15th March 2011

WASTE WATER TREATMENT WORKS: UPPF PROJECT PREPARATION TOOLKIT

Notes and Disclaimer:

1) *Whilst these toolkits have been made available by UPPF for external consumption, including use in support of the CIDB's 'Gateway' process for preparing infrastructure projects, it is emphasized that these toolkits are a work-in-progress and should not be used in a prescriptive fashion. UPPF will update these toolkits from time to time based on experience gained in preparing specific projects. Any suggestions for improvements or refinements should be emailed to UPPF / PPT for the attention of the National Co-ordinator on pptrust@worldonline.co.za*
2) *With respect to cost norms and professional rates, it is recognized that these will vary depending on such factors as locality, project complexity, level of experience, and local skills scarcities. The rates and cost norms provided should therefore be regarded as an indicative guideline only.*
3) *Municipalities or Government Departments may find these toolkits useful in: a) determining the main risk factors associated with a particular project; b) benchmarking budgetary requirements for project preparation; c) issuing RFP's or tenders for project preparation; d) determining whether professional work rendered meets an appropriate specification.*
4) *UPPF preparation managers must refer to UPPF's internal UPPF Standard Operating Procedures including; Preparation Flow Chart; Detailed Project Preparation Methodology; specimen letters of appointment for professionals; specimen RFP's for procurement.*
5) *UPPF is a joint venture between Project Preparation Trust of KZN (PPT) and the Infrastructure Finance Company Ltd (INCA). It was established through the Support Programme for Accelerated Infrastructure Delivery (SPAID) with funding provided by the Business Trust. UPPF's core business is to assist Municipalities in preparing a range of infrastructure projects and to thereby assist in addressing service delivery backlogs.*

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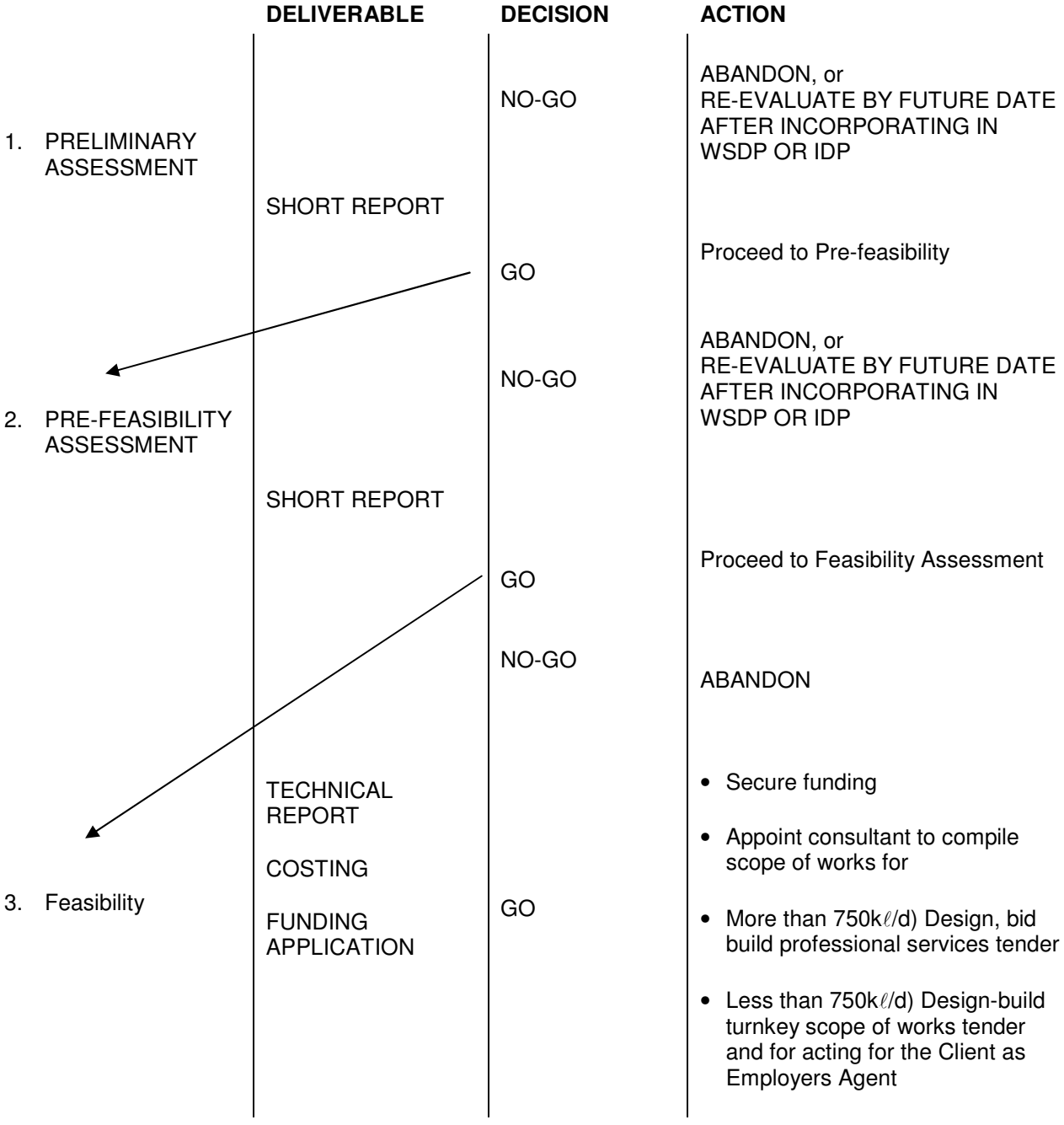
SANITATION PROJECT: SEWAGE TREATMENT WORKS UPGRADE

