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FINAL ROCK SLOPE REMEDIATION DESIGN REPORT
PROSPECT SOUTH ROCK SLOPE
MAINEDOT WIN 022966.00
PROSPECT, MAINE

by
Haley & Aldrich, Inc.
Portland, Maine

for
Maine Department of Transportation
Augusta, Maine

File No. 42690-008
May 2023

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Maine Department of Transportation
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Attention: Kate Maguire, P.E.
Senior Geotechnical Engineer – Highway Program

Subject: Final Rock Slope Remediation Design Report
Prospect South Rock Slope
MaineDOT WIN 022966.00
Prospect, Maine

Ladies and Gentlemen:

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to submit herewith our report entitled, "Final Rock Slope Remediation Design Report, Prospect South Rock Slope, MaineDOT WIN 022966.00, Prospect, Maine". Preparation of this report has been completed in accordance with the provisions of our General Consultant Agreement (GCA) with the Maine Department of Transportation (MaineDOT), No. 20200623000000000766 (dated 30 September 2020), the project-specific contract with MaineDOT (executed by your Richard J. Crawford on 27 June 2022), and the Haley & Aldrich, Inc. (Haley & Aldrich) proposal, dated 6 June 2022.

This report is intended to summarize the results of multiple phases of site inspection and engineering/ geologic data collection for the subject project. This report also presents our final relative ratings for each rock slope area that was identified by Haley & Aldrich as requiring remediation to address and mitigate the potential for future rock fall and presents stabilization design recommendations for select rock slope areas that were judged to be critical relative to public safety and annual maintenance.

Background and Existing Site Conditions

BACKGROUND

Haley & Aldrich was retained by MaineDOT to provide rock engineering consulting services associated with an approximately 670-ft long section of rock slope that is located on the west side of U.S. Route 1/ Route 3 and approximately 0.3 miles southwest of the Penobscot Narrows Bridge in Prospect, Maine (site; see Figure 1, Project Locus).

Haley & Aldrich previously completed preliminary design (Phase I) work scope for the subject project, which included initial field reconnaissance (i.e., geologic data collection) of the slope area and preparation of a preliminary design report entitled, "Preliminary Rock Slope Remediation Design Report, Prospect South Rock Slope, MaineDOT WIN 022966.00, Prospect, Maine," dated 27 March 2020 (preliminary report). It is our understanding that this preliminary report was used by MaineDOT to prepare a Preliminary Design Report (PDR) for the project, which was finalized on 12 June 2020.

Based on field observations made by Haley & Aldrich during the site reconnaissance efforts and our review of historic drawings provided by MaineDOT, it is our understanding that the existing rock slope was created by drill-and-blast rock removal methods in the early 1960s to widen and realign an earlier (1930s vintage) roadway configuration.

EXISTING SITE CONDITIONS

Based on field measurements collected by Haley & Aldrich during the site reconnaissance efforts that are described in subsequent sections of this report, the height of the rock slope typically ranges from approximately 10 ft or less at the south and north ends of the rock slope to approximately 70 ft near Area 3A (Sta. 13+95 to Sta. 14+30; see Figures 2 and 4). , which is located near the mid-point (approximate) of the rock slope. A summary of measured rock slope heights within the limits of the site are provided in Tables I and II.

One or more sub-horizontal "benches" are present along an estimated 60 percent of the rock slope length (i.e., approximately 400 ft) where rockfall debris has accumulated. In addition, rockfall debris was observed by Haley & Aldrich at many locations in the catchment area (ditch) at the base of the slope during the site inspections, which is indicative of an active rockfall environment.

A vegetated drainage ditch is located at the base of the rock slope along its entire length, which serves as a rockfall catchment area for falling rock blocks. The width of the ditch, as measured from base of rock slope to the edge of pavement, ranges from approximately 15 to 22 ft. The ditch foreslope has a variable inclination that typically ranges between approximately 1V:2H to 1V:4H. The ditch is approximately 1.5 to 2 ft deep relative to the edge of pavement. Existing ditch geometry measured along the length of the rock slope is also provided in Table I.

A utility pole (Central Maine Power Pole No. 419-09-18) is located in the central portion of the site within the existing drainage ditch, approximately 14 ft from the edge of pavement as shown on Figure 2 (2 of 2), Site Plan. Overhead power lines cross U.S. Route 1 from the scenic outlook area east of the roadway to the CMP pole at which point it crosses the roadway back to the east. The overhead power lines are not shown on Figure 2. The rock slope remediation work will require temporary relocation of overhead power lines to allow for the stabilization work to be completed safely.

Existing site conditions are generally shown on Figure 2, Site Plan (two pages).

BEDROCK GEOLOGY

The bedrock at the site is a member of the Penobscot Formation, which is a series of metamorphosed marine sediments that have been lithified and rotated into the current, high-angle to near-vertical orientation such that the primary rock foliation (i.e., relict of former bedding) has a high-angle to near-vertical orientation.

The bedrock is primarily quartz-rich siltstones, shales and quartzites with a variable degree of hardness but more typically is moderately hard to hard as judged by Haley & Aldrich. Nonetheless, weaker and more highly weathered layers were observed during the site inspections, including thin shale layers that readily "flaked off" with minor hammer blows.

The Mt. Waldo granitic pluton is mapped in contact with the Penobscot Formation parallel to the rock slope alignment west of the site. From that intrusive event, several fine to medium-grained white dioritic or granitic dikes and veins are visible throughout and across the rock slope.

Although most of the slope area is comprised of a cut rock slope, there are areas along the crest where thin glacial till deposits and/or topsoil are present overlying rock. These soil deposits support brushy vegetation near/at the top of the rock slope and larger, deciduous, and evergreen trees are present further beyond the top of slope. Generally, minor vegetation exists on the rock slope face, including but not limited to the presence of small sapling trees.

Spring 2022 Rockfall Event

On 18 March 2022 Haley & Aldrich representatives met with MaineDOT personnel to assess a rockfall event that occurred, with some rockfall debris reportedly (by MaineDOT) reaching the roadway. The source of the rockfall event was an approximate 10-ft x 10-ft portion of rock slope within the limits of Area 4A (see Figure 3, March 2022 Rockfall Location). Based on our observations and recommendations, MaineDOT placed a series of jersey barriers along the edge of pavement to help retain falling debris from future rockfall events and minimize the amount of debris from potentially entering the roadway.

Field Reconnaissance

NOVEMBER 2017 SITE INSPECTION

A two-person team of Haley & Aldrich geologists conducted an initial site inspection during the period 27 to 29 November 2017. In general, the purpose of the site inspection was to:

- Establish a project baseline at the site to aid in preliminary data collection efforts. The baseline extended from Sta. 10+65 (approximate; MaineDOT highway monument) located at/near the southern end of the site to Sta. 17+65 (approximate) at/near the northern end of the site.

- Define the horizontal and vertical limits of the rock slope based on the observed geometry and condition of the exposed rock slope. Estimate slope height, slope angle, azimuth/dip direction of the rock face, the approximate width of ditch (catchment area) at various locations along the slope, and to characterize the general orientation of the slope face to the roadway.
- Collect initial bedrock structural data from observed and accessible foliation and joint discontinuities as this information controls the extent to which rockfall will occur at the site. Bedrock structural data collected at the site included but was not limited to the following: joint dip angle and dip direction, aperture, infilling, persistence of discontinuities, visible seepage, and rock mass properties such as weathering and intact rock compressive strength.
- Observe, measure and document dimensions of specific areas of the rock slope that were safely accessible without the use of rope access techniques. This includes identifying zones of loose rock and approximate locations of key rock blocks that may control rockfall, determining important discontinuity orientations and their geometric relationship to the roadway, and highlighting structural features that unfavorably "daylight" towards the roadway.

