34	11,00	1,00	2,17	2,48	3,60	2,29
IA010	Improvement of Waste Water Treatment Plant (WWTP) - stabilization ponds	4,00	1,40	0,08%	0,58	0,20	-	0,00	2,67	2,60	4,00	2,23
IA013	Water Purification treatment Plant (WPP)	8,40	2,94	0,17%	1,06	0,37	1,26	1,00	1,83	2,15	3,85	2,22
IA265	Waste Water Treatment Plant Morropon	6,50	2,27	0,13%	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA259	Waste Water Treatment Plant Noroeste	16,25	5,68	0,32%	2,40	0,84	-	0,00	2,67	2,60	3,80	2,17
IA267	Waste Water Treatment Plant Pueblo Nuevo	6,50	2,27	0,13%	0,96	0,34	-	0,00	2,67	2,60	3,80	2,17
IA260	Waste Water Treatment Plant Aypate	4,06	1,42	0,08%	0,60	0,21	-	0,00	2,50	2,60	3,80	2,14
IA270	Waste Water Treatment Plant La Huaca	2,44	0,85	0,05%	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA264	Waste Water Treatment Plant Salitral	2,44	0,85	0,05%	0,36	0,13	-	0,00	2,33	2,60	3,80	2,10
IA024	Improvement of integrated solid waste management - Talara - Piura	4,05	1,42	0,08%	1,12	0,39	0,00	0,00	2,17	2,15	4,20	2,08
IA266	Waste Water Treatment Plant Colan	2,44	0,85	0,05%	0,29	0,10	-	0,00	0,00	1,27	3,80	2,07
IA269	Waste Water Treatment Plant Miramar	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA271	Waste Water Treatment Plant Vichayal	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA268	Waste Water Treatment Plant Viviate	0,73	0,26	0,01%	0,11	0,04	-	0,00	2,17	2,60	3,80	2,07
IA016	Sanitation systems, expansion and improvement of sewerage systems	16,68	5,83	0,33%	2,45	0,86	0,00	0,00	2,33	2,15	4,00	2,06
IA022	Construction and expansion of sewerage systems	27,19	9,51	0,54%	4,14	1,45	0,00	0,00	2,50	2,15	3,85	2,05
IA021	Improvement of sewerage systems - rehabilitation of sewer pipes	43,30	15,15	0,86%	6,47	2,26	0,00	0,00	2,50	2,15	3,85	2,05
IA020	Integrated solid waste management	51,36	17,97	1,02%	23,05	8,06	0,00	0,00	2,50	2,15	3,80	2,04
IA026	Construction and improvement of landfill sites	14,15	4,95	0,28%	6,45	2,26	0,00	0,00	2,50	2,15	3,70	2,01
IA289	Drinking water supply and sewerage systems - Piura, Piura	39,31	13,75	0,78%	4,62	1,62	0,00	0,00	2,17	1,88	4,00	1,97
IA012	Construction and improvement of distribution networks for household supply and sewerage systems from groundwater	288,99	101,10	5,74%	31,84	11,14	15,76	1,00	2,17	2,68	2,30	1,97
IA014	Sanitation systems - Latrines	1,11	0,39	0,02%	0,22	0,08	0,00	0,00	2,00	2,15	3,85	1,95

ID	Project title	Capital investment cost (at market prices, million PEN)	Capital investment cost (at market prices, million US$)	Share of total Investment	Total EAC (million PEN)	Total EAC (million US$)	Effectiveness (water saving potential, hm3)	C-E ratio Score (1-5)	Eco. Benefits Score (1-5)	Env. Score (1-5)	Social Score (1-5)	Final Score (ranked within each water user)
IA239	Expansion of drinking water services and sewerage systems - Piura, Piura	4,02	1,41	0,08%	0,91	0,32	0,00	0,00	2,00	1,88	4,00	1,93
IA025	Rural sanitation systems	2,94	1,03	0,06%	0,40	0,14	0,00	0,00	2,17	2,15	3,60	1,91
IA246	Improvement of drinking water distribution network from El Arenal WWTP - Talara, Piura	6,89	2,41	0,14%	7,02	2,46	0,00	0,00	1,67	1,88	4,00	1,87
IA015	Expansion of the distribution network for household water supply	130,80	45,76	2,60%	15,36	5,37	0,00	0,00	2,17	1,88	3,60	1,85
IA290	Improvement of drinking water supply - Piura, Piura	6,41	2,24	0,13%	0,75	0,26	0,00	0,00	1,33	1,88	4,00	1,80
IA023	Construction of stormwater urban drainage system	157,06	54,94	3,12%	20,39	7,13	0,00	0,00	1,33	1,78	3,75	1,71
IA004	Construction and expansion of distribution networks (for urban water supply) and sewerage systems	3,49	1,22	0,07%	0,64	0,22	-	0,00	2,00	1,68	3,20	1,66
	Manufacturing	**4,51**	**1,58**	**0,09%**			**-**					
IA241	Expansion and improvement of sewerage system - Industrial area in Sullana - Piura	4,51	1,58	0,09%	0,61	0,21	0,00	0,00	2,33	2,15	3,85	2,02
	Mining	**33,72**	**11,80**	0,67%			**-**					
IA175	Solutions to tackle water conflicts (household demand - irrigation - mining)	33,72	11,80	0,67%	-	-	0,00	0,00	1,00	1,88	4,20	1,79
	Multipurpose	**1.844,70**	**645,34**	**36,44%**			**395,00**					
IA255	Alto Piura project (water transfer, Tronera Sur dam, valley improvement and pumping plants)	1.163,42	407,00	23,09%	138,74	48,53	315,00	3,00	1,50	2,65	2,70	2,54
IA253	Las Peñitas dam - Piura river	460,00	160,92	9,13%	55,21	19,32	80,00	1,00	1,83	2,30	3,55	2,17
IA027	Expansion and improvement of flood defences (in riparian areas)	221,29	77,41	4,39%	24,38	8,53	0,00	0,00	0,83	0,53	4,00	1,40
		5.038,77	**1.762,73**	**100,00%**	**-**	**-**	**1.249,70**	**-**	**-**	**-**	**-**	**-**

2. Non-prioritised projects and interventions

2.1 Training, education and studies

The following table presents the projects for training, education and studies per catchment.

