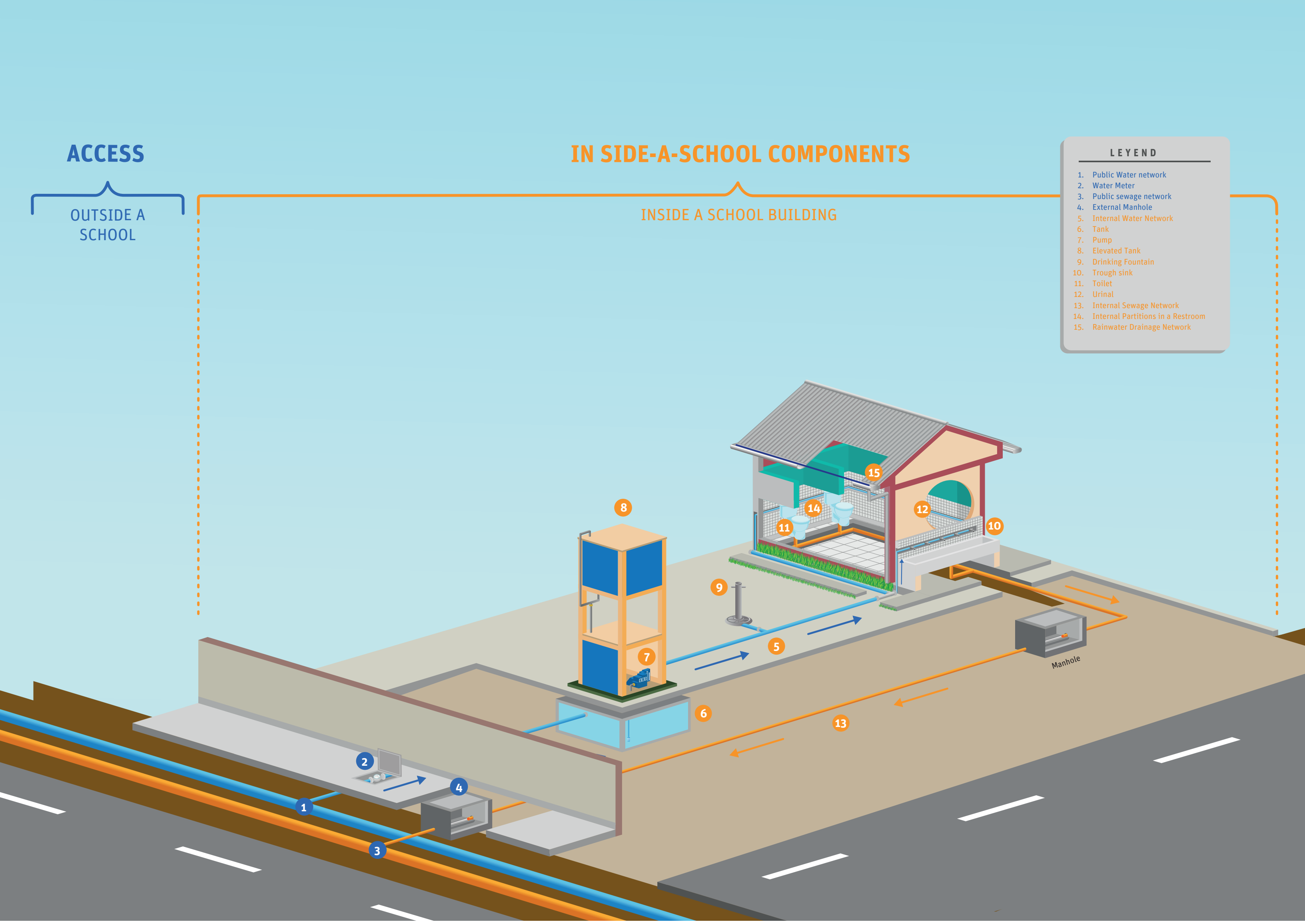


Technical Note 1

Identification of Investment Needs in School Water and Sanitation Infrastructure in Peru

BANCO MUNDIAL
BIRF • AIF | GRUPO BANCO MUNDIAL

GFDRR
Global Facility for Disaster Reduction and Recovery

1818 H St. NW
Washington DC, 20433 EE.UU.
Phone: 202-473-1000
Web site: www.worldbank.org

Graphic and design: Claudia Rospigliosi

INTRODUCTION

Universal access to safe water for all,[1] as well as equal access to suitable sanitation and hygiene services for all, with a special focus on women, girls, and people living in vulnerable conditions, are expected to be achieved by 2030. For the purposes of meeting this huge challenge, a comprehensive approach that allows designing and executing suitable investments in ecosystem protection and recovery, sanitary installations, and hygiene practices, is necessary at all levels.

Results from the School Infrastructure Census (2013 CIE) show that most school buildings, mainly in rural areas, lack the basic conditions, in terms of seismic vulnerability, corrective maintenance, furniture, equipment, and physical – legal registration, as well as access to quality water, sanitation, electricity, telecommunications services, and accessibility for the population with disabilities.

With assistance from the World Bank, the Ministry of Education of Peru (MINEDU) takes on the challenge and formulates the National School Infrastructure Plan (PNIE) as of 2025. As part of the General Education Law[2] and the National Education Project (PEN),[3] PNIE offers, for the first time ever in the national context, a proposal to plan school infrastructure in the long term under a comprehensive focus that aims at overcoming the current challenges of improving, rehabilitating, and managing the existing infrastructure, as well as to plan the new offer. PNIE is supported by a set of technical supporting papers that were prepared based on the 2013 CIE, one of them being the estimation of the water and sanitation gap for schools.

This technical note has been prepared by the World Bank's Water and Sanitation Program as part of the technical assistance Peru School Infrastructure Program (P152216). This work was led by Malva Baskovich, water supply and sanitation specialist, supported by a consultant team integrated by Doris Alfaro, Cecilia Montes Jave, Mercy Sandoval, Abel Bellido and Andres Quispe.

1. Universal access to water and sanitation is one of the 17 Global Goals in the new Agenda for Sustainable Development as of 2030 (SDG) that was established at the Sustainable Development Summit.
2. Law No. 28044, approved on July 17th, 2003 and published in El Peruano National Gazette on July 29th, 2003, and its Regulation that was approved by Supreme Decree No. 011-2012-ED and published on July 7th, 2012, hereinafter, the Regulation.
3. Under the leadership of the National Education Council, the PEN was formulated by Law (LGE, art. 80) that was approved in 2005, and declared a State Policy in 2007 by Supreme Order No 001-2007-ED.

