

Delhi Jal Board
Wastewater Management PPP Options
Study

Report on PPP Options

Final

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The World Bank



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1 EXECUTIVE SUMMARY

1.1 Introduction

Delhi Jal Board (DJB) is exploring options for public private partnerships (PPP) in the wastewater services as part of a strategy to expand sewerage access and to meet its environmental obligations.

The purpose of this report is to identify those models of partnership which are most relevant to DJB's situation and to discuss some of the advantages and risks associated with them. The report goes on to propose an outline for a possible PPP strategy.

The list of "most likely" PPP options is shown in the matrix of Options in Figure 1.1. Key characteristics of the options are shown in Table 1.1.

1.2 Network PPP Options

1.2.1

Existing network

The main challenges for PPP in the existing network are:

- to bring expertise and resources to improve the management of sewer spills which affect about 20% of the sewer network
- to create incentives to expand the network and wastewater services to areas currently not served.

With most of the network hidden from view, it is unrealistic to expect private companies to invest in rehabilitation or repair of the existing sewer network under a risk bearing PPP contract. So the PPP options available to DJB are limited to low risk Opex-type PPP contracts. The most promising PPP Options are:

Option (A): A Technical Assistance Contract, whose purpose would be to improve DJB's knowledge of the condition and performance of the network and help DJB apply best management practice.

Option (B): A Network Maintenance contract under which network maintenance activities are outsourced to a private company.

Technical assistance contracts can be a good first step towards deeper PPP, given a good working relationship between the parties. However, they have a mixed track record. TAs tend to focus on inputs rather than

outcomes, and would be heavily dependent on DJB providing support and resources to implement necessary changes.

The network maintenance option has cleaner lines of accountability and provides stronger incentives to drive improvements in service and efficiency.

The identified PPP options should not be seen as alternatives since they do different things. A potentially viable strategy for the network would be to commence with a technical assistance and to introduce a maintenance contract after 18 months (say) once baseline conditions have been assessed.

1.2.2 *New Network in existing drainage zones*

Conventional procurement approaches are likely to remain appropriate for most small and medium sized network developments in existing drainage zones.

For larger developments, the Design Build Operate model could be considered. The DBO model could be structured to reward the contractor for connecting new customers – leading to higher wastewater service coverage rates – and encourage more efficient work practices to reduce the need for multiple excavations.

1.3 **PPP Options for STP facilities**

The objectives for PPP at STPs are:

- To improve maintenance of the assets by securing allocation of financial resources to the maintenance function and through application of best management practice;
- To provide appropriate incentives for robust but efficient design, construction and operation;
- If possible, to attract private funding

1.3.1 *Existing STP facilities not requiring investment*

If the existing facilities are deemed to be fit-for-purpose and no major rehabilitation is required then the choice for DJB is either to continue to operate the facilities themselves or to outsource operations and maintenance through a performance based O&M contract. If properly structured, O&M contracts could offer significant advantages by:

- establishing clear accountability for meeting environmental standards,
- attracting good quality technical and management expertise,
- providing incentives for efficient operations, and
- creating hard budgetary commitments to ensure that adequate resources are allocated for maintenance.

1.3.2

New STPs and facilities requiring investment

If new investment is required, the basic choice is between a publicly funded “Design Build Operate” contract and a subsidised “Build Operate Transfer” contract. Both the DBO and the BOT contracts use life cycle cost bidding to encourage operators to come up with the most innovative and cost effective solutions.

Why would the BOT contract need to be subsidised? Financing a wastewater treatment project in India using 100% private capital could result in an increase in the unit costs of treatment, because private capital is more expensive than public capital in India. However, by mixing public and private capital, the average cost of capital can be kept to a minimum without significantly weakening the incentives for the private partner to deliver efficiency savings. Under the subsidised BOT (i.e. with DJB providing some public financing alongside that of the private sector), it would be expected that the higher cost of private sector finance would be offset by the operational and capital efficiencies that are undoubtedly available relative to traditional procurement approaches adopted by DJB.

The DBO and Subsidised BOT models provide broadly equivalent incentives for innovation and efficiency. One concern with the DBO model is that it may not secure the same degree of commitment from the private partner as a BOT. This risk can be overcome by well designed contract documentation and a sound prequalification process that ensures only firms which the requisite skills and incentives will be considered.

The strength of the subsidised BOT is that it brings additional capital to DJB and leverages DJB’s own funds, whilst creating stronger incentives for the private company. In other respects the DBO offers advantages over the Subsidised BOT model, including:

- *Lower cost of capital.* The DBO uses 100% public capital would result in cheaper cost of capital than the Subsidised BOT Option.
- *Lower initial transaction costs:* Internationally, the transaction and implementation costs for a first time BOT contract are typically in excess of \$1 million (442 Lakh).
- *Greater flexibility:* DBOs are much easier to adjust than Subsidised BOTs, not least because the Contractor would not need to seek consent for additional commitments from its financing partners.
- *Marketability:* Initial consultations with potential bidders indicated much greater interest in pursuing partnerships based on the DBO model than the Subsidised BOT model. In particular, the consultees had misgivings over the promptness of contract payments under a BOT, and the guarantees that would be offered in relation to private investment.

Taking these factors together the DBO option would appear to offer better value, and would have a higher chance of transaction success. Hence, DJB's current focus on the DBO model appears to be entirely appropriate.

However, it is clear that sources of cheaper public funding are finite and that DJB will need to access private capital if it is to meet its wider obligations. The subsidised BOT option has the potential to leverage public funds and gain more commitment from its private partner. However, for DJB to be successful in procuring a subsidised BOT it will need to make itself a more credible partner for the private sector. That will mean providing private investors with the necessary securities and guarantees and demonstrating over the longer term that it can be a solid partner to the private sector.

1.3.3

Biogas

It is expected that the most realistic way to exploit biogas would be to generate electricity to run sewage treatment plant and to make use of waste heat for drying sludge.

The efficiency of the biogas and electricity generating process is dependent to an extent of how upstream processes are managed. So, in many cases it will be most efficient to incorporate biogas facilities into the broader scope of PPP contracts for whole STP plants.

The design, operation and maintenance of digesters, biogas processes, and power generation units require special skills which are not necessarily available within DJB. So, there may be situations where an existing STP is to remain under DJB management where it would be worthwhile for DJB to outsource the biogas component under a stand-alone PPP contract.

Many of the problems with existing biogas facilities are caused by difficulties with the operation and maintenance of digesters. So it is assumed that the digesters will be packaged with the biogas facilities.

The most likely options for a stand-alone PPP Biogas contract are the same as those for an existing STP plant discussed in 1.3.1 and 1.3.2 above, and similar considerations will apply when selecting a preferred PPP model. It is anticipated that under all PPP Options the contractor would be remunerated through the sale of electricity to DJB. Such a payment arrangement would create strong incentives for efficient and reliable management of biogas. The buyer/seller relationship that would be implicit under such a remuneration arrangement may be attractive to the private sector.

In broad terms the advantages and disadvantages of the three PPP options are the same as for the existing STPs generally, and will not be repeated.

1.4 End-to-End PPP options

Having a single organisation responsible for providing all wastewater services in a given drainage zone creates conditions for clear accountability (both to DJB and to its customers) and would provide a platform for integrated planning and management within the drainage zone.

Some studies¹ have shown that there can be dis-economies of scale in water and sanitation services. That is, larger companies (with millions of connections) tend to be less efficient than medium-sized companies (with hundreds of thousands of connections). The findings would therefore suggest that DJB may achieve efficiency benefits by dividing the city into a series of smaller service areas. The end-to-end options described in this report provide a framework for developing such smaller service areas.

¹ Investigation into Evidence for Economies of Scale in the Water and Sewerage Industry in England and Wales, January 2004, Stone and Webster Consultants.

1.4.1 *Existing Drainage Zones*

For the existing sewer systems two PPP options are considered:

Option (A): Management Contract

Option (B): Operations and maintenance contract

The scope of work under both options could be broadly similar. The primary difference between the two options is that in a Management Contract, the private partner brings a management team and uses DJB's employees and equipment to undertake O&M activities. Under the O&M contract, the private partner brings all the resources necessary to undertake the work including the workforce, the materials and the required operating equipment.

The strength of the Management Contract would be that it brings additional expertise into the management of wastewater services. The main concern is that management contracts do not always provide the operator with the resources and autonomy necessary to be successful.

The O&M Contract provides clear lines of accountability and superior private sector management freedoms relative to Option A.

1.4.2 *New Drainage Zones*

For new systems, two different PPP alternatives are shortlisted.

Option (A): Design Build Operate

Option (B): Subsidised BOT/Concession

The primary difference between the two options is the source of funding. Option A uses public funding. Option B uses private funding, albeit with public subsidy as required. Under both options it has been assumed that DJB will continue to be responsible for billing customers for wastewater services.

Option B secures greater commitment from the private partner (the lower run-away risk), but for the reasons discussed in Section 1.3.2 the DBO would offer better value and would be more attractive to bidders. The main concern with the Subsidised BOT/concession model is its lack of flexibility. The contract would need to include periodic price review mechanisms, and some form of regulatory framework would need to be put in place to ensure the sustainability of the private partner and manage future investments. Such measures add complexity and increase private sector risks (political and regulatory).

The DBO offers lower cost, greater flexibility, and easier supervision. At this stage, the Subsidised BOT/Concession model appears to be more expensive, more complex, and introduces additional financial risks to the contractor given the uncertainties that apply in building underground networks vis a vis wastewater treatment plant. Since the Subsidised BOT/Concession option is a higher risk PPP model (when viewed from the private sector perspective) market testing would be necessary to determine the extent of interest and risk appetite of potential bidders.

If DJB wishes to attract private financing into an end-to-end PPP project then it may be worth considering a hybrid solution in which the STP is developed on a subsidised BOT basis, and the network is developed on a DBO basis. The BOT and DBO would be bundled together under a single procurement (i.e. both contracts would be undertaken by a single contractor).

1.5 Sludge Disposal PPP Options

DJB generates around 200 tonnes per day of sludge from its 18 STPs which it is finding increasingly difficult to dispose of. There is no scope for safe disposal of sludge in the existing dump sites operated by the Municipal Corporation of Delhi and therefore new sludge disposal routes need to be found as a priority.

DJB has recently invited expressions of interest for setting up sludge treatment and disposal operations under a BOT type arrangement. There is a risk that using the “market” to determine sludge disposal routes could result in a piecemeal approach to sludge disposal which may not be sustainable or cost effective in the longer term. Consequently, it is recommended that DJB should engage specialist consultants to assist it to develop a sludge management strategy which would consider the processing and disposal of sludge from its all its sewage treatment plants. The selection of suitable PPP models would then follow naturally from the agreed long term sludge management strategy.

Three sludge disposal PPP Options are discussed in the report:

Option (A): Design Build Operate

Option (B): Joint Venture (JV) Company

Option (C): Subsidised BOT

The type of PPP model that would be appropriate will depend to a significant degree on whether there any commercially viable forms of disposal can be identified. A Design Build Operate type model is suitable for defined-technology procurements² but less likely to be appropriate for disposal routes which seek to exploit the commercial potential of sludge, since the private partner would not carry the financial risk that the resulting facilities will be fit for purpose.

Disposal routes which seek to exploit commercial potential lend themselves to privately funded PPP solutions. The Joint Venture option would only be appropriate if it was determined that there was a significant upside potential from sludge revenues – and it is far from certain that this would be the case. The advantage of the option would be that it enables funding and revenue risks to be shared, potentially making a project more attractive to both the public and private partners. There may however be concerns that the role of DJB is less clearly defined because DJB would in effect be on both sides of the PPP contract.

The Subsidised BOT Option (Option C) has the cleanest lines of accountability and the strongest incentives to fully explore alternative revenue sources to defray operating costs. The costs of capital would be reduced by providing an amount of government subsidy.

1.6 Making PPP's Work for DJB

It is important to understand that outsourcing risks and responsibilities through PPP contracts will not absolve DJB of its broader responsibilities to its customers and its public stakeholders. PPPs involve creating contractual relationships that need to be managed. It also means building credibility in the market place as a sound partner in designing balanced contracts, administering them fairly, and building financial credibility. This will attract better quality partners which will ultimately deliver better value to DJB.

It is recommended that DJB consider setting up a dedicated Contract Management Unit (CMU) to procure and supervise its PPP programme. The role of the CMU would be:

- To manage the procurement of the PPP programme, working with transaction advisors where appropriate.

² I.E. Procurements in which the method of disposal (whether pellitisation or incineration etc.) is defined in advance

- To address day to day contract issues and be the single point of contact with private partner.
- To monitor compliance with the PPP contracts.
- To track trends in performance and report to DJB board
- Where necessary, provide clarification on contract interpretation issues.