Table G-31: Training, education and studies per catchment

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Caplina			
1621	Mejora De La Información Técnica Del Acuífero Caplina	3,47	1,21
1620	Plan De Comunicación Y Plan De Sensibilización De La Población De Tacna Ante La Sobreexplotación Del Acuífero Caplina	0,05	0,02
Chancay-Huaral			
1705	Estudio del proyecto de los reservorios de Purapa (Vichaycocha) y Quiles	6,00	2,10
1706	Actualización del conocimiento e inventario de fuentes de agua, determinación de demandas con propósitos de preservación y aprovechamiento.	3,15	1,10
1721	Estudios hidrológicos de detalle; geomorfológicos y de la dinámica fluvial; avenidas históricas; Mapas de vulnerabilidad; Mapas riesgos de inundación; Caracterización geológica y geomorfológica del cauce en la Cuenca Chancay-Huaral	2,40	0,84
1701	Estudio del proyecto de los reservorios de Quipacaca en Añasmayo y Yaco Coyonca en Huantaya	2,00	0,70
1720	Desarrollo de capacidades: cursos, seminarios, jornadas, voluntariados, proyectos I+D+i	1,50	0,52
1728	Incorporación de la GIRH en la Educación Básica Regulas y la Formación Técnica profesional	1,50	0,52
1729	Sensibilización para la valoración del agua, la corresponsabilidad y participación en la GIRH	1,25	0,44
1741	Fortalecimiento de capacidades de gestión (recursos humanos y logísticos).	1,25	0,44
1732	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	1,00	0,35
1731	Recuperación, innovación, desarrollo de prácticas de uso y conservación de recursos hídricos	0,75	0,26
1707	Acciones de sensibilización, capacitación para el sinceramiento de tarifas de uso de agua y la búsqueda del cofinanciamiento por las instituciones que participan de la gestión de los recursos hídricos	0,65	0,23
1722	Generación de información sobre vulnerabilidad de los Recursos Hídricos por efecto del cambio climático. Capacidad de adaptación y mitigación de sus efectos. Oportunidades generadas.	0,60	0,21
1723	Mapas de peligro, vulnerabilidad y riesgo con los nuevos escenarios climáticos.	0,50	0,17
1734	Promoción de prácticas de conservación de suelos y cobertura vegetal en la cuenca media y alta.	0,50	0,17
1769	Desarrollo de capacidades: cursos, seminarios, jornadas, voluntariados, proyectos I+D+i	0,50	0,17

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Chancay-Lambayeque			
2085	Ejecución de estudios hidrológicos, hidráulicos, geomorfológicos y de dinámica fluvial.	6,00	2,10
2016	Mejoramiento de gestión operativa de Comisiones de Usuarios	4,50	1,57
1904	Estudio Hidrogeológico del acuífero del Valle-Cuenca Baja	3,82	1,34
2112	Sensibilización para la valoración del agua, corresponsabilidad y participación de la GIRH	2,50	0,87
2114	Recuperación, innovación, desarrollo de prácticas de uso y conservación de recursos h id ricos	2,25	0,79
1924	Definición de la línea base de eficiencias en el uso agrícola y poblacional	2,00	0,70
2070	Estudio de evaluación de la salinidad en el valle Chancay-Lambayeque	1,98	0,69
2115	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	1,75	0,61
1901	Inventario de fuentes de agua en toda la cuenca	1,44	0,50
2123	Fortalecimiento de capacidades de gestión {recursos humanos y logísticos)	1,25	0,44
2089	Fortalecimiento del planeamiento operativo y logístico del Centro de Operaciones de Emergencia Regional y Locales.	1,20	0,42
2102	Desarrollo de estudios para la identificación de las zonas de erosión, deslizamientos y huaycos susceptibles de afectar las infraestructuras hidráulicas y a los servicios que estos prestan a la comunidad.	1,20	0,42
2106	Generación, divulgación de información y conocimiento sobre Vulnerabilidad de los Recursos H id ricos por efectos del cambio climático.	1,10	0,38
2026	Monitoreo de calidad de agua marina	1,00	0,35
2110	Recuperación y generación de conocimientos para el desarrollo de la GIRH en la cuenca	1,00	0,35
2088	Estudio y delimitación de las fajas marginales del río Chancay-Lambayeque en aras de su preservación.	0,85	0,30
2105	Evaluación especializada de los estudios de auscultación de la presa Tinajones	0,80	0,28
2024	Estudio hidrobiológico	0,75	0,26
2117	Apoyo a la promoción de prácticas de conservación de suelos y cobertura vegetal en la cuenca media y alta	0,75	0,26
2020	Evaluación y diagnóstico de la calidad de aguas subterráneas	0,60	0,21
2111	Incorporación de la GIRH en la Educación Básica Regular y la Formación Técnica Profesional	0,50	0,17
2025	Estudio de sedimentos en medio acuático	0,30	0,10
2073	Sistema de incentivos de conservación y de valor a la producción del agua, a partir de la determinación del valor económico del agua, que favorezca la protección de la cabecera de la cuenca	0,25	0,09
2095	Desarrollo de estudios para mejorar el conocimiento de la problemática de sequías.	0,25	0,09
2096	Preparación de la población y agricultores para hacer frente a los fenómenos de sequías.	0,25	0,09
2116	Apoyo a planes de protección de fuentes y manejo de residuos sólidos	0,25	0,09
2018	Actualización de inventario de fuentes contaminantes	0,21	0,07
1923	Sensibilización sobre el valor del agua	0,20	0,07