TABLE OF CONTENTS

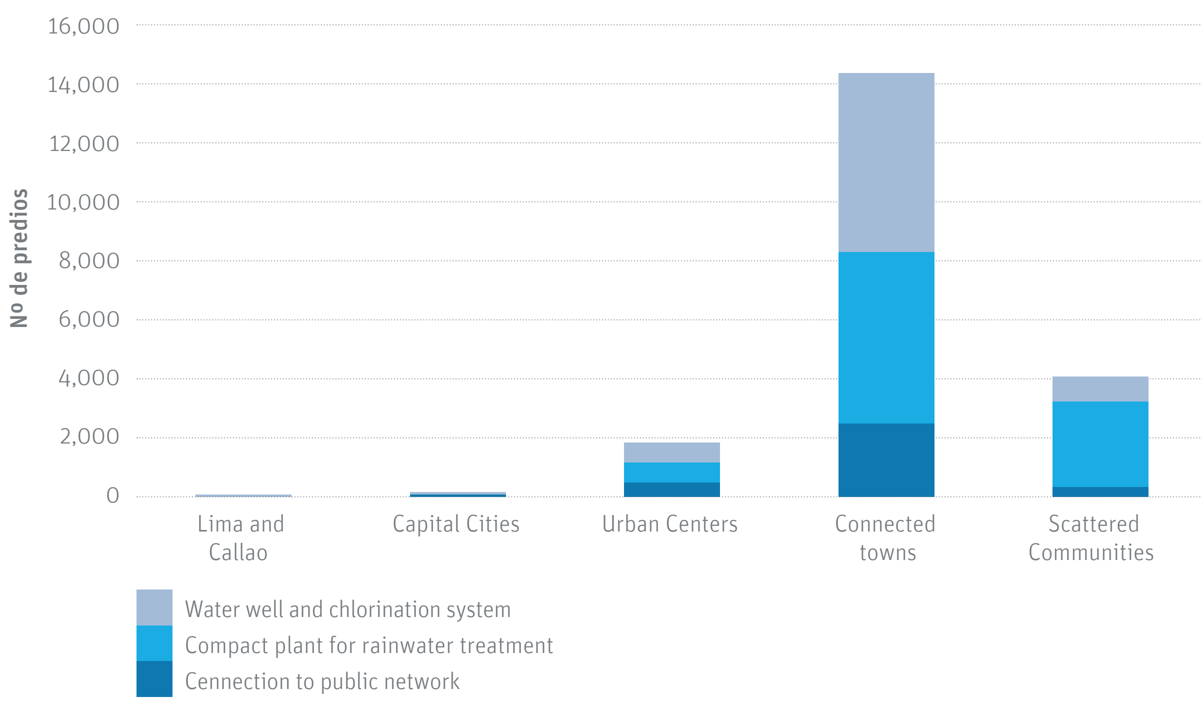
PURPOSE OF THE NOTE

This Technical Note summarizes the process that has been carried out to estimate the school water and sanitation gap in Peru. From an integrating view of the system, the process was organized in four phases, and was based on the statistical, legal, engineering, and cost analysis results.

The four phases in this process included: (i) defining indicators, (ii) defining legal standards, (iii) identifying the intervention needs, and (iv) estimating the water and sanitation gap for schools. This paper describes the main developed activities, offers details on the tools that were used, and offers a set of recommendations to guide the design and execution of similar projects in other countries.

According to the 2014 CIE, out of a total of 40,100 school grounds existing in the country, 20,699 of them require some type of intervention to assure access to water service. The connected towns pose the greatest intervention needs, as they account for 70 % of such requirement.

Graph 1. Number of School Grounds in Need of Intervention to have Water Access



This document constitutes an opportunity for knowledge generation, in terms of the best integration of water, sanitation, and hygiene with the national educational policy, in such a way that access to suitable and quality services by schools is increased, and its subsequent positive impacts on children's health and cognitive and social development are generated.

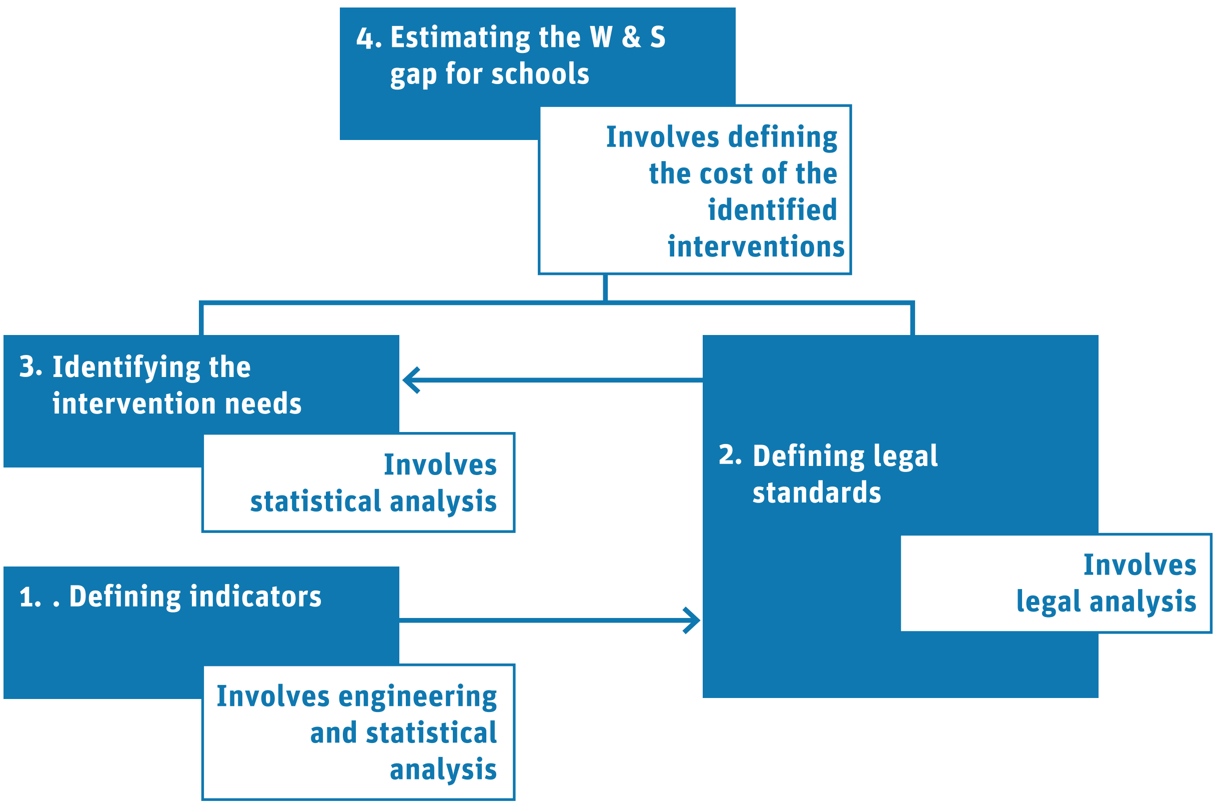
PHASES OF THE PROCESS

The four phases were:

1. Defining indicators
2. Defining legal standards
3. Identifying the intervention needs
4. Estimating the water and sanitation gap for schools.

The first three phases give each other feedback on a permanent basis; in this way, they support the fourth phase and estimate the water and sanitation gap for schools.

Graph 2. **Connection Between the Process Components for the School Water and Sanitation Gap Analysis**



Phase 1: Defining Indicators

This phase allowed to delimit the water and sanitation water service that is provided in schools, and its milestone was to determine the Comprehensive School Water and Sanitation System (SIASE.)

A school's water and sanitation system was first analyzed, both inside and outside the school grounds. The prioritized spaces inside a school were the school restrooms; their existence, non- existence, or conditions allow to define if the students have the necessary number of them. This analysis identified 15 SIASE components that were organized in five indicators, one of them outside the school grounds, and four, inside the school grounds: the first indicator describes the access; the second indicator involves the **water storage and pumping system**; the third indicator corresponds to the **suitability** of the restrooms; the fourth indicator is linked to the existence or non- existence of **water drinking fountains,** and finally, the fifth indicator involves the **rainwater drainage network.**

Each indicator's definition was prepared, for the purposes of assuring a uniform conceptual and operative management. The table below shows the relationship between the indicators, their components, and definition.

