

Republic of Lebanon

Ex-Post Evaluation of Japanese ODA Loan

“Coastal Pollution Control and Water Supply Project (L/A No.LBN-P1)”

External Evaluator: Jun Totsukawa, Sano Planning Co., Ltd

0. Summary

The project has aimed at addressing problems of water shortage and wastewater treatment by developing water supply and sewerage systems in Saida and Kesrouan in Lebanon, thereby contributing to the improvement of the living environment of the local residents. This objective has been consistent with the country’s development policy and needs as well as Japan’s ODA policy both at the time of the project appraisal and ex-post evaluation. Therefore, the relevance of the project is high.

The project period, on the other hand, has largely exceeded the original plan resulting from such external factor as Israel’s air strikes and internal problems related to the executing agency, namely land acquisition, design modifications, a prolonged process of approving a tunneling work. While the project cost is within the original plan, it is primarily because a part of the intended outputs were cancelled. Therefore, the project efficiency is evaluated to be low.

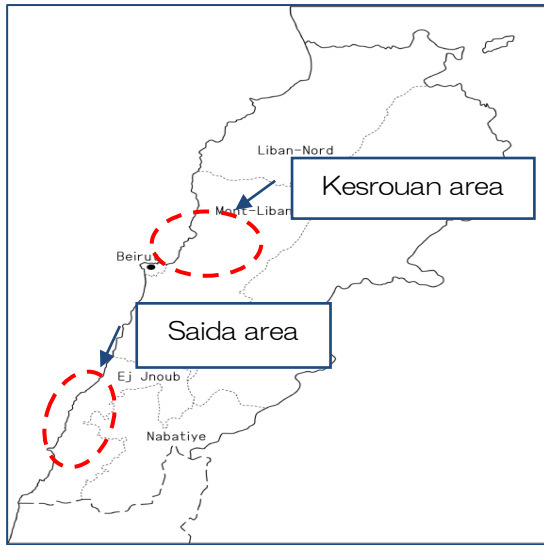
As for the project effectiveness, the water supply population has been gradually increasing in Kesrouan, achieving the target value for 2015 as of the ex-post evaluation. Many of the local residents have recognized more stable water supply and higher household efficiency than before. Population covered by the sewerage systems in Saida, has been also increasing, while also the local residents are aware of improved coastal views and odor to a certain degree. In addition, the wastewater treatment plant has mostly achieved the expected BOD¹ reduction rate. In light of the above, the project effectiveness and impact have been high.

In terms of the project sustainability, no technical problems have been identified both at Beirut Mount Lebanon Water Establishment (hereinafter referred to as BMLWE) operating and maintaining the Kesrouan water supply system and South Lebanon Water Establishment (hereinafter referred to as SLWE) operating and maintaining the Saida water treatment plant. On the other hand, the ex-post evaluation study identified organizational problems such as the number of employees (related to BMLWE) and a financial problem (related to SLWE), which may affect stable operations in the future. Therefore, the project sustainability is evaluated to be fair.

In light of the above, this project is evaluated to be partially satisfactory.

¹ Biochemical Oxygen Demand

1. Project Description



Project Locations



Coastline in Saida

1.1 Background

In 1992 when Lebanon's civil war lasted 15 years was ended, the World Bank (hereinafter referred to as "WB"), the European Union (hereinafter referred to as EU), and the European Investment Bank (hereinafter referred to as EIB) took an initiative in assessing post-conflict impact of infrastructure damage in the country. The results indicated that the water supply infrastructure had limited coverage due to the war-torn system, causing serious water shortage. Also, because of insufficient sewerage, wastewater had been released in wadis (dried rivers), polluting the groundwater as well as the environment in which the landscape and odor were worsened. This had significantly deteriorated the living environment of local residents.

Accordingly, an Emergency Rehabilitation, Recovery and Reconstruction Plan, drawing on findings of the said impact assessment of infrastructure damage, set out one of its high priorities in developing and improving water supply and sewerage infrastructure.

As a part of the post-conflict reconstruction assistance for Lebanon at that time, Japan and other aid donors such as WB, EU, EIB, Germany, France and the Arab Fund for Economic and Social Development revealed their cooperation schemes. Through the aid coordination of these donors, Japan launched this project to develop water supply in Kesrouan which was the then-developing suburban city of Beirut, and sewerage systems in the country's third largest city, Saida.

1.2 Project Outline

The objective of this project is to address problems of water shortage and wastewater treatment by developing water supply and sewerage systems in Saida and Kesrouan in Lebanon,

thereby contributing to the improvement of the living environment of local residents.

Loan Approved Amount/ Disbursed Amount	13,022 million yen/ 12,949 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	July, 1996 / March, 1997
Terms and Conditions	(Construction) Interest Rate 2.5% Repayment Period 25 years (Grace Period 7 years) (Conditions for Procurement: General untied) (Consulting service) Interest Rate 2.1% Repayment Period 25 years (Grace Period 7 years) (Conditions for Procurement: General untied)
Borrower / Executing Agency	Government of Republic of Lebanon/Council for Development and Reconstruction
Final Disbursement Date	March, 2012
Main Contractor	<ul style="list-style-type: none"> • Baresel AG (Germany)/Al Taj Est (Lebanon)(JV) • Sezai Turks Feyzi Akkaya Construction Company of Turkey (Turkey) • The Arab Contractors Osman Ahmed Osman & Co (Egypt)
Main Consultant	<ul style="list-style-type: none"> • Dah Nazih Taleb (Lebanon)/Montgomery Watson (UK) (JV) • Italian Environmental Engineering Co. (Italy) /Nippon Jogesuido Sekkei Co., Ltd (Japan)/Envirotech Ltd (Lebanon) • NJS Consultants Venture (Japan)
Related Studies (Feasibility Studies, etc.)	<ul style="list-style-type: none"> • Special Assistance for Project Implementation for Project Management and Monitoring (SAPI), Lebanon: Coastal Pollution and Water Supply Project (LBN-P1) (2002) • Special Assistance for Project Implementation for Project Management and Monitoring (SAPI), Lebanon: Coastal Pollution and Water Supply Project (LBN-P1) (2003)
Related Projects	The Water Supply and Sewage Improvement Project in Ein el-Hilweh Palestine Refugee Camp (associated with the Japanese ODA Loan)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa (Sano Planning, Co., Ltd.)

