Comments on the practical feasibility of prepared options for revising water management practices in the Sana'a Basin to increase the availability of water supply to Sana'a City.

1. Background and Purpose

Under contract to the World Bank, RTI has prepared an analysis of options for revising water management practices in the Sana'a Basin to increase the availability of water supply to Sana'a City. The consultant provides comments on the practical feasibility of each option, noting their "pros" and "cons" with regard to political, social, and environmental factors. An edited version of these comments will be included in the final project report. Options analyzed for phase 1 include:

1. Adjust diesel price
2. import qat
3. improve irrigation
4. improve urban system
5. increase recharge
6. purchase wells
7. Import from Red Sea/As Sabata'an Aquifer

2. Comments on the data and methods used in the analysis

- If social factors had been included in the WEAP model the results would have been more decisive
- Analysis using zoning of Sana'a basin following Russian study (Mos. 1986) might not be good zoning combining irrigation and urban supply. The Central Plains aquifer zone is not representative for Tawilah Sandstone aquifer, the primary aquifer supply Sana'a. The results would have been more realistic if the analysis covered the sandstone aquifer alone. Or extend the central plains aquifer zone to cover parts of Northwestern and Northeastern zones underlying by Sandstone.
- Using the costs of importing water from the As Sabata'an aquifer or desalinated Red Sea water ($3.40/cum and $8.00/cum, respectively) are too high. TREC, 2006 estimate of $1.10/cum for desalinated Red Sea water taken to Sana'a using solar energy.
- Field observations (Alderwish 1996), indicate that applied water to Qat is only 6500 m3/ha/yr. This is in line with report of FAO report, table 1, page 21, the water use for qat is 6659 cum/ha, and that indicate applied water. Other reporting figures for water consumed by Qat might indicate water requirement rather than applied or it is only rough guessing or/and copying each others. (Qat is very drought-resistant crop which uses less applied water than any other cash crop).
- Using for each scenario data from different sources can be good for researchers while it is so confusing for others.
- The results of the analysis would have been better if it had been covered through IWRM principles.

3. Practical feasibility of each option (Social & political):

Clearly, understanding the political and social factors of options has considerable explanatory power about what will work and what will not. It also indicates ways to increase the chances of option passing successfully. Comments given below are drawn on the following:

1. Implementing an option requires support from stakeholders, and support requires both a learning process and time; education and patience are indicated.
2. The twin motors of an option are necessity and opportunity. Any option will happen when the problem is most pressing – as with groundwater overdraft – and when the time is right – as with a politically favorable conjuncture occasioned by a decisive moment. Opportunism can push difficult options through.
3. There is a certain "adaptive capacity" in every community, more or less pronounced and powerful. Understanding this adaptive capacity is the key to predicting and promoting an option. At the local level, for example, this is the basis for the proposed certain option.
4. No one will act against their will, and the correct incentive structure is essential. Negative incentives like price rises must be matched by positive incentives like better supply/service levels, more ownership and control, subsidies targeted to produce socially optimal outcomes, etc.
5. Leadership is imperative. Wise decisions from the top always find it is way in least developing countries.

So deciding conclusively on practical feasibility of options (politically, socially and environmentally) requires detailed analysis for these factors. Given the short time for assignment, an indicative analysis (feasibility) is given for these options.

There are many discordant voices regarding the analyzed options. The short-time analysis considered here is based on the attitudes of stakeholders in water toward each analyzed option. Their attitude is derived from their vested interest. Stakeholders in water include political leaders and parliamentarians, central and local government, traditional leaders, NGOs, large and small farmers, domestic water users and the poor. Donors also can be considered as stakeholders. They are powerful agents for change because of their investment resources and the accompanying ability to influence what the Government does. Table (1) gives a brief of the attitude of each of these stakeholders toward each option. As requested, brief text comment is given below for each option.

