

## Bi-communal reuse of treated effluent in Cyprus

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### ABSTRACT

Cyprus is using almost all of its renewable water resources. Groundwater is rapidly depleting and sea water intrusion is occurring in the main coastal aquifers. Providing water for the expanding domestic and tourism sectors, while maintaining the agricultural sector, is becoming a critical issue. Complicating matters of water management, the island has been divided since 1974 into the Republic of Cyprus, the internationally recognized government, and the 'Turkish Republic of Northern Cyprus', which is recognized only by Turkey. However, the island's water resources do not conform to map lines and shared infrastructure predates the division, creating unique challenges for the island's two communities. With objectives to enhance bi-communal ties and address common water shortages, a feasibility study was recently performed to identify opportunities for reuse of 30,000 cubic metres per day of treated effluent generated by the New Nicosia Wastewater Treatment Plant (WWTP). The WWTP is being constructed to replace the Mia Milia/Haspolat WWTP, which services both the Turkish Cypriot community (TCC) and Greek Cypriot community (GCC) of the Nicosia area. The project involved transmitting treated effluent to TCC and GCC, benefiting both communities. The study scope included identifying opportunities for reuse, and identifying and assessing water storage and conveyance alternatives.

**Key words** | agriculture, bi-communal, distribution, reuse, stakeholder, storage

### BACKGROUND

Cyprus is the third largest island in the Mediterranean, measuring 240 kilometres (km) long and 100 km wide at its widest point, with Turkey located 75 km to the north. At present, almost all of the renewable water resources in Cyprus are utilized and the amount of water extracted vastly exceeds natural recharge. As a result, in a number of areas, groundwater is being rapidly depleted, and sea water intrusion is occurring in the main coastal aquifers. Providing water for the expanding domestic and tourism sectors, while maintaining the agricultural sector, is becoming a critical issue. The trend in recent years across the island, which is likely to continue in the future, is that larger quantities of water will be used for domestic water supplies at the expense of agriculture, sacrificing the Cypriot agricultural heritage and angering powerful farmer groups. Complicating matters of water management, the island has been divided since 1974 and border

crossings for the general population only resumed in 2003. The Republic of Cyprus, populated by the Greek Cypriot community (GCC), is the internationally recognized government and occupies the southern two-thirds of the island. The 'Turkish Republic of Northern Cyprus', populated by the Turkish Cypriot community (TCC), occupies the northern third of the island and is recognized only by Turkey.

The events of 1974 were wrenching for this small island and resulted in the Green Line, a United Nations-administered border separating the northern third of the island. This line splits Nicosia nearly in half. At that time, plans were under way to create a wastewater treatment plant (WWTP) for the growing city of Nicosia. In a significant accomplishment and demonstration of political will and the triumph of shared needs over community strife, these plans were slowly pushed forward until the Mia Milia/

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Haspolat Wastewater Treatment Plant (MM/H WWTP) was completed in 1980. This facility is located in the TCC, just outside of northern Nicosia, and provides wastewater treatment services to the entire Nicosia area. As the city has grown, the MM/H WWTP has been challenged in meeting the growing demand for its services. Stretched to capacity, local authorities within the GCC and TCC built on their well-established tradition of cooperation to commission a new state-of-the-art WWTP with plenty of capacity to meet current demand and the ability to expand to meet any growing needs. In the hopes of expanding the use of treated effluent on the island, the New Nicosia (NN) WWTP is designed to produce treated effluent suitable for unrestricted agricultural reuse.

To further build on the success of this challenging bi-communal effort and simultaneously help alleviate significant water scarcity problems on the island, the US Agency for International Development (USAID), through the Supporting Activities that Value the Environment (SAVE) project, commissioned the feasibility study for reuse of the NN WWTP treated effluent and biosolids. This activity aimed to enhance bi-communal ties and address the common problem of water shortages by identifying opportunities for reusing the 30,000 cubic metres per day ( $\text{m}^3/\text{d}$ ) of treated effluent from NN WWTP. The project concept involved transmitting treated effluent to both the TCC and GCC in the relative amounts of the wastewater influent generated by each community, for the maximum benefit of both communities. The study's scope included identifying reuse opportunities, and identifying and assessing alternatives for water storage and water conveyance. The Feasibility Study was prepared by CDM for the SAVE project, which is funded by USAID and managed and implemented by International Resources Group (IRG).

