



September 7, 2018

Mr. James McKay, Director  
Department of Public Works  
Town of Millis Memorial Building  
900 Main Street  
Millis, Massachusetts 02054

**SUBJECT: Proposal – Pavement Management Services**

Dear Mr. McKay:

Kleinfelder Northeast, Inc., (hereinafter "Kleinfelder") is pleased to submit this Proposal to the Town of Millis ("Client") for Pavement Management Services. We propose to provide the professional set forth in detail under Section 1 below, which include the development of a pavement condition assessment and management tool for the Town of Millis, Massachusetts. The approach was developed to align with the Asset Management Grant Proposal submitted to the Clean Water Trust in August 2018. If awarded, the Grant would provide the Town with \$88,500 in funding from the Trust to develop an asset management program for water, sewer, and stormwater infrastructure. By completing the Asset Management project concurrent with pavement management work proposed herein, the Town will have the tools and information to make informed decisions on infrastructure improvements in context to the recommendations for the other infrastructure systems.

The goal of this project is to provide the Town of Millis with an improved understanding of the condition of the Town's pavement, recommend pavement condition improvement projects, and provide an estimate of costs for these improvements. Through this project, Kleinfelder will develop and implement a tool that leverages historic and present-day condition data to make recommendations to meet the Town's pavement management program goals. Various management scenarios will be developed to provide decision makers with an understanding of the impacts of implementing pavement improvement projects on program costs and the network's condition over a 5-year period. The pavement management tool will allow the Town to:

- **Visualize**, on a dynamic map, the **current condition** of pavement assets
- **Predict pavement deterioration** over a 5-year period (beginning 2019)
- **Update pavement condition** based on planned projects or condition assessments
- Determine needs for **pavement treatments** and calculate **estimated project costs**
- Visualize, on a dynamic map, **future pavement projects**

The Scope of Work for pavement management services is described in Section 1 below.

## Section 1. Scope

### Task 1 – Prepare GIS Dataset for Pavement Management

The first step towards any sort of asset management is to develop an inventory of the owned assets. In this case, the pavement segments. To complete this work, Kleinfelder will:

1. Create a **create a pavement segments dataset** in GIS. The inventory will be provided as a geodatabase with the layers needed for pavement management. We will use the MassDOT roads layer from MassGIS and prepare the schema for pavement management purposes.
2. Use data from their pavement condition data from the last inspection, as provided by the Town of Millis, to **modify the MassDOT pavement segmentation** to match the Town's. It is our understanding that the last condition assessment took place around 2015. Kleinfelder will review the final dataset with the Town to make sure the segmentation is adequate and will update the segmentation, if needed, to prepare for the 2019 condition assessment.
3. **Update the GIS** to store the scores from the last condition assessment.

### Task 2 – Calibrate Pavement Model

#### Task 2.1 – Update Pavement Condition Indexes

With the inventory and historic condition scores prepared in a GIS, the next step is to calculate the current condition of the pavement. Kleinfelder will use a pavement condition simulation model that provides an estimate of condition based on industry standard deterioration curves. The deterioration curves are specific to the type of road (principal arterial, local road, etc.). The output of the model will be an estimated network pavement condition index (PCI) for 2019.

#### Task 2.2 – Field Data Collection

To improve the accuracy and applicability of the model for local conditions, Kleinfelder will calibrate the pavement condition model based on current data. Typically, this is achieved through field data collection, with pavement engineers assessing the pavement condition index for each segment. However, with 55 centerline miles of pavement, this effort would be costly.

Instead of a field data collection program of each pavement segment, Kleinfelder will work with a specialized vendor that will collect high resolution areal imagery using drone technology and process the imagery for analysis in the GIS. Kleinfelder's pavement experts will analyze the imagery, calculate a condition index for each assessed segment, and store the data in GIS for model calibration purposes. We recommend collecting data from approximately 10% to 20% percent of the road network for model calibration purposes. We will group segments based on their attribute data and modeled condition and will work with the Town to select representative segments for the flyovers. The fee assumes, based on a quote provided by the vendor in September 2018, that approximately 10 miles of pavement data collection and image processing services can be provided for approximately \$8,000.

#### Task 2.3 – Model Calibration

Kleinfelder will use the data captured in Task 2.2 to calibrate the pavement condition model and update the results for the network. Present day condition scores will be compared to the model-estimated segment PCI and the degradation curves will be refined accordingly, based on local

conditions. Using the updated deterioration curves, a refined 2019 PCI will be assigned to each segment for use in the recommendations provided in Task 3.

### Task 3 – Create 5-Year-Horizon Pavement Management Tool

With the model calibrated, the next step is to run the analysis for a 5-year period. The model will be used to select pavement treatment alternatives for each pavement segment. Kleinfelder will add a decision-making tool to the model that will select treatment alternatives and estimate costs, on a segment-by-segment basis.

Kleinfelder will develop a GIS-based tool that will allow the user to:

- Review and visualize the alternatives selected by the model
- Manually overwrite alternatives
- Create Pavement Projects
- Calculate Estimated Project Costs
- Calculate PCIs after project completion

Since different management strategies will impact costs and pavement condition, Kleinfelder will work with the Town to develop and simulate the effects of up to 4 management scenarios on program costs and network condition. Kleinfelder budgeted for one meeting with the Town of Millis to present the results of these scenarios and demonstrate the use of the tool.

To share the results of the project with Town stakeholders, Kleinfelder will produce graphic visualizations showing the proposed annual construction projects. Kleinfelder can create an interactive tool to be shared with the public, if the Town is interested, but this effort would be scoped under a separate work agreement.

## Section 2. Fee

Kleinfelder proposes to complete the above scope of work for \$39,800. A breakdown by task is as follows:

Task	Description	Fee
Task 1	Prepare GIS Dataset for Pavement Management	\$6,310
Task 2	Data Collection and Calibration of Pavement Model	\$23,100
Task 3	Create 5-Year-Horizon Pavement Management Tool	\$10,390
	<b>Total</b>	<b>\$39,800</b>

## Section 3. Schedule

Kleinfelder anticipates starting Task 1 in January 2019 and providing the Town of Millis with the proposed pavement inventory dataset for review four weeks from Notice to Proceed. Upon approval of the pavement segmentation, Kleinfelder will schedule the data collection. Task 2 is highly dependent on weather and clear streets. The 5-Year-Horizon pavement management tool will be completed by the end of May 2019.