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
2076	Desarrollo de capacidades para contrarrestar el desperdicio del agua y la destrucción de los ecosistemas	0,20	0,07
2100	Fortalecimiento de capacidades de las municipalidades para dar cumplimiento a regulaciones de ordenamiento territorial para evitar asentamientos de poblaciones en quebradas y cauces de alto riesgo por ocurrencia de huaycos.	0,20	0,07
2023	Re-categorización del río Chancay-Lambayeque y categorización de sus ríos tributarios	0,15	0,05
2097	Identificación de incentivos para atenuar los efectos de las sequías.	0,15	0,05
2072	Promoción de prácticas de riego y drenaje eficientes	0,11	0,04
Chira-Piura			
602	Generación de cartografía básica a Escala 1 En 25000 De Los Departamentos De Tumbes, Piura, Lambayeque y La Libertad, cíclicamente afectados por el fenómeno de El Niño	24,02	8,40
303	Fortalecimiento En La Gestión Del Manejo De Las Microcuencas ámbito Del Programa De Pequeña y Mediana Infraestructura de Riego en la Sierra Del Perú	15,69	5,49
7	Entrenamiento En Riego Tecnificado Y Asistencia Técnica-Perat 2009	4,60	1,61
736	Mejoramiento de Capacidades para el Ordenamiento Territorial Del Distrito de Huarmaca, Distrito de Huarmaca - Huancabamba - Piura	3,73	1,31
740	Mejoramiento y Desarrollo De Capacidades Para el Ordenamiento Territorial De Paita, Provincia De Paita - Piura	2,15	0,75
589	Fortalecimiento De Capacidades Para El Ordenamiento Territorial De la Provincia De Morropon - Piura	2,08	0,73
305	Fortalecimiento De Capacidades Para Mejorar La Productividad Del Algodón Pima En El Valle Del Chira, Valle Del Alto Piura Y Valle Del Medio Y Bajo Piura - Región Piura	1,93	0,68
590	Fortalecimiento De Capacidades Para La Implementación Del Ordenamiento Territorial De La, Provincia De Sechura - Piura	1,52	0,53
282	Fortalecimiento de la cadena productiva Del Café En 16 Localidades Integrantes De La Asociación Distrital De Productores Agropecuarios Zonal Huarmaca, Distrito De Huarmaca - Huancabamba - Piura	1,51	0,53
216	Desarrollo De Capacidades Regionales Para La Gestión Del Saneamiento Ambiental	1,12	0,39
717	Sensibilización, Difusión Y Asistencia Técnica En Agricultura De Riego a Agricultores En La Junta De Usuarios De Huancabamba	1,05	0,37
751	Capacitación/Entrenamiento De La Junta De Usuarios De Huancabamba En El Marco Del Programa Subsectorial De Irrigación Sierra	0,99	0,35
137	Fortalecimiento De La Gestión Del Área Natural Protegida Por El Estado Coto De Caza El Angolo En Las Provincias De Sullana Y Talara	0,93	0,33
95	Fortalecimiento De Capacidades Para Los Productores Del Cultivo De Maíz Amarillo Duro En El Bajo Piura Y Bajo Chira – Piura	0,47	0,16
20	Fortalecimiento De La Subgerencia De Seguridad Ciudadana Y Defensa Civil De La Municipalidad Distrital De Castilla, Distrito De Castilla - Piura - Piura	0,34	0,12
181	Fortalecimiento De La Cadena Productiva Del Cacao En Las Localidades De Los Ranchos, San Ramón De Las Vegas,Soccha Baja, San Martin De Pajonal, Cilia, San Francisco, Hualtalcal Y Huabal, Distrito De Canchaque - Huancabamba - Piura	0,30	0,10
6	Fortalecimiento Del Área De Catastro Y Habilitacion Urbana De La Municipalidad Distrital De Tambogrande Del, Distrito De Tambo Grande - Piura - Piura	0,29	0,10
203	Manejo De Recursos Naturales En Los Caseríos De Choco, Las Huacas Y La Cruz Del Distrito De Yamango, Provincia De Morropón-Región Piura	0,28	0,10
451	Mejorar La Gestión Para La Sostenibilidad De La Operación Y Mantenimiento Del Sistema De Agua Potable Y Alcantarillado De La Sede Central De La Eps Grau SA Ubicado En La Localidad De Piura	0,05	0,02

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
535	Mejoramiento De La Gestión Para La Sostenibilidad De La Operación Y Mantenimiento Del Sistema De Agua Potable Y Alcantarillado En La Planta De Operaciones De La Eps Grau S.A. Ubicado En La Localidad De Piura	0,03	0,01
Quilca-Chili			
1886	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	4,20	1,47
1883	Sensibilización para la valoración del agua, la corresponsabilidad y participación en la GIRH	3,50	1,22
1780	Determinación e implementación de caudales ecológicos en tramos prioritarios	2,80	0,98
1849	Determinación e implementación de caudales ecológicos en tramos prioritarios	2,80	0,98
1882	Incorporación de la GIRH en la Educación Básica Regular y la Formación Técnica y Profesional	2,80	0,98
1887	Promoción de prácticas de conservación de suelos y cobertura vegetal en la cuenca	2,80	0,98
1829	Sensibilización y promoción de prácticas de uso y conservación de recursos hídricos	2,40	0,84
1826	Sensibilización para la valoración del agua, la corresponsabilidad y participación en la GIRH	2,00	0,70
1825	Incorporación de la GIRH en la Educación Básica Regular y la Formación Técnica y Profesional	1,60	0,56
1828	Recuperación, innovación, desarrollo de prácticas de uso y conservación de recursos hídricos	1,60	0,56
1830	Promoción de prácticas de conservación de suelos y cobertura vegetal en la cuenca	1,60	0,56
1771	Elaboración de estudios hidrogeológicos en las subcuencas oriental y Yura, y pampas de La Joya, Salinas, Imata, y Cañahuas	1,50	0,52
1770	Estudios hidrológicos en los ríos Chili y Siguas. Inventarios de manantiales y bofedales en todas las subcuencas	0,86	0,30
1839	Estudios hidráulicos	0,80	0,28
1840	Mapas de peligrosidad, vulnerabilidad y riesgo	0,60	0,21
1819	Sinceramiento de las tarifas. Estudios económicos para el establecimiento de retribuciones y tarifas	0,50	0,17
1841	Estudios de detalle para realización de mapas de peligrosidad, vulnerabilidad y riesgo ante deslizamientos y derrumbes	0,50	0,17
1842	Estudios de detalle para realización de mapas de peligrosidad, vulnerabilidad y riesgo ante actividad volcánica y sísmica	0,50	0,17
1843	Elaboración de planes de contingencia tendentes a mejorar el manejo de la cuenca y la conservación de los recursos naturales	0,50	0,17
1837	Estudios hidrológicos	0,40	0,14
1838	Estudios geomorfológicos y de dinámica fluvial	0,20	0,07
1774	Evaluaciones de recursos hídricos a escala de subcuenca, incluyendo actualización de balances hídricos y estudios de determinación de eficiencias	0,15	0,05
1845	Actualización de balances hídricos y evaluaciones de recursos hídricos a escala de subcuenca	0,15	0,05
1844	Actualización y ampliación de los inventarios de fuentes de agua de la cuenca	0,14	0,05
1892	Promoción de la articulación de la gestión del recurso hídrico con la ordenación territorial, mediante la integración de las zonas inundables y sus limitaciones de usos en el planeamiento urbano	0,10	0,03

