India
Kolkata Metropolitan Development Authority
Uttarpara-Kotrung, Konnagar, Rishra
Serampore, Baidyabati, Champdani,

India
Technical Assistance for Kolkata Solid Waste Management Improvement Project
Final Report

August 2017

Japan International Cooperation Agency

(JICA)

Yachiyo Engineering Co., Ltd.

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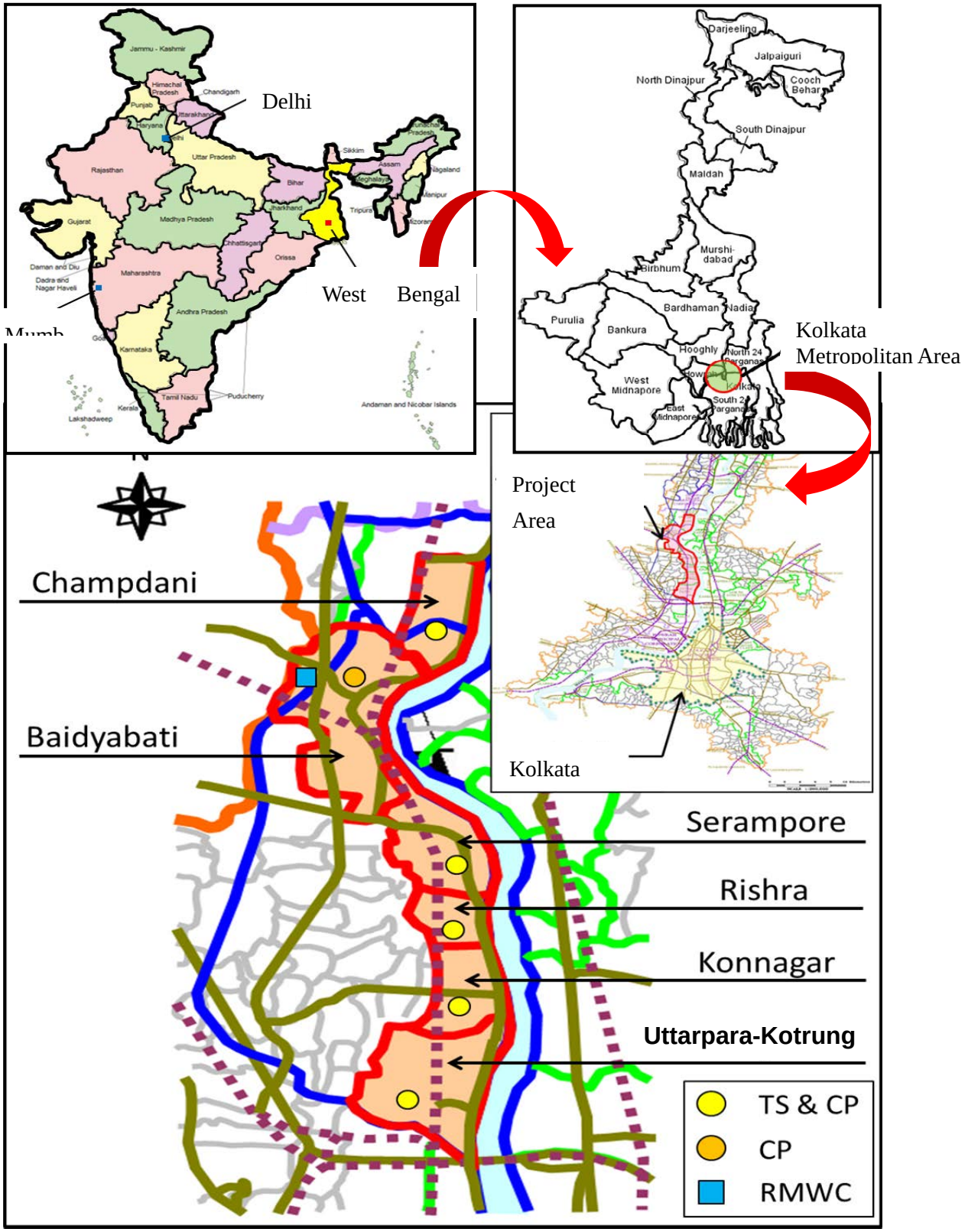
Map


Delhi
West Bengal
Kolkata Metropolitan Area
Project Area
Kolkata
Champdani
Baidyabati
Serampore
Rishra
Konnagar
Uttarpara-Kotrung
TS & CP
CP
RMWC
Darjeeling
Jalpaiguri
North Dinajpur
Cooch Behar
South Dinajpur
Maldah
Murshi-dabad
Birbhum
Bardhaman
Nadia
Purulia
Bankura
Hooghly
North 24 Parganas
Howrah
West Midnapore
South 24 Parganas
East Midnapore
Jammu - Kashmir
Himachal Pradesh
Chandigarh
Punjab
Uttarakhand
Haryana
Uttar Pradesh
Rajasthan
Bihar
Sikkim
Assam
Meghalaya
Nagaland
Manipur
Tripura
Mizoram
Jharkhand
Gujarat
Madhya Pradesh
Chhattisgarh
Orissa
Daman and Diu
Dadra and Nagar Haveli
Maharashtra
Andhra Pradesh
Karnataka
Goa
Tamil Nadu
Puducherry
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Lakshadweep
Andaman and Nicobar Islands

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List of Abbreviations

Acronym	Definition
ADM	Additional District Magistrate
C/P	Counterpart
CE	Chief Engineer
CEO	Chief Executive Officer
CP	Compost Plant
DA	District Administration
DO	Dissolved Oxygen
EC	Electrical Conductivity
EMP	Equipment and Manpower Plan
FDG	Focus Group Discussion
GW	Ground water
ICDS	Integrated Child Development Services
IFFCO	Indian Farmers Fertilizer Cooperative LTD.
INR	Indian Rupees
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
JPY	Japanese Yen
KMDA	Kolkata Metropolitan Development Authority
KMWSA	Kolkata Metropolitan Water and Sanitation Authority
KSWMIP	Kolkata Solid Waste Management Improvement Project
LEL	Lower Explosion Limit
MAD	Municipal Affair Department
MOU	Minutes of Understanding
O&M	Operation and Maintenance
OJT	On the Job Training
PPM	Parts Per Million
P&RD	Panchayat and Rural Development
PT	Property Tax
RWMC	Regional Waste Management Centre
SAPROF	Special Assistance for Project Formation
SAPI	Special Assistance for Project Implementation
SCP	Secondary Collection Point
SI	Sanitary Inspector
SLS	Sanitary Landfill Site
SWM	Solid Waste Management

t/d	ton per day
TA Project	Technical Assistance for KSWMIP
TS	Transfer Station
TT container	Tractor Trailler continer
UDD	Urban Development Department

CHAPTER 1. SUMMARY OF THE PROJECT

1.1 Background

Japan International Cooperation Agency (hereinafter referred to as "JICA") implemented the Special Assistance for Project Formation (hereinafter referred to as "SAPROF") study in 2005 in response to the request of the Government of India, and started the "Kolkata Solid Waste Management Improvement Project (hereinafter referred to as "KSWMIP")", in 2007 as the following figure. This ODA loan project procured necessary equipment and constructed waste treatment facilities. The equipment and facilities were not fully utilized due to insufficient management capacity of municipal staff in charge of waste management and due to improper waste separation with low awareness of the residents. Furthermore, an organization for facility management was not decided among the related local governments, and a necessary budget for Operation and Maintenance (hereinafter referred to as "O&M") was not secured. Under such situation, JICA determined to implement the "Technical Assistance for KSWMIP" (hereinafter referred to as "TA Project").

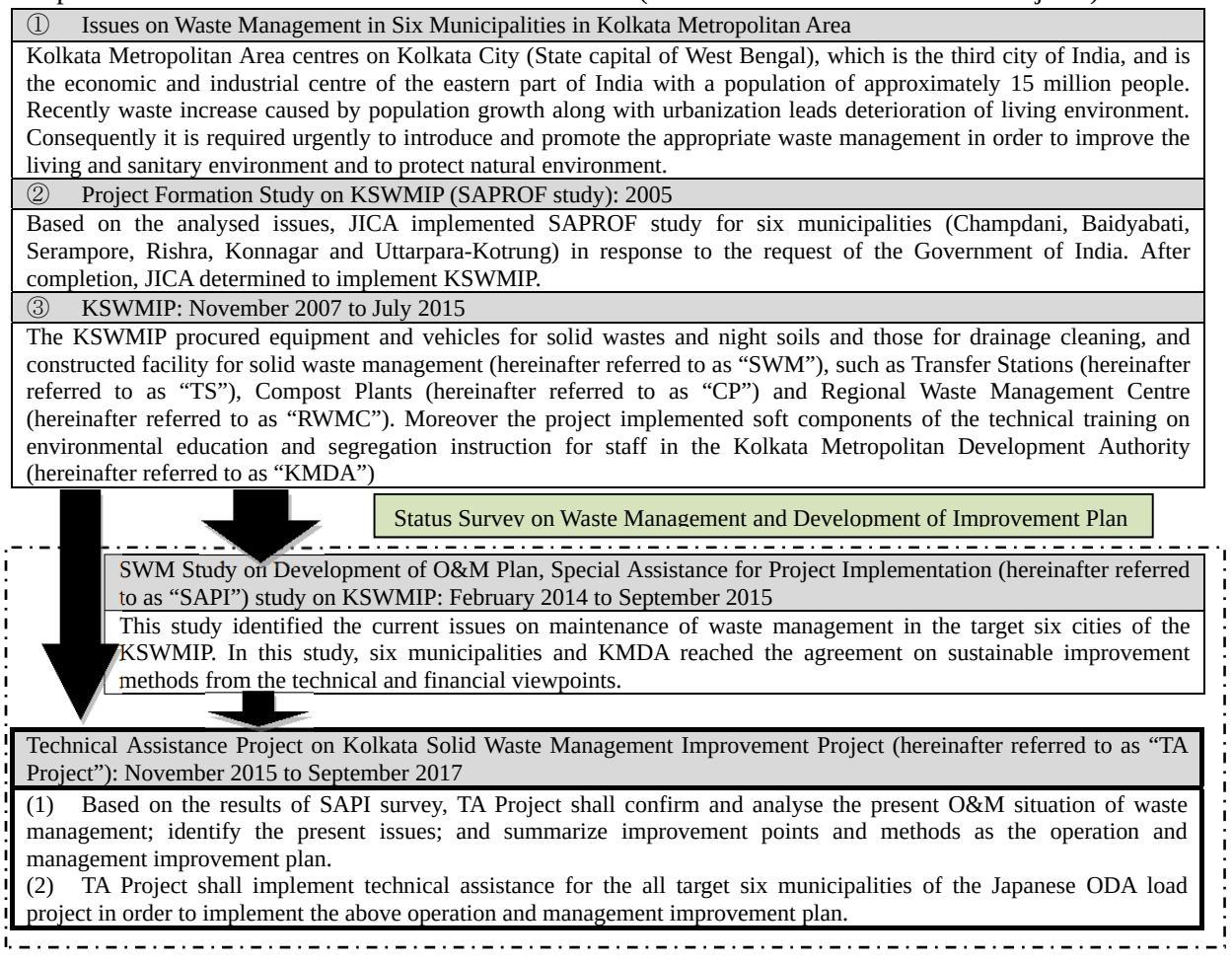


Figure 1-1 Background of this Project and Necessity of Additional Technical Assistance

1.2 Purpose

Based on the background, purpose and contents of KSWMIP, TA Project studies the O&M methods and environmental awareness activities with the counterpart (hereinafter referred to as "C/P") members in order to

make the most of the functions of the procured equipment and vehicles and constructed facility. With the results of this study, TA Project develops the operation and management improvement plan with C/P members, and transfers technologies on the facility O&M methods to the six municipalities in Kolkata Metropolitan Area in West Bengal State. In terms of environmental awareness activities on waste management, TA Project introduces the Japanese advanced knowledge and activities, especially on Reduce, Reuse, and Recycle to enhance the effect of KSWMIP.

1.3 Framework of Implementation of the Project

1.3.1 Target Areas and Wastes

■ Target Areas

The target areas of TA Project are the six municipalities, which are Champdani, Baidyabati, Serampore, Rishra, Konnagar and Uttarpara-Kotrung, in Kolkata Metropolitan Area in West Bengal State.

■ Target Wastes

The target wastes of TA Project are municipal solid wastes and night soils.

1.3.2 Implementation Agencies

C/P members and related agencies of TA Project are as follows;

1. C/P	KMDA and six municipalities (Uttarpara-Kotrung, Baidyabati, Konnagar, Serampore, Rishra and Champdani) in Kolkata Metropolitan Area in West Bengal State
2. Related agencies	Department of Urban Development, Government of West Bengal
3. Beneficiary	Direct beneficiary: staff in KMDA and six municipalities Indirect beneficiary: Residents in six municipalities

1.3.3 Implementation System

Figure 1-2 shows the implementation system of TA Project.

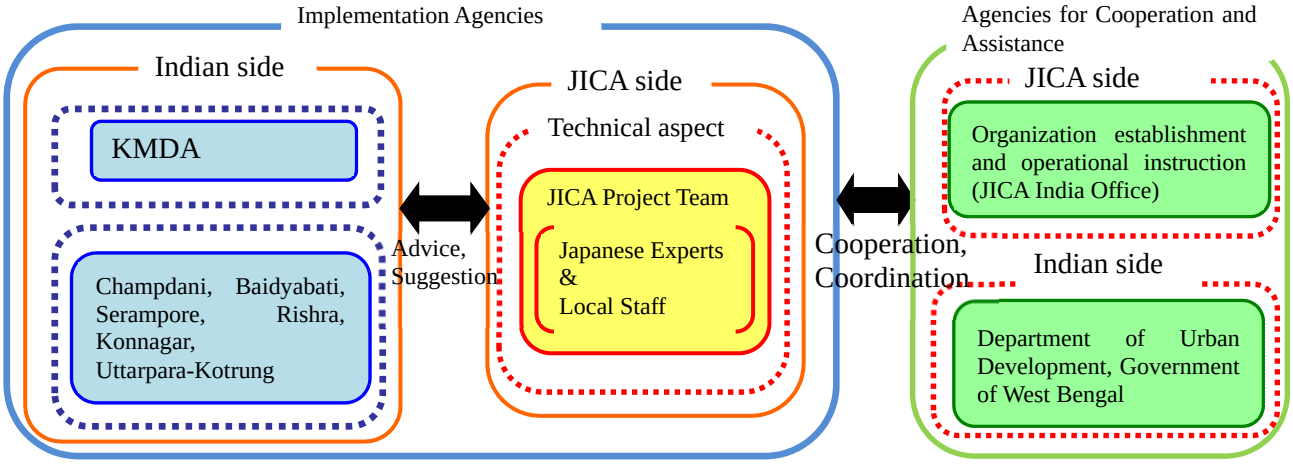


Figure 1-2 Implementation System of this Project

1.3.4 Responsibility and Scope of Work of the Consultant

The responsibility of the Consultant including the local staff namely JICA Project Team (hereinafter referred to as "JPT") of TA Project is to contribute to achievement of "1.2 Purpose" of TA Project. On the other hand, the largest issue of KSWMIP is that the O&M organization of constructed facility is not established and the O&M budget is not secured. This issue should be solved by the Indian side. JPT shall study and identify the background and reasons of this issue, and provide technical support, such as suggesting organization plans and methods of securing the O&M budget.

CHAPTER 2. ACHIEVEMENT OF ACTIVITIES

2.1 Efforts of Ensuring Sustainability after the Closure of the Japanese ODA Loan

JPT has consulted with KMDA and the six municipalities to secure the O&M cost, however the situation has not been improved. Consequently, JPT requested Chairman of the Municipal Affair Department (hereinafter referred to as "MAD") of West Bengal State Government to arrange a coordination meeting through JICA to address the issue.

(1) On 24 August, 2016, a joint coordination meeting among Urban Development Department (hereinafter referred to as "UDD") and MAD and the six municipalities was hold with presence of Minister of UDD and MAD. The meeting announced the underlying policy. TA Project will provide technical support to the six municipalities under the policy.
   1. The municipalities will submit their reasonable requirements in respect of manpower, equipment & machineries for consideration of the MAD. The municipalities will make every effort to make the cities clean and free from garbage.
   2. SWM Sector, KMDA in consultation with municipalities will prepare a consolidated requirement for Tractor Trailler container (hereinafter referred to as "TT container"), Pushcart and Tricycles which are damaged / additionally required for better performance of SWM for arrangement of fund from MAD.
   3. MAD will consider to provide realistic manpower support to the municipalities for operation of new SWM facilities.
   4. MAD shall consider extending permission for utilization of 14th Finance Commission Fund for O&M for the TS/CP and to help the municipalities overcome shortfall of fund for the same.
   5. Kolkata Metropolitan Water and Sanitation Authority (hereinafter referred to as "KMWSA") will provide technical support to the municipalities for O&M of the RWMC.
   6. Baidyabati Municipality will operate the RWMC after expire of the present O&M term and O&M fund will be arranged by MAD.
   7. KMDA officials, in consultation with the municipalities, prepare realistic requirement of battery operated vehicles for primary collection and waste for the MAD to provide fund and specification of the vehicles to the municipalities. Municipalities will procure such vehicles through e-tendering.
   8. The Municipalities shall prepare Action Plan for sustainability on the stipulation of the Minutes of Understanding (hereinafter referred to as "MOU") signed between KMDA and the Municipalities for which the SWM sector will extend support to the municipalities.
   9. MAD will ensure repair of the defective Compactors by deputing the concerned agency and that the chairmen will issue certificate only after they are thoroughly satisfied with the functioning of the compactors.

(2) MAD, KMDA and Baidyabati gathered on 27 February 2017, and they discussed O&M cost of RWMC. As a result, the contract of O&M cost will be extended for one month until end of March by using budget of KMDA, and the bidding of O&M after this April will be proceeded although the budget of O&M has not been approved by the state government yet.

(3) KMDA, KMWSA, chairman of Uttarpara-Kotrung, Baidyabati and Rishra, SIs in the five municipalities except Champdani have discussed O&M cost of TS/CP and RWMC. As the result, Baidyabati is in charge of O&M of RWMC, and the operation cost will be covered by support of MAD, as usual.

2.2 Preparation of Proposal of O&M cost for equipment and facilities required for SWM

2.2.1 Procurement Cost and Maintenance Fee for Waste Collection Equipment

In compliance with the discussion in the joint coordination meeting held on 24th August, 2016, chaired by Minister of UDD and MAD of state government, the municipalities had submitted preliminary proposal for budget on repair and replacement of primary and secondary collection equipment. MAD had reviewed the

proposal and approved Indian Rupees (hereinafter referred to as "INR") 6.535 million for repair and replacement of the equipment, as described in Table 2-1. KMDA made bidding announcement of repair and replacement of the primary and secondary collection equipment for the municipalities on 25 November, 2016. The repair and replacement work has been almost completed. Shown in the Table 2-2 is waste collection equipment to be delivered and repaired at each municipality. MAD is now reviewing remaining application amount.

Table 2-1 Approved subsidy for Repair and Renewal of Primary and Secondary Collection Equipment

Municipality	Requested Amount (INR 1,000)	Approved Amount (INR 1,000)	Remaining Amount (INR 1,000)
Uttarpara-Kotrung	3,696	3,696	0
Baidyabati	5,814	649	5,165
Konnagar	4,824	126	4,698
Rishra	7,079	779	6,300
Serampore	11,399	983	10,416
Champdani	3,180	302	2,878
Total	35,992	6,535	29,457

Table 2-2 Primary and Secondary Collection Equipment to be Delivered and Repaired

Municipality	Renewal		Repair	
	Push Cart	Tricycle	TT Container	Tricycle
Uttarpara-Kotrung	—	—	120	76
Baidyabati	14	28	—	—
Konnagar	6	4	—	—
Rishra	—	41	—	—
Serampore	38	35	—	—
Champdani	6	14	—	—

2.2.2 Manpower Cost and O&M Cost for TS/CP

The six municipalities submitted the proposal for repair and procurement of primary and secondary collection equipment as mentioned above, and INR 6,535 million has been approved. However, contents of the proposal are exclusively for primary and secondary collection equipment, and it was insufficient to implement sustainable waste management. The five municipalities except for Uttarpara-Kotrung have prepared and submitted another proposal of the Equipment and Manpower Plan (hereinafter referred to as "EMP") including manpower cost of primary and secondary collection and O&M cost of TS/CP to MAD. However, MDA has not made a response as of July, 2017.
Required manpower and O&M cost is summarized below.

Table 2-3 Summary of Required Equipment and Manpower Cost

Municipality	Required Manpower Cost (INR 1,000/year)	O&M Cost of TS/CP (INR1,000/year)	Submission date of the EMP
Uttarpara-Kotrung	-	7,600	7th June 2017
Baidyabati	8,089	2,888	10th Jan. 2017
Konnagar	6,958	4,835	18th Jan. 2017
Rishra	12,726	4,476	22nd Feb. 2017
Serampore	11,575	4,218	25th Jan. 2017
Champdani	14,638	4,115	13th Jan. 2017

2.2.3 O&M Cost for RWMC

Baidyabati prepared EMP for calculating O&M Cost of RWMC and submitted the EMP to MAD on January 10, 2017. MAD approved the EMP on April 15, 2017, however covered by the subsidy was only the cost for three months of operation from April to June 2017. Baidyabati again applied for the subsidy to MDA late April for operation after July, however, no comment has been back from MAD as of the beginning of July, 2017.

Table 2-4 O&M cost for RWMC

Estimated Cost (INR 1,000/year)	Submission Date	Approved Subsidy (INR 1,000)	Approved Date
18,288	10th Jan. 2017	4,500	15th Jan. 2017

2.3 Formulation of Action Plan for Improvement of SWM

TA Project has prepared Action Plan for Improvement of SWM, since June 2016, however, MAD requested municipalities to prepare another Action Plan for sustainability on the stipulation of the MOU signed between KMDA and the Municipalities. In addition, the municipalities were requested to prepare EMP as well responding the joint coordination meeting held on 24th August, 2016. As result there are three separated plans on SWM in the municipalities, Action Plan of TA Project, Action Plan related to signed MOU and EMP. TA Project is reviewing and modifying Action Plan of TA Project as integrated plan of these plans.

2.4 Transition of the Incoming Amount of Waste to the Facilities

2.4.1 RWMC

Shown in the Table 2-5 and Figure 2-1 below are the incoming amount of waste by month at RWMC. The incoming amount at RWMC has increased compared to the baseline amount from the beginning of the project implementation, now that it counts 117.5 ton per day (hereinafter referred to as "t/d") which is 56 % of the designed value. In 2017, the municipalities see slow growth of incoming amount for lack of equipment for primary collection while West Bengal State Government subsidized on procurement and repairing of equipment for waste collection late October of 2016 and primary collection equipment will be given to the municipalities. Incoming amount subsequently is expected to increase after the betterment of the equipment preparation. Waste delivered from the four municipalities except for Uttarpara-Kotrung and Baidyabati of Model City is mixed waste including compostable waste.

Table 2-5 Incoming waste amount at RWMC (Municipal Waste)

Unit：t/d

Municipality	Incoming amount in May, 2017	Baseline (January 2016)	Design value
Uttarpara-Kotrung	18.64	16.9	42.0
Baidyabati	24.03	22.8 (Mixed Waste)	30.0
Konnagar	18.27 (Mixed Waste)	14.1 (Mixed Waste)	20.4
Rishra	20.26 (Mixed Waste)	Nil	31.8
Serampore	31.52 (Mixed Waste)	14.1 (Mixed Waste)	55.2
Champdani	4.78 (Mixed Waste)	0.1	28.8
Total	117.50 (56%)	68.0 (33%)	208.2 (100%)

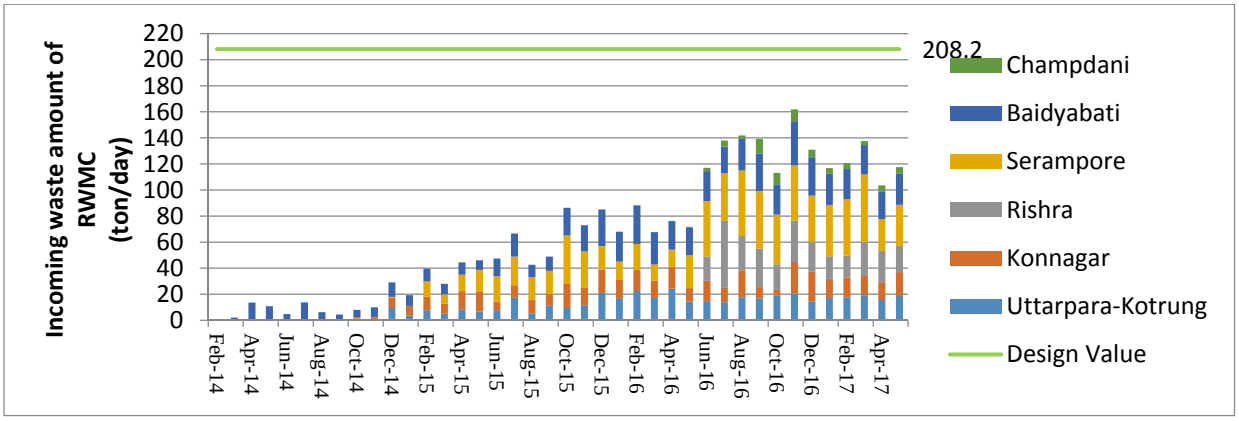


Figure 2-1 Incoming waste amount at RWMC (Municipal Waste)

From 15th April 2016 the quantity of sludge is being weighed and the data available is in t/d at RWMC. Most of septic sludge is not transported to RWMC, and only 3.64 t/d corresponding 7% to the design value is received at RWMC. Private sludge-removal companies are collecting the sludge at lower fare than the municipal service for open dumping, which accounts for the low achievement level. Uttarpara-Kotrung and Konnagar have not transported the septic sludge collected to RWMC due to long distance from RWMC. Uttarpara-Kotrung, however, has procured large tanker and is planning to deliver sludge to RWMC from July 2017.