Table (1) **Water Sector Stakeholders (political & social) - Their Interests and Attitude to the analyzed options**

options	**Political leader**	**Central government**	**Parliament**	**Sheikhs and Ulama**	**Local government**	**NGOs**	**Large farmers**	**Small farmers**	**Domestic users**	**the poor**	**donor**	**total pro**	**total anti**
stakeholders vested interest	*Patronage, Risk aversion*	*Pro-poor development mandate, capability, cost, and power*	*Pro-poor development mandate, Patronage, Populsim*	*Authority derived from status quo*	*Local development mandate*	*Public interest, Ethical motivations*	*Water rights to gain/ loss*	*Water rights to gain/ loss*	*Subsidized tap water*	*they are poor*	*development*		
Eliminate diesel subsidy	pro	pro	anti	anti	anti	Anti	anti	anti	anti	anti	pro	3	8
Import qat	anti	pro	anti	anti	anti	pro	anti	anti	pro	pro	pro	5	6
Improve irrigation	pro	pro	pro	pro	pro	pro	pro	pro	pro	pro	pro	11	0
Improve urban water supply	pro	anti	pro	pro	pro	anti	pro	pro	anti	anti	pro	7	4
Increase recharge	pro	pro	pro	pro	pro	pro	pro	pro	pro	pro	pro	11	0
Purchase wells in Central Plains zone	anti	anti	anti	anti	anti	pro	anti	pro	anti	pro	pro	4	7
Improve urban water supply and purchase wells	average											6	5
Import water from As-Sabata' an aquifer or Red Sea	pro	pro	Pro	pro	pro	anti	pro	pro	anti	Anti	pro	8	3

* the results shown in Table should be read with text.

1. Increase of diesel:

Out of the 11 stakeholders; based on invested interest, 3 stakeholders are pro to this option while 8 are against.

- Affect the small farmers through lowering their income as it will make them reducing their irrigated area.

- Users will suffer from the increase of crops prices.
- Large farmers should not be affected and they either shift to more profitable cash crops, i.e. crops price rise
- Domestic users will be largely affecting within the city as they depend on private water supply for domestic uses. The increase in diesel price has increased the price of water tankers. Poor and most of populations are suffering from bad handling method of water inside house. Recent study (Alderwish, 2012) shown that due to shortage/expensive water supply, population stores water in containers instead of using flow tap water. This practices results in contamination of water with negative impact on health.

Recently in April 2012, the government increased diesel price to $0.58 per liter. Although parliamentarians oppose the increase at first, they pass it with condition to exempt farmers from tax, (the unrest situation of the country seems enforce it). Adaptive capacity is pronounced in this situation.

It is politically feasible (done), but neither socially nor environmentally.
This clearly indicates that the results shown in the Table should be used together with written text for each option.

2. QAT Importation:

Although only 6 of stakeholders are against this option, it seems not feasible to implement this option. This may be explained by the following:

- Qat can only be transported through airlines and has to be fresh of the same day otherwise loose its price.
- Taxes from Qat represent major income (Fund) to the country.
- Farmers have investment in their wells, pumps, and distribution systems and are likely to be averse to stopping irrigation, i.e. they will shift to mixed vegetables which are cash and profitable and DO require more water than qat do. (Here the amount of applied water to Qat is important and will reverse expectations and violate the assumption that the saved water due to using the same amount of land with different crop will be used to supply Sana'a City. In short, the change in cropping pattern will not save water i.e. Importation of Qat would not result in save of groundwater.
- Socially, people prefer local commodity (crops) than important ones.
- Qat farmers have strong influence to parliamentarians, local government; tribe leaders (sheikhs) etc. who will not pass a law permitting importation of Qat.
- Rural economy probably would not be affected, as farmers will shift to other cash crops with more water use.

Socially, politically and environmentally not feasible

3. Improve Irrigation

All stakeholders are pro this option. The acceptance of this option indicates large public awareness of water scarcity and people are willing to cooperate with good solutions (with little negative impact) to conserve the resources. This push researchers to look for and find these solutions.