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Tacna			
1665	Proyectos De Reducción De Consumos, Tratamiento De Residuos Y Reutilización De Aguas	252,00	88,11
1642	Fortalecimiento De Las Juntas De Usuarios De Riego Del Valle De Tacna, La Yarada, Sama, Tarata, Locumba Y Candarave	35,00	12,24
1643	Fortalecimiento De La Eps Tacna Como Operador Del Saneamiento De Tacna, Pachía Y Locumba	35,00	12,24
1644	Fortalecimiento Del Pet Como Operador Multisectorial De Las Cuencas De Tacna	34,84	12,18
1637	Estudios De Recursos Hídricos Subterráneos Y Superficiales, De Demandas Hídricas Multisectoriales, Modelo De Asignación De Licencias E Inventario De Infraestructura Mayor Y Menor	24,70	8,64
1649	Programa De Cultura Del Agua Y Desarrollo De Capacidades Promovido Por El Ana A Través Del Proyecto De Modernización De La Gestión De Los Recursos Hídricos	3,20	1,12
1647	Redacción E Implementación De Los Planes De Contingencia Ante Sequías, Contaminación Puntual De Fuentes De Recurso Hídrico E Inundaciones	1,60	0,56
1646	Estudios De Zonificación Territorial De Riesgos Potenciales Ante Eventos Extremos	1,20	0,42
1635	Inventario De Fuentes De Información Y Diseño De Protocolos De Toma Y Validación De Datos	0,50	0,17
Tumbes			
1463	Generación De Cartografía Básica A Escala 1 En 25000 De Los Departamentos De Tumbes, Piura, Lambayeque Y La Libertad, Cíclicamente Afectados Por El Fenómeno de El Niño	24,02	8,40
1579	Mejoramiento De La Calidad De Servicio De Capacitación Y Asistencia Técnica De La Dirección De Competitividad Agraria De La Dirección Regional De Agricultura Tumbes Zarumilla - Contralmirante Villar - Tumbes	3,20	1,12
1246	Detección, análisis y zonificación de los puntos críticos en la cuenca ante fenómenos de riesgo hidrológico	3,15	1,10
1479	Desarrollo De Capacidades De Las Autoridades Regionales Para La Integración De La Variable De Cambio Climático En Los Procesos De Programación Y Planeación Territorial De La Región Tumbes	2,57	0,90
1269	Realización de campañas publicitarias para la corrección de malos hábitos y costumbres y de información de la gestión del agua	2,43	0,85
1563	Mejoramiento De La Imagen De La Ciudad Mediante Las Buenas Practicas De Higiene A La Población De Villa Aguas Verdes, Distrito De Aguas Verdes - Zarumilla - Tumbes	2,04	0,71
1279	Formación y transferencia tecnológica a las Comunidades de Usuarios	1,90	0,66
1453	Fortalecimiento De Capacidades Para El Ordenamiento Territorial, Provincia De Zarumilla - Tumbes	1,74	0,61
1280	Formación y capacitación específica de la gestión del agua a docentes	1,67	0,58
1266	Realización de ciclos de conferencias y exposiciones en escuelas	1,62	0,57
1268	Elaboración de productos promocionales (folletos, trípticos, DVD's, infografía y otros)	1,21	0,42
1442	Fortalecimiento De La Capacidad De Respuesta En Búsqueda Y Rescate Urbano En Estructuras Colapsadas Livianas En La Región Tumbes	1,08	0,38
1215	Realización de los estudios de determinación del caudal ecológico	0,40	0,14
1265	Integración de la política de la cultura del agua en el Proyecto Educativo Regional	0,40	0,14
1281	Campaña de concientización a los usuarios para el pago del agua	0,30	0,11

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
1204	Realización de estudios e innovación agraria para el análisis de la viabilidad de la sustitución de cultivos más eficientes y adaptables	0,30	0,10
1287	Mejora de los sistemas organizativos contables de las Organizaciones de usuarios	0,25	0,09
1267	Elaboración de un Plan Comunicacional (Sistema de Información y Comunicación)	0,24	0,08
1270	Creación de páginas web con promoción y mejora de la cultura del agua	0,22	0,08
1213	Evaluación de los sistemas de riego utilizados y detección de malas prácticas	0,20	0,07
1214	Evaluación de los sistemas de abastecimiento poblacional utilizados y detección de malas prácticas	0,20	0,07
1232	Realización de estudios para la determinación de los niveles de saneamiento requerido y de ubicación de PTAR	0,20	0,07
1293	Implementación De Ambiente Para Monitoreo De Aguas De Mareas En El Estero Rico Para La Facultad De Ingeniería Pesquera De La Universidad Nacional De Tumbes	0,14	0,05
1206	Inventariado inicial y actualización continua del inventario de captaciones superficiales	0,13	0,04
1194	Elaboración de una guía para la redacción de los Planes de operación y mantenimiento de las infraestructuras de captación, transporte, drenaje y medición de agua de los operadores de infraestructura hidráulica	0,10	0,03
1197	Elaboración de una guía para la redacción de los Planes de operación y mantenimiento de la infraestructura de captación, transporte, tratamiento, distribución y medición de agua para uso poblacional y/u otros usos	0,10	0,03
1429	Fortalecimiento De Capacidades Productivas Y Empresariales En La Asociación Agroindustrial Del Dulce, Provincia De Tumbes - Tumbes	0,03	0,01
1286	Análisis anual del financiamiento de la gestión del agua	0,03	0,01
1198	Redacción de los Planes de operación y mantenimiento de la infraestructura de captación, transporte, tratamiento, distribución y medición de agua para uso poblacional y/u otros usos	0,01	0,00
1195	Redacción de los Planes de operación y mantenimiento de las infraestructuras de captación, transporte, drenaje y medición de agua de los operadores de infraestructura hidráulica	0,01	0,00
PNRH			
2263	Inclusión en el currículo educativo y capacitación del profesorado	274,56	96,00
2264	Campañas publicitarias sobre cultura del agua	105,60	36,92
2268	Difusión en medios de comunicación	105,60	36,92
2267	Talleres de capacitación	67,64	23,65
2265	Talleres capacitación en las AAA y en las ALA	50,63	17,70
2266	Elaboración de los documentos de trabajo	31,68	11,08
2270	Investigación y capacitación cambio climático	17,00	5,94
2275	Inventario de zonas de riesgo	14,00	4,90
2221	Estudios de potencial de desalinización de aguas de mar para consumo humano en unidades hidrográficas con ciudades costeras importantes y/o riego de zonas agrícolas de exportación de alta rentabilidad	10,00	3,50
2269	Estudio efectos cambio climático en recursos hídricos	10,00	3,50
2271	Estudios vulnerabilidad cambio climático	10,00	3,50