The management of a PPP agreement requires a relatively hands-off approach that respects that day to day management has been contracted to the private party. The focus of supervision should be towards holding the private partner accountable for delivering the key project outcomes.

Careful thought should be given to identifying the values and attitudes required of the staff that will fill key posts involved in contract supervision.

DJB is currently in the process of developing a PPP procurement programme based around Design Build Operate and Build Operate Transfer contracts. It is strongly recommended that for the first tranche of PPP projects, DJB should engage professional transaction advisors to assist it to develop good quality templates for its bid documents. Good transaction advisers may be more expensive than using in-house staff, but can make the difference between a successful project and an unsuccessful one.

Finally, PPPs have to be paid for, like any other investment. A good financial model to understand the sources of financing (both capital and operational) is therefore a fundamental part of preparing a PPP programme. This will demonstrate the project's viability both to DJB and to the potential bidders.

1.7 Next steps

The steps towards creating a successful PPP programme might include the following:

- (a) Establish **Contracts Management Unit (CMU)** and appoint suitable staff;
- (b) Consult with State Government to identify **guarantees/ securities** that can be made available to the private partners (assuming privately funded PPPs are being contemplated)
- (c) Identify **pilot projects**, and confirm PPP feasibility, where DJB is facing challenges that it can't easily respond to given its constraints. If possible the locations of the pilot projects should be determined on the basis of their simplicity and their potential attractiveness to the private sector, as these factors would create the most favourable conditions for a successful pilot project. If appropriate, hybrid PPP models should be considered.

At the June Workshop an initial shortlist of potential pilot PPP projects was discussed as follows.

Table 9.1: Provisional List of models suitable for piloting

Asset Type		PPP Type
Network	Existing Drainage Area (Network Only)	Technical assistance + Maintenance Contract
	Existing STP	O&M Contract
STP	New STP	DBO Contract
	New STP	BOT Contract
End to End	End-to-End: Existing Drainage Area	Management Contract
	End-to-End: Greenfield	DBO or DBO/BOT hybrid ^(Note 1) .

Note 1: The envisaged hybrid model would involve developing the network on a DBO basis, and the STP on a BOT basis. A single contractor does both network and the STP to ensure single point accountability.

- (d) Hold a **private sector workshop** to assess potential private sector interest in the selected pilot projects and seek feedback on the pre-conditions for a successful transaction.
- (e) Appoint **transaction advisors**; to assist DJB with structuring the transactions, preparing procurement documents and evaluating bids. The documents prepared by the transaction advisors would become the templates for similar projects in the future³.
- (f) Prepare a **financial model** which will enable DJB to confirm the affordability of the proposed PPP strategy and put in place a long term financial plan.
- (g) Undertake **procurement** of the selected pilot PPPs;
- (h) **Learn the lessons** from the pilot projects before wider implementation.

By building its credibility through the successful implementation of a series of pilot PPP projects it would be expected that DJB would be in a position to progressively roll out a more ambitious PPP strategy within a few years.

³ DJB has already embarked on a programme of publicly funded DBOs. However, DJB does not yet have a suitable standard template for its proposed DBO bid documents. The draft documents developed to date appear to have evolved from traditional procurement documents and do not form an ideal starting point for developing a long term PPP relationship.

Figure 1.1 Matrix of Most Likely PPP Options for Wastewater

<i>Asset Type</i>	<i>Existing or New</i>	<i>Primary PPP Options</i>
Network	Existing Network	<ul style="list-style-type: none"> → Option A: Technical Assistance → Option B: Maintenance Contract
	New Network	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Conventional
Sewage Treatment Plant	Existing STPs & Biogas projects on existing STPs	<ul style="list-style-type: none"> → Option A: O&M Contract → Option B: Design Build Operate → Option C: Rehabilitate Operate Transfer
	New STPs	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Build Operate Transfer
End to End Solutions	Existing System	<ul style="list-style-type: none"> → Option A: Management Contract → Option B: O&M Contract
	New System	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: BOT/Concession
Sludge Disposal	New facilities	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Joint Venture Company → Option C: Build Operate Transfer

Table 1.1: Summarising the characteristics of the PPP Options

	Scope	Public or private funding	Incentives for efficiency	Clean lines of accountability	Flexibility	Value for money
Existing Network						
A. Technical Assistance	Knowledge building	Public	✓	✓	✓✓	✓✓
B. Network Maintenance Contract	O&M	Public	✓✓	✓✓	✓✓✓	✓✓
New Network (on its own)						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Conventional	Capex	Public	✓	✓✓✓	✓✓✓	✓✓
Existing STPs & Biogas at existing sites						
A. O&M Contract	O&M	Public	✓✓	✓✓✓	✓✓✓	✓✓✓
B. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
C. Subsidised Build/Rehabilitate Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓	✓✓
New STPs						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Subsidised Build Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓	✓✓
Existing End-to-End System						
A. Management Contract	O&M	Public	✓	✓	✓✓	✓✓
B. O&M Contract	O&M	Public	✓✓	✓✓✓	✓✓✓	✓✓✓
New End-to-End System						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Subsidised BOT/ Concession	Capex and O&M	Private*	✓✓	✓✓✓	✓	✓
Sludge Disposal						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Joint Venture Company	Capex and O&M	Mixed	✓✓	✓✓	✓✓✓	✓✓
C. Build Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓✓	✓✓

Key:

✓✓✓ = Good/Best

✓✓ = Acceptable

✓ = Weak. Least good.

2 BACKGROUND

2.1 Purpose of the study

Delhi Jal Board (DJB) is exploring options for public private partnerships in the wastewater services, as part of a strategy to expand access to waterborne sewerage and to meet its environmental obligations.

The purpose of this report is to identify the models of public private partnership which are most relevant to DJB's situation and to discuss some of the advantages and risks associated with them.

The report does not make specific recommendations as to which options should be applied. Each potential PPP project will need to be assessed on its individual merits. However a broad strategy is proposed in later sections.

During a workshop held at DJB offices in March 2011, DJB requested the consultant to provide advice on several issues relating to the design of PPP contracts, namely:

- How to determine the duration of a PPP Contract
- The use of Price Adjustment Mechanisms in PPP Contracts
- Asset Risk Mitigation in PPP contracts.

These issues are discussed in Annexes A1 to A3 of the report.

2.2 The PPP Concept

2.2.1

Why PPP?

Public-private partnerships (PPPs) are agreements between the public and private sectors for the provision of services or assets. Unlike traditional procurement contracts, PPPs allocate risks between the partners and create efficiency incentives for the service provider by linking financial reward to specific performance outcomes. For DJB's wastewater services the advantages may include:

- i. increased efficiency and reduced costs in the longer term;

- ii. addressing shortcomings in the quantity and capacity of public sector staff;
- iii. Improving environmental performance;
- iv. Improving the maintenance and longevity of the assets;
- v. mobilizing private funding to enable increased investment in the services.

2.2.2

PPP options considered in this report

The options in this report can be divided into two categories; PPP models that involve operating and maintenance activities (the “Opex” models) and PPP models that also include design and construction (the “Capex” models). The major characteristics of the various PPP Options discussed in this report are summarised in Table 2.1 and 2.2 below.

Readers wishing to learn more about these basic PPP forms are referred to a Government of India publication “Developing Toolkits for Improving Public Private Partnership Decision Making Processes” December 2010⁵.

Table 2.1: Summary of “Opex” type PPP Options used in this Report

PPP Model	Scope	Funding investment	Typical Payment to private partner	Key private sector risks	Suggested Duration
Technical assistance/ twinning	As specified. E.g. MIS, GIS, Hydraulic models	DJB	Fees paid by DJB	Limited (as per contract)	2-5 years
Operating and maintenance contract	O&M	DJB	Fixed fees or schedules of rates	Limited O&M risks as specified by contract	2 to 5 years
Management contract	O&M Investment advice, Supervise DJB staff	DJB	Fixed fee plus incentive bonus	O&M risks	3 to 7 years

⁵ See also the website <http://toolkit.pppinindia.com/>

Table 2.2: Summary of “Capex “ type PPP Options used in this Report

PPP Model	Scope	Funding investment	Typical Payment to private partner	Key private sector risks	Suggested Duration
Design Build Operate (DBO)	Design, build and operate a specified facility	DJB	Construction stage payments+ O&M fees.	Construction risks, O&M risk	13 to 20 years
Build Operate Transfer (Subsidised BOT) type contracts	Design, build, finance and operate a specified facility	Private (can be subsidised)	Capacity + Output charges	Investment risk, O&M risk	15 to 25 years
Concession	Full wastewater services, including investment	Private (can be subsidised)	Capacity + Output charges	Investment risk, O&M risk	15 to 25 years
Joint Venture Company	Exploit commercial opportunities (e.g. for re-use of sludge)	Joint public private	Depends on project	Shared Investment, O&M and commercial risks	.>15 years

2.3

PPP is not a panacea to resolve sector problems

It is important to understand that outsourcing risks and responsibilities through PPP contracts will not absolve DJB of its broader responsibilities to its customers and its public stakeholders. PPPs require a refocusing of the client towards management of contractors and away from doing things itself. It means creating contractual relationships that need to be managed, not simply “handing everything over”. It also means building credibility in the market place as a sound partner in designing balanced contracts, administering them fairly, and building financial credibility (particularly when the private sector is being asked to invest). This will attract better quality partners which will ultimately deliver better value to DJB.

Guidance on how DJB can build the skills for managing a PPP programme is provided in Section 8.

2.4 The Status of DJB's current PPP Strategy

DJB has already started a process of gradual introduction of PPP. Its PPP track record includes:

- Two successful O&M Contracts at Delhi Gate Nalla and the Dr. Sen Nursing Home Nalla STPs. O&M is undertaken by a private partner under a barter arrangement whereby effluent from the STPs is supplied to a nearby thermal power station.
- A manpower services contract at Rithala Phase II STP (which has recently been superseded by a 10 year contract for the rehabilitation, operation and maintenance of the plant (loosely described as a DBO).

DJB's future PPP programme focuses largely on Design Build Operate (DBO) and Build Operate transfer (BOT) models.

The planned DBOs include:

1. The Sewer Interceptor Project⁶ (value Rs 1,538 Crore)
2. Okhla STP tertiary treatment facilities
3. Two new 91 ml/d STPs at Pappankalan and Nilothi
4. Bio-Gas Engines and allied equipments for power generation at Okhla 636 ml/d STP (140 MGD).

The planned BOT projects include:

1. A pilot sludge irradiation plant of 45 mld (10 mgd), most probably at the Rithala STP complex.

⁶ The project will intercept around 1760 mld of sewage from open drains and will route it to the 7 existing treatment plants

2. A project for setting up and operating dry sludge processing units with the objective of value addition either as manure/fertiliser, fuel (briquettes) or for other unconventional applications.

DJB is also considering a possible “Asset Management Contract” at Coronation Pillar drainage zone.

It can be seen that DJB has started its PPP strategy with several short term “Opex” type PPP contracts which have focussed on improving the sustainability and efficiency of existing sewage treatment plant. It is now in the process of developing bid documents for a series of medium risk DBO contracts. These latter contracts will create broader opportunities for achieving capital and operational efficiencies, and for making the private partner more clearly accountable for meeting contract standards (particularly environmental standards). DJB’s current direction is towards higher risk privately financed PPP contracts driven in part by State Government policy which is encouraging DJB to seek private funding for its investment programme.

A key driver to reform is the long standing policy to freeze recruitment within DJB, which means that DJB does not have the manpower resources to operate new infrastructure as it comes on stream. Staff resource constraints will intensify in the future as a result of natural staff attrition. DJB envisages that in the medium term (10 to 15 years) the majority of its network and STPs will be operated by contractors under PPP contracts, with DJB increasingly becoming a PPP contracts manager.

3 SOME ISSUES TO BE CONSIDERED IN DEVELOPING PPP IN WASTEWATER SERVICES

3.1 Introduction

The purpose of this section is to discuss some of the key issues that DJB will need to consider as it develops its PPP strategy. In particular it identifies some of the challenges associated with mobilising private capital.

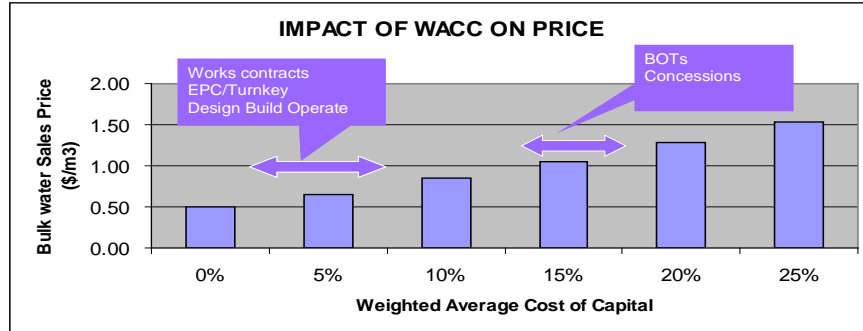
3.2 Public funding versus private funding

In the past DJB has relied on government funding for its wastewater investment programme. We understand that the State Government is now encouraging DJB to seek private funding to augment government sources.