The existing MM/H WWTP is located about 6 km north-east of the centre of Nicosia. Commissioned in May 1980 to serve the Nicosia area, MM/H WWTP employs lagoon treatment (Turker et al. 2009). The capacity of the plant is no longer adequate because of growth in the service area. Plant performance has deteriorated, and unacceptable effluent quality and noxious odour emissions are present. NN WWTP, currently being constructed, has been designed to produce a high-quality effluent. The new plant will use

membrane bioreactor technology for advanced biological nutrient removal, which should produce treated effluent suitable for unrestricted agricultural use, while also significantly increasing capacity of the current plant. The primary design elements are as follows:

- Population equivalent for design: 269,115 based on 2025 design horizon
- Sludge stabilization: anaerobic, biogas utilization with combined heat and power (CHP) unit
- De-nitrification: intermittent
- Phosphorus removal: enhanced biological phosphorus removal (EBPR)/chemical precipitation with e.g. Fe III
- Aeration basin: rectangular basin
- Plant configuration: two independent treatment trains
- Sludge thickening: mechanical
- Sludge dewatering: mechanical

It is anticipated that treated effluent from the NN WWTP can provide a valuable resource for cropland irrigation or other uses. This study (1) identified viable opportunities for reuse for the treated effluent and biosolids; (2) developed required storage/distribution system alternatives; and (3) screened alternatives. The result of this study was a preferred alternative distribution system that is favourable to a baseline scenario of no action.

Cyprus suffers from ongoing water scarcity issues owing to its climate coupled with limited groundwater supplies, which rely solely on rainwater recharge and few alternative water supplies. As a result of abstractions, groundwater quality and quantity is being depleted. Total dissolved solids (TDS) concentrations in local groundwater used primarily for irrigation may be expected to be about 3,000 milligrams per litre (mg/l). Although this level was based on a very limited data set of 27 irrigation wells in the TCC, it is indicative of a growing problem that is not sustainable. Continued use of this water for irrigation can have significant impact on crop yields. The NN WWTP will produce an average of 30,000  $\text{m}^3$  of treated effluent per day and so will be a significant alternative water supply suitable for a wide range of uses, primarily including irrigation, industrial, municipal and tourism. All of these areas can make use of treated effluent, freeing additional potable water resources.

## REUSE OPPORTUNITY IDENTIFICATION

Available 2010 water demand information for both the TCC and GCC are presented in Table 1. Agricultural demand was not available for the TCC.

The study team completed an inventory of potential reuse opportunities in the industrial, municipal and tourism sectors. Analysis of reuse options suggested limited opportunities with respect to industrial, municipal and tourism use. Effluent use in these sectors has less demand than that for the agricultural sector and would require installation of costly infrastructure without sufficient economic returns on these investments to warrant the costs. To reduce infrastructure costs, distribution by commercial tankers to the various consumers was considered. Owing to the need for a regulatory structure for controlling the final use of treated effluent, sale to the private sector via tankers was not recommended. However, providing controlled access via hydrants along transmission line routes could encourage treated effluent reuse by municipalities, reducing demand on domestic supplies.

Significant opportunities were identified for agricultural reuse of treated effluent, making this the focus of further analysis. Based on information gathered, dominant crops in both the GCC and TCC included fodder crops (alfalfa, wheat, barley) and fruit trees (olive, citrus). Fodder is an agricultural term for animal feed, and fodder crops are those plants that are raised to feed livestock either grown for grains, forage or silage. Cash crops are crops produced for their commercial value, which are readily saleable and are grown for profit. Analysis of these data suggested the existing cropping pattern was not optimal from a financial perspective, given the available water quality or quantity. Both the GCC and TCC are encouraging local farmers to switch to higher value crops to maximize the benefit of

their scarce water resources. These efforts are ongoing. For the purposes of this study, to establish a baseline against which the benefits of reuse scenarios could be compared, alternative cropping patterns were considered, producing a higher rate of return on the volume of water used for irrigation.

## TREATED EFFLUENT QUALITY

Table 2 provides a comparison of the GCC standards with World Health Organization (WHO) standards for unrestricted irrigation and EU standards for discharge to sensitive environments. Also presented are the design values for the New Nicosia WWTP.

