Alternative Water Treatment Technology/Process Options

Challenge ID: RFI0044/16 | Published: 29 August 2017 | Deadline: 29 September 2017
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Challenge owner: Rand Water

Business opportunity: The scope of the BID is to request for information on Alternative Water Treatment Technology/Process Options. Service provider who can prove superior technical and economic performance may be considered for piloting.

Technology maturity: Preference for late stage solutions that have passed proof of concept stage, are in pilot, ready to commercialise or commercialised. Commercialised solutions must motivate for suitability and applicability given the uniqueness of Rand Water's characteristics.

Delivery timelines:

Issue Date	Tuesday, 29 August 2017	At 12:00 PM
Non-compulsory site meeting date	Tuesday, 19 September 2017	At 11:00 AM
Last date for questions	Friday, 22 September 2017	At 12:00 AM
Closing date	Friday, 29 September 2017	At 12:00 PM

Challenge statement

Rand Water requests for information on alternative water treatment technology/process options to treat source water under current and future water quality scenarios without the application of carbon dioxide and with minimal modification to existing treatment process, or where the service provider can prove superior technical and economic performance.

BACKGROUND

Rand Water is a primary supplier of water to Gauteng and surrounding areas. The company has their head offices situated in Glenvista, Johannesburg with smaller offices in close proximity to water processing plants. You are requested to reply to this Bid document by providing your company's bid to Rand Water.

Rand Water abstracts water from the Vaal Dam for treatment at two purification plants in Vereeniging, namely Zuikerbosch Station and Vereeniging Station. These plants have a combined design capacity of approximately 5 000 mega litres per day (ML/d). A breakdown of the estimated treatment capacities (in ML/d) of each plant's sub-units is provided in Table 1 below, taking into account any current operational limitations.

This document specifies the functional and technical requirements by Rand Water.

Table 1: **Estimated Treatment Capacities for Rand Water's Zuikerbosch and Vereeniging Stations**

Zuikerbosch Station		**Vereeniging Station**	
Station 1	450 ML/d	Plant 1	300 ML/d
Station 2	450 ML/d	Plant 2	1 000 ML/d
Station 3	1 100 ML/d		
Station 4	1 800 ML/d		

Carbon dioxide has traditionally been an integral part of Rand Water's treatment process, where it is used in conjunction with lime for chemical stabilisation. From a water quality perspective this high pH lime and carbon dioxide regime is advantageous for a number of reasons:

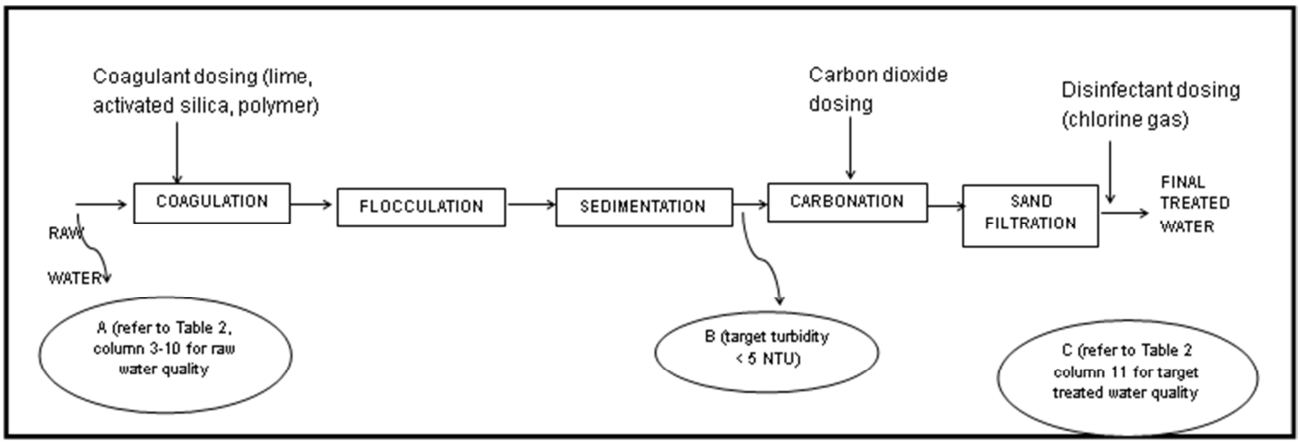
- Additional barrier for bacteria and virus inactivation
- Removal of most heavy metals
- Algal growth inhibition
- Re-carbonation for controlled chemical stabilisation