Whilst government objectives are understandable, it must be understood that the use of private capital may result in higher costs to DJB in the longer term. Depending on the assumptions adopted, the cost of public funding may be in the range 0 – 10%. The cost of private capital (as Weighted Average Cost of Capital, or WACC⁷) for a project in the Indian wastewater sector may be in the region of 15%. Figure 4.1 below provides an example of how unit costs can be affected by the source of capital. This illustrates the impact of various WACC values, but all with an assumption of 100% private capital. In the India context the final impact would depend on the relative costs, and mix of, private and public capital funds.

⁷ Weighted average cost of capital is the blended cost of debt and equity.

Figure 3.1: How cost of capital affects unit costs



Source: Analysis of unit costs of a planned water treatment plant (confidential client)

Most BOTs in the water and wastewater sector undertaken in India over the past ten years have been subsidised. It is almost certain that DJB will want to do likewise, given the differential in cost between public and private capital and the desire to keep tariffs relatively low.

In a subsidised BOT, the average cost of capital can be kept to a minimum without significantly weakening the incentives for the private partner to deliver efficiency savings. It would be expected that under a subsidised BOT, the higher cost of private sector finance could be offset by the operational and capital efficiencies that are undoubtedly available relative to traditional procurement approaches adopted by DJB

If DJB is to be successful in attracting private financing it will need to make itself a more credible partner for the private sector. That will mean providing private investors with the necessary securities and guarantees and demonstrating over the longer term that it can be a solid partner.

3.3 The Annuity Model vs the BOT Model

DJB has discussed the possibility of an “Annuity Model” as an alternative way to attract private finance.

The term “annuity model” is understood to have been imported from the transport sector, where the annuity model was used as an alternative to financing new roads from toll revenue. Under the annuity model, the public partner reimburses the private investor over the course of the contract through payment of an annuity.

The BOT model described in this report is in effect the same as the “annuity model” used in the transport sector. In most BOTs, the Contractor would be paid a monthly fixed fee (the Monthly Capacity Payment) and a variable monthly output fee (the Monthly Output Payment)⁸. The Monthly Capacity Payment covers the costs of debt and capital repayments in much the same way as the annuity model.

3.4 Provision of Sovereign Guarantees

It is certain that, if DJB wishes to pursue a private funded project, it will be necessary to provide investors with confidence that they will recover their investment.

It is understood that DJB does not currently have an investment status credit rating, in part because of the low level of water and wastewater tariffs. So inevitably, it would be necessary to provide investors with additional forms of security to make a PPP project bankable. The most common approach in such circumstances is for the Government (in this case the State government) to provide a sovereign guarantee, which would guarantee that the Government will step in to meet DJBs obligations in the event that DJB defaults. DJB will need to establish whether the Government of the National Capital Territory of Delhi is in a position to provide acceptable guarantees to private investors, given that it is not a fully fledged ‘State Government’.

Subject to policy and legal considerations there may also be opportunities to use DJB’s land assets⁹ as a form of security.

3.5 Potential to exploit external sources of income

Potential sources of revenue from the STP process include the following.

(a) *Effluent reuse:*

About 167 ml/d (equivalent to 13% of the total) of DJB’s treated wastewater is currently re-used as follows.

⁸ An alternative is to adopt a take or pay arrangement which obligates the client to pay for a specified quantity. The minimum “Take or Pay” amount serves much the same purpose as the capacity payment in that it ensures the private partner has a minimum income to cover interest charges and debt repayments.

⁹ It is understood that DJB owns significant amounts of land some of which may be surplus to its long term requirements.

- *Re-use as cooling water for thermal power stations:* DJB is already providing effluent from STPs at Delhi Gate Nalla and the Dr. Sen Nursing Home Nalla. DJB has plans to sell effluent to power stations from Rithala, Pappankalan and Okhla STPs.
- *Industrial re-use:* Most heavy industry has left Delhi so opportunities for industrial re-use are limited. There are however plans to use treated effluent from Okhla STP to Okhla Industrial estate.
- *Irrigation:* DJB supplies water for irrigation of municipal lawns as well as to a limited extent for agricultural use in areas adjoining STPs

It has been estimated¹⁰ that there is an additional demand of 450 ml/d of re-used water. The sale value of effluent would appear to be site specific. At the Delhi Gate Nalla and Sen Nursing Home STPs the effluent sale value in effect covers the costs of operating and maintaining the Biofor STP plants¹¹. At the other end of the scale, income from effluent reused for irrigation of municipal green spaces is likely to be only nominal – well short of O&M costs.

(b) Sludge disposal:

DJB encourages re-use of dried digested sludge for agriculture. Sludge from drying beds is sold by DJB at a nominal rate of 10 Rs per truck. Clearly, this falls a long way short of a commercial proposition.

DJB is in the process of investigating alternative sludge disposal routes (manure, fuel, incineration). It appears unlikely however that revenue from alternative sources can contribute significantly to the full costs of sludge processing and safe disposal.

(c) Biogas:

It is expected that biogas will be used for electricity generation at the STPs to provide power to run the plants. Alternative approaches involving the sale of biogas to third parties are unlikely to be cost

¹⁰ Inputs for the PPP Options Study, Asit Nema, March 2011,

¹¹ DJB has negotiated a barter deal whereby Pragmati power operates the plant on DJB's behalf.

effective. DJB's experience at Okhla with selling gas for domestic use is unlikely to be repeated. The use of biogas as a fuel for vehicles is unlikely to be viable.

The question arises as to whether the private sector is better suited to exploiting revenue opportunities than DJB. It is considered that:

- Effluent re-use opportunities are largely dependent of location and DJB is already seeking to exploit these to the full. It is difficult to see how the private sector could bring significant further added value.
- With respect to sludge disposal, it is not unreasonable to use the market to identify the most cost effective routes for disposal. However, it appears unlikely that potential revenues would be sufficient to cover the costs of processing and disposal.

3.6

The role of DJB staff in the PPP programme

DJB employs some 18,000 staff. DJB estimates that roughly 40% of these are involved with wastewater activities. If PPP projects are to become a significant part of DJB's future service delivery model, then DJB will need to address the issue of potential redeployment of its existing workforce.

Some PPP options discussed in this report (e.g. the management contract) automatically involve use of DJB staff. With other PPP models, such as DBO and O&M contracts it would be more usual for the private company to provide its own workforce. However, if the PPP programme is to be widespread then DJB may need to consider whether it would be appropriate in some cases for selected staff to be deputed to the private partner. A key issue will be possible mismatches between the skills of existing staff and those required by the private operator.

For projects involving construction of new assets (such as a new STP) and for relatively small scale O&M contracts, there is probably no need to consider transferring existing staff to the private partner. The private partners would be given full freedom to recruit, train and manage their own workforce.

If staff are to be deputed, there would need to be measures to protect the interests of both the workers and the private partner. Typically a PPP contract may include:

- Guarantees relating to the terms and conditions of deputed staff;
- Requirements for training and development of deputed staff;
- Procedures for the selection of staff to be deputed, and for transfer back to DJB as appropriate.

4 PPP OPTIONS FOR THE EXISTING SEWER NETWORK

4.1 Problem statement for the existing sewer network

In a typical wastewater service provider the value of the sewer network accounts for over 80% of the total value of the wastewater assets.

As with all assets, network asset require monitoring, maintaining, and occasionally replacing. The difficulty is that the network assets are mostly underground and problems are usually hidden from view. So, the importance of good network maintenance is often overlooked.

The Technical Report¹² has identified the following primary challenges associated with DJB network operations:

1. It has been estimated that about 20% of primary network is susceptible to blockages, spills caused by hydraulic inadequacy, collapse/damage, and root ingress.
2. Maintenance is currently carried out on a reactive basis. There is no planned maintenance programme.
3. There is an absence of information systems and procedures for monitoring the condition and performance of underground assets. For instance, it is understood that there is no advanced Management Information Systems (including GIS) and no hydraulic models for analysing the hydraulic adequacy of the network.
4. A large portion of Delhi households are not connected to the sewer network. Overall coverage is around 60%, and DJB is working on a programme to accelerate coverage in areas not yet covered (particularly Unauthorised Colonies and Slums)

¹² Inputs for the PPP Options Study, Asit Nema, March 2011

5. Wastewater tariffs are set well below cost recovery levels which results in there being a financial disincentive for DJB to expand coverage.

The priorities and objectives for any PPP solution must therefore be:

- To bring in know-how in respect of GIS, MIS, hydraulic analysis, and CCTV in sewerage networks,
- To bring expertise and resources to set up and implement a planned sewer maintenance programme,
- To create a framework with incentives to expand network and services.

4.2 Should Sewage Pumping Stations be bundled with the Network or the STPs?

The question arises as to whether Sewage Pumping Stations (SPSs) should be included in PPPs contracts for the network or for the STPs. There are no hard rules to apply and it is suggested that each project and SPS will be assessed on its own merits. The factors that would need to be considered are summarised below.

- Whether the specific E&M maintenance skills required to maintain an SPS are available within the network contractor;
- Geographic distribution of SPSs. Are the SPSs located close to the STP or are they distributed around the network?
- Efficiencies of scope or scale that may be achieved by combining SPS with the network or STP plant ;
- The extent of independence of operation of the STP and SPSs (are the SPS operated or monitored from a central control point).

4.3 PPP Options for the Existing network

With most of the network hidden from view (and hence an unknown quantity in terms of condition and performance), it is unrealistic to expect private companies to invest in rehabilitation or repair of the existing sewer network under a risk bearing PPP contract. So the PPP

options available to DJB are limited to low risk Opex-type contracts. The primary options for consideration are:

- (a) Network Option A: Technical assistance project
- (b) Network Option B: Maintenance project

The two options are compared in Table 4.1 .

- **Option A (Technical Assistance)** may be suitable as a first step before a deeper form of PPP. The objective of the TA would be to introduce international best practice into sewer network management including sewer mapping, hydraulic modelling, condition assessment, sewer categorization, blockage monitoring, scheduled cleaning etc.

Technical Assistance contracts have a mixed track record. The client may not accept TA recommendations or may not have the resources to implement them. Problems may arise because the TA provider is often required only to provide staff, and produce reports, rather than deliver tangible results. Nevertheless TAs can be successful given a good working relationship underpinned by shared objectives, and the necessary resources to enable the TA provider to make the changes that are needed.

- **Option B (Maintenance Contract)** involves outsourcing maintenance of the sewer network to a private company. Unlike Technical Assistance, the private partner is **directly** accountable for delivering performance improvements set out in the contract. Compared to Technical Assistance the lines of accountability are much clearer, and the incentives to perform are stronger.

Performance standards may include minimum response times, repair times, and compliance with an agreed planned maintenance programme.

The key issues that would need to be addressed in the contract include the following:

- The absence of a reliable baseline position for setting performance standards;
- The payment basis. If a schedule of rates type of payment arrangement is used it will be important to find an efficient way to check and approve payments.

The identified PPP options should not be seen as alternatives since they do different things. A potentially viable strategy for the network would be to commence with a technical assistance and to introduce a maintenance contract after 18 months (say) once baseline conditions have been assessed.

Table 4.1 PPP Options for the Existing Network

	Option	Description	Pre-conditions	Duration	Payment basis	Pros	Cons	Comments
A	Technical Assistance (Network Management)	<ul style="list-style-type: none"> • create MIS and GIS systems and procedures • Undertake surveys and studies of sewer networks (including hydraulic models) • set up planned maintenance programmes • undertake training of DJB staff • advise DJB on operational procedures • develop investment programme for DJB to implement 	DJB must allocate funding for TA fees and associated investment	2 to 5 years	DJB pays fees linked to specified deliverables.	Brings know-how. Builds capacity within DJB.	TA is an inputs-based contract. TA provider is not accountable for improving the service. Does not address the need to expand coverage.	May be a good first step before starting a deeper form of PPP. Success is very dependent on the quality of the working relationship, and the availability of resources to support improvements.
B	Maintenance Contract	<ul style="list-style-type: none"> • Set up GIS and MIS systems and procedures for the network; • set up and implement planned maintenance programmes; • clear blockages, repair collapsed sewers, provide 24 hour emergency response • install new sewer connections • advise DJB on investments needed in the network. 	DJB must allocate funding for contractor payments.	2 to 5 years	DJB pays on the basis of a schedule of rates	Contractor is accountable for improving network performance. Creates hard budgetary commitments to ensure adequate maintenance.	Requires more supervision and monitoring than Option A. Absence of reliable baseline information makes it difficult to set realistic targets initially.	Good PPP model to improve network maintenance.

