Regional Report on Desalination
Latin America & Caribbean

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ABSTRACT

This paper presents a general discussion of the following for the Latin America and Caribbean Region:-

i. description of the Region;

ii. the historical trends;

iii. the current activities, and

iv. the prediction for the future.

The prediction of the paper is that there will be a continuing increase in desalination activity in the region, especially if membrane desalination systems can be utilized to treat contaminated waters, in place of traditional coagulation-filtration systems, especially in coastal areas with seawater intrusion.

1. The Latin American & Caribbean Region

For the purposes of this paper, we have followed the United Nation's definition of Latin America & Caribbean Region as all of the Americas south of the United States, and the Caribbean Basin.

The statistics on the Region are approximately as follows:-

- No. of Countries & Territories: 46 (22% of World)
- Population: 440,000,000 (8% of world)
- Land Area: 20,000,000 square kilometers (15% of World)
- Desalination Plant Capacity [1]: 803,000 m^3/d (4% of World)

Based upon the above, it can be seen that there is approximately 50% of the worldwide per capita installation of desalination plants. However, it will be shown that there is very little capacity installed in the 12 largest countries listed in *Figure 1*, based on data from Appendix A, which constitute 90% of the population.

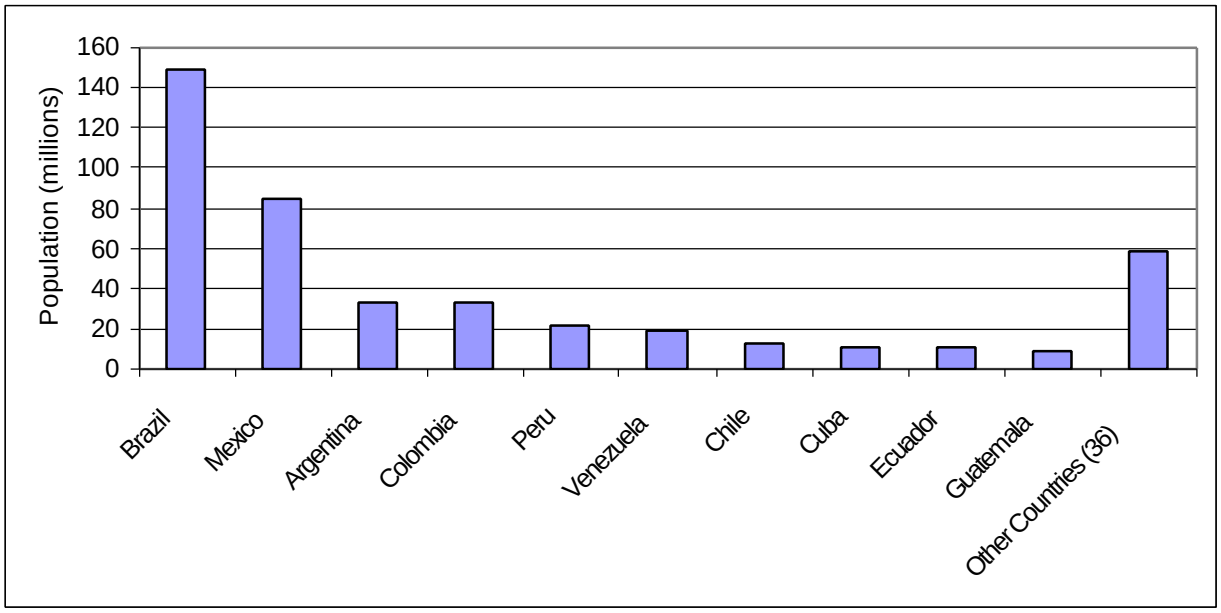

Figure 1 - Population by Largest Countries in the Region

Most of the Region is Tropical or Equatorial, with the result that there is significant rainfall. As a result, the Region may be characterized by adequate water supply, with the general exceptions being:-

- Atacama Desert region in sub-tropical Chile.
- Desert regions in sub-tropical Mexico
- The low elevation, high population density, islands of the Caribbean.

Figure 2 illustrates that the major population centers are in the coastal areas, with certain countries (e.g. Mexico and Columbia) having more evenly distributed populations.