2.2 Environment and Afforestation

The following table presents the environmental and afforestation projects per catchment.

Table G-31: Environmental and afforestation projects per catchment

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Chancay-Huaral			
1765	Programas de mantenimiento y conservación de cauces	5,00	1,75
1716	Conservación: declaración de reservas fluviales para la conservación de tramos de ríos con escasa o nula intervención humana, fuentes de agua y zonas de retención e infiltración.	5,00	1,75
1693	Fortalecimiento De La Gestión Ambiental De Los Humedales Costeros De Puerto Viejo - Cañete Y Santa Rosa - Huaral De La Región Lima	0,19	0,07
Chancay-Lambayeque			
2103	Formulación e implementación de normas técnicas para la ejecución de acciones de reforestación y forestación (nivel nacional, regional, local), para estandarizar las especies y zonas de reforestación, en los proyectos de restauración de la cubierta forestal.	0,25	0,09
Chira-Piura			
1181	Mejoramiento De Los Servicios Ambientales A Través De La Gestión Integral De La Sub Cuenca Macara - Cuenca Binacional Catamayo Chira	7,57	2,65
611	Mejoramiento De Las Capacidades Con Equidad De Genero Para El Manejo Y Conservación De Los Recursos Del Bosque Seco Ubicado En 18 Caseríos En El Valle Del Bajo Piura - Región Piura	3,13	1,09
839	Instalación De Modulos De Riego Tecnificado Y Reforestación En Las Microcuencas Canchaque-San Miguel Del Faique Y Lalaquiz, Distrito De San Miguel De El Faique - Huancabamba - Piura	2,76	0,97
529	Mejoramiento De La Gestión Y Manejo Integral Del Bosque De Cuyas, Provincia De Ayabaca - Piura	1,80	0,63
91	Mejoramiento De La Calidad De Vida De Las Familias Campesinas De La Sub Cuenca De Guanabano Del Distrito De Frias, Provincia De Ayabaca - Piura	1,15	0,40
569	Fortalecimiento De Capacidades Para Manejos De Bosques Secos En Zonas Reservadas De La, Provincia De Sechura - Piura	0,34	0,12
571	Fortalecimiento De Capacidades Para La Utilización De Los Recursos Naturales En La Actividad Artesanal En La Provincia De Sechura, Provincia De Sechura - Piura	0,30	0,10
217	Mejoramiento Recuperación Y Gestión De Bosques A Través De La Reforestación Y Forestación Con Plantas Nativas Y Exóticas En Comunidades De Samanga - Samanguilla, Mostazas Y Chocan, Provincia De Ayabaca - Piura	0,27	0,10
Quilca-Chili			
1885	Recuperación, innovación, desarrollo de prácticas de uso y conservación de recursos hídricos	2,80	0,98
1820	Establecimiento de mecanismos de compensación por servicios ambientales	0,60	0,21
1877	Establecimiento de mecanismos de compensación por servicios ambientales	0,10	0,03
Tacna			
1653	Mejoramiento De Los Servicios Para Conservación Del Carzo (Haplorhus Peruviana) En Monte Ribereño En El Distrito De Locumba, Jorge Basadre	0,88	0,31

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Tumbes			
1488	Mejoramiento De Las Capacidades Del Sector Público Y De La Sociedad Civil Para La Gestión De La Conservación De Bosques Para Mitigar El Cambio Climático En 5 Regiones Amazónicas Y 3 Regiones De Bosque Seco	36,51	12,77
1251	Detección y control de la deforestación	1,00	0,35
1503	Mejoramiento De Capacidades Para La Conservación Del Bosque De Manglar En Zarumilla, Provincia De Zarumilla - Tumbes	0,36	0,13

2.3 Hydrometric and water quality monitoring networks

The following table presents the hydrometric and water quality monitoring networks per catchment.

Table G-32: Environmental and afforestation projects per catchment

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
Chancay-Huaral			
1715	Operación red aguas superficiales y subterráneas en la cuenca Chancay-Huaral - Monitoreo	6,00	2,10
1763	Operación red aguas superficiales - Monitoreo	6,00	2,10
1764	Operación red aguas subterráneas - Monitoreo	6,00	2,10
1709	Actualización de estudios hidrogeológicos, e inventario de pozos y monitoreo del agua subterránea para aprovechamiento racional y una extracción sostenible.	2,75	0,96
1719	Caudales Ecológicos: Análisis, implantación y seguimiento en 13 puntos representativos de la cuenca	2,50	0,87
1768	Monitoreo del cumplimiento de Caudales Ecológicos	1,00	0,35
1714	Inventario y diseño red de control de calidad de aguas	0,20	0,07
Chancay-Lambayeque			
2098	Establecimiento de un sistema de alerta temprana y comunitaria de heladas	2,50	0,87
2021	Establecimiento y operación red de monitoreo de calidad de aguas subterráneas	2,40	0,84
1905	Monitoreo y Evaluación del Acuífero	1,36	0,48
2099	Monitoreo y evaluación de las zonas vulnerables a heladas mediante el sistema de alerta temprana y comunitaria.	1,20	0,42
2019	Operación red de monitoreo de calidad de aguas superficiales	0,75	0,26
Quilca-Chili			
1857	Operación y mantenimiento de la red de aguas superficiales	16,80	5,87
1797	Operación y mantenimiento de la red de aguas superficiales	9,60	3,36
1858	Operación y mantenimiento de la red de aguas subterráneas	4,20	1,47
1899	Sistema de prevención y contingencia ante inundaciones: Sistema de alerta temprana	2,50	0,87
1798	Operación y mantenimiento de la red de aguas subterráneas	2,40	0,84