4.4 PPP Options for a new Network Project

If a new network is being developed along with a new treatment works then an end-to-end PPP solution may be appropriate as described in Section 6. Otherwise, the primary PPP options for new Networks are:

- (a) Network Option A: Design Build Operate
- (b) Network Option B: Conventional procurement

Both options involve public financing of the network. It is unlikely that private financing of new networks will be feasible in the short and medium term¹³.

The two options are compared in Table 4.2 . The DBO model will only be viable for larger new network developments. They are unlikely to be cost effective for small infill network developments. The main advantage of the DBO model is that the contract could be designed to provide incentives for the Contractor to aggressively connect new customers to the network. So, rather than being reactive and waiting for new customers to apply for a sewer connection, the contractor would undertake public campaigns to ensure a higher take up than would otherwise have been the case.

Traditional approaches to laying new networks often involve multiple excavations. First the network is laid, and later individual connections are installed in response to customer applications. This can be inefficient. If properly structured, the DBO could provide incentives for a contractor to be much more efficient by laying sewer pipes and connecting customers using fewer visits.

On the negative side, the DBO would carry risks associated with the fragmentation of the services. There could be potential delays and inefficiencies arising from communication interfaces between customers, DJB and the contractor.

¹³ The pros and cons of private financing of networks are discussed in Section 6 in the “Concession/BOT” options for End-to-End systems.

DJB would need to be mindful that sewer assets need to be designed for an asset life of 60 – 100 years; much longer than a typical DBO contract. So the inherent incentives for the DBO contractor to build cheap short-lived assets would need to be countered with good quality assurance (QA) by DJB.

Option B (Conventional) involves developing the network through conventional works contracts. The primary advantages of these approaches are simplicity, flexibility, and the fact that the network operations would be integrated into DJB's standard operating procedures so there would be no complicated interfaces for DJB and its customers to navigate.

Table 4.2 PPP Options for New Network Projects

	Option	Description	Pre-conditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	DBO	<ul style="list-style-type: none"> Design and build new network in line with DJB Masterplan. Connect new customers Maintain network 	Funding in place.	10 – 15 years	Schedule of rates. + Monthly maintenance fees.	<p>Incentives can be provided to reward the contractor for connecting new customers – leading to higher sewer coverage rates.</p> <p>Contractor has incentive to construct network and connections as efficiently as possible.</p>	<p>Sewer assets should be long lived but contractor may have much shorter time horizon. So good QA required by DJB.</p> <p>Fragmentation risks – potential inefficiencies from managing the interfaces between customers, DJB and the contractor.</p>	<p>DBO unlikely to be efficient for smaller network projects.</p> <p>Consider an End-to-End solution if entire End-to-End system is being developed</p>
B	Conventional	<ul style="list-style-type: none"> Build new network under conventional works contracts Hand over network to DJB DJB installs connections 	Funding in place	Short-term	Schedule of rates	<p>Simplest and most flexible.</p> <p>No complex interfaces between DJB and operator.</p>	Weaker incentives to connect new customers, and maintain the network efficiently.	Likely to remain appropriate for most new network situations in DJB.

5 PPP OPTIONS FOR SEWAGE TREATMENT PLANT

5.1 Problem statement

The sewage treatment challenges facing DJB are immense. Delhi 's population continues to grow rapidly. At the same time, DJB must increase sewer coverage from 60% currently and meet ever rising environmental expectations. All this must be achieved in the context of sewerage tariffs which fall a long way short of O&M costs recovery levels.

DJB operates 18 Sewage Treatment Plant with a total installed treatment capacity of 2,300 ml/d. Under current DJB plans, an additional capacity of 600 ml/d across 6 locations will be constructed over the next few years. A further 370 ml/d capacity will be required to meet all expected flows from the Interceptor Sewer Project, and another 900 ml/d will need to be developed over the next ten years to meet projected growth to 2021.

According to the Technical Report, the main sewage treatment challenges in the short and medium term are as follows.

1. STP capacity utilisation has been close to 50% for a long time¹⁴.
2. Only 30% of installed sewage digester capacity is operational. Problems include corrosion, malfunctioning of the mixing arrangement, lack of insulation, heating and real-time process control.
3. Many STP assets are aging poorly and will require refurbishment earlier than would normally be expected. Problems include a lack of financial resources for effective maintenance and problems with specification and construction quality.
4. None of DJB's plants have modern automation and control systems. It is understood that DJB intends to progressively introduce SCADA

¹⁴ The flow situation is expected to improve by mid 2011 once the ongoing trunk sewer rehabilitation programme is completed.

systems to facilitate greater efficiency and improved process control.

5. It is understood that a proportion of older STP's are not currently able to meet their design treatment standards.

Some of DJB's problems with the condition of its STP assets may, in part, be attributed to the use of Engineering Procurement Construction (EPC) contracts (otherwise referred to as turnkey contracts or Design and Build contracts) which are awarded on the basis of lowest initial capital cost and do not provide strong incentives for contractors to design and build long-lasting assets.

The priorities and objectives for any PPP solution must therefore be:

- To improve maintenance of the assets by securing allocation of financial resources to the maintenance function and through application of best management practice;
- To provide appropriate incentives for robust but efficient design, quality construction and effective operation & maintenance;
- If possible, to attract private funding.

5.2

Scope and scale efficiencies available from bundling STP phases on the same site

DJB current practice appears to be to let separate PPP contracts for each phase (i.e. new treatment stream) of a STP plant. So, in effect each phase of the works is treated as a separate and independent plant. This approach could potentially result in:

- A loss of day to day operational flexibility.
- Loss of O&M scope and scale efficiencies (e.g. through duplication of staff and systems)
- Inefficient use of investment resources. For instance, opportunities to achieve scale efficiencies may be missed or there may be duplication of some plant or facilities.

Given the potential for additional efficiencies it may in some cases be worth considering combining all phases of a STP under a common management agreement.

5.3 PPP Options for STP plant

For DJB's STPs the PPP choices start with low risk O&M contracts, progressing to publicly funded DBOs and finally to higher risk Build Operate Transfer/ "Rehabilitate Operate Transfer" (ROT) contracts.

As discussed in Section 3.1, the privately funded BOT and ROT options would need to be subsidised in order to minimise the cost of capital and keep tariffs affordable.

The primary options for consideration for existing STP are therefore:

- (a) O&M Contract
- (b) Design Build Operate
- (c) Subsidised Rehabilitate Operate Transfer (ROT)¹⁵

For the new STP facilities the primary options for consideration are:

- (a) Design Build Operate
- (b) Subsidised BOT

5.4 Evaluation of STP PPP Options

The O&M contract, DBO and BOT/ROT contracts are compared in Tables 5.1 and 5.2 below.

5.4.1 *Benefits from outsourcing O&M activities*

If the existing facilities are deemed to be fit-for-purpose and no major rehabilitation is required then the choice for DJB is either to continue to operate the facilities themselves or to outsource operations and maintenance through an O&M contract.

Relative to the status quo there is potentially significant added value that could be achieved with O&M contracts:

¹⁵ The Rot is the same concept as a BOT but is applied to a pre-existing asset

- They establish clear lines of accountability for meeting performance standards set out in the contract
- They can attract good quality O&M expertise (e.g. process engineering, maintenance management)
- They create hard budgetary commitments which may help to ensure that adequate financial resources are allocated to maintenance. In the longer term this should save money for DJB because proper maintenance would extend the life, and improve performance, of its assets.
- They create incentives for efficient operations

DJB appears satisfied with the performance of its two O&M contracts at Delhi Gate Nalla and the Dr. Sen Nursing Home Nalla STPs. DJB has also gained useful experience with a manpower services contract at Rithala Phase II works. Whilst not a full O&M contract, DJB considers that the Rithala contract has resulted in better operations than would otherwise have been the case.

When designing an O&M contract, a key challenge is to define the boundary between what constitutes repair (under the responsibility of the Contractor) and what constitutes rehabilitation (under DJB's responsibility). In the former case it is also likely to be important to cap the liability of the operator given the inadequate maintenance in the past.

5.4.2 *Comparing DBO versus BOT (and ROT)*

If the proposed project involves the construction and/or rehabilitation of assets then the choice to be made is between the DBO and BOT options.

The DBO and BOT models provide broadly equivalent incentives for innovation and efficiency.

One of the main concerns with the DBO model is that it may not secure the same degree of commitment from the private contractor as a BOT. There is a higher risk that the contractor could lose interest and abandon the contract having made money in the design-build phase. Contractor commitment can be secured to an extent by ensuring that

there is an adequate performance bond. Commitment is less of an issue in a BOT because, in addition to the performance security, the contractor's initial investment is repaid over the life of the contract.

The DBO model offers a number of advantages over a BOT for DJB. These include:

- Lower cost of capital (see discussion in Section 2).
- Lower initial transaction costs: Internationally the cost of transaction fees for a "first time" BOT contract would be in excess of \$1 million. Bidder costs are also significant and will ultimately be borne by DJB. The transaction costs for a DBO would be somewhat less.
- Greater flexibility: The issue of flexibility is important. Technology changes rapidly, and new ideas for managing and operating plant frequently emerge. Government policies and DJB requirements may change as well. If there is a widespread adoption of inflexible long term contracts then this will slow down DJB's ability to respond to changing conditions. DBOs tend to be much easier to adjust than BOTs, not least because the Contractor would not need to seek consent for additional commitments from its financing partners.
- Marketability/Financial risk transfer to private sector: Initial consultations with some potential bidders indicated greater comfort with the DBO model than with the BOT model. Consultees indicated that they would be particularly mindful of DJB's low credit rating, and the measures provided to ensure the contractor is paid promptly.

Notwithstanding, DJB is concerned that public funding for investment will be limited, and it anticipates that it will need to access private capital in the near future if it is to be able to meet its strategic objectives. If DJB is to be successful in procuring and implementing a BOT in the medium term it will need to make the projects in question attractive to potential investors.

The following measures could be considered as a means of making a BOT project more bankable.

- (a) Subsidy: Providing low interest loans or grants to subsidise the initial construction cost (i.e. adopting a subsidised BOT)
- (b) Sovereign Guarantee: Provision of a guarantee from the State Government, or equivalent
- (c) Prompt payment: Provision of a pre-funded Escrow Account and/or an unconditional letter of credit from a reputable bank.
- (d) Transaction: Professional quality documents with fair risk allocation. Clear timetable for procurement specified from the outset, and all time targets met.
- (e) Supervision: Performance assessed annually by an independent technical auditor.
- (f) Price adjustment: Indexation and provision for exceptional review of price (See annex B for a discussion), supported by use of an independent adjudicator.
- (g) Dispute resolution: International arbitration.

Table 5.1 PPP Options for the Existing STPs

	Option	Description	Preconditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	Operations and maintenance contract	<ul style="list-style-type: none"> Undertake emergency repair and maintenance programme Develop and implement a planned maintenance programme Operate the STP to meet effluent quality standards 	<p>Data on the condition and performance of the existing plant must be made available to bidders</p> <p>Funding available for major rehabilitation during contract.</p> <p>Prompt payment of contractor's fees.</p>	3 - 5 years	Preferably fixed fee plus output related fee.	<p>Brings O&M know-how (process control and planned maintenance)</p> <p>Simple contract to procure and supervise.</p> <p>Ensures adequate budget allocation for effective maintenance.</p>	<p>Contractor can be frustrated if there is no funding to support essential replacement.</p> <p>Can be difficult to define the boundaries between repair (the Contractor's role) and rehabilitation (usually DJB's responsibility).</p>	<p>Suitable where existing plant is in reasonable condition and capable of meeting environmental standards.</p> <p>Use DBO or ROT if rehabilitation is required.</p>
B	DBO	<ul style="list-style-type: none"> Rehabilitate and expand existing STPs Operate and maintain plant to meet contract standards 	<p>Data on the condition and performance of the existing plant must be made available.</p> <p>Payment guarantees (e.g Escrow account).</p>	12 – 25 years	<p>Stage payments at Construction stage.</p> <p>Fixed and volume fees during operations phase</p>	<p>Uses public sources of capital which are significantly cheaper than private sources.</p> <p>Strong incentives for innovation and to develop assets based on lowest whole life costs.</p>	<p>Does not attract private finance.</p> <p>Less scope for innovation and efficiency than in a new build.</p> <p>Higher contractor run-away risk during the operations phase.</p>	<p>It is important to allocate risks and set standards that are consistent with the intrinsic capabilities/li limitations of the existing design.</p>