The quantities of carbon dioxide required by Rand Water have necessitated a permanent piped supply. However, the consistent provision of such a supply has proven challenging at times and as a consequence Rand Water seeks to consider alternate potable water treatment technology / process options that are not dependent on carbon dioxide.

With this RFI Rand Water requests information regarding your company and your Alternative Water Treatment Technology / Process Options which is your product. The same information will be gathered from different companies and will be used to follow up the sourcing process with an open RFP (Request for Proposal) or an open RFQ (Request for Quote).

CURRENT TREATMENT REGIME

The following is a schematic of the treatment process. **Table 2** can be found in Appendix 1.



Rand Water employs a conventional treatment process consisting of screening, coagulation and flocculation, sedimentation, carbonation (high lime process only), rapid gravity sand filtration, primary disinfection using chlorine and a later secondary disinfection process using monochloramine. Two chemical Treatment Regimes are individually employed for the purposes of coagulation and flocculation, namely;

- High lime, activated silica and carbon dioxide
- Polymeric coagulants and low lime

The lime, silica and carbon dioxide chemical treatment regime is a robust process that is able to deal with relatively large variations in source water quality. Essential to this process is the application of carbon dioxide for pH correction and chemical stabilisation, as the water treated by the high lime process has a pH of approximately 11 and is conducive to scale formation. Chemical stabilisation is achieved by reducing the pH with carbon dioxide. The benefit of such a complete **re-carbonation** process is that individual stabilisation variables such as calcium, alkalinity and pH can be controlled.

The polymeric coagulant process employs blends of inorganic and organic polymers for the removal of suspended matter. Low dosages of lime are used for the purposes of chemical stabilisation. Unlike that of the lime, silica and carbon dioxide process, stabilisation parameters such as calcium and alkalinity cannot be managed in this process and stabilisation can only be achieved through an upward adjustment of pH.

WATER QUALITY CHALLENGES

Notwithstanding the effectiveness of polymeric coagulants to remove suspended matter, there are at least two water quality scenarios which present a challenge when the polymer treatment process is employed.

Firstly, when the raw water has minimal alkalinity and low dosages of lime are used for stabilisation, the alkalinity cannot always be sufficiently raised without exceeding the upper limit of Rand Water's pH specification. This pH limit may also be breached before chemical stabilisation is achieved, as alkalinity is an important component in this regard. The second issue is that polymeric coagulants cannot be relied upon to effectively remove heavy metals under typical Rand Water treatment conditions. Although not of current concern, this aspect will become critical should metal concentrations in the source water increase to unsatisfactory levels.

Forecasts and knowledge around catchment activities indicate that the source water quality is likely to deteriorate in the future. Rand Water has no control over this aspect and it is therefore accepted that at least some deterioration in quality will be inevitable in the long term. Scenarios of direct consequence to Rand Water's ability to treat the raw water include inferior effluent quality from wastewater treatment plants, an increase in mining activities in the catchment and potentially higher proportions of low alkalinity water such as that of the Katse and Sterkfontein Dams.