Following the November 2017 site inspection, multiple areas of concern were identified by Haley & Aldrich that, in our opinion, posed varying degrees of risk for the occurrence of rockfall events that have the potential to encroach on or enter the roadway and possibly endanger the traveling public.

Based on our review and evaluation of the information gathered during the November 2017 site inspection, the rock slope was divided into five general "areas," designated Area 1 through Area 5. Due to the relatively low slope height (< 40 ft) and catchment area width (16 ft), Area 1 was judged by Haley & Aldrich to pose limited risk of rockfall and was not evaluated further.

The remaining four Areas (i.e., Area 2 through Area 5) were further subdivided into a total of 14 smaller, discrete areas based on one or more of the following observations:

- The presence of potential rock slope instabilities that were attributed to visibly detached, loose or otherwise unstable rock blocks.
- Visual evidence of unfavorable discontinuity orientation relative to the orientation of the rock slope face that could result in potential rockfall failure mechanisms such as toppling, wedge sliding, or planar sliding. Portions of the rock slope that appeared prone to ice-jacking or root wedging were also considered.
- Weathered, weak or altered bedrock zones.
- Areas where evidence of previous rockfall events was observed (e.g., rockfall debris present along benches or in the catchment area).

The approximate location and extent of each area is shown graphically on Figure 4, Rock Slope Remediation Area Location Plan. More detailed photographs of each area are shown on Figures 5 through 15. As noted above, measured slope geometry information specific to each area is summarized in Table I and Table II.

Based on the information collected during the initial site inspection, identified areas of concern were subjectively ranked and assigned initial relative ratings ranging from "slightly critical" to "most critical" based on our opinion of perceived rockfall risk. These areas are visually denoted in the attached tables and figures using red ("most critical"), orange (moderately critical), and yellow ("slightly critical") shading.

AUGUST 2018 SITE INSPECTION

A follow-up site inspection was conducted in August 2018 so that areas of the rock slope that were assigned initial ratings of "most critical" and "moderately critical" could be observed using rope access techniques because these areas are not easily visible from the base of the slope. In general, the purpose of the follow-up site inspection was to:

- Observe rock slope areas initially judged to pose the highest potential risk for rockfall, as well as areas of lower risk that were inaccessible without the use of rope access techniques.
- Observe, measure and document dimensions of specific rock slope areas, key rock block attributes, discontinuity location/orientation/condition, and identify zones of loose rock needed update/revise previously established prioritization and to aid in developing preliminary rock slope stabilization concepts.
- Collect additional catchment area dimensions to supplement the data collected during the November 2017 site inspection.
- Collect information to determine vegetation/tree removal requirements both on top of the rock slope and on the rock slope face itself.

A site inspection was completed by a two-person crew of Haley & Aldrich geologists from 21 to 24 August 2018 that allowed for a detailed examination of several rock slope areas. Rope access techniques were used to descend the rock slope face from the area above the top of the slope. Haley & Aldrich field personnel used a wholly independent two-rope fixed system, where one rope serves as the main descent rope, and the second rope as a backup or "safety" line. The ropes were anchored via industrial slings and runners to large trees above the crest of the rock slope. Progress down the rock slope face was controlled by manual descenders, allowing personnel to halt their advance and closely observe the previously identified areas of concern. Where possible, Haley & Aldrich personnel stood on small ledges or projections from the rock slope face to observe, document, photograph and measure critical features.

The rope access approach allowed Haley & Aldrich personnel the ability to directly observe rock structure and the spatial relationships between rock blocks that were not visible or discernable by routine observation from the base (roadway level) or top of the rock slope. Observed attributes included near-vertical separation joint orientations controlling potential block release, zones of weakened and sheared rock, sliding plane conditions where controlling joints dip out of the rock slope face towards the roadway, and measurements of rock block and other critical area dimensions. Observation and documentation of the rock slope conditions also allowed us to collect additional structural geologic data of the bedrock (e.g., discontinuity dip and dip direction, frequency, infilling,

visible seepage, persistence, aperture) and rock mass properties (e.g., weathering/alteration, estimation of intact rock compressive strength) at each identified area of concern.

JULY 2022 SITE INSPECTION

A final site inspection was conducted in July 2022, primarily to document the current condition of the previously identified areas of concern (since the previous site inspection was conducted four years prior). In general, the purpose of the site inspection was to:

- Confirm the horizontal and vertical limits of the "most critical" areas of concern along the rock slope based on the observed geometry and condition of the exposed rock slope and delineate construction project plan impacts as they relate to the existing right-of-way (ROW).
- Collect additional bedrock structural data from observed foliation and joint discontinuities along the entire length of the rock slope and specifically within the 14 areas of concern that were previously identified. This information was used to develop final design requirements for the systems needed to remediate the rock slope areas of concern. Bedrock structural data collected at the site included but was not limited to the following: joint dip angle and dip direction, aperture, infilling, persistence of discontinuities, visible seepage, and rock mass properties such as weathering and intact rock compressive strength.
- Identify zones of loose rock, approximate locations of key rock blocks that may control rockfall potential and determine important discontinuity orientations and their geometric relationship to the roadway, highlighting structural features that unfavorably "daylight" towards the roadway.

During the period from 11 to 14 July 2022, a two-person crew of Haley & Aldrich rope access certified geologists conducted a rope access site inspection of the rock slope using the same techniques that were used to complete the 2018 ropes access site inspection (see previous section).

Based on the observations and additional data collected during this follow up site inspection, the relative ratings for several of the previously identified areas of concern were updated (see section below). No new areas of concern were identified during the final site inspection.

Rockfall Failure Mechanisms

As noted in the preliminary report, a total of seven bedrock joint sets were measured during the 2017 and 2018 site inspections, four of which appear to control the kinematic behavior of the rock blocks at the site. No additional joint sets were identified and measured during the 2022 site inspection. The primary controlling joint set (foliation joint; "FJ") parallels the predominant high-angle to near-vertical foliation observed along the rock slope. The presence of foliation-parallel, high-angle joints along with other oblique joints create a condition where toppling of rock blocks towards the roadway is the primary rockfall failure mechanism of concern at the site. However, in several discrete areas, blocky, dilated rock blocks also have the potential to slide towards the roadway on low-angle joints dipping out of the rock face.

Several factors that can further influence the failure mechanisms noted above have been identified and are summarized below.

- Water can flow into open joints that have an unfavorable orientation with respect to rockfall potential and freezes, which creates the potential for the rock blocks to become dislodged. This type of failure mechanism is commonly referred to as "ice wedging". Snow and ice accumulation can also push rockfall debris from the benches that are present along portions of the rock slope down into the catchment area.
- Root "wedging" or "jacking" occurs when roots from vegetation present on, adjacent to or above the rock slope grow into discontinuities and over time (as the roots grow) creates the potential for the rock blocks to become dislodged. This was observed at several locations at the site, in particular along the upper portion of the slope.

Several fallen rock blocks were observed in the catchment area during the July 2022 site inspection that ranged in size from approximately 0.5-ft x 0.5-ft x 0.5-ft, to blocks of several cubic feet in volume. The observed rock blocks tended to be blocky and tabular/planar in geometry. In addition, and as noted above, a rockfall event occurred with source rock coming from Area 4A in March 2022. Based on our discussions with MaineDOT, it is our understanding that the falling rock blocks entered the roadway, which necessitated the installation of temporary jersey barriers along the western edge of the roadway along this portion of the rock slope. Based on our observations made during the March 2022 site visit, it is our opinion that a toppling failure occurred, which was likely influenced by a significant rain event that occurred prior to and/or during the rockfall event. Refer to Figure 3 for the approximate source location of the rockfall event.