2.2 Duration of Evaluation Study

This ex-post evaluation was carried out as follows.

Duration of the Study: October, 2014-June, 2015

Duration of the Field Study: None (A Lebanese local consultant pursued this part of the Study.)

2.3 Constraints during the Evaluation Study

At the time of the ex-post evaluation, a travel to Lebanon by a Japanese evaluator was restricted for security reasons, and therefore the following steps were alternatively taken to complete the study with support from a Lebanese local consultant; (1) the local consultant collected relevant information, along with interviews and beneficiary surveys in Lebanon, (2) a Japanese evaluator analyzed a set of information obtained from the local consultant, and (3) the Japanese evaluator and the local consultant had meetings in Cairo in Egypt, and reviewed the details including information and the background of the findings.

In the Project Completion Report of this project, some of the key information was not provided, such as its outputs. Thus the ex-post evaluation study had to obtain detailed project achievements from the findings of questionnaires. However, most of the Lebanese stakeholders involved in the project or who were familiar with its background have already retired. This severely restrained meeting opportunities with the key persons as well as the number of responses and the contents that were sent back from the questionnaires. It should be noted that this has been complemented as much as possible by additional interviews and on-site visit made by the Lebanese local consultant.

3. Results of the Evaluation (Overall Rating: C²)

3.1 Relevance (Rating:③³)

3.1.1 Relevance to the Development Plan of Lebanon

(At the time of the project appraisal)

To restore the society and the economy devastated by the civil war, the Government of Lebanon set out the “Horizon 2000,” presenting a public investment plan from 1995 through 2007. Incorporated as a short and medium term component in that plan, the “National Emergency Rehabilitation Program” was developed to include “Emergency Rehabilitation and

² A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

³ ③: High, ② Fair, ① Low

Reconstruction Projects” targeting particular areas of urgent needs. With support from WB, EIB and EU, Lebanon carried out an impact assessment of infrastructure damage and developed the findings into the said “Emergency Rehabilitation and Reconstruction Projects.” One of the highest priority works therein was recovery of the water supply and sewerage systems.

(At the time of the ex-post evaluation)

As of 2015 when the ex-post evaluation was conducted, Lebanon has pursued a policy to develop water supply and sewerage systems in a framework of the National Water Sector Strategy (prepared by the Ministry of Water and Energy in 2010, followed by the resolution of the Government of Lebanon in 2012). The strategy intends to rehabilitate and extend the water supply networks to respond to growing domestic and industrial water needs.

As for sewage, the above strategy aims at extending the networks and increasing the sewage treatment rate. In terms of the sewage treatment process, it tries to ensure that wastewater is disposed after going through at least a secondary level treatment until 2020.

At the time of the ex-post evaluation, therefore, development of the water supply and sewerage systems continues to constitute important components of Lebanon’s development policy to meet growing domestic water needs and to improve the sewage treatment.

In light of the above, the project targeting improved water supply and sewerage infrastructure was consistent with Lebanon’s development policy at the time of its appraisal. It remains a vital effort to address one of the priority policy areas of the country at the time of the ex-post evaluation as well.

3.1.2 Relevance to the Development Needs of Lebanon

(At the time of the project appraisal)

At the time of the project appraisal, the war-torn water supply infrastructure caused a serious water shortage. As for the sewerage infrastructure, insufficiently treated wastewater was released into wadis (dried rivers) due to inadequate sewage treatment plants. It permeated into the nearby ground and contaminated the groundwater, and deteriorated the living environment.

Furthermore, wastewater had flowed along the wadis to the coastlines endowed with tourism resources, causing a serious problem in Saida and Kesrouan where the project sites have been located. This had also posed an international problem on which EU and North African countries along the Mediterranean Sea had a keen interest likewise. Given these backgrounds, recovery of the water supply and sewerage services was an urgent issue in Lebanon.

One of the project sites is a city of Kesrouan located in about 20 km in the north of Beirut, which was projected to achieve a significant suburban development, given a good access to the capital. The Government of Lebanon had thus regarded infrastructure development in this area

as a key task. The third largest city of Saida had also pressing needs of infrastructure development due to a coastal pollution problem. In contrast to Beirut and the second largest city of Tripoli where infrastructure development projects had been implemented in succession, Saida had somehow lagged behind. Accordingly, the Government of Lebanon sought to meet the development needs of the city.

(At the time of the ex-post evaluation)

Problems in the water supply and sewerage sector in Lebanon include (1) insufficient water supply amount and a limited capacity to meet the growing demand, (2) inefficient and deteriorating water supply and sewerage networks, and (3) the sewerage coverage rate and treatment capacity to be improved (as described in the National Water Sector Strategy 2010).

For problems of (1) and (2) related to the water supply, although Lebanon has currently the higher “access rate to safe water” than the average in neighboring countries, the leakage rate is high likewise, resulting from damaged and deteriorating water pipes (The average access rate to safe water is 75% in neighboring countries in 2010, compared with 79% in Lebanon, whereas the leakage rate is 37% and 48% respectively). As for (3) related to sewerage, the country has a lower rate of sewage treatment relative to the amount of domestic water consumption than the average in the neighboring countries (The average rate in the neighboring countries is 32%, as opposed to 8% in Lebanon).⁴

Given these circumstances, further development and improvement of the water supply and sewerage infrastructure in Lebanon remain critical development needs at the time of the ex-post evaluation.

Of the selected project sites, Kesrouan continues to develop into a city in Beirut suburbs, as projected at the time of the appraisal. Developing the water supply and sewerage infrastructure remains an essential local need at present. Similarly, Saida has critical ongoing needs of addressing coastal pollution and developing sewerage networks.

In light of the above, the water supply and sewerage development intended by the project has been consistent with needs in both target areas. Selection of the project sites has been also consistent with the local needs at the time of the appraisal.