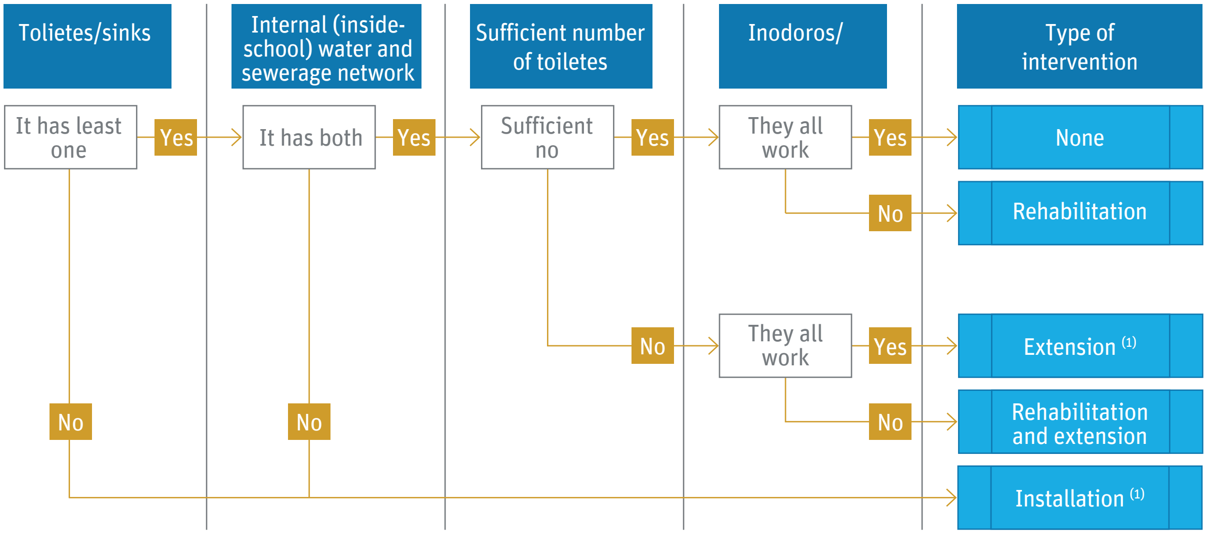
Table 1. SIASE Indicators and Components

No.	Indicator	Components	Definition
01	Access to water and sanitation	Water: 1. Water supply 2. Water meter.	It involves the probable situation of a school having or not public water and sewerage networks in its surroundings, and thus, having the option to get connected to networks, or alternatively, require other in situ water and sanitation access modalities.
		Sewage: 3. Excreta and wastewater disposal 4. External manhole	
02	Storage and pumping system	5. Tank 6. Pump 7. Elevated tank.	It involves the need and the presence or not of a water storage system in the school building, for the purposes to assure sufficient water volume availability during a school day, by means of three components.
03	Suitability of the Restrooms	8. Internal (inside school) water network 9. Internal (inside school) sewage network 10. Trough sink 11. Toilet 12. Urinal 13. Internal restroom partitions	It refers to schools requiring complete sets of sanitation fixtures with their corresponding networks and water and sanitation service.
04	Water drinking fountains	14. Drinking fountain	It is proposed as a new requirement to be installed in the schools that corresponds to a potential demand for an individual Drinking fountain service that supplies water for direct human consumption.
05	Rainwater drainage network	15. Rainwater drainage network	It corresponds to the requirement to supply a basic rainwater drainage system for all the school buildings at a school; such system is basically made up of chutes and downspouts.

The steps taken to build up these indicators included: (i) defining the decision- making rules by means of flowcharts, (ii) organizing the assumptions for each indicator's components, and (iii) preparing the algorithms methodological paperwork for indicator estimations.

Flowcharts for each indicator helped establishing the required intervention type. As an example, the graph below shows the flowchart for the restroom suitability indicator.

Graph 3. **Decision- making Rules to determine the Intervention Types, based on the Restroom Suitability Indicator**



(1) It includes the following components: Toiletes, Urinals, Internal (inside-school) Water Network, Internal (inside-school) Sewage Network, Internal partitions between Toilets.

The required intervention types to assure that a school building meets all five SIASE indicators were established. The table below shows the proposed interventions to meet the access indicator, and Annex 1 describes all remaining four indicators.

Table 2. **Interventions for Access Indicator**

Indicator	Interventions
Access to Water and Sanitation	Interventions for the Water Supply System • Connection from the school building grounds to the public potable water network is required as an intervention. This intervention also includes the water meter component. • Rainwater should be used and a compact water treatment plant should be installed. This system is installed at those schools located in the jungle area and in communities that lack a potable water supply utility. • Construction of a water well and a chlorination system. This system is proposed for those schools located in the Coast and the Andes Mountains and in communities that lack that lack a potable water supply utility. Interventions for the Sanitation System • Connection from the school building grounds to the public sewerage network, whenever the school building is located in a community with a public sewerage network. • In situ excreta and wastewater disposal and treatment system. This intervention is taken into account whenever the school building is located in climatic zones that are not floodplains and its community lacks the utility. • No defined intervention. This group of schools demands an in situ sanitation system but such schools are located in a floodplain zone; therefore, an intervention shall be evaluated for each case.

This first phase offered a series of recommendations to CIE:

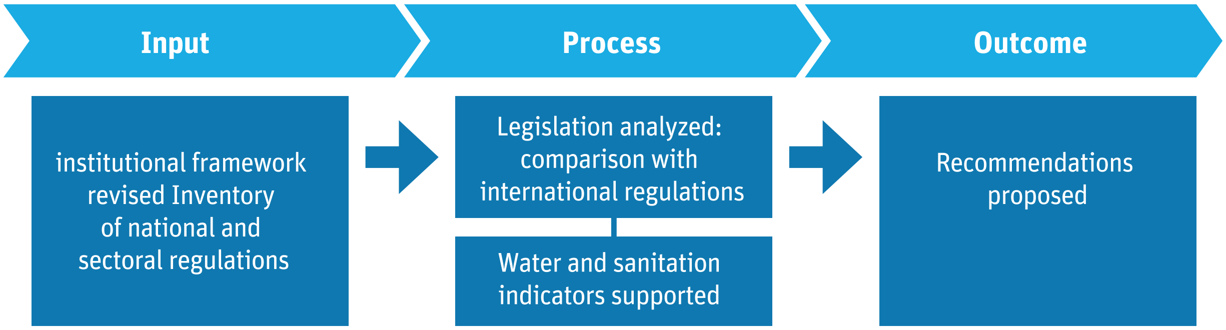
- Information gathering for all 15 SIASE components should be assured.
- Questions should be encouraged to address not only those aspects involving availability, but also those involving operativity and maintenance status, for the purposes of measuring the service quality.
- Information should be gathered on the sanitation fixtures, and their use should be differentiated upon the basis of gender and educational level, as the demand for use and the availability of these fixtures, are directly related to both aspects.
- CIE's focus on gathering information on the internal (inside school) water and sewage network and the availability of both services at local level, and how the internal (inside school) network is connected to the external (outside school) network should be kept. This is a critical point, as there is a significant number of schools that are not connected to the public network, although they have an internal (inside school) water or sewage network.

Phase 2: Defining Legal Standards

This phase was decisive to guide the identification of school water and sanitation intervention needs, based on the analysis of the existing sectoral and national policies and standards Its milestone was estimating the needs to update the national legislation with regard to the Latin American standards.

The route for this phase was based on three aspects: input, process, and outcome. The input was focused on revising the institutional framework and preparing an inventory of the national and sectoral regulations; the process analyzed the legislation and compared it with international regulations, and the indicators were supported in the paper on gaps; finally, the outcome provided legal and intersectoral interaction recommendations.

Graph 4. **Legislation Analysis Route**



The legislation framework analysis,[4] with regard to water and sanitation at schools brought to light the very scattered existence of budget and sectoral laws issued by the Ministry of Education (MINEDU) and other sectoral bodies, such as the Ministry of Housing, Construction, and Sanitation (MVCS) and the Ministry of the Environment (MINAM.)

4. National policies on behalf of school sanitation infrastructure, aiming at providing a suitable learning environment.

The alignment between CIE's school water and sanitation components and the regulations in force showed that 8 out of all 15 components have not been taken into account in the CIE; this motivated a search for supplementary information on the technical rules and papers.