Comparing effluent design values of the New Nicosia WWTP with GCC standards for agriculture unrestricted use shows that turbidity, total suspended solids (TSS), biochemical oxygen demand (BOD), faecal coliforms (*Escherichia coli*), and parasitic helminth worms are in compliance with GCC standards (Table 2), while chemical oxygen demand (COD) design value (60 mg/l) is two times higher than the GCC standards (30 mg/l). Cyprus's standards do not specify TDS level whereas WHO gives 450 mg/l as the limit for unrestricted reuse (Maas 1986, 1997; Maas & Hoffman 1997). The relatively high TDS levels (1,900 mg/l) would require management and its application is limited to crops characterized as moderately tolerant to saline conditions. High clarity of the effluent would allow broader use of irrigation methods. Most metals are expected to be below GCC guidelines for unrestricted agricultural reuse; however, levels of zinc in treated effluent are expected to exceed GCC guidelines. The GCC zinc criterion is very low compared with other international standards. Effluent levels of zinc from the NN WWTP should be below WHO standards. Further, because of the alkaline nature of the soils, additional zinc is likely to be needed by crops. Testing results indicate that the current TCC industrial area that discharges to the plant should not create problems with respect to heavy metal loads; however, periodic monitoring of individual industries for compliance with applicable sewer discharge limits is recommended to protect the downstream treatment system.

Table 1 | 2010 water demands

	TCC million m <sup>3</sup> /yr	GCC million m <sup>3</sup> /yr
Domestic	25.3	59.6
Agricultural	Not available	182.4
Industrial	2.0	6.0
Tourism and municipal	6.2	22.9

**Table 2** | Minimum treatment requirements for wastewater

Parameter	Unit	Treated effluent standards for unrestricted irrigation and discharge to sensitive areas		EU standards for discharge to sensitive areas		Design value for NN WWTP
		GCC Standard	WHO Standard	Shellfish	Bathing	
pH	Standard			7–9	6–9	
Turbidity	NTU	3				3
TDS	mg/l		450			
TSS	mg/l	10	50			5
BOD	mg/l	10		25		5
COD	mg/l	30		125		60
Total nitrogen-N	mg/l			10		10
Chlorine residual	mg/l					
Total phosphate	mg/l			1		1
Aluminium	mg/l	5	5			
Copper	mg/l	0.2	0.2			
Iron	mg/l	5	5			
Nickel	mg/l	0.2	0.2			
Lead	mg/l	5	5			
Cadmium	mg/l	0.01	0.01			
Zinc	mg/l	0.005	0.2			
Chromium	mg/l	0.1	0.1			
Molybdenum	mg/l	0.01	0.01			
Boron	mg/l	0.75	0.7			
Arsenic	mg/l	0.1	0.1			
Beryllium	mg/l	0.1				
Cobalt	mg/l	0.05				
Lithium	mg/l	2.5				
Manganese	mg/l	0.2				
Selenium	mg/l	0.02				
Vanadium	mg/l	2				
Mercury	mg/l					
Faecal coliforms ( <i>E. coli</i> )	count/100 ml		0.1/1,000 ml		100	5*, 15 max
Helminth eggs	egg/l					nil
Parasitic helminth worms	worm/l					nil

\*Not to exceed in 80% of samples.

Source: Fichtner-Heinrich (2008).

## AGRICULTURAL REUSE ANALYSIS

Extensive analysis of the use of treated effluent as a source of irrigation water was performed. This was due to the high priority placed on agricultural reuse

options by the key stakeholders, global best practices that often recommend treated effluent as a preferred source for irrigation water, and the limited opportunities for other reuse options. The objectives of this analysis were as follows:

1. Evaluate alternative cropping patterns on the basis of financial return
2. Identify reuse water storage requirements
3. Identify preferred irrigation methods and leaching requirements for various cropping patterns

