

Annex C

Unit Development Costs Derivation Methodology

1 Background

Along with the setting of the access targets come the investment requirements needed to realize the proposed plans. For the purposes of the master planning, the Consulting Team has developed unit cost estimates for infrastructure and non-infrastructure investments for the WSS sector.

Cost derivation for the identified water and sanitation projects was derived using the following procedure:

- a) Unit development costs were based on similar components of both ongoing and recently completed WSS project implement, engineered, or subjected to feasibility studies by the firms of the Consulting Team JV (EDCOP, TRACTEBEL and OI DCI);
- b) Implementation and project preparation dates, geographical locations and mode of implementation (PPP, Design-Bid-Build, Design-Build, Turn-key) were considered in order to proper level-off direct and indirect costs;
- c) Project costs were judiciously validated with available development plans and/or engineering drawings and/or technical reports and/or operational data;
- d) Cost components in terms of labor, construction materials, equipment usage, construction methodologies were also taken into account; and
- e) To properly consider dates of implementation and/or project preparation, local and foreign cost elements were also identified. This is to properly infuse escalation and foreign exchange costs in cost items with importation requirements, or those involving foreign technologies.

To raise the level of confidence on the derived cost, these were then compared to prices of completed and current projects with due considerations for the order of magnitude of the total project and the particular work items being referred to. The reference price was adjusted to reflect differing conditions with the reference project which include considerations of differences in the type of terrain, geographical location, local geology and project specifications.

Furthermore, various agencies and organizations (DILG, DPWH, DOH, private service providers) were consulted to gather insights and industry expertise based on current and previous practices and experience in costing out WSS projects.

2 Cost Components

Development cost estimates are mainly classified into two components consisting of direct and indirect costs as graphically shown in Figure 1.

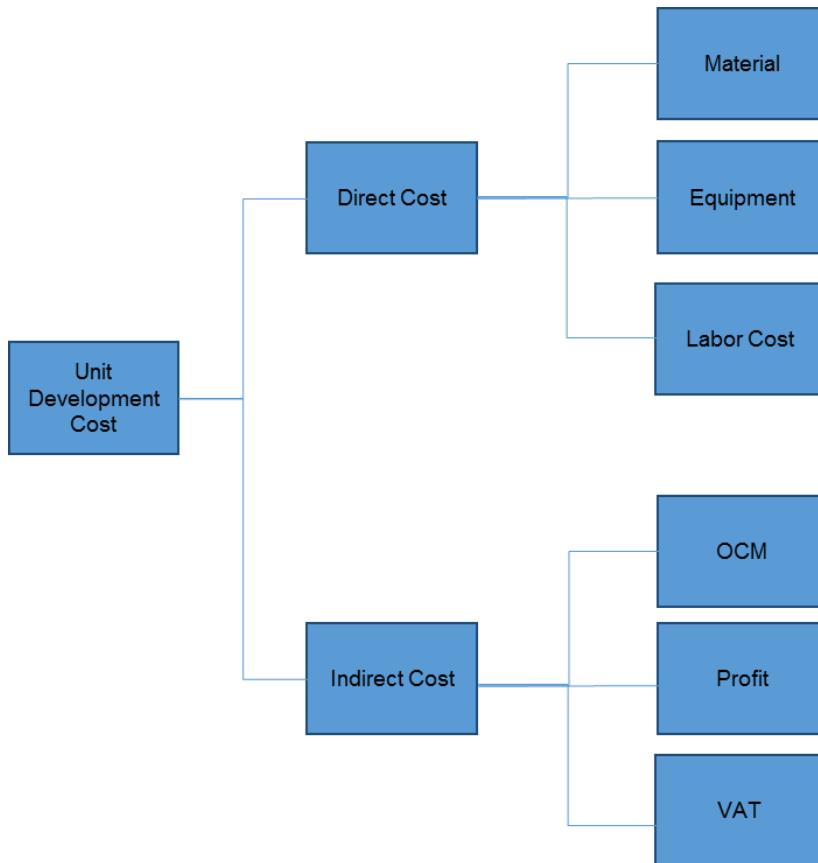


Figure 1: Unit Price Components

2.1 Direct Costs

Cost derivations conducted are mostly based on direct costs. These are items which are identifiable from a practical accounting standpoint as having been incurred in the performance of a specific item of work. These items include equipment, materials, and labor.