Table 2-6 Incoming Amount of Sludge at RWMC

Unit: t/d

Municipality	May 2017	Baseline (January 2016)	Design value
Uttarpara-Kotrung	n/a	n/a	11.0
Konnagar	n/a	n/a	8.3
Rishra	0.13	1.18	7.1
Serampore	2.13	1.97	11.0
Baidyabati	0.69	1.14	5.5
Champdani	0.69	1.33	7.3
Total	3.64 (7.2%)	5.62 (11.1%)	50.2 (100%)

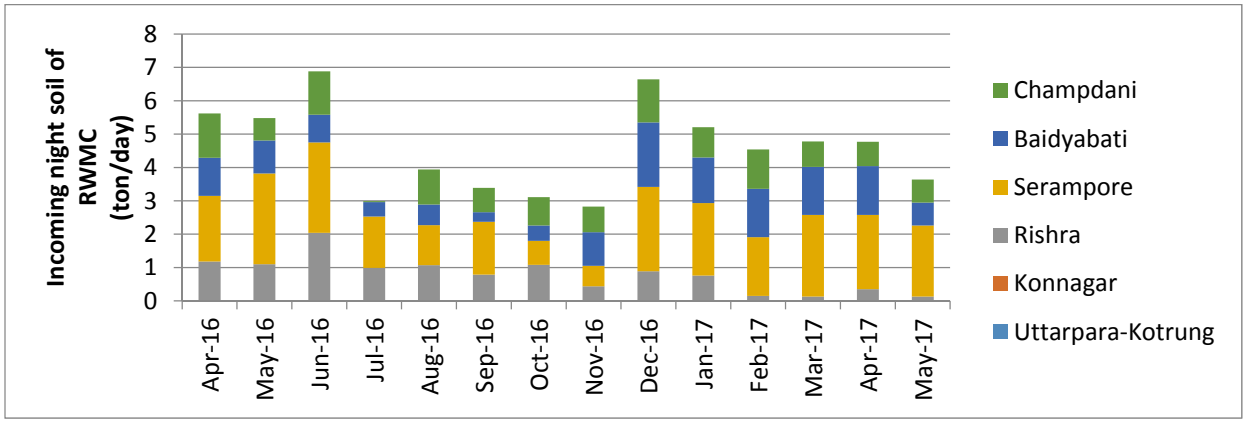


Figure 2-2 Incoming Amount of Sludge at RWMC

2.5 Formulation of Model City

JPT chose Uttarpara-Kotrung and Baidyabati as model cities out of the six municipalities implementing

KSWMIP in, and put focus on in the provision of technical instruction. In result, following improvements are found, and the cities are qualified as representatives.

2.5.1 Uttarpara-Kotrung

(1) Improvement in the Waste Collection

- The amount of collected waste has not been increased, however the quality of segregation has been improved.
- Waste collection vehicles can be repaired at the own workshop.
- Waste collection vehicles can be washed at the own workshop.
- Waste amount is measured appropriately and data is being reviewed.
- Auto-tipper vehicle is collection waste from waste handlers of primary collection to optimize their operation and directly deliver collected waste to TS/CP. The idea was brought by the Municipality and the auto-tipper vehicle was purchased by municipal budget.

(2) Improvement in the Faecal Sludge Management and Collection

- All the sludge is collected and being illegally dumped for the severe distance from the municipality to RWMC.
- The Municipality purchased large tanker. Sludge will be going to be transhipped from small tanker at TS/CP and will be delivered to the sludge management facility at RWMC.
- The aforementioned large tanker has been purchased by the own budget and is scheduled to be delivered to the TS/CP in the middle of July.

(3) Improvement of O&M at TS/CP

- The Municipality established TS/CP O&M organization within the municipality and allocated sufficient number of staff.
- The Municipality managed to prepare the O&M cost from the municipal budget.
- The Municipality has learnt appropriate method of TS/CP O&M.
- The Municipality initiated original idea of blending manure to improve the quality of compost.
- The Municipality installed deodorizing equipment at CP purchased by municipal budget.

2.5.2 Baidyabati

(1) Improvement in the Waste Collection

- The amount of collected waste has not been increased, however the quality of segregation has been improved.
- Waste collection vehicles can be repaired at the own workshop.
- Waste collection vehicles can be washed at the own workshop.

(2) Improvement of O&M at TS/CP

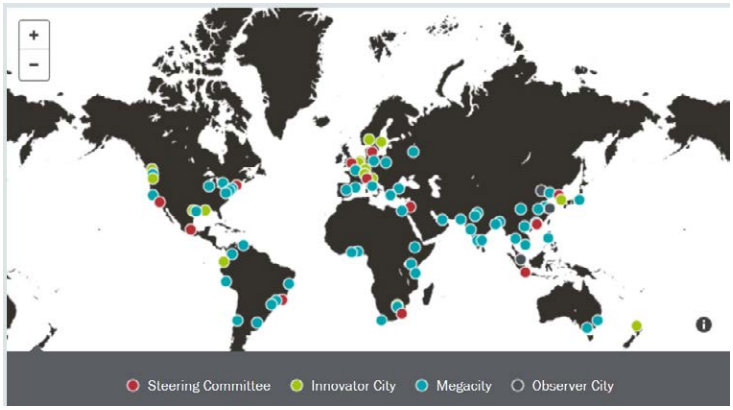
- The Municipality established TS/CP O&M organization within the municipality and allocated least required number of staff.
- The Municipality has built capacity of tender document preparation for private contractor.
- The Municipality is capable of managing the O&M contractor to certain extent.

(3) Improvement of RWMC O&M

- The Municipality established RWMC O&M organization within the municipality and allocated least required number of staff.
- The Municipality received O&M cost of RWMC from the West Bengal Government.
- The Municipality has built capacity of tender document preparation for private contractor.
- The Municipality established O&M management system using the daily log.
- The Municipality is capable of managing the O&M contractor to certain extent.

2.6 C40 Cities Award 2016

KSWMIP won an Award of C40 Cities Award 2016 in Mexico City on 1st December 2016.
C40 is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change. The 2016 C40 Cities Awards will once again aim to share highly replicable 'best practices' across cities and draw attention to outstanding performances that have achieved a high level of environmental success in a challenging context.



C40 Cities Award 2016

- Climate Action Plans & Inventories: Portland
- Adaptation Plans & Assessments: Paris
- Building Energy Efficiency: Melbourne & Sydney
- Clean Energy: Yokohama
- Finance & Economic Development: Shenzhen
- **Solid Waste: Kolkata Solid Waste Management Improvement Project (KSWMIP)**
- Adaptation in Action: Copenhagen
- Transportation: Addis Ababa
- Sustainable Communities: Curitiba
- Social Equity & Climate Change: Seoul

2.7 Ripple Effects of the KSWMIP to the Neighbour Cities

2.7.1 Site Visit by the Commissioner of Panchayat and the Rural Development

JPT introduced KSWMIP to the Commissioner of Panchayat and Rural Development (hereinafter referred to as "P&RD", Additional District Magistrate (hereinafter referred to as "ADM") of Hooghly District Administrator (hereinafter referred to as "DA") which the six municipalities are located in, and so on at RWMC and CP in Baidyabati April 5, 2017.

	
Site Visit by Commissioner and ADM	Presentation by JPT

2.7.2 Coordination meeting organized by ADM

ADM raised interest in KSWMIP after the site visit. Subsequently, ADM planned regional management system of waste involving neighbouring panchayats around the six municipalities of KSWMIP, and introduced the idea to the municipal chairman of KSWMIP, Pradhan, or heads of the panchayat, and JPT at a coordination meeting on April 19th, 2017. After 5 Gram Panchayats showed their interest in the idea in the meeting, ADM directed the chairman of the municipalities in KSWMIP to accept wastes from the neighbouring panchayats at TS/CP, and the chairman agreed to the instruction. ADM promised to apply for the subsidy for the municipalities to purchase waste collection equipment to West Bengal Government at the end of the coordination meeting, and requested JPT for technical assistance.

	
Coordination meeting	Presentation by JPT

2.7.3 Establishment of Regional Waste Management System involving Gram Panchayats

As of July 2017, ADM is processing the purchase of waste collection equipment with utilization of the owe budget of the DA. JPT is assisting in calculating number of equipment and vehicles. Gram panchayats of the target will initiate segregation of compostable waste and waste collection following to KSWMIP after obtaining the equipment. Collected wastes will be delivered to the closest TS/CP of KSWMIP from the gram panchayats.

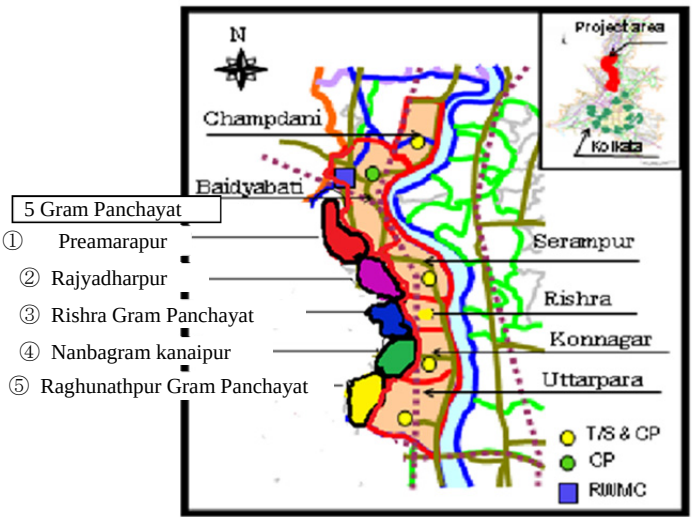


Figure 2-3 Location of Gram Panchayat

2.8 Guidance of Japanese Garden at Eco Park

TA Projejct dispatched two Japanese garden experts to advice construction of a Japanese garded in Eco Park as a support of environmental education activated implemented by the state government, responding strong request from the state government. The Japanese garden experts provide following advices and explanations on the construction site and workshop:

- To change the position some stone lanterns to a mountain or the small island,
- To place some speakers outside and to provide Japanese classical music to foster Japanse ambience,
- To instruct mehod of fabrication of bamboo fence with utilization of local materials
- To propose name of the Japnese gardent, and
- To explain principal of Japanese gardend through comparation between Japan and European countries

Opening ceremony of Japanese garden at Eco Park has been held on 28th February 2017 after the Japanese garden was rebuilt in accordance with Japanese garden expert advice. Attendances of the opening ceremony are Mr. Taga (Consul General), Mr. Hakim (Minister of the state urban development), Mr. Datta (Mayor), Mr. Sen (President of HIDCO), Mr. Lator (Garden Architect), etc.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Advice in the construction</td><td>Workshop on Japanese Garden</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Opening Ceremony</td><td>Japanese Garden</td></tr>
</table>

CHAPTER 3. ACTIVITY OF SURVEY AND PLANNING

3.1 Explanation of Inception Report and Work Plan

JPT has explained goal and summary of activities of TA Project to KMDA and the six municipalities. The six municipalities expressed position and corporative attitude to this project because they are strongly recognizing the problem on SWM including securing the operation budget for the facilities constructed by KSWMIP. The six municipalities are thinking of drawing financial support from West Bengal State Government through the project. Individual discussions and topics among the municipalities are shown in Table 3-1.

Table 3-1 Contents of Discussion and Topic

Organization	Date	Contents of discussion and topic
KMDA	December 3rd	The expert team explained to KMDA that the expert team intensively does technical assistance to Uttarpara-Kotrung and Baidyabati as model cities, and KMDA has understood it. It was confirmed that Chief Engineer and Superintending Engineer would be the C/P of TA Project. KMDA agreed to send a letter to the six municipalities for appointment of the counterpart and instruction of JPT.
Uttarpara-Kotrung	December 14th	The municipality contracted with a private company for operating CP without any commission fee and the private company started the operation on 9th December, 2015. The profit on sale of produced compost would be the company's profit. The municipality has an idea to sell the produced compost to some tea gardens in north area of the West Bengal. In addition, the municipality would like to organize the six municipalities and sell the composts produced from the six municipalities jointly due to the scale merit.
Baidyabati	December 10th	In order to secure operating costs of the facilities, Baidyabati has already submitted demanding paper written about financial support to MAD, government of West Bengal State. Also, in order to secure financial resources, Baidyabati has been starting collecting SWM fee from the residents.
Konnagar	December 14th	Although KMDA has indicated that KMDA is handing over TS/CP, Konnagar assumed that all of the works were not completed such as tree plantation.
Rishra	December 16th	Rishra requested the expert team to support awareness raising activity continuously in TA Project so that existing six social mobilizers still continue their activities.
Serampore	December 10th	Bins distributed by KMDA for segregating the waste have been deteriorated due to several years. Serampore requested to distribute the bins so that the bins are missing or broken. Serampore requested the expert team to support awareness activity for segregating waste so that construction work of TS/CP will been completed soon.
Champdani	December 16th	Bins distributed by KMDA for segregating the waste have been deteriorated due to several years. Champdani requested to distribute the bins so that the bins are missing or broken.

JPT explained the Inception Report which includes Uttarpara-Kotrung and Baidyabati as model cities where JPT intensively does technical assistance, KMDA has understood the concept. On the other hand, there are demands that six municipalities would like JPT not to exclude other four municipalities as model cities. Especially, the awareness raising activity, such as instruction of separation of organic waste, has been being at a standstill after suspension of the soft component activity under Japanese ODA Loan in December 2014. The six municipalities indeed requested JPT to resume these awareness activities with utilization of six social mobilizers in each municipality.

TA Project will conduct the awareness raising activity in four municipalities except for Serampore and Rishra with utilization of some social mobilizers. And then from 2nd year, awareness raising activity will be

conducted in all six municipalities including Serampore and Rishra municipality.

3.2 Survey of Contents of Waste Management, Organization and Financial in 6 Municipalities in Kolkata Metropolitan Area, West Bengal State.

3.2.1 Collection and Arrangement of Existing Materials/Data

Table 3-2 indicates handing over date of the facilities constructed by KSWMIP to municipalities and current situation of O&M as of December 2015. One year trial operation of the TS/CP in Uttarpara-Kotrung and Baidyabati with utilization of Japanese ODA loan was completed, and these facilities had been handed over to the two municipalities. Both of the municipalities had made a contract with a private company or the operation, and the private companies have just launched the operation of facilities.

Table 3-2 Handover Date of Related Facilities to Each Municipality and O&M Situation (As of December 2015)

Item	Handover date to the municipalities	Construction Contractor	Operation and Maintenance
TS and CP			
1. Uttarpara-Kotrung	30th October 2015	JUSCO	KMDA has handed over TS/CP to Municipality Municipality has hire private operation company from 9th December
2.Konnagar	January 2017	JUSCO	O&M of TS/CP will be started from January 2016 with utilization of ODA loan by the construction contractor. After handover Municipality will find some private operator to operate TS/CP. Municipality has an idea to find contractor who will operate TS/CP from the revenue generated from sale of compost and recyclable. There should not be any burden on municipality
3.Rishra	March 2017	S.G Construction	Construction is under process and 70% complete. Construction will expected to get completed by March 2016. O&M of TS/CP will be started from April 2016 with utilization of ODA loan by a operation company
4.Serampur	January 2017	D. Hati	Construction is 95% completed. O&M of TS/CP will be started from January 2016 by aoperation company
5.Baidyabati	2nd November 2015	JUSCO	Municipality hire a operation company from 9th Dec 2015
6.Champdani	October 2016	M.C Ghoshi	KMDA has hired a operation company for one year operation with utilization of ODA load since Oct 2015 Municipality will be handed over TS/CP in Oct 2016
RWMC	July 2016	SMS	TS/CP was constructed and O&M with utilization of ODA loan was started by a private operation company. Due to malfunction, new tender has been called by KMDA for the operation of RWMC. New private operation company started the operation from October 2015.

"Collection and Arrangement of Existing Materials/Data" had been conducted since January 2016 and the result is shown in below. In consideration of the result, JPT had prepared O&M Improvement Plan

(1) Outline of SWM

The six municipalities provide primary collection service with the residents basically six days per week. The secondary collection in the six municipalities was covered by the municipalities as well with utilization of tractors and TT containers. Number of trips of the collection vehicles in Konnagar and Champdani was five times per working day and the two municipalities used the vehicles more frequently than the other municipalities whose collection vehicles collected waste 2-3 times per working day. Municipalities did not

have sufficient vehicles to collect all generated waste, and therefore increasing waste collection efficiency was measure change for the municipalities to reduce the uncollected solid waste. Even though weighbridges were installed TS/CP, waste collection amount was not exactly grasped due to insufficient use of the weighbridges. At first, the municipalities shall measure and record waste amount incoming the facilities by the weighbridge.
The municipalities collect sludge from septic tanks in response to request from the residents. Even though the state government has prohibited municipalities in the state to impose any service charge to the residents as mentioned below, the municipalities collect the sludge with collection fee.

Table 3-3 Summary of existing conditions on SWM (Technical Information)

Items	Sub-items	Uttarpara-Kotrung	Baidyabati	Konnagar	Rishra	Serampore	Champdani
(1) General	Name of the Department in charge of SWM	Public Health and Convenience Department	Conservancy and Public Health	Conservancy	Conservancy	Conservancy	Public Health
(2) Primary collection	Household covered by the primary collection	All	Approx. 85% of households	80% Household	50% in an alternative day	80% Households	30% only
	Who provide the primary collection (private or municipality, it proportion)	Municipality	Municipality	Municipality	Municipality	Municipality	Municipality
	Working hours and days	7 hrs. and 7 days	3-4 hrs. and 6 days	7 hrs. and 6 days	4 hrs. and 6 days	6 hrs. and 6 days	5 hrs. and 6 days
	Equipment for the primary collection work	Tricycle and Auto tipper	Pushcart, Tricycle and Auto tipper	Pushcart, Tricycle and Auto tipper	Pushcart, Tricycle and Auto tipper	Pushcart, Tricycle and auto tipper	Pushcart, Tricycle and auto tipper
	Collection system (door-to-door, bell etc.)	Door to door	Door to door	Door to door	Door to door	Door to door	Door to door
	Number and volume of open dumping sites	One site Around 30,000-50,000 m^2. (Removed now)	One site Around 12,500 m^2	One site Around 12,500 m^2	One site Around 10,000 m^2	One site Around 20,000 m^2	2 sites Around 10,000 m^2
(3) Secondary collection	Who provide the primary collection (private or municipality, it proportion)	Municipality	Municipality	Municipality	Municipality	Municipality	Municipality
	Working hours and days	7 hrs. and 7 days	3-4 hrs. and 6 days	7 hrs. and 6 days	4-5 hrs. and 6 days	6 hrs. and 6 days	5 hrs. and 6 days
	List of vehicles and equipment	Tractor, TT Container	Tractor, TT Container	Tractor, TT Container	Tractor, TT Container	Tractor, TT Container	Tractor, TT Container
	Number of trips per working day	2 trips	1-2 trips	5 trips (Morning-3trips and evening 2trips)	2-3 trips	2-3 trips	5 trips
	Maintenance and inspection system for the vehicles	Municipality own	Outside Agency	Maintained by Municipality	Municipality own garage and mechanic of municipality	Own Mechanic, Welder, Electrician of Municipality	Outside Agency

Items	Sub-items	Uttarpara-Kotrung	Baidyabati	Konnagar	Rishra	Serampore	Champdani
	Spare parts storage system	Municipality Own	In municipality own garage	Supplied by outside agency as per requirement.	Garage of municipality and purchase from market.	In municipality own garage	Outside Agency
(4) Night soil collection	Collection system (who collect, frequency per household, fee charged for the collection)	Driver and 3 cleaners, 5 years and INR 500 for 3200 litters and commercial 1500 INR	Contractual	Driver and 2 cleaners, 15-20 years and INR 650 for single households	Driver and Supervisor and 2 cleaners, 15-20 years and INR 100 for 30 CFT.	Driver and 3 labour, 15-20 years, INR 1000 for 1500 litter and INR1500 for 3200 litter	Driver and 3 cleaners, 15-20 years and INR 900 for 3200 litters
	List of equipment and vehicle	Cesspool and Night soil tractor	Cesspool	Cesspool, Tractor and 3 Cart.	Cesspool	Cesspool	Cesspool
	Person in charge of collecting night soil (section, position)	Mates supervisor and public health staff	SI	Conservancy Supervisor	SI	SI	Cashier
	Collection fee	INR 500 for 3200 litters and commercial INR 1500	Party pay to Contractor INR 1200 per trip and Contractor pay to Municipality INR500 per trip	INR 650 per household	INR 100 for 30 CFT and INR700 carrying cost	INR 1000 for 1500 litter and INR1500 for 3200 litter	900 per 3200 litters
(5) TS/CP	Operation cost (if the facility is operated)	57.6 lakh last year	1.5 lakh per month	Agency Not operated till now	Not operated	Not Started	Not operated
	Amount of incoming organic waste and other waste, outgoing other waste to RWMC and recyclables segregated by material basis	22 t/d, 43.78 t/d and 75 t/d and 8 t/d	50 t - 15 t is organic	16 t/d	Not applicable	Not applicable	Not applicable
	Amount of compost produced and recyclables segregated	12 t/d Recycle and 8 t/d Compostable.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
	Market price of the compost and the recyclables	INR 2-3.00/kg	INR 2.00/kg	Not applicable	Not applicable	Not applicable	Not applicable

Items	Sub-items	Uttarpara-Kotrung	Baidyabati	Konnagar	Rishra	Serampore	Champdani
(5) Awareness raising	Person in charge of awareness raising (section, position)	Supervisor and Social Mobilizers	Chairman and Councillors and SI	Social mobilizer, SI and the Chairman	Chairman and Social Mobilizers	Public Health and SWM Standing Committee with Chairman and SI	Counsellors and Conservancy
	Typical activities conducted by the municipalities (program etc.)	Ward program and handbill	Meeting in every ward	Ward wise meeting	Not applicable	Meeting through social mobilizer and ward committee member	Not applicable

(2) RWMC

1) Incoming Amount of Waste and Septic Tank Sludge

Operation by contractors of RWMC started since July of 2015, and incoming amount of waste and septic tank sludge has been gradually increasing. However, it is only approximately 34% and 12% of the planned amounts respectively for waste and septic tank sludge.

2) Operating situation and challenges

Incoming waste is managed and landfill site is cleaned appropriately; however, waste dumping and other operation are not managed appropriately.

Table 3-4 Current situation, Issues, and Countermeasures of RWMC (As of February 2016)

Image	Current situation/Issues /Countermeasures
	Vehicle control • Incoming waste amount of both solid waste and septic tank sludge is measured by the contractor. • Incoming vehicle is washed and cleaned every time after entering the landfill site. • Vehicle controls are well managed.
	Disposal Operation • Waste disposal plan for the landfill is not prepared. • Waste is not compacted • Soil cover is not applied • Landfill site with the conditions is generally called "Open dumping site." <Countermeasures to be taken> • To supervise the Contractor to conduct the disposal operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.
	Facility Maintenance (Liner sheet) • The liner sheet on the slope around the bottom of landfill site is torn for heavy equipment or waste transportation vehicles. Instructions to heavy equipment or vehicle operators may be needed. • Joint part of liner sheet near shoulder of slope of landfill site is peeling off. • Leachate may be leaked from these torn parts. The contractors, however, are not aware of it. Facility is not maintained properly. <Countermeasures to be taken> • To supervise the Contractor to conduct the facility maintenance in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the

Image	Current situation/Issues /Countermeasures
	guidance.
	**Facility Management (Liner sheet)** • Direct dumping of waste on the liner sheet could cause damage on the sheet from sharp materials in the waste. For the reason, protection with soil is generally required before filling waste near the sheet. However, sheet is not protected on this site, and thus, the sheet is torn as aforementioned. <Countermeasures to be taken> • To supervise the Contractor to conduct the facility maintenance in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.
	**Disposal Operation in Rainy season** • Size of the working road and damping platform with steel plate for the rainy season is not big enough. Compaction of the basement under steel plate is lacked, and thus, the facility is not kept smooth enough for vehicle movement. <Countermeasures to be taken> • To supervise the Contractor to conduct the disposal operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.
	**Facility maintenance (Cleaning at site and road)** • Roads and storm water drainage inside the site is cleaned appropriately.
	**Leachate treatment operation** • Leachate is stored inside the landfill site, which will worsen quality of leachate and generate odour. Storing leachate inside the landfill site might cause leakage by tearing the liner sheet as well. • Basically effluent should not be stored inside the landfill site. • Management of Dissolved Oxygen (hereinafter referred to as "DO") and aerobic bacteria is required to generate aeration in the pond. However, it is not managed. <Countermeasures to be taken> • To instruct the Contractor to avoid storing leachate inside the landfill site; to supervise the Contractor to conduct the facility maintenance in accordance with the Contract, together with KMDA. Any

Image	Current situation/Issues /Countermeasures
	penalty can be considered, if the Contractor does not follow the guidance.
	**Septic tank sludge treatment operation** • Septic tank sludge treatment is not operated appropriately. For instance, treatment situation of bio digester and gas tank is not acknowledged. <Countermeasures to be taken> • To supervise the Contractor to conduct the disposal operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.

(3) TS/CP

Operating situation and problems as of February 2016 are shown in the Table 3-5. All the facilities had little incoming waste. For the small amount of incoming waste, the facilities could not operate appropriately. TS in Konnagar did not provide segregation service to collect valuable materials. Measurement of incoming waste by weighbridge was not carried out, either.

