SECTION 31 32 00.10
SOIL STABILIZATION BY PERMEATION GROUTING

Basis of Design: SW-RP1 | Revision 1 | Issued 2026-09-24

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes stabilization of soil and filling of voids behind seawalls, bulkheads, and retaining structures by injection of single-component, water-reactive, hydrophobic polyurethane resin through driven injection pipes in upward stages.

B. Section includes cut-off of water and soil migration through joints and cracks in the structure by the same method.

C. Work of this Section corrects loss of backfill behind a retaining structure. Completion is judged by placement of the design volume at each depth or attainment of refusal, and by cessation of soil migration through the structure.

D. Section includes installation of drains in the structure after injection to relieve hydrostatic pressure.

E. Repair of the retaining structure itself and sealing of cracks and joints from the face of the structure are specified separately.

1.2 RELATED REQUIREMENTS

A. Division 01 - Product Requirements, including controlled substitution procedures.

B. Division 01 - Quality Requirements.

C. Geotechnical report, where furnished.

1.3 REFERENCES

A. ASTM International:

1. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM D756 - Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions.
3. ASTM D1042 - Standard Test Method for Linear Dimensional Changes of Plastics.
4. ASTM D1310 - Standard Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus.
5. ASTM D3505 - Standard Test Method for Density or Relative Density of Pure Liquid Chemicals.
6. ASTM D3574 - Standard Test Methods for Flexible Cellular Materials: Slab, Bonded, and Molded Urethane Foams.
7. ASTM D4878 - Standard Test Methods for Polyurethane Raw Materials: Determination of Viscosity of Polyols.

B. NSF International:

1. NSF/ANSI/CAN 61 - Drinking Water System Components: Health Effects.

1.4 PREINSTALLATION MEETINGS

A. Convene a preinstallation meeting before starting work of this Section. Review at minimum:

1. Current Technical Data Sheets and Safety Data Sheets for each product to be used.
2. Structure type (precast panel, sheet pile, or poured concrete) and the injection pipe layout it requires under Article 3.2.
3. Mudline and toe elevations, design depths, and design volume per vertical foot.

4. SW-RP1 Accelerator dosage for the temperature expected.
5. Containment barrier deployment and environmental permits for work over water.
6. Drain type, size, and locations, and installation from the water side.
7. Tidal windows, access, and vessel traffic constraints.
8. Method of volume metering and the injection record to be maintained.

1.5 ACTION SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Current Technical Data Sheet for each product and accessory to be used, including revision date.

C. Safety Data Sheet for each product and accessory to be delivered to the site.

D. Grouting Plan: Drawing showing treatment length, pipe layout and spacing, design depth of each pipe relative to the mudline, design volume per vertical foot (1/2 to 2 gallons), staging sequence, and drain locations.

E. Accelerator Schedule: SW-RP1 Accelerator dosage by volume and the published start time, end time, and expansion at that dosage and temperature.

F. Containment Plan: Type and deployment of the containment barrier on the water side and the method of recovering foam that emerges through the structure.

G. Drain Data: Product data and installation instructions for the drains proposed.

1.6 INFORMATIONAL SUBMITTALS

A. Site Investigation Report: Structure type, joint locations, mudline elevation, and extent of soil loss, including voids beneath adjacent walkways and pavers.

B. Injection Record: For each pipe and stage, depth, volume placed, accelerator percentage, pressure, and the observation on which injection was stopped.

C. Emergence Record: Location and quantity of foam emerging on the water side and the recovery action taken.

D. Drain Installation Record: Location, size, and elevation of each drain installed.

E. Installer Qualification: Evidence that the Installer satisfies Article 1.7.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have completed Alchatek contractor training, or Alchatek Technical Service shall be present at the start of the work.

B. Utility Locate: Contact the applicable one-call utility locate service on every project before driving any tube or drilling any hole.

C. Environmental Permits: Confirm all permits governing work over water are in place before injection begins.

D. Safety Data Sheets: Personnel shall review the Safety Data Sheet for each product before handling or injecting.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in unopened original containers bearing the product name and manufacturer identification.

B. Store products in a dry area between 50 and 80 deg F (10 and 26 deg C). Shelf life is 24 months in unopened containers stored within this temperature range.