DECISION MAKING TREE



SECTION A: GENERAL INFORMATION

A. Targeted capital funder:

Potential funders are to be identified during pre-assessment. Due to most municipal Sewage Treatment Works serving a range of households and industries the Municipal Infrastructure Grant (MIG) will not necessarily be prepared to fund any upgrade **in total,** unless the upgrade is required specifically due to a MIG recognized low cost development taking place and requiring treatment capacity.

Should MIG be willing to fund a portion of the project capital, then the MIG guidelines, including DWAF requirements, will need to be followed in order to apply for the MIG funds. In any event the likelihood is high that MIG funding will be available for at least a portion of the total costs and therefore the default approach is to be in compliance with MIG.

B. Flow Chart:

Primarily based on the MIG flowchart **(See Annexure C)**.

C. Funder Requirements

i. *Funding application and approval flow chart:*
In the event of MIG funding availability for the whole or a portion of the project, the MIG funding application process must be used. MIG have a prescribed Flow Chart **(Annexure C)**, funding application (project registration) from **(Annexure D)** and Project Registration Checklist **(Annexure E)**.

ii. *Formats and documentary requirements (including support documents required) for applications for capital funding/project business plans.*
MIG funding will require application in the prescribed forms. MIG have detailed guidelines on processes, procedures, levels of service and unit costs **(refer to Annexures C, & F)**. In addition DWA's detailed format for feasibility report **(Annexure F)** is a valuable resource, which adequately covers all of the work packages and broad specifications for a sewage treatment project.

MIG require a Project Registration Form **(see Annexure D)** to be completed and submitted via the internet based Management Information System (MIS). The project preparation manager (or whoever is responsible for completing this form) will need to liaise with the client municipality in order to obtain access to the MIS on behalf of the municipality. This will be in the form of a user name and password. This level of access will usually be limited to inputting the required project information but exclude any level of project approval. In the MIS the project application form is completed and then submitted for approval by the municipality and thereafter the provincial MIG management unit (PMMU) with final project approval being provided by however, that some municipalities complete the MIG/MIS forms and process internally and therefore do not require assistance from the project consultant. This must be verified by the PPM up front.

For sanitation projects approval of the project by the DWA is required prior to the project being approved by the PMMU. A DWA technical report or water project feasibility report is required and this is submitted directly to the provincial DWA office

preferably prior to the completion and submission of the MIG 1 form.

The DWA (KZN) has developed a generic Water and Sanitation Project Feasibility Report Format **(See Annexure F)** and the inputs into this report will form the basis of the feasibility stage, work packages on this type of project.

Requirements for approval (at different stages if there are different stages).

Where MIG funding is a possible source, the MIG 1 project registration form includes a section indicating approval of the project application by the municipal council (Council Resolution) and the municipal manager prior to submission of the form to the PMMU.

DWA approval of the project is required prior to the PMMU approving the MIG 1 project registration form. DWA approves the Project Feasibility Report with feedback provided to the municipality. The Final DWA approval process is also managed via the MIS.

The NMMU considers and approvers the project registration once it has been approved and submitted by the PMMU.

iii. *Formats and documentary requirements for funding approvals (e.g. committee resolution, budget vote number, agreement between funder and municipality etc.)*

Once the project has been approved by the NMMU, a memorandum of agreement (MOA) is drafted by the MIG office for signature between MIG and the municipality. The MIG 1 form is incorporated into the MOA and funding is made available by MIG for expenditure on the project by the municipality.

iv. *How preparation is currently funded, permissible allocation to preparation – e.g. % fee scale + feedback from funders on this issue, potential flexibility and how to achieve it.*

For small to medium sized projects project preparation funding usually forms part of the total project cost as estimated and indicated in the MIG 1 project registration form. Project preparation consultants are usually appointed to carry out the feasibility stage work and project funding application at risk. The cost of the work comprising these aspects/stages should be incorporated into the total project cost and can then be recovered via the municipality once funding is approved and released for expenditure. However for large projects the municipality may motivate and obtain MIG funding for the feasibility study as a stand-alone MIG-funded 'project'.