As a basis for crop pattern development, crops were selected considering the need for the crop, existing dominant crops, farmers' acceptance of the crop, reclaimed water quality, climate and land suitability, and crop value and market availability. The primary constraint was treated effluent quality. Based on sampling and testing of NN WWTP influent, TDS was on the order of 2,000 mg/l. Therefore, treated water effluent would be an improvement to the quality of water observed in irrigation wells within the TCC, averaging about 3,000 mg/l. However, for the purpose of this analysis, crops were limited to those characterized as saline tolerant or moderately tolerant (Rhoades *et al.* 1993). Although it is possible that additional physicochemical processes could be added to the NN WWTP design thus rendering the effluent more suitable for less saline tolerant crops, such as fruit trees, the intent here was to promote saline tolerant agriculture and minimize additional treatment costs. The agricultural demand for saline tolerant and moderately tolerant crops is already well in excess of the expected effluent flows. Crops selected for the analysis included both perennial and winter crops to balance effluent use and to minimize excess effluent and/or storage capacity requirements. These included fodder crops (barley, barley forage, wheat, wheat forage, sorghum and alfalfa) and cash crops (pomegranate, olives, carob, fig and date palm).

Forty-five alternative cropping patterns without storage were analysed and 30 cropping patterns with storage utilization were analysed. The analysis involved a monthly water balance, including:

- Dependable precipitation defined at a 70% probability of occurrence in a given month
- Monthly projected NN WWTP discharge based on historical records
- Crop irrigation water demand

Crop irrigation water demand was calculated monthly for selected crops by considering crop evapotranspiration, leaching requirements and irrigation losses. The actual

crop evapotranspiration was estimated as:

$$ET_c = K_c \times ET_o \quad (1)$$

where  $ET_c$  represents actual crop evapotranspiration (mm/day);  $K_c$  represents crop coefficient derived according to the guideline for computing crop water requirements (FAO Paper 56, Allen *et al.* 1998); and  $ET_o$  (mm/day) represents grass reference evapotranspiration calculated using the Penman Monteith approach and Class A pan evaporation.

Farm irrigation efficiency was estimated at 75%. The leaching requirement (LR) is the ratio of the net depth of leaching water to the net depth of water, which must be applied for consumptive use. Calculating the leaching requirement for drip irrigation is greatly simplified by (Keller & Bliesner 2001):

$$LR = \frac{EC_w}{EC_d} \quad (2)$$

where  $EC_w$  = irrigation water salinity (deciSiemens per metre, dS/m); and  $EC_d$  = drainage water salinity (dS/m) (approximately equal to  $2 \max EC_e$ ).

$$LR = \frac{EC_w}{2 \max EC_e} \quad (3)$$

where  $\max EC_e$  = electrical conductivity of the saturated soil extract that will reduce crop yield to zero (dS/m).

For sprinkler and surface irrigation systems, leaching requirement was calculated using the following equation:

$$LR = \frac{EC_w}{5 EC_e - EC_w} \quad (4)$$

where  $EC_e$  is estimated electrical conductivity of the average saturation extract of the soil root zone profile for an approximate yield reduction (dS/m).

The  $EC_e$  value which will give 10% yield reduction, as presented in the FAO Irrigation and Drainage Paper No. 29 (Ayers & Westcot 1994), was used to define leaching requirements. It was found of the crops evaluated, with the exception of alfalfa, irrigation losses should provide adequate leaching.

In general, cropping patterns were developed by selecting a base crop that was maximized. Additional crops

were added as water was available. The possible cropping patterns were then evaluated in terms of area of cultivated land and value of crops produced. The value of crops produced was calculated based on economic and crop yield data available for both the GCC and TCC. The process was performed with and without utilizing storage to augment irrigation during periods of peak demand.

The results of this analysis suggest that areas of cultivation can be increased by 50–170% with fodder crops as the main crop, and 12–66% with fruit trees as the main crop if storage is used. The value of crop yields could be increased by 40–220% with fodder crops as the main crop and 36–62% for fruit trees.

Figures 1 and 2 show that the addition of storage could dramatically increase the area of cultivated land and the value of the crops produced. However, few sites offered natural storage on the flat Mesaoria plain and construction of large storage facilities was costly. Therefore, a target storage volume was identified by considering the value of crops

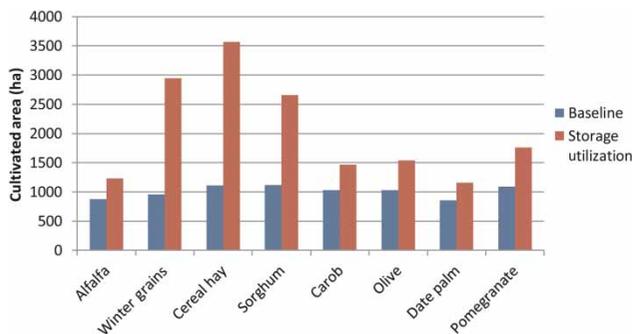


Figure 1 | Comparison of cultivated area by main crop with and without storage.

