CITY MANAGER'S REPORT

For February 13, 2024

TO: Mayor Tutiakoff and City Council Members
FROM: William Homka, City Manager
DATE: February 13, 2024

- **Genius Star XI:** The Genius Star XI has been at the Unalaska Marine Center (city dock) since January 30, 2024. Technical experts have completed remediation of the damaged energy segments and that team has demobilized. Nothing from the vessel was moved dockside in Unalaska and all cargo remained aboard the ship. The salvage team is continuing their work to secure the cargo for the purpose of getting the ship underway to a confirmed receiving port, which appears to be their original destination in San Diego, California. The community air monitoring effort was demobilized yesterday; all readings taken during the response were normal. Live stakeholder updates have ceased. A final review and inspection of the vessel by the USCG is scheduled for February 9; and Unified Command is working on transit and passage plans for the vessel which they hope to complete by February 12. The vessel should be on its way shortly after that.

- **Training:** We contacted William Dann of Professional Growth Systems and requested a proposal for his services. I've attached his scope of work and terms for your review. It proposes training/discussion among Council and with City Manager and the Mayor to gain agreement on the appropriate roles of each and a plan to improve the working relationships and effectiveness of the team that leads the City into the future. We need to schedule dates when all of City Council will be available to participate.

- **Geothermal Project:** This topic will be discussed at a work session on February 27, 2024. OCCP's request for Amendment 4 of the PPA includes new terms.

- **Power Plan:** Tonight's agenda includes a resolution to approve a contract with Electric Power Systems Inc. (EPS) to study options for adding 15MW of conventional (fossil fuel) generation to existing resources at the Dutch Harbor Power Plant, in another location yet to be determined or a combination of the two. It includes a distribution load flow analysis that evaluates the suitability of the existing distribution system and determine if any upgrades may be required in in conjunction with the proposed power source.

- **City Financial Reports:** The Finance Department will present monthly financials at the 2nd council meeting every month. This change will give the department time to include the prior month's report more timely rather than have a month in between reporting.

- **Power Outage – January 29:** On January 29th at 21:21 a power surge caused the breaker on engine 8 to open, shutting down the engine and putting it into alarm. An investigation by the lineman located a failed switch (Margaret Bay Switch). The Margaret Bay Switch is a 4-way switch that allows power to route through East Point Rd and Airport Beach Rd loop, the City Substation, and controls the City/Unisea Intertie.

- **Rock Rock Slope Hazard Removal Project:** We received R&M's report dated January 31, 2024. I have attached a copy of the report along with some comments from our contractor who performed the hand scaling work for your review.

Currently, our team is in the process of gathering additional information regarding the most suitable alternative to pursue. We understand the importance of ensuring the safety of the Latitude 54 building while also being mindful of cost considerations. To this end, DPW and our consultants are assessing the various options available to us.

It's crucial to acknowledge that there is no one-size-fits-all solution for this project. Each recommendation comes with its own set of advantages and disadvantages. Therefore, we anticipate that the final approach will likely involve a combination of the recommendations.

- **Staffing Update:** Our recruitment firm, Baker Tilley, has 5 applicants for DPU Director and is continuing direct recruitment efforts. The first review of applicants will be made on February 12.

  The tables below summarize the current staffing levels.

Monthly HR Information
January 16, 2023 – February 9, 2024

Type of Action	Number Of	Internal	External
Hires	2	1	1
Pending Hires	2	0	2
Pending Offers	1	NA	NA
Resignations	1	NA	NA
Separations	0	NA	NA

Position Openings

Department	# Of Openings	Notes
Administration	1	HR Mgr
Clerks	0	NA
DPS	4	Police Officer (2), Police Sergeant (2)
DPU	9	Director of Public Utilities, Water Operator, SW Supervisor, SW Op I WW Supervisor, Util Lineman (2), Util Lineman Chief, Apprentice Lineman
DPW	2	City Engineer, Installation Maint Worker
Finance	1	Controller
PCR	4	3 Lifeguards, Rec Coordinator
Planning	1	GIS Admin Replacement
Ports	0	NA
TOTAL	22	

Proposal for City Council Development

Presented to City of Unalaska
February 7, 2024

PROFESSIONAL GROWTH SYSTEMS

Professional Growth Systems
721 Depot Drive
Anchorage, Alaska 99501
www.professionalgrowthsystems.com

This proposal is the result of a series of telephone conversations and email exchanges with the City Manager and Assistant City Manager dating back to December 20, 2023

Summary

The City is seeking training/discussion among Council and with City Manager and the Mayor to gain agreement on the appropriate roles of each and a plan to improve the working relationships and effectiveness of the team that leads the City into the future.

Objectives

Among the results to be achieved from partnering between the City of Unalaska and Professional Growth Systems are the following:

A. An understanding of what each Council member as well as City Manager and Mayor see as needed improvements in governance/leadership of the City

B. Common agreement on the role of the Council vs. management in moving the community forward

C. An assessment of how well the Council is performing on each of the ten major responsibilities of a governing board/Council

D. An understanding of the basic tools needed for effective governance

E. Drafting of a prioritized plan/schedule for accomplishing any development goals defined in the session

Scope of Work

A. Survey Data from Participants

There is an old adage in training that "the learner learns what he wishes to learn, when he wants to and from whom he wants to". In order to assure that the session adds value to the participants, each participant in the training will be interviewed in advance and asked, "What questions do you want answered?", "What outcomes would make spending the proposed time together valuable to you?". A summary report of findings from the interviews will be presented at the beginning of the training session.

B. Supply Pre-Reading

Based on the results from the interviews, participants will be sent via email reading on topics that address the learning objectives.