ID No	Title of the project/ intervention	Capital investment cost (@ market prices in million PEN)	Capital investment cost (@ market prices in million of USD)
1900	Promoción de la implementación de un sistema de alerta temprana ante actividad volcánica y sísmica	2,00	0,70
1796	Actualización de inventario, revisión de red de monitoreo de calidad de aguas superficiales y diseño de red de monitoreo de aguas subterráneas	1,00	0,35
Tacna			
1640	Operación Y Mantenimiento De Centro De Control De Información Hídrica En La AAA I Caplina-Ocoña	7,50	2,62
Tumbes			
1465	Rehabilitación, Mejoramiento E Implementación De 23 Estaciones Hidrométricas En Ríos De La Costa Priorizados Con Recursos Ordinarios	7,55	2,64
1236	Control y monitoreo de la calidad las aguas superficiales	2,15	0,75
1237	Control y monitoreo de la calidad las aguas subterráneas	0,82	0,29
1218	Operación y mantenimiento de las estaciones hidrométricas existentes	0,79	0,28
1239	Estudio de caracterización zonal y puntual por el uso de productos químicos de la actividad agrícola (herbicidas, plaguicidas, agroquímicos y otros productos)	0,70	0,24
1240	Caracterización físico-química y biológica de las aguas superficiales	0,60	0,21
1217	Operación y mantenimiento de las estaciones meteorológicas existentes	0,45	0,16
1238	Estudio de trazabilidad de las fuentes de contaminación. Determinación de componentes contaminantes y geoquímica natural de la cuenca	0,40	0,14
1235	Control y monitoreo de los puntos de vertimiento de aguas residuales y de la calidad del agua vertida	0,29	0,10
1223	Monitoreo de la red piezométrica de control de los acuíferos	0,26	0,09
1222	Establecimiento de una red piezométrica de control de los acuíferos	0,20	0,07
1241	Caracterización fisico-química de las aguas subterráneas	0,20	0,07
1243	Definición de una red de monitoreo de la calidad de las aguas subterráneas	0,20	0,07
1224	Monitoreo de la red de estaciones hidrométricas	0,13	0,04
1229	Identificación de los puntos de contaminación de la cuenca y actualización	0,06	0,02
1242	Definición de una red de monitoreo de la calidad de las aguas superficiales	0,01	0,00
PNRH			
2243	Monitoreos de calidad del agua	229,01	80,07

Appendix H
Workshop Report

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1. Introducción

La última etapa del proyecto "*Hidroeconomic Analysis and Priorisation of Water Resources Initiatives in Peru for WRG 2030*" contempló un Workshop con los stakeholders que participaron en las entrevistas del "*Stakeholders Engagement*". El workshop fue importante para nutrir el diagnóstico y el análisis PESIA.

Los objetivos del Workshop incluyeron:

- Alcances del estudio.
- Priorización de proyectos.
- Retroalimentación con los stakeholders.

Fue desarrollado el 25 de Setiembre en el Hotel Hilton en Lima entre las 10:30am a 15:30pm. Participaron stakeholders de múltiples plataformas: privadas, públicas y organizaciones no gubernamentales. También participaron directivos del 2030 Water Resources Group, quienes compartieron la presentación con el equipo de expertos de AMEC, INCLAM e IMDEA.

Fuente: AMEC, 2014

El equipo de expositores fue el siguiente:

- Anders Berntell, Executive Director, 2030 Water Resources Group.
- Michael Norton, Project Director.
- Jim McCord, Team Leader.
- Gonzalo Delacamara, Hidroeconomic Analysis.
- Jordi Pastor, Stakeholders Engagement.
- Guillermo Pedroni, PESIA Analysis.

Hubo una buena respuesta de parte de los stakeholders, quienes participaron activamente del Workshop. A continuación, la lista de asistentes y la institución a la que pertenecen:

Tabla H-1: Lista de Participantes e Instituciones

Nombres y Apellidos	Institución
Alejandro Conza	Agua Limpia
Mercedes Castro	Agua Limpia
Armando Casis	Asociación UNACEM
Edgar Orellana	Banco Interamericano de Desarrollo
Julia Sobrevilla	Coca – Cola
Jorge Del Castillo Gálvez	Diálogo y Soluciones
Antonio Bernales	Futuro Sostenible
Miguel Bentín	Agroinversiones Valle y Pampa
Aaron Drayer	Global Green Growth Institute Perú
Víctor Guevara	Ministerio de Vivienda, Construcción y Saneamiento
Guido Bocchio	Southern Perú Copper Corporation
Jon Bickel	Swisscontact
Luis Alberto Gonzáles	The Nature Conservancy
Gustavo Perochena	World Bank
Jacqueline Villanueva	Sociedad Nacional de Minería, Petroleo y Energía
Joe Torre	Ciudad Saludable
Guilherme De Sa Ribeiro	Andrade Gutierrez
Anders Berntell	2030 WRG
Alastair Morrison	2030 WRG
Jim McCord	AMEC (PERÚ)

Nombres y Apellidos	Institución
Michael Norton	AMEC (UK)
Guillermo Pedroni	AMEC (PERÚ)
César Fonseca	2030 WRG Perú Country Representative
Gonzalo Delacámara	Instituto IMDEA Agua
Jorge Helmbrecht	Water Idea
Maria Esperanza Gonzales	AMEC (PERÚ)
Yerson Guarniz	AMEC (PERÚ)
Diana Montes	AMEC (PERÚ)

Fuente: AMEC (PERÚ) 2014.

2. Metodología

La estructura del Workshop se basó en dos etapas. La primera etapa fue informativa y se presentaron los objetivos y alcances del proyecto, así como las principales tareas del estudio: a) Revisión de documentos para la compilación de proyectos, b) Identificación de proyectos y compilación de datos, c) Preselección de proyectos, d) consulta a stakeholders, e) Análisis hidroeconómico, f) Análisis PESIA[1], y g) Resultados de priorización. Estos contenidos son también presentados en el Informe Final.