3.1.3 Relevance to Japan’s ODA Policy

To respond to a wide range of reconstruction efforts led by Hariri administration upon the termination of the prolonged civil war, the Government of Japan delegated a team to Lebanon to discuss economic cooperation policies in November 1997. Articulating its ODA policies, it consulted with the Lebanese counterpart with respect to the country’s economic situations,

⁴ The average rate in the neighboring countries and the rate in Lebanon are based on the “National Water Sector Strategy (2010).”

reconstruction and development policies as well as prospective bilateral cooperation. At the outset of the reconstruction process, the Government of Japan provided an emergency financial assistance of about one million dollars for the sake of those people affected by the armed conflict with Israel in April 1996. In the “Friendship League Meeting for Lebanon Reconstruction Assistance” in the following December, the Government of Japan announced support for the country’s post-conflict reconstruction process.

Along with the above post-conflict reconstruction assistance for Lebanon, Japan revealed a policy to implement its bilateral cooperation including its ODA loans, primarily focusing on environmental projects.

In light of the above, this project has been highly relevant to Lebanon’s development plan and development needs, as well as Japan’s ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating:①)

3.2.1 Project Outputs

3.2.1.1 Project Outputs of the Water Supply Development in Kesrouan

Table 1 shows a comparison of planned and actual project outputs related to the water supply development in the Kesrouan site. The outputs have been modified from the project appraisal phase, and the background and factors underlying such changes are provided below.

(The background and factors for the modification of the project outputs)

As indicated above, some of the components have differences in the planned and actual outputs. Difference resulting from the extension of water transmission pipes was caused by topographical conditions. On the other hand, unsuccessful land acquisition led to major differences in the planned and actual outputs in terms of the number of pumping stations, distribution reservoirs and the length of water transmission lines, although the changes were considered to be inevitable. Factors related to these modifications are as follows.

Table 1. Comparison of the Planned and Actual Project Outputs
(Kesrouan site: Water supply development)

		Number and scope of facilities	
		Plan	Actual
Extension of the Madiq water intake		Renovation of water intake facility	Renovation of water intake facility
Water transmission facilities	Water transmission tunnel	5 km	5 km
	Water transmission pipes	44.5 km	61 km
	Pumping stations	13	6
Water distribution facilities	Distribution reservoirs	22	11
	Distribution lines	202 km	59 km

Source: Reference provided by JICA and the questionnaire responses

1) Water transmission pipes:

The original plan intended to install water transmission pipes along the highway between Zouk Mikael and Aaqabe. Unable to obtain a construction approval for part of this section from the Ministry of Public Works and Transport, the project had to detour it, imparting a curved connection to the pipes. Consequently, an additional pipeline was provided for a section of 16.5 km. The reason for the disapproval of the original plan was rapidly increasing traffic volume in the highway at that time under which this transmission pipe construction planned. The said authority concluded that such highway road should not be closed for the purpose of the construction work.

2) Pumping stations, distribution reservoirs and distribution lines:

Although it was the Ministry of Water and Energy that initially planned construction of pumping stations, distribution reservoirs and distribution lines, Committee of Development and Reconstruction (hereinafter referred to as CDR) subsequently took over the plan as an executing agency when entering into the implementation phase (The project had assigned CDR as an executing agency at the time of appraisal, therefore, its transfer was in line with the original plan).

To pursue the above-mentioned construction, land acquisition should have been completed prior to the project launch. In fact, a large part of the acquisition process had not progressed beforehand, and had to be resumed at the project outset. Although CDR undertook land acquisition spending substantial time, it decided not to acquire all the land portions, considering the project's loan disbursement period. Unable to acquire all the land areas that were originally planned, the project had to reduce the number of the facilities to fit in the limited site.

Notably, CDR's report indicates that the Government of Lebanon constructed facilities corresponding to cancelled establishment in this project, allocating its own financial resources.

They include seven pumping stations and 16 distribution reservoirs. Also, BMLWE, which operates water supply services in Kesrouan, has been successively constructing distribution lines.

The above-mentioned factors account for the context in which the planned and actual outputs turned out to be different. The project is quite unique in that it was planned and implemented jointly by the competent authority in the water sector, namely the Ministry of Water and Energy, and CDR that is responsible for reconstruction and development. Although it would be reasonable, considering conditions of Lebanon on the heels of the civil war, such inter-agency effort entailed some difficulties in detailed information sharing. This will be further discussed below in the lessons learned from the project.

3.2.1.2 Project Outputs of the Sewerage Extension in Saida

(Reasons and factors for the modification of the project outputs)

Table 2 shows difference between some of the actual and planned outputs. The modifications of the plan were inevitable due to topographical conditions where the target facilities (sewer pumping stations and outfall sewer) were planned. Also, the scope of work was revised because intended output (main sewer line) had been provided by other project. Detailed factors related to these modifications are as follows.

1) Sewer lines

Sewer lines were installed in accordance with the original plan. However, they were eventually extended beyond the original scope, financed with part of the budget cancelled for main sewer line construction that is described below.

2) Main sewer line

Prior to the project launch, part of the intended main sewer line work had been alternatively provided by the City Planning Department of the Government of Lebanon to deliver a component of its own road construction project. Therefore, the JICA project constructed a main sewer line for the remaining section of 2.4 km. This completed 6.8 km of the main sewer line, as originally planned by the project, combined with the work complemented by the City Planning Department.

Table 2. Comparison of the Planned and Actual Project Outputs
(Saida site: Sewerage extension)

		Number and scope of facilities	
		Planned	Actual
Sewer lines		37.8 km	42.52 km
Main sewer line		6.8 km	2.354 km (a total of 6.8 km constructed in conjunction with other project)
Sewer pumping stations		2 stations	4 stations
Water treatment plant	Inlet pump	1	1
	Outlet pump	1	1
	Initial treatment plant	1	1
	Outfall sewer	1.7 km	1.9 km

Source: Source: Reference provided by JICA and the questionnaire responses

3) Sewer pumping stations

Additional pumping stations were required as a result of extending total length of the sewer lines and due to the topography over the construction route.

4) Outfall sewer

The outfall sewer was constructed for 1.9 km in consideration of the topography of the project site.

3.2.2 Project inputs

3.2.2.1 Project cost

The total project cost was lower than planned during the project appraisal. As mentioned in the outputs section above, while the scope of work was added and cancelled in part, the project was completed within the planned costs.