C. Council/Management Training

A 3-4 hour training session for Council/management representatives to accomplish the following:

- Address questions raised in the interviews
- Reach agreement on role of Council, Mayor and City Manager
- Understand the tools that need to be in place for effective governance
- Complete a self-evaluation of Council performance on the 10 basic responsibilities of a governing board
- As needed, develop a prioritized list of needed improvements

D. Strategic Planning
On the day following the Council training, PGS will meet with the City Manager and others of his choosing to go over elements of a sound strategic planning process and discuss the need for such a process for the City.

Terms and Conditions

PGS agrees to complete the above scope of work in exchange for an investment of $4,900 in professional fees plus travel costs to be billed upon completion of the scope of work.

Acceptance

This proposal is accepted and forms an agreement between the City of Unalaska and Professional Growth Systems, Inc.

For Professional Growth Systems: For City of Unalaska

William M. Dann, Founder

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Anchorage, Alaska 99507
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31 January 2024 R&M No. 3052.02

Peggy McLaughlin, Director
International Port of Dutch Harbor
748 Ballyhoo Road
Unalaska, Alaska 99692

RE: Slope Scaling Site Observation and Mitigation Alternatives - DRAFT
Port of Dutch Harbor, Latitude 54 Building, Unalaska, Alaska

Dear Ms. McLaughlin,

The City of Unalaska and the International Port of Dutch Harbor (Dutch Harbor) contracted R&M Consultants, Inc. (R&M) to provide on-site monitoring and assessment services in support of the rock slope hazard removal project at the Latitude 54 Building at the Port of Dutch Harbor. This first phase of the project included four days of light rock scaling work performed by your contractor Southeast Roadbuilders and which R&M provided on-site observations. The objectives of the rock scaling were previous outlined in R&M's report *Slope Hazard Removal Objectives*[1] and identified priority areas on the slope. This letter presents a summary of our observations made during the scaling activities, along with citing the progress made in reducing risk and identifying the rockfall hazards that remain.

To address the remaining hazard, multiple options for further mitigation are presented. Within that, an alternatives analysis was completed that compares each of the alternatives in terms of benefits versus drawbacks and challenges, coupled with a ranking matrix that scores multiple categories according to relative risk and relative cost. Findings of the alternatives analysis are summarized in **Table B-1** attached in **Appendix B** with conclusions at the end of this report. This focuses on the pending hazard at the south-west corner, however consideration should be made for integrating into future long-term solutions planned for the remainder of the existing rock cut.

SLOPE SCALING - SITE OBSERVATIONS

Scaling of the rock slope was performed by Southeast Roadbuilders between the dates of 04 to 07 December 2023. Scaling was accomplished by hand-operated tooling including pry bars. Scaling initiated in the upper portion of the wedge (identified as WU 1a)[1] and also included its upper corner with the existing backwall cut and the lower portion of the wedge (WL). Scaling was accomplished with the assistance of a 135-foot-reach manlift (see **Photos 1 through 4**, **Appendix A**). Some portions of the upper wedge were not entirely reachable with the manlift. After the reach to the upper wedge was exhausted, scaling from the man lift transitioned to areas at the left side of the cut slope (identified as CSL). Accumulations of rock fragments that were scaled off the face are noted at the base of the slope shown in **Photos 3 and 4**. Scaling activities then switched to roped-access from above the slope and focused on the upper portion of the wedge (WU 1a), as shown in **Photos 5, 6, and 10**. An outline of the areas where scaling was completed and conditions of the slope at the end of scaling activities are shown in **Photos 7 through 10**.

It is important to highlight that a critical joint within the wedge, located at the lower third of the Upper Wedge, was further revealed upon removal of surface rocks during scaling. The critical

[1] R&M Consultants, Inc., Slope Hazard Removal Objectives, Port of Dutch Harbor, Latitude 54 Building, Unalaska, Alaska, dated 05 December 2023.

feature of this joint is that it strikes in an opposing direction normal to the primary sill joint (which serves as base for the wedge, as shown in **Photos 5, 6, and 8, Appendix A**). The continuity of this joint into the slope is unknown; however, in a scenario where this opposing joint continues further across the wedge and/or into the hillside, the joint could create a discontinuity boundary to which the lower third of the upper wedge dislodges independent of the wedge above. The susceptibility of this rockfall at the lower third of the Upper Wedge is viewed as the greatest hazard remaining and should be priority for mitigation.

EXISTING CATCHMENT AND SLOPE GEOMETRY

The existing catchment area at the south-west corner of the building includes 29 to 32 foot separation between the base of the rock cut to the edge of the building, comprised of a relatively flat-bottomed ditch. There is currently a 6-inch-thick concrete wall along the south-west corner and along the backside of the building that is offset by 8.5 feet from the building. The existing concrete wall is 5.5 feet high with a chain link fence fastened above that is an additional 8 feet high. The height of the slope at the top of the wedge is about 70 feet and at the bottom is about 35 feet above grade at the parking lot. The Upper Wedge has a dimension of about 32 feet in the direction of its basal joint and about 35 feet wide at its broadest. The Lower Wedge is another 8 foot dimension below the upper wedge. Depth of the Upper Wedge is impossible to know; based on projection, the depth is estimated 20 to 24 feet at its thickest. The base plane of the wedge is defined by a prominent sill joint that is oriented dipping at about 52° vertically with dip direction of about 46° (in the NE direction). The existing rock cut behind the building dips at about 70° to 75° with dip direction of about 145° (in the SE direction).