Final Rock Slope Area Assessment

Haley & Aldrich has identified a total of 14 areas of concern along the rock slope (designated Area 2A through 2C, 3A through 3E, 4A through 4D, and 5A through 5B) that have been judged to pose potential safety and long-term maintenance issues. The locations and approximate limits of these areas are shown on Figure 4.

Based on observations made during our 2017, 2018 and 2022 site visits, we have developed final relative ratings for each identified area of concern. The final ratings range from "slightly critical" to "most critical" as summarized below and as shown on the attached Table II and Figure 4.

- "most critical" red 5 areas (Area 2A, 3A, 4A, 4B, and 5B)
- "moderately critical" orange 5 areas (Area 2B, 3B, 3E, 4C, and 5A)
- "slightly critical" yellow 4 areas (Area 2C, 3C, 3D, and 4D)

As stated above and based on the relatively low slope height (< 40 ft) and catchment area width (16 ft), it is our opinion that the rock slope condition within Area 1 poses limited risk of rockfall. Because of this no areas of concern were identified in Area 1. Some of the relative ratings summarized in our 27 March 2020 preliminary report were modified based on the data collected during the 2022 site inspections. The areas whose preliminary rating changed are summarized below (also refer to Table II).

- Upgraded from "moderately critical" to "most critical": 1 area (Area 4A)
- Upgraded from "slightly critical" to "moderately critical": 1 area (Area 3B)

In addition, the overall extent (size) of some areas summarized in our preliminary report were modified because of the recent inspections. For example, the overall extent of Area 4C was lengthened slightly as compared to the limits shown in the preliminary report.

Based on our review of our preliminary evaluations and the observations made and data collected during the 2022 site inspection, additional technical evaluations were not considered necessary to determine the final ratings presented above.

Selected representative photographs of the each of the 14 areas of concern are provided on Figures 5 through 15. Final rock slope remediation design recommendations are provided in the following section.

Final Design Recommendations

In general, recommended rock slope remediation measures for each area with relative ratings of "most critical" (five total), "moderately critical" (five total) and "slightly critical" (four total) shown on Figure 4 and in Table II will include the use of scaling and vegetation removal, passive rock reinforcement elements (i.e., rock dowels), and/or a draped high-strength wire mesh netting. A general description of each of the recommended rock slope remediation measures is provided below, followed by stabilization recommendations for each area.

RECOMMENDED ROCK SLOPE REMEDIATION MEASURES

Rock Dowels

A rock dowel is a passive (either no design load or very light lock-off load applied after installation) rock reinforcement element that typically consists of a solid steel bar that is inserted into a sub-horizontal hole that is drilled beyond potential failure surfaces in the rock mass and is grouted in-place. Rock dowels can be loaded in shear and/or tension, based on desired function and physical situation in the field. The rock dowels proposed and discussed herein will consist of 1-3/8-in. diameter, continuously threaded, grade 75 (f_y = 75 ksi) galvanized, solid steel bars. Total bar lengths for this project are anticipated to range between approximately 10 and 25 ft. Given the propensity of the rock at the site to "flake", the use of dowels is less preferable than removal of the rock hazard by scaling. This is because drilling operations will likely be difficult and may result in less than desirable conditions for the

recommended bond zone between rock and grout, and may also "crush" the surrounding rock, creating conditions that could cause structural failure of the dowels and/or induce future rockfall events.

Draped Wire Mesh Netting

This rock remediation measure generally consists of a high tensile strength, galvanized steel wire mesh netting that is anchored to the crest of the rock slope using wire rope cable anchors and is placed over the rock face. The draped netting provides a curtain-effect and allows rock blocks to fall but controls their horizontal movement or trajectory, typically directing the blocks into the catchment area at the toe of the slope or along a sufficiently wide bench. This recommended remediation measure varies from what was recommend in the preliminary report (anchored wire mesh netting), due to the propensity of the rock at the site to fragment into small rhombic shapes. The effects of drilling for dowels used in an anchored wire mesh netting would likely shatter surrounding rock and the small geometric shapes of any failing rock behind the pinned mesh could slip through the mesh openings and create space for overloading of the mesh design. It is our opinion that a draped system is more easily maintained but still provides retention of rock blocks and protection of the adjacent roadway.

The recommended draped wire mesh netting system consists of approximately 22 wire rope cable anchors used to anchor the top and lower corners of the wire mesh netting to the rock face. The wire rope cable anchors will consist of 3/4-in. diameter, galvanized, double wire rope complying with Independent Wire Rope Core (IWRC) Class 6x19 and Extra Improved Plowed Steel (EIPS) with an estimated length of 10 ft. The perimeter of the netting contains wire rope, to keep the system tight. We recommend that draped netting be powder coated (i.e., colorized to match the rock slope for aesthetic reasons) and enhanced with additional corrosion protection. We estimate that the draped mesh will be approximately 100-ft long (along the length of the rock slope) and 60-ft high, which includes an allowance for the mesh to extend above and beyond the top of the slope.

Scaling

Rock scaling is the most ideal solution for mitigating the rockfall hazards at the site. Scaling is used to remove loose rock fragments/blocks, soil and vegetation from slopes that pose a rockfall hazard both during and after construction. Scaling is typically performed as an initial process on a rock slope remediation project and generally proceeds from the top of the slope to the bottom. Scaling is completed by removing loose material using hand tools consisting of pry-bar, picks, and/or shovels. Where large rock blocks require removal, several different techniques can be used including inflatable air bags, hydraulic splitters, and winching as well as mechanical methods using conventional excavation equipment or hoe-ramming, if deemed to be safe. Scaling may require the Contractor to consider temporary rockfall mitigation measures, either through use of sacrificial netting, jersey barriers or other means. We recommend that prior to vegetation removal and scaling along the entire length and height of the rock slope a "sand blanket" be placed within the existing catchment area to provide a cushion for falling rock blocks. This along with the installation of a line of temporary jersey barriers along the roadway centerline, will help prevent falling rock from entering the active roadway. After all rock slope remediation work is completed (including scaling along the entire length and height of the rock slope), we also recommend that vegetation, scaled rock blocks and the "sand blanket" be removed from the

catchment area. The Contractor should consider implementing temporary pavement protection measures so that the existing pavement is not damaged from falling rock(s) or other construction related activities.

The recommended project-specific scaling requirements consist of a three-part approach:

- Removal of vegetation from the entire slope face (including the 14 identified areas of concern), extending from the base of the slope to an area extending approximately 15 ft above and beyond the crest of the slope face. Large-scale tree cutting is not anticipated. However, several trees along the crest of the slope may require removal if they are judged (during construction) to have the potential to become uprooted during periods of inclement weather and fall down the slope face. We anticipate that most of the vegetation removal will be completed by the Contractor prior to or simultaneous with the initial hand/light mechanical and targeted scaling efforts recommended below.
- Initial hand-scaling or a light mechanical scaling to remove small, loose blocks and fallen debris that exists across the entire rock slope face (including the 14 identified areas of concern). This includes removal of the extensive rockfall debris that has accumulated on sloping benches to date.
- More robust, targeted scaling in each area of concern as shown in Figure 4. In general, targeted scaling could include hand and mechanical scaling and is anticipated to be more time intensive than initial scaling due to the size of the rock blocks and their location on the slope relative to the roadway level.

RECOMMENDED ROCK SLOPE REMEDIATION MEASURES BY AREA

A summary of recommended rock slope mediation measures for each area are summarized below and are also presented in Table II.