Notwithstanding the historical data in Table 2, it should be appreciated that a constant supply of water from Lesotho and a variety of environmental factors have increased the variability of the water quality in the Vaal Dam. This is most pertinent in terms of alkalinity, metal concentrations, conductivity and the frequency of the occurrence of algal blooms. The Upper Vaal Catchment is also prone to cycles of drought and floods. Droughts can last up to three years, while flooding is usually quick and intense (as the most recent incident proved, where Vaal Dam's level increased from 64% to 103% in 7 days.) During such cycles some water quality variables show significant changes, notably the turbidity of the water which increases rapidly during floods. In addition, the source of the turbidity also changes from inorganic to organic matter, complicating treatment option decisions. The impact of climate change is likely to increase the severity and potentially the frequency of both droughts and floods. Treatment technology proposals must take into account such periodic water quality variations in the source water.

REQUEST FOR INFORMATION / INNOVATION CHALLENGE

Rand Water invites proposals for technology-based solutions to the challenges of treating water with low alkalinity and/or elevated metal concentrations. These should ideally be technologies that are beyond the proof of concept stage, ready to commercialise or commercialised. They must be suitable for use in drinking water treatment and should not impact negatively on the quality of the final product. The proposals should be based on the water quality criteria and assumptions provided in Table 2. Historical water quality data (2007 to 2017) for the source water is provided for context, but the proposed technology solutions must take into account the anticipated changes in raw water alkalinity and metal concentrations (column

10). Note that these potential changes cannot be quantified at this stage and therefore solutions should stipulate ranges or limits for which the solution will be both viable and practical.
The proposals must also clearly indicate all water quality variables that will be addressed by the solutions, as well as any variables that may be negatively impacted. In both cases, this must be in the context of Rand Water's desired final water quality (column 11).

The proposed solutions must be able to treat Rand Water's source water under current and future water quality scenarios without the application of carbon dioxide and with minimal modification to existing current treatment processes or the solution must demonstrate superior technical and financial performance.

SPECIFIC REQUIREMENTS/EVALUATION CRITERIA

In responding to the Challenge, solution providers must include comprehensive information for Rand Water to assess the technical potential as well as high-level economic impact of the solution as illustrated in Table 3 in appendix 1.

The technology proposals must satisfy the following minimum requirements:

- Detailed description of proposed solution (satisfy the proposed scope);
- Stage of technology maturity and details of existing plants;
- Evidence of suitability for drinking water treatment;
- Estimated performance for Rand Water's current and anticipated water quality;
- Estimated capital and operating costs;
- Technical and performance limitations of the technology;
- Health and safety issues;
- Examples of case studies; and
- Provide signed letters of successful project implementation from client/case studies.

PRE-QUALIFIERS

- The company responding must own the product.
- The company responding will be required to demonstrate its product/solution as per the Rand Water business requirements in a form of a presentation.
- The company responding should provide a client site with a successful implementation which resembles the Rand Water business requirements.
- Record of previous experience: Refer to table 4 in appendix 1
- A Due Diligence will be conducted on shortlisted contractors, to establish its assets, liabilities and to evaluate its commercial potential.

- Shortlisted contractors will be required to do a presentation to Rand Water's project team as a form of reference of previous work done of similar scope and/or size. Rand Water reserves the right to visit shortlisted companies (office, site, reference sites, etc)
- This Request For Information (RFI) will follow a procurement process whereby Rand Water will implement an open RFP or an open RFQ sourcing strategy for the responses from the RFI
- Service Providers are required to enter into a Joint Venture with a smaller contractor (SMME) that is 100% black owned. The smaller JV partner shall receive a minimum of 30% of the value of the contract.
- Pricing Schedule – Refer to table 5 in appendix 1

CONFIDENTIALITY OF YOUR RESPONSE

All information will be treated as strictly confidential and will be used for the evaluation of the RFI only. Unless otherwise provided for in the Agreement, and with the exception of those matters set out herein below, the Parties warrant that each shall keep confidential all matters relating to the Project, and that the Parties, their employees, agents and servants shall not divulge or disclose to any organisation or any person any information, data, documents, secrets, dealings, transactions or affairs relating to or incidental to the Works and/or the Project.