	Option	Description	Preconditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
C	Rehabilitate Operate Transfer (ROT) (Subsidised as necessary)	<ul style="list-style-type: none"> • Raise private finance • Rehabilitate existing STP • Operate and maintain plant to meet contract standards 	<p>Public funding contribution (as necessary).</p> <p>Reliable and extensive data on condition and past performance must be available to bidders.</p> <p>Robust state/federal funding guarantees or equivalent.</p> <p>Robust payment guarantees.</p>	15 – 30 years	Monthly Capacity Payment + Monthly Output Payment (usually)	Similar incentives for innovation and cost efficiency as the DBO. Private investment is at risk so incentives may be even stronger	<p>Higher cost of capital than DBO.</p> <p>Higher transaction and set up costs than the DBO. Not suitable for small value projects.</p> <p>Slightly less flexible contract than the DBO.</p> <p>Less scope for innovation and efficiency than in a new build.</p>	<p>Unlikely to be viable except for large high value rehabilitation projects.</p> <p>Private sector interest/ appetite needs to be carefully monitored.</p>

Table 5.2 PPP Options for the New STPs

	Option	Description	Preconditions for implementation	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	DBO	<ul style="list-style-type: none"> Design and construct new STP Operate and maintain plant to meet contract standards 	<p>Data on incoming sewage characteristics must be made available.</p> <p>Payment guarantees.</p>	12 – 25 years	<p>Stage payments at Construction stage.</p> <p>Fixed and volume fees during operations phase</p>	<p>Low cost of capital.</p> <p>Strong incentives for innovation.</p> <p>Strong incentives to achieve lowest whole life costs.</p>	<p>Does not meet DJB's aspiration of using private finance.</p> <p>Potentially less commitment during the operations phase.</p>	<p>This is a lower risk contract model than the BOT and is likely to be more attractive to potential bidders.</p>
B	BOT	<ul style="list-style-type: none"> Raise private debt/equity finance Design and build new plant Operate and maintain plant to meet contract standards 	<p>Public contribution in the form of grant and/or soft loans.</p> <p>Reliable and extensive data on condition and past performance must be available to bidders.</p> <p>Robust state/federal funding guarantees or equivalent.</p> <p>Robust payment guarantees.</p>	15 – 30 years	<p>Monthly Capacity Payment + Monthly Output Payment (usually)</p>	<p>Similar incentives for innovation and efficiency as the DBO.</p> <p>Private investment is at risk so incentives may be stronger.</p>	<p>Higher cost of capital than DBO.</p> <p>Higher transaction and set up costs than the DBO.</p> <p>Less flexible contract than the DBO.</p>	<p>Not suitable for small low value projects.</p> <p>Much higher risk contract than the DBO.</p> <p>Private sector interest/appetite needs to be carefully gauged.</p>

5.5 PPP options for Biogas

Biogas is a by-product from the digestion of sewage sludge. In section 3 it has been concluded that the most realistic way to exploit biogas would be to generate electricity to run the treatment plant and to make use of waste heat for drying sludge.

The efficiency of the biogas and electricity generating process is dependent to an extent of how upstream processes are managed. So, in many cases it will be most efficient to incorporate biogas facilities into the scope of broader PPP contracts for STP plants as summarized in Tables 5.1 and 5.2. For example, if a new STP is to be developed, the biogas and associated sludge digestion facilities would form part of the BOT or DBO contract, rather than being separated out under a separate PPP contract.

There may however be situations where an existing STP is to remain under DJB management and where it may be worthwhile for DJB to outsource the biogas component under a stand-alone PPP contract.

The design, operation and maintenance of digesters, biogas processes, and power generation units requires special skills which are not necessarily available within DJB and a PPP approach can be used to ensure more effective exploitation of Biogas resources than has been possible in the past.

The most likely options for a stand-alone PPP Biogas contract are the same as those for an existing STP plant, namely:

- (a) O&M Contract
- (b) Design Build Operate
- (c) Build Operate Transfer / Rehabilitate Operate Transfer

Many of the problems with existing biogas facilities are caused by difficulties with the operation and maintenance of digesters. So it is assumed that the digesters will be packaged with the biogas facilities.

In broad terms the advantages and disadvantages of the three options are the same as discussed in Section 5.4 for the existing STPs, and will not be repeated here. The key difference is in the type of remuneration arrangement that would be used in a Biogas project. Instead of using

monthly payments, (see Table 5.1), DJB would instead purchase electricity from the private contractor. Such a payment arrangement would create strong incentives for efficient and reliable management of biogas.

The buyer/seller relationship that would be implicit under such a remuneration arrangement may be attractive to the private sector, particularly if the PPP contract offers the contractor an option of selling electricity into the grid in the event of non payment of electricity charges by DJB.

Table 5.3 PPP Options for stand-alone biogas projects

	Option	Description	Preconditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	Operations and maintenance contract	<ul style="list-style-type: none"> Undertake emergency repair and maintenance programme Operate and maintain the digesters and biogas facilities. If appropriate, use waste heat to dry sludge Sell electricity to DJB 	<p>Provide guarantees relating to undigested sludge quantity and quality</p> <p>Ensure funding available for major equipment replacement during contract period.</p> <p>Prompt payment of contractor's fees.</p>	3 - 5 years	Sale of electricity to DJB and/or grid.	<p>Brings biogas know-how.</p> <p>Simple contract to procure and supervise.</p> <p>Ensures adequate budget allocation for effective maintenance.</p>	<p>Contractor can be frustrated if there is no funding to support essential replacement.</p> <p>Can be difficult to define the boundaries between repair (the Contractor's role) and rehabilitation (DJB's responsibility).</p>	<p>Suitable where existing biogas facilities are in reasonable condition and fit for purpose.</p> <p>Use DBO or BOT/ROT if rehabilitation required or new facilities to be constructed.</p>
B	DBO	<ul style="list-style-type: none"> Build new or rehabilitate existing new Biogas facilities (depending on situation) Operate and maintain the digesters and biogas facilities. If appropriate, use waste heat to dry sludge Sell electricity to DJB 	<p>Provide guarantees relating to undigested sludge quantity/ quality.</p> <p>If rehabilitation, then provide data on existing plant .</p> <p>Payment guarantees (e.g Escrow account).</p>	12 – 25 years	<p>Stage payments at Construction stage.</p> <p>Sale of electricity to DJB and/or grid. during operations phase</p>	<p>Uses public sources of capital which are significantly cheaper than private sources.</p> <p>Strong incentives for efficient biogas operations.</p>	<p>Does not attract private finance.</p> <p>Higher contractor run-away risk during the operations phase.</p>	Likely to be most marketable of the two Capex options.

	Option	Description	Preconditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
C	Build Operate Transfer (BOT) Rehabilitate Operate Transfer (ROT) (subsidised if necessary)	<ul style="list-style-type: none"> Raise private finance Build new or rehabilitate existing new Biogas facilities (depending on situation) Operate and maintain the digesters and biogas facilities. If appropriate, use waste heat to dry sludge Sell electricity to DJB 	<p>Public funding contribution (if required)</p> <p>Provide guarantees relating to undigested sludge quantity/ quality.</p> <p>If rehabilitation, then provide data on existing plant .</p> <p>Robust state/federal funding guarantees or equivalent.</p> <p>Robust payment arrangements.</p>	15 – 30 years	Sale of electricity to DJB and/or grid.	Strong incentives for efficient biogas operations.	<p>Higher cost of capital than DBO.</p> <p>Higher transaction and set up costs than the DBO. Not suitable for small value projects.</p> <p>Less flexible contract than the DBO.</p>	<p>Self-evidently the unit cost of electricity will be higher under this option as the price must also cover the capital costs.</p> <p>Private sector interest/ appetite needs to be carefully gauged.</p>

6 END-TO-END PPP SOLUTIONS

6.1 Rationale for considering End-to-End solutions

For existing and new sewerage systems, DJB may either consider separate solutions for the network and the STP plant, or could adopt an End-to-End solution in which a whole drainage zone could be outsourced to the private sector. What would be the advantage of an End-to-End solution?

Delhi is the eighth largest city in the World. Organisations involved in managing water and sewerage services in very large conurbations can often be unwieldy and difficult to manage. Some studies¹⁶ have shown that there are dis-economies of scale in water and sanitation services. That is, larger companies (with millions of connections) tend to be less efficient than medium-sized companies (with hundreds of thousands of connections).

The findings would therefore suggest that DJB may achieve efficiency benefits by dividing the city into a series of smaller service areas. Unbundling the Delhi service area into multiple smaller service areas would have several advantages:

- Smaller zones may be easier to manage and more efficient
- Smaller organisations can potentially be more nimble and responsive to customers
- Unbundling can enable comparative competition between service providers.

Whilst a case may be made for the merits of unbundling relative to the status quo, there is a further question as to whether an End-to-End solution is intrinsically more efficient than the separate PPP approach discussed in Section 4 and 5. It is considered that:

¹⁶ Investigation into Evidence for Economies of Scale in the Water and Sewerage Industry in England and Wales, January 2004, Stone and Webster Consultants.

- There are several relatively new STPs that DJB has developed which are underutilised. Potentially, given the right incentives, the private sector might be more successful and efficient at encouraging new households to connect to the network.
- Having a single organisation responsible for providing all wastewater services in a given drainage zone creates conditions for clear accountability (both to DJB and to its customers) and would provide a platform for integrated planning and management within the zone. It may also be possible to create financial incentives for the contractor to improve network maintenance. For instance, if a blockage reduces flow to a treatment plant then (assuming the contractor is paid in part on the basis of the volume of sewage treated) the operator will have stronger incentive to fix the blockage quickly.
- There may be some modest savings from combining procurement of a combined PPP, and through potential synergies with operation and maintenance of sewage pumping stations and STPs. Otherwise the skills and resources needed to maintain the network are somewhat different from those used to operate and maintain a STP.
- It is not expected that an End-to-End solution would be any more marketable or more suitable for private investment.

So, in conclusion, end-to-end solutions have potential to deliver superior performance in the right conditions, but may not be a universally applicable across DJB.

6.2 End-to-End solutions in existing drainage zones

6.2.1 PPP options considered

For the existing systems two PPP options are considered:

- Existing End-to-End Option A Management Contract
- Existing End-to-End Option B Operations and maintenance contract

In the longer term it may be possible also to consider a concession contract. A concession option would be potentially viable when DJB has developed better knowledge of existing assets and a track record in successful PPP management.

6.2.2 *Evaluation of PPP options*

The primary difference between the two options is that under Option A, the private partner brings a management team, and uses DJB's employees and equipment to undertake O&M activities. Under Option B, the private partner brings all the resources necessary to undertake the work including the workforce, the materials and the required operating equipment.

The advantage of Option A is that it brings a strategic approach, combined with external know-how into the management of wastewater services. The private partner would be required to implement best management practice, and to train and supervise staff deputed by DJB. To be successful, DJB would need to establish a funding arrangement to support investment in new equipment, new connections, and in network improvements. The main concerns with this option is that:

- management contracts do not always provide the operator with the autonomy and commercial freedoms necessary to be successful. The Option would require DJB to step back from day-to-day decision making, and embrace its new role in monitoring and enforcing the contract.
- Success depends on the quality and suitability of the staff which it would inherit from DJB.

Option B, the O&M Contract, provides much superior management autonomy to Option A. For example, the contractor has the freedom to recruit, pay and train staff as it sees fit, rather than to work with personnel and staff terms and conditions inherited from DJB. Further, the private partner does not depend to the same extent on DJB approvals or budget allocations before implementing new procedures. So the prospects for success are probably greater than Option A. The main drawbacks are that:

- DJB would retain overall accountability of the services and would undertake all management activities outside of the contract
- The option does not address the need to develop and train DJB staff

- The arrangements for payment and monitoring of network operations may be complex (based on a schedule of rates/Bill of Quantities)
- The synergies to be achieved by combining network activities and STP activities appear limited. Having separate contracts for O&M of network and STPs may provide DJB with greater flexibility.

Table 6.1 PPP Options in Existing Drainage Zones (End-to-End)

	Option	Description	Preconditions	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	Management Contract	<ul style="list-style-type: none"> Operate and maintain the sewer system in specified zone on behalf of DJB DJB staff deputed to the Operator who supervises and trains DJB staff. Develop improved operating procedures, GIS, and MIS. etc 	<p>Funding for managers fees.</p> <p>Establish a "Operator's Investment Fund to support investment necessary to enable the contractor to be successful.</p>	3 – 5 years	Fixed fees + bonus for achieving targets	<p>Integrated management of drainage zone.</p> <p>Brings management expertise & technical know-how.</p> <p>DJB staff benefit from exposure to new management practices.</p>	<p>Management contracts provide limited management autonomy.</p> <p>Operator's effectiveness may be constrained by requirement to take DJB staff.</p> <p>Costs of a management contract may be in the range \$3m - \$6m.</p>	Could be considered as a first step in a process to unbundle the service area into smaller more manageable zones.
B	Operations and maintenance contract	<ul style="list-style-type: none"> Operate and maintain the sewer system in specified area on behalf of DJB Operator uses its own management and operations staff. Develop improved operating procedures, GIS, and MIS. 	<p>Fees to support O&M contract</p> <p>Funding for investment in network expansion.</p>	3 – 5 years	<p>Fixed+ variable fees for STP.</p> <p>Schedule of rates for network.</p>	<p>Integrated management of whole drainage zone.</p> <p>Contractor is accountable for improving STP and network performance</p>	<p>Absence of baseline data about the network would make setting targets problematic.</p> <p>Does not address need to develop and train DJB staff.</p>	Because network baseline conditions are not known, the payment and monitoring of network activities may be complex.