The major reasons are that; (1) the project cost was reduced because the length of the distribution lines required for the water supply facility was shortened, and the number of pumping stations as well as distribution reservoirs was also reduced; (2) part of the budget for the land acquisition was not spent because some of the targeted land was not acquired as originally planned; and (3) part of the main sewer line was provided by another project, requiring no budget execution planned for this part in the project. Calculated from the original cost estimate, the total budget equivalent to 2,666 million yen was not executed supposedly, including (1) about 877 million yen for distribution lines, (2) about 409 million yen for distribution reservoirs, and (3) about 181 million yen for pumping stations, (4) about 634 million yen for land acquisition, and (5) 565 million yen for main sewer line.

On the other hand, the output added to the original plan is an extension of sewer lines in the sewerage project. Whereas the planned cost was 458 million yen for the sewer line work, the project supposedly brought about the output worth about 512 million yen.^{5,6}

In pursuant to the above, the cancelled construction portions are excluded from the original cost estimate, while at the same time adding the cost required for construction of facilities beyond the original scope. When compared with a revised cost estimate, the actually executed cost turned out to be 114% of that estimate. Given increased and decreased outputs, therefore, the project cost increased in comparison with the original plan, eventually exceeding the planned amount.

Table 3. Difference between the Planned and Actual Disbursement of the Total Project Costs
(unit: million yen)

	Output	Estimated cost	Actual cost	Difference	Rationale of the cost estimation
Water supply	Pumping stations	335	154	▲181	Reduction corresponding to the estimated cost (The project has not delivered the original output, and thus the difference indicated in the left column should be deducted from the total original cost. This applies to a reason for the reduced cost below as well.)
	Distribution reservoirs	818	409	▲409	Reduction corresponding to the estimated cost
	Distribution lines	1,234	357	▲877	Reduction corresponding to the estimated cost
Sewerage	Sewer lines	458	512	△54	Addition to the estimated cost (The additional cost contributed to enhance the project effect, and the difference indicated in the left column should be regarded as a part of the total original cost.)
	Main sewer line	863	298	▲565	Reduction corresponding to the estimated cost
Water supply and sewerage	Land acquisition	1,234	600	▲634	Reduction corresponding to the estimated cost
Total		4,942	2,330	▲2,612	—

Source: Created by the ex-post evaluation study team based on reference provided by JICA

⁵ Extension of water transmission pipes and outfall sewer was attributed to a design change, and not intended to enhance the expected effect as such. Thus, the extension work is not included in the comparison with the planned cost. Also note that sewer pumping stations are not included in the comparison, as the estimated cost is unavailable.

⁶ The project designed distribution reservoirs and pumping stations in varied scopes in terms of facility size, and yet the ex-post evaluation study was unable to obtain information on which sites completed the construction. Therefore, this section applies a weighted average to estimate the costs. Though possibly varied depending on the diameter, the cost of pipes is also estimated with a weighted average because detailed figures are not available.

Table 4. Planned and Actual Disbursement of the Project Costs

	Construction		The project total (Comparison with the estimated cost during the project appraisal)	The project total (Comparison with the estimated cost revised for additional and cancelled outputs)
	Japanese ODA loan	Government of Lebanon		
Planned	13,022 million yen	1,533 million yen	14,555 million yen	11,943 million yen
Actual	12,949 million yen	756 million yen	13,705 million yen (94% of the original estimate)	13,705 million yen (114% of the revised estimate)

Source: Reference provided by JICA and the questionnaire response

3.2.2.2 Project Period

The actual project period significantly exceeded the planned period, as in a difference indicated in Table 5.

Table 5. The Planned and Actual Project Periods

Planned	Actual
March 1997-November 2001 (57 months)	<p>March 1997-November 2011 (177 months) (310% of the planned period)</p> <p>*This would be 228% of the planned period when 47 months were excluded from the above as a period affected by Israel's air strikes.</p>

Source: Reference provided by JICA and the questionnaire responses

Note: The period affected by Israel's air strikes is described in detail below.

The major reasons for the extended project period are outlined below. The estimated number of additional months associated with them is based on the questionnaire response from CDR.

1) Land expropriation process

Land expropriation required a long period of time for both water supply and sewerage projects. This included time spent on obtaining financial resources necessary for the land expropriation.

⇒ A delay of more than about 18 months (Though difficult to estimate, the expropriation caused at least 18 months of the delay in the project)

2) Design change

The original plan intended to install water transmission pipes along the highway between Zouk Mikael and Aaqiibe. However, unable to obtain a construction approval for part of this section from the Ministry of Public Works and Transport, the project had to reroute the pipeline

to detour the original section, resulting in a curved laying of the pipes. A design change of this rerouting entailed additional time.

⇒ A delay of about 18 months

3) Approval related to excavation

- Tunneling work and excavation required time to obtain a construction approval (Construction of a water tunnel from Madiq catchment).

⇒ A delay of about 24 months

- Excavation work was delayed due to archeological findings in the ground.

⇒ A delay of about 12 months

- Excavation work required time to deal with soft ground in the target site.

⇒ A delay of about 12 months

4) Additional works

Additional pumping stations were constructed in Saida.

5) Influence of the war

• The entire project was suspended by the war erupted in July 2006 (Israel's attack on Lebanon) . Lasted about 2 months at most, the war damaged infrastructure extensively in the country, which significantly affected subsequent construction works in the project.

Specifically,

- Major bridges in the project area were damaged, requiring more time to transport supplies for the project.
⇒ About 18 months required to complete the bridge reconstruction
- Due to damage on an airport and oil storage tanks in northern Saida, the project experienced difficulties in procuring fuel necessary for its entire works. In Saida, it took a long time in finding and disposing the significant amount of unexploded cluster bombs in the ground.
⇒ About 18 months required for completion of the disposal
- In the water supply project in Kesrouan, although distribution line works were planned on an old road, it came to be used as an alternative route of a highway damaged by air strikes. Thus, the intended laying works were suspended until the repair of the highway was completed.
- Consultants and contractors evacuated from Lebanon for five months.
⇒ Although difficult to estimate a period of the entire delay, it took about 47 months

from Israel's air strikes to the above-mentioned bridge reconstruction which was most recently completed.

6) Stagnated administrative functions

Upon the expiration of Lahoud administration in October 2007, a political conflict between dominant groups intensified, resulting in postponement of election. Consequently, administrative functions had been paralyzed for months, as the presidential office had been vacant from November 2007 through May 2008, followed by major violent conflicts occurred in the country. This had suspended the project works.