RFI PROCEDURE AND SUBMISSION

To answer this RFI please address all requirements under "SPECIFIC REQUIREMENTS/EVALUATION CRITERIA" and capture estimated costs where requested. The answers to this RFI will be evaluated by staff from different functions in Rand Water. Rand Water will not bear the costs of the RFI.

SUBMISSION OF RFI

The information must be deposited in the RFI/RFP box at the following address:

RAND WATER
522 IMPALA ROAD
GLENVISTA
2058

GPS COORDINATES

Rietvlei (Head Office)	28.03741	- 26.2938	1661.524

- All submission may be made before 12h00 on the closing date stipulated on the cover page of the RFI;
- Proposals delivered after the time for closing will be rejected;
- Proposals must be hand delivered;
- Responsibility for timely delivery rests with the RFI respondent.
- The sealed Bid shall be properly addressed with the name of the vendor and the item description written on the outside of a sealed package as indicated below.

DESCRIPTION
RFI0044/16 *Alternative Water Treatment Technology/Process Options*

Contacts

Employers Representative

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Employers Representative

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NB: An electronic version of this RFI can be requested via email from nradebe@randwater.co.za or tmasoka@randwater.co.za

TO RESPOND TO THIS CHALLENGE, VISIT www.randwater.co.za FOR TENDER PROCEDURES. Tenders can be collected from Rand Water Head Office reception, between 10:00am and 15:00pm, excluding the 12:45pm-14:00pm lunch hour at the amount of R100.00. Call (011)682-0402 to check if tender documents are available.

Appendix 1

Table 2: **Water Quality Criteria and Assumptions for Technology Solutions**

1	2	3	4	5	6	7	8	9	10	11
Determinant	**Units of Measure**	**Source Water Quality (2007 to 2017)**							**Potential Source Water Quality Change**	**Target Water Quality**
		Mean	**Median**	**Std Dev**	**Min**	**Max**	**95th Pctl**	**99th Pctl**		
Chemical and Physical Properties										
Alkalinity	(mg/l as $CaCO_3$)	69.52	68.00	13.08	5.00	230.00	86.00	105.00	Decrease	≥55 to ≤120
Colour	(mg/l as Pt-Co)	67.42	62.00	37.58	5.00	269.00	129.00	195.00		≤10
Conductivity	(mS/m)	19.71	19.00	7.50	1.60	145.00	24.00	31.00		≤100
pH	(pH units)	7.95	7.98	0.51	5.14	11.69	8.67	8.89		≥7.6 to ≤8.8
Turbidity	(NTU)	56.71	57.00	19.28	6.40	125.00	91.00	110.00	Variable	≤0.5
Total Dissolved Solids	(mg/l)	166.30	165.00	44.14	78.00	455.00	230.00	410.00		≤685
Hardness	(mg/l as CaCO3)	-								≥20 to ≤200
CCPP	(mg/l as $CaCO_3$)	-								-2 to +3
Taste	(FTN)	-								≤2
Odour	(TON)	-								≤2
Organic Determinants										
Dissolved Organic Carbon	(mg/l)	5.18	5.10	1.27	2.00	9.70	7.40	8.30	Variable	TOC ≤7
Phenols as C_6H_5OH	(ug/l)	3.55	3.20	1.89	0.30	17.00	7.10	9.80		≤7.5
Micro Elements										
Antimony	(µg/l as Sb)	0.77	0.50	0.63	0.05	6.50	2.00	2.60	Increase	≤11
Arsenic	(µg/l as As)	1.37	0.96	1.56	0.10	8.00	3.20	8.00	Increase	≤9
Cadmium	(µg/l as Cd)	2.51	2.50	0.09	2.50	4.90	2.50	2.50	Increase	≤2.75
Chromium (Total)	(µg/l as Cr)	3.41	0.01	6.25	0.01	15.00	15.00	15.00	Increase	≤45