La exposición de temas estuvo a cargo de Michael Norton (presentaciones), Jim McCord (objetivos, alternativas de inversión, preselección y resumen de resultados iniciales), Jordi Pastor (mapeo de grupos de interés), y Gonzalo Delacámara (análisis hidroeconómico e impactos sociales y ambientales). Para mayor detalle de la agenda del Workshop, véase Anexo A.

Al final de esta primera etapa, hubo un momento de debate y resolución de dudas con los stakeholders.

La segunda etapa consistió en una dinámica de grupos con los stakeholders (breakout session). En ella se formaron grupos de trabajo con el fin de recoger observaciones, comentarios y sugerencias sobre la metodología y análisis para la priorización de proyectos.

[1] Political, Environmental, Social Impact Assessment.

3. Dinámica de grupos

Para la realización de la dinámica de grupos se formaron tres grupos, conformados por representantes de distintos sectores (público, privado y ONGs). Se procuró tener diversidad de stakeholders en cada grupo para enriquecer la discusión, sin orden de intervención, pero con apoyo para el control del tiempo de la dinámica.

Además de los stakeholders, cada grupo contó con:

a) Un facilitador, encargado de dirigir la dinámica y registrar los comentarios y sugerencias de cada stakeholder en los papelógrafos dispuestos.

b) Un especialista técnico, quien se encargó de absolver las dudas de los participantes.

Los facilitadores y especialista técnicos sólo dieron soporte a la dinámica de grupos sin influir en las opiniones de los participantes.

Además, se dispuso un cuarto facilitador general que se encargó de observar la dinámica externamente, registrar momentos claves de participación y tomar el tiempo de los momentos de la actividad para que todos los grupos avancen de manera similar.

La dinámica de grupos tuvo tres etapas. En la primera etapa se presentó gráficamente un ejemplo de priorización de proyectos en una cuenca familiar a los participantes: Rímac Chillón Lurín. El objetivo fue mostrar los cambios en la priorización de proyectos al pasar de un análisis costo-beneficio a un análisis integral. En este caso particular, la tipología de proyectos varió de “represas y reservorios” a incorporar proyectos de “saneamiento” y “plantas de tratamiento”.

La segunda etapa consistió en la evaluación de los criterios y sus respectivas variables, utilizados en el análisis del estudio hidroeconómico. Estos criterios y variables se pueden observar en el Anexo B.

La tercera etapa trasladó la evaluación de los stakeholders a las ponderaciones de cada criterio, en el análisis del estudio hidroeconómico. Las ponderaciones se pueden observar en el Anexo C.

Estas dos últimas fases tuvieron una duración aproximada de 30 minutos cada una. Al finalizar las actividades se realizó la exposición de los resultados de cada grupo. Luego se realizó una breve ronda de comentarios sobre las exposiciones y, finalmente, se cerró la dinámica con la intervención del equipo de expertos, quienes respondieron las observaciones y aclararon dudas y comentarios.

4. Resultados

La dinámica de grupos generó una diversidad de observaciones, comentarios y sugerencias respecto a los criterios y sus valores2, y a otros aspectos vinculados a la priorización de proyectos.

La siguiente Tabla 1-2 muestra la sistematización analítica de observaciones, comentarios y sugerencias que stakeholders plantearon durante la dinámica, la pertinencia de los mismos a los objetivos del estudio, las respuestas que se dieron durante la dinámica, y la valoración de los comentarios en una escala del 1 al 5[3].

Tabla H-1: Sistematización Analítica de Observaciones, Comentarios y Sugerencias

Tema	Comentarios	Pertinencia del comentario al estudio	Respuesta	Valoración del comentario
Best Practices	Se remarcó la: • Importancia de procesos de participación en la implementación del proyecto. • Rescate de los niveles de institucionalidad en la zona del proyecto para que aporten sostenibilidad al mismo.		Se comentó que las Best Practices mencionadas están referidas al momento de la implementación y no al de priorización de proyectos. Sin embargo, resalta que ya se aplicó un filtro con esa suposición de potenciar aquellos proyectos que tienen un entorno institucional más favorable. Por ello, se listaron proyectos en cuencas donde hay Consejo de RR.HH., Secretaría del Consejo y actividad de financiamiento agilizada de estudios y perfiles (ANA, PMGRH).	3
Vacíos en Documentos	• Por ejemplo, SEDAPAL no tiene plan de gestión efectivo y todavía no existe un plan de cuenca para Rímac-Chillón-Lurín. • Incluir demanda de agua de actividades mineras en los planes de cuencas (Ejemplo cuenca Tacna)		No están directamente relacionados a la metodología de la priorización de proyectos.	2
Cambio Climático	Incorporar índices de adaptación al cambio climático.	✓	El cambio climático ha sido incorporado en el PESIA cualitativamente. No ha sido incorporado en el Workshop porque no se estableció una traducción cuantitativa.	4

[2] Se distinguen en el estudio cuatro criterios: Financieros, Económicos, Sociales y Ambientales. Para mayor detalle de las variables de cada criterio, véase Anexo B.

[3] En donde 1 es menos importante y 5 es más importante.

Tema	Comentarios	Pertinencia del comentario al estudio	Respuesta	Valoración del comentario
Portafolio de Proyectos	• Descartar la visión de medir proyectos específicos y concretos. • Incluir conjunto de proyectos que contribuyan a enfrentar desafíos más complejos.	✓	La metodología es eficaz al abordar el portafolio de proyectos (no uno a uno). Además, la sinergia contribuye a enfrentar los principales retos en recursos hídricos del país: a) closing the water gap, b) managing floods, c) tackling water pollution, d) adapting climate change, e) enhancing biodiversity levels, y f) strengthening the catchment approach to water management.	4
Condiciones Políticas	Discrecionalidad de autoridades políticas en priorización y viabilización de proyectos.		Desvinculada a la metodología de priorización de proyectos.	3
Condiciones Legales	Exceso de normatividad y permisos (En especial los proyectos que implican tanto el uso de tierras privadas y colectivas).		Esta observación no aplica a los fines del estudio.	3
Criterios de Gestión	Dificultades por lentitud en la gestión de proyectos por gobiernos locales y/o regionales		No está vinculado a los objetivos de la metodología o el estudio.	3
Criterio Financiero	Incluir el Costo de Capital como parámetro en el criterio financiero.	✓	Se acoge.	5
Tipos de proyectos	• Incluir proyectos de conservación de biodiversidad. • Replantear aquellos que impliquen el "vertido de aguas residuales" por otros que re-usen dichas aguas.		Los proyectos del estudio fueron extraídos de los Planes de Gestión de las cuencas seleccionadas, el Plan Nacional de Recursos Hídricos, el banco del SNIP, etc. El estudio no guarda responsabilidad directa sobre la presencia de pocos proyectos vinculados a la conservación de la biodiversidad, o la presencia de proyectos que implican el vertido de aguas residuales. Se ha trabajado sobre información existente.	3
Análisis Costo-Beneficio	• Primero desarrollar el análisis social, económico y ambiental, luego incorporar el análisis costo-beneficio.	✓	La sugerencia aleja al estudio de un análisis holístico e integral.	4