There are reports, happening a decade ago, of a "school bus" sized block that dislodged from the face of the 100 to 120 foot high rock cut and damaged the north-west corner of the Latitude 54 building. Subsequent to that event, the north-west corner of the building was notched out and refaced and a concrete barrier wall was added. For comparison of geometry, that concrete wall is 8 feet high with a 30 inch wide footer base (it is unknown how deep the footer is buried or if its keyed), but favorable is the extra width of the catchment ditch that is notably wider at 33 to 51 feet to the wall, compared to 29 to 32 foot separation at the subject south-west corner.

ALTERNATIVES FOR FURTHER MITIGATION

Scaling is considered a successful first step, and further mitigation is recommended for next phase. The lower third of the Upper portion of the Wedge (WU 1a), from the overhang up to the opposing joint, remains the greatest rockfall hazard and is still considered the highest priority. Second to that are any remaining unstable portions of the overall wedge.

A number of possible alternatives for further mitigation, each ranging in form and function, are discussed below, including: a) stabilizing the wedge by rock bolting, b) restraining the rock, c) removal by blasting or mechanical means, and d) building a barrier by various means. Also presented are possible experimental uses of re-purposed tires that could be integrated into a number of barrier systems. Conceptual designs for each of the five alternatives, plus the options for re-purposing tires, are given below for evaluation. Conceptual designs should be considered preliminary and more detailed design and analysis needs to be performed for the preferred alternative(s).

1.0 Alternative 1 – Rock Bolts into the Wedge with Rockfall Netting

This alternative entails installing active rock bolts through the wedge that are drilled and anchored into the rock behind. A detailed design is necessary to determine number, size, and length of anchors. A conceptual configuration would include 4 to 5 primary rock bolts, each installed a minimum of 12 to 15 feet behind the potential failure planes of the wedge. Total bolt length could be on the order of 35 feet, depending upon number and size. Anchor bolts should be high-strength all-thread bars set into cleaned and flushed drill holes that are cement-grouted in place. Grouting should be in two stages with an unbonded length through all or most of the wedge. Rock bolts should have an over-sized bearing plate mated to the face (to transfer load and reduce erosion/rock toppling) and be post tensioned. The purpose of tensioning is to develop normal stresses on the rock joints and thereby engaging inter-block/inter-joint friction and interlock.

Rockfall netting should be integrated into the solution, to protect against smaller sub-block failures caused by fracture frequency within the wedge. Rockfall netting should be comprised of a wire mesh with cable net anchor system that is draped onto the slope. An example product is Tecco Rockfall Drape by Geobrugg. The netting needs to be properly anchored and secured into the slope above the wedge and may also require anchors and cables attached along the sides, depending upon the system. Additional dowels are not necessary to pin the netting onto the face.

1.1 Benefits of: Alternative 1 – Rock Bolts

A properly designed and successfully installed rock bolting system would effectively stabilize the wedge and greatly reduce or eliminate the risk of large block failures. Tensioning the bolts engages inter-block / inter-joint friction. Accompanied with rockfall netting, the system would also be effective at trajectory control, directing small and medium sized blocks toward the existing catchment at the base of the slope. We consider bolting the wedge as the best alternative serving to stabilize the rock, besides removal.

1.2 Drawbacks and Challenges of: Alternative 1 – Rock Bolts

The greatest drawbacks of this alternative are construction difficulties performing work up on the slope and cost. Specifically, it will be challenging to position a drill rig at the face of the wedge to install the anchor bolts. Care must be given not to destabilize sub-blocks during the installation, however this risk can be managed safely during construction. Access with a drill rig above the wedge will also be necessary to install anchors to secure the rockfall netting from above.

2.0 Alternative 2 – Cable Lashing with Rockfall Netting

Alternative 2 is conceptualized as a series of rock anchors set beyond the left and right margins of the wedge and then attached to high-strength cable that is laced between the anchors across the wedge face. The total number of anchors is estimated to be 3 to 4 minimum on each side of the wedge. A double-leg wire-rope-to-anchor system would be required for attaching independent cable lashings. Anchors must be drilled at an angle pitched up into the rock, such that primarily tension forces develop on the anchor (to minimize bending on the tendon), and in order to counter the retraining forces on the cables. Once attached, cables need turnbuckles for tensioning the restraint onto the face. Rockfall netting should be draped over the slope same as Alternative 1. There may become a need or usefulness for a rock fence or rock attenuator integrated at the base of the slope. There is insufficient space for an attenuator as a stand-alone solution.

2.1 Benefits of: Alternative 2 – Cable Lashing

In comparison to Alternative 1, in lieu of rock bolting, the only advantage of cable lashing is allowance for positioning the drill rig to the sides of the wedge and thereby working outside of its trajectory.

2.2 Drawbacks and Challenges of: Alternative 2 – Cable Lashing

Like Alternative 2, the greatest challenge will be positioning a drill rig up on the slope to complete the work and cost. The other critical drawback of this alternative is that this system is completely passive, and despite tensioning the lashing cables, does not add tension forces into the rock mass. Because of that, unlike bolting the wedge as stated in Alternative 1, lashing does not serve to stabilize the rock mass. There would also remain potential for smaller sub-blocks to dislodge and not be restrained by or slip between the cables, depending upon the configuration and frequency of the cable ties. The geometry is not ideal for tensioning anchors and cable. This alternative is not recommended for these reasons.

3.0 Alternative 3 – Blasting

This alternative entails controlled blasting to remove the remaining unstable portions of the wedge. The building needs to be protected from fly-rock and debris during blasting using a temporary barrier and blast mats on the slope. Measures would also need to be taken to ensure no damage to the nearby petroleum tanks. A blasting plan should be submitted for review and approval prior to work. The cavity left by removing the wedge would collect and concentrate surface runoff which may need management system in place.