2.1.1 Material Cost

The material cost inputs considered in this analysis consist of canvassed cost from different suppliers which include the cost of hauling to site. The 12% value added tax was removed from canvassed materials.

The current market price of construction materials was gathered/collected by canvassing/market price survey. Quotations from various suppliers were taken most especially major construction materials i.e., cement, reinforcing steel bars, steel pipes etc. were requested.

The cost of materials included processing crushing, stockpiling, loading, royalties on quarries, local taxes, hauling cost, wastage or losses and others.

2.1.2 Equipment Cost

The operated rental rates per hour of the construction equipment were adopted based on the Associated Construction Equipment Lessors (ACEL), Inc. Equipment Rental Rates 25th Edition (2014). Rental rates indicate depreciation, cost of maintenance, fuel, lubricants, insurance and also wages of the equipment operator.

Minor equipment and tools that are not reflected in ACEL 25th Edition were taken from the latest rental rate schedule of the Department of Public Works and Highways (DPWH) – Bureau of Equipment.

2.1.3 Labor Cost

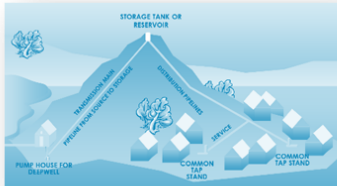
Labor cost includes wages and all fringe benefits such as vacation and sick leave, bonuses, SSS contributions, PAGIBIG, PhilHealth and workmen compensation.

The following government agencies were the sources of data considered in the analyses:

- National Wages and Productivity Board
- Department of Labor and Employment
- Social Security System
- Pag-ibig Fund
- Philhealth Insurance Co. Inc.
- Several Local Contractor

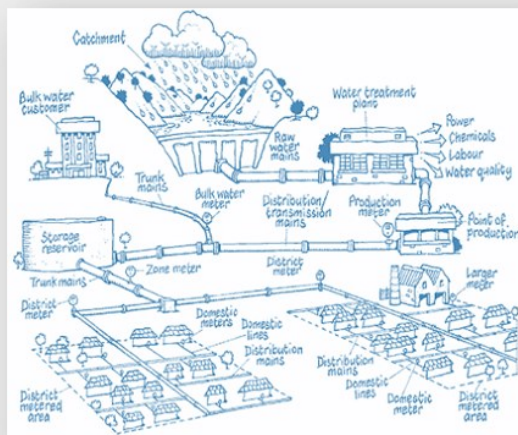
WSS facilities and components considered for cost derivations includes the following:

Table 1: Costing Considerations Components

Subsector	Components
Water Supply	Level I Point Sources ▪ Source development (surface water) ▪ 2m x 2m x 2m concrete spring box ▪ Tapping point ▪ Supplies 25 households within 250 meters ▪ No provision for water treatment 
	Level II Systems ▪ Source Development (surface water) ▪ Treatment (hypochlorinator) ▪ Storage Facility (5 cubic meter ground reservoir) ▪ Transmission pipe ▪ Communal faucets 

Level III Low

- Source Development (surface water)
- Infiltration gallery
- Treatment: Conventional treatment facility
- Transmission lines
- Distribution (pipe network, control valves, tap stands)
- Electrical signal system
- Water Treatment Plant (Conventional, Membrane, RO, COCODAF, etc.)
- Storage (Raw Water, Treated Water)
- Distribution System (pipe network, control valves, individual connections, flushing facilities, fire hydrants)
- No pumping required



Level III High

- Same with Level III Low
- Instead of infiltration gallery, weir / dam will be constructed
- Pumping facilities will be constructed

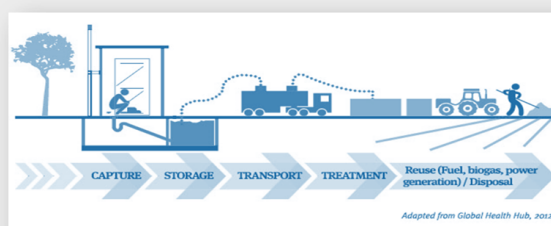
Basic, Improved

- Toilets
- Septic tanks



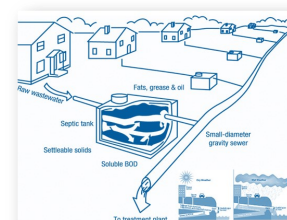
Septage Management Systems

- Septage Treatment Plant
- Vacuum Trucks
- Disposal Area(s)