Tema	Comentarios	Pertinencia del comentario al estudio	Respuesta	Valoración del comentario
Cambio en ponderación de criterios	Aumentar el peso a los criterios sociales y ambientales, en relación a los financieros y económicos. Criterio Social de 0.25 a 0.30 y Criterio Ambiental de 0.20 a 0.25.	✓	La ponderación es relativa al tipo de proyecto o a la zona de ejecución. Sin embargo se consideró adecuado discutir la ponderación sugerida.	4
Variables	En términos generales hubo una coincidencia de las variables utilizadas en el estudio.	✓	Se discutió la pertinencia de las variables.	4

Fuente: AMEC (PERÚ) 2014.

5. Conclusiones

5.1 Conclusiones Generales

- En términos generales, el Workshop fue exitoso porque convocó a stakeholders de diversas plataformas (privadas, públicas y organizaciones no gubernamentales) y logró la deseada interacción entre éstos y el equipo de expertos.
- Permitió observar las diferentes posiciones que adoptan los grupos de interés y el modo de priorizar alternativas de inversión.

  Stakeholders del sector privado priorizaron factores financieros y económicos. El sector de ONGs priorizó los factores sociales y ambientales por sobre el resto. El sector público resaltó la necesidad de fortalecer la gestión a nivel local y regional de los ejecutores de proyectos.

5.2 Conclusiones de la Dinámica de Grupos

A continuación se detallan las principales conclusiones del Workshop:

- En la evaluación de los criterios utilizados, y sus respectivas variables, los tres grupos se concentraron en aspectos vinculados a la implementación y viabilidad de los proyectos priorizados. A pesar de que estos aspectos guardan relación directa con los fines del estudio, no forman parte de los objetivos.
- Una preocupación general es la sostenibilidad del proyecto para evitar, por ejemplo, que a los 3 o 4 años de implementado fracase. Para ello, los stakeholders sugirieron tomar en cuenta lo siguiente:
  - Participación en dos niveles: a) con la población beneficiaria, a fin de recoger percepciones de usos de agua, y b) con autoridades e instituciones presentes, a fin de ganar legitimidad y viabilidad.
  - Revisión de condiciones políticas: fomentar el involucramiento de autoridades locales y/o regionales para procurar no extender los plazos de ejecución de proyectos.
  - Revisión de condiciones legales: considerar el sistema burocrático y legal que podría entorpecer la ejecución de los proyectos, especialmente en los casos que requieran permisos de tierras.
- Los grupos coincidieron en incrementar el peso de los criterios sociales y ambientales.

- Alta preocupación por proyectos que generan impactos positivos en el medio ambiente. Por ejemplo, conservación de la biodiversidad, o la reutilización de aguas residuales. Dichos proyectos forman parte de una corriente diferente de concepción de los recursos hídricos que, de acuerdo a lo discutido en el workshop, todavía no es incorporada en las políticas hídricas en el país. Se trata de una preocupación compartida por el equipo de expertos del estudio; sin embargo corresponde a estudios diferentes al abordado.

Annex A: Workshop Agenda

Agenda

10:30	Bienvenidos + Introducciones
10:45	Presentación de 2030 Water Resources Group – Sr. Anders Berntell, Director Ejecutivo
11:00	Presentación del Objetivo y los Resultados del Proyecto:
	Objetivos del Proyecto
	Listado de proyectos de inversión
	Mapeo de los grupos de interés – Resultados de entrevistas
	Desarrollo y Aplicación del Modelo Hidroeconómico
	Political, Environmental, and Social Impact Assessment (PESIA)
	Resultados integrados de Hidroeconomico – PESIA Analisis
11:45	Conversacion sobre temas sociales y institucionales
12:00	Almuerzo de "networking"
12:45	Dinámica de grupos con los participantes
1:30	Presentaciones del dinámicas de grupos
2:15	Resultados finales y próximos pasos
2:30	Cierre

Annex B: Used Criteria

Criterios Sociales	Aumentan o disminuyen los conflictos sociales		
	Permite el acceso a recursos hídricos		
	Mejora la salud de la población		
	Estimula la equidad social		
	Reduce exposición a desastres naturales		
	Afecta o apoya a la estructura organizacional		
Criterios financieros	Coste anual equivalente		
	Eficacia técnica de las medidas (hm³)		
Criterios económicos	Beneficios directos	Mejora de la productividad	
		Reducción de riesgos sobre la salud	
		Reducción del riesgo de desastre	
		Resiliencia frente a la escasez	
		Costes evitados para satisfacer la demanda de agua	
	Beneficios indirectos	Generación de empleo	
		Inversión inducida.	
		Impactos sobre el PIB	
Criterios Ambientales	Positivos	Costes ambientales evitados (Cantidad)	
		Costes ambientales evitados (Calidad)	
		Mejoras hidromorfológicas	
		Mejora del nivel de biodiversidad	
	Negativos	Aumento de la escasez de agua y el riesgo de sequía	
		Vertido de aguas residuales	
		Cambios adversos desde un punto de vista hidromorfológico	
		Daños asociados a la contaminación atmosférica	

Annex C: Weighting of used criteria

Social Criteria	**¿0.25?**	
Financial Criteria	**¿0.35?**	
Economic Criteria	**¿0.20?**	
Environmental Criteria	**¿0.20?**	