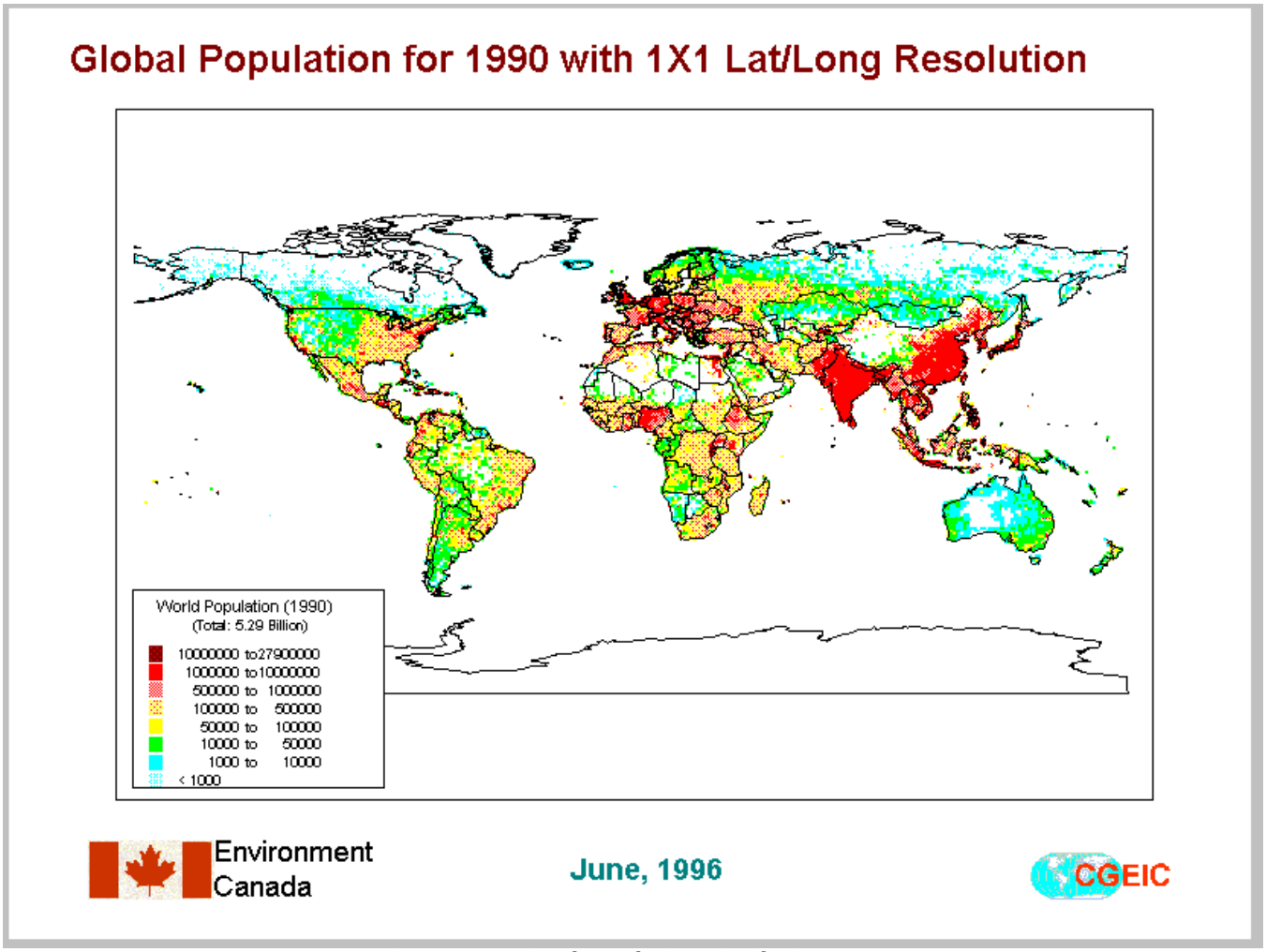

Figure 2 - Regional Population Distribution

2. The Need for Safe Drinking Water

The Pan American Health Organization ("PAHO"), is an international health agency with more than 90 years of experience in working to improve health and living standards in the countries of the Region. It is the Regional Office for the World Health Organization. It has 27 country offices and nine scientific centers to support the countries of Region in dealing with priority health issues.

Review of the work of PAHO at www.paho.org indicates that it considers the major water problems in the Region are associated with improving the safety of water supplies and sanitation.

For example, in the Region, diarrheal diseases are among the first five leading causes of death for infants under one year of age [2]. These diseases are primarily the result of contaminated water and inadequate sanitation.