Sewerage System

- STP
- Septic tanks
- Connection
- Interceptors
- Disposal Area(s)

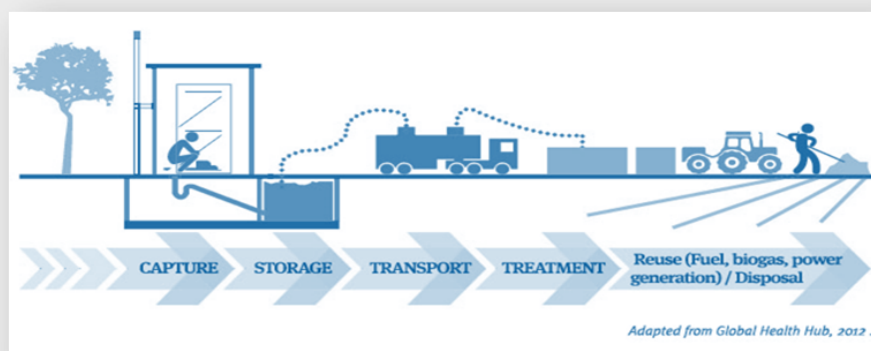


Available and applicable technologies for different sanitation approaches

Development costs are derived on a per household basis, as targeting is anchored on the increase of the total number of households that will have access to safe and sustainable water supply and sanitation services in the future. Tables 21 and 22 show the derived direct costs for WSS facilities and components broken down into levels of services, components, and overall design and technological considerations.

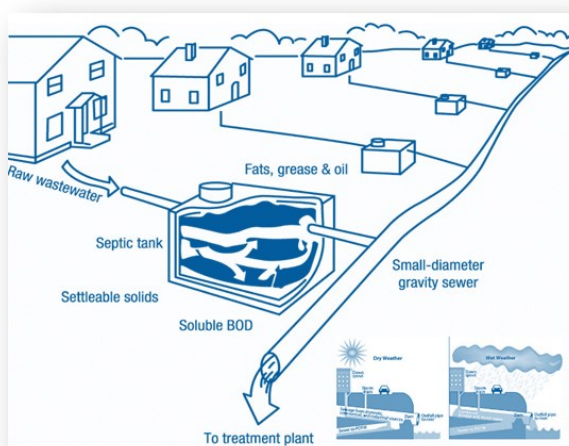
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Table 2: Water Supply Development Costs

Cost Item	Cost per HH (High Scenario)	Cost per HH (Low Scenario)
Level I Water System	PhP 8,400 / HH	-
Level II Water System	PhP 18,700 / HH	-
Level III Water System	PhP 31,800 / HH	PhP 28,600 / HH

Derived direct costs are slightly higher than current industry rates¹ but would be better to employ for conservative purposes. Level III systems considered a high and low scenario. The former approach considered a water system whose distribution is run by gravity, while the latter uses pumping stations, entailing longer pressurized pipelines and higher electrical costs (power consumption).

For sanitation costs, derived costs are based on estimations done by the DPWH for their use in the NSSMP. Development costs included in the document are at 2011 price levels which are escalated to 2018 prices for use in the PWSSMP.

Table 3: Sanitation Development Costs

Cost Item	PhP per HH
Basic and Improved Access	
In-place cost of individual toilets	4,000
In-place cost of individual septic tanks	22,500
Total Cost to achieve Safely Managed Sanitation, in terms of facility	26,500
Septage Management	
per capita for large systems	1,250
per capita for medium-sized systems	1,350
per capita for smaller systems	1,650
Sewerage System	
Large Flows > 200k pop.	27,000
Moderate Flows 100k-200k pop.	33,250
Smaller systems < 100k pop.	39,500

Source: NSSMP (For Septage Management and Sewerage System)

Economies of scale are observed in septage management systems and programs as the larger facilities generally cost less per unit volume of septage treated than smaller systems. Items in blue are adopted as unit development costs. Largest unit development costs for septage and sewerage are adopted for conservative purposes.

¹ DILG uses PhP 5,000, PhP15,000, and PhP 25,000 per HH for Levels 1, 2, and 3, respectively.

2.2 Indirect Costs

Indirect costs, on the other hand, are those which may appropriately spread to various items of work and include mark-ups on the estimated direct costs or these are costs that are not directly involved in the execution of the work items. These are costs which cannot be accounted for as having been incurred in the performance of a specific item of work.