Table 3-5 Current situation/Issues/Countermeasures of TS/CP (As of February 2016)

Image	Current situation/ Issues/ Countermeasures
	**Champdani CP** • Only little amount of waste is brought. • Operating activity includes measuring the amount of incoming waste and cleaning of site <Countermeasures to be taken> • To encourage the Chairman and SI to bring waste into the CP; to improve the secondary collection, based on the action plan prepared by Champdani municipality. • To supervise the Contractor to conduct the operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.
	**Serampore CP** • Only little amount of waste is brought. • Operating activity includes measuring the mount of incoming waste and cleaning of site <Countermeasures to be taken> • To encourage the Chairman and SI to bring waste into the CP; to improve the secondary collection, based on the action plan prepared by Serampore municipality. • To supervise the Contractor to conduct the operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.

Image	Current situation/ Issues/ Countermeasures
	**Konnagar CP** • Little amount of waste is brought to the CP. • Segregation of valuable materials is not carried out at TS. • Most of the waste brought to TS is mixed waste. • Amount of waste is not measured. • Operation activity includes cleaning of TS and landfill site. <Countermeasures to be taken> • To encourage the Chairman and SI to bring waste into the CP as well as the proper utilization of weighbridge; to improve the secondary collection and strengthen social mobilization activities, based on the action plan prepared by Konnagar municipality. • To supervise the Contractor to conduct the operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.
	**Rishra CP** • Little amount of waste is brought to CP. • Segregation of valuable waste is carried out at TS. • Most of waste brought to TS is mixed waste. • Operation activity includes measurement of incoming waste and cleaning of TS. <Countermeasures to be taken> • To encourage the Chairman and SI to bring waste into the CP as well as the proper utilization of weighbridge; to improve the secondary collection and strengthen social mobilization activities, based on the action plan prepared by Rishra municipality. • To supervise the Contractor to conduct the operation in accordance with the Contract, together with KMDA. Any penalty can be considered, if the Contractor does not follow the guidance.

(4) Institutional and financial information

The summary of the survey conducted in January and February in 2016 is shown in Table 3-6

Table 3-6 Summary of Survey

Sectors	Survey Items	Remarks
1. SWM	No. of permanent and non-permanent staff	By position and duty
	Monthly gross salary	By position and duty
	No. of vehicle and equipment	
	Service delivery	Collection volume, service coverage and frequency, etc.
2. Financial	Budget from the last three years	• Structure of overall revenues and expenditures • Arrears of Property Tax (hereinafter referred to as "PT") • Budget preparation schedule

In March 2016, the JPT interviewed to the chairman and the related staff to confirm the additional data and information that were not collected during the survey.

1) Institutional aspects

The necessary data and information has been already given to the JPT.

2) Financial aspects

The complete budget reports of last 3 years have been already given to JPT. JPT confirmed the further information as presented in Table 3-7. These are quite common with all six municipalities.

Table 3-7 Additional Information

	Topics	Summary of Information
1	Revenue	Largely depends on the Central and State Government grants (80%)
2	Staff salary	Substantially depends on the State Government grants (from 30% to 40%)
3	PT	• Municipality's own stable source of revenue. • The arrears have accumulated to the considerable amount that are several times as much as the year demand amount. • Most of the citizens pay normally. Sleeping industries have not paid even though they continue to own their property within the municipality jurisdiction area • The Government regulates to re-sasses the property in every 10 years; however some municipalities do not follow it. • The municipalities that re-assessed recently have recorded a revenue increase of PT by some 50%.
4	Ban on collecting the service charge	• The State Government has banned the municipality from collecting the service charges other than PT since 2011. • It is unclear when the ban is lifted. • The water sector, the biggest service sector, consumes a lot of electricity for pumping water from underground; however, the municipalities cannot cover the costs.
5	SWM charge	• Baidyabati was only a municipality that started the collection in 2012, but stopped it in 2015 due to the above 4. • Obviously every municipality has a will to collect the SWM charge in future.
6	Budget preparation	• To start over the period of December and February, to be approved in the middle or end of March by the board of council, and to be executed from April • Budget account items of municipality are provided by the State Government. In line with the account items, the budget is elaborated by the finance section and submitted to the board of council after pre-approval of the chairman and executive officer. The board approves the budget finally after a careful discussion. • The budget of municipality is generally prepared following the previous year's budget. So, in order to reflect a new improvement activities such as of this project in the budget, the conservancy section should request it toughly and the top management should instruct it strongly as well. • Preliminarily 3 months' budget was prepared for FY 2016/17 due to the election of the State Assembly. The rest of 9 months' is to be prepared after the election.
7	Budgeting O&M cost of TS/CP	• Every municipality has a will to budget the necessary expenditure. • They want to learn the operation technology and the cost structure.
8	Management of RWMC	• The critical issue of July 2016 is understood by every municipality. • They have no objection to sharing the cost among 6 municipalities. • Some chairmen suggested holding a meeting of 6 municipalities in May or June soon after the election vote to discuss how to share the cost.

The budget of the financial year of 6 municipalities is shown in Table 3-8.

Table 3-8 Budget of FY2014/15 (Million INR)

Budget Items				Uttarpara-Kotrung	Champdani	Baidyabati	Serampore	Rishra	Konnagar
				Initial Budget	Revised Budget	Actual	Revised Budget	Revised Budget	Actual
Revenues	For current expenditures	Tax	PT	19.3	10.8	10.6	14.0	17.7	7.1
		Fee & charges	Septic tank clear	0.6	0.2	0.1	0.5	0.5	0.7
			Others	56.4	21	20.9	44.9	82.1	17.9
			Total	57.0	32.0	31.6	59.3	100.3	25.7
		Grant	Salary grant	30.0	59.5	34.2	123	60.1	55.6
			Others	67.6	59.7	32.3	76.4	24.2	-
			Total	97.6	119.2	66.5	199.4	84.3	55.6
		Others		19.6	19.6	13.7	-	-	23.4
		Total		193.5	193.5	122.4	258.7	160.4	111.8
	For capital expenditures	Grants: Finance Committee.	Central Gov.	29.0	209.4	18.6	27.0	135.5	58.1
			State Gov.	37.7		20.6	20.0	18.0	
			Total	66.5	209.4	39.2	47.0	153.5	58.1
		Others		22.9	15.0	36.0	380.9	66.0	17.0
		Total		89.4	224.4	75.2	427.9	219.5	75.1
	Total			282.9	376	197.6	686.6	379.9	186.9
Expenditures	Current	Salary and welfare		101.9	87.2	86.8	182.1	42.9	73.7
		Fuel		1.7	n/a	1.3	n/a	n/a	8.0
		Electricity		29.0	n/a	4.2	10.0	n/a	n/a
		Others		52.4	62.2	38.4	79.2	112.9	16.9
		Total		185.0	149.4	130.7	271.3	155.8	98.6
	Capital	Miscellaneous		96.5	220.3	68.5	360.3	198.6	65.7
	Total			281.5	369.7	199.2	631.6	354.4	164.3
Balance of the Year				1.4	6.3	-1.6	55.0	17.7	22.6

Note: The years of collected budget books vary; for the reason, FY 2014/15 that is common to all municipalities is utilized.
Source: Budget of each Municipality

The budget of the Government of West Bengal is shown in Table below. The table indicates that the revenue of the Government depends largely on external sources such as the tax allocation and grants from the Central Government and the bank loan: on the contrary, the state tax that is an own revenue of the Government is small, only around 30%. Concerning the expenditures, the current expenditures including the subvention of the regional government staff salary amount to 80%. The capital expenditures are modest at around 20% of total Government spending.

The Budget Branch of the Finance Department is responsible for collecting and elaborating the budget. In line with the budget timeframe of the Central Government, the Branch gathers the proposals from all departments in October, discusses about proposal intensively with the departments and afterwards submits to the State Assembly. The Assembly deliberates and approves it finally.

Table 3-9 Budget of Government of West Bengal（billion INR）

Budget Account			FY 2015/16	FY 2016/17	FY 2017/18	
			Actual	Revised	Budget	
Revenue	Current	State tax	424.9	489.3	557.9	31%
		Non-tax	18.6	20.4	22.2	1%
		State share of Union tax and duties	371.6	446.2	495.1	27%
		Grant from Central Government	282.2	337.5	351.2	19%
		Sub-total	1,097.3	1,293.4	1,426.4	78%
	Capital	Market loan	248.3	327.8	452.9	24%
		Others	74.2	40.3	-56.4	-2%
		Sub-total	322.5	368.1	396.5	22%

	Total		1,419.8	1,661.5	1,822.9	100%
Expenditures	Current	General services	456.9	504.7	524.5	29%
		Social services	473.9	587.2	629.2	35%
		Economic services	249.7	289.9	267.6	15%
		Contributions to Local Bodies	7.8	6.2	5.1	0.4%
		Sub-total	1,188.3	1,388.0	1,426.4	78%
	Capital	General services	7.0	10.8	11.0	0.6%
		Social services	46.3	58.7	73.8	4%
		Economic services	70.9	82.8	107.0	6%
		Repayment of loans	93.4	109.0	195.0	11%
		Others	8.6	14.3	9.7	0.5%
		Sub-total	226.2	275.6	396.5	22%
	Total		1,414.5	1,663.6	1,822.9	100%
Balance			5.3	-2.1	0.0	

Source: Annual Financial Statement of the West Bengal State 2017-2018, Department of Finance

3.2.2 Time and motion survey[1]

(1) Outline of the survey

Time and motion survey was conducted in order to improve the current waste collection vehicle performances. The survey was carried out in 6 municipalities from April to June, 2016; the target waste was municipal waste and night soil. The incoming waste at each TS/CP was also surveyed to complement the analysis of municipal waste collection.

(2) Analysis of primary and secondary collection

1) **Identified Issues**

It was found out that most of the issues for primary and secondary collection are common in six municipalities; these issues have come into insufficient manpower and equipment for collection of waste, which further influences the collection coverage of less than 30% for the entire area. The segregation status of waste is also very poor. Some of the municipalities still have the habit of dumping waste in open and the environmental management is poor in municipalities. The identified issues of primary and secondary collection are summarized in the Table 3-10.

Table 3-10 Identified Issues of Primary and Secondary Collection

Items	Issues
Common issues in six municipalities	• Primary collection manpower is insufficient. • Primary collection vehicles are insufficient • Primary collection coverage is poor less than 30% of household covered on daily basis. • Segregation quality is mediocre. • Secondary collection point (hereinafter referred to as "SCP") are insufficient. • Safety management is inadequate.

[1] This is a suvry on efficiency of waste collection work. Surveyors follow waste handor and tractors to observe their work behaivior and situation of collection ponts and to check colletion time and route. The result would be utilized to enhance the effieicency of the collection work.

Items	Issues
	• Maintenance of equipment is inadequate.
Specific issues in Champdani	• Secondary waste collection is irregular. • Waste is open dumped. • No socialization activities are organized.
Specific issues in Serampore	• Segregation at house hold is very poor. • Waste handling is improper. • Municipality does not sending waste to TS/CP. • Waste is open dumped. • Secondary collection system is irregular. • No socialization activities are organized.
Specific issues in Rishra	• Segregation at household is very poor. • Waste is open dumped. • No socialization activities are organized.

1) Collected Data

The data on primary and secondary collection compiled by the time and motion survey is summarized as follows.

Table 3-11 Collected data on primary and secondary collection

Municipality / Description	Uttarpara -Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani
Number of wards	24	20	23	29	23	22
Number of households	40824	19968	27906	42258	29963	24193
Population	159147	76122	124577	181842	121110	111251
Average number of households per ward	1701	998	1213	1457	1302	1099
Municipal Area (km^2)	10.90	04.26	04.95	07.45	14.15	05.70
Number of collection vehicle (Tricycle)	54	24	70	55	95	20
Number of collection vehicle (Pushcart)	-	-	-	35	-	-
Number of waste handlers	60	24	64	96	105	16
Collection days per week	7	6	6	6	6	6
Working time	6:00 to 12:30	6:45 to 12:00	6:30 to 12:30	6:00 to 12:00	6:00 to 12:00	6:00 to 12:30
Average number of households collected per day	12960	2232	8384	11070	11590	2620
Average household covered per waste handler	240	93	131	123	122	131
Average distance collection by waste handler per day	5 km	3.5 km	4 km	4 km	3.5 km	4 km
Collection coverage per day	31%	11%	30%	26%	38%	11%
Household waste segregation percentage	66%	61%	1%	1%	85%	33%
Road condition	Moderate condition bituminous road					
SCP in municipality (TT container)	57	37	17	35	42	20
Capacity of SCP	600 kg					
User fee Charges	No					

(3) Analysis of night soil collection

1) Identified Issues

The night soil collection survey reveals that in all municipalities, it is a source of revenue generation, but then also municipalities find it difficult to run the system. The identified issues of night soil collection are summarized in the Table 3-12.

Table 3-12 Identified issues of night soil collection

Items	Issues
Common issues in six municipalities	• Maintenance of equipment is inadequate. • Safety management is inadequate.
Specific issues in Uttarpara-Kotrung and Konnagar	• Septic sludge is open dumped. • Municipality finds it uneconomic to send the septic sludge collected to RWMC due to long distance and time taken for it.

2) Collected Data

The data on night soil collection compiled by the time and motion survey is summarized as follows.

Table 3-13 Collected data on night soil collection

Municipality / Description	Uttarpara -Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani
Number of collection vehicle	5	3	2	2	2	2
Number of collection teams	3	2	2	1	1	1
Collection days per week	7	6	6	6	6	6
Working time	7:00 to 12:00	7:00 to 11:00	7:00 to 11:00	7:00 to 14:00	10:00 to 16:30	7:00 to 12:00
Disposal location	Open dump	Open dump	RWMC	RWMC	RWMC	RWMC
Equipment maintenance	OK	OK	Poor	Poor	OK	OK
Equipment maintenance schedule	Not Available					
Residents acceptance	Acceptable					
Safety/Sanitary condition	Poor					
User fee/Charges	Yes					

(4) Analysis of TS/CP

From the TS/CP survey, it was observed that the operation of TS/CP is not in an organized manner. Record maintenance of waste, its temperature, moisture and turning collected waste are not maintained. TS/CP also do not have any schedule of activities to be monitored. The staff members working in TS/CP do not care about the safety part and use to work without protective gears for workers. The information on TS/CP compiled by the time and motion survey is summarized as follows.

Table 3-14 Collected data on TS and CP

Municipality / Description	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani
Facility handover to municipality	Yes	No	No	No	Yes	No
Operation status	Yes	Yes	Yes	Yes	No	Yes
Operated by	Municipality	Private Agency				
Working days per week	7	6	6	6	6	6
Waste recording system available	Yes	No	Yes	Yes	No	Yes
Working time	7:00 to 16:00	8:00 to 17:00	Not yet started	7:00 to 17:00	Not operating	8:00 to 17:00
Recording of moisture	No	No	No	No	No	No
Recording of temperature	No	No	No	YES	No	Yes
Recording ambient air quality	No	No	No	No	No	No
Segregation done by workers	Yes	Yes	Yes	Yes	No	Yes
Scheduled maintenance of equipment	No	No	No	No	No	No
Is outside rag picker allowed in TS/CP	Yes	Yes	Yes	No	No	No

Municipality / Description	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani
Is rag picking in organized manner	No	No	No	-	-	-
Production of manure	Yes	Yes	No	No	Yes	No
Sale of manure started	Yes	No	No	No	Yes	No
Monitoring system	No	No	No	No	No	No
Safety management	No	No	No	No	No	No

3.2.3 SCP survey

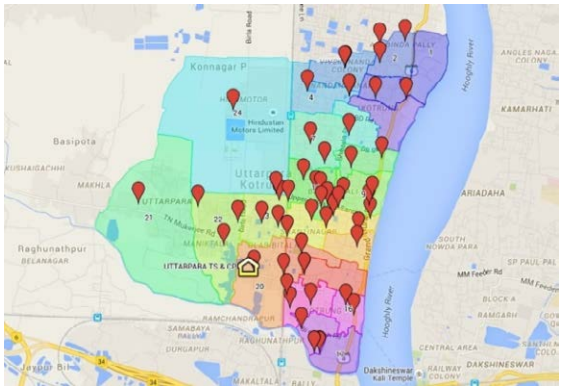
(1) Outline of the Survey

SCP survey has been conducted after the conclusion of the contract in March 2016. The survey was carried out in 6 municipalities from May to July, 2016. The purpose of the survey was to identify the location and conditions of existing SCPs in 6 municipalities.

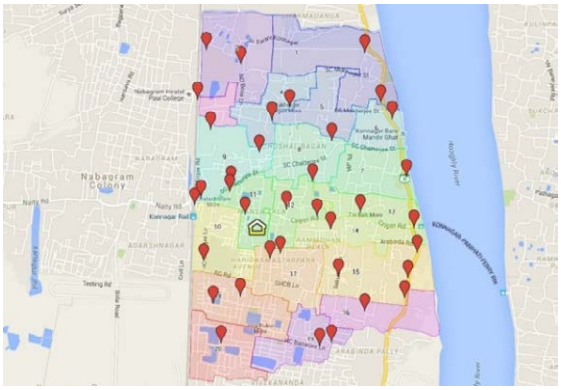
(2) Location of TT Container

Location of TT Container which is main facility of secondary collection is shown in Table 3-15.

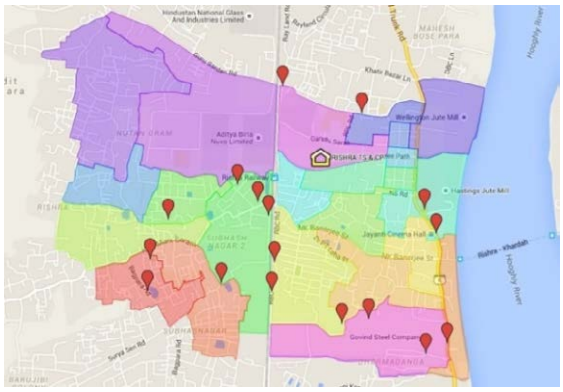
Table 3-15 Location Map of SCP (TT Container)



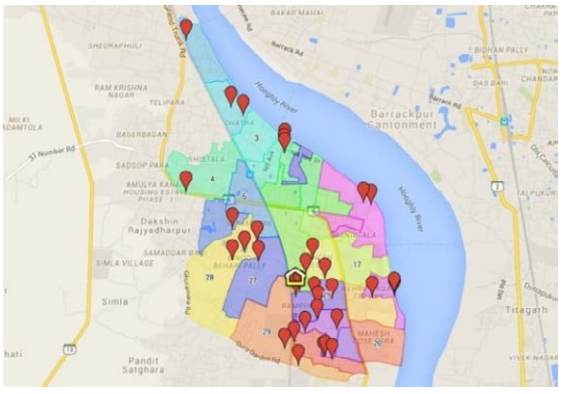
Uttarpara-Kotrung



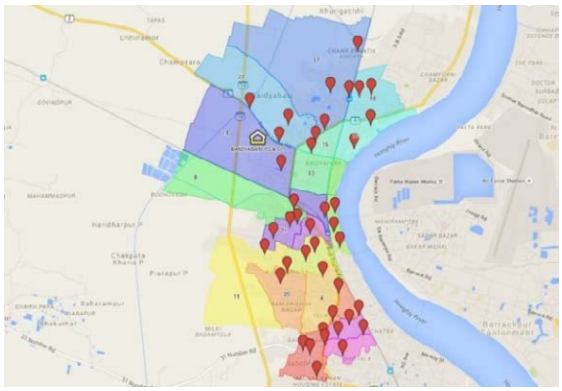
Konnagar



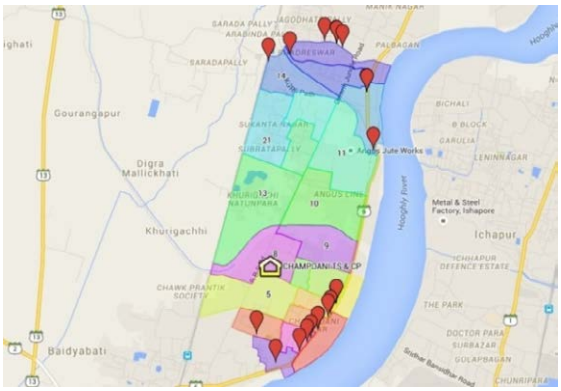
Rishra



Serampore



Baidyabati



Champdani

TS/CP SCP Location

(3) Summary of Survey Results

Most of the municipalities have open road side dumping system, in which animals come in search of food, eat it and also scatter it over road. Roadside dumping chokes the drains, which in turn leads to water clogging and water comes out to streets.

SCP (organic waste, cows)

SCP (scatering waste)

In some of the locations it is noted that from the TT containers provided by the Japanese ODA loan project, rag pickers pick materials and scatter waste outside the TT containers.

The number of SCP containers was very less in the ward locations and the distance between TT containers is very long, waste handler's trip time increase due to this and their work efficiency reduces. The containers normally get full and waste overflow from the container.

Overall maintenance of TT containers is poor, never being cleaned; the damages to TT containers are also not rectified; normally the TT containers are thrown away when it get damage. In some of the places the tires were in bad shape or missing from container. The municipalities shall wash TT containers to prevent rust and repire the equipment quickly.


Damaged TT containers thrown away in Konnagar & Serampore

The number of community bins is also very limited. Konnagar was one of the municipalities, which has extensively installed community bins on road side; on an average distance of 100m a community bins can be found. In addition, many of the TT containers were not numbered for identification in Konnagar, which makes the control and management of TT containers more difficult.

In Uttarpara-Kotrung, Konnagar and Baidyabati any Big Open dumping locations could not be found, but in Serampore, Champdany and Rishra open dumping of waste still happens by waste handlers.

SCPs, the conditions of TT containers and TS/CP details at each municipality are shown in the Table 3-16:

Table 3-16 Waste collection Points at Each Municipality

Municipality	Area in km^2	Total Wards	TT container	Roadside Dumps	Big Open Dumps	Community Bins
Uttarpara-Kotrung	10.90	25	57	30	0	1
Konnagar	4.26	20	37	110	0	122
Rishra	4.95	23	17	40	2	7
Serampore	7.45	29	35	260	2	33
Baidyabati	14.15	22	42	95	0	35
Champdani	5.70	22	20	80	2	2

Table 3-17 Condition of TT Containers at Each Municipality

Municipality	TT container in use	Not Require Repair	Repair Required	Replacement Required
Uttarpara-Kotrung	57	46	11	0
Konnagar	37	23	14	0
Rishra	17	14	3	0
Serampore	38	23	14	1
Baidyabati	42	34	8	0
Champdani	20	10	10	0

(4) Gap Analysis of SCP TT Containers

Table 3-18 is a suggestion on the number of TT containers required in each municipality area, the calculation is based on assumptions mentioned below. A normal container capacity is 2.16 m^3, density of waste is assumed to be 0.35 the capacity of waste it can accumulate is 750 kg. Taking 80 % filling of container as average, the waste in one (1) container comes to 600 kg. (Assumptions: Waste collected in one TT container is 600 kg.) In this case, it was found out that 373 of TT containers were calculated as the gap for six

municipalities.

Table 3-18 Gap Analysis of TT Containers

Municipality	Population	No. of Household	Waste Generated (t/d) (IPE Global Data)	Current TT Containers	Requirement	GAP
Uttarpara-Kotrung	159147	40824	70	57	117	60
Konnagar	76122	19968	34	37	57	20
Rishra	124577	27906	53	17	88	71
Serampore	181842	42258	90	38	150	112
Baidyabati	121110	29963	63	42	105	63
Champdani	111251	24193	40	20	67	47
Total	**774049**	**185112**	**350**	**208**	**584**	**373**

(5) Suggestions to Improve SCP

Based on the results and analysis of SCP survey, the following points are suggested to improve the current SCP.

- Municipality shall procure and increase the number of TT containers, this will in turn increase the number of trips and collection efficiency of waste handlers as their trip distance is reduced.
- In coordination with municipality there should be a uniform distribution of TT container to improve the collection coverage, catering to most part of municipalities.
- The maintenance system shall be introduced in municipalities through which TT should be repaired. The TS/CP have a workshop facility which can be utilized for this activity.
- Municipality should allot funds for maintenance of waste collection equipment.
- Washing TT continer should be carried out in TC/CP at least once a week. This can be done in a planned rotational basis, since it is difficult to clean all the containers at once. It will improve the life of TT container.
- Regular cleaning of SCP location should also be taken, as most of the SCP locations are spread with waste. Rag picking shall be in an organized way in TS, specially rag pickers who collect waste from TT containers should be asked to collect the recyclables from TS.
- Each TT Container should be numbered for identification, this would help in maintaining records, like when all the containers were washed and repaired etc.
- Social awareness should be spread, by which the road side dumping of the waste needs to be restricted.
- With the use of map and digital technology people should be informed about the waste dumping container locations, which can be used by them to find and put waste in bins or TT containers.

3.3 Establishment of Action Plan for Improvement of SWM

The Project had prepared Action Plan for Improvement of SWM as mentioned in Chapter 2. During the preparation, MAD requested the municipalities to prepare Action Plan for sustainability on the stipulation of

the MOU signed between KMDA and the Municipalities. In addition, the Project supported to formulate EMP for primary and secondary collection and EMP for O&M of TS/CP, beside preparation of the action plan. The summary of an Action Plan for Improvement of SWM is described as follows. Most of the contents of the action plan for the municipalities are same.