6.3 End-to-End solutions on Greenfield sites

6.3.1 PPP options considered

For new systems, two different PPP alternatives are shortlisted.

- (a) Design Build Operate
- (b) Subsidised BOT/Concession

6.3.2 Evaluation of PPP options

The two PPP Options are compared in Table 6.1.

PPP models for whole new wastewater systems on Greenfield sites are potentially more marketable than in those in existing drainage zones, because they do not face the same issues with the absence of baseline information about existing assets.

The role of the contractor and the scope of services would be similar under both options. Both options provide similarly strong incentives for efficient design and operation and both would attract similar expertise to the sector. Both are full service contracts so both options result in a very clear separation of roles and responsibilities.

The primary difference between the two options is the source of funding. Option A uses public funding. Option B uses private funding, albeit with public subsidy as required. As has already been noted the cost of public funding is less than the cost of private funding, so the DBO would almost certainly offer better value. On the other hand, the DBO carries a higher contractor run-away risk during the operations phase.

Aside from the cost of capital, the other main concern with the BOT/concession model is its lack of flexibility. In a conventional BOT for a STP, nearly all the investment takes place up front, and the investor recovers its investment over the course of the contract. In a PPP which includes development of a sewerage network, the contractor will need to respond to changing customer growth and demand patterns. Inevitably therefore the contract will need to be made sufficiently flexible to ensure additional investment is provided when needed. The contract would need to include price adjustment mechanisms (see annex A2) and a form of regulatory framework would need to be

established. Such measures add complexity and increase private sector risks (political and regulatory).

A further concern is that the incentives for a private concessionaire to make additional investments reduce steadily over the course of the contract. In the final years of a contract, it may be very difficult to persuade a concessionaire to invest in new assets/facilities.

In conclusion, the DBO offers lower cost, greater flexibility, and easier supervision. At this stage, the subsidised BOT/Concession model would be expensive and would risk procurement failure. However, in the medium term, if public investment funds are not available, then the BOT/Concession model could be considered, subject first to establishing whether there would be any market interest from good quality bidders.

An alternative approach for attracting private financing into an end-to-end PPP project would involve a hybrid approach in which the STP is developed on a subsidised BOT basis, and the network is developed on a DBO basis. The BOT and DBO would be bundled together under a single procurement (i.e. both network and STP would be developed and operated by a single contractor in order to provide single point accountability).

Table 6.2: PPP Options for new End-to-End Systems

	Option	Description	Preconditions for implementation	Duration	Payment basis (indicative)	Pros	Cons	Comments
A	Design Build Operate	<ul style="list-style-type: none"> Design and build new network and STP plant Provide all services necessary to operate and maintain network and plant to meet contract standards Develop network to meet demands over the course of the contract. 	<p>Funding to support initial investment.</p> <p>Funding to support subsequent investment in network growth</p> <p>Payment guarantees.</p>	12 – 25 years	<p>Construction: Stage payments & schedule of rates.</p> <p>Fixed and volume fees for operations phase</p>	<p>Low cost of capital.</p> <p>If structured correctly, strong incentives to ensure high sewer connection take-up rate.</p> <p>Strong incentives to achieve lowest whole life costs.</p> <p>Flexible contract.</p>	<p>Does not meet DJB's aspiration of using private finance.</p> <p>May not be possible to design an outcome based contract. Therefore the scope of design innovation may be limited.</p> <p>Requires effective lines of communication between the customers, DJB and the Contractor.</p>	<p>This is a lower risk contract model than the BOT and is likely to be more attractive to potential bidders.</p>
B	Subsidised BOT/ Concession	<ul style="list-style-type: none"> Raise private debt/equity finance for initial construction. Design and build new network and plant Provide all services necessary to operate and maintain network and plant to meet contract standards Develop network to meet demands over the course of the contract. 	<p>Public contribution in the form of grant and/or soft loans</p> <p>State guarantees or equivalent.</p> <p>Robust payment guarantees.</p> <p>Regulatory framework.</p> <p>Minimum contract size to justify transaction costs.</p>	15 – 25 years	Monthly Capacity Payment + Monthly Output Payment (usually)	<p>Similar incentives for innovation and efficiency as the DBO. Private investment is at risk so incentives may be stronger.</p>	<p>Higher cost of capital than DBO.</p> <p>Less flexible because of private funding. Would require price adjustment provisions and regulatory framework.</p> <p>Higher transaction and set up costs than the DBO.</p> <p>Private sector will regard this as a high risk contract.</p>	<p>Not suitable for small low value projects.</p> <p>Much higher risk contract than the DBO, and more difficult to supervise.</p> <p>Private sector interest/ appetite needs to be carefully monitored.</p>

7 SLUDGE DISPOSAL PPP OPPORTUNITIES

7.1 Problem statement

DJB generates around 200 tonnes per day of sludge from its 18 STPs which it is finding increasingly difficult to dispose of. Some sludge is sold for manure and the remainder is either stocked or disposed of in low lying areas. However, DJB has no recourse to sanitary landfill sites and the dump sites operated by the Municipal Corporation of Delhi are nearing full storage capacity. In view of this new sludge disposal routes need to be found as a priority.

Furthermore, given the current technology and management practices a large area of land is wasted through the use of sludge drying beds which help in raising the solids content to only 40%.

It is expected that DJB will need to invest in improved sludge processing and disposal practices. The investment would include measures to reduce the volume of sludge, to address offensive odours and to make sludge suitable for handling and disposal in line with good environmental practice.

7.2 Sludge disposal – future strategy

According the Technical Report, the most promising options for sludge disposal are:

- Incineration, either in a dedicated plant or combined incineration with municipal solid waste
- Drying/pelletizing of digested sludge (and possibly mixing with other fertilizers) to make it suitable for transport and land application
- Processing sludge for briquettes as an alternative fuel

DJB is understood to favour disposal options which involve reuse as briquettes or manure. But no studies have yet been carried out to establish whether reuse options are financially viable.

DJB has commenced a “sludge disposal” procurement for a privately financed PPP on an “open technology” basis. Bidders will be invited to propose the method of disposal and the type of technology to be used. It is understood that 15 companies have been shortlisted, offering a wide variety of different solutions.

There is a risk that the market-led approach currently being adopted by DJB could result in a piecemeal approach to sludge disposal which may not be sustainable or cost effective in the longer term. Any strategy for sludge disposal needs to take account of the complementary investment required in upstream operations. Different disposal solutions impose different requirements on the design and operation of the STPs in terms of dry solid content, handling and heat value. For these reasons it is more usual for water companies to develop an integrated plan for the development of sewage treatment assets and the disposal of sludge.

For these reasons it is recommended that DJB should engage specialist consultants to assist it to develop a sludge management strategy which would consider the processing and disposal of sludge from its all its sewage treatment plants. The selection of suitable PPP models would then follow naturally from the agreed long term sludge management strategy.

7.3 Sludge PPP Options

Subject to the results of the Sludge Management Strategy, the mostly likely PPP options are:

- Sludge Option A: Design Build Operate
- Sludge Option B: Joint Venture Company
- Sludge Option C: BO T

The three PPP Options are compared in Table 7.1. All three options anticipate that new sludge processing and disposal facilities will need to be developed.

The type of PPP model that would be appropriate will depend to a significant degree on the proposed method of disposal and whether there any commercially viable forms of disposal can be identified.

A Design Build Operate type model would be most appropriate for defined-technology procurements¹⁷. So, for instance, if the Sludge Management Strategy determines that sludge is to be disposed through incineration, then it would be appropriate to develop and operate the incineration facilities through a DBO contract. The DBO model is less likely to be appropriate for disposal routes which seek to exploit the commercial potential of sludge, since the private partner would not be backing its commercial proposition with its own money and therefore would not carry the risk that the resulting facilities will be fit for purpose.

Disposal routes which seek to exploit commercial potential lend themselves to privately funded PPP solutions. The challenge is to combine the incentives and autonomy associated with privately funded contracts with lower costs of public capital. Options B and C offer two alternative approaches.

Option B involves creating a joint venture with DJB to create a special purpose company to dispose of sludge. The joint venture approach would enable funding and revenue risks to be shared; potentially making a project more attractive to the private sector. However, the option would not be appropriate unless there was a significant upside potential from sludge revenues – and it is far from certain that this would be the case. There would also be concerns that the lines of accountability are less well defined because DJB would in effect be on both sides of the contract.

The BOT Option (Option C) is in many ways the cleanest of options. The private company is fully accountable for developing the facilities, and has the strongest incentives to fully explore alternative revenue sources to defray operating costs. The costs of capital could be reduced by providing an amount of government subsidy.

¹⁷ I.E. Procurements in which the method of disposal (whether pellitisation or incineration etc.) is defined in advance

Table 7.1 PPP Options for Sludge Disposal

	Option	Description	Preconditions for implementation of Option	Payment basis (indicative)	Pros	Cons	Comments
A	DBO	Design, construct, operate and maintain the new facilities necessary to dispose sludge.	Funding in place	Construction fees + Output related fees during operations period.	Simple approach with relatively low private sector risks. Low cost of capital.	DJB must define disposal route (e.g. incineration etc). Weaker incentives to exploit revenue sources since no private finance at risk.	Suitable for defined-technology procurements.
B	Joint Venture Company	Winning bidder forms a joint venture Special Purpose Company (SPC) with DJB. SPC would design, build, finance, operate and maintain new sludge disposal facilities.	DJB (or State Govt) fund share of the equity and provide proportion of the debt to support investment in new facilities. Guarantees to be provided to underpin private investment component. Also guarantees relating to sludge quality, and sludge amount.	Charge per tonnage disposed (measured as dry solids equivalent) with minimum Take or Pay.	Good incentives to secure most cost effective disposal route. Potential revenue and environmental risks are shared. Some private finance attracted. Blended public/private cost of capital. Both parties have self interest in the success of the project.	Corporate governance issue because DJB would be both sides of the contract. Bidders may be concerned over potential for interference by DJB. Profit sharing may blunt upside for private investor and reduce incentives for revenue exploitation.	May be politically attractive. Private sector is likely to insist on management control.

	Option	Description	Preconditions for implementation of Option	Payment basis (indicative)	Pros	Cons	Comments
C	Build Operate Transfer (subsidised as necessary)	Finance, design, construct, operate and maintain the new facilities necessary to dispose sludge.	Public contribution in the form of grant and/or soft loans State guarantees. Possible up front subsidy.	Charge per tonnage disposed (measured as dry solids equivalent) with minimum take or pay.	Clearer lines of accountability, and stronger incentives than Option B. Similar cost of capital to Option B could be achieved with public subsidy.	High speculative risks carried by private partner. High costs of capital if not subsidised.	

8 MAKING PPPS WORK FOR DJB

8.1 Objectives

The success of any future PPP programme in DJB will depend to a large degree on the extent to which it can develop a reputation as a reliable partner to the private sector.

International experience with the implementation and supervision of PPP contracts has not been universally good. A particular skill set is required to effectively procure and manage long term PPP contracts with the private sector. Such skills are rarely available within public sector organisations.

This section examines some of the actions that DJB can consider to make itself a good partner for the private sector and thereby underpin a successful PPP programme.

8.2 Factors contributing to procurement success

The following is a checklist of suggested actions required to deliver a successful transaction and to attract good firms to participate in PPP contracts.

- **Transaction team:** It is recommended that for the first tranche of PPP projects, DJB should engage professional transaction advisors. Good transaction advisers may be more expensive than using in-house staff, but can make the difference between a good project and a bad one.
- **Market consultations:** Many PPP procurements fail because the public partner has not understood the concerns of the private sector. Procurement failure can usually be avoided by eliciting feedback from the potential bidders at various stages in the planning and procurement process.
- **Procurement Process:** The procurement process should be transparent and fair. Competitive processes will usually achieve the cheapest and best result. A separate prequalification process should

be undertaken to eliminate firms that are judged not to have the capacity to undertake the work.