Mark-ups on the estimated direct cost or costs that are not directly involved in the execution of work items were classified under the "Indirect Cost". The table below, which was taken from DPWH Department Order 197, Series of 2016, summarizes the percentage of indirect costs allowed with regard to the estimated direct costs:

Estimated Direct Costs (EDC)	Indirect Cost % for OCM and Profit		Total Indirect Cost % for OCM and Profit
	OCM (% of EDC)	PROFIT (% of EDC)	
Up to PhP 5M	15	10	25
Above PhP 5M up to PhP 50M	12	8	20
Above PhP 50M up to PhP 150M	10	8	18
Above PhP 150M	8	8	16

Value Added Tax

A Value Added Tax of 12% for direct equipment and labor cost (Reference BIR Regulations) will be included in the indirect costs.

Based on industry standards and the Consulting Team's experience in cost estimation, the following assumptions are to be adopted in the preparation for the indirect costs of the project:

Table 4: Indirect Costs

Indirect Cost	Water Supply	Sanitation
Physical and Price Contingencies	10%	10%
Feasibility Studies	3%	2%
Detailed Engineering Design	6%	4%
Construction Supervision	5%	4%
ROW / Land Acquisition	3%	2%
Organizational Cost/Permits	2%	2%
Capacity Development	PhP 33,350 / staff*	PhP 667,000**

*1 staff per 100 HH (LWUA standards)

**fixed costs

Capacity building costs were based on the standard practice of government agencies and offices in their conduct of and/or participation in trainings and seminars. Costs employed are also within on maximum amount allowed as per DBM and COA guidelines². Derived capacity development costs are based on the following considerations:

- Participant to attend a five-day workshop with Day 1 as travel time
- Each participant to be budgeted PhP 2,000 per day which covers meals and accommodation
- For out of town seminars, a PhP 10,000 per person is allotted for transportation costs
- Capacity development activities to engage six (6) resource persons for four (4) days at eight (8) hours per day at PhP 2,000 per hour
- PhP 15,000 per day for venue rental for 4 workshop proper days
- For water supply, one (1) personnel per 100 HH connections will be capacitated
- For sanitation, 20 personnel per province will be capacitated

Water Quality Testing Laboratories

The establishment of a water quality testing laboratory per province is also included in the investment requirements. Basis of costs are from LWUA estimates and considered provision of both bacteriological and physical/chemical analyses. Breakdown of costs are shown below:

Table 5: Direct Costs for Civil Works, Laboratory Equipment, Chemical, Glasswares, and Supplies

Cost Component		Bacteriological Analysis	Physical / Chemical Analysis
A	Civil Works	2,000,000	
B	Equipment	1,625,000	3,462,000
C	Chemical/Culture Media/ Reagent	17,450	24,443
D	Glassware/Supplies	118,980	66,000
E	Grand Total (in PhP)	7,313,873	
F	Adopted Total (in PhP)	7,500,000	

Source: LWUA

² National Budget Circular No. 563: Guidelines on Participation of Government Officials and Employees in Conventions, Seminars, Conferences, Symposia, and Similar Non-Training Gatherings Sponsored by Non-Government Organization or Private Institutions

3 Cost Regional Deviations

In the derivation of development costs, the base cost was computed using prevailing construction and project implementation costs for the National Capital Region (NCR). However, with the archipelagic nature of the Philippines, cost deviations will be considered as regional and geographical factors are entered into the equation. These deviations will be taken into account when having the laid-out programs provided corresponding costs considering the 16 regional administrative boundaries.

As each region has its own distinct geographical, economical, and accessibility characteristics, labor, material, and equipment costs are bound to be different to others. Given that premise, regional factors are multiplied to the NCR base costs to appropriate cost components and to realistically estimate investment requirements of proposed water supply and sanitation projects in each respective locales.

Table 24 shows the regional ratios relative to NCR base costs that shall be employed in the project. Likewise, in anticipation of possible funding from international sources (whether ODA or PPP, among others) breakdown of development costs into local and foreign components shall be done.