Table 3-19 Summary of Action Plan for Improvement of SWM (eg. Baidyabati)

	Main issues	Action
Waste collection	(1) Lot of uncollected waste	To increase equipment and manpower • Increase in collection equipment • Increase in waste collection workers • Maintenance of equipment To improve collection efficiency • Increase of number of SCP • Training of waste handler for better performance • Introduce of incentive system for waste handler and award system for the cleanest ward
	(2) Improper management and monitoring	To strength monitoring system of waste collection • Preparation of monitoring plan for primary collection • Establishment of complaint cell • Impose penalty system for open dumping of waste
Night soil collection	(1) Improper maintenance of the equipment	To strengthen maintenance system
TS/CP operation and management	(1) Poor management of the operation and quality control	To strengthen operation and quality management • Operation manual and training • Implementation of treatment as per the manual • Quality check of produced manure
	(2) Improper recording and monitoring system	To establish proper waste data recording system • Review of maintained records • Maintain the system • Analysis of the data
	(3) Lock of safety rule and environmental plan	To strengthen environmental and safety management system • Environmental management plan • Safety management rules • Provide safety training and safety gear
Finance and institution	(1) Unclear SWM cost	To improve the methods to grasp SWM cost
	(2) No fee collection under the initiative of the State Government	To set up a table for fee collection, based on the above cost recovery, as part of the preparation of commencement of fee collection.
	(3) Lack of the proper budgeting forSWM cost	To prepare a budget proposal, based on the data estimated through the above two themes (1) and (2), prior to the municipality budgeting process
Social mobilization	(1) Improper source separation and insufficient compost sale caused by low public awareness	To enhance source separation and compost sales by strengthening social mobilization
	(2) Poor relationships with the public and other municipalities resulted from lock of public relations	To establish good relations with the public by promoting public relations

The six municipalities had already prepared EMP for O&M of waste collection and TS/CP with support from JPT and submitted MAD. However the six municipalities have not yet received any decision on the plan.

Table 3-20 Necessary O&M Cost for Waste Collection and TS/CP

Municipality	Manpower Cost for waste collection (INR 1,000/year)	O&M Cost of TS/CP (INR 1,000/year)	Proposal submission date
Uttarpara-Kotrung	-	7,600	7th June 2017
Konnagar	6,958	4,835	18th Jan. 2017
Rishra	12,726	4,476	22nd Feb. 2017
Serampore	11,575	4,218	25th Jan. 2017
Baidyabati	8,089	2,888	10th Jan. 2017
Champdani	14,638	4,115	13th Jan. 2017

CHAPTER 4. OPERATING BODY AND FUNDS FOR RUNNING COST

4.1 RWMC

4.1.1 Operating Body

The KMDA, the MAD and six municipalities, at the joint coordinate meeting held in August of 2016 and February of 2017, decided who operates the RWMC. Pursuant to the decision, Baidyabati has started running the RWMC by subcontracting to a private entity.

> The facilities of the RWMC shall be handed over to and operated by municipality of Baidyabati from April of 2017. The necessary funds for running shall be provided by the MAD of the State Government

A lot of complications arose until the definite decision and its proceedings are shown in Table 4-1.

Table 4-1 Proceedings until Decision of RWMC Operating Body

Month and Year	Proceedings
March 2016	The KMDA operated until July 2016 after completion of construction in October of 2015
	However, the operating body as well as the funds after the end of the KMDA operation from August 2016 had not been decided. Accordingly, the JPT persuaded the KMDA and 6 municipalities to hold the joint coordinate meeting promptly.
May 2016	At the joint coordinate meeting, the KMDA suggested to hand over the RWMC to the body that is established and operated jointly by 6 municipalities from August 2016.
May 2016	After the above meeting, 6 municipalities held the meeting and agreed to accept the suggestion of the KMDA. At the same time, they requested the KMDA to operate continuously the RWMC for months until they could prepare the functional organization and the funds for ready-to-start operation
June 2016	The KMDA suggested to select one municipality among 6 municipalities, and hand over the RWMC to the selected municipality from August 2016.
August 2016	The extension of JICA Yen Loan was approved, and it got the KMDA operate the RWMC continuously until February 2017.
	At the joint coordinate meeting, the hand-over of the RWMC to Baidyabati from March 2017 was definitely decided.
February 2017	The KMDA extended its operation period for more one month until March 2017.
From April 2017 and ongoing	Baidyabati has accepted the managerial responsibility of the RWMC and started its operation.

4.1.2 Funds for Running Cost

Provision of the funds from the MAD of the State Government was decided at the joint coordinate meeting held on 24th of August of 2016. In January 2017, Baidyabati estimated the O&M cost at 1,526 thousand INR a month and proposed it to the MAD, yearly base of which amounts to 8.3 million INR. The O&M cost will be estimated again in the next financial year considering the incoming waste volume and the expenditures actually incurred during the previous financial year.

4.2 TS/CP

4.2.1 Operation by Municipality

After completion of construction and operation by the KMDA, the facilities of TS/CP have been transferred to each municipality one after another, and operated by themselves respectively. The O&M cost of each municipality is estimated as shown in the Table 4-2**.** (Cf. Table 5-18 and Table 5-19.)

Table 4-2 TS/CP: Hand-over Date and O&M Cost

Municipality	Annual O&M Cost (INR 1,000)	Date of Transfer
Uttarpara-Kotrung	3,788	October 2015
Baidyabati	3,855	November 2015
Konnagar	3,995	January 2017
Rishra	4,863	June 2017
Serampore	3,870	January 2017
Champdani	3,068	October 2016

Note: The O&M cost is different from the EMP presented inTable 2-3 and Table 5-18
Source: Joint estimate by each municipality and the JPT for the purpose to reflect into 2017/18 budget

4.2.2 Funds for Running Cost

EMP decided at the joint coordinate meeting on August 2016 contains also the O&M of TS/CP. Accordingly, the municipalities submitted the proposal letter to the MAD in January and February 2017 (Uttarpara-Kotrung only in June); however, none of approval nor disbursement has been made as of June 2017. The “Repair and Additional Expenditures of Equipment for Primary and Secondary Collection” was also decided at the same meeting as above. The proposal of 6 municipalities totalled INR 36 million, among which INR 4 million was sanctioned in October 2016; however, the rest of INR 32 million has not been approved yet.

Thus, such subventions cannot be dependable in future, so that the municipalities have to secure the O&M cost with its own budget accordingly.

CHAPTER 5. TECHNICAL ASSISTANCE ACTIVITIES

5.1 Selection of Model City

JPT selected Uttarpara-Kotrung and Baidyabati as model city and provided technical assistance for the other four municipalities to follow their achievements and lessons for the following reasons;

(1) Segregation at source is comparatively done well.
(2) TS/CP is operated.
(3) As to Baidyabati, the Municipality will take charge of RWMC operation

5.2 Establishment of Data Management Form on the Amount of Waste and Composition

Uttarpara-Kotrung and JPT has created the record form of incoming waste at TS/CP based on the data analysis from the 1st year. (See the details in the Appendix 2 and Appendix 3) Items in the record form are shown in the Table 5-1. Person in charge of record fill the data in handwriting and input the data on computer afterwards.

Table 5-1 Data Record Form on the Incoming Amount of Waste at TS/CP (Uttarpara-Kotrung)

Sl No		
Date		
Incoming Waste	Driver Name	
	Vehicle Type	
	Vehicle no	
	Area wise	
	Number of Container	
	In Time	
	Out Time	
	Incoming waste amount (ton)	Compostable waste
		Non Compostable waste
		Drain Sludge
		Septic Tank Sludge
Outgoing Waste	Inert waste to RWMC (ton)	
	Recyclable Material from TS	Plastic
		Bottle
		Glass
		Paper
		Metal
		Total Recyclable
Remarks		

5.3 Improvement of Waste Collection System

5.3.1 Creation of Waste Collection and Delivery Manual

JPT provided an On-The-Job training (hereinafter referred to as "OJT") to SI and waste handlers with the waste collection and delivery manual prepared by JPT. The manual was reprinted in pocket-size as well for the use at facilities and provided to SI and waste handlers of the model cities, Uttarpara-Kotrung and Konnagar.

		
Training on primary collection in Uttarpara-Kotrung	Training on secondary collection in Uttarpara-Kotrung	Training on primary collection in Konnagar

5.3.2 Model Cities

(1) Uttarpara-Kotrung

1) **Incoming Amount of Waste**

Waste collection rate at Uttarpara-Kotrung is approximately 75%, out of which 65% is delivered to TS/CP. The rest 10% is dumped in the open. The incoming amount at TS/CP is respectively 90% of the designed valuee at TS and 30% of the designed value at CP, and the deficient amount compared to the designed value is remarkable. On the other hand, the quality of segregation has been improved in both compostable waste and non-compostable waste. Since the composition may be varied from the beginning of KSWIMP, waste amount and waste composition survey needs to be done to see the difference and to review. To improve the collection rate, number of the waste handlers for primary collection shall be increased.

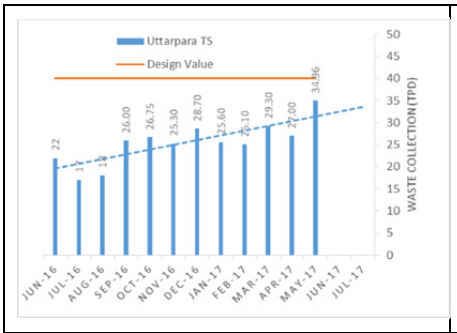
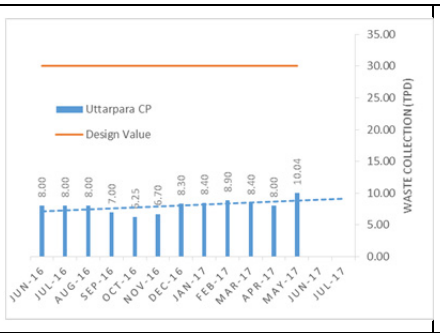
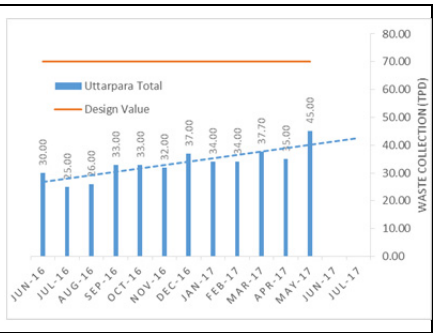
		
Incoming amount at TS	Incoming amount at CP	Incoming amount at TS/CP

Figure 5-1 Transition of incoming amount of waste (Uttarpara-Kotrung)

1) **Instruction on the Analysis of Weighbridge Data**

JPT instructed Uttarpara-Kotrung how to analyse number of trips of vehicles and amount of collected waste of the month of weighbridge data. Result is shown in the Appendix 4 Analysis of number of trip by each vehicle and collected waste amount. JPT and C/P studied to optimize vehicle operation by reviewing the factors for low operation rate from the data. Shown below is the number of trips and amount of collected waste by vehicle type, by municipality, and by month. JPT instructed waste handlers on the collection work after finding delays of a few collection vehicles revealed by the data from November 2016. In result, operation result has been improved since December 2016. As to March 2017 and after, introduction of auto-tipper vehicles increased the amount of collected waste.

Table 5-2 Record of incoming and discharged amount of waste at TS/CP (Uttarpara-Kotrung)

Area	Vehicle Type	Values	2016		2017				Grand Total
			Nov	Dec	Jan	Feb	Mar	Apr	
KOTRUNG	Auto Tipper	Trip No	70	92	102	108	447	443	1,262
		Collection Qty	51375	73280	85140	85,395	261,750	271,450	828,390
	Open Truck	Trip No	18	35	41	32	46	51	223
		Collection Qty	43355	86615	102175	61,230	96,625	107,560	497,560
	T.T. Container	Trip No	130	171	179	156	4	8	648
		Collection Qty	113680	175495	181455	160,235	2,765	3,595	637,225
	Open Trailer	Trip No	103	100	107	151	160	157	778
		Collection Qty	108655	108250	124015	101,030	119,495	122,785	684,230
MAKHLA	Auto Tipper	Trip No	43	48	48	51	147	148	485
		Collection Qty	25235	27300	27385	30,545	84,435	91,525	286,425
	T.T. Container	Trip No	81	95	70	67	16	9	338
		Collection Qty	42945	42795	34160	31,955	4,855	2,530	159,240
	Open Trailer	Trip No	40	40	37	43	52	50	262
		Collection Qty	39860	38785	33185	28,125	45,495	40,670	226,120
UTTARPARA	Auto Tipper	Trip No	201	252	226	198	488	425	1,790
		Collection Qty	98280	134335	122120	108,435	270,482	264,951	998,603
	Open Truck	Trip No	27	38	29	42	41	31	208
		Collection Qty	76475	106150	80910	105,962	92,555	77,090	539,142
	T.T. Container	Trip No	74	81	86	200	82	71	594
		Collection Qty	55410	60710	65440	163,698	33,448	29,255	407,961
	Open Trailer	Trip No	49	61	67	88	79	67	411
		Collection Qty	41675	49985	55005	57,805	45,113	43,525	293,108
Total Trip No			836	1,013	992	1,136	1,562	1,460	6,999
Total Collection Qty			696,945	903,700	910,990	934,415	1,057,018	1,054,936	5,558,004

2) Instruction on the Maintenance of Equipment

The following three activities were introduced by JPT as to the capacity building on the maintenance of equipment;

- Numbering on each container to keep track of the location of TT containers and damages on them;
- Regular provision of maintenance services by creating record notebook for maintenance of equipment;
- Regular washing of vehicles and equipment.

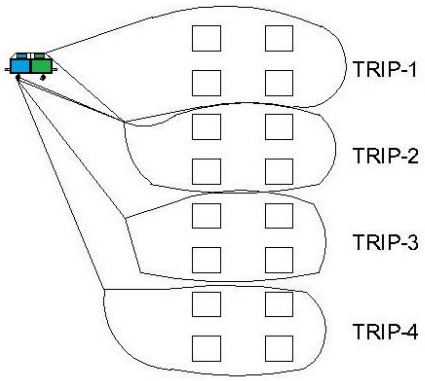
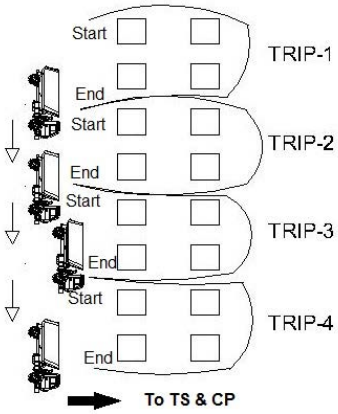
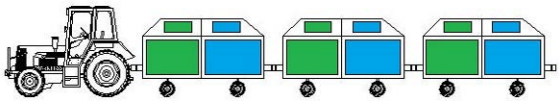
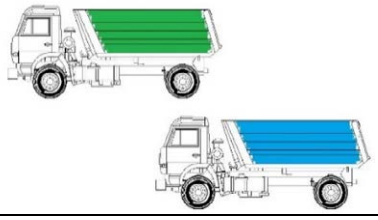
		
Numbering on the container	Repairing vehicle	Washing vehicle

3) Improvement of Waste Collection Process

SI planned and implemented auto-tipper vehicles to collect waste from waste handlers of primary collection directly deliver to TS/CP to cut time of round-trips in-between the house-to-house collections. Auto tipper vehicles were procured by municipal budget.

Table 5-3 Comparative table of Waste Collection Process

Original Plan	Current Process
1. Target wards	
ALL wards	All wards same as original plan
2. Primary collection system	
Use Tricycle / Push cart for primary collection Number of Tricycle : 54 units	Using Tricycle for primary collection Number of Tricycle : 54 units
(2) Unloading the collected waste to TT Container. TT container is transported to TS/CP and then empty TT container is placed same location. 	(2) Unloading collected waste to Auto tipper which is roaming around in main road in segregated manner. Organic waste and the other waste are loaded in Green and Bule Auto tipper, reapectively. Waste storaged into TT container is also reloaded to Auto Tipper. 

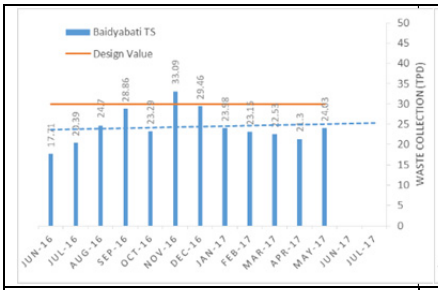
Original Plan	Current Process
	
Waste handler of each trip starts the work from secondary collection point, such as TT container, and returns to same location.	Waste handler of each tri starts at different location so that travel time is reduced.
3. Secondary collection system	
TT Containers are having partition for organic and other waste for waste separation Number of Tractor : 6 Number of TT container : 56 Approximately 3 TT containers are placed per ward 	Two different auto tippers are used for collection of organic and other waste separately. Number of Auto tipper : 16 (8 Green and 8 Blue) Approximately one Auto tipper is covering 3 wards Number of Tractor : 5 units Number of TT container : 60 units (Normally shifted to TS/CP on Sundays and cleaned) 
TT containers are daily hauled by the tractors to TS/CP for unloading waste.	Auto tipper takes waste from waste handlerto TS/CP for unloading waste. Organic waste and other waste are taken by green and bule auto tipper, respectively. On sunday, waste storaged in TT containers is taken by the auto tipper to TS/CP and parallerly TT containera are hauled to TS/CP for cleaning
4. Comparison of system	
Tractor can not pass narrow path and not turn at cross point due to long hauling TT containers	Auto tipper can easily move in traffic.
Waste handlers waste lot of travel time to transport the garbage to SCP.	Waste handlers can save the collection time, because the auto tippers roam in the main road to receive waste from the waste handlers.
Waste pickers pick up the valuables from TT container and it makes the surrounding dirty.	During the collection work, drover always available in the vehicle to monitor and it prevent surrounding from to become dirty.
The residents throw waste in mixed manner or sometimes dispose mixied waste in the compartment for organic waste. Some resients put the waste outside of TT container. It is not possible for municipality to monitore the SCP.	In case that the residents dispose their waste to the auto tipper, the resinents utilize waste handler as usual. When the resident pass the waste to the auto tipper, the driver can instruct the residents which waste to be put in which vehicle.
Fuel cost is saved.	Fuel cost is increased.

(2) Baidyabati

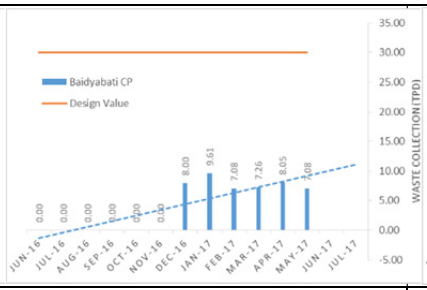
1) Incoming Amount of Waste

Waste collection rate of Baidyabati is approximately 70% and all the collected 70% of the waste is delivered to TS/CP. The incoming amount at TS/CP is respectively 100% of the designed value at TS and 30% of the

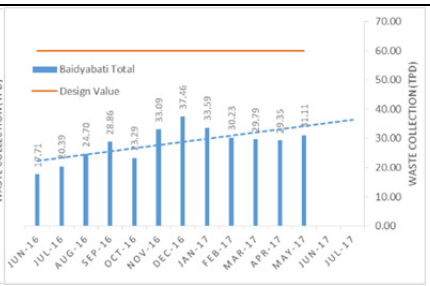
designed value at CP, and the deficient amount compared to the designed value is remarkable. On the other hand, the quality of segregation has been improved in both compostable waste and non-compostable waste. Since the composition may be varied from the beginning of KSWIMP, waste amount and waste composition survey needs to be done to see the difference and to review. To improve the collection rate, number of the waste handlers for primary collection shall be increased.



Incoming amount of waste at TS



Incoming amount of waste at CP



Incoming amount of waste at TS/CP

Figure 5-2 Transition of Incoming Waste Amount (Baidyabati)

2) Instruction on the Maintenance of Equipment

The following three activities were introduced by JPT as to the capacity building on the maintenance of equipment;

- Numbering on each container to keep track of the location of TT containers and damages on them;
- Regular provision of maintenance services by creating record notebook for maintenance of equipment;
- Regular washing of vehicles and equipment.

Numbering on containers

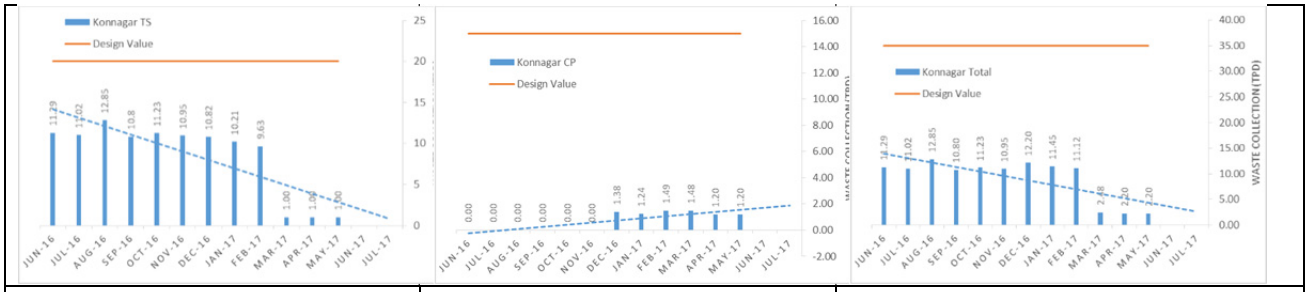
Repairing of equipment

Washing equipment

5.3.3 The Other Four Cities

(1) Incoming Amount of Waste of Konnagar

While KMDA handed over TS/CP of Konnagar to the Municipality in March 2017, the Municipality has hardly accepted waste in the TS/CP for lack of O&M cost. Waste collection rate of Konnagar municipality is 70% and 10% is delivered to TS/CP. Approximately 50 %, or 20t/d of mixed waste is delivered directly to RWMC to SCP. The rest 10% is openly dumped. To improve the collection rate, number of the waste handlers for primary collection shall be increased.



Incoming amount of waste at TS	Incoming amount of waste at CP	Incoming amount of waste at TS/CP

Figure 5-3 Transition of Incoming Waste Amount (Konnagar)

(1) Incoming Amount of Waste of Rishra

Waste collection rate of Rishra is 60% and 50% is delivered to TS/CP. The rest 10% is openly dumped. CP is not receiving enough amount, which indicates segregation of waste is not done well. To improve the collection rate, number of the waste handlers for primary collection shall be increased. Rishra municipality is planning to procure 45 tricycles for primary collection with municipal budget and deliver to each ward in July, 2017. Collection rate is expected to be improved after the introduction of new tricycles.

Incoming amount of waste at TS	Incoming amount of waste at CP	Incoming amount of waste at TS/CP

Figure 5-4 Transition of Incoming Waste Amount (Rishra)

(2) Incoming Amount of Waste of Serampore

Waste collection rate of Serampore is 60% and 20% is delivered to TS/CP. Another 20 %, or approximately same amount of mixed waste as delivered to TS/CP is delivered directly to RWMC to SCP. The rest 20% is openly dumped. CP is not receiving enough amount, which indicates segregation of waste is not done well. To improve the collection rate, number of the waste handlers for primary collection shall be increased.

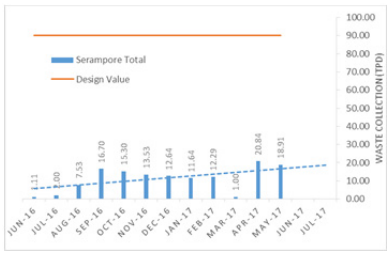
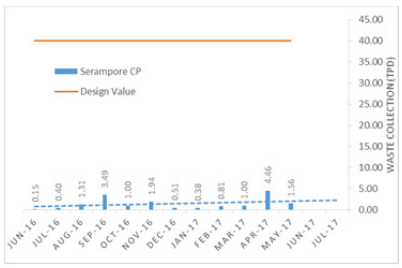
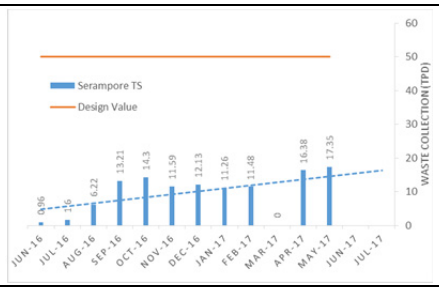
		
Incoming amount of waste at TS	Incoming amount of waste at CP	Incoming amount of waste at TS/CP

Figure 5-5 Transition of Incoming Waste Amount (Serampore)

(3) Incoming Amount of Waste of Champdani

While KMDA handed over TS/CP of Champdani to the Municipality in late October 2016, the Municipality has hardly accepted waste in the TS/CP for lack of O&M cost. Waste collection rate is approximately 10%. To improve the collection rate, number of waste handler for primary collection should be increased. Wastes not reaching at TS/CP is openly dumped as in the past. Waste segregation has not been practiced well.

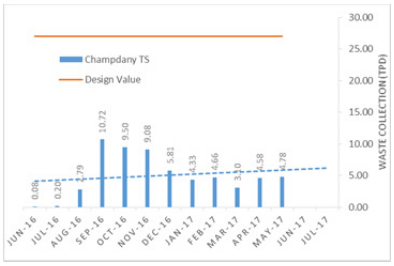
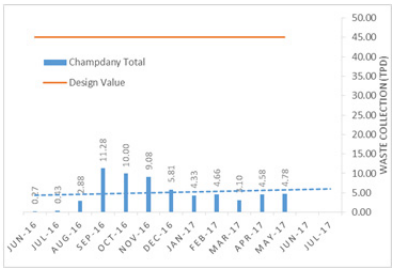
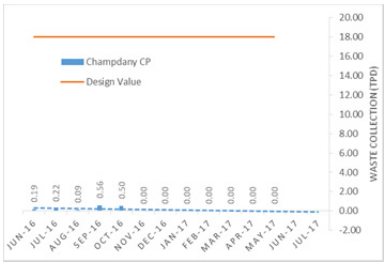
		
Incoming amount of waste at TS	Incoming amount of waste at CP	Incoming amount of waste at TS/CP

Figure 5-6 Transition of Incoming Waste Amount (Champdani)

5.4 Improvement of Operation of TS/CP

5.4.1 Model City

(1) Uttarpara-Kotrung

1) Establishment of O&M Organization

Uttarpara-Kotrung municipality has established O&M organization and allocated sufficient number of staff as shown in the Figure 5-7.