Table 3. Alignment of the SIASE Components with CIE and the Regulations in Force

No.	SIASE Components	Information provided by CIE	Legislation Analysis	Sectors issuing Regulations		
				MINEDU	MVCS	MINAM
1	Water supply	Service available in the area	Sufficiently regulated and documented in CIE.	■	■	
2	Water supply	Not available	Not available in CIE. Sufficiently regulated and described with technical specifications.		■	■
3	Excreta and wastewater disposal	This area has sewerage service	Sufficiently regulated and documented in CIE.	■	■	
4	External manhole	Not available	Sufficiently regulated.		■	
5	Tank	No. of tanks and/ or elevated tanks	Sufficiently regulated. CIE gathers information about their existence, but fails to describe their characteristics and whether they are operative or not.	■	■	
6	Pump	Not available	Sufficiently regulated. CIE fails to gather this information, despite the fact that the presence and operativity of pumps guarantee the service.		■	
7	Elevated tank	Maintenance status of walls and slabs. No. of tanks and/ or elevated tanks	Partially regulated. CIE gathers information on availability, partial information on the maintenance status, but no information on storage capacity.		■	
8	Internal (inside school) water network	If this network is available or not	Partially regulated (pipes are not taken into account) and documented in CIE.	■	■	
9	Internal (inside school) sewage network	If this network is available or not	Sufficiently regulated and documented in CIE but no information is provided on presence of internal manholes.	■	■	
10	Trough/ Sink/ Handwashing basin	Cannot be used	Sufficiently regulated. CIE brings together in one single group all sinks (that may include more than one faucet) and sinks (that have no more than one faucet.)	■	■	
11	Toilet	Total sanitation fixtures, type	Not sufficiently regulated, in terms of a differentiated demand per educational level and gender. CIE brings together all toilets for students, teachers, and staff in one single group.	■	■	
12	Urinal	Not available	Not sufficiently regulated, in terms of operativity.	■	■	
13	Internal restroom partitions	Not available	Not regulated and not present in CIE.			
14	Drinking fountain	Not available	Not regulated and not present in CIE. Drinking fountains should be taken into account every time they are associated to the use of filters or any other devices or mechanisms that guarantee safe water consumption.			
15	Rainwater drainage network	Not available	Not regulated and not present in CIE.			

Legislation was thoroughly revised, upon the basis of each one of the questions in CIE, for the purposes of identifying the existence or non- existence of any national or sectoral regulations. Annex 2 shows an example of an analysis of the regulations, upon the basis of the CIE questions.

When analyzing the international regulations, two studies that evaluate the regulations on infrastructure at Latin American level in the last few years were taken into account;[5,6] likewise, regulations were successfully directly revised and evaluated. The first study offers a comparative analysis of the legislation and infrastructure in Mexico, Chile, Colombia, and Brasil, with regard to Peru, although Peru is not included as one of the analyzed countries in such study. The IDB study[7] explores the infrastructure conditions in the basic education schools around the region, by using the SERCE database, and analyzes the connections between the school infrastructure conditions and the school performance in grammar and mathematics tests of third and sixth grade students.

The main findings include: (i) the development of certification systems for school infrastructure, issued by infrastructure- specialized institutions, (ii) the progress made in the decentralized infrastructure policy and management by Mexico and Colombia, (iii) the connection between the design and construction processes of public buildings, such as schools, and land use (spatial) planning processes that has been developed in Colombia, and (iv) the decision- making based on evidence research studies.

The legislation analysis of different countries generated a matrix on the supply of toilets, urinals, sinks, drinking fountains, and water availability that will provide guidance to PNIE. Annex 3 shows the minimum requirements, in terms of sanitation fixtures, per country.

As a result of this second phase, the following recommendations were made:

- The role played by various stakeholders in water and sanitation infrastructure planning and design should be identified and defined, and direct interaction between MINEDU and MVCS, the Regional and Local Governments should be strengthened.
- Aspects, such as operativity, maintenance, and design of all of SIASE's 15 components should be standardized.
- A research component for decision- making, from evidence, that measures the investment's impact on infrastructure and learning accomplishments should be structured.
- The public investment system should be strengthened so that the locally managed infrastructure investment projects respond to the existing legislation and the previously defined quality standards.

5. Estudio de infraestructura educativa en Latinoamérica. Planes, programas y normas en Chile, México, Colombia Y Brasil. Oscar Malaspina. Banco Mundial y Ministerio de Educación de Perú, 2014. (Study on School Infrastructure in Latin America. Plans, Programs, and Regulations in Chile, Mexico, Colombia, and Brazil. Oscar Malaspina. World Bank and Ministry of Education of Peru, 2014.)
6 Estudio de infraestructura educativa en Latinoamérica. Planes, programas y normas en Chile, México, Colombia Y Brasil. Oscar Malaspina. Banco Mundial y Ministerio de Educación de Perú, 2014. (Study on School Infrastructure in Latin America. Plans, Programs, and Regulations in Chile, Mexico, Colombia, and Brazil. Oscar Malaspina. World Bank and Ministry of Education of Peru, 2014.)
7 Ditto.

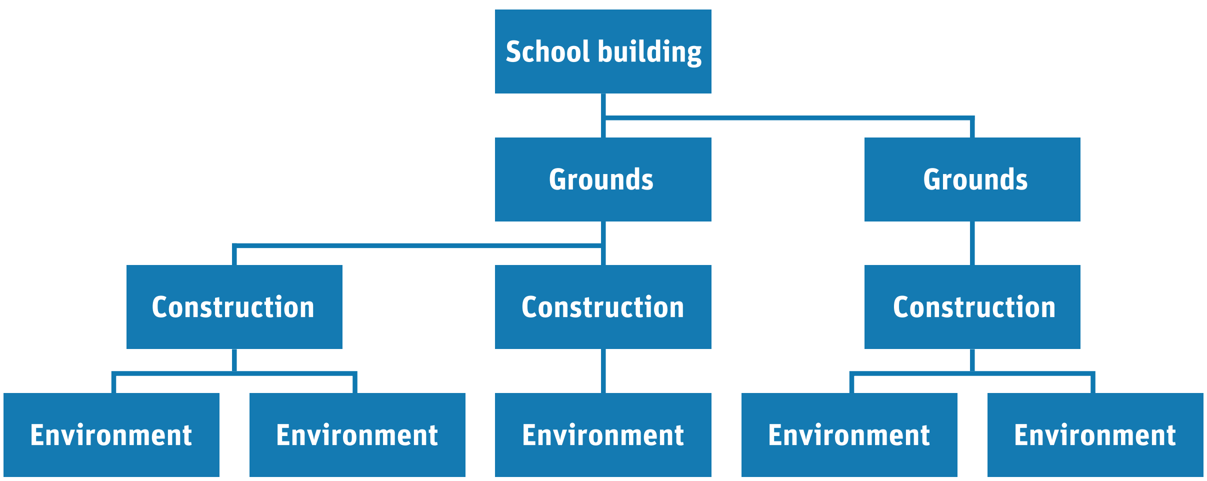
Phase 3: Identifying the Intervention Needs

Identifying or quantifying school water and sanitation service access and quality demand reached the milestone of showing the magnitude of the intervention needs.

Analysis criteria in this phase included:

- Each school's assessment includes the status of each one of SIASE's 15 components.
- Each component's analysis starts with the minimum unit that is reported in the CIE, and it is then consolidated at school level. The analysis units can be any of four types: (i) environment, (ii) construction, (iii) grounds, and (iv) school building, as shown in Graph 5.
- Methodology for each one of SIASE's 15 components describes (i) the basic assessment unit, (ii) identified questions and information sources, (iii) decision- making rules, (iv) operative definitions for the decision- making rules, (v) the algorithm to identify the intervention type per school, (vi) elements that need to be taken into account to estimate the gap, and (vii) the component assumptions that were made, given the lack of information.