Table 6: Regional Development Cost Deviations

Region	Material 50%		Labor 15%		Equipment 35%	
	Foreign 20%	Local 30%	Foreign 6%	Local 9%	Foreign 7%	Local 28%
	Factor		Factor		Factor	
<i>NCR</i>	-		-		-	
CAR	104.90%		59%		3%	
1	110.85%		61%		3%	
2	105.48%		66%		2%	
3	105.60%		74%		2%	
4-A	123.95%		74%		2%	
4-B	122.58%		59%		3%	
5	120.18%		57%		3%	
6	122.77%		63%		5%	
7	114.59%		71%		5%	
8	117.78%		56%		5%	
9	123.62%		58%		8%	
10	125.74%		66%		8%	
11	108.66%		66%		8%	
12	132.14%		58%		8%	
CARAGA	142.40%		59%		8%	
ARMM	132.14%		52%		10%	

4 Derived Costs

The derived regional unit development costs for water supply and sanitation facilities are shown in the following tables:

Table 7: Summarized Regional Unit Development Costs for Water Supply

Region	Development Costs Per Household (in PhP)			
	Level 1	Level II	Level III Low	Level III High
<i>NCR (Base Costs)</i>	<i>8,400</i>	<i>18,700</i>	<i>28,600</i>	<i>31,800</i>
CAR	8,200	18,200	27,900	31,000
1	8,400	18,800	28,800	32,000
2	8,300	18,400	28,200	31,300
3	8,400	18,600	28,500	31,700
4-A	9,100	20,300	31,200	34,600
4-B	8,900	19,900	30,400	33,800
5	8,800	19,600	30,000	33,300
6	9,000	20,100	30,800	34,300
7	8,800	19,600	30,000	33,300
8	8,700	19,500	29,800	33,100
9	9,100	20,200	31,000	34,500
10	9,300	20,700	31,700	35,200
11	8,600	19,100	29,200	32,500
12	9,400	21,000	32,200	35,800
CARAGA	9,900	22,000	33,800	37,500
ARMM	9,400	21,000	32,200	35,800

Table 8: Detailed Regional Development Costs for Water Supply: Levels 1 and 2

Region	Level I						AMOUNT
	Material		Labor		Equipment		
	Foreign 20%	Local 30%	Skilled 6%	Unskilled 9%	Foreign 7%	Local 28%	
NCR	1,669	2,503	501	751	584	2,336	8,400
CAR	1,751	2,626	295	443	602	2,406	8,200
1	1,850	2,775	305	458	602	2,406	8,400
2	1,760	2,640	330	496	596	2,383	8,300
3	1,762	2,643	370	556	596	2,383	8,400
4-A	2,068	3,103	370	556	596	2,383	9,100
4-B	2,046	3,068	295	443	602	2,406	8,900
5	2,006	3,008	285	428	602	2,406	8,800
6	2,049	3,073	315	473	613	2,453	9,000
7	1,912	2,868	355	533	613	2,453	8,800
8	1,966	2,948	280	421	613	2,453	8,700
9	2,063	3,094	290	436	631	2,523	9,100
10	2,098	3,148	330	496	631	2,523	9,300
11	1,813	2,720	330	496	631	2,523	8,600
12	2,205	3,308	290	436	631	2,523	9,400
CARAGA	2,376	3,565	295	443	631	2,523	9,900
ARMM	2,205	3,308	260	390	642	2,570	9,400

Level II						
Material		Labor		Equipment		AMOUNT
Foreign 20%	Local 30%	Skilled 6%	Unskilled 9%	Foreign 7%	Local 28%	
3,730	5,595	1,119	1,679	1,306	5,222	18,700
3,913	5,869	660	990	1,345	5,379	18,200
4,135	6,202	683	1,024	1,345	5,379	18,800
3,934	5,902	739	1,108	1,332	5,326	18,400
3,939	5,908	828	1,242	1,332	5,326	18,600
4,623	6,935	828	1,242	1,332	5,326	20,300
4,572	6,858	660	990	1,345	5,379	19,900
4,483	6,724	638	957	1,345	5,379	19,600
4,579	6,869	705	1,057	1,371	5,483	20,100
4,274	6,411	794	1,192	1,371	5,483	19,600
4,393	6,590	627	940	1,371	5,483	19,500
4,611	6,917	649	974	1,410	5,640	20,200
4,690	7,035	739	1,108	1,410	5,640	20,700
4,053	6,080	739	1,108	1,410	5,640	19,100
4,929	7,393	649	974	1,410	5,640	21,000
5,312	7,967	660	990	1,410	5,640	22,000
4,929	7,393	582	873	1,436	5,744	21,000

Table 9: Detailed Regional Development Costs for Water Supply: Level III Low and High Scenario