⇒ About 10 months

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

At the time of the project appraisal, financial internal rate of return (FIRR) was estimated to be 13.4% in the Kesrouan project and 10.8% in the Saida project respectively. At the time of ex-post evaluation, however, FIRR could not be obtained since the data was unavailable at the executing agency regarding the annual costs paid by the Government of Lebanon for each project component as well as the profit generated from the water tariffs.

In light of the above, although the project cost was within the plan, it was because some of the original target outputs were not constructed. Also, the project period substantially exceeded the plan. Therefore efficiency of the project is low.

3.3 Effectiveness⁷ (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1 Quantitative Effects of the Water Supply Development in Kesrouan

Achievements of the target indicators in the Kesrouan water supply project are indicated in the table below.

⁷ Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 6. Achievements of the Target Indicators in the Kesrouan Water Supply Project

	Baseline	Target	Actual	Actual
	1997	2015	2011	2014
	Project appraisal year	4 years after completion	Project completion year	3 years after completion
Water-supply population (persons)	120,755	199,098	NA	276,450
Rate of non-revenue water (%)	NA	20	NA	35

Source: Reference provided by JICA and the questionnaire responses.

Note: 1) Data of 2015 is used to evaluate achievement of the target value, which comes closest to 2014 that provides the project's most recent actual achievement. The said target value is taken from the reference document provided by JICA.

2) The rate of non-revenue water is based on the National Water Sector Strategy (2010).

At the time of the project appraisal, quantitative indicators were not specified. The ex-post evaluation study therefore assessed the effectiveness of the Kesrouan water supply project based on the data obtained from the Government of Lebanon, specifically the population served with water supply and the rate of non-revenue water.

As indicated in Table 6, the target rate of non-revenue water has not been achieved primarily because existing distribution lines remain deteriorated. As of 2014, however, the water-supply population already reached the target value of 2015. This is achieved not only by the project effect, but also presumably by the distribution line works of the Government of Lebanon pursued in the post-project phase.

Also, many local households have recognized the improvement of water shortages and the stability of water supply, as initially intended by the project. This will be discussed in the impact section below. In light of the above, the effect of the Kesrouan water supply project has been generally high, although unable to attain the target value of the rate of non-revenue water.

As in the latest monitoring results shown in Table 7, the quality of water distributed to households satisfies the portable water requirements specifying the tolerable limit of turbidity, coliform and common bacteria.

Table 7. Monitoring Results of the Water Quality

Month and site of measurement	Measuring item	Coliform	Bacteria	Turbidity
	Baseline	Less than 1 colony/ml	Less than 150 colonies/ml	Less than 1.0 NTU
April 2015 Police station in Jounieh		Under 1 colony/ml	5 colonies/ml	0.92 NTU

Source: Reference provided by BLMWE

3.3.1.2 Quantitative Effects of the Sewerage Extension Project in Saida

Achievements of the target indicators in the Saida sewerage project are shown in the table below.

Table 8. Achievements of the Target Indicators in the Saida Sewerage Project

	Baseline	Target	Actual	Actual
	1997	2014	2011	2014
	Year of the project appraisal	3 years after completion	Year of completion	3 years after completion
Population Covered by Sewerage Systems (person)	0	NA	66,666	196,891

Source: Reference provided by JICA and the questionnaire responses

Note: It is unknown whether a target value was specified initially, and the year 2014 is used, which provides the latest available data.

Table 9. Changes in the Population Covered by Sewerage System

(unit: person)						
Year	2009	2010	2011	2012	2013	2014
Population Covered by Sewerage Systems	33,178	51,472	66,666	87,782	145,348	196,891

Source: Questionnaire responses

As shown in Table 9, the population covered by sewerage systems has been increasing year by year, particularly achieving a rapid increase of the served population in those two years in the post-project period from 2011 and 2012. Given the fact that the area has the population of 387,500 as of 2014, about 51% of the residents are covered by the sewerage systems.⁸

In three years from the project completion, the coverage by the sewage networks reached more than a half of the population in the area. A main sewer line and sewerage networks extended by the project have contributed to an increase in the population covered by these systems in the target area, demonstrating its effect.

Also, the table below shows a BOD concentration measured at a treatment plant constructed by the project.⁹ Given that the project appraisal set out a target BOD reduction of 30%¹⁰ at the primary treatment plant, the current plant operation has generally achieved the objective as expected.

⁸ The population in Saida estimated as 387,500 is based on the questionnaire response from SLWE. Lebanon has not carried out an accurate population survey since the last national census in 1932. Therefore, note that the number of population often varies depending on census reports.

⁹ This wastewater treatment plant is intended for a primary treatment process using a sand basin and screening, as opposed to a secondary treatment plant to provide substantially high removal rates.

¹⁰ This is based on the "Guidelines Manual for Planning and Design of Sewerage Treatment Plant" cited in the Project Appraisal Document.

Table 10. BOD Reduction at the Sewer Treatment Plant

Year	2013 (2 years after completion)	2014 (3 years after completion)
Mean inflow concentration (mg/l)	344	360
Mean outflow concentration (mg/l)	270	242
Rate of reduction	21.4%	32.9%

Source: Questionnaire responses

3.3.2 Qualitative Effects

Outcomes corresponding to qualitative effects are described in the section of Impacts.

3.4 Impacts

3.4.1 Observed Impacts

The beneficiary surveys¹¹ revealed project impacts described below.

3.4.1.1 Impacts by the Kesrouan Water Supply Project

As shown in Table 11 and 12, local residents have perceived improved household efficiency and living standards, by which the project has contributed to increase the amount of water supply and reduce duration of water cutoff.

Table 11. Public Awareness on the Reduced Water Shortage (summer)

(unit: %)

	Strongly agree	Generally agree	Neither agree or disagree	Slightly disagree	Disagree	Do not know
The amount of water supply has increased	50	22	6	0	20	1
Duration of water cutoff has decreased	54	18	6	0	20	2

Source: Results of the beneficiary surveys

Table 12. Public Awareness on the Living Standard and Household Efficiency

(unit: %)

	Strongly agree	Generally agree	Neither agree or disagree	Slightly disagree	Disagree	Do not know
The essential quality of life has improved	70	6	2	2	16	4
Household efficiency has increased	74	4	2	2	18	0

Source: Results of the beneficiary surveys

¹¹ Beneficiary surveys targeted 50 local residents in the project sites in Kesrouan and Saida respectively. In the latter, an additional survey was carried out with 15 persons working for tourism agencies to evaluate the project impact on tourism.