Graph 5. Relation between the Analysis Units

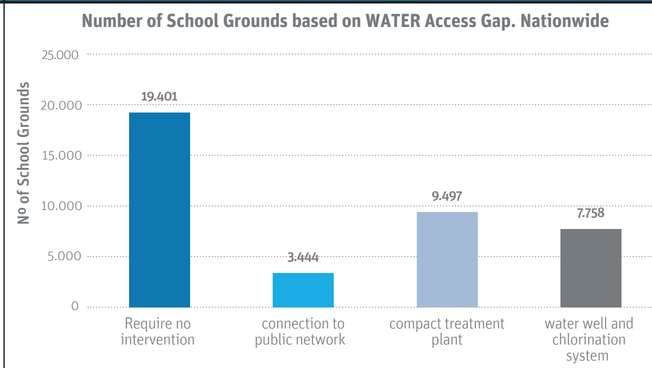
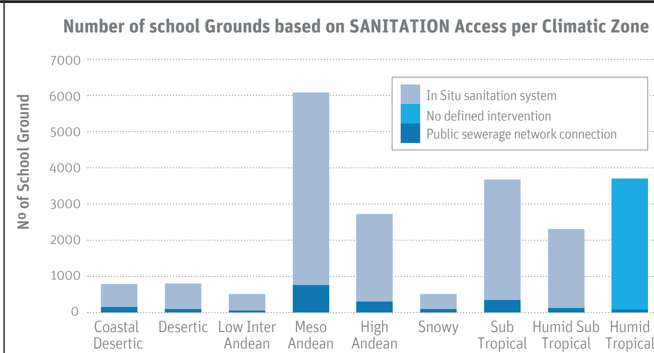
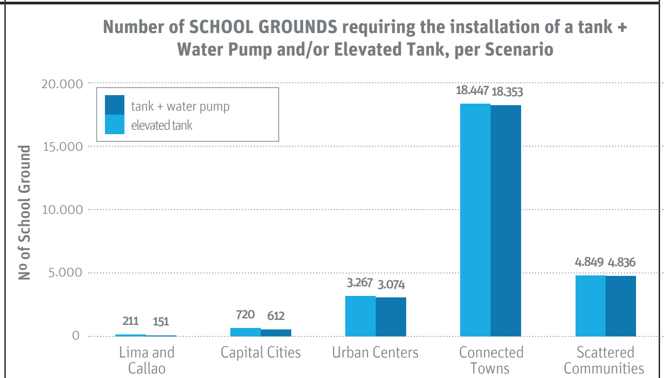
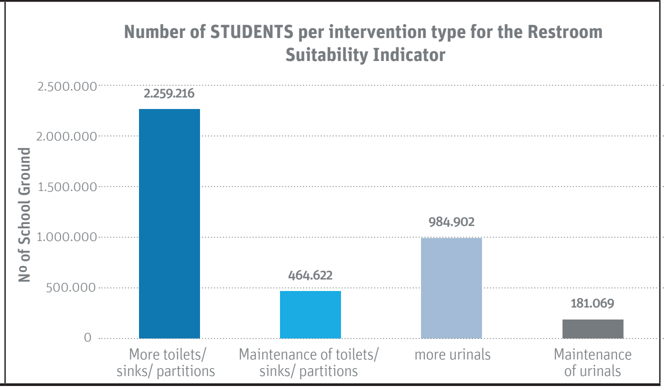


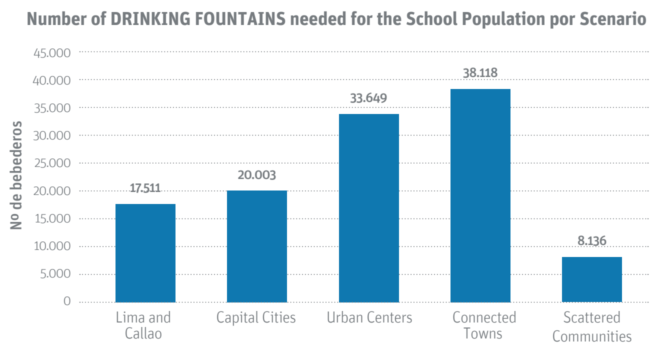
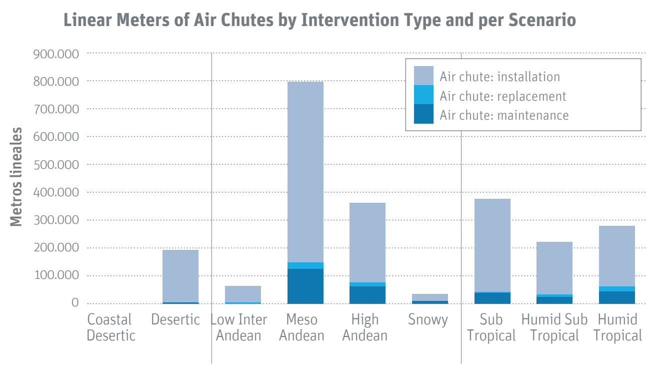
For the purposes of quantifying the interventions for each one of all of SIASE's five indicators, a measurement unit was agreed with the MINEDU technical team. Annex 4 shows a table with the measurement units per intervention component.

The statistical analysis of the information defined the intervention needs for each one of SIASE's 15 components per scenario and climatic zone.[8] Table 4 shows the results of the indicators per required intervention type, based on some examples per scenario and climatic zone.

8 In coordination with MINEDU, the criteria for data grouping that could help to estimate different magnitudes of needs were defined. For example, the grouping per scenario (Lima and Callao, capital cities, urban centers, connected towns, and scattered communities), as well as the grouping per climatic zones (coastal desert, desert, low inter Andean, meso-Andean, high Andean, snowy, sub- tropical, humid sub- tropical, and humid tropical) were used. For the purposes of estimating the gap, an analysis per department (the country's political division) was also included.

Table 4. Results of the Intervention Needs per SIASE Indicator

<table>
<tr><th>Indicator</th><th>Results based on Intervention Type</th><th>Results based on Scenarios and Climatic Zones</th></tr>
<tr><td rowspan="2">Access</td><td>Number of school grounds based on the required intervention type to have access to WATER
19,401 require no intervention
3,444 connection to public network
9,497 compact treatment plant
7,758 water well and chlorination system</td><td>
</td></tr>
<tr><td>Number of school grounds based on the required intervention type to have access to SANITATION
18,893 require no intervention
2,095 connected to public sewerage network
3,605 have no defined intervention
15,507 insitu sanitation system</td><td>
</td></tr>
<tr><td>Water Storage and Pumping System</td><td>Number of school grounds based on the required intervention type to have a water storage and pumping system available
12,208 require no intervention
27,494 tank and water pump
27,026 elevated tank
In elevated tanks:
1,290 mild rehabilitation
725 moderate rehabilitation
129 replacement</td><td>
</td></tr>
<tr><td>Suitability of the school restrooms</td><td>Number of school students based on the required intervention type to improve the suitability of the school restroom
2,259,216 more toilets/ sinks/ partitions
464,622 toilet/ sink/ partition maintenance
984,902 more urinals
181,069 urinal maintenance</td><td>
</td></tr>
</table>

<table>
<tr><th>Indicator</th><th>Results based on Intervention Type</th><th>Results based on Scenarios and Climatic Zones</th></tr>
<tr><td>Drinking fountains</td><td>Number of drinking fountains required to serve the school population
• 117,417</td><td>
</td></tr>
<tr><td>Rainwater drainage network</td><td>Linear meters of air chutes based on the required intervention type and scenario
• 317,985 air chute maintenance
• 78,162 air chute replacement
• 1,949,042 air chute installation
Linear meters of Downspouts based on the required intervention type and climatic zone
• 101,394 downspout maintenance
• 21,386 downspout replacement
• 706,927 downspout installation</td><td>
</td></tr>
</table>

This third phase generated the following recommendations:

- CIE should gather information on the total number of sanitation fixtures (sinks, toilets) that allows differentiating the use of these fixtures, based on gender and educational level, as these conditions determine the demand for their use and availability.
- Information on the number of toilets for students, teachers, and staff should be differentiated, for the purposes of distinguishing their use, and prevent underestimating any unmet demands.
- Information on the number of faucets in the sinks should be gathered, for the purposes of establishing if the number of available faucets is sufficient to meet the demand.

Phase 4: Estimating the Water and Sanitation Gap

Based on the defined intervention needs and the legislation analysis, the cost units for the SIASE components were defined, as follows: (i) cost unit for the Access indicator was Peruvian Nuevos Soles per grounds, (ii) cost unit for the storage and pumping system was Peruvian Nuevos Soles per m3 and cost unit for the water pumping equipment was Peruvian Nuevos Soles per grounds, (iii) cost unit for the Suitability indicator was Peruvian Nuevos Soles per student, (iv) cost unit for the Drinking fountains indicator was Peruvian Nuevos Soles per unit, whereas (v) cost unit for the rainwater drainage was Peruvian Nuevos Soles per linear meter.