Area of Concern	Targeted Scaling?	Rock Dowels/ Wire Rope Cable Anchors? (Est. No., Length)	Draped Wire Mesh Netting?	Comments
2A	yes	yes (4, 25-ft long)	no	see note 2 and Figure 5
2B	yes	yes (3, 15-ft long)	no	see note 2 and Figure 6
2C	yes	no	no	see note 2 and Figure 6
3A	yes	yes (8, 15-ft long)	no	see note 2 and Figure 7
3B	yes	yes (4, 15-ft long)	no	see Figures 7 and 8
3C	yes	yes (1, 10-ft long)	no	see note 2 and Figure 8
3D	yes	no	no	see Figure 9
3E	yes	yes (1, 10-ft long)	no	see note 2 and Figure 10
4A	yes	yes (22, 10-ft long)	yes	see note 3 and Figure 11
4B	yes	yes (6, 15-ft long)	yes	see notes 2 and 3, Figure 11
4C	yes	yes (5, 15-ft long)	no	see notes 2 and 3, Figure 12
4D	yes	yes (2, 15-ft long)	no	see note 2 and Figure 13
5A	yes	yes (8, 15-ft long)	no	see note 2 and Figure 14
5B	yes	yes (8, 15-ft long)	no	see Figure 15

Notes:

1. Vegetation removal and light scaling recommended for entirety of rock slope including areas of concern and entire surrounding rock face.
2. Rock dowels only required if targeted scaling isn't successful at removing rock blocks of concern. Actual dowel locations will be determined in the field by Haley & Aldrich based on post-scaling rock slope conditions.
3. Draped wire mesh netting installed after vegetation removal and targeted scaling is completed in Area 4A, and after benches are cleaned of all rockfall and scaling debris.

More detailed information for each area of concern is provided below.

Area 1 (Sta. 10+65 to Sta. 11+90; see Figures 2 and 4)

Area 1 ranges in height up to approximately 38 ft above the roadway. This mixed soil-and-rock area is comprised of sloping, moss-covered ledges. Where bedrock is exposed and visible, it tends to be blocky and appears stable. Because of this and because of the width of the catchment area (approximately 16 ft, see Table I), Area 1 is judged to have a low probability of having a rockfall event and therefore, was not assigned a relative rating. Other than the removal of vegetation from the slope and the initial light or mechanical scaling effort no other rock slope stabilization is recommended in this area. The condition of the rock slope in Area 1 as observed during the 2022 site inspection did not change from the conditions observed during the 2017 and 2018 site inspections. It is possible that this area may be used by the Contractor to access the top of slope during construction, and as such, vegetation removal beyond the 15-ft crest limit may be needed, as discussed with MaineDOT during development of Plan Impacts Complete (PIC).

Area 2 (Sta. 11+90 to Sta. 13+40; see Figures 2 and 4)

We identified three areas of concern in Area 2, designated Area 2A, Area 2B and Area 2C. These portions of the rock slope are made up of a near-vertical face of bedded quartzite, with multiple benches of varying length (along the slope) and width (into and out of the slope) present throughout the area. The rock slope in this area is approximately 56-ft high (maximum). Toppling and planar sliding failures are the predominant failure mechanisms due to the presence of steep, laminated foliations/bedding, and root wedging is exacerbating these conditions. The overall condition of the rock slope in Area 2 as observed during the 2022 site inspection has generally worsened as compared to the conditions observed during the 2017 and 2018 site inspections. Specifically, we noticed that the opening of foliation planes and joints has been exacerbated by continued weathering.

- **Area 2A (Sta. 13+05 to Sta. 13+25; see Figures 4 and 5; Red)** - As shown on Figure 5, several rock blocks at the top of Area 2 form a cluster of at least four loose rock blocks (approximately 8-ft high x 3-ft wide x 3.5-ft deep) located approximately 50 to 55 ft above the roadway. Open joints observed in the field, suggest that planar sliding from ice-wedging and root jacking is the likely failure mechanism. Removal of these blocks by targeted scaling is recommended and is expected to be feasible. If targeted scaling is not successful in removing the blocks, we anticipate that four, approximately 25-ft long dowels will be needed to stabilize the blocks at the approximate locations shown on Figure 5. Actual dowel locations, if required, will be determined in the field by Haley & Aldrich based on post-scaling rock slope conditions.

- **Area 2B (Sta. 12+40 to Sta. 12+90; see Figures 4 and 6; Orange) and Area 2C (Sta. 12+55 to Sta. 12+80; see Figures 4 and 6; Yellow)** - As shown on Figure 6, root jacking has created several large rock blocks at the crest of the slope in Area 2B, which exhibit open, soil-filled backside joints that appear prone to toppling or failure by planar sliding along an open basal joint dipping at about 10 degrees (from the horizontal) toward the roadway. These blocks are located approximately 40 to 55 ft above the roadway.
  Targeted scaling is recommended in Area 2B. If scaling is not successful in removing the blocks, we anticipate that three, 15-ft long dowels will be needed to stabilize the blocks at the approximate locations shown on Figure 6. Actual dowel locations, if required, will be determined in the field based on post-scaling rock slope conditions.

  Area 2C is comprised of four smaller blocks (about 3-ft high each and 2 to 4-ft thick) extending about 25 ft linearly along the crest of the slope with open backside joints that are prone to planar sliding failure, primarily from ice wedging. These blocks are located approximately 50 to 55 ft above the roadway. During the 2022 site inspection the limits of Area 2C were expanded to the north, because flaking of open foliation planes extending beyond the limits presented in the preliminary report was observed.

Given the thin nature of the separating foliation plans in Area 2C and the open joints of the blocks along the crest in Area 2C, targeted scaling is recommended for this area. Based on our observation of the existing slope conditions, it is our opinion that targeted scaling will be successful in removing the rock blocks and therefore, do not anticipate the need for rock dowels.

AREA 3 (Sta. 13+40 to Sta. 14+65; see Figures 2 and 4)

Rockfall hazards in this area include several delaminated blocks located at or near the crest of slope that are prone to sliding and toppling failure. Loose rock rubble/debris was observed on lower bench surfaces below this area that reflect ongoing rockfall. In addition, Haley & Aldrich noted approximately 20 pieces of rock in the catchment ditch in this area (with typical dimensions of 1-ft x 1-ft x 2.5-ft). A significant, sloping bench is located about 20 ft above the toe of slope and could serve as a launching feature if struck by falling rock blocks. The overall condition of the rock slope in Area 3 as observed during the 2022 site inspection has generally worsened as compared to the conditions observed during the 2017 and 2018 site inspections. Similar to Area 2, we observed the opening of foliation planes and joints has been exacerbated by continued weathering.

It is our opinion that most of the rock blocks falling from the slope below the bench would likely be retained in the catchment area. Because of this, we are not recommending any remedial measures be performed on the slope below the bench in this area. However, it is our opinion that there is potential for rock blocks falling from above the bench to fall beyond the catchment area and project out into the roadway. Because of this, we recommend that loose rock blocks present above the bench be removed during the initial slope-wide scaling program as summarized above.

- **Area 3A (Sta. 13+95 to Sta. 14+30; see Figures 4 and 7; Red)** - The southern portion of Area 3A (see Figure 7) has a dislodged blocky character, is approximately 25 to 30 ft tall and 35-ft long, and the top of the slope is at approximately 50 to 70 ft above the roadway. Multiple large blocks exhibit open backside joints, open basal joints, and appear unconnected to the main body of the slope. Modes of failure are sliding and toppling, exacerbated by ice and root wedging. It is our opinion that at least ten rock blocks require stabilization or removal.