Region	Level III Low						AMOUNT
	Material		Labor		Equipment		
	Foreign 20%	Local 30%	Skilled 6%	Unskilled 9%	Foreign 7%	Local 28%	
NCR	5,720	8,580	1,716	2,574	2,002	8,008	28,600
CAR	6,000	9,000	1,012	1,519	2,062	8,248	27,900
1	6,341	9,511	1,047	1,570	2,062	8,248	28,800
2	6,033	9,050	1,133	1,699	2,042	8,168	28,200
3	6,040	9,060	1,270	1,905	2,042	8,168	28,500
4-A	7,090	10,635	1,270	1,905	2,042	8,168	31,200
4-B	7,012	10,517	1,012	1,519	2,062	8,248	30,400
5	6,874	10,311	978	1,467	2,062	8,248	30,000
6	7,022	10,534	1,081	1,622	2,102	8,408	30,800
7	6,555	9,832	1,218	1,828	2,102	8,408	30,000
8	6,737	10,106	961	1,441	2,102	8,408	29,800
9	7,071	10,607	995	1,493	2,162	8,649	31,000
10	7,192	10,788	1,133	1,699	2,162	8,649	31,700
11	6,215	9,323	1,133	1,699	2,162	8,649	29,200
12	7,558	11,338	995	1,493	2,162	8,649	32,200
CARAGA	8,145	12,218	1,012	1,519	2,162	8,649	33,800
ARMM	7,558	11,338	892	1,338	2,202	8,809	32,200

Level III High						
Material		Labor		Equipment		AMOUNT
Foreign 20%	Local 30%	Skilled 6%	Unskilled 9%	Foreign 7%	Local 28%	
6,360	9,540	1,908	2,862	2,226	8,904	31,800
6,672	10,007	1,126	1,689	2,293	9,171	31,000
7,050	10,575	1,164	1,746	2,293	9,171	32,000
6,709	10,063	1,259	1,889	2,271	9,082	31,300
6,716	10,074	1,412	2,118	2,271	9,082	31,700
7,883	11,825	1,412	2,118	2,271	9,082	34,600
7,796	11,694	1,126	1,689	2,293	9,171	33,800
7,643	11,465	1,088	1,631	2,293	9,171	33,300
7,808	11,712	1,202	1,803	2,337	9,349	34,300
7,288	10,932	1,355	2,032	2,337	9,349	33,300
7,491	11,236	1,068	1,603	2,337	9,349	33,100
7,862	11,793	1,107	1,660	2,404	9,616	34,500
7,997	11,996	1,259	1,889	2,404	9,616	35,200
6,911	10,366	1,259	1,889	2,404	9,616	32,500
8,404	12,606	1,107	1,660	2,404	9,616	35,800
9,057	13,585	1,126	1,689	2,404	9,616	37,500
8,404	12,606	992	1,488	2,449	9,794	35,800

Table 10: Summarized Regional Unit Development Costs for Sanitation

Region	Improved (Whole System) PhP/Capita	Basic PhP/Capita	Shared / Communal / Limited PhP/Capita	Sewerage PhP/HH	Septage PhP/HH
NCR (Base Costs)	5,300	4,500	5,300	39,500	1,650
CAR	4,950	4,200	4,490	38,530	1,730
1	5,200	4,410	4,720	40,060	1,670
2	5,060	4,300	4,540	38,990	1,630
3	5,170	4,390	4,590	39,490	1,650
4-A	5,850	4,970	5,270	43,840	1,800
4-B	5,610	4,760	5,140	42,720	1,760
5	5,490	4,660	5,040	42,040	1,730
6	5,670	4,820	5,180	43,200	1,780
7	5,480	4,650	4,920	41,740	1,730
8	5,390	4,580	4,960	41,610	1,720
9	5,650	4,790	5,190	43,400	1,790
10	5,830	4,950	5,310	44,380	1,830
11	5,200	4,410	4,680	40,330	1,690
12	5,960	5,060	5,510	45,420	1,860
CARAGA	6,360	5,400	5,890	47,910	1,950
ARMM	5,890	5,000	5,480	45,270	1,860

5 Nonphysical Investments

The nonphysical investment (NPI) requirements of the PWSSMP cover the a) implementation cost required to carry out programs and activities under the 8 Key Reform Areas; and b) project management cost of the Operational Plan.