As a result, the major thrust of PAHO is to secure safe drinking water. This is being tackled by simple systems such as chlorination of feedwater and education of the population.

Thus, it would appear, that other than in isolated pockets, there is currently little need envisioned for desalination in the Region.

3. Current Desalination Activities

Figure 3 (Caution: logarithmic scale) shows the per-Capita Desalination Capacity for the 10 countries where it has been most widely implemented, in accordance with the Desalting Plant Inventory [1]. While some of the plants have been decommissioned, it clearly shows that desalination has been most widely implemented in the Caribbean Basin, rather than Central and South America. It is interesting to note that none of the countries in Figure 3 are in the 10 most populous countries of *Figure 1*.

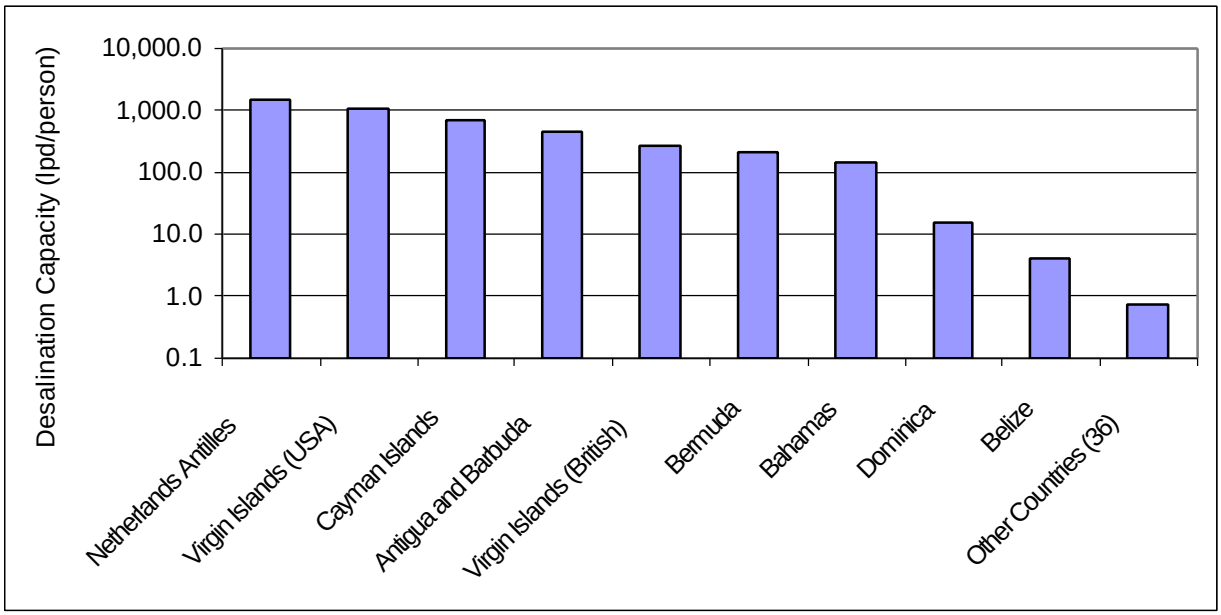

Figure 3 - Regional per-Capita Desalination Capacity

Similar to the Canary Islands, the Caribbean has somewhat been the 'test bed' for desalination manufacturers. As a result, the following are some examples of technological developments that have been tried/proven in the Caribbean:-

- Experimentation with Multi-Stage-Flash ("MSF") distillation units, including vertical tubes, 316 SSTL vessels (early '70s). During this period, primarily in the U.S. Virgin Islands there was extensive work done on new large scale designs.

- First Commercial acceptance of Seawater Reverse Osmosis ("SWRO") technology (late '70s). The first market to accept the use of SWRO was the Caribbean, primarily for resort applications.

- Successful implementation of low-temperature Multi Effect Distillation (MED) utilizing aluminum tubes (early '80s) [1]. These units were first installed on a large scale in the U.S. Virgin Islands, and have proven to be very successful.

- Development of Build-Own-Operate-Transfer ("BOOT") contracts for desalting (late '80s). In the late '80s, as Caribbean Governments wanted larger desalination facilities, BOOT contracts were developed to restore confidence where they had previously had unsatisfactory experience with desalination. This has led to the acceptance of BOOT contracts on a worldwide basis.

In recent years, there has been significant implementation of desalination (brackish and seawater) in the following countries, which are not in Figure 3.

