

Example 7.17

A sample of water has been found to contain the following:

alkalinity: 220 mg/l as CaCO₃

hardness: 180 mg/l as CaCO₃

calcium (Ca⁺⁺): 140 mg/l as CaCO₃

- (a) What is the non-carbonate hardness?
- (b) What is the Mg⁺⁺ content in mg/l as substance?

To use figure 7.1, the absence of any significant hydroxides must be assumed. Since the alkalinity is greater than the hardness, the figure indicates the following compounds in the water:

$$\begin{aligned} \text{NaHCO}_3 &= 220 - 180 = 40 \text{ mg/l as CaCO}_3 \\ \text{Mg}(\text{HCO}_3)_2 &= 180 - 140 = 40 \text{ mg/l as CaCO}_3 \\ \text{Ca}(\text{HCO}_3)_2 &= 140 \text{ mg/l} \end{aligned}$$

There is no non-carbonate hardness in the water.

The Mg⁺⁺ ion content in CaCO₃ is equal to the Mg(HCO₃)₂ content as CaCO₃. Appendix A can be used to convert CaCO₃ equivalents to amounts as substance.

$$\text{Mg}^{++} = \frac{40}{4.1} = 9.6 \text{ mg/l as substance}$$

7 WATER QUALITY STANDARDS

Minimum drinking water quality standards have been set by the Safe Drinking Water Act. Typical minimum standards are given in table 7.9 as *Maximum Contaminant Levels (MCL's)*. Values in table 7.9 are subject to change as new legislation is enacted.

8 WATER DEMAND

Water demand comes from a number of sources, including residential, commercial, industrial, and public consumers, as well as unavoidable loss and waste. In project planning, a minimum of about 165 gallons per capita-day should be considered. This 165 gpcd is a total of all demands, as given in table 7.10. If large industries are present (such as canning, steel making, automobile production, electronics, etc.), then those industries' special needs must also be considered.

For ordinary domestic use, the water pressure should be 25 to 40 psi. A minimum of 60 psi at the fire hydrant is usually adequate, since that allows for up to 20 psi pressure drop in fire hoses. 75 psi and higher is common in commercial and industrial districts.

Table 7.9
Typical Water Quality Standards
(subject to change)

contaminant/quality	MCL
inorganic compounds	
arsenic	0.05 mg/l
barium	1.0 mg/l
cadmium	0.01 mg/l
chloride	250 mg/l
chromium	0.05 mg/l
copper	1.0 mg/l
cyanide	0.005 mg/l
iron	0.3 mg/l
lead	0.05 mg/l
manganese	0.05 mg/l
mercury	0.002 mg/l
nitrate	10 mg/l
selenium	0.01 mg/l
silver	0.05 mg/l
sulfate	250 mg/l
zinc	5.0 mg/l
organic compounds	
trihalomethanes (total)	0.1 mg/l
organic pesticides	
endrin	0.0002 mg/l
lindane	0.004 mg/l
methoxychlor	0.1 mg/l
toxaphene	0.005 mg/l
2,4-D	0.1 mg/l
2,4,5-TP(silvex)	0.01 mg/l
miscellaneous regulations	
pH	6.5-8.5
turbidity	1 NTU
color	15 units
microbiological	1 coliform/100 ml
total dissolved solids	500 mg/l
odor (in threshold odor numbers)	3 T.O.N.

Table 7.10
Annual Average Water Requirements (gpcd)

(Excluding fire fighting)

residential	75-130
commercial & industrial	70-100
public	10-20
loss & waste	10-20
	<u>165-270 total</u>