- **Procurement timetable:** Clients sometimes underestimate the time needed to procure a PPP contract. Typically a “first time” PPP transaction takes 12 to 18 months to complete. It is important to start with a realistic timetable which makes appropriate time allowances for government approvals. Potential bidders may withdraw if the client is unable to adhere to its own procurement schedule, or if they are not given adequate time to complete their due diligence.
- **Bid data room:** All information relevant to bidders should be assembled together and made available to bidders. Nowadays such data may be provided electronically, or in a virtual data room.
- **Bid documents:** Good quality well drafted bidding documentation should be developed. Bidding is likely to be more competitive if the documents provide the following:
 - A fair allocation of risks. Generally the risks that should be handed over to the Contractor are those that it is able to manage (or at least insure against). There is little benefit to be had from transferring unquantifiable risks to the Contractor.
 - Provisions for bid securities, performance securities, parent company guarantees, liquidated damages, and liabilities should collectively be commensurate with the size of the project and its potential returns.
 - Performance targets should be clearly defined, measurable, and achievable. The number of performance targets should be kept to sensible minimum.
 - Role should be clearly defined, with simple interfaces between the parties. The number of approvals should be kept to a minimum.
 - Payment conditions which provide confidence that the private partner will be paid on time.

- In the case of PPP projects which involve private investment, sufficient guarantees to satisfy the funding institutions.

Further guidance on best practice for implementing PPP projects is provided in a Government of India publication “*Developing Toolkits for Improving Public Private Partnership Decision Making Processes*”¹⁸ December 2010.

Finally, PPPs have to be paid for, like any other investment. A good financial model to understand the sources of financing (both capital and operational) is therefore a fundamental part to preparing any PPP project. This will demonstrate the project’s viability both to DJB and to the potential bidders.

8.3 Building a successful partnership during the supervision stage

While contractual and commercial arrangements may define the allocation of risks and responsibilities, the contract does not by itself guarantee a successful outcome. The management of a PPP agreement requires a range of “hard” and ‘soft’ skills in both DJB and the private party. These include:

- **Approach:** The management of a PPP agreement requires a relatively hands-off approach that respects that day to day management has been contracted to the private party. Effective PPP supervision requires the institution to move away from traditional contract management approaches which tend to focus on inputs. Too much intervention by DJB would risk souring relations and stifling innovation. The focus of supervision should be towards building a constructive partnership and holding the private partner accountable for delivering the key project outcomes.
- **Selecting key staff:** DJB’s project manager and others responsible for managing the partnership will have a major influence on the way the PPP contract develops. The behaviour of individuals in a contractual relationship is often a reflection of their attitudes.

¹⁸ See website: <http://toolkit.pppinindia.com/>

Careful thought should be given to identifying the values and attitudes required of the staff that will fill key posts.

- **Reporting:** During the course of a PPP contract there will often be an imbalance between the information available to the private partner and the information available to the client. This information asymmetry can lead to the emergence of mistrust. The parties should agree on reporting protocols (data, frequency, format etc) from the start. All reported data should be subject to independent audit.
- **Building trust between the parties:** Trust is a key feature of a successful partnership. Ultimately it has to be earned through actions and behaviours.
- **Partnership Management:** PPP projects can become adversarial. Some contracts make provision for the parties to agree a “partnership management plan” which set out procedures for routine dialogue and for addressing disagreements at an early stage.
- **Independent auditors:** The presence of independent third party auditors adds credibility and transparency to the project. Impartial third party auditors can be used:
 - To check data provided by the Contractor, and to produce an annual report card of performance
 - To arbitrate on issues of disagreement
 - To advise the client on issues of enforcement

8.4 Suggested organisational requirements

It is understood that DJB is planning to implement a range of PPP contracts across its water and wastewater services. The skills and expertise for implementing and overseeing the PPP programme will need to be developed within DJB.

Recognising that particular skills will be required, many public organisations internationally establish dedicated units to oversee PPP contracts. It is recommended that DJB follow standard international

practice and consider setting up a **Contract Management Unit (CMU) to manage its PPP programme.**

The role of the CMU would be:

- To manage the procurement of the PPP programme, working with transaction advisors where appropriate.
- To address day to day contract issues and be the single point of contact with private partner.
- To monitor compliance with the PPP contracts.
- To track trends in performance and report to DJB board
- Where necessary, provide clarification on contract interpretation issues.

Careful consideration will need to be given to the recruitment of key CMU staff as discussed in Section 9.3 above. Public servants are rarely incentivised to achieve good contracting outcomes.

Consideration may need to be given to the creation of appropriate job specifications and recruitment of people from the private sector with the requisite experience. Also the difficult questions of remuneration and incentivisation need to be considered.

9 DEFINING A FUTURE PPP STRATEGY

9.1 Summarising the PPP options for the wastewater services

The previous sections have discussed PPP options that may be appropriate for DJB's Wastewater services. The PPP Options were assessed in four categories:

- A sewerage network on its own
- STPs on their own
- End-to-end solutions (sewerage network + STP combined)
- Sludge disposal

Figure 9.1 attached summarises the primary PPP Options that have been identified for these categories. The key characteristics of the PPP Options are summarised in Table 9.1.

The decision as to which option to apply in which location will depend on a detailed evaluation of diverse factors such as:

- Financial feasibility/ affordability
- Legal considerations
- Private sector sentiments (appetite for risk)
- The type of guarantees available from government

Annex B includes a drainage zone table which may be helpful for developing a more detailed site-specific PPP programme. In many cases, a detailed PPP evaluation will enable a hybrid solution to be developed.

9.2 A possible Strategy for DJB in Wastewater Services

At a workshop held at DJB's headquarter offices on 8 June 2011, the following was established:

- DJB seeks to use PPP to improve the quality of wastewater services, to improve efficiency and, if feasible, to gain access to private capital.
- DJB intends to introduce PPP into its wastewater activities progressively. Its vision is that within a timescale of ten to 15 years DJB will have evolved into a "contracts management" organisation in which the majority of its activities are undertaken through contracts with the private sector.

The timetable for bring in private financing has yet to be determined. It will depend to an extent on whether suitable payment guarantee mechanisms can be developed, and the affordability of a long term BOT programme.

The steps towards creating a successful long term PPP programme might include the following:

- (a) Establish Contracts Management Unit (CMU) and appoint suitable staff;
- (b) Consult with State Government to identify guarantees/ securities that can be made available to the private partners (assuming privately funded PPPs are being contemplated)
- (c) Identify pilot projects, and confirm PPP feasibility, where DJB is facing challenges that it can't easily respond to given its constraints. If possible the locations of the pilot projects should be determined on the basis of their simplicity and their potential attractiveness to the private sector, as these factors would create the most favourable conditions for a successful pilot project. If appropriate, hybrid PPP models should be considered.

At the June Workshop an initial shortlist of potential pilot PPP projects was discussed as follows.

Table 9.1: Provisional List of models suitable for piloting

Asset Type		PPP Type
Network	Existing Drainage Area (Network Only)	Technical assistance + Maintenance Contract
	Existing STP	O&M Contract
STP	New STP	DBO Contract
	New STP	BOT Contract
End to End	End-to-End: Existing Drainage Area	Management Contract
	End-to-End: Greenfield	DBO or DBO/BOT hybrid ^(Note 1) .

Note 1: The envisaged hybrid model would involve developing the network under a DBO, and the STP under a BOT. A single contractor does both network and the STP to ensure single point accountability.

- (d) Hold a private sector workshop to assess potential private sector interest in the selected pilot projects and seek feedback on the pre-conditions for a successful transaction.
- (e) Appoint transaction advisors; to assist DJB with structuring the transactions, preparing procurement documents and evaluating bids. The documents prepared by the transaction advisors would become the templates for similar projects in the future¹⁹.
- (f) Prepare a financial model which will enable DJB to confirm the affordability of the proposed PPP strategy and put in place a long term financial plan.
- (g) Undertake procurement of the selected pilot PPPs;
- (h) Learn the lessons from the pilot projects and incorporate lessons learned into subsequent projects.

¹⁹ DJB has already embarked on a programme of publicly funded DBOs. However, DJB does not yet have a suitable standard template for its proposed DBO bid documents. The draft documents developed to date appear to have evolved from traditional procurement documents and do not form an ideal starting point for developing a long term PPP relationship.

By building its credibility through the successful implementation of a series of pilot PPP projects it would be expected that DJB would be in a position to progressively roll out a more ambitious PPP strategy within a few years.

Figure 9.1 Matrix of Most Likely PPP Options for wastewater

<u>Asset Type</u>	<u>Existing or New</u>	<u>Primary PPP Options</u>
Network	Existing Network	<ul style="list-style-type: none"> → Option A: Technical Assistance → Option B: Maintenance Contract
	New Network	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Conventional
Sewage Treatment Plant	Existing STPs & Biogas projects on existing STPs	<ul style="list-style-type: none"> → Option A: O&M Contract → Option B: Design Build Operate → Option C: Rehabilitate Operate Transfer
	New STPs	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Build Operate Transfer
End to End Solutions	Existing System	<ul style="list-style-type: none"> → Option A: Management Contract → Option B: O&M Contract
	New System	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: BOT/Concession
Sludge Disposal	New facilities	<ul style="list-style-type: none"> → Option A: Design Build Operate → Option B: Joint Venture Company → Option C: Build Operate Transfer

Table 9.1: Summarising the characteristics of the PPP Options

	Scope	Public or private funding	Incentives for efficiency	Clean lines of accountability	Flexibility	Value for money
Existing Network						
A. Technical Assistance Contract	Knowledge building	Public	✓	✓	✓✓	✓✓
B. Network Maintenance Contract	O&M	Public	✓✓	✓✓	✓✓✓	✓✓
New Network (on its own)						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Conventional	Capex	Public	✓	✓✓✓	✓✓✓	✓✓
Existing STPs & Biogas at existing sites						
A. O&M Contract	O&M	Public	✓✓	✓✓✓	✓✓✓	✓✓✓
B. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
C. Subsidised Build/Rehabilitate Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓	✓✓
New STPs						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Subsidised Build Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓	✓✓
Existing End-to-End System						
A. Management Contract	O&M	Public	✓	✓	✓✓	✓✓
B. O&M Contract	O&M	Public	✓✓	✓✓✓	✓✓✓	✓✓✓
New End-to-End System						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Subsidised BOT/ Concession	Capex and O&M	Private*	✓✓	✓✓✓	✓	✓
Sludge Disposal						
A. Design Build Operate	Capex and O&M	Public	✓✓✓	✓✓✓	✓✓	✓✓✓
B. Joint Venture Company	Capex and O&M	Mixed	✓✓	✓✓	✓✓✓	✓✓
C. Build Operate Transfer	Capex and O&M	Private*	✓✓✓	✓✓✓	✓✓	✓✓

Key:

✓✓✓ = Good/Best

✓✓ = Acceptable

✓ = Weak. Least good.

Annex A:
**Guidance on specific issues raised by DJB at
workshop in February 2011**

A1: Guidance on how to determine the duration of a PPP Contract

The table below sets out some of the factors that need to be considered when deciding on the duration of a contract.

It should be borne in mind that most international PPP contracts include provisions for an extension of the contract period by mutual agreement beyond contract date.

Contract Type	Suggested duration	Factors to be considered
Technical assistance	2 – 5 years	Duration depends on the time needed to complete the activities to be performed;
O&M Contracts	3 – 7 years	Five year contracts are fairly typical. Consider shorter duration contracts (i.e. duration at lower end of the range): <ul style="list-style-type: none"> • for pilot contracts • when there are uncertainties over future DJB budgets • if there is uncertainty about future costs (e.g. high inflation). • in rapidly developing/changing conditions or where baseline conditions are not well understood
Management Contract	4 - 7 years	Five years is typical for a management contract. Factors to consider: <ul style="list-style-type: none"> • Short term contracts (less than 4 years) are unlikely to be justified in the context of relatively high transaction costs. • A short term contract would potentially not provide the operator enough time to make necessary changes. • There may be pricing risks with longer term contracts (6-7 years) in higher inflation environments. • It is sometimes worthwhile fine tuning the contract period so that it aligns with the client's normal financial year.
Design Build	12 – 20	<ul style="list-style-type: none"> • If the duration of the contract is too short the

Contract Type	Suggested duration	Factors to be considered
Operate	years	<p>incentives for the Contractor to design and build an appropriately robust plant and achieve “<i>lowest whole life costs</i>” start to erode. So the full benefits of the DBO model will not accrue.</p> <ul style="list-style-type: none"> • The downside of longer term contracts (15 years or more) is that they are usually inflexible (by necessity since flexible contracts open the door to claims). So there is the risk that the Client will be tied into a contract which is unable to adapt to the client’s changing expectations and needs. Keeping contracts at the shorter end of the suggested range will maximise DJBs scope to flexibly adapt to changing conditions. • Some items of plant may have a shorter natural asset lifespan than the contract duration (e.g. filter membranes). The contract should make provision for replacement through a “Major Replacements Fund”. • Some DBO contracts are longer than 20 years. Such long durations would only be appropriate where the Client wants a long term relationship and there is a stable macro-economic environment. Very long term contracts (> 20 years) are probably not appropriate at this stage in DJB’s development.
Build Operate Transfer	15 to 25 years	<ul style="list-style-type: none"> • In shorter contracts the monthly fees to be paid to the private partner become much higher and may be unaffordable. • However - the total amount to be paid in interest over the duration of the contract will be higher in a longer contract. • It is good practice to model the costs for different contract durations so that DJB can make an informed decision based on actual costs. • Until DJB has established a track record of successful BOTs, the private sector is likely to see long term BOT contracts as high risk – and this would likely affect the price. So early BOTs should probably be at the shorter end of the suggested range. In due course longer term contracts may be appropriate.