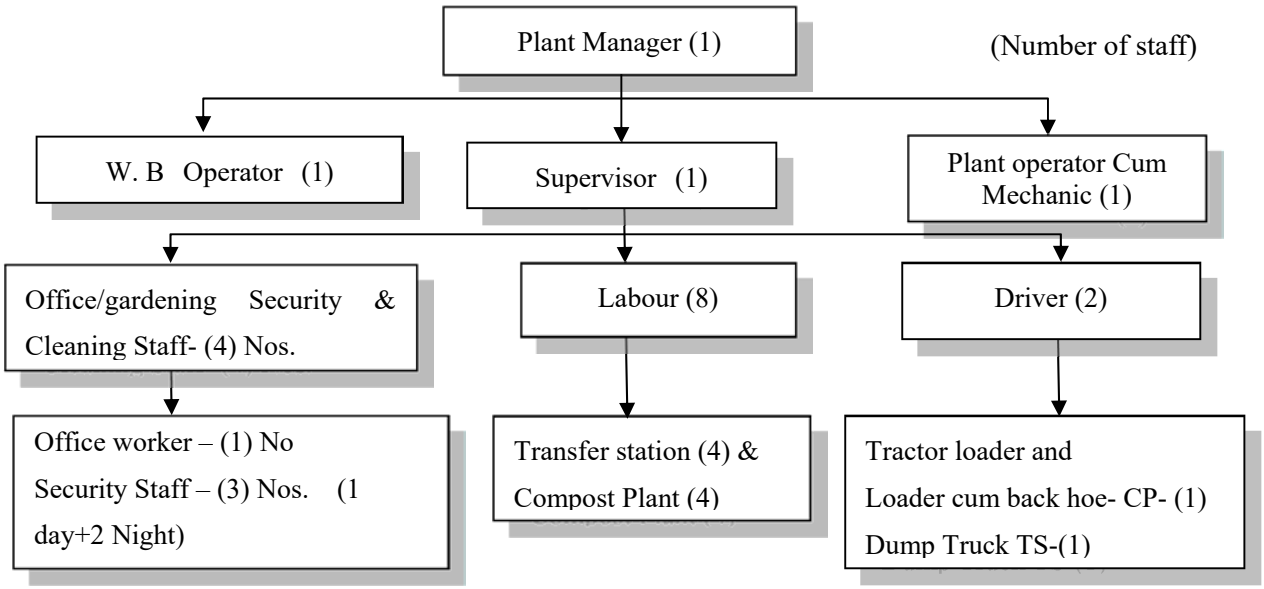


Figure 5-7 O&M Organization Structure

2) Preparation of O&M Manual

JPT prepared TS/CP O&M manual and provided an OJT training to SI and workers at TS/CP with the manual. The manual of pocket size has been prepared and provided to SI and TS/CP workers.

3) O&M Instruction

JPT has organized workshop regularly to instruct on O&M improvement and discuss the issues. Operation as of July, 2017 has been improved drastically compared to the beginning of the TA Project. Improvements seen after the workshop are the followings;

		
Weighbridge operator record daily every day and report its operation to SI (cf. Appendix 5)	Waste pickers working in safety gear in TS and separating valuables.	Waste pickers sell valuables.
		
Waste pickers are instructing the drivers about dumping place at CP.	Waste pickers are wearing personal protective equipment and removing non-application of compost.	Cell arranged in random order are regularly arranged.

		
Cell is regularly being cutting back.	Deodorizer is regularly being sprinkled.	Temperature and moisture are regularly being measured.

4) Guidance for the promotion of compost sale

(a) Organization of Workshop for Compost Sales Promotion

JPT has held a workshop for the promotion of compost sale on 17th January 2017. There have about 60 attendances. The attendances and contents of the discussion are as shown below.

【Attendants】

①	Chairman	:	1
②	KMDA	:	1
③	Councillors of Uttarpara-Kotrung Municipality	:	7
④	Farmers	:	17
⑤	Press Staff	:	1
⑥	Youth Club	:	20
⑦	Nurseries	:	13
⑧	Members of Business Association	:	4
⑨	Chemical Fertilizer Company	:	1

【Contents of the Discussion】

① Possibility of testing the quality of compost product by using a land which the municipality is not using.

② Possibility of testing the quality of the product for another time because the results showed the large amount of mercury and potassium which did not reach the criteria at previous quality test

③ Make fancy package of compost.

④ Implement traveling sale. Let social mobilizer distribute flyers which describe purpose of the sale.

⑤ Business association considers the sale at local market.

【Discussion Results】

Quality experiment will be done again, and traveling sale will be implemented as a pilot project.

- SI and JPT have been invited and attended the compost workshop, which has been hosted by Indian Farmers Fertilizer Cooperative LTD. (hereinafter referred to as “IFFCO”), on 24 February 2017. JPT explained the contents of this project and what JPT is now finding sale destination of the compost. JPT has visited IFFCO office because IFFCO showed the interest. JPT has visited IFFCO office on 16th March 2017, and mayor of Uttarpara-Kotrung and IFFCO will directly discuss the compost sale on 4th

April 2017.

- JPT visited IFFCO office on June 15, 2017, and received a list of approximately 300 retailers. As of July, 2017, JPT and Municipality is contacting with retailers.

(b) Implementation of Pilot Project on Compost Mobile Retail for Residents

JPT and Municipality implemented pilot project on compost mobile retail for residents for a month from June 16, 2017. Chairman and deputy chairman participated the inauguration ceremony on the first day. Advertisements on the sale is spread through newspaper, leaflet, and miking. Compost sells for INR 2.00 per kg. All the130 kg (26 bags of 5 kg) of compost were sold in the first one hour and demand has been large enough. Sales of the compost are deposited into Compost Account and the Compost Account is utilized for only SWM purpose.

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Chairman and deputy chairman at the inauguration ceremony.</td><td>Municipality arranged the vehicle and package for compost.</td><td>Humble amount of 130 kg was prepared for the first day.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>First customer, administrative director of a Youth Club</td><td colspan="2">Miking and advertising leaflet provision in mobile retailing</td></tr>
</table>

(2) Baidyabati

- CP has been handed over to Baidyabati on December 3, 2015.
- Baidyabati handed over the operation of CP to private contractor and the contractor started the operation from December 9, 2015. After a few months, the contractor left, and as of July 2017, CP had been non-operational.
- Baidyabati started new contract with different contractor in December, 2016, and CP's operation is resumed.
- JPT regularly check O&M work of the contractor.
- The quality of service by the contractor is not seem at all to be good.

5.4.2 The Other Four Cities

Current situation and improvement activities of TS/CP at the other four cities are as follows;

Table 5-4 Current Situation and Improvement Activities of TS/CP

<table>
<tr><td>Rishra TS/CP</td><td>

KMDA hands over TS/CP to the municipality in July 2017. The facility is operated by a private company assigned by KMDA
JPT organized bus tour for chairman, CIC, and SI on May 15, 2017 to encourage municipalities to O&M on their own in consideration of lack of qualified O&M contractors available in the market.
JPT took the participants of the bus tour to Uttarpara-Kotrung TS/CP operated well by the Municipality and Rishra TS/CP operated by unqualified contractor poorly.
After site visits of the bus tour, discussion was held in the presence of chairman and SI from Uttarpara-Kotrung, councillors of Rishra, Chief Engineer (hereinafter referred to as “CE”) of KMDA, and JPT.
In the discussion, councillors of Rishra raised voice requesting support from Uttarpara-Kotrung and JICA on TS/CP operation by the Municipality
Rishra is planning the form of management after handover from KMDA
Shown below are the images from bus tour.

<table>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>JPT explained the purpose of the bus tour and problems on SWM in Rishra to the councillors of Rishra</td><td>JPT explained the operational situation of Rishra TS/CP to councillors of Rishra.</td><td>JPT organized discussion in presence of chairman and SI of Uttarpara-Kotrung, councillors and SI of Rishra, and KMDA.</td></tr>
</table>
</td></tr>
<tr><td>Konnagar TS/CP</td><td>

Facility has been handed over on 6th March 2017.
Konnagar had to pause operation of TS/CP to take care of complaints from neighbours when former contractor caused bad odour from poor O&M.
The problem was solved by intermediate action by JPT and Social mobilizer, however the municipality continues pausing of facility O&M until the state government subsidize O&M cost.

</td></tr>
<tr><td>Serampore TS/CP</td><td>

KMDA handed over TS/CP to the municipality in March, 2017
Municipality outsourced O&M of CP to the contractor. The contractor is manufacturing compost from mixed waste and the quality of compost is poor.
Municipality manages O&M of TS by themselves, and transfers waste to RWMC regularly.

</td></tr>
<tr><td>Champdani TS/CP</td><td>

The Facility is handed over to the municipality in the end of October 2016.
The municipality tried to operate the facility by itself; however the CP is not operational because of lack of O&M budget.
Municipality plan to operate TS/CP by themselves when subsidy for O&M of TS/CP is provided by the State Government.

</td></tr>
</table>

5.5 Operation improvement of RWMC

5.5.1 Establishment of O&M Organization

RWMC has been handed over from KMDA to Baidyabati since April 2017. Shown in the Table 5-8 is O&M organization structure of RWMC. Chairman and SI manage the contractor.

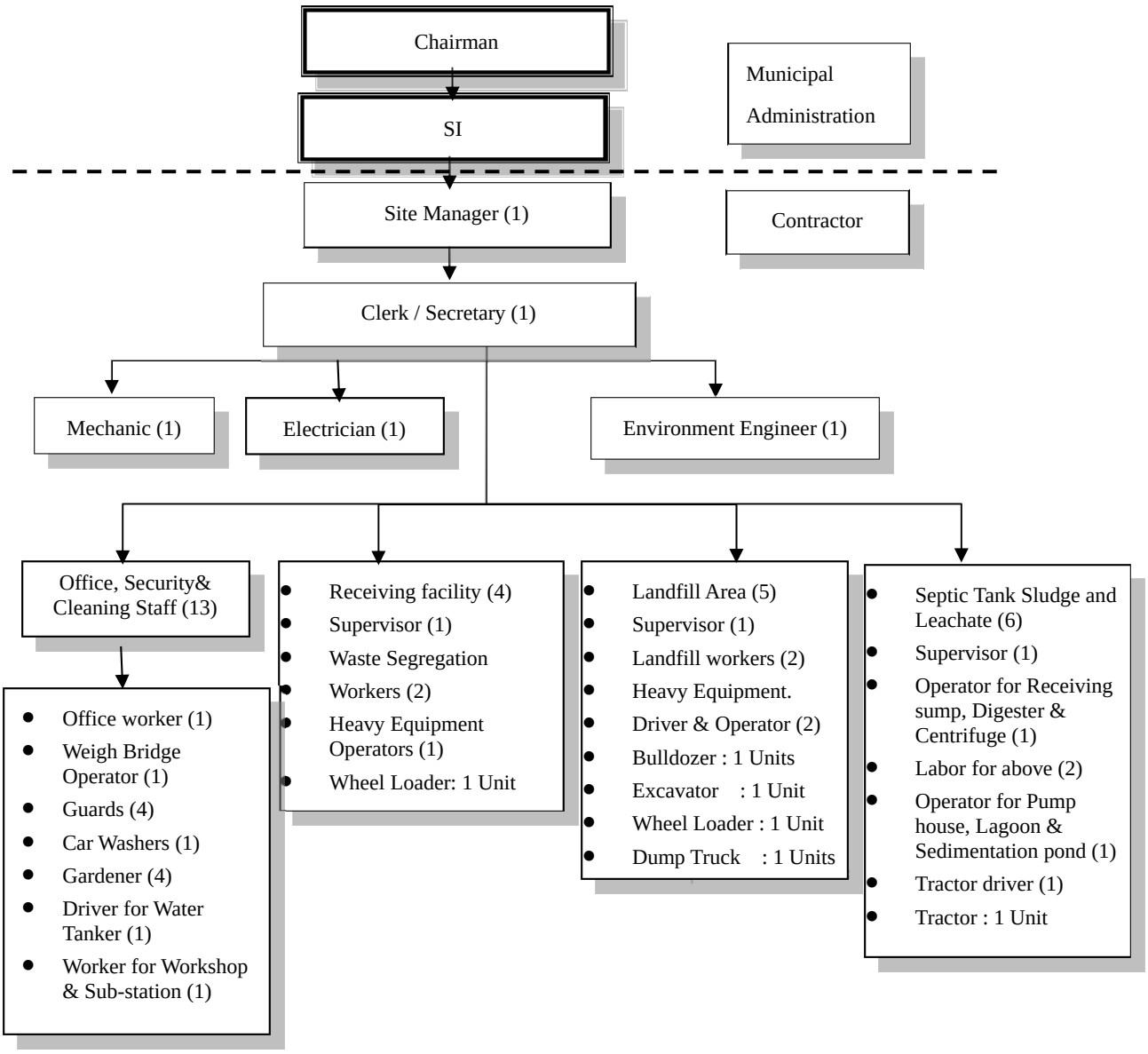


Figure 5-8 O&M Organization Structure (RWMC)

5.5.2 Receiving O&M cost

MAD approved subsidy for three-month RWMC O&M cost on April 15, 2017. Baidyabati invested the subsidy in the operation of RWMC by contractor, however, the subsidy will be running out in July 2017. Baidyabati applied to MAD for subsidy for the following months after July. MAD has not responded to the application yet.

5.5.3 O&M Guidance

JPT, SI, and the contractor hold monthly meeting. Progress of O&M and issues and challenges are discussed.

(1) Operational Condition and Challenges

Operational condition of RWMC is shown below. Waste dumping is appropriately managed, while leachate and sludge are not managed properly.

<table>
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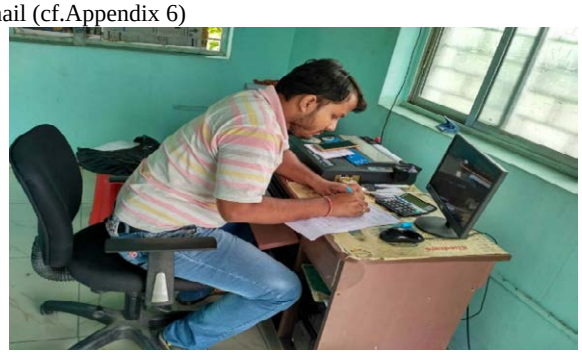
- Keeping daily operational record and reporting system

The contractor prepares daily O&M record, and report to SI by email (cf.Appendix 6)



</td>
<td>

- Weighing and Record

Incoming waste quantity of both solid waste and septic tank sludge are measured and record daily, monthly and for each municipality.

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<td>

- Vehicle Control

Incoming vehicle is washed and cleaned every time after entering the landfill site.

</td>
<td>

- Cleaning of the Premises

The contractor cleans inside the premises every day.

</td>
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<tr>
<td>

- Disposal Operation

The contractor spread the dumped waste daily.

The contractor implemented intermediate soil cover regularly.

</td>
<td>

- Development of dumping platform and track way

The contractor is building dumping platform and track way inside the sanitary landfill site (hereinafter referred to as “SLS”) with steel plate along with the progress of reclamation.

</td>
</tr>
</table>

• Facility Maintenance (Liner sheet) The liner sheet on the slope around the bottom of landfill was torn for heavy equipment the agencies have repaired. The contractor set protective soil on the slope in the landfill. 	• Facility Management (Liner Sheet gas remove) The contractor has not extended the all gas vent pipes such as gas pipe and gabion. 
• O&M of leachate treatment facility The contractor is not treating leachate properly and thus, the leachate puddles inside SLF during rainy season. Aeration is implemented only for around eight hours. JPT instructed on the treatment of leachate during rainy season. 	• O&M of Sludge Management Facility The contractor accepts sludge at RWMC, while they do not comprehend the status of digester or gas tank. JPT instructed on the management of water line and generated gas. 

(1) Discrepancy between technical specifications of contract and actual operation

Discrepancies between technical specifications of contract and actual operation by the contractor are shown in Table 5-5.

Table 5-5 Discrepancy between technical specifications of contract and actual operation

Technical Specifications of Contract		Actual Operation by the Contractor
Item	**Page**	
3.4 Receiving Waste	TS-6	Uttarpara-Kotrung and Baidyabati are sending segregated non-compostable waste and the other municipalities are segregating only at 70-80%. The contractor refuses the incoming waste when waste contains great amount of the compostable waste.
4.1.4 Health, Safety, Security and Environmental control		The contractor has not submitted required documents to Baidyabati.
(4) Health, Safety, Security and Environmental (HSSE) manual	TS-21	The contractor started taking pictures and recording videos of their operation.
(5) Environmental Management Plan	TS-21	The contractor has not submitted O&M plan to Baidyabati.
4.1.6 Progress Photographs and Video Films	TS-23	The contractor records incoming waste and sludge properly.
4.1.9 O&M Plan	TS-26	
4.1.12 Emergency response protocol Plan	TS-28	
4.1.14 Records	TS-30	
4.1.16 Landfill Operation	TS-32	The contractor regularly implement intermediate soil

Technical Specifications of Contract		Actual Operation by the Contractor
Item	**Page**	
(2) Intermediate soil cover		cover. The contractor has set protective soil on the slope in Cell-1.
4.1.17 Environmental Monitoring system (1) Leachate Quantity (Daily) (2) Leachate Quality (Weekly) (3) Groundwater Quality –within the site (Quarterly) (4) Groundwater Quality –outside the site (Yearly) (5) Air quality (Once in two month)	TS-35	The contractor has carried out environmental monitoring test with simple finder, however haven't received environmental monitoring test by official organization
5.1 Performance test for leachate treatment and septic tank sludge treatment plant	TS-36	The contractor has not carried out performance test.

5.5.4 Guidance on the Environmental Monitoring

JPT has instructed the contractor how to do environmental monitoring by using the monitoring equipment procured by Japanese ODA loan. Monitoring position is as shown in Figure 5-9, and the results are as shown in Table 5-6 Quality of groundwater is next to the quality of general groundwater. CO_2 and CH_4 counts large in number in landfill gas, which JPT reads waste including compostable in. Compostable come from Konnagar, Rishra, and Serampore, and JPT regularly told not to send compostable, however no successful result has come. Leachate finds slightly high electrical conductivity (hereinafter referred to as "EC"). All the compositions should be checked in the test for water discharge by official testing organization.

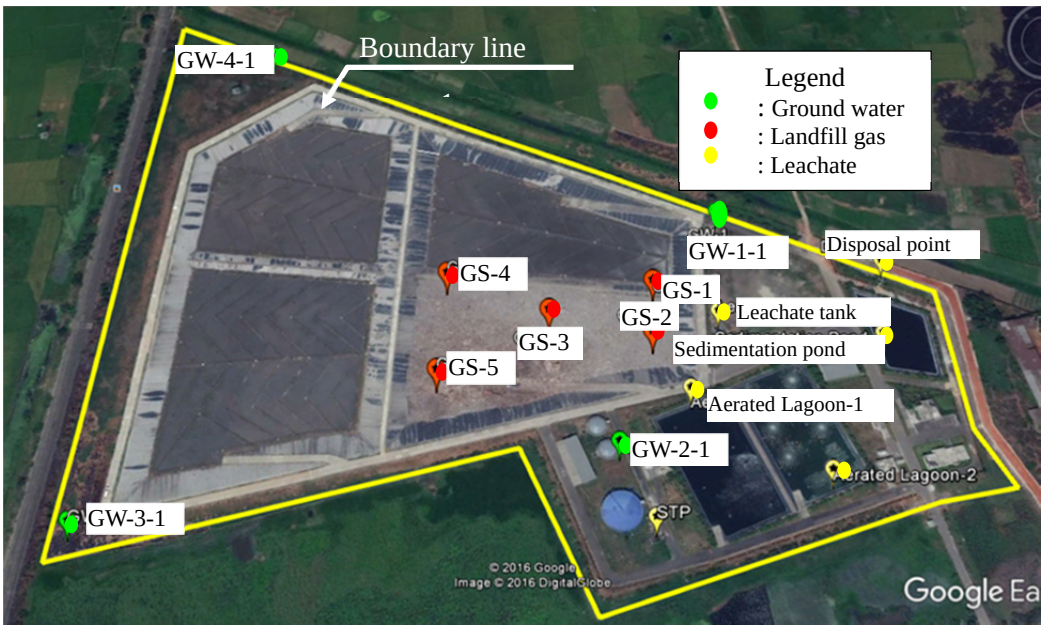


Figure 5-9 Monitoring Locations

Table 5-6 Monitoring Results - 1 (Ground water, EC)

Date	GW-1	GW-2	GW-3	GW-4
10 Feb. 2017	221 μS/cm	193 μS/cm	223 μS/cm	206 μS/cm

Date	GW-1	GW-2	GW-3	GW-4
15 Mar. 2017	204 µS/cm	183 µS/cm	187 µS/cm	198 µS/cm
14 June. 2017	224 µS/cm	520 µS/cm	298 µS/cm	349 µS/cm

Table 5-7 Monitoring Results - 2 (Ground water level)

Date	GW-1-1	GW-2-1	GW-3-1	GW-4-1
10th June 2017	EL+ 78.936	EL+79.031	EL+78.551	EL+86.121

Table 5-8 Monitoring Results - 2 (Landfill Gas)

To be Monitored	Monitoring Parameters	10th Feb. 2017	13 June 2017
GS-1	CO_2	657 PPM	4013PPM
	CH_4	0	0
	CO	0	0
	O_2	0	0
	H2	0	0
GS-2	CO_2	572 PPM	2742 PPM
	CH_4	45%LEL	Hi
	CO	0	0
	O_2	0	0
	H_2	0	0
GS-3	CO_2	4130 PPM	1889 PPM
	CH_4	94%LEL	17%LEL
	CO	0	0
	O_2	0	0
	H_2	0	0
GS-4	CO_2	1531 PPM	4972 PPM
	CH_4	0	0
	CO	0	0
	O_2	0	0
	H_2	0	0
GS -5	CO_2	7586 PPM	1102 PPM
	CH_4	0	0
	CO	0	0
	O_2	0	0
	H_2	0	0

Table 5-9 Monitoring Results - 3 (Leachate)

Date	Sampling Locations	Ph.	EC
10 Feb. 2017	Leachate Tank	7.2	828 µS/cm
	Aerated Lagoon-1	7.5	456 µS/cm
	Aerated Lagoon-2	8.6	365 µS/cm
	Sedimentation Pond	9.0	416 µS/cm
	Disposal Point	7.6	421 µS/cm
15 June 2017	Leachate Tank	6.5	1,102 µS/cm
	Aerated Lagoon-1	7.3	882 µS/cm
	Aerated Lagoon-2	8.5	875 µS/cm

Date	Sampling Locations	Ph.	EC
	Sedimentation Pond	9.3	849 µS/cm
	Disposal Point	9.2	806 µS/cm

5.5.5 Calculation of Remaining Land Filling Capacity of Landfill

JPT has instructed SI of Baidyabati how to calculate remaining land filling capacity of landfill. As a result of the calculation, remaining capacity showed 1.42 million m^3. In terms of the period of remaining land filling, the result showed 22 years in case the amount of initially planned waste which will be carried in the landfill is assumed. Details are shown in Appendix 7.

5.5.6 Tender Support

O&M of RWMC was handed over from KMDA to Baidyabati in April 2017. Baidyabati has decided to outsource O&M of landfill after April 2017. Baidyabati needed to select a contractor for O&M, and JPT has supported technical aspects such as preparation of tender documents.

5.6 Improvement of Night Soil Collection

5.6.1 Collected Amount of Night Soil

Night soil of Uttarpara-Kotrung and Konnagar is not carried because of the reasons why the municipalities are far from RWMC and the carrying is not economical. The collected waste amount of other municipalities are much less than collected waste as planned.

5.6.2 Comparison between Planned Incoming Amount and Received Amount from Each Municipality

Large difference has been seen between planned incoming amount and actual collected amount. For the reason, comparison between them has been done. The result is as shownin the Table 5-10.

Table 5-10 Comparison between Incoming Amount and Received Amount in RWMC

	Incoming Waste Amount in RWMC (t/d)	Received Amount from Each Municipality 【February 2017】	
		Weight (t/d)	Number of households
Uttarpara-Kotrung	Nil	8.00	94
Konnagar	Nil	2.0 – 3.0	40
Rishra	0.15	2.10	39
Serampore	1.76	1.76	28
Baidyabati	1.45	1.50	34
Champdani	1.18	1.18	35
Total	4.54	-	-

(1) Model City

1) Uttarpara-Kotrung

In order to secure economically efficient delivery of night soil to RWMC, transhipment to large tanker at TS/CP has been discussed. Uttarpara-Kotrung has decided to purchase a large tanker (Capacity: 12m^3) with its municipal budget. Uttarpara-Kotrung has scheduled to receive the tanker in the beginning of July, 2017. As soon as the tanker comes on their hand, sludge is delivered to RWMC.

2) Baidyabati

Incoming amount in RWMC and received amount of each municipality are almost same as shown in Table 5-10. For the reason, night soil collected in Baidyabati is likely delivered to RWMC. However, private companies are collecting night soils from residents directly and dumping in the open. JPT directed SI to take regulatory action against the open dumping of night soil by private companies.

(2) Other Municipalities

1) Konnagar

Konnagar is not carrying night soil to RWMC as well as Uttarpara-Kotrung. JPT has instructed Konnagar to apply for support from state government to purchase large tanker. Chairman and SI are discussing the support.

2) Rishra, Serampore and Champdani

Incoming amount and received amount in Serampore and Champdani are almost same as shown in Table 5-10. For the reason, night soil collected in the municipalities is likely carried in RWMC. However, private companies are collecting night soils from residents directly and dumping in the open. JPT directed SI to take regulatory action against the open dumping of night soil by private companies.

5.7 Improvement of Environmental Awareness Activity

In the 2nd Year, JPT implemented the awareness raising activities at all the six municipalities based on the improvement plan prepared in the 1st Year. The activities were planned for the following purposes;

1) Encouraging governmental agencies' further understanding of waste management;
2) Improving the individual and institutional capacities of municipalities in the environmental awareness field;
3) Promoting the sales and the use of composts; and
4) Establishing the culture of segregation at home.