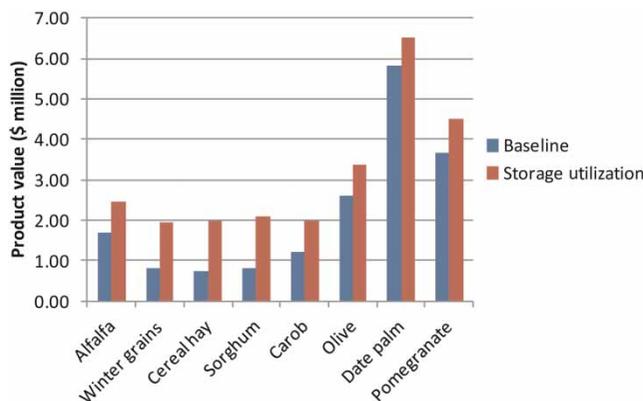


Figure 2 | Comparison of crop value by main crop with and without storage.

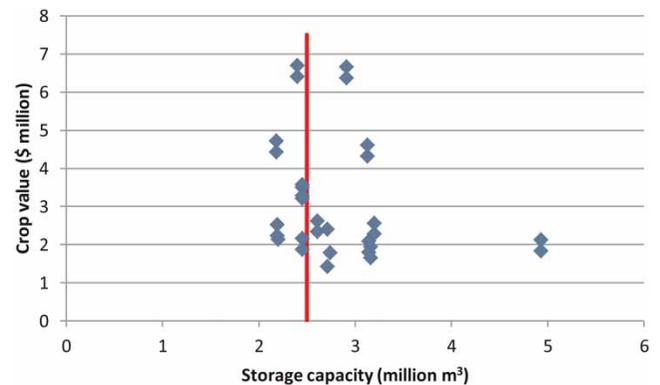


Figure 3 | Crop value vs. required storage capacity.

the storage would support. Figure 3 plots the scenario crop value by the storage volume required. Based on the distribution of results, a target storage volume of 2.5 million cubic metres was defined.

## BIOSOLIDS REUSE

The feasibility study also examined reuse options for the biosolids to be generated from the NN WWTP. Stabilized biosolids contain nutrients (such as nitrogen, phosphorus, potassium) and organic matter that can reduce the use of conventional fertilizers and improve soil quality. Three approaches were considered to generate a biosolid-based product for agricultural use, including the most commonly preferred approach of land application and two others that would generate a 'value-added' product suitable for retail: composting to create a high-end soil amendment and heat-drying to create a fertilizer. Land application of NN WWTP biosolids is recommended because of its financial benefits, as well as its ease of implementation, giving farmers a low-cost approach to providing both nutrients and organic matter to their fields, improving water retention, tilth and other soil qualities.

## STORAGE AND TRANSMISSION ALTERNATIVE ANALYSIS

The analysis of transmission and storage options looked at the best ways in which the effluent could be stored in the rainy season when there was little or no demand and then

distributed throughout the dry months to enable a steady supply of irrigation water, as opposed to the current seasonal supply to farmers in the area, which relies almost entirely on rainfall. Further, distribution options had to allow for the water to be shared between the two communities. Six alternatives for transmission and water storage were evaluated: two existing reservoirs located in the TCC, the proposed storage reservoir at the GCC Vathia Gonia WWTP, aquifer recharge, a new reservoir to be constructed at the TCC public farm area, and use of the existing lagoons at the MM/H WWTP with distribution lines extending to both the TCC public farm area and the GCC Vathia Gonia WWTP. Each of these options was assessed based on effectiveness, cost and ability to implement. Following initial screening, construction of a reservoir on the site of the existing MM/H WWTP treatment lagoons (onsite storage option) and at an offsite location were considered viable for further analysis.

