Outage performance of the M-block fading with additive white Gaussian noise (BF-AWGN) is investigated in the low-power regime. We consider delay-constrained constant-rate communications with perfect channel state information (CSI) at both the transmitter and the receiver (CSI-TR), under a short-term power constraint (STPC) and a long-term power constraint (LTPC). Subject to STPC, we show that selection diversity that allocates all the power to the strongest block is asymptotically optimal. Then, we provide a simple characterization of the outage probability in the regime of interest. We quantify the reward due to CSI-TR over the constant-rate constant-power scheme and show that this reward increases with the delay constraint. For instance, for Rayleigh fading, we find that a power gain up to 4.3 dB is achievable. Subject to LTPC, we show that the above guidelines still holds and that the outage performance improves due to the flexibility of the LTPC over the STPC. More interestingly, we prove that LTPC allows zero-outage communication even at low SNR and characterize the delay-limited capacity at low SNR in a simple form. More precisely, we establish that the delay-limited capacity scales linearly with the power constraint, for a given M <; ∞. Our framework highlights the benefit of fading at low SNR as the delay-limited capacity may outperform the AWGN capacity. For instance, for Rayleigh fading and with M = 3, the delay-limited capacity is 16% higher than the capacity of an AWGN channel.