C. SW-RP1 is moisture sensitive. Use opened containers as soon as possible.

D. Retain empty accelerator containers for disposal. Dispose of surplus resin and accelerator in accordance with local regulations.

1.9 FIELD CONDITIONS

A. Application temperature range: 34 to 95 deg F (1 to 35 deg C).

B. SW-RP1 is water reactive. Liquid water must be present for the resin to react. Soil shall be slightly damp to saturated.

C. Excessive foam build-up in confined spaces can result in high internal temperatures and expansion pressures. In large void fills, stage injections and allow cooling time between lifts.

D. Quantity of material depends on jobsite conditions, including the amount of water, temperature, amount of catalyst, and expansion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Alchatek (www.alchatek.com).

B. Substitution of products from other manufacturers is governed by the controlled substitution procedures of Division 01.

2.2 BASIS-OF-DESIGN PRODUCT

A. Basis-of-Design Product: SW-RP1.

B. Description: Single-component, closed-cell, hydrophobic, water-reactive, solvent-free and phthalate-free, low-viscosity polyurethane injection resin for cut-off of large water leaks and void filling around seawalls. Semi-rigid, high strength. Up to 50 times expansion.

C. Accelerator: SW-RP1 requires SW-RP1 Accelerator for proper foam formation and to adjust set times.

2.3 SUBSTITUTIONS

A. SW-RP1 is the product specified for this Section.

B. A product proposed for substitution shall satisfy every requirement of Article 2.4 and shall be supported by current published technical data demonstrating compliance.

C. Where drinking water certification is required, a product not carrying NSF/ANSI/CAN 61 certification is not an acceptable substitution.

2.4 PERFORMANCE REQUIREMENTS

A. Injected material shall react and cure in the presence of water.

B. Injected material shall be closed cell, hydrophobic, and semi-rigid in the cured state.

C. Reaction time shall be adjustable by catalyst dosage.

D. Where the work occurs within a drinking water source or its zone of influence, injected material shall be NSF/ANSI/CAN 61 certified.

2.5 PRODUCT PROPERTIES

A. SW-RP1, uncured (Technical Data Sheet Rev. 7/1/2026):

1. Appearance: Brown liquid.
2. Viscosity at 77 deg F (25 deg C), ASTM D4878: 215 cP (215 mPa-s).
3. Density at 77 deg F (25 deg C), ASTM D3505: 69.9 lb/cu ft (1.12 kg/dm3).

B. SW-RP1, cured:

1. Density, free rise, ASTM D3574: 1.2 lb/cu ft (0.019 kg/dm3).
2. Compressive strength (with fine sand), ASTM C39: Up to 1,803 psi (12.4 MPa).
3. Shrinkage, ASTM D1042 / D756: 0 percent.
4. Expansion: Up to 50 times.

5. Certification: Certified by ALS Global to NSF/ANSI/CAN 61 for contact with drinking water.

C. SW-RP1 Accelerator, liquid:
   1. Appearance: Yellow-orange liquid.
   2. Viscosity at 77 deg F (25 deg C), ASTM D4878: 75 cP (75 mPa-s).
   3. Density at 77 deg F (25 deg C), ASTM D3505: 65.5 lb/cu ft (1.05 kg/dm3).
   4. Flash point, ASTM D1310: 313 deg F (156 deg C).

D. Reaction and expansion with SW-RP1 Accelerator (start / end / expansion):
   1. 41 deg F (5 deg C): 5 percent, 18 / 95 seconds / 40x; 8 percent, 15 / 60 seconds / 42x; 10 percent, 15 / 48 seconds / 42x.
   2. 59 deg F (15 deg C): 5 percent, 18 / 78 seconds / 40x; 8 percent, 14 / 51 seconds / 42x; 10 percent, 11 / 41 seconds / 42x.
   3. 77 deg F (25 deg C): 5 percent, 14 / 55 seconds / 49x; 8 percent, 10 / 43 seconds / 49x; 10 percent, 8 / 35 seconds / 49x.

E. Properties will vary depending on application conditions.

2.6 ACCESSORIES

A. Accelerator: SW-RP1 Accelerator, added at 2 to 10 percent by volume.

B. Injection Pipes: 1/2 inch injection pipes of length adequate to reach the design depth.

C. Drains: Check-valve type drains that allow water to vent from behind the structure while retaining soil.

D. Containment Barrier: Floating boom or barrier capable of capturing foam emerging through the structure on the water side.