The onsite option was expanded to include four alternative configurations. The total area of the existing MM/H WWTP is about 69 ha. However, the title for all but 25 ha of this land is in dispute and it was unknown whether these issues would be resolved within a reasonable time. Therefore, two configurations, one involving 69 ha and one involving 25 ha were considered. In addition, at present the lagoons are unlined and constructed with the natural soils. As a cost-saving measure, construction of a shallow

reservoir without a liner that would also encourage aquifer recharge was considered. To evaluate these alternatives, cost curves were developed relating the volume of storage to capital cost of construction. These curves are presented in Figure 4.

Based on input from the stakeholders, the preferred option was identified as utilizing the existing 25 ha of uncontested property to construct a lined reservoir with a capacity of 2 million m<sup>3</sup>. While this option does not provide for the target amount of storage, it will still allow for use of almost all of the treated effluent and is able to be implemented immediately. If acquisition of the contested property is possible before the storage and delivery system go to tender, then it would be a relatively easy thing to adjust the final design accordingly.

The recommended storage and distribution system consists of the following components for the treated effluent.

### Storage facilities

The proposed storage facilities are to be constructed at the same location as the existing facultative lagoon by constructing a 2 million m<sup>3</sup> storage reservoir. The new reservoir with a total area of 25 ha with 8.2 m high berms will be constructed of fill material excavated from the base of the lagoons and lined with a geomembrane.

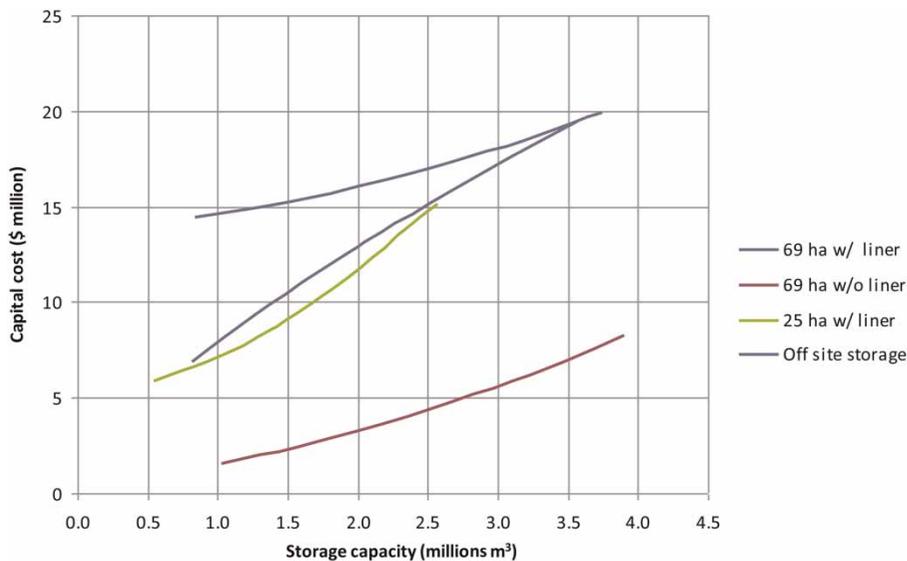


Figure 4 | Storage options cost-volume relationship.

### Transmission lines

The proposed project includes two transmission lines. The first will be constructed to convey water to the TCC public farm area. The proposed line will be 600 mm diameter and 14.15 km long. The second transmission line will extend to the GCC Vathia Gonia WWTP. This transmission line will again be 600 mm in diameter and about 17.8 km long. The nominal capacity of each line will be 30,000 m<sup>3</sup>/day.

### Pump station

The pump station is proposed to service distribution to both communities with a nominal *peak* capacity of 60,000 m<sup>3</sup>/day, with 30,000 m<sup>3</sup>/day in each direction. The two different design pressures can be handled in the simplest manner with two pump systems, each consisting of one single duty pump and one standby pump. For purposes of this conceptual analysis biofilm formation and its effect on transmission was not considered in detail. This would need to be more thoroughly evaluated during detailed design and development of operation and maintenance requirements.

### Sludge disposal

As part of the plant decommissioning, approximately 107,000 m<sup>3</sup> of sludge in the lagoons will require appropriate disposal. With over-excavation necessary to excavate the sludge, the total amount of material requiring disposal increases to about 205,000 m<sup>3</sup>. A new landfill under construction should be able to accept the sludge; however, associated costs may be prohibitive. Further assessment of the quantity and quality of sludge requiring disposal is needed to determine the most effective method of disposal.