Consultation to multiple sources included NGO and public entity projects, for the purposes of revising and contrasting referential unit cost information on water and sanitation, as well as school infrastructure.

For cost estimation, descriptive reports and a sample of approved detailed design studies provided by the DIGEDIE (the General Directorate of School Development) were reviewed, with an emphasis on restroom specialty. Supplementary, profiles and projects under execution in the National Investment System were reviewed, for the purposes of defining referential added costs to cost estimation that support or refine the preliminary findings in the studies.[9]

A set of cost coefficients were calculated for some interventions: for replacement (an additional 10 %), for elevated tank moderate (30 %) and mild (20 %) rehabilitation costs; for sanitation fixture maintenance costs (30 %); for chute maintenance costs (30 %), and for rainwater drainage network downspout maintenance costs (30 %.)

The SIASE costs were combined with costs from other specialties, such as structures (dirt moving, as- built, ditch digging, etc.), architecture (design, houses, doors, windows, paint, etc.), and electrical installations (grids, control panels, wiring, etc.) Unit cost database from MINEDU's executing agency was used. This generated a cost increase, given the high effect of the structure costs (between 30 % and 90 % in some cases.)

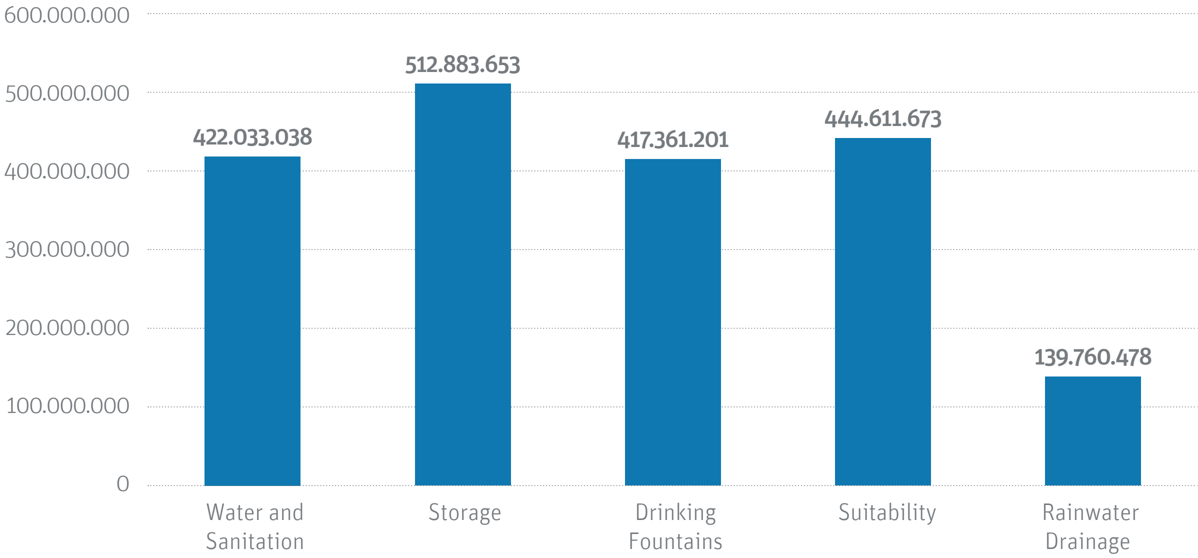
Transportation costs (placed- at- worksite costs) were included. Annex 5 shows the cost methodology per indicators and components.

The statistical analysis of the unit cost matrix and the investment need database per indicator provided the following information:

- Total investment required to close the current school water and maintenance infrastructure gap is PEN 1.936 billion, with the departments of Lima, Cajamarca, Piura, Junin, Hunacavelica, Cusco, Huanuco, and Puno being a priority, as they require 50 % of the investment.
- PEN 1.173 billion (61 %) should be invested to close the water and sanitation infrastructure gap in the rural area.
- The evaluation per indicator points out the following:
  - Closing the school water and sanitation access gap requires an investment of PEN 422 million; this represents 22 % of the total investment.
  - Closing the school water storage and pumping system gap requires an investment of PEN 512 million; this represents 26 % of the total investment.
  - Closing the school restroom suitability gap requires an investment of PEN 444 million; this represents 23 % of the total investment.
  - Closing the school water drinking fountain gap requires an investment of PEN 417 million; this represents 22 % of the total investment.
  - Closing the rainwater drainage network gap requires an investment of PEN 139 million; this represents 7 % of the total investment.

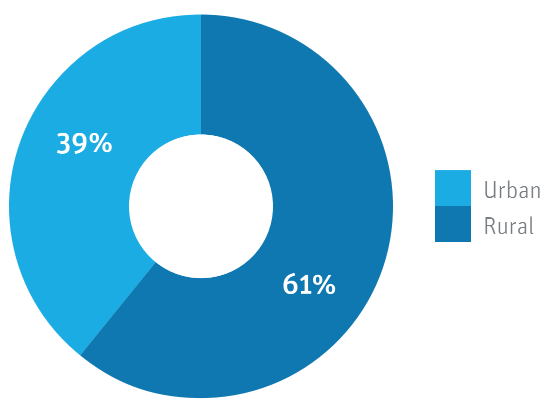
9 A relevant piece of information is that in both cases, the proportion of land set apart for restrooms ranges between 3 % and 8 % of the project total cost, with this percentage being the highest when a tank and an elevated tank are included.

Graph 6. **Investment per Indicator (in peruvian soles)**



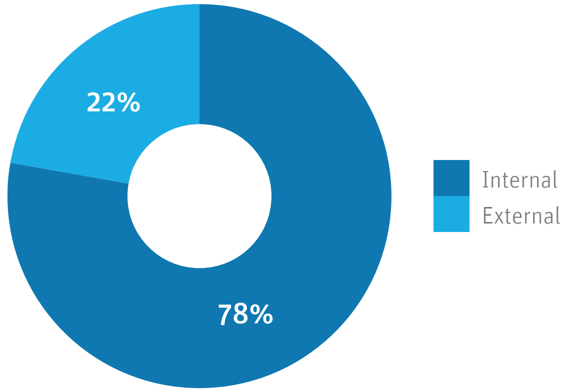
- A larger investment was identified to be required in the rural area of around PEN 1.173 billion, against the PEN 763 million required for the urban area.

Graph 7. **Investment Cost Percentages for Urban and Rural Areas**



- It was also found that a larger investment is channeled towards the school infrastructure internal components that are the Education sector's responsibility, whereas a smaller investment is devoted to the external components that are focused on water and sewerage access and are the Ministry of Housing, Construction, and Sanitation's responsibility.

Graph 8. Investment in the External and Internal components



As a result of having carried out this phase, the following recommendations were generated:

- With regard to the cost structure, the preparation of a Referential Database of School Infrastructure Construction Unit Costs (structure, architecture, restrooms, and electrical installations) requires to be promoted by the PRONIED (the National School Infrastructure Program) cost area; such unit costs should be officially approved and regularly updated on an annual basis, and their use should be mandatory, for the purposes of formulating investment projects. This concerns not only the Education sector but other sectors as well, such as the Ministry of Housing, Construction, and Sanitation.
- The cost estimation methodology for the sanitary components needs to be improved and extended on an ongoing basis, by compiling more information, in terms of quantity, quality, and diversity, from various public and private sources.