E. Pump Flush: Alchatek Pump Flush.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Locate utilities through the applicable one-call service before driving any pipe.

B. Determine the structure type (precast concrete panel, sheet pile, or poured concrete wall) and the location of every joint.

C. Determine the mudline elevation and the toe elevation of the wall.

D. Identify signs and extent of soil loss: sinkholes or voids near the wall, cracking in the wall or nearby slabs, and voids beneath adjacent walkways, pavers, and pedestals.

E. Where available, review the geotechnical report and confirm against field conditions. Adjust the Grouting Plan where conditions differ.

F. Confirm environmental permits and containment requirements. Do not begin injection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install the containment barrier on the water side before injection begins.

B. Injection Pipes: Install pipes on the landward side of the wall, within 12 inches of the wall, to the lowest depth requiring injection, by mechanical driving, water jetting, or air jetting:
   1. Precast concrete panel walls: At each joint, to 1 foot below the mudline.
   2. Sheet pile walls: At each joint, to 1 foot below the mudline.
   3. Poured concrete walls: On 2 foot centers, to the toe of the wall.

C. Confirm the soil is slightly damp to saturated. Add water where soil is dry.

D. Use separate pumps for water and resin. Flush the resin pump with Alchatek Pump Flush before injection so it is completely free of water.

E. Personal Protection: Provide eye and face protection, chemical-resistant gloves, long sleeves and long pants, work boots, and safety vests. Provide respiratory protection in confined spaces.

3.3 MIXING

A. Shake the SW-RP1 Accelerator vigorously before use.

B. Add accelerator at 2 to 10 percent by volume and mix homogeneously into the resin. Select the dosage for the reaction time required by field conditions and temperature.

C. Protect catalyzed resin from moisture and rain.

D. Mix only the amount that will be used. Catalyzed material cannot be stored.

3.4 INSTALLATION

A. Injection Equipment: Single-component diaphragm pump or airless sprayer with a ball valve on the hose to control flow and a pressure gauge visible to the operator. Use a separate pump for water.

B. Upward Staging:

1. Begin injection at the bottom of each pipe, approximately 1 foot below the mudline.
2. Inject 1/2 to 2 gallons per vertical foot, as required by soil and void conditions, or until sufficient back pressure is established.
3. Raise the pipe 12 inches and repeat.
4. When the pipe is within 24 inches of the surface and material flows back to the surface, stop and move to the next pipe.

C. For poured concrete walls, inject at the toe, then move to the adjacent pipe and repeat.

D. Injection Rate and Pressure: Inject at a rate that allows material to permeate the soil, not exceeding 1 gallon in 5 minutes. Keep pump pressure between 40 and 100 psi. High pressure and high volume fracture the soil and produce lenses of resin rather than tight columns. Increase pressure above this range only where the soil is too tight to accept material.

E. Monitor the water side throughout injection for foam emerging through joints and for displacement at the mudline.

F. Where required, inject behind the wall through mechanical packers or ports in the structure.

G. Hydrostatic Pressure Relief: After injection, install check-valve type drains in the structure from the water side, using a core drill to make 2-1/2 inch or 4 inch holes sized to the height of the wall. Install in accordance with the drain manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

A. Record depth, volume, accelerator percentage, and pressure for each pipe and stage.

B. Record the location and quantity of foam emerging on the water side, and recover emerged material from the containment barrier.

C. Confirm drains are installed and functioning before demobilization.

D. Where soil migration through the structure continues after cure, identify the affected length, re-inject, and re-verify.

3.6 CLEANING

A. Remove injection pipes from the ground.

B. Clean up cured and uncured resin. Place spilled liquid resin in a sealed container and dispose of in accordance with local environmental regulations.

C. Clean the resin pump with Alchatek Pump Flush after injection. Where the pump will not be used for several days, fill it with oil until next use. Never rinse the pump with water.

D. Remove packers from concrete, where used, and fill holes with fast-setting patching material.

E. Remove the containment barrier only after all emerged foam has been recovered.

3.7 PROTECTION

A. Protect the adjacent work area with plastic sheeting where necessary.

B. Protect pavers, walkways, and pedestals disturbed by the work, and restore them on completion.

END OF SECTION 31 32 00.10