3.1 Benefits of: Alternative 3 – Blasting

The primary advantage of this alternative is removal of the hazard. Blasting would likely achieve a more complete excavation of the wedge compared to mechanical removal (Alternative 4).

3.2 Drawbacks and Challenges of: Alternative 3 – Blasting

There are several challenges to executing blasting, including: a) challenging to access the rock face with drilling equipment for drilling blast holes, b) during multiple shots, there is risk of further destabilizing the rock/wedge making subsequent shots unsafe or less feasible, c) potential for back shatter or over-breakage into rock mass not intended for removal, and d) significant effort required to temporarily protect the building during blasting. The current contractor has deemed blasting unfeasible & unsafe, that is, without significant effort to protect the building, workers, and blast area. This alternative has a risk for uncontrolled rockfall during construction. There is also a substantial-to-severe risk of destabilizing unintended rock behind the wedge or discovering unfavorable rock conditions at the backwall of the blasted cut; where each of these carries the potential for additional unforeseen mitigation. We view these challenges and risks as fatal flaws.

4.0 Alternative 4 – Mechanical Rock Removal

Alternative 4 entails removing the wedge by various mechanical tooling; such as pneumatic demolition hammers, rock drills, and hydraulic breakers. These methods could be used in combination with splitters or separators, such as chemical expanders, mechanical/hydraulic splitters, or air bags. Personnel, equipment, and the building would need to be protected from rockfall during construction.

Use of heavy equipment would be the most productive way to mechanically excavate rock, however the rock slope is just out of reach for most equipment positioned from the ground, except for a larger sized specialized long-reach excavator with breaker. Therefore, it would require a means to suspend equipment on the slope, such as anchored platforms from above or maybe a crane lift. If not practical, the other option is hand-operated tooling. Given their lower busting energy, hand-operated tooling would be more time-consuming, labor intensive, and potentially less effective at completely removing materials from deeper into the wedge.

The rock mass of greatest hazard and highest priority for removal is the lower half of the Upper portion of the Wedge (WU 1a). This would include removing rock from the wedge at least up to the opposing joint and then cutting that back face to stable form. After removal, condition and stability of the remaining rock needs to be evaluated to determine if additional excavation or mitigation is warranted. Looking up at the wedge from the catchment ditch, there appears to be a few joints at the planar interface between the Lower Wedge (WL) and the Upper Wedge (WU) that could be exploited by splitting.

4.1 Benefits of: Alternative 4 – Mechanical Rock Removal

The primary benefit of Alternative 4 is avoiding the challenges with executing blasting. And would be especially beneficial if mechanical excavation could somehow be conducted with specialized heavy equipment from the ground. There is also less risk of disturbing the rock mass beyond the wedge with these directed methods (as opposed to opportunity for over-breakage or back shatter during blasting). By excavating smaller portions of rock at a time there is lower risk of striking the building with debris (compared to blasting), especially if protected properly. Removing most or all of the wedge, including the lower half of WU, would effectively eliminate or greatly reduce the hazard. There is an opportunity to use stacked tire bales (see option 6 below) as temporary and permanent barrier.

4.2 Drawbacks and Challenges of: Alternative 4 – Mechanical Rock Removal

There is a moderate potential for uncontrolled rockfall during construction, albeit of smaller size if managed, and risk of inadvertently destabilizing unintended rock. This alternative requires measures to protect the building during construction. Mechanical excavation by hand-operated tooling is labor intensive and may not remove as much rock as heavier equipment would.

5.0 Alternatives 5a & 5b – Barriers: Concrete Wall or MSE Embankment

Alternative 5a entails constructing a concrete wall to serve as a barrier along the corner of the building. The wall needs to be tall enough to block the trajectory and bouncing of rockfall and have strength to withstand rockfall impact. The best configuration would be an L-shaped wall built immediately inside and same alignment as the existing wall (which should be left in-place) and as near the building as possible to allow the widest catchment ditch. The required length of the wall is estimated to be roughly 45 feet. The necessary wall height should be determined based on a detailed rockfall analysis; but for planning purposes, the required height is estimated to be about 14 to 15 feet high at its crest and can tapper toward its edges. The wall section is envisioned similar to a cantilever retaining wall and with toe slab and counterforts. The thickness of the wall needs to be determined by structural design. Concrete volume is estimated to be about 50 CY.

Stackable interlocking pre-cast concrete blocks could also be considered; however the higher wall needed here would require a double-wide stack for stability. And therefore, a cast-in-place wall this high is a more efficient use of concrete.

A similar solution, Alternative 5b includes forming a barrier using a two-sided mechanically stabilized earth (MSE) embankment. An example reinforced embankment includes a gabion-faced MSE wall on both sides and the core of the embankment is comprised of layers of granular fill that is reinforced horizontally with geosynthetic fabric and where the geosynthetic wraps back into the next layer of reinforced fill. Both sides of the wall are faced with gabion baskets that have integral tails that are also tied into the horizontal reinforcement. Reinforcing the core fill materials with the wrapped geosynthetic layers makes the embankment intrinsically stable, such that stability is maintained independent of facing, in case the facing materials suffer damage from rock fall. Damage to the facing could be repaired afterwards. Smaller sized gabion baskets typically 1.5 foot square are recommended for this application. As with the concrete wall, the embankment height should be determined based on a detailed rockfall analysis, but is estimated the same 14 to 15 feet. The reinforced embankment prism is conceptually 9 foot minimum base width, slightly battered faces at 1H:6V, and about 5 foot minimum width at its top. The wall should be positioned as far as possible away from the base of the rock slope to maintain as much catchment width as possible and positioned beyond the potential impact zone or a minimum 14 foot separation.