CONCLUSIONS

The process carried out to estimate the water and sanitation infrastructure gap has allowed to draw some conclusions about the view on school infrastructure, the school infrastructure census, and the intersectoral and multi- sectoral interaction:

- **The school infrastructure and carrying out the interventions:** (i) The school water and sanitation infrastructure and its sustainability involves its construction, operation, and maintenance by the service personnel, teachers, and students, as well as the hygiene measures adopted by the users. In this sense, the school syllabus and management are required to have programs included in them that promote behavioral hygiene changes and capacity building for the service's operation and maintenance; (ii) the legislation framework should be supplemented with guidelines that include the design, operation, and maintenance of the school infrastructure's external and internal components, for the purposes of assuring a sustainable quality service; (iii) awareness raising and promotion processes with the regional governments need to be established in the country for the school infrastructure to cause an impact on the learning and development processes at local level.
- **The school infrastructure census:** (i) CIE has taken a great first step towards establishing a view on school infrastructure in the country; however, for the purposes of gathering accurate information on SIASE, a census sheet should include all 15 proposed components organized under the five indicators, (ii) operativity and maintenance status that allow to establish the service quality or define maintenance requirements should be incorporated, and (iii) CIE should gather information on SIASE's operation and maintenance capacities from the service personnel, for the purposes of establishing the capacity gap, and establish capacity building strengthening actions.
- **The intersectoral and multi- sectoral interaction:** Although there are coordination levels between MINEDU and MVCS, mechanisms need to be institutionalized that favor progress towards (i) sharing information on the infrastructure gaps and unanimous decision- making, (ii) promoting the involvement of the private sector and the civil society in funding and implementing infrastructure, its management and maintenance, (iii) identifying common mechanisms and strategies and prioritized scopes for the enforcement of regulations, and (iv) coordinating the investment priorities with the sub- national authorities and their investment plans by 2025.

REFERENCES

- Agua: Panorama General. Banco Mundial. (Water: World Overview. World Bank) http://www.bancomundial.org/es/topic/water/overview
- Agua, saneamiento e higiene. UNICEF. (Water, Sanitation, and Hygiene) http://www.unicef.org/spanish/wash/index_schools.html
- Agua y saneamiento: Evidencias para políticas públicas con enfoque en derechos humanos y resultados en salud pública. Organización Panamericana de la Salud, Oficina Sanitaria Panamericana, Oficina Regional para las Américas de la Organización Mundial de la Salud. EUA. 2011. (Water and Sanitation: Evidence for Public Policies with a Focus on Human Rights and Results on Public Health. Pan American Health Organization, Pan American Sanitary Office, Regional Office for the Americas - World Health Organization.)
- Alianza por la salud alimentaria. (Alliance for Food Health) http://alianzasalud.org.mx/acceso-a-agua-potable/#sthash.1Gyeanor.dpuf
- CONPES 3831. Declaración de Importancia Estratégica del Plan Nacional de Infraestructura Educativa para la Implementación de la Jornada Única Escolar, Bogotá, Colombia. Junio 2015. (Declaration of the Strategic Significance of the National School Infrastructure Plan for the Implementation of a Single School Day, Bogota, Colombia. June 2015.)
- Koopman. J. Diarrhea and School Toilet Hygiene in Cali, Colombia. 1978
- Lucinda Mileham. Seguridad hídrica y cambio climático: hechos y cifras. 2010. (Water Safety and Climate Change: Facts and Figures. 2010.) http://www.comda.org.mx/category/agua-y-cambio-climatico/page/2/
- Mantenimiento de instalaciones sanitarias. Guía No. 2 UNESCO, Oficina Regional para América Latina y el Caribe. 1999 (Sanitary Installation Maintenance. Guide No. 2 UNESCO, Regional Office for Latin America and the Caribbean. 1999.)
- Plan Nacional de Inversiones para el sector saneamiento 2014 – 2021, PISSAN, setiembre 2014. Perú. (2014 – 2021 National Investment Plan for the Sanitation Sector, PISSAN, September 2014. Peru.)
- Reglamento Nacional de Edificaciones DS N° 011-2006-VIVIENDA. Perú (National Construction Standards SD No. 011- 2006- VIVIENDA.)
- UNICEF, Agua, Saneamiento e Higiene (WASH) en las Escuelas. 2012. (UNICEF, Water, Sanitation, and Hygiene (WASH) in Schools. 2012.)

ANNEX 1

Table A1. SIASE Indicator Definitions[10]

Indicator	Interventions
Water Storage and Pumping System	At elevated tank level • Elevated tank requires mild rehabilitation • Elevated tank requires moderate rehabilitation • Elevated tank requires replacement At school grounds level • Installation of elevated tank is required • Installation of tank and water pumping pump is required
Suitability of the school restrooms	• Restroom maintenance • Urinal maintenance • Sink faucet maintenance • Toilet installation • Urinal installation • Sink faucet installation
Drinking fountains	• Number of drinking fountains required in each school
Rainwater drainage network	• Maintenance required • Replacement required • Installation required

10. The Access indicator is described in Table 2.

ANNEX 2

Table A2. Analysis of the Regulation, based on each CIE Question

CIE question No.	Question	Regulation	Regulation Details	Scope of the Regulation	Specific targets of the Regulation	Remarks
CVI-SD-P1	THIS BUILDING HAS AN INTERNAL WATER NETWORK Yes ....1 No ....2 go to 2	Legal criteria for the design of regular basic preschool buildings, elementary and high school buildings, and special basic (for children with disabilities) school buildings. August 2006. Ministry of Education, Vice- Ministry of Institutional Management, School Infrastructure Office.	Y. Item III Restrooms: 3.10 Distribution networks • Points out water storage and pumping equipment characteristics Page 77 • 3.11 Hot water network. Points out the characteristics of these insta-llations Page 78 • 3.16 Water for firefighting. Points out the characteris-tics of these systems Page 81	Nationwide	Preschool, elementary and high school, and special basic (for children with disabilities) levels	This variable's analysis depends on other variables. In this sense, the following situations should be taken into account: SITUATION 1: If a school building has a water connection anywhere on the school building grounds. And if the school building lacks an internal water network. Intervention type involves an extension of the connections to provide service elsewhere on the grounds. SITUATION 2: When a school building lacks a water connection on its grounds. And the school building has or lacks an internal water network. Intervention type involves the installation of a potable water network in the school buildings. Solving this situation is a priority, due to its impact on sanitation.

ANNEX 3

Table A3. Sanitation Fixture Ratios per Student per Country

Aparato sanitario	Educational Level	Peru		Chile		Mexico		Colombia		Argentina	
		Men	Women	Men	Women	Men	Women	Pres-chool	Basic regular school	Men	Women
Toilet	Elemen-tary	1 out of every 50 students	1 out of every 30 stu-dents	1 out of every 60 students or a fraction thereof	1 out of every 30 students or a fraction thereof	1 out of every 30 students	1 out of every 20 stu-dents	1 out of every 15 students	1 out of every 15 students	1 out of every 50 students	1 out of every 35 stu-dents
	High	1 out of every 60 students	1 out of every 40 stu-dents	1 out of every 60 students or a fraction thereof	1 out of every 30 students or a fraction thereof	1 out of every 30 students	1 out of every 20 stu-dents	1 out of every 15 students	1 out of every 15 students	1 out of every 50 students	1 out of every 35 stu-dents
Urinal	Elemen-tary	1 out of every 30 students				1 out of every 30 students		1 out of every 75 students		1 out of every 35 students	
	High	1 out of every 40 students				1 out of every 30 students		1 out of every 35 students		1 out of every 35 students	
Sink	Elemen-tary	1 out of every 30 students	1 out of every 30 stu-dents	1 out of every 40 students	1 out of every 40 students	1 out of every 40 students	1 out of every 40 stu-dents	1 out of every 35 students	1 out of every 35 students	1 out of every 35 students	1 out of every 35 stu-dents
	High	1 out of every 40 students	1 out of every 40 stu-dents	1 out of every 40 students	1 out of every 40 students	1 out of every 40 students	1 out of every 40 stu-dents	1 out of every 40 students	1 out of every 40 students	1 out of every 35 students	1 out of every 35 stu-dents
Drinking fountain	Elemen-tary			1 out of every 100 students		1 out of every 40 students	1 out of every 40 stu-dents	1 out of every 150 students	1 out of every 150 students	1 out of every 50 students	1 out of every 50 stu-dents
	High			1 out of every 100 students		1 out of every 40 students	1 out of every 40 stu-dents	1 out of every 150 students	1 out of every 150 students	1 out of every 50 students	1 out of every 50 stu-dents
Water	Elemen-tary	20 Liters/ student/ day.						50 Liters/ student/ day.			
Water	High	25 Liters/ student/ day.									