As shown in the results of the beneficiary surveys in Table 11 and 12, many of the local residents in the target areas are stably supplied with water compared with before. They perceived higher household efficiency and better living standards, in essence, as a result of an increased amount and improved duration of water supply.

3.4.1.2 Impacts by the Saida Sewerage Extension Project

Saida Sewerage Extension Project has achieved outcomes as in Table 13 and 14.

Table 13. Public Awareness on Neighboring River Views, Water Quality (with Visual Observation) and Odor (during the summer) (unit: %)

	Strongly agree	Generally agree	Neither agree or disagree	Slightly disagree	Disagree	Do not know
River views and water quality have been improved	10	8	2	0	20	60
Odor has been reduced	28	10	2	8	14	38

Source: Results of the beneficiary surveys

Table 14. Public Awareness on Coastal Views, Water Quality (with Visual Observation) and Odor (during the summer) (unit: %)

	Strongly agree	Generally agree	Neither agree or disagree	Slightly disagree	Disagree	Do not know
Coastal views and water quality have improved	12	34	14	14	18	8
Odor has reduced	22	28	10	12	22	6

Source: Results of the beneficiary surveys

As shown in Table 13, public awareness is relatively low with respect to improvement of the river views and water quality that can be observed visually. Only about 20% of the respondents indicated a positive response. On the other hand, about 40% of the respondents have recognized reduced odor. The response that one has not observed improved views and water quality supposedly results from frequent disposal of wastes into rivers, which is still practiced today.

Table 14 shows more respondents recognized the improvement in coastlines than in rivers, and about 50% of them answered that they “strongly agree” and “generally agree” with such improvement. For one reason, those who reside along the rivers have identified the positive changes thereof, while others may not be able to clearly observe such improvement. On the other hand, local residents in coastal areas are relatively aware of the changed view whereby they visit more frequently. Currently, a final disposal site located in the coast of Saida is being

removed, and this may have led to a response that odor has been reduced.¹²

Responses regarding the project impact on the tourism are shown in Table 15 (provided by 15 respondents).

Table 15. Public Awareness on the Project Impact on the Tourism (unit: %)

	Strongly agree	Generally agree	Neither agree or disagree	Slightly disagree	Disagree	Do not know
The project has a positive impact on the tourism.	0	0	13	13	73	7

Source: Results of the beneficiary surveys

Although the project has improved landscape views and water quality, few respondents perceive its effect leading to tourism promotion (Table 15). In fact, affected by the local security concerns in recent years, tourists in Lebanon have been decreasing as a whole (Table 16). Also, among other cities in the country, Saida has been regarded as one of those cities with a deteriorating security situation, the local tourism has a trend of stagnation.

【Reference】

Table 16. Changes in the Tourist Population in Lebanon (unit: person)

Year	2010	2011	2012	2013
Number of tourist	2,168,000	1,655,051	1,365,845	1,274,362

Source: Ministry of Tourism of Lebanon

3.4.2 Other Impacts

(Impacts on the Natural Environment)

Measured by an environmental NGO, coliform units observed in Saida coastal area are shown in the table below.¹³

Table 17. Coliform Count in Saida Coastal Area

Year	2007	2013
Number of coliform colonies (per 100 ml)	244	50

Source: Arab Forum for Environment and Development

¹² Jointly pursued by the Ministry of Environment and UNDP from 2012 to 2015, a project to remove the final disposal site operated since 1982 is mostly completed as of June 2015.

¹³ The wastewater treatment plant constructed by the project is located about 200 m from the coastline.

The coliform count has been significantly improved since 2007, mostly achieving the global standard. For instance, given that the Environmental Protection Agency of the United States sets out the (recreational) water quality criteria for an allowable coliform count not more than 250 per 100 ml,¹⁴ figures in the table are generally satisfactory.

This improvement is primarily attributed to the project effect as well as the removal of the final disposal site which has been used for a long time in the coastal area of Saida.

(Resettlement and Land Acquisition)

Although the project involved no involuntary resettlement, it required a significant time to acquire land for distribution reservoirs, pumping stations, a tunnel and a wastewater treatment plant. The land price related to the acquisition had been determined in the process duly guided by a judge in charge of land property transactions. Therefore, the project entailed no enforced proceedings, though requiring time.

Table 18. Outline of the Land Acquisition

	Acquired land area (m ²)	Number of land owners (person)
Kesrouan	51,000	596
Saida	104,000	14

Source: Questionnaire responses

As described above, local residents have recognized that the water supply project in Kesrouan has increased the amount of available water and has reduced the duration of water cutoff, while also improving their household efficiency and living standards. In the sewerage extension project in Saida, some local residents indicated that river and coastal views and odor problems have been improved. On the other hand, the project has not yet made expected visible impact that helps develop attractive tourist spots by reducing coastal pollution, ultimately promoting the local tourism.

In summary, the project has evidently demonstrated its effects. It has gradually increased the population covered by the water supply and sewerage systems, meeting the target criteria of the water quality defined in project indicators such as the portable water standard and BOD removal rate. Local residents in the target areas have experienced positive impact that hours of the water supply have been extended and their living standards improved.

In light of the above, the project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

¹⁴ Kinji Yamada. "Criteria Applied Overseas related to Coliform Bacteria." *Journal of Japan Sewage Works Association*. Feb. 2013. Japan Sewage Works Association.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

The water supply systems in Kesrouan are operated by BMLWE. According to the organization, the number of full-time employees is in shortage, with approximately only one third of staff allocated. BMLWE therefore employs temporary staff to engage in operation and maintenance of the facilities.

The sewerage plants are operated and maintained by SLWE. The actual service provider pursuing regular operations and maintenance work is a private company called Nicole Saba based on an agreement with SLWE which is responsible for monitoring of its services. The three-year contract is likely to be renewed in September 2015. Under the project director, Nicole Saba allocates a total of 44 employees, which is mostly sufficient to operate and maintain the project's treatment plant, consisting primarily of staff members serving logistics (25 in total including 18 plant operators), machine maintenance (7 persons), electric facilities (5 persons), laboratory (2 persons), accounting and secretaries.