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Determinant	Units of Measure	Source Water Quality (2007 to 2017)							Potential Source Water Quality Change	Target Water Quality
		Mean	Median	Std Dev	Min	Max	95th Pctl	99th Pctl		
Cobalt	(µg/l as Co)	2.41	0.02	5.74	0.01	110.00	10.00	10.00	Increase	<250
Cyanide (Recoverable)	(µg/l as CN)	12.30	10.00	4.19	10.00	20.00	20.00	20.00		≤110
Lead	(µg/l as Pb)	6.65	8.00	5.21	0.20	165.00	8.00	8.00	Increase	≤9
Mercury	(µg/l as Hg)	0.40	0.50	0.19	0.09	0.52	0.52	0.52	Increase	≤3.5
Nickel	(µg/l as Ni)	2.32	0.02	4.22	0.01	30.00	10.00	10.00	Increase	≤40
Selenium	(µg/l as Se)	1.72	1.00	2.31	0.50	31.00	5.50	8.30	Increase	≤25
Uranium	(ug/l as U)	0.46	0.36	0.47	0.10	6.50	1.00	2.30	Increase	≤15
Vanadium	(µg/l as V)	2.51	0.03	4.46	0.02	20.00	10.00	14.00	Increase	<100
Macro Elements & Miscellaneous Determinants										
Aluminium	(mg/l as Al)	1.06	0.00	5.59	0.00	188.57	7.59	9.91	Increase	≤0.165
Ammonia	(mg/l as N)	0.20	0.20	0.67	-0.02	24.00	0.24	0.50		≤0.2
Barium	(mg/l as Ba)	0.06	0.05	0.04	0.00	1.10	0.11	0.18		≤0.375
Boron	(mg/l as B)	0.01	0.00	0.01	0.00	0.11	0.03	0.03		≤1.215
Calcium	(mg/l as Ca)	14.68	14.00	5.79	0.40	110.00	19.00	28.00		<80
Chloride	(mg/l as Cl)	7.15	6.90	2.45	0.50	50.00	9.90	13.00		≤160
Copper	(mg/l as Cu)	3.05	0.02	11.83	0.01	365.00	10.00	21.00		≤1.0
Fluoride	(mg/l as F)	0.20	0.19	0.09	0.05	2.10	0.26	0.37		≤0.9
Iron	(mg/l as Fe)	0.52	0.00	1.38	0.00	14.40	4.27	5.54	Increase	≤0.155
Magnesium	(mg/l as Mg)	7.23	7.10	2.24	0.04	40.00	9.30	13.00		<50
Manganese	(mg/l as Mn)	0.01	0.00	0.01	0.00	0.17	0.03	0.05	Increase	≤0.055
Molybdenium	(mg/l as Mo)	2.27	0.01	4.16	0.01	10.00	10.00	10.00		<0.06
Nitrite	(mg/l as N)	0.04	0.03	0.08	0.01	1.70	0.08	0.28		≤0.9
Nitrate	(mg/l as N)	0.32	0.24	0.44	0.10	11.00	0.72	1.80		≤6
Combined	(NO_2/0.9 +									≤1

1	2	3	4	5	6	7	8	9	10	11
Determinant	**Units of Measure**	**Source Water Quality (2007 to 2017)**							**Potential Source Water Quality Change**	**Target Water Quality**
		Mean	**Median**	**Std Dev**	**Min**	**Max**	**95th Pctl**	**99th Pctl**		
nitrite+nitrate	NO_3/11)									