The cost norms for project preparation will vary quite considerably depending on the magnitude and complexity of the project. This is discussed in more detail below.

D. Risk Profile:

i. *Level of confidence in hydraulic inflows and biological loading estimates.*

Estimating of future inflows to the works requires an understanding or appreciation for the level of storm water influx to the sewerage network, which can cause major fluctuations in the hydraulic flows reaching the works. This could require potentially costly measurement and analysis of the status quo. In addition, an assessment of other development plans, particularly industrial developments that may take place, could require more sophisticated treatment systems or at least an allowance for required modifications to take place in future.

ii. *Time frames required for environmental investigations, applications and approvals.*

Dependant on the extent of the upgrade, approval from DWAF in addition to DEAT may be required, in particular if the receiving catchment is classified as sensitive and therefore requires stricter effluent standards. The time frame for obtaining environmental approval must be estimated with the appropriate DEAT officials and allowed for in any requirements.

The level of environmental input required and the assessment of any approvals required must be determined as soon as conceptual design options are determined. In some cases a small water supply project may not require even a basic assessment and application to the DEA. Where a basic assessment or environmental impact assessment is considered necessary, the project schedule and cost estimate must be revised to allow for a minimum of 6 months from the start of the process to the approval and issuing of a Record of Decision by the Department.

In some cases, the Feasibility study can be completed prior to the RoD being issued, by obtaining recommendations from the environmental assessment practitioner and local DEA office on the likely requirements of a RoD.

iii. *Funding source and ability or viability of municipality possibly raising the required loan capital.*

Sewage Treatment Works upgrades can be expensive and as mentioned above, may require loan funding in addition to any grant (MIG) funding being available for the capital works. The municipality's financial status and ability to service a large capital loan should be assessed during the pre-assessment.

E. **Total Cost**: Refer to Part B (Summary Scope of Work and Cost Norm). It is noted that, as at March 2011, the indicative preparation costs are estimated to range from between R 412,307.44 and R 673,737.75 for projects with capital values of between R6million and R12million respectively. These estimates include a provision for preparation management, travel disbursements and contingencies.

SECTION B: SUMMARY SCOPE OF WORK AND COST NORMS

Please refer to the separate excel spreadsheet provided which identifies the work packages for the various stages of project preparation, summary scope of work, and indicative professional time inputs and cost norms.

SECTION C: DETAILED SCOPE OF WORK

PRELIMINARY ASSESSMENT STAGE				
Inputs	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
1. The Project a. Any existing technical work already completed (e.g. past feasibility report); b. Assessment of availability of suitable project preparation professionals; c. Telephonic interviews / meetings with personnel from municipality, MIG / DWAF, any professionals working on this or a nearby project, ward councillor, community leadership if required; d. Interviews / meetings with professionals working on this or other nearby projects, relevant provincial government departments, ward councillor, community leadership, Local Municipality where relevant; e. Site visit;	Preliminary Assessment Report containing an Appraisal of the Project based on a preliminary project risk profile. This would need to cover project, stakeholder and funding risks related to the project including: a. Receiving water catchment standards as determined by DWAF (including available effluent disposal permits); b. Need (including commentary on the likely accuracy of demographic data, required treatment capacity assumptions, and ultimate level of intended service); c. Recommendations on project professional team. d. Availability of project professionals required to undertake project preparation. e. Professional conflicts (e.g. any existing professionals with 'turf' issues / 'entrenched service providers' which lack competence / proven track record / willingness to work constructively with PPT) f. Socio-political dynamics (e.g. any problematic dynamics between the traditional authority and municipality if applicable); g. Comment on Environmental issues (any obvious and very apparent environmental issues such as restrictions on increased effluent flows, land availability for sludge drying or similar treatment activities, etc); h. Land ownership - likely opposition from landowner / servitudes / PTOs / expropriation, etc; Recommendations within the following options: Category 'A' low risk, no apparent material risks detected, project viable and should proceed rapidly into pre-feasibility and feasibility stages; Category 'B medium risk, some potential material risks which require careful mitigation during next pre-feasibility stage, project potentially viable subject to further assessment during pre-feasibility stage, project should not move into feasibility stage before re-assessment at the completion of the pre-feasibility stage to ensure that the identified risks have been adequately mitigated or eliminated; Category 'C' high risk, material risks detected with limited reasonable prospects for mitigation, no further preparation should occur.	Civil engineer (specializing in water and wastewater treatment project) Process engineer (civil or chemical degree) Electrical engineer Experienced environmental practitioner. A good knowledge of sewage treatment plants and the legislation surrounding their development within South Africa should be available within the professional team. Engineering capacity and experience in sewage / wastewater treatment is essential, together with experience in the feasibility and design stage of sewage treatment projects. The civil or process engineer should preferably be a Pr.Eng with 10 years experience in water and wastewater treatment.	Two to three weeks.	Two to three weeks.