### Biosolids facilities

Land application of NN WWTP biosolids is recommended because of its financial benefits, as well as its ease of implementation. Land application of biosolids offers farmers a low cost approach to providing both nutrients and organic matter to their fields, improving water retention, tilth and other soil qualities. To implement this approach it is necessary to purchase two sludge spreaders.

## ECONOMIC VIABILITY

The economic analysis suggests that for an initial capital investment of about US\$43.5 million (approximately €33.5 million) for the storage facility, pump station and transmission line, and an annual operating cost of \$1.65 million (approximately €1.27 million), the NN WWTP can deliver 30,000 m<sup>3</sup>/day of treated effluent for reuse. Annualized over 25 years at 5% interest, the cost is about \$0.454/m<sup>3</sup>. In the baseline scenario, water for irrigation would have to be gained from other sources. The \$0.454/m<sup>3</sup> cost is less than the estimated cost of importing water to the TCC from Turkey, currently being considered at about \$0.48/m<sup>3</sup>. Including water storage in the distribution approach can more than double the area under cultivation and economic value of produced crops, depending on the actual cropping pattern implemented. It is important to note that an additional capital cost of about \$2.10 million (€1.62 million) may be needed for sludge removal (not including disposal fees).

The approach to biosolids handling is estimated to cost \$566,000 (€435,400) with \$286,700 (€220,500) annual operation and maintenance costs, and include purchase and operation of two sludge spreaders. In the baseline scenario, these biosolids would have to be hauled to a landfill for disposal at an estimated \$170,000/yr (€130,800/yr). This estimate does not include landfill disposal fees. The possibility of revenue generation from the sale of biosolids is uncertain. An outreach and education campaign, including demonstration tests, as part of an overall treated effluent reuse management plan may increase acceptance of biosolids application and the local value of biosolids as a soil amendment.

## ANCILLARY BENEFITS

The project will also provide the following ancillary benefits.

### Social and cultural benefits

The proposed project will provide irrigation water for about 2,000 ha of agricultural land currently deprived of this resource. This will improve the livelihood of local farmers, preserving the agricultural heritage of the local

communities. However, providing technical assistance to farmers on proper management practices is needed.

### Enhancing bi-communal ties

The MM/H WWTP has long been a prime example of the GCC and TCC working together to serve a common good. The proposed project will further this working relationship, strengthening these ties and further enhancing the image of the cooperating authorities from the Sewerage Board of Nicosia (SBN) and the 'Nicosia Turkish Municipality'.

### Environmental issues

Retaining control of the entire lagoon area and preventing future development will help limit the potential for exposure to harmful substances potentially remaining after decommissioning and limit the environmental liability associated with the MM/H WWTP. In addition, the subsequent creation of a 65-ha open water pond would promote eco-tourism, particularly for bird enthusiasts.

### CONCLUSIONS

Increasingly, adversarial communities are facing the common problem of shrinking *shared* water resources and the threat of being unable to provide such basic necessities as cheap high-quality water to its people. Throughout history, most acts of aggression have natural resources as their cause. The study described above involved two adversarial communities sharing a common island and a common water problem. In this model project, the GCC and TCC are using their shared resource management needs to provide the incentive for pursuing a peaceful approach to solving their mutual problem and sharing in the benefits of water reuse. It is the opinion of the project team that despite differing approaches to water resource management and institutional frameworks, stakeholders on both sides of the Green Line are committed to finding peaceful, mutually beneficial solutions. The level of interest and cooperation in this project has been remarkable and

can serve as an example to communities in conflict around the world. The project team was able to complete its work with relatively little political interference because of the shared appreciation and respect for the water challenges facing the island. Since the project provides clear benefits to both communities proportional to their contributions, potential conflict and obstruction is minimized. Stakeholders on both sides realize the gravity of the problem they are facing and refused to allow the politics of the day impede this important work, depriving their communities of the significant potential benefits. This is highly commendable.

From a technical perspective, the work completed was not groundbreaking. Current standard technical engineering methods were used to arrive at an optimal solution. The noteworthy and groundbreaking factor was the cooperation shown between two communities in conflict, and hopefully this can serve as a milestone in GCC/TCC relations and reconciliation. It is this outcome, more than any other, that needs to be replicated in the future.

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