8.34. For all $A \in \mathcal{F}_T$ and $n \geq 1$, $A \cap \{T = n\} \in \mathcal{F}_n$. Therefore,

$$\mathrm{E}\left[M_T \mathbf{1}_{\{T=n\}}\ ;\ A\right] = \mathrm{E}\left[M_n \mathbf{1}_{\{T=n\}}\ ;\ A\right] = \mathrm{E}\left[\mathrm{E}(Y \,|\, \mathcal{F}_n);\, A \cap \{T = n\}\right] = \mathrm{E}\left[Y \mathbf{1}_{\{T=n\}};\, A\right].$$

Also, $A \cap \{T = n\} \in \mathcal{F}_T$; thus,

$$\mathrm{E}\left[\mathrm{E}(Y \,|\, \mathcal{F}_T);\, A \cap \{T = n\}\right] = \mathrm{E}\left[\mathrm{E}\left(Y \mathbf{1}_{A \cap \{T=n\}} \,\middle|\, \mathcal{F}_T\right)\right] = \mathrm{E}\left[Y \mathbf{1}_{\{T=n\}};\, A\right].$$

Consequently, $\mathrm{E}(Y \,|\, \mathcal{F}_T) = M_T$ a.s. on $\{T = n\}$ for all n, whence a.s. on $\cup_{n=1}^{\infty}\{T = n\} = \{T < \infty\}$. The result follows.