5.1 Benefits of: Alternatives 5a & 5b – Concrete Wall or MSE Embankment

The primary benefit of placing a barrier wall is avoiding the construction difficulties associated with mitigation or removal work happening up on the rock slope. Secondarily, construction is relatively straight-forward for the various walls.

The concrete wall (Alt. 5a) has the benefit over the MSE embankment (Alt. 5b) due to its narrower profile, which allows for more catchment space at the base of the slope that is more effective at protecting the building. The MSE Wall (Alt. 5b) has the benefit over the concrete wall (Alt. 5a) given its flexibility, greater mass, and potential cost savings. Both wall types also have the potential benefit of integrating re-purposed tires into the design, as discussed in sections below.

5.2 Drawbacks and Challenges of: Alternative 5a & 5b – Concrete Wall or MSE Embankment

The main drawback to building a barrier is that it only serves to protect the building, but the rockfall potential remains unmitigated. Cost could be an impediment for the concrete wall, which is expected to be more than the embankment.

6.0 Experimental Use of Old Tires

We understand that the City Landfill has a surplus of waste tires. Re-purposing these tires is evaluated here as a potential cost-effective, albeit unsightly, means to enhance mitigation measures and/or provide a rockfall barrier. It is understood there is an abundance of loose tires of various sizes, and also the ability to form bales of tires by using a hydraulic press to compress 50 to 70 tires and then wrap the bundle with ties. The finished dimensions of the bales are roughly 5 x 4 x 2.5 feet. Admittedly, we offer no direct experience nor are we aware of any use on civil projects in Alaska. However, Colorado Department of Transportation (CDOT) completed a 2005 feasibility study in response to growing interest in the utilization of recycled tire bales for use in civil transportation applications, concluding that tire bales are viable and effective as use for fill embankments and in applications as rockfall barriers. We view their use as a viable cost-effective measure to utilize local materials and enhance the barrier alternatives.

Internal or external stability of these wall configurations have not been evaluated here. Internal interface shear and frictional resistance of the compiled bales is unknown, but is expected to be lower compared to gravel fill in part due to its lower unit weight (less than a third), but should be sufficient with proper design. Defining physical and engineering properties of the stacked bales would be required to assess a stable configuration. Behavior of the stacked bales in response to rockfall strikes is also unknown, but is expected to be favorable. For these reasons, their use should be considered experimental. Trial configurations could be built and tested on the grounds of the landfill for evaluation. All tie wires should have sufficient integrity to withstand handling and construction and be protected from corrosion to maintain long-term strength over their service life. Potential environmental issues, such as possible leachate into surface waters, have not been evaluated here. Nor has there been any consideration of any fire protection measures related to ignitability and flammability of tire bales.

Experiment 6a – Tire Bales Stacked In Front of a Concrete Wall

This conceptual configuration includes a single row of stacked bales placed in front of a concrete wall barrier with separation. These could be added as an impact buffer to Alternative 5a to reduce impact energy onto the wall and thereby reduce strength demand on the concrete. Tire bales can be placed flat in a "brick fashion" with their least dimension (2.5 feet) vertically and each layer staggered to offset joints. The single row of bales would be on the order of 5 bales tall, 50 foot base length, and tapered down at 1H:1V steps at each end. The total number of bales is estimated to be 45.

Experiment 6b – Tires Used as Impact Face of MSE Wall

Potential use of tires could be integrated into the MSE embankment barrier (Alt. 5b). The first scenario could entail using a single stack of tire bales to form the front impact side of the reinforced berm, which are built integrated with the layers of geosynthetic reinforced earthen fill described in Alternative 5b. The facing on the opposite side could remain as reinforced gabion baskets, but where the basket heights are adapted to match the (2.5 foot) layering heights of the bales. Nominal dimensions could be 15 feet height, 13 feet wide at the base, and about 9 feet wide at the top. The total number of bales is estimated to be 45. Another scenario is building the MSE wall as described in Alternative 5b, but enhanced by adding individual tires in stacks that are woven and lashed together in front of the MSE wall to dissipate energy and protect the facing from damage. This latter scenario is not evaluated separately when comparing alternatives.

Experiment 6c – Tire Bales Stacked as Stand-Alone Barrier

It may be possible to stack tire bales in a stable fashion to serve as a stand-alone barrier, in lieu of Alternatives 5a or 5b. A concept section would include two rows of stacked bales built as a trapezoidal prism with the inner core space between stacks filled with angular gravel fill that is reinforced with geosynthetics. The stacks could be six bales high or 15 feet, have a widened base at least 15 feet wide, 10 feet wide or two bales across at the top, and battered faces no steeper than 1H:6V. The total number of bales is estimated to be 100. Any fill materials exposed at the ends of the wall would need to be contained by layered geosynthetic fabric and the fabric covered. Important to reiterate is that internal and external wall stability has not been evaluated here and is necessary if selected. Options 6a and 6b are preferred over 6c.

Experiment 6d – Tire Bales Stacked as Temporary Protection During Rock Removal

Stacks of tire bales could also be considered as a temporary protective barrier for the building during construction.

ALTERNATIVES ANALYSIS

To facilitate decision making, an alternatives analysis was completed that compares each of the options in terms of benefits versus drawbacks and challenges, coupled with a ranking matrix that scores each across multiple categories according to relative risk and relative cost. The alternatives analysis includes seven categories subject to ranking (defined below) and each received a score based on relative scale 1 to 5 (better to worse, defined below). Findings of the alternatives analysis are presented in **Table B-1** (**Appendix B)** and conclusions are given at the end of this report.