A great paragraph in the report says 'It is important to consider the structure and nature of the "benefits" from improved irrigation technology. First, the primary benefit is a reduction in pumping costs (less water needs to be pumped to achieve the same level of crop transpiration and hence yield). This is a private benefit (that is, it accrues to the farmers) and is sufficient to justify private investment in the technology. Second, the impact of this private benefit (a reduction in fuel consumption) is precisely the reverse of the impact of increasing diesel prices, and could act to offset any progress in decreasing pumping. Third, any actual savings of water would be offset if farmers utilized the "water savings" from improved technology to expand their irrigated area, or sold "excess" water to neighbors. We add here it has been observed happening now: while Sana'a Basin Management Project tried to impose condition for farmers when providing them with the irrigation technique. As the project completed! There is no follow up, it seems every body is expanding its irrigated area. And finally, given that the perennial crops (qat and grapes) were, for the most part, planted many years ago, they will have developed deep rooting systems consistent with infrequent, heavy applications of water, and may not immediately adapt to frequent, shallow irrigations.

Considering the comments mentioned above (data and zoning), the results would be different regarding the extension of the life of the aquifer due to this option. As mentioned in the report: 'On the other hand, it is clear that the increased profitability to farmers is sufficient for farmers to pay off those investments in much less than the expected lives of the aquifer zones in every zone.'

Politically, socially and environmentally Feasible

4. Improve Urban Water Supply

7 stakeholders are agree to this option, while 4 are against. Stakeholders against are the central government as they have to allocate fund for the improvements. NGOs, domestic users and poor also would not by happy to pay more (cost recovery) for their bills due to un-tangible improve in the service they receive.

Considering the comments given above would further confirm the conclusion of the report that option is economically not justified. i.e. The little gain of only 10% of the withdrawal water. In fact, thinking resource-wise, the 20-30% is important source of groundwater recharge that dilute the pollution of groundwater aquifer under the city.

There is error reporting northeastern zone in table (32) –twice.

Socially, politically and environmental unfeasible, at least for the time being

5. Increase Recharge of the Aquifer

All stakeholders are with this option. The likely stakeholders to be against are farmers can accept that option with good awareness and conflict resolution mechanism for upstream and downstream dwellers (Alderwish, 2011).
Please consult the study also for detailed discussion of the actual benefit of dams within Sana'a basin. It has been found that check (cascade) dams are inexpensive and good structures for groundwater recharge. However, to have the opportunities for recharge the central plain aquifer zone and extend the life of Sandstone aquifer, zoning in the analysis needs to be revised as suggested above.

Socially, politically and environmentally Feasible

6. Reduce Irrigation by Purchasing Wells

With 7 stakeholders likely to be against this option, 4 stakeholders are expecting to be pro as they may not be negatively affected.

The big social factor that would confront this option is even if some farmers accept to sell their wells (e.g. good compensation), others within the area will not let them sell their (own) water to urban Sana'a. In other word, they are emptying their groundwater resources, their land and no future for their children.

Socially, politically and environmentally not feasible

7. Import Water from the As Sabata'an (Marib) Aquifer or Desalinated Water from the Red Sea

- Import water from As Sabata'an (Marib) aquifer should not be politically and socially feasible as the area is not in control of the government. Special arrangement may be required.

- Import desalinated water from the Red Sea, politically, socially and environmentally is feasible

8. Combination of Improve Urban Water Supply and Purchase Wells Scenarios

Feasibility of this option would be an average of the feasibility (pros and cons) of the two options.

4. Personnel Notes

- One of the major challenges that could face these options is the poor institutional capacity of Yemen.

- Issues of urban supply in regard to water resources management include:
  - Scarcity of the resource
  - Conflict between private rights and public interest;
  - Weak management and Regulatory capacity,
  - The need to act on wastewater reuse

- Consequently: for the future the following has been foreseen (***first time to be said***):
  - Providing 'tertiary' treated urban wastewater to farmers especially those withdraw their water from the Sandstone for irrigation, even free of charge, would save and replenish the groundwater resources of Sana'a.

  - Using desalinated Red sea water (using solar energy $1.1 per CUM) for urban supply and constructing check dams to recharge shallow aquifer for farmers would prolong the live of the Sana'a Basin.