- Barbados
- Trinidad
- Jamaica
- Anguilla
- Turks & Caicos

These countries have relatively plentiful natural water resources per-capita, with desalination being implemented primarily due to supply/demand distribution, and seawater intrusion in groundwater

It should be noted that, with the exception of Trinidad (where there is significant industrial activity), all of the countries in Figure 3 and the more recent implementation list above have significant tourist resort facilities, which places a significant demand on water resources, both in terms of required quantity and quality.

4. Future Desalination Activities & Conclusion

It is anticipated that the demand for desalination in the Caribbean will continue to grow, expanding into traditionally self-sufficient islands, as the cost of desalinated water becomes more competitive with natural resources, to result in a more sustainable supply.

In Central and South America, the requirements are significantly different from that of the Caribbean. The real pressing need is for a safe supply of water from existing natural resources. At present, the solution to this appears to be sterilization and reduction of contamination of existing sources. In the intermediate term, the desalination market is thus more likely to be due to the use of low-pressure brackish membrane elements in removing contamination, primarily in areas where there is some seawater intrusion, requiring desalination to be part of the process. The penetration of this technology will be significantly enhanced if membrane technology can eliminate part of the normal clarification & filtration processes employed in treating surface waters.

5. Bibliography

1. Wangnick, Klaus; 1996 IDA Worldwide Desalting Plants Inventory, Report No. 14; Wangnick Consulting GMBH.

2. Pan American Health Organization; "Partnership Formed to Improve Drinking Water Safety in Latin America"; Washington D.C.; July, 1999.

Appendix A

Latin America & Caribbean Region

Population & Desalination by Country (as defined by the UN)

Country	Population		Desalination Capacity	
	(quantity)	(% of total)	(m3/d)	(lpd/person)
Anguilla	6,900	0.00%		
Antigua and Barbuda	65,000	0.01%	28,533	439.0
Argentina	32,321,997	7.33%	15,960	0.5
Aruba	61,000	0.01%		
Bahamas	255,000	0.06%	37,565	147.3
Barbados	257,000	0.06%		
Belize	189,000	0.04%	757	4.0
Bermuda	61,000	0.01%	13,171	215.9
Bolivia	7,171,003	1.63%		
Brazil	149,041,985	33.80%	1,079	0.0
Cayman Islands	25,500	0.01%	16,986	666.1
Chile	13,173,003	2.99%	28,904	2.2
Colombia	32,299,987	7.32%	7,165	0.2
Costa Rica	3,034,999	0.69%		
Cuba	10,608,001	2.41%	18,926	1.8
Dominica	72,000	0.02%	1,135	15.8
Dominican Republic	7,170,000	1.63%		
Ecuador	10,547,002	2.39%	3,933	0.4
El Salvador	5,172,000	1.17%		
Equatorial Guinea	351,999	0.08%		
Falkland Islands	2,000	0.00%		
French Guiana	98,001	0.02%		
Grenada	91,000	0.02%		
Guadeloupe	390,000	0.09%		
Guatemala	9,197,001	2.09%		
Guyana	796,002	0.18%		
Haiti	6,486,000	1.47%		
Honduras	5,137,998	1.17%	651	0.1
Jamaica	2,402,999	0.54%	6,094	2.5
Martinique	361,000	0.08%		
Mexico	84,486,010	19.16%	207,917	2.5
Montserrat	12,400	0.00%		
Netherlands Antilles	175,000	0.04%	249,704	1,426.9
Nicaragua	3,675,999	0.83%		
Panama	2,418,001	0.55%		
Paraguay	4,277,001	0.97%	1,000	0.2
Peru	21,549,997	4.89%	24,538	1.1
Puerto Rico	3,530,000	0.80%		
St. Lucia	133,000	0.03%		
St. Vincent	107,000	0.02%		
Trinidad	1,236,000	0.28%		
Turks And Caicos Islands	12,350	0.00%		
Uruguay	3,093,999	0.70%		
Venezuela	19,320,998	4.38%	19,629	1.0
Virgin Islands (British)	16,600	0.00%	4,227	254.6
Virgin Islands (USA)	107,000	0.02%	114,852	1,073.4
Regional Total	440,997,732	100.00%	802,726	1.8

World Total	5,291,059,610		20,300,000
Percentage of World	8.3%		4.0%

Population Source: 1990 Data, Environment Canada / CGEIC

Desalination Source: Desalting Plants Inventory [1]