[Regular activities]

		Items	Target Group	Description
Advocacy	1.1	Advocacy	High-level officials (Chairman, CIC, Councillors, Ward committees)	Social mobilizers and JPT talk to high-level officials about issues to have him take the hold of SWM situations in their own Municipality.
	1.2	Linkage	SI, CIC, and their supervisors	JPT encourages stakeholders' execution of planned activities and support.
	1.3	Capacity Building	Primary collectors and their supervisors	JPT provides workshop/training for primary collectors and their supervisors to develop capacities on SWM
Community mobilization	2.1	Community dialogue	Communities (Mothers, housemaids)	JPT instructs segregation and environmental responsibility at community meetings.
	2.2	Focused Group Discussions (FGD)	Women, Mother groups	JPT discusses SWM with targeted groups and share the importance of improving the situation to draw their participation and cooperation.
	2.3	Public meetings / Rallies	General public	Reaching out to larger number with the features and benefits of TA Project through a public meeting or rallies.
	2.4	House to house visits	House maid, women	JPT visits or revisits to families to remind them of the importance of segregation and proper disposal and encourage their cooperation
	2.5	School education	Teachers, Students, Parents	Sensitization and motivation of youth, students to appreciate TA Project and propagate the messages and adopt the new behaviour through the campaign
	2.6	Miking	General public	Taking of segregation to generate community pressure
	2.7	Street drama	General public	Professional actors make script to promote the participation to SWM and play on the street to generate community pressure
	2.8	Distribution of leaflets in local Newspaper	General public	JPT prepares leaflets in the name of the Municipality and distribute them with newspaper. Mobilizers bring the leaflets to communities where people don't read newspaper as well.
Monitoring	3.1	Monitoring of primary collection	Primary collectors, families	Interaction with families and the waste handlers to check quality of segregation and timing and quality of collection
	3.2	Weekly feedback meeting	S.I.	Post field visit experience sharing meeting with SI for further improvement of the linkage.
	3.3	Monthly Review Meeting	Municipality	JPT invites Municipality to review the activities of social mobilizers from previous month and discuss bad and good impacts.

[Occasional activities]

Objective	Items	Target Group
Advocacy	Bus tour	①CICs, SIs and engineers ②Councillors and SIs
	Compost workshop	Municipality, residents, and others
Community mobilization	Local exhibition (Book fair, Science fair)	General public
	Local TV channel	General public

Six social mobilisers for each municipality and three coordinators respectively for every two municipalities executed the activities and monitoring with four indicators, 1) change in the quality of municipal services, 2) statistical status of the TS/CPs, 3) change in the behaviour pattern of the citizens, and 4) change in the behaviour pattern of the institutions. Shown below is the updated action plan.

5.7.1 Progress of the activities

Current situation of each municipality, result of monitoring based on the indicators, and activities conducted

were followings;

(1) Model City

1) Uttarpara-Kotrung

(a) Current situation and issues and challenges

■ Current Situation

- Uttarpara-Kotrung municipality has been running the system efficiently and effectively.
- Municipality sends auto tipper to collect compostable waste from waste handlers and to give the waste handlers more time for collection from households.
- Mobilization activities were provided to communities and institutions by social mobilizers. Groups of people were participating the segregation but, to include all the citizens of the municipality, Municipality needs to take initiative to implement direct approach to the rest of the groups.
- Social mobilizers promoted behaviour change through mobilization activities and linkage, and the Municipality supported the mobilizers.
- Social Mobilisers held meeting to motivate institutions to encourage the participation to the segregation with the authorities.
- JPT and the S.I discussed about mixed-up medical waste with the non-compostable waste.

■ Issues, Challenges, and Countermeasures

- Uttarpara-Kotrung finds challenges in the waste collection from apartments, celebration houses and institutions.
  - → JPT demanded the SI and waste-handlers to arrange collection plan for the area and in result, a group of apartment dwellers started showing positive attitude.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

The municipality has taken initiatives to improve the SWM system of the municipality. The municipality purchased auto tippers by their own fund to collect waste from waste handlers and deliver to CP. It encourages the effectiveness of waste handlers' collection from households and thus, larger amount of waste is coming to TS/CP.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-11 is incoming amount of waste at Uttarpara-Kotrung TS/CP.

Incoming amount of compostable waste in CP has been increased by 1.74 t/d and incoming amount of waste in TS has been increased by 5.48 t/d between December 2016 and May 2017.

Table 5-11 Incoming amount at Uttarpara-Kotrung TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	10.04 t/d	34.48 t/d	44.52 t/d
2) December 2016	8.30 t/d	29.00 t/d	37.30 t/d
Increase（1-2）	1.74 t/d	5.48 t/d	7.22 t/d

iii) Changes in the Behaviour Pattern of the Citizens

61% families are properly disposing segregated waste and the practice of disposal to the waste handler is widespread whether it is in segregated or mixed manner. The practice of dumping is remarkably decreased.

iv) Changes in the Behaviour Pattern of the Institutions

Schools, Integrated Child Development Services (hereinafter referred to as "ICDS") centres, celebration houses were the focus of the mobilization activities in the 2nd Year. It was found that schools and ICDS centres are fast accepting the system. A few schools and 6 ICDS centres of ward 11 and 14 practice segregation and they need municipal support by way of deputing waste handlers during the open hours of school or centre to collect waste and secondary containers for the disposal in a segregated manner. As to markets, Uttarpara-Kotrung municipality sends separate vehicles to collect market wastes and compostable waste of good quality is coming to the CP.

2) Baidyabati

(a) Current situation and issues and challenges

■ Current Situation

- Waste is collected in the primary collection regularly from all the wards.
- Waste handlers collect and deliver waste as instructed. Monitoring by the municipality is done regularly and closely.
- A group of people and institutions requested bin provisions but, without provision from Municipality, people are segregating.
- People are segregating regularly and disposing the waste to waste handlers.
- JPT and SI shared information regularly, and discussed with the chairman and councillors.

■ Issues, Challenges, and Countermeasures

- Some parts of Baidyabati situated in low lying area experience water logging problems and waste collection services are not provided and these areas are badly littered with waste. This has been brought to the notice of the Chairman and the SI by the social mobilizers.
  - → JPT demanded the SI and waste-handlers to arrange collection plan for the area, however improvement has not seen. Immediate action is needed to be taken by the Municipality.
- Some areas are covered by the waste handler for three days a week which is not sufficient to clean the area and coverage of all the families. People are demanding to increase the days of the collection.
  - → JPT will discuss the issue with the SI to increase the number of collection days per week. In result, the social mobilization activities for after April will include the review of factors why the collection services are not provided every day.
- Waste collection from the institutions are not matched with timing and convenience of the Institutions

JPT held meetings to demand institutions to be more patient with the current schedule.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

All the waste handlers are working on the primary collection every day. However, issues on celebration

houses, restaurants, and theatres need to be dealt with by the municipality.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-12 is incoming amount of waste at Baidyabati TS/CP.

Incoming amount of compostable waste in CP has been decreased by 1.92 t/d and incoming amount of waste in TS has been decreased by 4.97 t/d between December 2016 and May 2017.

Table 5-12 Incoming amount at Baidyabati TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	7.08 t/d	24.03 t/d	31.11 t/d
2) December 2016	9.00 t/d *	29.00 t/d	38.00 t/d
Increase（1-2）	- 1.92 t/d	-4.97 t/d	- 5.99 t/d

* Visual observation

iii) Changes in the Behaviour Pattern of the Citizens

3,082 were revisited from October, 2016 to June, 2017 and 87% were segregating regularly. Advocacy with the municipality in regular manner has led to resolution of many problems.

i) Changes in the Behaviour Pattern of the Institutions

Institutions such as ICDS and schools are trying on their own to change the practice within their premises following the awareness meetings. In ward 16, one school placed separate bins for segregation. Markets are sending waste regularly. Celebration Houses and restaurants are yet to come up.

(2) The Other Four Municipalities

1) Konnagar

(a) Current situation and issues and challenges

■ Current Situation

- Konnagar started segregated primary collection and waste handlers are directly delivering the collected waste to CP to produce compost.
- Most of the families are ready to dispose segregated waste and eagerly want regular services from the municipality.

■ Issues, Challenges, and Countermeasures

- Non-compostable waste was delivered directly to RWMC from the SCP and TS is rarely receiving waste.
  - → JPT demanded the SI to deliver non-compostable waste to TS and in result, non-compostable waste has started to come to the TS in May, 2017. It is still in irregular manner and improvement is in need.
- Segregated primary collection service is provided to all the wards. The municipality found it difficult to increase the frequency and covered wards for lack of enough number of waste handlers.
  - → JPT demanded the SI to consider increasing the frequency of collection. In result, mixed waste started to be being received.
- Segregated compostable waste was mixed with other waste at SCPs.

→ JPT discussed with the SI to inspect the mixture situation. However, Municipality did not expand the target area for lack of manpower.

- Primary collection services do not cover public institutions or apartments where a great number people are generating waste.

→ JPT talked with the secretariats of apartments. However, Municipality did not start approaching to institutions and apartments for lack of enough number of waste handlers.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

Mobilizers provided the social mobilization activities, however, the effect was not expanded as much as it could have since the segregated waste collection is carried out at only limited number of wards. On the other hand, municipality started segregated waste collection, and in June, 2017, waste handlers are starting the preparation at all the wards.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-13 is incoming amount of waste at Konnagar TS/CP.

Incoming amount of compostable waste in CP has been increased by 1.14 t/d and incoming amount of waste in TS has been decreased by 1.00 t/d between December 2016 and May 2017.

Table 5-13 Incoming amount at Konnagar TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	1.20 t/d	1.00 t/d *	2.20 t/d
2) December 2016	0.00 t/d	0.00 t/d	0.00 t/d
Increase（1-2）	1.20 t/d	1.00 t/d	2.20 t/d

* Visual Observation

iii) Changes in the Behaviour Pattern of the Citizens

700 families out of monitored 2,261 in the house-to-house visits were segregating and disposing waste properly. Social mobilizers are encouraging behaviour change in people through various activities. People are recognizing the mobilization activities, understand the roles of responsibilities, and agree to participate. However, maintaining the motivation, Municipality is required to make efforts.

iv) Changes in the Behaviour Pattern of the Institutions

2 schools and 3 ICDS centres at ward 4 were disposing waste in mixed manner before, however, they arranged bins for segregation and started practicing the segregation. Municipality has yet to approach market committee or celebration houses.

2) Rishra

(a) Current situation and issues and challenges

■ Current Situation

- Most of the families are ready to dispose segregated waste and they eagerly want regular services from the municipality. Consequent upon continuous social mobilization, people are prepared to accept the

system willingly.

- The municipality has taken a good initiative by repairing 15 tricycles and waiting for another 15 tricycles to be ready shortly.
- ICDS centres, celebration houses, and schools also dispose waste to the waste handlers in segregated manner.
- On the other hand, Municipality decided to initiate segregated waste collection at 2 wards. 2 more wards will be added, municipality states.
- Municipality has stared segregated collection from four wards.

■ Issues, Challenges, and Countermeasures

- Waste from ICDS, celebration houses, and school are not collected regularly.
  → JPT talked with SI on waste collection from institutions, however, Municipality did not start regular collection for lack of resources.
- In some wards, waste handler come to collect twice a week even in mixed manner due to lack of the equipment.
  → JPT talked with the SI on arranging daily collection and situation of collection cart, however the frequency of collection has not been improved for lack of vehicle for the collection as Municipality explains.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

C-I-Cs, conservancy, and SI are trying to improve the system and enhance the capacity of the waste handlers. The municipality is regularly collecting waste from drains and roads. Primary Collection in a regular manner has been initiated and it is expected that it will gain momentum as more wards are involved.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-14 is incoming amount of waste at Rishra TS/CP.

Incoming amount of compostable waste in CP has been decreased by 0.70 t/d and incoming amount of waste in TS has been decreased by 2.40 t/d between December 2016 and May 2017.

Table 5-14 Incoming amount at Rishra TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	0.60 t/d	23.60 t/d	24.20 t/d
2) December 2016	1.30 t/d	26.00 t/d	27.30 t/d
Increase（1-2）	- 0.70 t/d	- 2.40 t/d	-3.10- t/d

iii) Changes in the Behaviour Pattern of the Citizens

Only 29 families of wards 21 & 22 were segregating though the families of all the wards where social mobilisers intervened have accepted regular proper segregation and disposal. People are ready to segregate, however Municipality is not providing the services.

iv) Changes in the Behaviour Pattern of the Institutions

Schools, ICDS centres, and other waste generating institution, who agree to segregates were requesting for

new bins as they had not received any bin from the municipality. Social Mobilizers instructed them to arrange bins.

3) Serampore

(a) Current situation and issues and challenges

■ Current Situation

- KMDA handed TS/CP over to Serampore municipality, and the municipality contracted with private company with its O&M. The municipality initiated segregated waste collection, deployed waste handlers, and expanding the service to more wards.
- Segregated primary collection was initiated at ward 4, 5, 6, and 28 in 2017. The segregation rate is 55%.
- Public institutions such as celebration houses are segregating as well.
- JPT is providing leaflets through newspaper distribution channel and at local events. IEC materials are provided as well, and the municipality is sharing public relations.

■ Issues, Challenges, and Countermeasures

- Lack of manpower is the issue of Serampore municipality, which is the obstacle to expand the primary collection service to more wards.
  - → JPT instructed the SI on the deployment of waste handlers, however Municipality did not improve manpower.
- TT and most of the SCPs are broken and out of control.
  - → JPT instructed SI on repairing the TT and SCPs, however, no Municipality did not take initiative for lack of budget.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

The municipality initiated segregated waste collection at 4 wards. Quality of collected compostable waste is good. SI and C-I-C were very active. The number of covered ward is increasing, which means segregated waste collection service is accepted by the people and the municipality is taking responsibility. Municipality has given the responsibility of segregated waste collection to waste handlers and owners of celebration houses. In result, 3 celebration houses brought segregated waste to CP.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-15 is incoming amount of waste at Serampore TS/CP.

Incoming amount of compostable waste in CP has been increased by 1.06 t/d and incoming amount of waste in TS has been increased by 5.35 t/d between December 2016 and May 2017

Table 5-15 Incoming amount at Serampore TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	1.56 t/d	17.35 t/d	18.91 t/d
2) December 2016	0.50 t/d	12.00 t/d	12.50 t/d
Increase（1-2）	1.06 t/d	5.35 t/d	6.41 t/d

iii) Changes in the Behaviour Pattern of the Citizens

People are segregating at ward 4, 6, and 28 where the segregated waste collection has been initiated.

iv) Changes in the Behaviour Pattern of the Institutions

3 ICDSs of ward 28 started participation segregation. They arranged bins by themselves and promoting the segregation to the visitors of the institutions. Celebration houses are segregating and disposing to TT container as well. Three celebration houses are bringing to TS/CP.

4) Champdani

(a) Current situation and issues and challenges

■ Current Situation

- Champdany municipality is not proactive in regard of SWM improvement. Only primary collection is going on in ward 1 & 2 and in other wards waste handlers are not assigned for house to house collection but they collect drain silt and the families of those areas are disposing waste to them in mixed manner. Waste only comes to TS/CP is not operated. Municipality is not regularly sending waste handlers to house-to-house waste collection.
- Mobilizers continue social mobilization activities to promote the benefits of segregation.
- 100% of the families at ward 1 and 2 were segregating and disposing waste to waste handler at primary collection.
- 30% families are denied to listen the Social Mobilisers as the municipality not yet provided any services. However, the mobilisers went with the waste handlers who are sweeping road and collecting household waste to build a good practice within the families.

■ Issues, Challenges, and Countermeasures

- Champdani Municipality is not taking initiative.
  - → JPT instructed the SI to initiate collection and monitoring of collection.
  - → To prepare for the initiation of Municipality for the waste collection, JPT have put flyers on SWM in front of the citizens, distributing the leaflets through the newspapers in the social mobilization activities.

(b) Monitoring Indicators

i) Changes in the Quality of the Municipal Services

The municipality does not have a regular collection service for the whole municipality. SCPs are broken, waste handlers are not appointed for regular collection, vehicles like push cart, tricycles are not repaired. There is no monitoring in TS/CP by the municipality. Only drain silt collection and road sweeping is going on by the municipality.

ii) Statistical Status of the TS/CP (Incoming Waste)

Shown in the Table 5-16 is incoming amount of waste at Champdani municipality.

Incoming amount of compostable waste in CP has not been increased and incoming amount of waste in TS has been decreased by 1.00 t/d between December 2016 and May 2017

Table 5-16 Incoming amount at Champdani TS/CP

	Waste in CP	Waste in TS	Total
1) May 2017	0.10 t/d	4.00 t/d	4.10 t/d
2) December 2016	0.10 t/d	5.00 t/d	5.10 t/d
Increase（1-2）	0.00 t/d	- 1.00 t/d	- 1.00 t/d

* Visual observation

iii) Changes in the Behaviour Pattern of the Citizens

Most families of ward 1 & 2 where social mobilization activities are done are segregating, which could be model to expand to other areas. Monitored families are all ready and waiting to initiate enough.

iv) Changes in the Behaviour Pattern of the Institutions

4 ICDS centres at ward 1 and 2 are willingly segregating waste and disposing it to waste handlers. Municipality needs to directly approach to the other public institutions.

Book fair

Focus Group Discussion at an ICDS

Environmental education in a school

House-to-house visit

5.8 Organizational and Financial Improvement

5.8.1 Financial Conditions of Municipalities

The JPT made interviews to six municipalities on their financial management in March 2016 and collected their financial data. The results are summarized in Table 3-8 and Table 3-11.

It is noted that the revenues and expenditures of the municipalities are balanced by and large; however, the revenues depend heavily on the Government's grants and subventions. Besides, it is revealed that the SWM costs are not calculated totally and the user fees are not collected, which means the SWM services have not

been ever managed properly from the financial viewpoints.

5.8.2 Problems and Issues

The problems revealed from the above 5.8.1 are summarized below.

1. The user fees are not collected.
2. The SWM costs are not grasped by the municipalities. The cost estimates and analysis have not been made.
3. The SWM year budget is prepared by the financial section based on the previous year budget: the participation of the conservancy section in the preparation work is quite little.

In future, it is likely to be demanded the more improved service of collection or transport and the more frequent operation of TS/CP. To meet the necessary funds for that, the municipalities, especially the conservancy section, should review and enhance the SWM-related financial management together with the financial section

5.8.3 Financial Management Enhancement Plan

Accordingly, the JPT has formulated the enhancement plan as in Table 5-17 by taking into consideration the above problems and explained it to top management of the municipalities.

Table 5-17 Incoming amount at Champdani TS/CP

Themes	Issues	Enhancement Plan	Remarks
1. SWM cost	None of SWM costs is figured out properly and operation-wisely.	To estimate the SWM cost scientifically and operation-wisely	To revise the SWM cost periodically
2. SWM User Fees	The fees have not been collected.	To calculate the user fees based on the above.	Necessity of the preparedness for lifting the ban of the State Government
3. Budgeting	The participation of the concerned sections in budget preparation has been invisible.	To prepare the budget proposal based on the cost estimated above.	Necessity of the intensive bottom-up participation

5.8.4 Execution of Enhancement Plan

(1) To estimate SWM Cost

Over this period from January up to March 2017, the JPT wrote a program in excel so as to get the municipalities come to calculate the SWM cost by themselves. The JPT, by using projector, instructed both the conservancy section and the financial section how to use the excel program. The said program works like the following: when the municipalities make a full input of necessary data, the entire SWM cost is output automatically in 6 different services which are mandatory for municipality. The input works were completed by the end of March 2017.

Table 5-18 and Table 5-19 show the output costs. These costs are regarded commonly as the "SWM standard cost" of the municipality.

Table 5-18 SWM Standard Costs (1)

Service Sector	Baidyabati		Serampore		Champdani	
	INR 1,000/year	Composition Rate (%)	INR 1,000/year	Composition Rate (%)	INR 1,000/year	Composition Rate (%)
1. Primary Collection	9,040	15.2	24,787	35.9	12,969	27.9
2. Secondary Collection	10,310	17.3	16,577	24.0	11,881	25.5
3. Street Sweeping	290	0.5	15,285	22.0	10,617	22.8
4. Drain Cleaning	34,939	58.6	2,828	4.1	7,989	17.2
5. Septic Tank Sludge Cleaning	1,212	2.0	5,775	8.4	-	-
6. TS/CP	3,855	6.5	3,870	5.6	3,,068	6.6
Total	59,646	100.0	67,052	100.0	46,526	100.0
Ratio to Recurrent Expenditure Budget	37%	-	24.2%	-	25%	-

Source: Conservancy Section of each municipality and JPT

Table 5-19 SWM Standard Costs (2)

Service Sector	Uttarpara-Kotrung		Konnagar		Rishra	
	INR 1,000/year	Composition Rate (%)	INR 1,000/year	Composition Rate (%)	INR 1,000/year	Composition Rate (%)
1. Primary Collection	43,828	44.5	9,713	27.4	27,492	39.7
2. Secondary Collection	12,688	12.8	5,239	14.8	12,311	17.8
3. Street Sweeping	2,971	3.0	2,576	7.8	8,268	11.9
4. Drain Cleaning	27,123	27.4	11,951	33.7	11,898	17.2
5. Septic Tank Sludge Cleaning	8,389	8.5	1,769	5.0	4,437	6.4
6. TS/CP	3,788	3.8	3,995	11.3	4,863	7.0
Total	98,767	100.0	35,423	100.0	69,269	100.0
Ratio to Recurrent Expenditure Budget	53%	-	26%	-	38%	-

Source: Conservancy Section of each municipality and JPT

(1) To Calculate SWM User Fees

Table 5-20 shows the SWM user fee calculated on the basis of Table 5-18 and Table 5-19. Incidentally, the septic tank sludge cleaning fee is not included because the cleaning service is delivered on demand and the user pays the fee at the time of delivery.

Table 5-20 SWM User Fee

Municipality	Uttarpara-Kotrung	Baidyabati	Konnagar	Rishra	Serampore	Champdani
INR/month/family	175	150	135	180	120	145
Nos. of family	42,944	32,191	20,841	29,488	45,383	26,710

Note: Nos. of family are estimated for the year of 2017
Source: JPT

The JPT explained the user fee to the chairman, the other top management and the conservancy section of each municipality. Consequently, they understood and agreed it. Upon getting consent of the chairman, the JPT made a presentation at the municipality council meeting as shown below (of five municipalities except Konnagar as of the end of June) because the implementation of the fee collection is subject to the approval of the council. The council members did not raise any objection at the meeting, and every chairman concluded that they would make a decision after further discussion.

i) Showing the differences between before- and after-project: visually with photos
ii) Focusing on the high % of SWM cost: compared to total recurrent expenditures of municipality.
iii) Appealing the necessity of user fee collection: suggesting a step-wise collection of monthly fee per family of Table 5-20.

The municipalities except for Champdani had a meeting and agreed a joint resolution on introduction of SWM user fee collection dated 10th July 2017. It is assumed that there are some obstables to be solved toward the enforcement, and however this movement is a remarkable progress for SWM fee collection.

(2) Preparation of SWM Budget

The above (1) was actually worked by both the conservancy section and the financial section envisaging also SWM budget formulation.

On the basis of the above SWM cost calculated, the JPT instructed the municipalities in April 2017 how to reflect to SWM budget preparation. Incidentally, this reflection is to be started only with the financial year of 2018/19 because the 2017/18 budget preparation work was almost over at this time of April.

5.9 Establishment of New Body for the Operation of RWMC

It was confirmed in the joint coordination meeting held on 24th August, 2016 that Baidyabati Municipality would operate the RWMC from March 2017 and O&M fund will be arranged by MAD. With technical support from KMDA, Baidyabati plan to operate RWMC by contractor with technical support from KMDA.

5.10 Setting Target Values and Report of Achievement Progress

In the course of preparation of Action Plan for Improvement of SWM, target values were set as follows based on the design capacity of each facility and current incoming waste amount to the facility. Achievement in 2017 is also shown below.

Table 5-21 Achievement of target value set in the action plan

Achievement of target value set in the action plan (TS)

Municipality	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani	Total
Design capacity (t/d)	30	25	25	40	30	30	180
Planned incoming waste amount in 2017 (t/d)	20	9	14	26	13	13	95
Planned incoming waste amount in 2018 (t/d)	20	9	15	26	14	14	98
Target amount in August 2017 (t/d)	10	3	4	8	4	4	33
Target amount in August 2018 (t/d)	16	5	8	13	7	7	56
Actual amount in May 2017(t/d)	10.04	1.20	0.6	1.56	7.08	0.1	20.58
	100%	40%	15%	20%	177%	3%	62%

Achievement of target value set in the action plan (CP)

Municipality	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani	Total
Design capacity (t/d)	45	25	35	60	40	40	245
Planned incoming waste amount in 2017 (t/d)	43	21	33	58	41	30	226
Planned incoming waste amount in 2018 (t/d)	44	21	34	59	42	30	230
Target amount in August 2017 (t/d)	34	17	17	29	33	15	145
Target amount in August 2018 (t/d)	44	21	34	59	42	30	230
Actual amount in May 2017(t/d)	34.48	1	23.6	17.35	24.03	4	104.46
	101%	6%	139%	60%	73%	27%	72%

Achievement of target value set in the action plan (RWMC)

Municipality	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani	Total
Planned incoming waste amount in 2015 (t/d)	42	20	32	56	40	29	219
Target amount in August 2017 (t/d)	34	17	17	29	33	15	145
Target amount in August 2018 (t/d)	44	21	34	59	42	30	230
Actual amount in May 2017 (t/d)	18.64	18.27	20.26	31.52	24.03	4.78	117.5
	55%	107%	119%	109%	73%	32%	81%

Achievement of target value set in the action plan (Night Soil)

Municipality	Uttarpara-Kotrung	Konnagar	Rishra	Serampore	Baidyabati	Champdani	Total
Design capacity (t/d)	11	8.3	7.1	11	5.5	7.3	50.2
Target amount in August 2017 (t/d)	3.3	2.5	3.6	5.5	4.4	3.7	23
Target amount in August 2018 (t/d)	6.6	5	7.1	11	5.5	7.3	42.5
Actual amount in May 2017 (t/d)	NIL	NIL	0.13	2.13	0.69	0.69	3.64
	-	-	4%	39%	16%	19%	16%

CHAPTER 6. ACHIEVEMENTS

6.1 Result of Assignment

Assignment schedule as of November 2015 is shown in the Figure 6-1. In the 2nd Year, assignment schedule was modified. Details are shown in the Figure 6-1. Final record of assignments is shown in the Figure 6-2.