2. The Municipality; a. Face to face meeting with relevant municipal personnel (as broad-based as possible and including senior municipal officials and preferably also the Municipal Manager in medium sized municipalities or the Deputy Municipal Manager in metros); b. Municipal plans – in particular: IDP, Water Services Development Plan (where it exists), and Spatial Development Plan. c. Provision of standard Preparation Services Agreement to Municipality d. Explanation of its main terms and conditions, e. And acquisition of verbal feedback;	The Preliminary Assessment Report should comment on: a. Municipal prioritisation, acceptability of terms of PPT project preparation services and Preparation Services Agreement terms. b. Municipal buy-in to the project (not just IDP inclusion, but also de-facto and apparent commitment from senior officials and politico's); c. Prioritization of project – IDP / WSDP / Sector Plan; d. Record of people interviewed, positions and contact details. e. Attendance registers			
3. The Capital funder. a. Telephonic discussions / meetings with prospective capital funder(s);	The Preliminary Assessment Report should comment on: a. Municipal prioritisation, acceptability of terms of PPT project preparation services and Preparation Services Agreement terms. b. Source of targeted capital funding (e.g. MIG / MIG-loan funding mix / DoH etc); c. Availability of capital funding for the project (e.g. existing municipal MTEF budget allocation / IDP priority / MIG approval); d. Confirmation of in principle support from potential capital funder/s. e. Detailed budget estimate for project preparation. f. Projected timetable (schedule) for project preparation.			

PRE FEASIBILITY STAGE (CIDB 'Assessment')				
Inputs	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
A.Situational Analysis including influent characteristics and treatment plant assessment: i) Analyze influent flows (average volumes, daily peaks and storm flows); ii) Analyze influent chemical and biological characteristics (COD and BOD), iii) Analyze existing treatment plant capacities (biological and hydraulic) iv) Analyse treatment processes v) Analyze and assess existing unit treatment process capacity (incl. sludge disposal) and plant management. vi) Confirm receiving water/catchment requirements (legislative and environmental) vii) Comment on current release/disposal of final effluent, grit, screenings and sludge viii) Comment on staffing levels and current plant classification ix) Obtain copies of existing licence, GA or permit as applicable and comment on compliance	The Situational Analysis must yield the basis for the proposed technical intervention with data reflected in a number of tables as follows: i) Current demographics, industrial impact and service levels ii) Quantification of the expected sewage characteristics and correlations with available data iii) Confirmation of existing classification, permits and staffing levels and identification of shortcomings iv) Current bottlenecks and anecdotal identification of process problems v) Assessment and quantification of available process capacity and unit process capacity vi) Availability of electricity vii) Comment on current maintenance practices. viii) Effectiveness of bylaws and the policing thereof	Civil engineer (specializing in water and wastewater treatment project) Process engineer (civil or chemical degree) Electrical engineer Experienced environmental practitioner. A good knowledge of sewage treatment plants and the legislation surrounding their development within South Africa should be available within the professional team. Engineering capacity and experience in sewage / wastewater treatment is essential together with experience in the feasibility and design stage of sewage treatment projects. The civil or process engineer should preferably be a Pr.Eng with 10 years experience in water and wastewater treatment.	Three to four weeks.	Three to four weeks.
B. Future Treatment capacity assessment i) Assess the catchment demographic profile ii) Confirm development plans (residential and industrial) iii) Consider assumptions for storm water ingress (increasing or decreasing) iv) Recommend requirements for storm flow attenuation v) Assess the expected changes in chemical and biological composition of incoming effluent vi) Assess the expected changes in incoming flow vii) Assess the potential changes in treated effluent standards required for receiving stream / catchment viii) Assess grit, screenings and sludge treatment and disposal requirements.	The Future Capacity Assessment must identify technically feasible interventions with data reflected in a number of tables as follows: i) Future demographics, service levels and impact of industries ii) Quantification of the expected sewage characteristics and correlations with similar situations or industry norms iii) Confirmation of new classification, permit requirements and staffing levels iv) Likely de-bottlenecking strategies v) Assessment and quantification of required process capacity and possible re-use of existing infrastructure vi) Electricity requirements vii) Comment on likely future maintenance practices. viii) Identification of technically feasible process interventions			