Ortho Phosphate	(mg/l as P)	0.08	0.05	0.21	0.00	6.50	0.20	0.39		< 1
Potassium	(mg/l as K)	2.36	2.30	0.97	0.31	15.00	3.70	4.60		< 25
Sodium	(mg/l as Na)	9.28	9.10	4.06	1.90	105.00	12.00	20.00		≤110
Sulphate	(mg/l as SO_4)	15.59	15.00	6.58	1.00	290.00	20.00	25.00		≤135
Zinc	(mg/l as Zn)	4.40	0.01	11.63	0.01	295.00	20.00	30.00		≤2.5
Biological Determinants										
Chlorophyll 665	(µg/l)	4.62	3.90	3.02	0.04	50.00	9.80	16.00		<1
Geosmin	(ng/l)	7.22	6.00	9.18	0.00	325.00	18.00	37.00		<30
Giardia	(org/10 litre)	0.00	0.00	0.06	0.00	1.00	0.00	0.00		0
Cryptosporidium	(org/10 litre)	0.04	0.00	0.33	0.00	5.00	0.00	1.00		0
Daphnia Pulex	(Survival %)	99.54	100.00	2.80	55.00	100.00	100.00	100.00		>90
Microbiological										
Heterotrophic Plate Count	(cfu per 1 ml)									≤50
Total Coliforms	(cfu per 100 ml)	616.55	407.50	1029.86	13.00	14136.00	1733.00	3076.00		0
E. coli	(cfu per 100 ml)									0
Somatic Coliphages	(count per 10 ml)	0.95	0.00	1.95	0.00	24.00	4.00	8.00		0
Disinfectant										
Residual disinfectant	(mg/l)									≥0.2 free chlorine

Table 3: Evaluation Criteria

Criteria	Detail	%Weighting
Detailed description of proposed solution. Extent to which current water treatment process (coagulation , flocculation, sedimentation, sand filtration and disinfection) infrastructure will be used with minimal modifications if any	Satisfy the proposed scope	20%
Stage of technology and details of existing plants	Provide details of stage of technology and list of existing plants	5%
Evidence of suitability for drinking water treatment	Technology has been successfully used for drinking water treatment. Indicate source water quality treated and final water quality	15%
Estimated performance for Rand Water's current and anticipated water quality	Comprehensive analysis of the proposed technology solution in the context of Rand Water source water quality challenges. Impact of solution on all water quality variables in Table 2 to be included.	25%
Estimated capital and operating costs	Detailed cost estimation per 100 ML/day based on Rand Water target water quality requirements.	10%
Technical and performance limitations of the technology	Disclosure of known limitations of the technology as well as safety and health issues anticipated with its implementation and operation. All relevant hazards to be provided in detail.	5%
Provide signed letters of successful project implementation from client/case studies	One signed letter/case study	5%
	Three signed letters or more	5%
Presentation	Demonstrate the product/solution to Rand Water's project team as per scope of work	10%
	Total	**100%**

Table 4. RECORD OF PREVIOUS EXPERIENCE, QUALITY OF WORKMANSHIP AND SAFETY

The Tenderer shall provide details of at least 3 recently **completed** works (similar to the work set out in this RFI). Individuals listed as references must be contactable and willing to provide information relating to the performance of the Tenderer (in terms of safety and health, workmanship, documentation, timeous completion, etc.). In order to verify the quality of workmanship, an inspection of the works may also be undertaken should Rand Water deem it necessary.

1	**Description of Works**	
	Project Title :	
	High level project description :	
	Client :	
	Contract No. :	
	Contract Value (excl. VAT) :	
	Role(Note 1) :	
	Award Date :	
	Completion Date :	
	Location of Works :	
	Project Manager :	
	Construction Manager :	
	Contact Details of Reference at Client Company	
	Name :	
	Position Held :	
	Tel :	Cell :
	Fax :	email :

TABLE 5. PRICING SCHEDULE

Services	Description	Amount (R)	
Site establishment	Site establishment		
Bed or pilot plant	Set up ,including construction of testing bed or pilot plant		
Testing of pilot plant	Operation and testing of pilot plant		
Analysis	Test analysis		
Final report	Final report		
Additional Services	Pertaining to all stages of the project		
	Total		