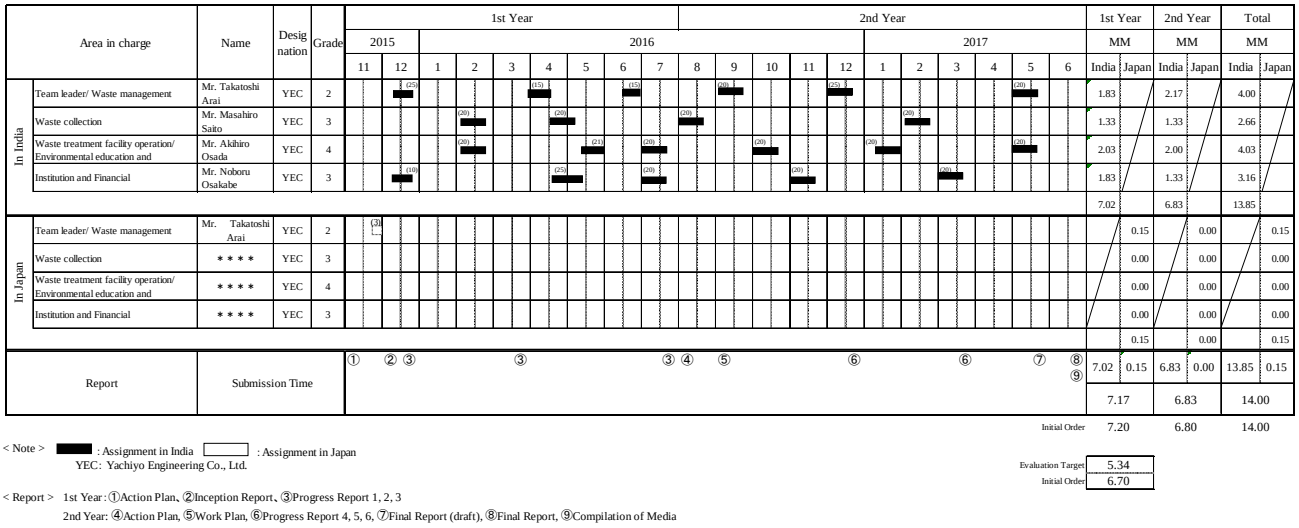


Figure 6-1 Assignment Schedule as of November 2015 at the time of contracting

Table 6-1 Change in the Assignment Plan

Position	Name	MM		Changes and contexts
		Before	After	
Team leader/ Waste management	Takatoshi ARAI	4.00	3.44	The MM has been **decreased** - To make the guidance in the establishment of waste amount and composition data management system more effective, the role of the assignment was handed over to the waste collection position.
Waste collection	Masahiro SAITO	2.66	5.13	The MM has been **increased** - to instruct the establishment of waste amount and composition data management system and preparation of EMP.
Waste Treatment Facility Operation / Environmental Education and Segregation Guidance	Akihiro OSADA	4.03	2.50	The MM has been **decreased** - To hand over the role of environmental education and segregation guidance to the Environmental Education and Segregation Guidance 2 position.
Environmental Education and Segregation Guidance 2	Kanako KATAYAMA	-	2.50	The MM has been **increased** - To put the two roles for environmental education and segregation guidance together and take care of the increased number of target municipality.
Institution and Financial	Noboru OSAKABE	3.16	3.83	The MM has been **increased** – To initiate the activities to secure O&M cost for newly established body for RWMC and TS/CP
Japanese Garden 1	Makoto SUZUKI	-	0.20	The MM has been **increased** - To assist designing Japanese Garden in Eco Park

Position	Name	MM		Changes and contexts
		Before	After	
Japanese Garden 2	Tatsuya NAKAJIMA	-	0.20	as a part of Environmental Education

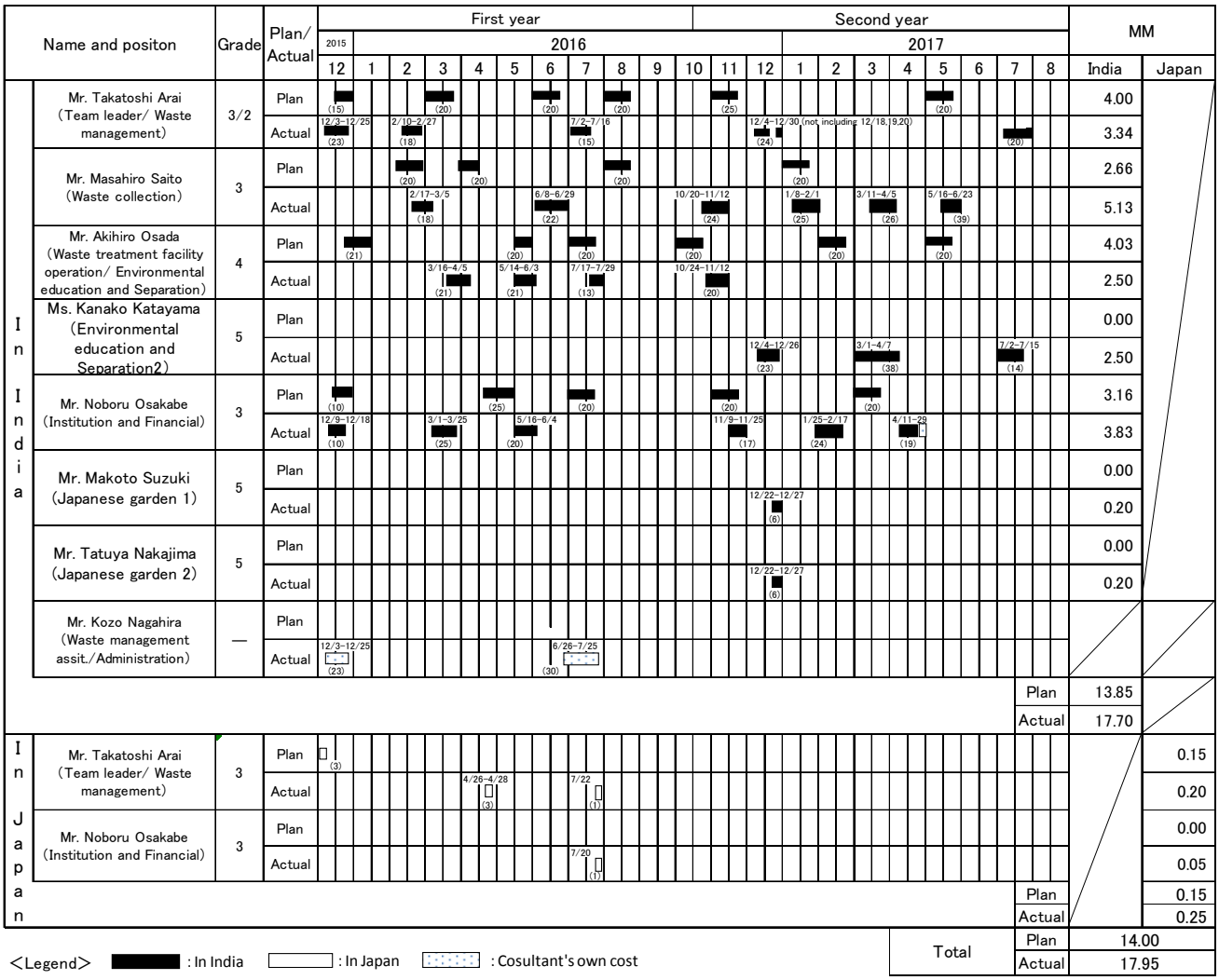


Figure 6-2 Actual Record of Assignment

6.2 Procurement Record of Equipment

Equipment procured in the TA Project is shown in the Table 6-2.

Table 6-2 Procurement Record of Equipment

No.	Item	Quantity	Cost in Japanese Yen (hereinafter referred to as "JPY")
1	Desktop computer	1	63,800
2	Laptop computer	2	136,600
3	Printer	1	94,400
4	Projector and Screen	1	77,600

No.	Item	Quantity	Cost in Japanese Yen (hereinafter referred to as "JPY")
5	Digital Camera	1	12,500
6	Video Camera	1	31,600

6.3 Result of Operational Cost in the Site

Shown below is the estimation of the actual expense of operational cost in the site involved in TA Project.

Table 6-3 Estimation of the actual expense of operational cost (General Operational Cost)

Item		Estimation of Expenditure (in JPY)
1	Local Human Resources	31,280,000
2	Vehicle	2,786,000
3	Facility and equipment O&M	1,000
4	Consumables	280,000
5	Travel and transportation	458,000
6	Communication	133,000
7	Document Preparation	1,228,000
8	Miscellaneous	1,529,000
Total		37,695,000

Table 6-4 Estimation of the actual expense of operational cost (Consignment)

Item		Estimation of Expenditure (in JPY)
1	Time and Motion Survey	2,440,900
2	Location Survey for SCP	971,200
3	Composition survey of compost	45,900
Total		3,458,000

CHAPTER 7. EFFORTS AND LESSONS FROM THE IMPLEMENTATION OF TA PROJECT

The challenges, efforts, and lessons from implementation of TA Project are described below:

7.1 Efforts to assure sustainability after Extension of Japanese ODA Project Loan

The main issue as of Decemver 2015 is that the O&M cost for the procured machineries and constructed facilities by Japanese ODA loan has not been assured. JPT has had discussions on how to secure O&M cost with KMDA and the six municipalities, however it did not reach the solution. Consequently JPT requested organizing the coordination meeting to the Chairman of MAD (West Bengal) through JICA. In result, on 24th August 2016, MAD, KMDA and the six municipalities had a joint coordination meeting, and discussed the following points:

- The six municipalities submitted the EMP for facility operation to MAD.
- Baidyabati municipality will operate RWMC after the completion of Japanese ODA loan. MAD will prepare fund for the operation.
- KMWSA will give technical supports on RWMC operation.

MAD approved a part of the cost for procurement of waste collection vehicles and equipment and repairmen and three-month O&M cost for RWMC. JPT is urging MAD on subsidizing on the other costs from the EMP.

7.2 Improvement in Communication with C/P through organizing meeting regularly

The distance between the project office of TA Project located in KMDA and municipal offices of C/P is hindrance for satisfactory communication. For the reason, JPT visits the municipal offices regularly to report progress, discuss the issues and talk about the following steps and activities regularly.

7.3 Efforts for SWM User Fee Setting

The collection of user fee is essential to secure the necessary funds for SWM without leaning heavily on the subventions from the State Government, so that the JPT gave an instruction step-wisely on how to set user fee to the municipalities.

i) To estimate and grasp the SWM cost
ii) To calculate and set the user fee
iii) To explain the cost and fee to the top management and the related sections of the municipalities in order to get them understand
iv) To make a presentation and appeal the necessity of the user fee collection to the council members at the regular meeting

The SWM services of the municipalities are free of charges, so that it is not easy to get the citizens understand why they should pay the user fee. Obviously a tough effort is inevitable to get them aware of the necessity of the fee before starting collection. To attain this, it is recommendable to hold community meeting ward-wisely.

However, it seems difficult for the municipalities to run this kind of awareness activities by themselves because of their limited number of personnel, experience and knowledge. For the reason, the activities should be run by the municipalities with the support of the JPT.

Ordinarily, the use fee is accounted as a general revenue as presented in Table 3-8, but not as an earmarked revenue especially for the SWM. In order to serve an adequate SWM, the necessary budget for it is to be secured accordingly. Obviously the necessary budget is not given by somebody, but is to be acquired through so-to-speak a fighting spirit. The conservancy section is strongly required to demonstrate and request the necessity of the said budget to the chairman, finance section and board of council by using the appropriate data.

7.4 Efforts to secure retailers of compost made at Compost Plant

7.4.1 Case Study on Compost Sales and O&M Cost of TS/CP

TS/CP in Uttarpara-Kotrung montly prodeces 75 ton of compost with utilization of INR 300,000 of O&M cost. Case study of compost sales and O&M cost of TS/CP is conducted with following assumpitions;

- 20% of compost produced is procured by residents by INR 5/kg of unit cost, and
- 80% of compost produeced is procured by furtilizer company by INR 2.5/kg of unit cost

The case study assumed following two cases;

Case 1: Compost sales in case that present production volume is sold out

Case 2: Required compost production & sales volume amount to satisfy with O&M cost

As result of the estimation shown in table below, present production volume, 75 ton/month is not satisfy for covering the O&M cost. 100 ton/month of sales is required for the municipality to cover the O&M cost of TS/CP.

Table 7-1 Case Study on Compost Sales and O&M Cost of TS/CP

	Case 1 Compost sales in case that present production volume is sold out	Case 2 Required compost production & sales volume amount to satisfy with O&M cost
Compost production volume (ton/month)	75.0	112.5
Volume procured by ferrilizer company (ton/month)	60.0	90.0
Volume procured by the residents (ton/month)	15.0	22.5
Unit price for fertilizer company (INR/kg)	2.5	
Unit price for the residents (INR/kg)	5.0	
Sales amont to fertilizer company (INR/month)	150,000	225,000
Sales amont to the residents (INR/month)	75,000	112,500
Total sales amount (INR/month)	225,000	337,500
O&M cost of TS/CP (INR/month)	300,000	330,000*

*: O&M cost is increased by 10% due to increase of production volume

7.4.2 Efforts to secure retailers of compost made at Compost Plant

To compensate a part of O&M cost for the compost plant, JPT has supported Uttarpara-Kotrung to sell compost made at the CP. Uttarpara-Kotrung contacted with retailers and made retailing contract for compost sale with a micro retailer however, the micro retailer disappred without receiving payment from the retailer after delivery of the compost. The municipality shall find good market. JPT is planning with the Municipality to secure several channels. Targets are the followings;

(1) Fertilizer for kitchen garden in households

JPT implemented pilot project of retailing to residents with mobile shop with the Municipality and C/P. JPT promoted sales through advertisement in newspaper, provision of leaflets, and miking.

(2) Fertilizer for public institutions

JPT requested chairman to order public institutions in the municipality to use the compost for the fertilizer of the garden. The chairman is considering the idea as of July, 2017.

(3) Fertilizer for agriculture

IFFCO introduced retailers of compost after participating compost sales promotion workshop organized by JPT. Municipality is negotiating with the retailers as of July 2017. The retailers are potential heavy buyer.

7.5 Lessons on the creation of ownership in C/P

JPT made efforts to invite as many visitors as possible to TS/CP of Uttarpara-Kotrung and RWMC to motivate C/P and site staff to be proud of their role and the O&M practices. In result, SIs of Uttarpara-Kotrung and Baidyabati started taking responsibility on the activities of the TA Project such as O&M of TS/CP and RWMC and negotiation for compost sale step by step. Uttarpara-Kotrung municipality procured waste collection equipment to improve efficiency and a large tanker for sludge delivery. SI of Baidyabati started participating meetings to prepare tender document for contractor and make agreement on the contents of activities of O&M of RWMC. Technical assistance would be expected to motivate SI to take initiative in the activities on SWM in other four municipalities.

7.6 Efforts to Expand the TA Project to the Other Four Municipalities

In consideration of the upcoming expansion of TA Project to other four municipalities, JPT organized bus-tour for chairman, CIC, SI, and staff working on SMS of Serampore and Rishra. The participants took a look at their TS/CP operated poorly before visiting model TS/CP of Uttarpara-Kotrung. JPT explained commitments would improve their operation by showing successful example of Uttarpara-Kotrung.

7.7 Efforts to Expand the Effects of KSWMIP to Neighbouring Areas

KSWMIP introduced regional SWM system including a sanitary landfill to West Bengal State for the first time. To expand the system to other areas, JPT invited interested officials and organizations to RWMC and TS/CP of Baidyabati to explain the overview of TA Project. Invited officials include 1) Japanese Consulate in Kolkata, 2) MAD, 3) P&RD, 4) DM, 5) DA, 6) Pollution control board, 7) University of Hooghly Institute of Technology. ADM of DA raised interest in KSWMIP after the site visit. Subsequently, ADM planned regional management system of waste involving neighbouring five panchayats around the six municipalities of KSWMIP, and planning the procurement of waste collection equipment. Panchayat will transport waste collected by the procured equipment to neighbouring TS/CP of KSWMIP.

7.8 Enhancement of Commitment from Decision Makers, Mayor and Councillors, to TA Project

Capacity development of staff and worker and cooperation from the residents are required to utilize at most the facilities constructed by KSWMIP. Besides, understand from the decision makers, the mayor and the councillor to KSWMIP and their effort are also required to establish the operation body and to secure the operation cost. The Project had held site visits and workshops for the decision makers to RWMC and TS/CP many times to enhance their involvement and understanding to KSWMIP. And then the decision makers had been requested to have a speech toward improvement SWM including KSWMIP in order to enhance mood for develop their commitment.

As a positive indication of effort for enhancing the commitemen form the decision makers, the six municipalities issued a joint resolution on introcuding SWM User fee, althought the state government officially abundant collection of drining waster fee.

CHAPTER 8. ACHIEVEMENT AND PROPOSAL

TA Project is designed as following, based on the background, purpose, and subjects of KSWMIP as described in Chapter 1. In other words, TA Project was designed "to transfer Japanese technology, implement capacity development to Indian side for effective utilization of equipment and facilities of KSWMIP."

In TA Project, JPT studies to find the most O&M method and social mobilization for equipment and vehicles procured by KSWMIP with C/P. Based on the result of the study, JPT prepares O&M improvement plan with C/P and transfer Japanese technologies on O&M of facilities to the six municipalities of Kolkata Metropolitan Area in West Bengal State. JPT introduces Japanese advanced knowledge and experiences of social mobilization and establish the culture of Reduce, Reuse, and Recycle to make most of the effects of KSWMIP.

8.1 Achievement of the Objectives

In the beginning of TA Project, RWMC and TS/CPs were lack of main body for the operation and operational cost was not secured. However, after the provision of technical assistance by JPT, following results are achieved. Municipalities' capacity of facility O&M is developed.

(a) Operating Body of RWMC and TS/CP

- Operating body of RWMC is determined to be Baidyabati and operating body of TS/CP of each municipality is determined to be each municipality. All the facilities are activated.

(b) O&M Cost of RWMC

- KMDA handed over the role of RWMC O&M to Baidyabati in April, 2017, and MAD approved subsidy for three-month O&M, or INR 4.5 million on March 27, 2017.
- MAD had requested Baidyabati to submit necessary documents to receive subsidy for after July 2017 and Baidyabati submitted on April 21.

(c) Applying for Subsidy for SWM O&M Cost: EMP

- The six municipalities applied for SWM O&M subsidy to MAD. Approval is to be in the progress.

(d) Subsidy for Repairing and Renewal of Equipment for Primary and Secondary Collection

- The six municipalities applied to MDA for subsidy for repairing and renwal of primary and secondary collection equipment in the beginning of September, 2016 and INR 650 million of subsidy has been approved. KMDA made bidding announcement on November 25, 2016 and procured and repaired waste collection equipment for the six municipalities.

(e) Introduction of SWM user fee collection

- The municipalities except for Champdani had a meeting and agreed a joint resolution on introduction of SWM user fee collection dated 10th July 2017. It is assumed that there are some obstables to be solved toward the enforcement, and however this movement is a remarkable progress for SWM fee collection.

(f) Segregation of Compostable Waste and Generation of Compost by Uttarpara-Kotrung

- Uttarpara-Kotrung is operating TS/CP with their own budget. While the municipality still faces challenges such as compost sale, operation in Uttarpara-Kotrung is next to successful case. TA Project shared experiences and attitudes of Uttarpara-Kotrung with the other five municipalities by inviting the latter to Uttarpara-Kotrung.

(g) Continuous Social Moviliztion Activity toward Source Separation of Organic Waste

- TA Project has carried out social movilization activites for the residents in the six municipalities aiming source separation of organic waste to be composted at the compost plant. There are still many areas in which the residents had not initiate the source separation of the organic waste, however habit of the source separation has gradually expanded into many areas such as Uttarpara-Kotrung municipality.

8.2 Proposal for Improving O&M Capacity of the Six Municipality

- TA Project contributed to determine operating body for the facilities developed in KSWMIP, and encouraged state government to subsidize O&M cost of the facilities. The six municipalities and KMDA must continue to reach state government to avert back set. Japanese side, in addition, has to continue monitoring and put follow-up support when needed.
- A part of O&M cost is expected to be subsidized by state government, however, the municipalities had better secure the O&M cost by their efforts. To the end, promoting sales of compost manufactured at TS/CP and collecting SWM user fee collection should be considered. Particullary, the six municipalities issued a joint resolution on introducing SWM fee collection on July 2017. The municipalities shall in trocuse the SWM user fee collection without any delay.
- TA Project organized site visit at TS/CP of Uttarpara-Kotrung and RWMC for CICs and Sis and shared good practice and issues with all the target municipalities at the same time as strengthening cooperation. The cooperation promoted in TA Project will contribute for the municipalities to address the challenges from now onward if they continue.
- TA Project implemented various activities of social mobilization with social mobilizers and coordinators. Social mobilizers are to be leaders of Environmental Education in the municipalities and for the reason, the municipalities continue to implement social mobilization with their inputs.
- TA Project prepared action plan for improvement SWM and then carried out activities for the improvement with initiative from JPT. The municipality shall continue the improvement activity and revise the action plan as well for further improvement of SWM.

Appendix 1 Detailed Activity Plan

Activities	Schedule/Actual Results	2015	2016											2017							
		First Year								Second Year											
		12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
(1) Preparation of Project Plan (first year)	Schedule	→																				
	Actual Results	→																				
(2) Preparation of Project Plan (second year)	Schedule									→												
	Actual Results												→									
(3) Preparation, explanation and discussion of Inception Report (draft)	Schedule	→																				
	Actual Results	→		→																		
(4) Survey of the overall waste management in 6 municipalities																						
① Collection and analysis of existing materials	Schedule																					
	Actual Results					→																
② Time and motion survey (by subcontractor)	Schedule																					
	Actual Results								→													
③ Survey on secondary collection points (by subcontractor)	Schedule																					
	Actual Results								→													
(5) Preparation of Action Plan for Improvement of Solid Waste Ma	Schedule																					
	Actual Results			→																		
(6) Technical Assistance for Municipalities																						
(a) Establishment of management system on data of waste quantity and quality																						
① to examine the recording data in each facility (receiving amount, area, composition) and others	Schedule																					
	Actual Results																					
② to examine the format for data collection method and output	Schedule																					
	Actual Results																					
③ to establish the data input and management system	Schedule																					
	Actual Results																					
(b) Improvement of waste collection																						
① to establish the system of understanding and analyzing the collection situation	Schedule																					
	Actual Results																					
② to prepare the waste collection improvement plan and manual	Schedule																					
	Actual Results																					
③ to prepare the equipment management plan and manual	Schedule																					
	Actual Results																					
④ to provide training for municiapal staff	Schedule																					
	Actual Results																					
(c) Operation improvement of TSs and CPs																						
① to establish the receiving control system	Schedule																					
	Actual Results																					
② to establish the quality management system of received wastes	Schedule																					
	Actual Results																					
③ to establish the environmental management system	Schedule																					
	Actual Results																					
④ to establish safety management system	Schedule																					
	Actual Results																					
⑤ to prepara contrac guildlines and manage the operation by private company	Schedule																					
	Actual Results																					

Activities		Schedule/Actual Results	2015	2016								2017									
				First Year								Second Year									
			12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
(d) Operation improvement of RWMC																							
①	to establish the receiving control system	Schedule																					
		Actual Results																					
②	to establish the landfill management system	Schedule																					
		Actual Results																					
③	to establish the O&M management	Schedule																					
		Actual Results																					
④	to establish the environmental management system	Schedule																					
		Actual Results																					
⑤	to prepara contrac guildlines and manage the operation by private company	Schedule																					
		Actual Results																					
(e) Improvement of night soil collection																							
①	to prepare the collection improvement plan	Schedule																					
		Actual Results																					
②	to prepare the equipment management plan	Schedule																					
		Actual Results																					
③	to implement the collection improvement plan	Schedule																					
		Actual Results																					
④	to implement the equipment management plan	Schedule																					
		Actual Results																					
(d) Improvement of environmental awareness activity																							
①	to prepare the improvement plan	Schedule																					
		Actual Results																					
②	to prepare the material for environmental education	Schedule																					
		Actual Results																					
③	to hold workshops and tours of visiting waste management facility	Schedule																					
		Actual Results																					
④	to implement environmental education and separation instruction	Schedule																					
		Actual Results																					
(e) Improvement of organizational and financial affairs																							
①	to instruct the organizational system and preparation of budgetary plan	Schedule																					
		Actual Results																					
②	to instruct the setting and collection of fees	Schedule																					
		Actual Results																					
(f) Support to New Management Body of RWMC		Schedule																					
		Actual Results																					
(g) Setting target values and report of achievement progress		Schedule																					
		Actual Results																					

Appendix 2 Record of incoming waste at TS/CP

Daily Incoming and out going Waste Record at Uttarpara TS&CP For the Month of January, 2017