C. Effluent sample testing In the likely event that no recent and reliable data already exists	The Inlet and other raw water sampling must be used to verify assumptions and to inform likely risks to be addressed in new Bylaws as follows: i) Testing results or comments of applicability ii) Recommendation regarding new bylaws			

FEASIBILITY STAGE (CIDB 'Concept')

*Note: In normal circumstances a civil engineer will be appointed to compile the feasibility study report (i.e. as the lead consultant and team member responsible for most tasks). However, the engineer will usually be required to use certain information supplied by other professionals / specialists in conjunction with his / her own input. Due to this, the PPT norm of setting out a toolkit by work packages is not altogether practical and instead the toolkit for this section has been set out by professional and with close reference to the existing and generally adequate DWAF guidelines (**Annexure H**)*

Total cost: Approximately R59,600 to R102,400 depending on project complexity and scale.
Total timeframe: 6 – 8 weeks

Inputs Civil Engineer: Feasibility Study for Sewer Treatment Works Upgrade	Outputs	Professional Knowledge and Skills	Indicative Level of Effort	Indicative Duration

The inputs for this appointment are defined in **Annexure H**, with the exception of those tasks, which are defined below for the other members of the professional team (i.e. environmental, social, geotechnical, and geo-hydrological specialists). The civil engineer is required, to carry out all the necessary tasks and responsibilities which are his / her own responsibility and in addition, to monitor and manage the work required to be done by other service providers and professionals identified above. The Civil Engineer assumes overall responsibility for the project's feasibility. It is assumed that a Pre-feasibility stage has preceded this appointment in which case the work which has already been completed during the pre-feasibility stage will inform and flow into the feasibility stage.
 	
The primary aspects that require consideration and input are:
• A situational analysis is to be completed including an assessment of the raw sewage sources, their characterization, quantification, treatability and DWA discharge or re-use authorization requirements.
• Assessment of the design, capacity and layout of the existing treatment plant including the appropriateness of the components, e.g. pond systems or sludge handling practices are perhaps too small and not conducive to upgrading. Modifications to the plant or components of the plant may be required. Consideration must be given to the operation and maintenance capacity that is in place and the needs in this regard after upgrading (i.e. will the upgraded plant be more technically demanding and so require more highly trained / experienced operators).
• Sewage demand assessment both the current and estimated future demands, with due consideration to peak flows and infiltration. This is an important aspect and must be approached carefully by evaluating any data that is collected, for accuracy and validity.
• Assessment of upgrading / rebuild options, recommendations and decision on preferred concept (including infrastructure upgrading such as modification of plant components (e.g. inlet works, settling tanks, anaerobic treatment, activated sludge treatment etc); improved peak flow handling; as well as treatment processes (e.g. sludge thickening and drying, digestion management etc); and management issues) - includes meetings / workshop with client municipality..
	The outputs of this appointment are broadly defined in **Annexure H**. It is noted that in the event of MIG funding being required or available, a draft report in the required DWA format including inputs by other professional service providers and including an Executive Summary of the findings is required.
	
	The primary outputs to be included in the feasibility report are:
	• Defining the findings emanating from the inputs defined above including the assessment of the status quo with regard to the existing plant and raw sewage influent characteristics.
	• Reporting on the various upgrading options, e.g. capacity upgrades, process upgrades, component upgrades;
	• Assessment of upgrading options, recommendations and decision on preferred concept including:
	  ○ infrastructure upgrading such as modification or extensions of existing plant components (;
	  ○ upgrading of treatment processes;
	  ○ and management issues - includes meetings / workshop with client municipality technical staff.
	• Conceptual design of preferred upgrading option including;
	  ○ process modifications and first stage sizing of new plant components;
	  ○ upgrading of mechanical and electrical infrastructure; and
	  ○ upgrading of existing civil structures and new structures required.
	• Implementation Estimates & Program including;
	  ○ estimates for capital costs;
	  ○ operation and maintenance costs (10 to 15 year life span);
	  ○ financial viability and socio economic analysis; and
	  ○ A detailed program (timetable) for implementation.
		Civil engineer (specializing in water and wastewater treatment project) with experience in preparing, planning, designing and preferably also implementing wastewater treatment plants. Some specialist design input may be required in the event that special treatment systems are anticipated and inputs from a Process engineer (civil or chemical degree) and Electrical engineer may also be required	Between 10 and 15 days – this assumes a relatively simple project	6 – 8 weeks (this will vary depending on the size and complexity of the project).

• Cost estimates and program. Estimates of cost both capital and operation and maintenance must be determined over the life of the upgraded works and a socio-economic evaluation completed in accordance with the requirements of the DWA report format.				

