4-2. System Design Guidelines

As mentioned above, the main factors influencing sea water system designs are the osmotic pressure and the physical durability of sea water elements, while those affecting brackish water system designs are scaling and fouling potential of the feed water. Hence, sea water systems could be built relatively easily by designing the permeate flow rate within the limit of the two factors with a minimal attention to scaling and fouling potential of seawater. The usual sea water recovery of 30 to 40% can be obtained from single-array systems.

Comparatively, brackish water systems require more elaborate designs mainly due to various scaling and fouling potentials of the feed waters and additionally due to multi-array systems when more than 50% recovery is desired. The system designed with high permeate flux rates is likely to experience higher fouling rates and more frequent chemical cleaning. The silt density index (SDI) value of the

Table 2. System Design Guidelines

Feed Source		Well Water/ Softened Water	Softened Surface Water	Surface Water	Sea Water
Feed SDI		< 3	3 - 5	3 - 5	< 5
Max, % Recovery per Element		19	17	15	10
Max. Permeate Flow Rate per Element, gpd (m^3/d)	2.5" Diameter	710(2.7)	500(1.9)	500(1.9)	500(1.9)
	4" Diameter	2100(8.0)	1870(7.1)	1740(6.6)	1500(5.6)
	8" Diameter	7400(28)	6600(25)	5800(22)	5800(22)
Max. Feed Flow Rate per Element, gpm (m^3/h)	2.5" Diameter	5.7(1.3)	5.7(1.3)	5.7(1.3)	5.7(1.3)
	4" Diameter	18(4.1)	18(4.1)	18(4.1)	18(4.1)
	8" Diameter	62(14.1)	60(13.7)	55(12.6)	60(13.7)
Min. Concentrate Flow Rate per Element, gpm (m^3/h)	2.5" Diameter	1(0.22)	1(0.22)	1(0.22)	1(0.22)
	4" Diameter	4(0.91)	4(0.91)	4(0.91)	4(0.91)
	8" Diameter	16(3.6)	16(3.6)	16(3.6)	16(3.6)

pretreated feed water correlates well with the amount of fouling material present.

Experience from the correlation of the SDI value with the membrane fouling trend can set the limits on permeate flux and element recovery for different types of waters, which is the starting point of the system design guidelines shown in Table 1 below.

The guidelines in Table 1 are based on a continuous process with a well designed and operated pretreatment system. Exceeding the limits will result in more frequent cleanings than about four times a year, and a reduced membrane life.