Seven categories subject to ranking include:

- Two categories for post-construction risk, including:
  - Relative measure of **rockfall hazard mitigated**, and
  - Degree of **protection provided for the building** and **life / safety**.
- One category for **relative cost**.
- Four categories for risk during construction, reflecting its complexity, include:
  - **Constructability**,
  - Relative **risk of uncontrolled rockfall** during construction,
  - **Construction life / safety**, and
  - **Unintended destabilizing of rock** behind the targeted wedge & unforeseen additional mitigation.

Relative scoring for risk and cost ranged between 1 and 5 defined as follows:

- **1** = **Lowest** risk or cost
- **2** = **Minor** risk or cost
- **3** = **Moderate** risk or cost
- **4** = **Substantial** risk or cost
- **5** = **Severe** risk or cost or fatal flaw

Total scores are a collective tally from each category, with the first three categories (post-construction risk and cost) receiving a priority weighted factor of 1.5 and the other four categories (construction risk) allocated a weighting factor of 1.0. Important to note is that all costs are relative and actual dollar costs for construction have not been estimated.

CONCLUSIONS

Conclusions of the alternatives analysis are summarized in **Table 1** below. In our view, removal of the rock by mechanical methods (**Alternative 4**) is the best alternative to **reduce or eliminate the hazard**, while also not being overly challenging for construction. This is especially true if removal can be performed by using specialty equipment to reach from the ground. Bolting the wedge (**Alternative 1**) is the **best and only recommended means to stabilize** the rock in-place. It is our opinion, building a barrier using tires bales as the impact face of an MSE embankment (**Option 6b**) provides the **highest ratio of effectiveness to cost**. However, none of the barrier alternatives stabilize or remove the looming rock overhead.

Table 1: Conclusions of Alternatives Analysis

Alternative	Conclusions	Total Score
Alternative 1 – Rock Bolts into the Wedge with Rockfall Netting	• **Best method to stabilize rock in-place.** • High Relative Cost. • Moderately challenging construction.	23
Alternative 2 – Cable Lashing with Rockfall Netting / Rock Attenuation	• **Not Recommended**. • Passive system does not stabilize wedge. • Highly challenging construction and high relative cost.	28
Alternative 3 – Blasting	• Substantial challenges to executing blasting. • Greatest potential for destabilizing unintended rock. • Current contractor deemed blasting unfeasible / unsafe. (without significant measures of protection). • **Concluded to have fatal flaws**.	27
Alternative 4 – Mechanical Rock Removal	• **Best alternative to reduce the rockfall hazard** while also not being overly challenging or risky for construction. • Especially beneficial if mechanical excavation could somehow be conducted with specialized equipment from the ground (e.g. large long-reach excavator with breaker)	23
Alternative 5a – Barrier: Concrete Wall	• Amongst all barrier types, the concrete wall is most effective at protecting the building. • See option 6a for adding impact face. • All barrier types do not mitigate stability of the rock, yet • Are straight-forward to build.	21
Alternative 5b – Barrier: MSE Embankment	• High effectiveness to cost ratio. • See option 6b for adding impact face. • All barrier types do not mitigate stability of the rock, yet • Are straight-forward to build.	20
Option 6a – Tire Bales Stacked In Front of a Concrete Wall	• Cost effective and locally available. • Impact buffer reduces impact energy and wall thickness. • All barrier types do not mitigate stability of the rock, yet • Are straight-forward to build.	20
Option 6b – Tires Bales Used as Impact Face of MSE Embankment	• **Highest effectiveness to cost ratio**. • Cost effective and locally available. • All barrier types do not mitigate stability of the rock, yet • Are straight-forward to build.	18
Option 6c – Tire Bales Stacked as Stand-Alone Barrier	• Cost effective and locally available. • Widest base (~15 ft) takes up key catchment space. • Not preferred over options 6a and 6b. • Experimental and unproven. Stability needs verifying.	19
Option 6d – Tire Bales Stacked as Temporary Protection During Rock Removal	• Various forms and uses are to be determined. • Cost effective and locally available. • Experimental.	n/a

CLOSURE

The information presented in this report is based on our understanding of the proposed project, our site observations, and the other pertinent information listed herein. Because subsurface characteristics can change significantly within a given area, and with the passing of time, the possibility exists that important conditions not disclosed by this investigation may be discovered on the site during construction. Should this situation occur, the influence of the new information on the design aspects should be evaluated without delay.

R&M Consultants, Inc. performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of study described within.

We appreciate the opportunity to perform this geotechnical investigation. Should you require further information concerning the investigation or this report, please contact us at your convenience.

Very truly yours,

R&M CONSULTANTS, INC.

DRAFT NO SIGNATURES

Travis Ross, PE
Senior Geotechnical Engineer

ATTACHMENTS: Appendix A: Photograph Log.

