This paper puts forth a dynamic framework for investigating the subgrid scale physics of decaying two-dimensional turbulence utilising a modular approach with eddy viscosities in various functional forms. The derivation of the low-pass spatially filtered implementation of the Navier–Stokes equations is given by using the vorticity-streamfunction formulation. Two different implementations of the viscosity kernels based on the representation of the eddy viscosity terms are proposed and tested by solving a canonical two-dimensional decaying turbulence problem. It is seen that the implementation of the eddy viscosity formulation plays a distinct role in the dissipative behaviour of the different viscosity kernels. Among eddy viscosity kernels tested, we found that the Leith eddy viscosity formulation yields superior results with higher correlation coefficients.