FEASIBILITY STAGE (CIDB 'Concept')				
Inputs Social Consultant: Social Facilitation & Communications:	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
The inputs for the overall project are defined in **Annexure H** (although it is noted that with this type of project generally only limited tasks are required to be addressed by the social consultant). The social consultant needs to work closely with and under the instruction of the Civil Engineer who assumes overall responsibility for the project's feasibility. A. <u>Community liaison and communications</u>: The Social consultant will be primarily responsible for assisting the project preparation team (mainly via the appointed Civil Engineer) with the communication and liaison with affected communities, if any, which will include: • *Obtain regular updates on the development of the feasibility study being carried out by the civil engineer and to communicate this accurately to the affected communities.* • *Setup, facilitate and minute community meetings.* Particularly at the start of the planning phase and towards the end once the study is nearing completion and conclusions and recommendations are being developed. It is noted that these meetings may need to involve other members of the professional team (e.g. Civil Engineer).	The outputs for the overall project are limited to assistance provided as indicated above. A brief report providing an overview of the input provided to the project feasibility should be drafted into a report and submitted to the engineer for inclusion in the Feasibility Study Report with a copy to the project preparation manager. The report needs to include signed attendance registers and minutes of meetings held	Social facilitation qualifications / experience / skills requirements are: Excellent communication skills; Experience in social facilitation in the context of municipal infrastructure projects; An understanding of the requirements in terms of social input to the standard DWAF feasibility study report.	Approximately 4 to 8 days. It is suggested that the payment structure be either: a) half payment halfway through, full payment upon submission of final feasibility report; or b) monthly payments approved by the Civil Engineer and PPM / NC.	6 to 8 weeks.
B. <u>Inputs relating directly to the DWAF scope of work / feasibility requirements:</u> • *Section 7. Environmental Acceptability: Assist the appointed environmental consultant with the social impact assessment of the project. It is noted that in most projects, an environmental practitioner / consultant will also be appointed to carry out an initial environmental assessment of the project as required in terms of the National Environmental Act. The social consultant will also be required to maintain regular communication with and assist the environmental practitioner with their assessment of the impact of the proposed project on the community, specifically in this regard to the social impact of the project. Care should be taken to avoid duplication of tasks and confusing / overlapping / duplicating communications with the community.*				

FEASIBILITY STAGE (CIDB 'Concept')				
Inputs Geotechnical Specialist: Preliminary Geotechnical Assessment	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
The geotechnical specialist will be required to work closely with and under the instruction of the Civil Engineer who assumes overall responsibility for the project's feasibility. The Geotechnical Specialist will be required to carry out such work as will be determined by the project preparation manager / engineer, which will inform and provide input to the project feasibility study. This work may include, but not be restricted to, the following key aspects: • Preliminary investigations into expected ground conditions for bulk excavations at new structure sites; and • Expected ground conditions for pipeline trenches.	The study findings and recommendations are to be drafted into a report to be submitted to the engineer for inclusion in the Feasibility study Report with a copy to the project preparation manager and should include preliminary estimates into areas of expected rock or hard excavation at new structure sites and pipeline routes.	A minimum BSc or B.Tech qualification in geology or related field is required. Experience in and skills and in pipeline trenching and bulk excavation geology should also be available.	Approximately 2 to 3 days. It is suggested that full payment be made upon submission of final feasibility report approved by the Civil Engineer and PPM / NC. Some cost included for machinery	The duration of this work is expected to be between 2 to 4 weeks and should take place as early on in the study as possible.