ANNEX 4

Table A4. **Measurement Units per Intervention Type for the SIASE Indicators**

Indicator	Service Type	Units quantifying each Intervention
Access	Water Supply System	Number of grounds requiring a public water supply network connection[11]
		Number of grounds requiring a compact treatment plant[12]
		Number of grounds requiring a water well and chlorination system
	Sanitation System	Number of grounds requiring a public sewerage network connection public sewerage
		Number of grounds requiring an in situ excreta and wastewater disposal and treatment system
		Number of grounds without a defined intervention
Water Storage and Pumping System	Elevated tank	Number of Elevated tanks requiring mild rehabilitation
		Number of Elevated tanks requiring moderate rehabilitation
		Number of Elevated tanks requiring replacement
	Grounds	Number of grounds requiring tank installation[13]
		Number of grounds requiring elevated tank installation
Suitability of the school restrooms	Toilet, sink, and restroom internal partitions	Number of students requiring component maintenance
		Number of students requiring restroom installation
	Urinals	Number of students requiring urinal maintenance
		Number of students requiring urinal installation.
Drinking fountains	Drinking fountains	Number of drinking fountains required in school buildings[14]
Rainwater drainage network	Air chutes	Linear meters of air chutes requiring maintenance
		Linear meters of air chutes requiring replacement
		Linear meters of air chutes requiring installation
	Rainwater downspouts	Lineal meters of rainwater downspouts requiring maintenance
		Lineal meters of rainwater downspouts requiring replacement

11. Includes a water meter
12. For rainwater use
13. Water pumping pump included.
14. Neither CIE nor CE ask questions about identifying the number of existing Drinking fountains or their characteristics, but the estimation of this component's gap is 100 % at the schools. The information used to estimate the component's gap was the number of students served during the time of greatest demand at a school. This information is registered at CIE. The Mexican standard that establishes 1 Drinking fountain for every 40 students is suggested to be used as a reference.

ANNEX 5

Table A5. Cost Methodology per Indicator and SIASE Component

Indicator / Component	Methodology	Sources
Access		
Connection to Public Water Network	Coupling costs from school building to the public water network, it includes water meter costs. General connection costs for installation are also included.	BD PRONIED, PISSAN
Compact water (rainwater or river) treatment plant	Consultations with private suppliers. Average production estimation was 10,000 liters. Estimations were made upon the basis of water purification containers and micro filters, and its average cost was PEN 1,500, no VAT (IGV) included.	Private suppliers[15]
Water well and chlorination system	The well was estimated under the concept of a artesian well, based on PRONIED data. The chlorination system was estimated based on drip chlorination system information from the rural water GIZ/ Proagua projects.	PRONIED and GIZ/ Proagua Projects.
Sewerage network connection	The coupling cost from the school building to the sewerage network is taken into account; it includes the sewerage manhole y and connection cost.	PRONIED and Detailed Design Studies
In Situ System	It involves the installation cost of a Septic Tank (5 m3) and a set of 2 percolation tanks with source at the foundation from PRONIED and the Detailed Design Studies; it includes the installation costs of a complete bathroom (toilet, sink, shower) from WSP's "Mi Baño" ("My Bathroom") Project.	PRONIED, Detailed Design Studies, "Mi Baño" ("My Bathroom") Project
Storage		
Tank	Estimations were made, based on PRONIED's DB and an average 15 m3 tank; it also includes the direct structure costs (concrete construction costs, form and form stripping, and steel) and the indirect costs. Estimations were compared with the average costs in the detailed design studies, with the PRONIED costs being more thorough.	PRONIED- Detailed Design Studies
Water Pump (+ Pump house)	Estimations were made, based on a set of 2 motor- driven pumps, 2.5 hp, plus accessories, as per PRONIED's DB, to be operated alternately. PRONIED includes the costs for a pump house with high structure, architecture, and electrical installation components.	PRONIED and Detailed Design Studies
Elevated Tank	Similarly to the Tank, the Elevated Tank was estimated, based on an average 5 m3 model, according to PRONIED's DB. Reinforced concrete, form and form stripping, steel, and other architecture and sanitary installation costs are included.	PRONIED and Detailed Design Studies
Elevated Tank Replacement	Based on the proportion of demolition costs in the case of some Detailed Design Studies that reached 20 %, in terms of structure. In addition, the replacement cost was estimated as follows: ET Replacement Cost = ET Cost + ET Cost * 0.2.	Detailed Design Studies and PRONIED
Elevated Tank Moderate Rehabilitation	Moderate rehabilitation was estimated, by taking into account the average reinforcement cost in some cases in the Detailed Design Studies, that ranged between 48 % and 68 %. Then, a 60 % average was assumed as complete rehabilitation. Moderate rehabilitation was then estimated as follows: ET Rehab. cost = ET Cost * 0.3	Detailed Design Studies

15. Direct consultation was made to a British supplier, Life Saber Systems Peru, Peru Branch; Mr. Agama Darío, Manager, cell phone No. 997576354.

Indicator / Component	Methodology	Sources
Elevated Tank Mild Rehabilitation	Likewise, mild rehabilitation cost was subsequently estimated as no more than 20 % of the Elevated Tank costs: ET Rehab Cost = ET Cost * 0.2.	Detailed Design Studies
Suitability		
Sanitation fixtures and accessories + Sewage System + Water System. Complete sanitary combo.	Average basic model toilet and sink costs were estimated, based on PRONIED's DB. These costs include partition installations, as their costs have been separately calculated, based on PRONIED's database and other Detailed Design Studies.	PRONIED and Detailed Design Studies
	Installation costs of sewage networks and accessories in the modules were included just as in the external (out of school) works out of the modules, but inside a school. Rainwater drainage system costs were deducted when applicable, as they are separately reported. Total cost was divided by the number of students in a school.	PRONIED and Detailed Design Studies
	All the water networks, both inside and outside the sanitary installations, but inside a school were included. The water storage system was deducted every time it appears under such item. In every case, the water system total cost was divided by the number of students in a school, that is, an average of 732 students.	PRONIED and Detailed Design Studies
Maintenance of Sanitation fixtures + Sewage + Water. (Complete combo)	It was estimated to be 30 % of the sanitation fixture installation costs, plus sewage, plus water (complete sanitary combo.)	PRONIED and Detailed Design Studies
Urinal Installation	It is 100 % of the estimated urinal costs under the sanitation fixture and accessories item, based on PRONIED and the standard school building model with 732 students.	PRONIED and Detailed Design Studies
Urinal Maintenance	It is 30 % of the urinal costs. In this case, preventative maintenance costs include regular everyday cleaning and disinfection activities, etc.	Detailed Design Studies
Drinking Fountains		
Drinking Fountain Installation	This represents the cost of an individual stainless steel drinking fountain that is connected to the water network. Work was carried out by linear meter, as reported by the Detailed Design Studies. Concrete chutes constructed on the ground were not taken into account, as they make it difficult to determine the quantity in meters for each school building.	Private Suppliers[16]
Rainwater Drainage		
Rainwater Chute	These are galvanized iron air chutes. They are estimated by linear meter.	PRONIED and Detailed Design Studies
Downspout	It is the average cost per linear meter of the costs of the installed downspout, as reported by PRONIED and the Detailed Design studies. Costly concrete ground or underground installations are not taken into account.	PRONIED and Detailed Design Studies
Downspout and /or pipe replacement	Overall replacement costs include the component costs plus a 10 % of the component cost for demolition. They are applied in every case involving downspouts and/ or pipes.	Detailed Design Studies
Downspout and/ or pipe rehabilitation	Rehabilitation cost is 30 % of the component cost, upon the basis of the average complete reinforcement cost.	Detailed Design Studies

16. Consultation was made to a supplier on the Internet, Web Todo Agua, for a drinking fountain Model Elkay EZS8 with a water cooler, wall mounted, and 30 liter/ hour flow.

BANCO MUNDIAL
BIRF • AIF | GRUPO BANCO MUNDIAL

GFDRR
Global Facility for Disaster Reduction and Recovery