Appendix B: Table B-1: Summary of Alternatives Analysis for Further Mitigation

Photo 1	**Photo 2**
	
Description: Day 1 Scaling Operations at WU 1a Via Manlift Photo Date: Dec 05, 2023	**Description:** Day 1 Scaling Operations at WU 1a Via Manlift Photo Date: Dec 05, 2023

Photos 3a & 3b

Description: Scaling Progress and Accumulations of Rocks Scaled Off the Face (WU 1a, CSL) After Day 1.
Photo Date: Dec 05, 2023

Photos 4a & 4b

Description: Scaling Progress and Accumulations of Rocks Scaled Off the Face (WU 1a, CSL) After Day 1.
Photo Date: Dec 05, 2023

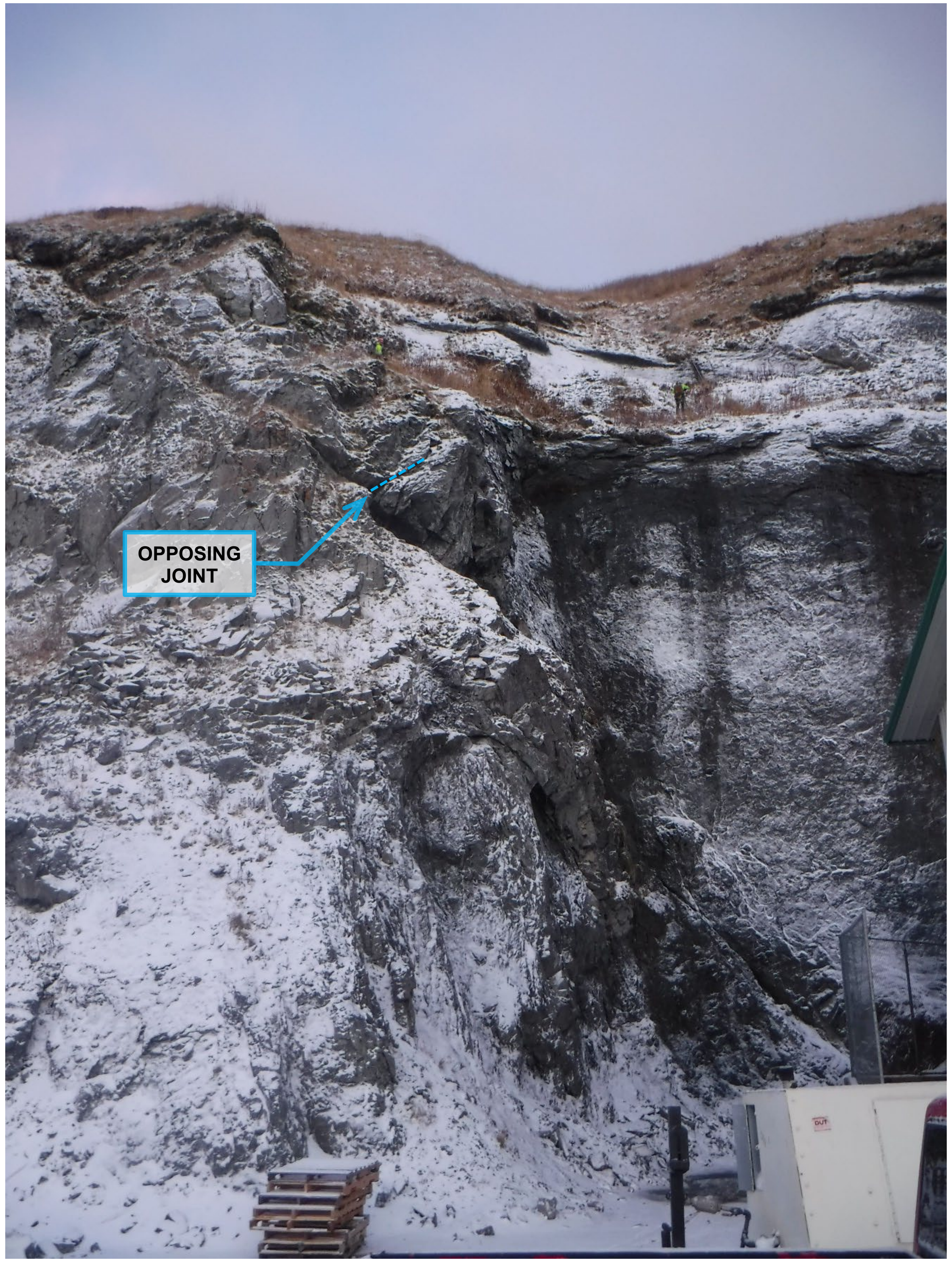
Photo 5	Photo 6
	
Description: Scaling Progress Photo Date: Dec 07, 2023	**Description:** Scaling Progress Upper Wedge Photo Date: Dec 07, 2023

