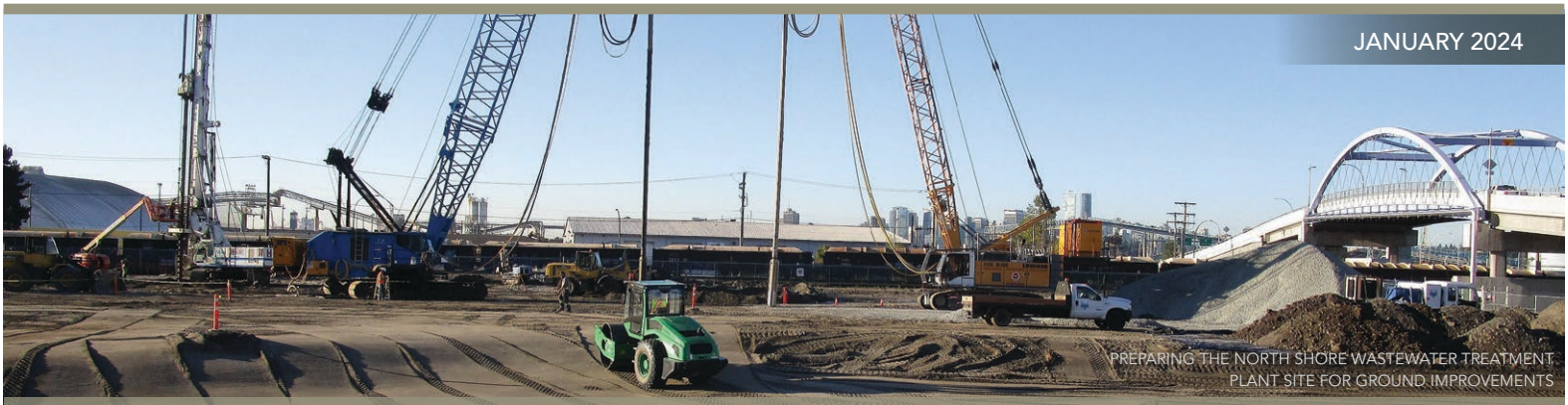

JANUARY 2024

PREPARING THE NORTH SHORE WASTEWATER TREATMENT PLANT SITE FOR GROUND IMPROVEMENTS

Ground Improvements at the North Shore Wastewater Treatment Plant

Purpose of Ground Improvements

Ground improvements are construction methods used to improve the geotechnical engineering properties of soil, including:

- Controlling short- and long-term settlement
- Mitigating liquefaction during earthquakes
- Improving bearing capacity (the ability of soil to support the weight of structures)
- Increasing slope stability

LOCATION OF THE NORTH SHORE WASTEWATER TREATMENT PLANT

Need for Ground Improvements at the North Shore Wastewater Treatment Plant

The North Shore Wastewater Treatment Plant site's underlying soil is typical of land adjacent to the Burrard Inlet near the mouth of the Capilano River. The site is underlain by various post glacial soil layers, including coarse grained gravel and cobbles and intermixed layers of sand, silt, clay, and trace organics. Some of these soil layers are potentially:

- Compressible and subject to future settlement when heavy buildings and tanks are constructed
- Loosely compacted and subject to liquefaction during earthquakes

The construction of ground improvements helps to address these soil issues and provides a high level of resilience for long-term operations and maintenance of the treatment plant. The ground improvements also meet post-disaster requirements set out in the BC Building Code.

NORTH SHORE WASTEWATER TREATMENT PLANT PROJECT SITE, ADJACENT TO THE BURRARD INLET

PRELOADING SAND ON THE EAST SIDE OF THE SITE

DRILLING AND VIBRATION OF GRANULAR MATERIAL TO INSTALL STONE COLUMNS

Ground Improvement Methods at the North Shore Wastewater Treatment Plant

Two main ground improvement methods have been constructed at the treatment plant site:

- Installation of stone columns to prevent liquefaction during earthquakes, to ensure the treatment plant is able to operate after a major earthquake
- Preloading with sand stockpiles to minimize future settlement of buildings and structures

The upper portion of the subsurface soils on the site (up to about 33 metres below ground surface) were first densified in 2017 and 2018 using a construction method referred to as "vibro-replacement stone columns." A total of 3,700 stone columns were installed in a three-metre-by three-metre-grid pattern throughout the site. Stone column installation also produces less noise and vibration than pile driving for ground densification. All new treatment plant structures, including buildings and tanks, are founded on raft slab (steel-reinforced concrete) foundations, which are supported by the densified ground.

The preloading program included stockpiling 100,000 cubic metres of sand on the site for a period of six months between 2018 and 2019. To minimize the volume of sand required for preloading, the site was divided into zones and sand stockpiles were moved between the zones before ultimately being removed and hauled off site for reuse by the District of North Vancouver.

Both methods of ground improvements used for the North Shore Wastewater Treatment Plant are common in the Metro Vancouver region, and have been used at other wastewater treatment plants including the Iona Island Wastewater Treatment Plant, Northwest Langley Wastewater Treatment Plant, and Annacis Island Wastewater Treatment Plant.

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Together we make our region strong

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