  During the 2022 site inspection, observations of open foliation planes along the slope face and large joint-bound blocks were deemed to pose the most significant risk. The preliminary report recommended stabilization with dowels or anchored mesh. However, given the observations made during the 2022 site inspection and the further weathering of joints and foliation planes that were observed, stabilization is considered less desirable and therefore, the removal (using targeted scaling) of these hazards in a controlled setting is recommended. If targeted scaling is not successful in removing the blocks, we anticipate that eight to ten, 15-ft long dowels will be needed to stabilize the blocks at the approximate locations shown on Figure 7. Actual dowel locations and number of dowels will be determined in the field based on post-scaling rock slope conditions.

- **Area 3B (Sta. 13+90 to Sta. 14+15; see Figures 4, 7 and 8; Orange)** - Area 3B consists of at least two large, loose rock blocks located approximately 35 to 45 ft above the base of the slope and directly below Area 3A (see Figures 7 and 8) with open basal and/or backside joints present and visible. Modes of failure are sliding and toppling, exacerbated by ice wedging.

  During the 2022 site inspection further opening of foliation planes and jointing in Area 3B were observed (see Figures 7 and 8). Given the height of these blocks relative to the roadway, the ability of the bench below to project falling rock into the roadway, and the recent rockfall of similar blocks (March 2022 rockfall event), Area 3B has been elevated from "slightly critical" to "moderately critical." Removal of these rock blocks is expected to be feasible by using targeted scaling techniques. However, if scaling is not successful in removing the blocks, we anticipate that four, 15-ft long dowels will be needed to stabilize the blocks at the approximate locations shown on Figure 7. Actual dowel locations, if required, will be determined in the field based on post-scaling rock slope conditions.

- **Area 3C (Sta. 13+80 to Sta. 14+05; see Figures 4 and 8; Yellow)** - Area 3C consists of a series of loose, sloping blocks in a trapezoidal arrangement (see Figure 8) that is approximately 25-ft wide. The feature is approximately 7-ft high on the left (south) side, and 35-ft high on the right (north) side, and the top surface creates an approximate 1.5-ft deep bench that slopes towards the road. These blocks are located approximately 10 to 30 ft above the roadway.

  During the 2022 site inspection, there were no noticeable changes to the observed conditions in Area 3C. The presence of open foliation planes has created loose flakes of rock and ice wedging and root jacking has moved the blocks away from the rock mass towards the roadway.

  We recommend that targeted scaling be used in Area 3C to remove the loose rock blocks present in this area. If targeted scaling is not successful in removing the blocks, we anticipate that one, 10-ft long dowel will be needed to stabilize the uppermost "key" rock block at the approximate location shown on Figure 8. Actual dowel locations and number of dowels will be determined in the field based on post-scaling rock slope conditions.

- **Area 3D (Sta. 13+05 to Sta. 13+55; see Figures 4 and 9; Yellow)** - As shown on Figure 9, Area 3D is comprised of high-angle jointed blocks extending vertically to form a flaking, potentially unstable and narrow bench. Behind the flaking blocks is a 2 to 6-in. wide vertical aperture (gap) that creates a toppling failure mechanism and is also vulnerable to ice wedging (see Figure 9). These blocks are located approximately 10 to 30 ft above the roadway. During the November 2017 site inspection, a rockfall event was observed that originated from Area 3D (estimated at Sta. 13+70) with a rock block landing in the catchment area after striking the slope at several locations. Other blocks that had previously fallen in this area were observed in the catchment ditch and ranged in size but were typically 2.5-ft long x 2.5-ft wide x 1.0-ft deep.

During the 2022 site inspection, there were no noticeable changes to the observed conditions in Area 3D. The presence of open foliation planes has created loose flakes of rock and ice wedging and root jacking causes (pushes) the blocks towards the roadway. The rectangular blocks above Area 3D have also continued to open, and because of this, Area 3D has been extended (lengthened, to the south and north along the crest limits to include these blocks.

We recommend that targeted scaling be used to remove the loose rock blocks present in Area 3D. If targeted scaling is not effective in removing the blocks, we recommend that the area be left as is and included as part of a targeted future maintenance and monitoring program. We also recommend that any open backside joints be filled with dry-pack concrete, to minimize or prevent future water infiltration and ice wedging and root jacking.

- **Area 3E (Sta. 14+20 to 14+31; see Figures 4 and 10; Orange)** - As shown on Figure 10, Area 3E is comprised of three rock blocks that form a pyramidal shape that is roughly 11-ft wide at its base is located approximately 35 to 40 ft above the roadway. Due to the separation joints and wide apertures observed behind the blocks, this area was judged to be prone to instability due to ice wedging and planar sliding failure.

  Based on observations made during the 2022 site inspection, it is our opinion that the condition of Area 3E has worsened since 2018, with additional soil infilling of the backside joint. This infilling has increased the likelihood for ice wedging failure along this joint. It is worth noting that this open joint appears to extend behind the entire bench upon which the failing blocks from Area 3E rest, as seen in the lower photo on Figure 10.

  We recommend that targeted scaling be used to remove the loose rock blocks present in Area 3E.

Area 4 (Sta. 14+65 to Sta. 16+65; see Figures 2 and 4)

Area 4 contains four identified areas of concern, with hazards ranging from poor rock quality on near-vertical slopes to loose rock blocks near the crest of the slope. Evidence of previous and recent rockfall events was observed throughout this area during the site inspections.

- **Area 4A (Sta. 14+75 to Sta. 15+45; see Figures 4 and 11; Red)** - As shown on Figure 11, Area 4A exhibits steeply inclined, bedded quartzite, with at least two mid-slope benches. The benches were formed below a “slabby” and spalling high-angle rock face that appears to become steeper to the north. This area is located approximately 40 ft to nearly 65 ft above the roadway. Based on observed staining and discoloration, Area 4A is likely to be wet and exhibit flowing water seasonally.

Area 4A was the source area for the March 2022 rockfall event (see Figure 4). Given the demonstrated ability of falling rock from this area to reach the roadway, this area was elevated to critical after our 2022 site inspection, and the limits of the area were expanded (lengthened) to the south. While the size of blocks in the catchment area remains, on average, approximately 1-ft x 1-ft x 1-ft, the rock is delaminating along the near-vertical foliation planes with a significant volume of rock remaining on the face. No other significant changes to the geometry of the slope or the benches were noted during the 2022 site inspections.

We recommend that targeted scaling be used to remove weak rocks on the face of the slope and all accumulated rockfall debris be removed from the benches. Depending on the integrity of the bedrock behind the weak surficial slabs, to prevent further rockfall from reaching the roadway, we recommend installing a draped wire mesh starting at the crest line (top of slope) and extending down to the first bench. We estimate that the in-place mesh will measure approximately 100-ft long (along the length of the slope) x 60-ft tall (approximately 6,000 square feet). We also estimate that the mesh will be supported by approximately 17, 10-ft long wire rope cable anchors along the top and near the lower corners of the mesh. Given the deteriorated condition of the poor rock in this location, the installation of dowels is no longer considered a technically feasible option as the drilling operations for the installation would likely crush the rock and induce further failure.

- **Area 4B (Sta. 14+75 to Sta. 15+45; see Figures 4 and 11; Red)** - As shown on Figure 11, Area 4B consists of a series rock blocks located approximately 55 to 65 ft above the roadway, each having open backslope joints and basal joints that slope towards the roadway. The blocks appear to be loose and dislodged, with a 1.5-ft wide open gap behind the blocks. During the 2022 site inspection these blocks were observed to be in a failing state, and a small rockfall event was induced by Haley & Aldrich personnel while rappelling down the slope. Overall, the length of the upper blocks along the slope is approximately 70 ft. Other rounded boulders (from exposed glacial till) were observed at/near the top of the rock slope during the site inspection(s).

