Nutrient-laden stormwater runoff causes environmental and ecological impacts on receiving water bodies. Biosorption Activated Media (BAM) composed of the sand, tire crumb, and clay have been implemented in stormwater best management practices due to its ability to efficiently remove nutrients from stormwater runoff, such as in roadside linear ditches, via unique chemophysical and microbiological processes. In this study, a set of fixed-bed columns were set up to simulate some external forces in roadside linear ditches and examine how these external forces affect the performance of BAM. In our experiment, scenario 1 simulates the impact that animals such as turtles, tops and ants produce conduits on the top layer of BAM. Scenario 2 simulates the presence of animals on BAM, together with external compaction. Finally, scenario 3 simulates external compaction such as traffic compaction alone. Furthermore, two baseline conditions were included to sustain the impact assessment of these three scenarios, respectively. They are the long-term presence of carbon in stormwater as carbon can be transported by stormwater runoff from neighboring crop fields, and the long-term presence of copper ions in stormwater as copper depositions can also be found because of electrical wiring, ruffing, stormwater pounds disinfections and automobile brake pads in transportation networks. This systematic assessment encompasses some intertwined filed complexity in real world systems driven by different hydraulic conditions, microbial ecology, Dissolved Organic Nitrogen (DON) reshape/removal, and long-term addition of carbon and copper (alone) on the effectiveness of total nitrogen removal. The removal efficiencies are substantially linked to varying microbial processes including mineralization, ammonification, nitrification, denitrification, and even dissimilatory nitrate reduction to ammonium, each of which is controlled by different dominant microbial species. The identification of DON compounds at the molecular level was done via a Fourier Transform Ion Cyclotron Resonance Mass Spectrometry (FT€"IR€"MS) whereas the quantitation of microbial species was done by using quantitative Polymerase Chain Reaction (qPCR). The results from the interactions between microbial ecology and DON decomposition were compared to the external forces and baseline conditions to obtain a holistic understanding of the removals efficiencies of total nitrogen. With the aid of qPCR and FT€"IR€"MS, this study concluded that the long-term presence of carbon is beneficial for nutrient removal whereas the long-term copper addition inhibits nutrient removal.