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## OVERVIEW

### MACHIAS LANDFILL INVESTIGATION

**BACKGROUND:** MaineDOT has completed an environmental and geotechnical assessment of subsurface conditions at the closed Machias Landfill. The primary objectives of this assessment focused on defining the existing stability of the landfill and current groundwater quality conditions. Additionally, based on findings, an evaluation was performed relative to potential impacts to the landfill associated with rising surface water levels in adjacent wetlands and the nearby Middle River.

**ASSESSMENT:** Work at the closed Machias Landfill included a subsurface investigation, groundwater monitoring, laboratory testing, and hydrogeologic and geotechnical evaluations. Eight subsurface test borings were drilled around and through the Landfill; groundwater observation wells were installed in five of the eight borings. Geologic and geotechnical samples were collected from the borings.

Groundwater levels and water quality samples were collected from the observation wells.

Geotechnical and water quality samples were sent to certified laboratories for testing. Information on the engineering properties of soils and the chemistry of groundwater near the Landfill was obtained.

Information captured in the field and from testing was used to perform engineering and hydrogeologic evaluations of conditions at the Landfill. Standard industry practices, aided with computer-assisted modeling, served as the basis for the evaluations.

**FINDINGS:** Groundwater at the Landfill flows generally from west to east with discharge into the adjacent wetland. Laboratory testing of groundwater samples suggest the Landfill has caused some impact on existing water quality; the most notable concerns are inorganic compounds (dissolved metals) and PFAS compounds. Barium, cadmium, iron, and manganese were found to exceed Maine Department of Environmental Protection (MDEP) Maximum Exposure Guidelines (MEGs) for drinking water.

PFAS compounds also exceeded Maine Drinking Water standards. The Maine Center for Disease Control (CDC) has implemented an interim drinking water standard of 20 ng/L-parts per trillion (ppt; alone or in combination) for the six regulated PFAS contaminants that include: perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluoroheptanoic acid (PFHpA) and perfluorodecanoic acid (PFDA). Total PFAS (6) results ranged from 26.5 ng/L to 181 ng/L with all samples exceeding the CDC 20 ng/L standard.

Engineering calculations and computer modelling indicate the Landfill is currently stable. Underlying soil and groundwater conditions are favorable to support the Landfill. The calculated “Factor of Safety” values (a geotechnical measure of how stable a slope is given underlying soil characteristics and geometry of the slope) exceed recommended levels. Even under extreme structural forces such as an earthquake, engineering calculations indicate the Landfill exceeds the “pseudo-static seismic load” factor of safety threshold.

Further technical evaluations to determine the sensitivity of the Landfill’s global stability relative to increasing surface and groundwater levels were performed. Results of these evaluations indicate that elevated water levels outside the landfill (i.e., at the toe of the landfill slope) would not negatively impact global stability factors of safety. Elevated water levels within the landfill (i.e., inboard of the landfill toe) were found to have a slight negative impact on the factor of safety, but the levels would need to be raised considerably (i.e., up to approximately elevation 31, about 30 feet above the current river level and 11 feet above measured stabilized groundwater levels within the landfill) to cause an unsatisfactory factor of safety.

Calculations indicate that increasing water levels in the Middle River estuary system associated with MaineDOT’s proposed Machias Dike alternatives will not adversely impact the Machias Landfill. Depending on the proposed alternative, surface water levels in the Middle River are anticipated to increase upwards of 14 plus feet; as discussed previously, any anticipated rise in surface water levels associated with the Machias Dike alternatives will not adversely impact the Landfill.