Recycled concrete aggregate (RCA) is one of sustainable construction materials and its use in drainage systems by replacing virgin aggregate is beneficial from both economic and environmental perspectives. However, the use of RCA as pipe backfill materials may cause a long-term performance issues such as clogging potential due to fine accumulation and calcite precipitation on filter fabric. Therefore, this study investigated the performance of RCA regarding flow rate and calcite precipitation. Long-term permeability testing was conducted to measure the reduction of flow rate with time and the effect of filter fabric's opening size on the flow was also evaluated. The accelerated calcite precipitation (ACP) procedure was devised and used to estimate "life-time" calcite precipitation of RCA for French Drains. The ACP procedure was then studied further and improved to maximize the calcite precipitation in each cycle. The enhanced method was used to compare the calcite precipitation of limestone and RCA samples - sources with varying chemistry and history. Key findings are (1) that excessive fines can cause significant reduction in RCA's drainage performance, (2) that the clogging due to calcite precipitation of RCA may not be as significant as the existing and/or accumulated fines, (3) that the calcite precipitation yield is increased with a decrease in heating temperature as well as an increase in heating time and surface area, and (4) the potential for calcite precipitation from RCA is not as significant as limestone for Type I Underdrain gradation.