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A2: Guidance on the use of Price Adjustment Mechanisms in PPP Contracts

1 Purpose of this annex

DJB has requested guidance on the use of Price Adjustment Mechanisms in PPP contracts. This Annex discusses the types of price adjustment mechanism that are available and the situations where such mechanisms are applicable.

2 Types of price adjustment mechanism

The type of price adjustment applied to a particular project depends on:

- Macro-economic conditions (inflation rate, exchange rate policy)
- The type of contract (e.g. management contract or DBO) and its duration
- Whether private funding is involved
- The technical, economic, regulatory and policy environment as it affects the predictability of future costs and revenues
- The type of bidders to be attracted to the project (international companies may seek exchange rate protection).

There are three broad types of price adjustment in common use in PPP contracts.

- **Indexation**, where prices are adjusted on the basis of a defined formula. Price adjustments usually take place annually. The purpose of indexation formulae is to protect the Contractor against inflation and/or exchange rate movements over which it has no control.

Indexation formulae are generally not necessary for contracts under (say) two years duration, except possibly in conditions of very high inflation. Otherwise they may be used on all types of contract. They are widely used in operations and maintenance contracts, management contracts, DBOs, BOTs, Lease Contracts, and Concession Contracts. Provided the clauses are well drafted, indexation arrangements are simple to administer.

- **Exceptional Price Reviews:** Exceptional Reviews may be initiated by either party to the contract. Exceptional Price Reviews are usually provided in long term contracts to allow for an adjustment of price, or performance standards, in the case that there has been (or will be) a material change in circumstances that is outside the control of Contractor. For instance, there may have been a long term change in raw sewage quality, or the DJB may wish to change the specifications of the plant or alter the scope of work of the Contractor.

Exceptional Reviews are appropriate for many longer term contracts – say contracts more than 5 years duration. Exceptional Reviews are unlikely to be included in management contracts or O&M contracts but are frequently found in DBOs, BOTs, Leases and Concession Contracts. Even where PPP contracts do not include a specific Exceptional Review provision, the same principles of price adjustment are often implicit in the Force Majeure clauses. PPP contracts will set out a procedure for undertaking an Exceptional Review which will generally involve appointing an independent third party adjudicator to assess a fair adjustment to price and/or performance standards.

- **Periodic Price Reviews:** Under a Periodic Price Review the prices and/or the performance standards are routinely adjusted at predetermined intervals (usually 4-5 years). Period Price Reviews are often used in long term lease and concession contracts in the water sector where the conditions and expectations for the services are constantly evolving. In these circumstances, it may also be appropriate to consider setting up a framework for the regulation of the contract.

Periodic Price Reviews will normally only be considered for long term full-service contracts (lease or concession contracts) in the water

sector, where it is unrealistic to attempt to define performance standards and prices for a period of more than 4 to 5 years. Periodic Reviews are not normally provided in DBO and BOT contracts because it is less likely that the scope of work or contract performance standards will need to be changed during the course of the contract. However, Periodic Reviews may be necessary for very long duration DBOs and BOTs.

There is an inherent tension between the natural desire for a flexible contract that can accommodate changes over a period of time, and the need to make the contractor firmly accountable for delivering specified outputs for a predetermined price. Periodic Reviews will tend to erode the principle of accountability, so it is the author's view that Periodic Reviews should be avoided if possible.

A3: Guidance on Asset Risk Mitigation in PPP contracts

1 Purpose of this annex

Bidders are sometimes unwilling to bid for risk bearing contracts when they do not have adequate information about the condition and performance of a given asset. Their reluctance is understandable given that, on the one hand they are expected to guarantee a particular level of performance, whilst on the other hand they don't have sufficient information to determine the price of meeting those performance standards.

This Annex provides guidance on how to mitigate PPP risks associated with the absence of reliable information about assets.

2 Measures that may be considered

Different approaches are likely to be appropriate for above- ground assets and below ground assets.

Above ground assets are usually accessible and can be inspected and surveyed. There are often reasonable records of environmental compliance, breakdowns/outages and previous maintenance activities. Provided these records are made available, bidders may feel that there is sufficient data for them to undertake their due diligence and price the risks.

However, bidders will be aware that rehabilitation works are more difficult to estimate than new works. It is often the case that it is only when the works begin that the full extent of repairs becomes evident. So even with reasonable records and access for inspections, there can be no guarantee that bidders will be prepared to take the asset risk. The following measures may be considered to mitigate contractor risks:

- **Change contract model:** If bidders are unwilling to bid then it may be that the wrong form of contract is being used. PPP is not the best

solution for every situation and it may be that a conventional works contract would be more appropriate.

- **Surveys and records:** DJB could engage specialist firms to undertake ground investigations, inspections, materials tests, CCTV surveys, etc.
- **Contract price adjustments:** Contractor risks can be limited by allowing the Contractor to make claims in the event of unforeseen conditions. So if problems during the contract which could not reasonably have been foreseen, then the contractor would be reimbursed accordingly.
- **Flexible performance standards:** Generally, PPP contracts should define clear outcomes rather than required inputs. In some situations, and with some types of contract, it may be possible to adjust performance standards to take account of improved information during the course of the contract on the basis of recommendations of the independent auditor.
- **Use incentives rather than performance standards:** If the baseline is unknown it may be possible to develop incentive payment arrangements which reward the private partner for its achievements. For instance, in a network O&M contract, the private partner could be rewarded for each blockage cleared within a given timescale. With such an incentive arrangement the private partner does not take risk on the number of blockages it is required to clear - since this is something outside of his control (substantively).

For network assets, which are below-ground, it is usually the case that knowledge of the condition and performance is very limited. It is extremely difficult to establish performance standards and predict O&M costs given that there may be no established baseline data²¹.

For PPP contracts in existing wastewater networks the following mitigation measures may be considered:

²¹ This is a common problem with many international PPP contracts. PPP contracts often have targets for (say) unaccounted for water, but in reality such targets are rarely realistic and consequently very difficult to enforce.

- **Avoid concession type contracts:** Concession type contracts, which require the contractor to take network investment risks, are rarely suitable in developing country environments;
- **Establishing a baseline:** Give the contractor a period of 12 – 18 months in which it must set up data gathering systems and establish a baseline for recording blockages, overflows, sewer collapses etc.. The independent auditor sets performance standards thereafter.
- **Use O&M targets:** Focus on targets which the contractor can control such as “speed of response to blockages etc” rather than targets which are a function of the condition of the assets (such as total numbers of sewer collapses).
- **Incentives:** Provide incentive payments for introducing good management practice rather than setting unrealistic targets linked to the performance of assets.

Annex B: Drainage Zone Analysis Table

Annex B: PPP Opportunities by Drainage Zone

Drainage Zone	Current/planned PPP and Investment Projects						Additional PPP Opportunities
	Primary Network	Trunk Sewers and Sewage Pumping Stations	Sewage Treatment	Sale of effluent	Biogas generation	Sludge Disposal	
Sen Nursing Home			BIOFOR under O&M contract with Pragati Power.	To Pragati Power	n/a	Largely chemical sludge, goes to dump site/Okhla	
Delhi Gate Nala			BIOFOR under O&M contract with Pragati Power.	To Pragati Power	n/a	--do--	
Okhla		70Km of trunk mains rehabilitation programme to be completed by April 2011. A further 17Km required (no firm plans yet)	Okhla 1: Demolition and new Construction of new Phase I WWTP under YAP-III. Design and Build. Okhla 2: Renovation and upgrade to deliver 20/30 effluent under YAP-III. Design and Build. Okhla 3: Renovation and upgrade to deliver 20/30 effluent under YAP-III. Design and Build. Okhla 4: Renovation and upgrade to deliver 20/30 effluent under YAP-III. Design and Build. Setting up 10 MGD Sewage Treatment Plant to treat effluent from secondary level to tertiary level.	145 for irrigation; Recent demand for 160 mld from NTPC Badarpur, to be developed.	10 Year Design Build Operate. Planned for Bio-Gas Engines and allied equipments for power generation at 140 MGD STP.	Project proposed for pelletisation for use as manure; briquetting for use as fuel; co-combustion with municipal solid waste at the upcoming plant at Ohkla.	
Coronation Pillar	DJB reported to be considering an end-to-end (from customer to STP) Asset Management Project at Coronation Pillar	10.6 Km of trunk sewers completed by April 2011. A further 0.6 Km will be rehabilitated under YAP III.	Old Phase (45 Ml/d) STP to be demolished and replaced by a new 40 MGD [182MLD] Sewage Treatment Plant with tertiary treatment and a Pumping Station at Coronation Pillar including rising main up to Yamuna river.	Effluent being taken by Delhi Irrigation and Flood Control Dept. for distribution in agriculture fields.	Biogas utilisation in a cogeneration system.	--do--	Opportunities: Old Phase STP (45 Mld), possible BOT or DBO project. Stand-alone Biogas projects at Coronation

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Drainage Zone	Current/planned PPP and Investment Projects						Additional PPP Opportunities
	Primary Network	Trunk Sewers and Sewage Pumping Stations	Sewage Treatment	Sale of effluent	Biogas generation	Sludge Disposal	
			Rehabilitation of the gas holders required at STP Phases 1,Phase 2 and Phase 3				Pillar Phases 1,2 and 3.
Keshopur		29.3 Km trunk sewers rehabilitation complete by end April 2011.	Plant undergoing renovation (Commissioning 03/11)	30% for irrigation	--do--	--do--	
Rithala		13 Km of Trunk Mains to be rehabilitated under planned projects.	Renovation of Phase-I WWTP and Construction of Tertiary Treatment Plant will be carried out under the under JAP 3 programme. Not available for a PPP approach. Rehabilitation and operate contract recently awarded for Phase II (as at June 2011). Phase-III at very early stage of planning	DJB has agreed terms for 25 MGD effluent to be sold to PPCL for the Bavana Power project, and 2 MGD to NDPL for the Rithala Power Project.	Co-generation system in place in Phase-II.	--do--	
Vasant Kunj			Vasant Kunj STP: 2 Phases. Satisfactory condition Mehrauli STP: 36% utilisation. Satisfactory condition.				
Shahdara		17.7 Km of trunk mains to be rehabilitated under YAP-III.	Kondli STP: Phase-I, II and III: (203ml/d): Renovation of WWTP-Phase-I, Phase-II & Phase-III and Construction of Tertiary Treatment Plant. Phase IV: New 203 ml/d STP under construction		Biogas utilisation in a cogeneration system.	Pelletisation, briquetting or incineration.	

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Drainage Zone	Current/planned PPP and Investment Projects						Additional PPP Opportunities
	Primary Network	Trunk Sewers and Sewage Pumping Stations	Sewage Treatment	Sale of effluent	Biogas generation	Sludge Disposal	
Yamuna Vihar			Yamuna Vihar: New Phase-III of 113 mld under construction.		--do--	--do--	
Ghitorni			No sewage generation in catchment				
Narela			12% capacity utilisation.				
Rohini			No sewage generation in catchment				
Pappankalan			Phase-II: 91 ml/d. Will shortly go to tender. Funding from JNNURM.	90 mld to DDA; Demand for 80 mld to PPCL-Bamnauli.	Biogas utilisation in a cogeneration system.	Pelletisation, briquetting or incineration.	
Najafgarh			24% capacity utilisation.				
Nilothi			25% capacity utilisation. Full flow expected in 5 months.		Biogas utilisation in a cogeneration system.	Pelletisation, briquetting or incineration.	
Commonwealth Games Village			Not used.				
New Drainage Zones	New	New	New	New	New	New	Potentially suitable for end-to-end solutions

Note:

- Asset management planning to include CCTV surveys, preparation of GIS maps, MIS; preparation of preventive maintenance plans and investment/replacement plans.
- Excess sludge from small and medium sizes STPs can be brought to centralised facilities e.g., at Ohkla, Rithala, etc. for final treatment and disposal through pelletisation, briquetting or incineration.