In summary, in terms of sustainability of BMLWE's organizational structure, it poses a challenge, when evaluated from the above situation, which it relies on temporary contract basis workers for its operation and maintenance. SLWE, on the other hand, has managed operation and maintenance, flexibly using an outsourcing scheme. This is evaluated to be sustainable to a certain degree at present.

3.5.2 Technical Aspects of Operation and Maintenance

Evaluation of BMLWE's operation and maintenance performances in the past indicates it has rarely experienced technically unsolvable problems, and the organization now duly manages the services.

However, it is partly uncertain how BMLWE will continuously develop technical capacities for staff. Regulations stipulating on the establishment of BMLWE mandate that an organization structure should include a labor safety and training department to conduct refresher training programs. Currently, it implements no periodical and systematic training, while practically relying on OJT to have its staff learn techniques within their organization. In fact, with such OJT-based technical learning, staff can carry out most of their routine works, though, ideally, technical capacity development should be planned and provided in a coherent manner. Related to this issue, UNICEF plans to offer a training opportunity in 2015.

In SLWE, on the other hand, staff attends a training based on its annual training plan. In 2014, it offered courses in the subjects of GIS, IT, water management, drainage, chlorination and laboratory testing. In addition, in October 2014, 8 SLWE staff participated in the water supply and sewerage training in Jordan funded by USAID.

As an actual operator of the treatment plant, Nicole Saba has a system to provide various training programs on a quarterly basis, focusing on operational improvement. In addition, the company has experiences of participating in overseas training programs assisted by Sweden, Holland, Spain and France, which indicates its training system has been developed in general.

The company has had no major problems so far in terms of operation and maintenance performances, supposedly matching a certain level of techniques.

In summary, while no major problems have been identified with respects to operation and maintenance techniques in the both projects, BMLWE has partly a technical concern as mentioned above.

3.5.3 Financial Aspects of Operation and Maintenance

Estimated expense of BMLWE's operation and maintenance in 2014 include 330,000 USD for salaries, 200,000 USD for electricity (regular power distribution), and 750,000 to one million USD for fuels (for an independent power generation). As local power supply is unstable, and is available about 10 to 14 hours a day on average, therefore requiring an independent power generation for the remaining hours.¹⁵ As a result, operational costs have been increasing.

On the other hand, among four other Water Establishments, BMLWE has a better revenue condition that its service areas covering Beirut, which has been reaching the cost recovery level to achieve a balance of payments.¹⁶

SLWE proposed its operation and maintenance costs for 2014 in the sum of 990,000 USD, including 772,000 USD for operation and maintenance (service contract expenses), 136,000 USD for fuels, and electricity for 82,000 USD. However, due to non-payment of the water supply and sewerage services in the target areas, SLWE has been unable to fully obtain the water charges that should have been collected.¹⁷ Given this circumstance, SLWE operates with the government's financial support.

As indicated above, both organizations have some challenges to be addressed for the future, including financial improvement by systematizing water rate collection, reducing fuel expenses and redressing non-subsidized operations. On the other hand, given that the water supply and sewerage services are essentially basic needs of people, it is highly likely that the government will continue to subsidize these operations. Its officials have a similar prospect.

In summary, although operation and maintenance of both project outputs have no major problems in terms of finance that may disrupt a future service delivery, some of the issues as

¹⁵ Financial statement was unavailable for this ex-post evaluation, as they are not disclosed.

¹⁶ Source: Lebanon - Social impact analysis: electricity and water sectors. Washington, DC: World Bank, 2009

¹⁷ The Ministry of Water and Energy is working for applying a water rate collection system based on the amount of water used in each household, and the pilot areas have started to set up water meters. Targeting 2021, the Ministry of Water and Energy intends to gradually extend the coverage of water meters so that each Water Establishment will be able to operate with/based on its own cost recovery revenue.

mentioned above need to be addressed, including systematized water rate collection.

3.5.4 Current Status of Operation and Maintenance

The water supply facilities have been duly operated so far. In the sewerage systems provided, SLWE outsourced a repair of a pumping station to a private company in 2012, and has identified no critical problems in facility operations.

However, the sewerage systems need to cope with the following issues to ascertain higher sustainability in operation and maintenance.

1) Treatment of wastewater released from local industrial plants

Untreated wastewater is disposed from tanning factories, paint manufacturers, and soap factories. In particular, wastewater released from tanning factories are highly acid, affecting drainage pipes and water treatment systems extensively¹⁸.

2) Maintenance responsibility and implementation of drainage pipe clearing

Article 221 of the Water Act in Lebanon defines that Water Establishments are responsible for maintenance of drainage pipes. Accordingly, the Saida project has included drainage pipe cleaning as a part of a service agreement with the entrusted private company. Provided with a truck designed for drainage pipe cleaning from UNICEF in 2014, an outsourced company, Nicole Saba, now pursues cleaning works which had not been carried out much frequently until then. This should be continued on a regular basis in accordance with a cleaning schedule.

SLWE is preparing a cost plan equivalent to about 800,000 USD related to a renewal of the installed facilities and equipment. Part of this budget is already allocated to purchase six pumps in 2015 (about 230,000 USD). BMLWE, on the other hand, does not need to renew the project's facilities and equipment for the time being, and will cope with any damage within its ordinary budget.

As mentioned in the financial sustainability section, an unstable power supply has resulted in more financial burden for BMLWE and SLWE than necessary. Power supply is usually available to BMLWE for half a day, while SLWE can obtain the supply for 18 hours per day in general, and 12 hours during the rainy season. The voltage is also unstable, frequently disrupted, which decreases operational efficiency of pumps. According to BMLWE, an independent power generation requires the cost approximately more than five times than the regular power distribution.

¹⁸ The Ministry of Environment assumes a primary role in monitoring and inspection of wastewater released from industrial plants (The Ministry of Industry is also involved in providing administrative guidance).

In summary, the current status at the time of the ex-post evaluation is that the project facilities have been operated regularly without serious failures or damages, however, from a mid- and long-term point of view, there remain some issues to be addressed for stable facility operations.