  Because of the loose nature of these blocks and the propensity of the rock to cleave along the foliation planes, we recommend that targeted scaling be used to remove the loose rock blocks along the crest of the slope. Based on the condition of the blocks observed during the 2022 site inspection, we anticipate that removal of the blocks will not be difficult. However, if targeted scaling is not successful in removing the blocks, we anticipate that six, 15-ft long, rock dowels will be needed to stabilize the blocks at the approximate locations shown on Figure 11. Actual dowel locations and number of dowels will be determined in the field based on post-scaling rock slope conditions. Installation of vertical or near-vertical rock dowels may be difficult because drilling will be parallel with the foliation planes and may split the blocks. In the event that drilling vertical dowels is determined not feasible in the field (after targeted scaling is complete), the rock dowels could be installed at a horizontal or sub-horizontal angle provided suitable embedment in bedrock beyond the open, backside joints can be achieved. The draped wire mesh netting system recommended for Area 4A will also cover Area 4B. Once targeted scaling is

complete and based on the post-scaling rock slope condition, there may be no need to install dowels. This will need to be verified in the field during construction by Haley & Aldrich.

- **Area 4C (Sta 15+10 to Sta 15+65; see Figures 4 and 12; Orange)** - As shown on Figure 12, Area 4C consists of an overhang that forms a horizontal bench, located approximately 20 to 25 ft above the roadway and includes multiple individual rock blocks that are approximately 6-ft high. Open backside joints are present behind the blocks and the front overhang appears to have dislocated laterally by up to approximately 12-in. Staining and discoloration observed in this area during the site inspections suggests that this area is likely to be seasonally wet.

  Based on the observed condition of the rock slope during the 2022 site inspection, the limits of the area were expanded (lengthened) slightly to the south and north (see Figure 12).

  We recommend that targeted scaling be used to remove the loose rock blocks present in Area 4C. We anticipate that the blocks are likely too large for conventional hand scaling methods. However, given that this area is only 20 to 25 ft above the roadway level, a mechanical hoe-ram positioned in the roadway would be capable of reaching these areas and could be effective in breaking up and removing the blocks. If targeted scaling is not successful in removing the blocks, we anticipate that five, 15-ft long dowels that extend past the backside separation joint into the bedrock mass will be needed to stabilize/secure the rock blocks at the approximate location shown on Figure 12. Actual dowel locations and number of dowels will be determined in the field based on post-scaling rock slope conditions. We also recommend that the approximately 12-in. wide gap behind the blocks (see Figure 12) be cleaned out and be filled with grout prior to drilling to ensure that a secure bond between the rock and dowels along their entire embedded length.

- **Area 4D (Sta 15+65 to Sta 15+80; see Figures 4 and 13; Yellow)** - As shown on Figure 13, Area 4D consists of one large rectangular rock block the bottom of which is located approximately 4 ft above the catchment area. The rock block measures approximately 14-ft high x 9-ft wide x 1.5-ft thick. The upper one-third (approximate) of the block has a backside open joint that is filled with moss, and rotational or toppling failures appear possible due to ice jacking, particularly if the supporting lower toe blocks fail. The block is located approximately 4 to 18 ft above the roadway.

  The condition of the rock slope in Area 4D as observed during the 2022 site inspection did not change from the conditions observed during the 2017 and 2018 site inspections. Due to its size and proximity to the roadway, we recommend that this area be remediated by targeted scaling. A mechanical hoe-ram positioned in the roadway could be used to break up and remove the large rock block. If removal of the rock block by targeted scaling is judged to be unsafe after the initial slope-wide scaling is completed, then we recommend securing the block with two, 15-ft long rock dowels at the approximate locations shown on Figure 13. We anticipate that these dowels could be installed from the bottom of the slope.

The draped wire mesh netting system recommended for Area 4A will also be covering Area 4B. Once targeted scaling is complete and based on the post-scaling rock slope condition, there may be no need to install dowels for any blocks that remain after scaling is completed. If targeted scaling is not effective than we anticipate that two, 15-ft long dowels will be required. This will need to be verified in the field during construction by Haley & Aldrich.

Area 5 (Sta 16+65 to Sta 17+65)

Area 5 contains two identified areas of concern, primarily due to rockfall from the steeply inclined rock structure and the presence of at least three mid-slope benches extending back from the road. The benches are littered with rockfall debris, likely resulting from toppling failures due to ice jacking. Fallen rock debris was also observed in catchment area. The condition of the rock slope in Area 5 as observed during the 2022 site inspection did not change from the conditions observed during the 2017 and 2018 site inspections. The fallout zone from the previous rockfall event did not show signs of further failure.

- **Area 5A (Sta 16+35 to Sta 17+25; see Figures 4 and 14; Orange)** - As shown on Figure 14, Area 5A shows clear evidence of previous rockfall landing on lower benches and falling into the catchment area adjacent to the roadway. The 2017 and 2018 site inspections noted that near Sta. 6+25, a suspected rockfall event appeared to have damaged the western edge of pavement. This area has vertical slabs of jointed, loose rock which pose potential toppling hazards. The blocks in this area are located approximately 30 to nearly 50 ft above the roadway.

  Based on observations made during the 2022 site inspection, it is our opinion that due to its size (approximately 27-ft wide and 25-ft high), distance above the roadway, and poor quality of the rock, removal of the rock blocks in Area 5A is required. We recommend that targeted scaling be used to remove the loose rock blocks present in Area 5A.
  Once targeted scaling is complete and based on the post-scaling rock slope condition, there may be a need to install additional eight to ten, 15-ft long rock dowels at the approximately locations shown on Figure 14. Actual dowel locations and number of dowels will be determined in the field based on post-scaling rock slope conditions.

- **Area 5B (Sta 17+30 to Sta 17+65; see Figures 4 and 15; Red)** - Area 5B is adjacent to Area 5A (see Figure 15) and consists of several rock blocks and evidence of recent rockfall that, in our opinion, is attributed to toppling of columnar vertical joints intersecting with vertical foliation, likely triggered by high rainfall events. The blocks in this area are located approximately 30 to 47 ft above the roadway. The exposed failure zone (see Figure 15) is approximately 15 to 17 ft above the toe of the slope, releasing 10 to 20 prismatic blocks with typical block size 2-ft x 3-ft x 1.5-ft in dimension. Blocks remaining on the rock face exhibited 6-in. of lateral movement along basal joint planes, likely from ice wedging. Accumulated rockfall debris was observed on the rock bench located about 35 ft above toe of slope.

  Observations during the 2022 site inspection noted no significant changes to the fall out zone in this area since the 2018 site inspection. However, it was noted that the open joint displayed more infilling of soil and heavier growth of vegetation.

We recommend removal of debris on the bench and the use of targeted scaling to remove the joint-bound blocks behind the fallout zone. Given the size of these blocks, this area may require in-place stabilization of any blocks that cannot be scaled using rock dowels. The locations of the rock dowels, if needed, will be determined in the field. We currently estimate that eight, 15-ft long dowels will be needed to stabilize blocks that cannot be scaled (see Figure 15 for approximate locations).

Recommendations for Future Work

There are several items that require additional development and consideration during the final design and contract document preparation phase (Phase II) of the project. These items are summarized below.

- Assist MaineDOT in the development of final design and quantities for use in preparing an engineer's cost estimate.
- Assist MaineDOT in the development of Contract Documents (plans and special provisions) that are consistent with the design intent noted herein.
- Provide field engineering oversight during rock slope remediation as needed to assess post-scaling rock slope conditions and determine the need for additional remediation measures as noted herein.