		Incoming Waste											Outgoing Waste							
									Type Of Waste					Recyclable Material from TS						
Sl no	Date	Driver Name	Vehicle Type	Vehicle no	Ward no/Zone	Nos. of Container	In Time	Out Time	Compost in KG.	Non Compost In KG.	Drain Sludge In KG.	Septic Tank Sludge In KG.	Innert to RWMC in KG.	Plastic	Bottle	Glass	Paper	Metal	Total Recyclable	Remarks
1	01.01.2017	SUNDAY								0	0	0	0	0	0	0	0	0	0	
2	02.01.2017								11145	21815	21080		21575	125	95	195	90	65	570	
3	03.01.2017								9235	31315	9255	0	11555	85	70	165	85	60	465	
4	04.01.2017								9950	28520	15545	0	19260	90	80	170	85	50	475	
5	05.01.2017								10245	34105	9465	0		75	70	150	85	55	435	
6	06.01.2017								10920	40345		0	20585	85	80	160	80	45	450	
7	07.01.2017								9830	27360	11305	0	7615	90	85	170	75	65	485	
8	08.01.2017	SUNDAY								0		0								
9	09.01.2017								15940	38770	13710	0	28345	250	135	185	170	85	825	
10	10.01.2017								10115	33305	9130	0	18945	230	120	170	140	70	730	
11	11.01.2017								8895	29925	12665	0	17525	220	140	120	110	60	650	
12	12.01.2017								10195	27345	9025		17860	200	110	120	150	65	645	
13	13.01.2017								9065	25725	17230	0	20720	130	145	130	170	20	595	
14	14.01.2017								9360	15035	16860	0	16490	185	70	65	50	25	395	
15	15.01.2017	SUNDAY								0		0								
16	16.01.2017								11435	31235	10325	0	28145	240	120	220	180	100	860	
17	17.01.2017								8570	35895	3870	0	18240	210	100	205	150	80	745	
18	18.01.2017								9610	32490	6150	0	16645	175	70	140	130	50	565	
19	19.01.2017								10710	26260	9325	0	17565	180	80	160	145	70	635	
20	20.01.2017								9925	31465	6475	0	12110	195	125	185	160	75	740	
21	21.01.2017								8375	25895	6695	0	17855	200	110	120	150	65	645	
22	22.01.2017	SUNDAY								0		0								
23	23.01.2017								9560	33725	3780	0	18015	230	110	200	160	85	785	
24	24.01.2017								10575	33720	2060	0	17820	195	100	185	150	80	710	
25	25.01.2017								10060	42075	6305	0	25820	190	100	190	155	90	725	
26	26.01.2017	***REPUBLIC DAY***								0		0								
27	27.01.2017								13575	47035	4330	0	10150	225	100	180	170	90	765	
28	28.01.2017								9300	39865	4475		43790	240	100	150	150	95	735	
29	29.01.2017	SUNDAY								0		0								
30	30.01.2017								14380	23825	670	0	21650	250	135	185	170	85	825	
31	31.01.2017								10230	27960		0	46185	230	120	170	140	70	730	
						TOTAL WT. :-			261200	785010	209730	0	494465	4525	2570	4090	3300	1700	16185	

Appendix 3 Analysis of incoming waste amount

Appendix 4 Analysis of number of trip by each vehicle and collected waste amount

AREA	Vehicle Type	Vehicle no		2016		2017	Grand Total
				Nov	Dec	Jan	
KOTRUNG	AUTO	1	TRIP NO.	1			1
			COLLECTION QTY.	540			540
		2	TRIP NO.	4			4
			COLLECTION QTY.	2510			2510
		3	TRIP NO.	1	1		2
			COLLECTION QTY.	400	600		1000
		4	TRIP NO.	2		1	3
			COLLECTION QTY.	560		400	960
		7	TRIP NO.		1	2	3
			COLLECTION QTY.		900	1045	1945
		47	TRIP NO.		1	2	3
			COLLECTION QTY.		750	990	1740
		49	TRIP NO.			3	3
			COLLECTION QTY.			1580	1580
		50	TRIP NO.	40	49	46	135
			COLLECTION QTY.	33830	38545	41015	113390
		51	TRIP NO.	22	40	46	108
			COLLECTION QTY.	13535	32485	38990	85010
		52	TRIP NO.			2	2
			COLLECTION QTY.			1120	1120
	EICHER	15	TRIP NO.		3		3
			COLLECTION QTY.		4665		4665
		35	TRIP NO.	18	31	35	84
			COLLECTION QTY.	43355	78870	85745	207970
		36	TRIP NO.		1	6	7
			COLLECTION QTY.		3080	16430	19510
	T.T.	1	TRIP NO.	2	2		4
			COLLECTION QTY.	1690	1100		2790
		2	TRIP NO.		4	4	8
			COLLECTION QTY.		3900	2355	6255
		3	TRIP NO.			1	1
			COLLECTION QTY.			470	470
		4	TRIP NO.	38	55	57	150

				34230	51475	58960	144665
						1	1
						935	935
				37	53	49	139
			COLLECTION QTY.	32340	54870	49825	137035
		5	COLLECTION QTY.	5	5	4	14
			TRIP NO.	4120	5000	2945	12065
		7	COLLECTION QTY.	41	46	54	141
			TRIP NO.	33615	51195	57100	141910
		13	TRIP NO.		3		3
			COLLECTION QTY.		2970		2970
		15	TRIP NO.	1	2	6	9
			COLLECTION QTY.	1130	3970	5820	10920
		16	TRIP NO.			1	1
			COLLECTION QTY.			780	780
		28	TRIP NO.	3			3
			COLLECTION QTY.	2620			2620
		29	TRIP NO.	1		1	2
			COLLECTION QTY.	535		350	885
		35	TRIP NO.	1		1	2
			COLLECTION QTY.	2730		1915	4645
		50	TRIP NO.		1		1
			COLLECTION QTY.		1015		1015
		51	TRIP NO.	1			1
			COLLECTION QTY.	670			670
	T+R/T	1	TRIP NO.	1		1	2
			COLLECTION QTY.	370		670	1040
		2	TRIP NO.		1	13	14
			COLLECTION QTY.		400	14735	15135
		3	TRIP NO.	1			1
			COLLECTION QTY.	1320			1320
		5	TRIP NO.	4	4	1	9
KOTRUNG			COLLECTION QTY.	6425	5600	1290	13315
		7	TRIP NO.	1		2	3
			COLLECTION QTY.	650		1955	2605
		8	TRIP NO.	1			1
			COLLECTION QTY.	1515			1515
		9	TRIP NO.	1			1
			COLLECTION QTY.	375			375
		11	TRIP NO.	5			5
			COLLECTION QTY.	5065			5065

		12	TRIP NO.	2		1	3
			COLLECTION QTY.	3130		1350	4480
		13	TRIP NO.	6			6
			COLLECTION QTY.	6330			6330
		14	TRIP NO.	2		1	3
			COLLECTION QTY.	2220		1580	3800
		15	TRIP NO.	17	28	13	58
			COLLECTION QTY.	19390	32025	18090	69505
		16	TRIP NO.		3	9	12
			COLLECTION QTY.		2935	11365	14300
		17	TRIP NO.			2	2
			COLLECTION QTY.			1830	1830
		18	TRIP NO.			1	1
			COLLECTION QTY.			1490	1490
		19	TRIP NO.	12	15	20	47
			COLLECTION QTY.	13690	17645	17740	49075
		23	TRIP NO.	17	22	15	54
			COLLECTION QTY.	20080	25545	18745	64370
		24	TRIP NO.	4	7	6	17
			COLLECTION QTY.	4465	6815	6295	17575
		28	TRIP NO.	24	20	18	62
			COLLECTION QTY.	20070	17285	23870	61225
		29	TRIP NO.	2		2	4
			COLLECTION QTY.	1470		1130	2600
		35	TRIP NO.	1			1
			COLLECTION QTY.	390			390
		47	TRIP NO.	1			1
			COLLECTION QTY.	1190			1190
		51	TRIP NO.			1	1
			COLLECTION QTY.			940	940
		52	TRIP NO.	1			1
			COLLECTION QTY.	510			510
		223	TRIP NO.			1	1
			COLLECTION QTY.			940	940
MAKHLA	AUTO	4	TRIP NO.	1			1
			COLLECTION QTY.	340			340
		7	TRIP NO.	1			1
			COLLECTION QTY.	660			660
		9	TRIP NO.	2			2
			COLLECTION QTY.	1020			1020

		46	TRIP NO.	15	2	4	21
			COLLECTION QTY.	8560	1090	1990	11640
		47	TRIP NO.	20	30	42	92
			COLLECTION QTY.	11930	16320	23720	51970
		48	TRIP NO.	3			3
			COLLECTION QTY.	1885			1885
		50	TRIP NO.	1		1	2
			COLLECTION QTY.	840		965	1805
		53	TRIP NO.		16	1	17
			COLLECTION QTY.		9890	710	10600
	T.T.	1	TRIP NO.	1	2	2	5
			COLLECTION QTY.	770	1000	2470	4240
		2	TRIP NO.		1		1
			COLLECTION QTY.		350		350
		4	TRIP NO.	10	10	8	28
			COLLECTION QTY.	4625	4075	2790	11490
		5	TRIP NO.			2	2
			COLLECTION QTY.			920	920
		7	TRIP NO.	18	19	21	58
			COLLECTION QTY.	9205	8995	8655	26855
		9	TRIP NO.	15	16	5	36
			COLLECTION QTY.	9555	9190	2725	21470
		10	TRIP NO.	37	46	28	111
			COLLECTION QTY.	18790	18635	14715	52140
		11	TRIP NO.		1		1
			COLLECTION QTY.		550		550
		15	TRIP NO.			4	4
			COLLECTION QTY.			1885	1885
	T+R/T	4	TRIP NO.		1		1
			COLLECTION QTY.		530		530
		14	TRIP NO.	39	36	35	110
			COLLECTION QTY.	38500	34210	30500	103210
		15	TRIP NO.		2		2
			COLLECTION QTY.		2405		2405
		19	TRIP NO.			1	1
			COLLECTION QTY.			890	890
		24	TRIP NO.	1		1	2
			COLLECTION QTY.	1360		1795	3155
		28	TRIP NO.		1		1
			COLLECTION QTY.		1640		1640

UTTARPARA	AUTO	1	TRIP NO.		1		1
			COLLECTION QTY.		490		490
		3	TRIP NO.	15	26	40	81
			COLLECTION QTY.	8645	15015	22560	46220
		4	TRIP NO.		38	30	68
			COLLECTION QTY.		19530	15650	35180
		7	TRIP NO.	24	56	42	122
			COLLECTION QTY.	13985	33055	24325	71365
		9	TRIP NO.	64	6		70
			COLLECTION QTY.	31900	3135		35035
		10	TRIP NO.	1			1
			COLLECTION QTY.	400			400
		19	TRIP NO.			1	1
			COLLECTION QTY.			1020	1020
		29	TRIP NO.	1			1
			COLLECTION QTY.	425			425
		46	TRIP NO.	1			1
			COLLECTION QTY.	540			540
		47	TRIP NO.	2		3	5
			COLLECTION QTY.	1150		1645	2795
		48	TRIP NO.	17	9		26
			COLLECTION QTY.	7185	3920		11105
		49	TRIP NO.	39	58	64	161
			COLLECTION QTY.	18380	31020	31865	81265
		50	TRIP NO.	1		1	2
			COLLECTION QTY.	570		1210	1780
		51	TRIP NO.	11	2		13
			COLLECTION QTY.	4645	1700		6345
		52	TRIP NO.	21	56	40	117
			COLLECTION QTY.	8635	26470	19955	55060
		53	TRIP NO.	4		5	9
			COLLECTION QTY.	1820		3890	5710
	EICHER	9	TRIP NO.		1		1
			COLLECTION QTY.		720		720
		16	TRIP NO.		1		1
			COLLECTION QTY.		3130		3130
		26	TRIP NO.			1	1
			COLLECTION QTY.			3385	3385
		35	TRIP NO.	1	1		2
			COLLECTION QTY.	2310	3300		5610
		36	TRIP NO.	24	35	28	87

			COLLECTION QTY.	68280	99000	77525	244805
		37	TRIP NO.	1			1
			COLLECTION QTY.	2195			2195
		49	TRIP NO.	1			1
			COLLECTION QTY.	3690			3690
	P.T.	1	TRIP NO.	23	20	19	62
			COLLECTION QTY.	11130	10725	10435	32290
		14	TRIP NO.	1			1
			COLLECTION QTY.	580			580
		36	TRIP NO.	1			1
			COLLECTION QTY.	2025			2025
	T.T.	1	TRIP NO.	74	73	76	223
			COLLECTION QTY.	62655	58520	66050	187225
		2	TRIP NO.		10		10
			COLLECTION QTY.		9830		9830
		4	TRIP NO.	2		1	3
			COLLECTION QTY.	1230		1110	2340
		7	TRIP NO.	8	1	1	10
			COLLECTION QTY.	6245	1020	1360	8625
		9	TRIP NO.	63	55	73	191
			COLLECTION QTY.	48140	41790	58150	148080
		10	TRIP NO.	3	2	3	8
			COLLECTION QTY.	1660	1635	1940	5235
		11	TRIP NO.		2		2
			COLLECTION QTY.		2165		2165
		15	TRIP NO.			3	3
			COLLECTION QTY.			3195	3195
		16	TRIP NO.		7	7	14
			COLLECTION QTY.		4440	5875	10315
		24	TRIP NO.	1			1
			COLLECTION QTY.	985			985
		29	TRIP NO.		1		1
			COLLECTION QTY.		195		195
		36	TRIP NO.			1	1
			COLLECTION QTY.			2380	2380
		52	TRIP NO.		1		1
			COLLECTION QTY.		760		760
UTTARPARA	T+R/T	1	TRIP NO.	19	20	24	63
			COLLECTION QTY.	10315	9585	13280	33180
		2	TRIP NO.	1	4	1	6
			COLLECTION QTY.	1750	2120	1380	5250

Appendix 5 O&M Record (TS/CP in Uttarpara-Kotrung)

Operation and Maintenance Record for CP and TS :

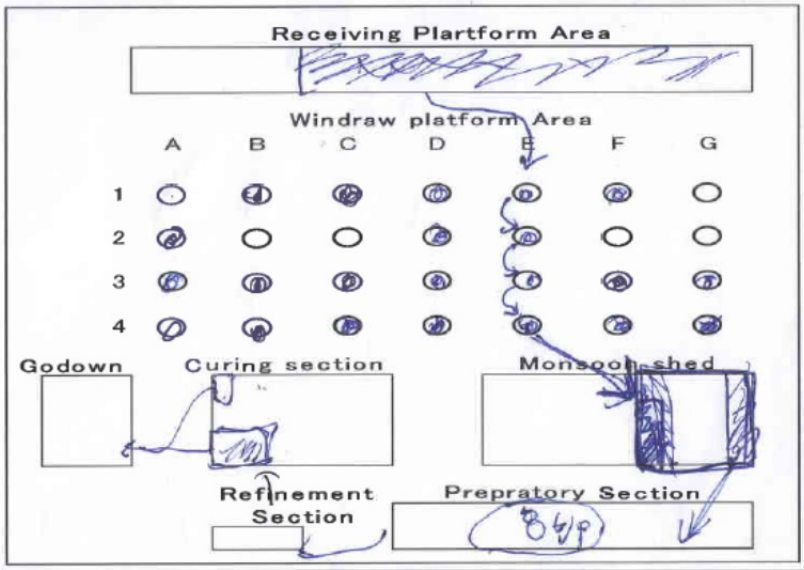
Date: 09.06.2017	Weather: Cloudy	Recorder: Rahul Prasad

1. Quantity & Quality of incoming waste

Total Quantity of incoming waste :	59.630 t/d
Total Quantity of organic waste for compost plant:	11.410 t/d
Quality of Segregation (tentative %)	80-85 % (C-P)

2. Compost plant operation :

2.1	**No. of heavy equipments and working situation**			
	Wheal loader + J.C.B. Number : 2 (Yes/No) Working hr : 5 hr	Dual Trommel with Conveyour Working Hr : 4 hr	Vibro screen Working Hr: hr	Gravity screen Working Hr : hr
2.2	**Moisture measurement : Windrow cell (Yes/No), Monsoon shed (Yes/No), Curing section (Yes/No)**			
	Temperature measurement : Windrow cell (Yes/No), Monsoon shed (Yes/No), Curing section (Yes/No)			
2.3	**Operation situation**			



2.4	Amount of compost produced :	t/d
2.5	**Comments:**	

3. Transfer station :

3.1	**No. of staff & heavy equipments and working situation**	
	Wheal loader, Back Hoe Loader Number : 1 (Yes/No) Working hour : 3 hour	Segregation staff Number : 15 (Yes/No) Working hour : 8 hour

4. Facility Operation:

4.1	**Weigh bridge:**	Operation (Yes/No) ,Working hour in previous day: 13 hour
4.2	**Administrative office :**	Operation (Yes/No)
4.3	**Generator:** Used in previous day?	Yes/(No) (hour)

5. Cleaning

5.1	**Operation Road :** (Yes/No)	4.5	**Leachate tank :** (Yes/No)
5.2	**Compost Plant :** (Yes/No)	4.6	**Use of sanitizer :** (Yes/No)
5.3	**Transfer station :** (Yes/No)	4.7	**Drain cleaning :** (Yes/No)
5.4	**Building :** (Yes/No)	4.8	**Other** office (Yes)

6. Visitors

6.1	**Organization Name:** JICA , **Number:** 1 Persons, **Purpose:** Providing the maintenance copy to plant

7. Emergency

7.1	**Injure: , Staff Name:**	, Situation of an injury :

Appendix 6 O&M Record (RWMC)

Operation and Maintenance Record for RWMC Landfill Site:

Date: 12.06.2017	Weather: Cloudy	Recorder: Debasish Sarkar

1. Landfill Work:

1.1	Dumping place(See drawing) : A-I -②& C-I-②													
1.2	No. of heavy equipments and working situation													
		Wheel loader:			Excavator: Ex-70			Bull dozer:			Dump truck			Sprinkler tanker: No
		Start	End	Total	Start	End	Total	Start	End	Total	Start	End	Total	
	Landfill Work	0	0	0	507.8	510.5	2.7hr	843.6	844.0	0.4 hr	Not Received			
	Soil Cover Work	Nil												
1.3	Landfill Work	Number of Passes: 3 nos.									Thickness per day: 600-700 mm			
1.4	Soil cover	Number of Compaction: No									Thickness per day: 0			
1.5	Comments: In the area of C-I-② only small vehicle dumping waste. : In the area of A-I -②only Heavy vehicle dumping waste.													

2. Weighbridge Record

	Champdani	Baidyabati	Serampore	Rishra	Konnagar	Uttarpara	Chandannagar	Total
Waste(TPD)	16.070	32.320	36.635	32.730	23.190	36.925	0	177.870
Septic(TPD)			3.00					3.00

3. Facility Operation:

2.1	Car wash :	Water jet, Operation No,	No. of machine : 0,	Working hours: 0
		Pool, Operation Yes	Working hours:	8 hour
2.2	Weigh bridge:	Operation Yes	Working hours:	8 hour
2.3	Office room:	Operation Yes		
2.4	Generator: Used in previous day? No			
2.5	Leachate treatment	Transfer Pump : Yes	Working hours: 6 hour	
		Aeration Lagoon-1: Yes	Working hours: 5 hour	
		Aeration Lagoon-2: Yes	Working hours: 5 hour	
		Re-circulation: Yes	Working hours: 0 hour	
2.6	Septic Tank Sludge treatment	Transfer Pump		
		Receiving pit: Yes	Working hours: 1 hour 30 mnt	
		Digester: No	Working hours: 0 hour	
		Relay Tank: No	Working hours: 0 hour	
		Chemical dozing: No	Working hours: 0 hour	
		Sludge dewatering: No	Working hours: 0 hour	
2.7	Site lighting: Used in previous day? Yes (9 hour)			
2.8	Comments: Site lighting Used as per weather condition			

4. Construction Work for Operation (New) **4. Facility Maintenance (Existing)**

3.1	Gas vent pipe : No		4.1	Gas vent pipe : No	
3.2	Operation Road : No		4.2	Operation Road : No	
3.3	Dumping platform: No		4.3	Dumping platform: No	
3.4	Other:		4.4	Other:	

5. Cleaning

5.1	Operation Road	Control Area : Yes	Landfill Area : Yes
5.2	Rainwater Drainage	Control Area : Yes	Landfill Area : Yes
5.3	Other:		

6. Environmental Monitoring

6.1	Water quality, Ground water: pH and EC No	Leachate water : PH and EC No
6.2	Landfill gas : C02, CH4, CO, O2, CO No	

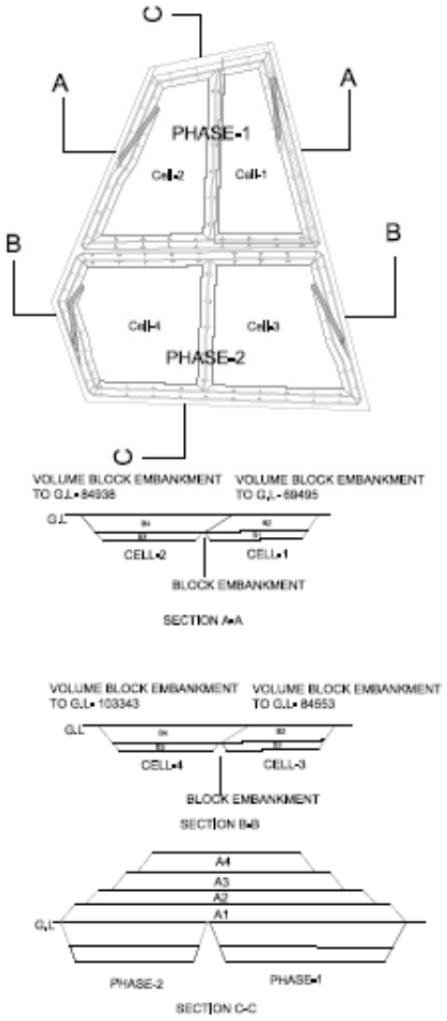
7. Visitors

7.1	Organization Name: Number: Purpose

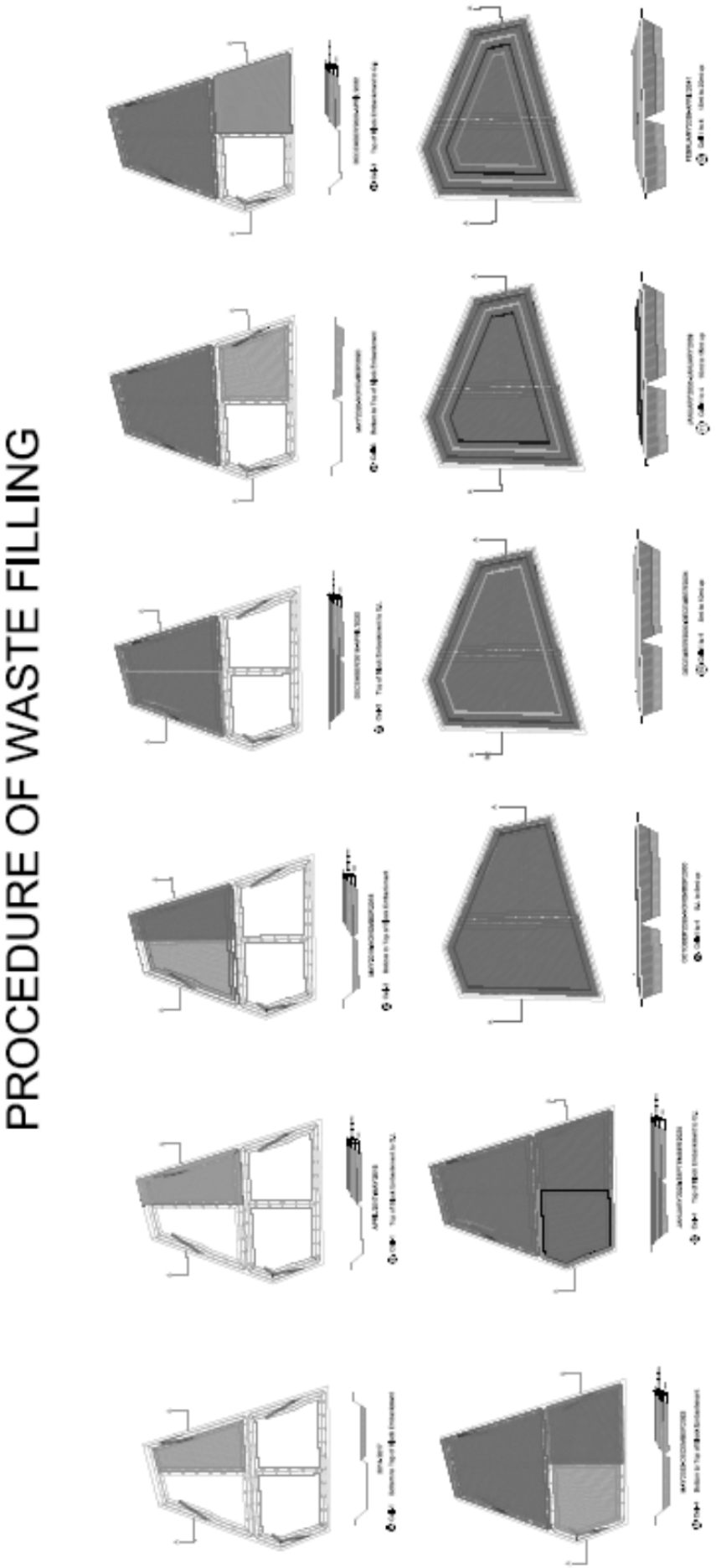
8. Emergency

8.1	Injure:0 , Staff Name : Nil Situation of an injury : Nil
8.2	Fire: Number: Place: No: Nil

Appendix 7 Analysis of remaining volume and time for landfill



Landfill Position			Volume (m3)	Landfill Period in days
Phase-1	Cell 1	B1	30,000	-
		B2	69,495	409
	Cell 2	B3	29,442	173
		B4	84,938	500
Phase-2	Cell 3	B1	35,519	209
		B2	84,553	497
	Cell 4	B3	36,320	214
		B4	103,343	608
Phase-1 & Phase-2	Cell 1 to Cell 4	A1	338,055	1,989
		A2	264,590	1,556
		A3	199,579	1,174
		A4	143,022	841
Total			1,418,856	8,170
Time taken to fill Landfill upto 20 mt Height				**22 yrs**


PROCEDURE OF WASTE FILLING