**Comparative Analysis of Levee Elevation Data: Project Overview**

**Objective**

The National Levee Database (NLD) comprises a comprehensive dataset of hand-measured levee topographic profiles and operation information. These topographic profiles, many of which were measured in the wake of Hurricane Katrina, serve as a historical baseline dataset of levee geometries. We aim to compare these historical elevation profiles against the modern, more recently collected datasets from the USGS 3D Elevation Program (3DEP, 2016-present) which postdates historical levee topography collection. By doing so, we aim to uncover anomalies or signs of damage, providing insights into the effectiveness of remote levee characterization and assessment. In Q2 we designed and implemented the protoype (0.0.1) software and database infrastructure for assessing the condition of levees overseen by the Army Corps. Our goal is to deliver a modular, open-source, easy-to-use Python software stack that can be deployed to assist in routine monitoring of levee infrastructure. The prototype architecture is a geospatial data processing stack designed to interact with various APIs and geospatial libraries to retrieve, process, and analyze elevation data associated with levee systems. It leverages a combination of remote sensing data, digital elevation models (DEMs), and geospatial analysis techniques to provide insights into the elevation profiles of levee systems. We interface with two APIs to fetch data about levee systems: the National Levee Database API (NLD2 API v4.2.1) and Google Earth Engine. Best practices are employed to not overwhelm the NLD2 API. The NLD provides a raft of data on each levee system, including their topographic profiles. We employ retry mechanisms and a circuit breaker pattern to handle failures which are not uncommon. Google Earth Engine provides 1-m resolution USGS 3DEP elevation data. Custom formatters were employed to transform the NLD2 API topographic data into standard geospatial data formats. This transformation allowed us to harmonize the NLD2 API profile data with Google Earth Engine data formatting requirements. Sampling involves querying the DEMs at the same hand-sampled locations along the levee profiles. These locations are determined based on the Earth Engine geometries derived from the converted NLD2 API JSON responses. The architecture is scalable and robust and can be deployed on all available NLD API2 levees. Future work includes:

**Comparison with Reference Data:** The sampled elevation data from 3DEP is then compared with reference elevation data, which could be historical data from the National Levee Database (NLD) or other relevant datasets. This comparison aims to identify discrepancies that might indicate changes in levee elevation, potential erosion, subsidence, or other forms of damage.

**Discrepancy Analysis:** This involves statistical analysis of the elevation differences, including calculating mean, median, standard deviation of elevation discrepancies, and identifying outliers. Spatial analysis techniques may also be employed to visualize the distribution of discrepancies along the levee profile, helping to pinpoint specific areas of concern.

**Interpretation and Decision Making:** The results of the discrepancy analysis inform stakeholders about the current condition of the levee systems. Significant discrepancies may warrant further investigation through field surveys or more detailed remote sensing analysis.

This component of the stack is essential for leveraging modern geospatial data and analysis techniques to monitor and assess the integrity of levee systems. By systematically comparing current elevation data with historical profiles, stakeholders can make informed decisions regarding levee maintenance, improvement, and risk management.