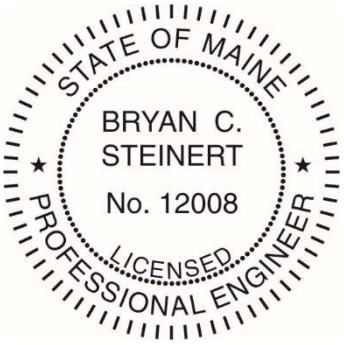
Closure

We appreciate the opportunity to provide preliminary geotechnical engineering consulting services on this project. We trust the information summarized herein and provided in the attachments meets your present needs. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Christopher Eddy
Senior Engineering Geologist

Bryan C. Steinert, P.E.
Senior Project Manager



Wayne A. Chadbourne, P.E.
Principal

Enclosures:

Table I - Measured Rock Slope and Catchment Ditch Geometry
Table II – Recommended Rock Slope Remediation Measures
Figure 1 – Project Locus
Figure 2 – Site Plan (Sheets 1 and 2)
Figure 3 – March 2022 Rockfall Location
Figure 4 – Rock Slope Remediation Area Location Plan
Figures 5 through 15 – Rock Slope Remediation Areas

Table I
Measured Rock Slope and Catchment Ditch Geometry
Prospect South Rock Slope Stabilization
MaineDOT WIN 022966.00
Prospect, Maine

Haley & Aldrich, Inc. File No. 42690-008

Area No.[1]	Approximate Station Limits[2]			Approximate Rock Slope Geometry						Approximate Catchment Ditch Dimensions[5,6]				Comments
	Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Station[2]	Instrument Height (ft)	Distance to Top of Slope[3]		Instrument Angle Above Horizontal[3]		Slope Height[4] (ft)	Ditch Width (ft)	Ditch Depth (ft)	Backslope/ Foreslope Angle (deg)	Toe of Slope to Fog Line Distance (ft)	
						(yds)	(ft)	(deg)	(radians)						
1	10+65	11+90	125	10+65	5.1	--	--	--	--	--	--	--	--	--	Start of rock slope (south)
				11+65	5.1	27	81	17	0.2967	38	16	--	--	25	
2	11+90	13+40	150	12+15	5.1	32	95	24	0.4189	50	15	--	--	26	
				12+65	5.1	33	100	22	0.3840	47	21	2.0	10°/22°	31	
				13+05	5.1	34	101	27	0.4712	55	22	--	--	32	Alisa and Duke
				13+15	--	--	--	--	--	--	18	1.5	21°/21°	--	
3	13+40	14+65	125	13+45	5.1	37	111	35	0.6109	69	--	--	--	--	
				13+65	5.1	38	113	26	0.4538	54	19	--	--	29	
				14+05	5.1	37	111	32	0.5585	64	17	--	--	28	Large Blocks
				14+15	--	--	--	--	--	--	21	1.9	15°/13°	--	
				14+65	5.1	40	120	35	0.6109	69	21	1.7	15°/13°	32	Near maximum height of slope
4	14+65	16+65	200	15+15	5.1	33	100	34	0.5934	67	21			31	Flakes/spalling rock
				15+30	--	--	--	--	--	--	21	1.8	15°/18°	--	
				15+50	--	--	--	--	--	--	19	1.5	17°/12°	--	
				15+65	5.1	35	106	27	0.4712	55	18	--	--	28	Overhanging blocks
				16+15	5.1	33	100	24	0.4189	50	16	--	--	25	
				16+65	5.1	33	99	22	0.3840	47	21	1.8	21°/13°	30	
5	16+65	17+65	100	17+15	5.1	31	92	19	0.3316	41	16	--	--	26	Site of recent upper rockfall
				17+35	5.1	23	68	6	0.1047	17	15	--	--	26	End of rock slope (north)

Notes:

[1] - Refer to Figure 2, Site Plan and Figure 4, Rock Slope Remediation Area Location Plan.

[2] - Stationing based on project baseline established by MaineDOT and are considered approximate (see Figure 2).

[3] - Distance to top of slope and instrument angle measured using handheld Leica Rangefinder from the roadway level.

[4] - Height of slope reflects top of exposed rock, as seen from viewing location. Rock may extend vertically above the visible top of slope.

[5] - Ditch width measured from base of rock slope to edge of pavement, and from base of rock slope to white fog line on western edge of Rt 1/Rt 3.

[6] - Catchment ditch slope angles were measured using a brunton compass. First angle represents catchment ditch backslope at base of rock slope down to bottom of ditch. Second angle represents catchment ditch foreslope extending from bottom of ditch up to edge of roadway.

Prepared By:	CME	10/1/2022
Checked By:	BCS	11/30/2022
Reviewed By:	WAC	12/20/2022

Table II
Recommended Rock Slope Remediation Measures
Prospect South Rock Slope Stabilization
MaineDOT WIN 022966.00
Prospect, Maine

Haley & Aldrich, Inc. File No. 42690-008

LEGEND:
MOST CRITICAL
MODERATELY CRITICAL
SLIGHTLY CRITICAL

Area No.[1]	Approximate Station Limits[2]			Approximate Range in Rock Slope Height[3,5] (ft)		Approx. Height from Toe of Slope to Bottom of Feature[4] (ft)	Approx. Height from Toe of Slope to Top of Feature[4] (ft)	Final Relative Rating	Feature Description	Recommended Rock Slope Remediation Measures
	Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Min.	Max.					
1	10+65	11+90	125	1	40	NA	NA	none	Low slope height, judged low risk. Rockfall would likely be contained in ditch.	light scaling and vegetation removal
2	11+90	13+40	150	40	56	NA	NA	NA	NA	light scaling and vegetation removal
2A	13+05	13+25	20	--	56	48	56		Alisa & Duke, high blocks	vegetation removal, light and targeted scaling, four rock dowels @ 25 ft ea.
2B	12+40	12+90	50	--	--	40 to 45	50 to 55		Root Jacking	vegetation removal, light and targeted scaling, three rock dowels @ 15 ft ea.
2C	12+55	12+80	25	--	--	25	55		Flaking Blocks(4"-6" sheets peeling off blocks)	vegetation removal, light and targeted scaling
3	13+40	14+65	125	56	72	NA	NA	NA	NA	vegetation removal and light scaling
3A	13+95	14+30	35	50	72	45	70		High blocks. Rockfall event witnessed during Phase I field program	vegetation removal, light and targeted scaling, eight rock dowels @ 15 ft ea.
3B	13+90	14+15	25	--	42	35	42		Blocks at top of area, below bottom of Area 3A	vegetation removal, light and targeted scaling, four rock dowels @ 15 ft ea.
3C	13+80	14+05	25	--	--	10	27		Stack of trapezoidal blocks above bench and road	vegetation removal, light and targeted scaling, one rock dowel @ 10 ft
3D	13+05	13+55	50	--	--	12	30		Rock Flakes, and evidence of recent rockfall	vegetation removal, light and targeted scaling
3E	14+20	14+31	11	40	40	35 to 40	39 to 44		High blocks on slope	vegetation removal, light and targeted scaling, one rock dowel @ 10 ft
4	14+65	16+65	200	47	69	NA	NA	NA	NA	vegetation removal and light scaling
4A	14+75	15+45	70	56	68	40	65		Spalling and flaking rocks at height; source of 2022 rockfall event.	vegetation removal, light and targeted scaling, draped wire mesh netting
4B	14+75	15+45	70	55	65	55	65		Upper blocks at crest of slope; small rockfall during 2022 field investigation	vegetation removal, light and targeted scaling, six rock dowels @ 15 ft ea., draped wire mesh netting
4C	15+10	15+65	55	18	20	20	26		Lower Overhang above road sliding forward	vegetation removal, light and targeted scaling, five rock dowels @ 15 ft ea.
4D	15+65	15+80	15	18	18	4	18		Lower Slab at roadway, toppling or rotational failure	vegetation removal, light and targeted scaling, two rock dowels @ 15-ft ea.
5	16+65	17+65	100	17	47	NA	NA	NA	NA	vegetation removal and light scaling
5A	16+35	17+25	90	17	47	30	47		Toppling of blocks/slabs high up on slope above benches. Includes part of Section 5+/-	vegetation removal, light and targeted scaling, eight rock dowels @ 15 ft ea.
5B	17+30	17+65	35	41	45	30	47		Recent rockfall, large jumble of blocks on bench, unstable	vegetation removal, light and targeted scaling, eight rock dowels @ 15 ft ea.