FEASIBILITY STAGE (CIDB 'Concept')				
Inputs Environmental Practitioner: Preliminary Environmental Assessment	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
The inputs for the overall project are defined in **Annexure H** (although it is noted that only certain tasks as outlined below are the responsibility of the environmental practitioner). The environmental practitioner will be required to work closely with and under the instruction of the Civil Engineer who assumes overall responsibility for the project's feasibility. A Social Consultant will also be employed as part of the project preparation team and will be instructed to work closely with the environmental practitioner assisting with providing information and introductions to any interested and affected communities. The inputs envisaged will cover but not necessarily be limited to the following: • Consider the preliminary project scope of work as provided by the civil engineer and define the possible environmental issues pertaining to the project; • Carry out a site visit, preferably with the engineer, and conduct a preliminary inspection of the project area; • Determine a list of any possible interested and affected parties; • Meet or liaise with the relevant local office of the Department of Environmental Affairs to obtain their initial assessment of the project and project area; • Obtain any other information required to complete a preliminary assessment of the environmental impact that the proposed project may have on the community, land and surroundings; • Assess the preliminary findings with regard to the National Environmental Management Act, 1998 (Act No. 107 of 1998) together with Regulation No. 385 (21 April 2006) and the Government Listing Notices No. 386 and 387; and • Determine requirements in terms of NEMWA • Determine water use license / water quality management report requirements • Any other Permit application that may be applicable. Determine whether a Basic Assessment, as contemplated in the Environmental Regulations No. 385 Sections 22 to 26 will be required or whether a Scoping and Environmental Impact Assessment will be required as stipulated in the Environmental Regulations No. 385 Sections 27 to 36.	The outputs for the overall project are defined in **Annexure H** (although it is noted that only certain tasks as outlined below are the responsibility of the environmental consultant). The primary output of the preliminary investigations mentioned above must be to report to the engineer on the probable need for either a Basic Assessment or full Environmental Impact Assessment in terms of the Act and regulations. This report is to include a brief overview on the following: • In the event of additional land being developed for the extension to the works, the physical, landscape and ecological characteristics of the land and its surroundings; • The current and potential land – uses of the land development area; • The social and economic impact on communities in the area surrounding the project; • The existing infrastructure and/or services in or around the project area and surroundings; • The existing social and community structures, services and facilities in and around the project area; • The levels of present and possible pollution, in the future as a result of the proposed project; • Any risks or hazards to the environment posed by the project; • The health and safety of the public; • The social costs of the proposed project; • The effect of the proposed project on different groups or individuals; • What mitigating measures could be implemented to reduce negative impacts and enhance positive impacts of the project; • Identify any areas, which are environmentally sensitive or zoned as such (e.g.: areas proclaimed as wilderness or for conservation) and comment on the implications. Based on the preliminary assessment, identify whether or not there appear to be any material barriers to the proposed project from an environmental impact perspective, what the barriers are, and the viability of overcoming them. Comment on whether further environmental assessment may be needed, how would this be decided, what would it consist of and at what indicative cost.	The environmental practitioner must be approved and comply with the General requirements for EAPs, as contemplated in National Environ-mental Management Waste Act as follows: An EAP appointed must – • be independent; • have expertise in conducting environmental impact assessments, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity; • perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant; • comply with the Act, these Regulations and all other applicable legislation; • take into account, to the extent possible, the matters listed in regulations when preparing the application and any report relating to the application; and • disclose to the applicant and the competent authority all material information in the possession of the EAP that reasonably has or may have the potential of influencing – o any decision to be taken with respect to the application by the competent authority in terms of these Regulations; or o the objectivity of any report, plan or document to be prepared by the EAP in terms of these Regulations for submission to the competent authority.	A full EIA will be required for any construction works	The duration of this work is expected to be between 20 to 40 weeks and should take place as early on in the study as possible.

FUNDING APPLICATION (Refer to Annexures D & E)				
Total cost: Approximately R4,000 to R8,000 Total timeframe: 1 – 2 days				
Inputs <u>Funding Application for Sewer Treatment Works Upgrade</u>	**Outputs**	**Professional Knowledge and Skills**	**Indicative Level of Effort**	**Indicative Duration**
The inputs for this appointment will originate primarily from the DWAF feasibility study report. The MIG funding application is basically in the format of the MIG 1 Project Registration Form provided in ***Annexure D*** and using the guidelines / checklist in ***Annexure E***. The application must be carried out using the MIS and a user name and password should be obtained through the municipality.	The output will be a successfully submitted MIG registration form using the MIS.	Civil engineer responsible for compiling the feasibility study report.	R8,000 to R10,000	Depends on funding source.

SECTION D: SPECIMEN GANTT CHARTS

Please refer to the separate document provided for specimen Gantt charts for the preparation of this project type (timetables).

SECTION E: BRIEF TECHNICAL INTRODUCTION

1. GENERAL

Ongoing sampling and monitoring of the flows and effluent from the WWTW over the last 12 months should be indicative of the flow and characteristics of the sewage and should provide the basis for design. However, where no data is available, assumptions in line with generally accepted engineering practice can be used.

The required technology is informed by the quality of flow and the nature of the organic load.

2. SITE SELECTION

The following factors must be taken into consideration in identifying the optimum site:

- A significant amount of public funds would have been spent on existing sites. As far as possible, this infrastructure should be utilized to avoid expenditure on duplication of available infrastructure.
- Existing infrastructure associated with existing sites may include:
  - gravity outfall sewers and pump mains leading to the site
  - electrical supply
  - access roads for vehicular traffic and linking to main routes
  - sludge handling and drying infrastructure
- Potential odour impacts on surrounding property
- Availability of land for potential beneficial re-use and prior lawful use of water
- Ability to discharge to the receiving environment

Given the above considerations, a wider cost benefit must be considered when deciding on replicating existing treatment capacity and re-routing sewerage infrastructure to an alternative site. Such a decision is also influenced by constrains defined by town planning objectives, existing infrastructure, topography and availability of land.