In light of the above, some minor problems have been observed in institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project has aimed at addressing problems of water shortage and wastewater treatment by developing water supply and sewerage systems in Saida and Kesrouan in Lebanon, thereby contributing to the improvement of the living environment of the local residents. This objective has been consistent with the country's development policy and needs as well as Japan's ODA policy both at the time of the project appraisal and ex-post evaluation. Therefore, the relevance of the project is high.

The project period, on the other hand, has largely exceeded the original plan resulting from such external factor as Israel's air strikes and internal problems related to the executing agency, namely land acquisition, design modifications, a prolonged process of approving a tunneling work. While the project cost is within the original plan, it is primarily because a part of the intended outputs were cancelled. Therefore, the project efficiency is evaluated to be low.

As for the project effectiveness, the water supply population has been gradually increasing in Kesrouan, achieving the target value for 2015 as of the ex-post evaluation. Many of the local residents have recognized more stable water supply and higher household efficiency than before. Population covered by the sewerage systems in Saida, has been also increasing, while also the local residents are aware of improved coastal views and odor to a certain degree. In addition, the wastewater treatment plant has mostly achieved the expected BOD reduction rate. In light of the above, the project effectiveness and impact have been high.

In terms of the project sustainability, no technical problems have been identified both at BMLWE operating and maintaining the Kesrouan water supply system and SLWE operating and maintaining the Saida water treatment plant. On the other hand, the ex-post evaluation study identified organizational problems such as the number of employees (related to BMLWE) and a financial problem (related to SLWE), which may affect stable operations in the future. Therefore, the project sustainability is evaluated to be fair.

In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(Recommendations to both BMLWE and SLWE)

1) The third network extension of the water supply and sewerage systems

To make best use of the project benefits, it is of utmost importance to extend the water supply and sewerage networks to households. While BMLWE and SLWE have been working for the installation, it is recommended that this should be continued in the future.

2) Ensuring collection of water rate

It is suggested that the percentage of collecting water supply and sewerage rates should be increased. This will directly contribute to financial improvement of Water Establishments. While currently implemented on a trial basis in the country, a meter-based system should be expanded in wider areas to urgently achieve a service delivery supported by the cost recovery. The ex-post evaluation study recommends the introduction of immediate and wider coverage of a meter-base system even to the coverage area of BMLWE, whose cost recovery has been reportedly been realized. It promises to promote the organization's financial improvement.

3) Stabilization of power supply

Unstable power supply has led to more cost burden than required for Water Establishments. Although such power supply itself cannot be attributed to BMLWE and SLWE, they need to strongly request related ministries to improve local power generation and distribution, ensuring the stability.

(Recommendation to BMLWE)

4) Allocation of a proper number of staff

Currently, BMLWE is understaffed, and therefore is managing regular operations by allocating temporary contract basis workers. In terms of sound organizational management, it is of vital importance to make techniques, experiences and lessons shared and established within an organization, which will certainly lead to more consistent facility operation and maintenance. BMLWE is recommended to plan increasing the personnel and deliver the plan to obtain an appropriate number of full-time workers.

5) Measures against water leakage

Currently, high water leakage rate is a problem in operating the water supply service. Reduction of the water leakage rate can contribute to increase profit of the Water Establishments. To cope with this, it is recommended to repair and replace water pipes.

(Recommendation to SLWE)

6) Ensuring that drainage pipe cleaning is carried out

In Saida, a private company outsourced by SLWE is cleaning drainage pipes with a cleaning truck. Regular cleaning of drainage pipes is one of the indispensable maintenance works, requiring an established practice. SLWE thus needs to prepare a cleaning schedule specifying sites and timing and ensure the implementation.

4.2.2 Recommendation to JICA

None

4.3 Lessons Learned

1) Points to be paid attention in a project, which is jointly implemented by line ministries and executing agencies

This project had been jointly implemented by the Ministry of Water and Energy responsible for the water sector and CDR in charge of reconstruction and development efforts of the country. In practice, their roles were assumed in a way that the Ministry of Water and Energy pursued preliminary planning, preparation and post-project management, while CDR an executing role separately during the project period. In a country recovering from the civil war, this kind of execution structure is understandable. However, the inter-agency information sharing had been sometimes less promoted than expected. As a result, information related to the project's land acquisition process had not been handed over sufficiently, making it difficult to complete the planned number of facilities and requiring significantly longer time than intended.

In a project in which different agencies are planned to start the implementation at different timelines, it is essential for its step-by-step delivery to check elaborately in advance to what extent they share information regularly. To do so, not only executing agencies, but also JICA, as a coordinating body, may serve as a liaison to provide an independent checking mechanism.

-End-

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1.Project Outputs	<p>Kesrouan site: Water supply project Madiq catchment extension Water transmission facility Water transmission tunnel: 5 km Water transmission pipes: 44.5 km Pumping stations: 13 Distribution facilities Distribution reservoir: 22 Distribution lines: 202 km</p> <p>Saida site: Sewerage extension project Sewer lines: 37.8 km Main sewer line: 6.8 km</p> <p>Sewer pumping stations: 2 Water treatment plant Inlet pump: 1 Outlet pump: 1 Primary treatment plant: 1 Outfall sewer: 1.7 km</p>	<p>Kesrouan site: Water supply project Madiq catchment extension Water transmission facility Water transmission tunnel: 5 km Water transmission pipes: 61 km Pumping stations: 6 Distribution facilities Distribution reservoir: 11 Distribution lines: 59 km</p> <p>Saida site: Sewerage extension project Sewer lines: 42.52 km Main sewer line: 2.354 km (A total of 6.8 km was constructed combined with other project.)</p> <p>Sewer pumping stations: 4 Water treatment plant Inlet pump: 1 Outlet pump: 1 Primary treatment plant: 1 Outfall sewer: 1.9 km</p>
2.Project Period	March 1997 - November 2001 (57 months)	March 1997-November 2011 (177 months) or *(130 months) when 47 months were excluded from the above as a period affected by Israel's air strikes
3.Project Cost		
Amount paid in Foreign currency	6,436 million yen	Unknown
Amount paid in Local currency	8,119 million yen (local currency)	Unknown (local currency)
Total Japanese ODA loan portion	133,152 million LBP 14,555 million yen 13,022 million yen 1LBP=0.0609JPY (As of October 1995)	Unknown 13,705 million yen 12,949 million yen 1LBP=0.0710JPY (Average between January 2000 through November 2011)
Exchange rate		