Notes:
[1] - Refer to Figure 2, Site Plan and Figure 4, Rock Slope Remediation Area Location Plan.
[2] - Stationing based on project baseline established by MaineDOT and are considered approximate (see Figure 2).
[3] - Height of Slope reflects top of exposed rock, as seen from viewing location. Rock may extend vertically above the visible top of slope.
[4] - Height from toe of slope to bottom and top of features are scaled estimates based on measurable features relative to overall measured height of slope.
[5] - "--" denotes rock slope height not measured.

Prepared By:	CME	10/1/2022
Checked By:	BCS	11/30/2022
Reviewed By:	WAC	12/20/2022

MAP SOURCE: ESRI

SITE COORDINATES: 44°33'26"N, 68°48'29"E

HALEY ALDRICH

PROSPECT SOUTH ROCK SLOPE STABILIZATION
MAINEDOT WIN 022966.00
PROSPECT, MAINE

PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
MAY 2023

FIGURE 1

42459-001_1_LOCUS.PDF

Notes:
Areas in Green proposed treatments: scaling only
Areas in Blue proposed treatments: scaling and doweling
Areas in Red proposed treatments: scaling, doweling, and mesh

Area 1
10+65 TO 11+90

Area 2
11+90 TO 13+40

JOSEPH THERIAULT
MAP 4 LOT 10-1

MONUMENT "H"

10+65 11+15 11+65 12+15 12+65 13+15 13+65

SOUTHBOUND LANE
U.S. ROUTE 1
NORTHBOUND LANE

SCENIIC
OVERLOOK

EXISTING CULVERT DRAINAGE EASE.
STA.344+02
SEE S.H.C. FILE NO. 14-79

SEE S.H.C. FILE NO. 14-79

SEE S.H.C. FILE NO. 14-79

CONST. LIMIT LINE

LINE

LINE

EXIST. CHANNEL DIVERSION LIMITS

HIGHWAY DITCH DRAINAGE
SEE S.H.C. FILE NO. 14-79

2003
TERRANCE W. LEACH
MAP 4 LOT 16

STATE OF MAINE
MAP 4 LOT 15-1

LEGEND

11+65 PROJECT BASELINE STATIONING

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

WIN
22966.00

HIGHWAY PLANS

	DATE	BY
PROJ. MANAGER		
DESIGN-DETAILED		
CHECKED-REVIEWED		
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

PROSPECT

SITE PLANS

HALEY ALDRICH

PROSPECT SOUTH SLOPE STABILIZATION
MAINE DOT WIN 022966.00
PROSPECT, MAINE

SITE PLAN
(SHEET 1 OF 2)

SCALE: AS SHOWN
MARCH 2020

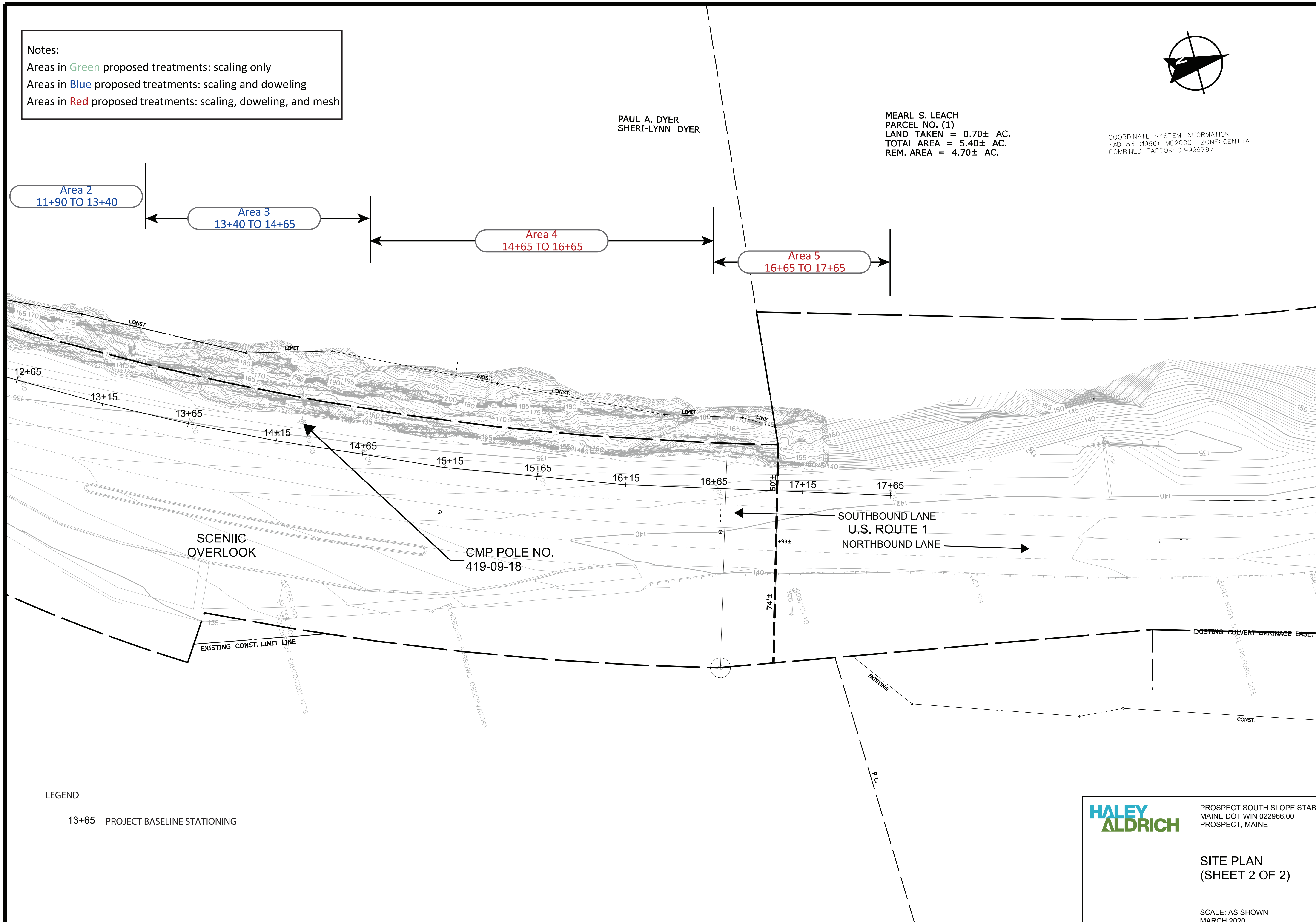
FIGURE 2

Notes:

Areas in Green proposed treatments: scaling only

Areas in Blue proposed treatments: scaling and doweling

Areas in Red proposed treatments: scaling, doweling, and mesh



LEGEND

13+65 PROJECT BASELINE STATIONING

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

HIGHWAY PLANS

WIN
22966.00

SIGNATURE | P.E. NUMBER | DATE

PROSPECT

SITE PLANS

HALEY ALDRICH

PROSPECT SOUTH SLOPE STABILIZATION
MAINE DOT WIN 022966.00
PROSPECT, MAINE

SITE PLAN
(SHEET 2 OF 2)

SCALE: AS SHOWN
MARCH 2020

FIGURE 2