Preliminary and primary treatments are common to most sewage treatment processes and consist of screening and grit removal. This requirement is common to all available sewage treatment solutions. Secondary treatment options must be informed by the following:

- The effluent results that will have to produced by the facility.
- Effluent will be (i) released to river via the natural watercourses and/or storm water drainage system, (ii) irrigated or (iii) released to river and irrigated.

3. TREATMENT ALTERNATIVES

There are a significant number of approaches for process selection of sewage treatment systems and a balance must be found between system costs, operation and maintenance requirements and effluent quality. Where there is a demand for irrigation water, the utilization of the potential irrigation water source and nutrients also plays a role in the identification of the optimum sanitation approach.

Given the above, the following groups of treatment options should be considered:

- Oxidation ponds (various)
- Anaerobic/bio filter/clarification process trains (various)
- Activated sludge technology (various)

From the selection matrix, it is clear that the required effluent quality dictates the technology selection. For activated sludge systems the UCT, Bardenpho and Johannesburg activated sludge processes may be considered, but this processes require larger structures (higher capital cost) for biological phosphorous removal, the ongoing requirements for process control data, a high level of operator skill and possibly chemical removal clarification of phosphates.

Membrane technology and conventional clarification may also be considered in line with capital cost, ability to handle hydraulic peaks, chemicals usage, ongoing requirements for process data, complexity, as well as the running cost associated with the operation and maintenance required for this technology. It should be noted that capital cost of membranes is very high and the current replacement interval of membranes is roughly ten (10) years depending on the technology used and suppliers.

The Modified Ludzak-Ettinger (MLE), Sequential Bach Reactor, Carrousel and pasveer are a more simple and robust activated sludge technologies. It requires a lower level of operator skill and process information than the other activated sludge options above, while still reliably achieving General Limit Values. It cannot achieve Special Limit Values, but the phosphate standard can be achieved by adding a ferri-dosing facility for chemical precipitation.

The use of anaerobic digesters must be considered in conjunction with the above, but this can only be informed by process design inputs from a specialist.

Although not exhaustive, the above discussion summarise the main technological options that may be considered for the provision of wastewater treatment of predominantly municipal sewage.

TREATMENT ALTERNATIVES AND SELECTION MATRIX FOR WASTEWATER TREATMENT WORKS

Treatment process	Description	Key features	Applicable for facilities receiving > 500 kℓ/day	Footprint	Sophistication	Equipment	Operating and maintenance	General Limit Values	Special Limit Values
Oxidation pond systems	Various combinations of anaerobic, primary, secondary, tertiary and irrigation ponds, with or without recycle	Various combinations	No	Largest without recycle. Second largest with recycle	Low	Recycle pumps	Normally lowest cost Very low skill	Not achievable	Not achievable
Anaerobic treatment followed by biofilters and clarification, can include pond system	Combination of process steps. After anaerobic treatment, supernatant passes over fixed media and is clarified before disinfection.	Various combinations ranging from conventional to PETRO	Yes	Medium	Low/Medium	Recycle pumps, rotating bio-disks or rotating arm and disinfection	Low to high cost Skilled operation	Not achievable	Not achievable

Activated sludge (ASP) and conventional clarification	Oxygen is mechanically supplied to bacteria which feed on organic material and provide treatment.
	Clarification by means of settling
		Various processes including:
		• Biological N removal
		  ○ Modified Ludzak-Ettinger
		• Biological N and P removal
		  ○ UCT
		  ○ Bardenpho
		  ○ Johannesburg
			Yes	Small	High	Aerators, mixers, recycle pumps, clarifier equipment (settling tanks) and disinfection	High cost
							
							Skilled to highly skilled operation
								Achievable	Achievable

Activated sludge (ASP) and membrane technology	Oxygen is mechanically supplied to bacteria which feed on organic material and provide treatment
	Filtration by means of physical membrane separation
		Various processes as for conventional ASP:
		• Biological N removal
		  ○ Modified Ludzak-Ettinger
		• Biological N and P removal
		  ○ UCT
		  ○ Bardenpho
		  ○ Johannesburg
			Yes	Smallest	Very High	Aerators, mixers, recycle pumps, membrane modules, blowers, diffusers, automated valves, PLC control, chemical wash facilities for in situ cleaning of membranes and disinfection	High to very high cost
							
							Highly skilled operation
								Achievable	Achievable

* Please note that anaerobic digestion is not discussed as it is a process step and not a stand-alone treatment system. However, its use must be considered, as there are numerous benefits as part of a holistic process approach.
** Sludge handling is also not discussed in detail, but must also be considered in line with likely re-use or disposal options.