Equation 16.2 is used to find the mean range for an observation period, and Eq. 16.3 is used to find the mean tide level for that period.

$$R = \mathrm{HW} - \mathrm{LW} \qquad 16.2$$

$$\mathrm{TL} = \frac{\mathrm{HW} + \mathrm{LW}}{2} \qquad 16.3$$

Equation 16.4 calculates the equivalent 19-year mean range at the subordinate station.

$$\mathrm{MR}_s = \frac{(\mathrm{MR}_c)R_s}{R_c} \qquad 16.4$$

Equation 16.5 calculates the equivalent 19-year mean tide level at the subordinate station.

$$\mathrm{MTL}_s = \mathrm{MTL}_c + \mathrm{TL}_s - \mathrm{TL}_c \qquad 16.5$$

The equivalent 19-year mean high water at the subordinate station can be determined by adding one-half of the 19-year mean range to the 19-year mean tide level.

$$\mathrm{MHW}_s = \mathrm{MTL}_s + \frac{\mathrm{MR}_s}{2} \qquad 16.6$$

Likewise, the equivalent 19-year mean low water at the subordinate station can be determined by subtracting one-half of the 19-year mean range from the 19-year mean tide level.

$$\mathrm{MLW}_s = \mathrm{MTL}_s - \frac{\mathrm{MR}_s}{2} \qquad 16.7$$

The values for 19-year mean higher high water and lower low water can be determined using Eq. 16.8 through Eq. 16.10.

$$\mathrm{MHHW}_s = \mathrm{MHW}_s + \frac{(\mathrm{MHHW}_c - \mathrm{MHW}_c) \times (\mathrm{HHW}_s - \mathrm{HW}_s)}{\mathrm{HHW}_c - \mathrm{HW}_c} \qquad 16.8$$

$$\mathrm{MLLW}_s = \mathrm{MLW}_s + \frac{(\mathrm{MLW}_c - \mathrm{MLLW}_c) \times (\mathrm{LW}_s - \mathrm{LLW}_s)}{\mathrm{LW}_c - \mathrm{LLW}_c} \qquad 16.9$$

$$\mathrm{MLLW}_c = \mathrm{MLW}_c - \mathrm{DLQ}_c \qquad 16.10$$

Example 16.1

Tidal observations were made for one month at a survey site, resulting in the following monthly mean values from a gauge datum.

$$\text{high water (HW)} = 6.21 \text{ ft}$$
$$\text{low water (LW)} = 2.62 \text{ ft}$$

Simultaneous observations were made at a nearby control tidal station that reported the following 19-year mean values from a gauge datum.

$$\text{mean tidal level (MTL)} = 4.55 \text{ ft}$$
$$\text{mean tidal range (MR)} = 3.40 \text{ ft}$$

The monthly mean values on the gauge datum at the control site were

$$\text{high water (HW)} = 5.20 \text{ ft}$$
$$\text{low water (LW)} = 2.00 \text{ ft}$$

What is the calculated value of the survey site's mean high water (MHW)?

Solution

Using Eq. 16.2, the observed subordinate range, R_s, is

$$R_s = \mathrm{HW}_s - \mathrm{LW}_s = 6.21 \text{ ft} - 2.62 \text{ ft} = 3.59 \text{ ft}$$

The control range, R_c, is

$$R_c = \mathrm{HW}_c - \mathrm{LW}_c = 5.20 \text{ ft} - 2.00 \text{ ft} = 3.20 \text{ ft}$$

Using Eq. 16.3, the observed tide level, TL_s, is

$$\mathrm{TL}_s = \frac{\mathrm{HW}_s + \mathrm{LW}_s}{2} = \frac{6.21 \text{ ft} + 2.62 \text{ ft}}{2} = 4.415 \text{ ft}$$

The control observed tide level, TL_c, is

$$\mathrm{TL}_c = \frac{\mathrm{HW}_c + \mathrm{LW}_c}{2} = \frac{5.20 \text{ ft} + 2.00 \text{ ft}}{2} = 3.60 \text{ ft}$$

Using Eq. 16.4, the subordinate station mean range is

$$\mathrm{MR}_s = \frac{(\mathrm{MR}_c)R_s}{R_c} = \frac{(3.40 \text{ ft})(3.59 \text{ ft})}{3.20 \text{ ft}} = 3.81 \text{ ft}$$

Using Eq. 16.5, the subordinate mean tide level is

$$\begin{aligned} \mathrm{MTL}_s &= \mathrm{MTL}_c + \mathrm{TL}_s - \mathrm{TL}_c \\ &= 4.55 \text{ ft} + 4.415 \text{ ft} - 3.60 \text{ ft} \\ &= 5.365 \text{ ft} \end{aligned}$$