NPI requirements involving the reform area programs shall also cover fees of consultants and experts that shall assist in the various stages of the Plan implementation. Concerned fields involve research, studies, consultative and development work, technical, environment, economics and finance, and legal. This shall be implemented in the first four years of the planning horizon covering years 2019 through 2022.

Preliminary NPI for reform programs and activities was calculated by estimating required man months, in a span of four years of implementation, per field/discipline on each reform area. Man-month rates are estimated and assumed based on prevailing averages in program implementation observed by the Consultant Team throughout the years. Rates also cover not only the professional fees of the experts needed, but the activities to be undertaken in each reform area as well.

Estimated person-years for reform program implementation totals to 42. Employed per person-year rates of each field are as follows:

Table 11: Assumed Rates for Programs Implementation

Field/Discipline	Experts Needed	Unit Cost per Person - Year (in PhP Million)
Technical / Environmental	Hydrologists, Hydrogeologists, Environmentalists, Engineers & Scientists involved in Water Resources, Water Supply, Wastewater Engineering	6
Institutional	Organizational & Utilities Management, Sociological & Cultural Concerns, Regulations (Resource & Economic)	10
Eco-Financial	Financial Experts, Economists	6
Legal	Statutory Provisions, Laws - Clean Water Act. Public Service Act, PPP, PD's and EO's on Water, Department of Water	10
Support	Researchers, Surveyors, Intermediate Engineers	2

The overall implementation of the plan will be handled by a special task unit (i.e. a Project Management Office (PMO)). The PMO is to be adequately staffed to evaluate proposed projects, assist in project preparation, organization (and/or strengthening) of the implementing units for specific sub-projects (WDs, LGUs, CBOs), and provide assistance in technical and environmental concerns (water sources, review of proposals, environmental concerns, climate change adaptation works, economic and financial evaluation, contract reviews, etc.).

Required man months per year for Project Management Costs totals to 16.5. This value is multiplied by four to cover the four-year implementation. Rates in Table 11 were also likewise used.

Table 12 shows the estimated NPI requirements for the a) Implementation Cost of the Programs; and B) Project Management Cost of the Operational Plan.

Table 12: Estimated Nonphysical Investment Requirements for 2019 - 2022

Reform Areas		Person-Year (PY) Required for 2019 - 2022				
		Technical, Environmental	Institutional	Eco-Financial	Legal	Support
Unit Cost per Man-Month (in PhP Million)		6	9.6	6	9.6	1.8
A	Implementation Cost of the Programs					
1	Effective Delivery of Water Supply and Sanitation Services	1	1	1	0.5	3
2	Regulating Water Supply and Sanitation		2	1	1	1
3	Creating Effective WSS Institutions		2	1	1	1
3	Balancing Water Supply and Demand	2		1		1
4	Ensuring Climate Resiliency	2	1		0.5	2
6	Enhancing Access to Funding and Financing	1	1	2		2
7	Driving Research and Development	2		1		2
8	Managing Data and Information	2	0.5	0.5		2
	Subtotal	10	7.5	7.5	3	14
B	Project Management Cost of the Operational Plan (per year)*	2	1	1	0.5	12
C	TOTAL (in PhP Million)	12	8.5	8.5	3.5	26

* Number of PYs to be multiplied by 4

Nonphysical Investment Requirement for 2019 - 2022									
Technical, Environmental	Institutional	Eco-Financial	Legal	Support	Subtotal	OPE, Miscellaneous (25% of Subtotal)	Total	Taxes (15% of Total)	Grand Total
6	9.6	6	4.8	5.4	31.8	7.95	39.75	5.96	45.71
-	19.2	6	9.6	1.8	36.6	9.15	45.75	6.86	52.61
-	19.2	6	9.6	1.8	36.6	9.15	45.75	6.86	52.61
12	-	6	-	1.8	19.8	3.2	23	3.45	26.45
12	9.6	-	4.8	3.6	30	1.12	31.12	4.67	35.79
6	9.6	12	-	3.6	31.2	7.8	39	5.85	44.85
12	-	6	-	3.6	21.6	5.4	27	4.05	31.05
12	4.8	3	-	3.6	23.4	5.85	29.25	4.39	33.64
60	72	45	28.8	25.2	231	49.62	280.62	42.09	322.72
48	38.4	24	19.2	86.4	216	75.6	291.6	43.74	335.34
108	110.4	69	48	111.6	447	125.22	572.22	85.83	658.06