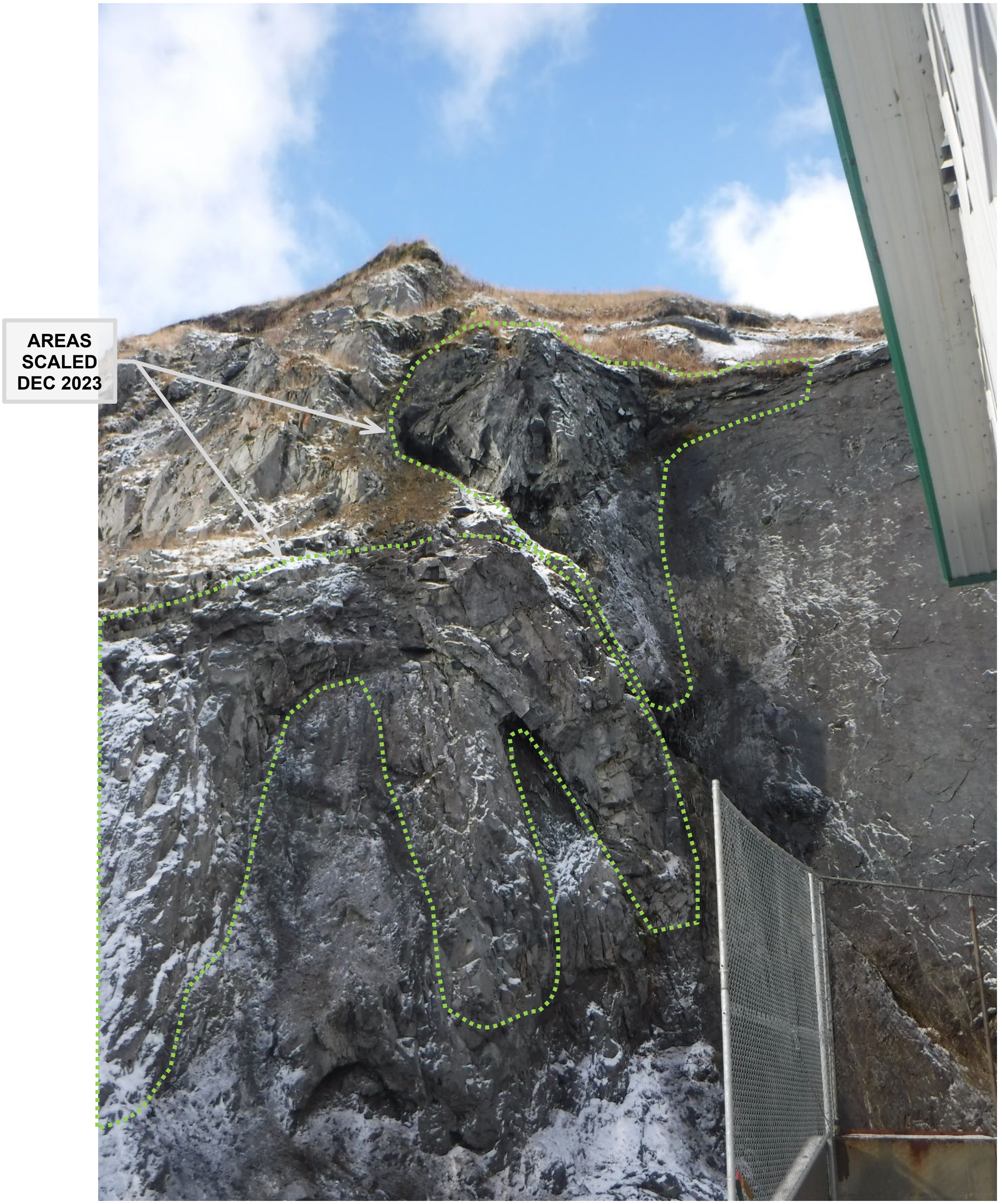
Photo 7	Photo 8
	 
Description: Condition and Outline of Completed Scaling Photo Date: Dec 07, 2023	**Description:** Condition and Outline of Completed Scaling Photo Date: Dec 07, 2023

Photo 9	Photo 10
	
Description: Condition and Outline of Completed Scaling Photo Date: Dec 06, 2023	**Description:** Condition and Outline of Completed Scaling Photo Date: Dec 07, 2023

TABLE B-1: SUMMARY OF ALTERNATIVES ANALYSIS FOR FURTHER MITIGATION - DRAFT
PORT OF DUTCH HARBOR, LATITUDE 54 BUILDING, UNALASKA, ALASKA

Alternative	Features	Benefits	Drawbacks and Challenges	Comments	Ranking Categories and Score							Total Score
					Post-Construction Risk		Cost	Construction Phase Risk				
					Rockfall Hazard Mitigated	Building Protection & Life/Safety	Relative Cost A	Constructability	Uncontrolled Rockfall During Construction	Construction Life/Safety	Unintended Destabilizing Rock / Additional Mitigation B	
					Respective Scores Weighted by Factor of 1.5 in Total			Respective Scores Weighted by Factor of 1.0 in Total				
Alternative 1 – Rock Bolts into the Wedge with Rockfall Netting	• 4 to 5 primary bolts. • Bolts installed 12 to 15 feet behind the potential failure planes of the wedge. • Total bolt length could be on the order of 35 feet. • High-strength all-thread bar grouted in place. • Rockfall netting draped over the slope (e.g. Tecco Rockfall Drape by Geobrugg).	• Stabilizes the wedge, greatly reducing risk of large blocks. • Tensioned bolts engaging inter-block/inter-joint friction. • Rockfall netting effective at trajectory control of small and medium sized blocks.	• Construction difficulties performing work up on the slope. Specifically, it will be challenging to position a drill rig at the face of the wedge to install the anchor bolts. • Care must be given not to destabilize sub-blocks during construction. • Access needed above the slope for anchoring rockfall netting.	• **Best method to stabilize rock in-place**.	2	2	4	3	3	3	2	23
Alternative 2 – Cable Lashing with Rockfall Netting / Rock Attenuation	• Estimated 4 anchors on each side of the wedge. • High-strength cable that is laced between the anchors across the wedge face. • Rockfall netting draped over the slope. • May need rock fence or rock attenuator integrated at base of slope.	• Only advantage of cable lashing (instead of rock bolting Alt. 1), is allowance for positioning the drill rig to the sides of the wedge and thereby working outside of its trajectory.	• Construction difficulties performing work up on the slope. • Passive system does not add tension forces into the rock mass, therefore does not stabilize the wedge. • Only restrains larger intact blocks, medium and smaller blocks still have potential to slip between cables. • Geometry not ideal for tensioning anchors and cable.	• **Not Recommended**. • Passive system does not stabilize wedge.	4	3	4	4	3	2	2	28
Alternative 3 – Blasting (in combination with protecting the building)	• Controlled Blasting	• Primary advantage is removal of the hazard. • Blasting achieves more complete excavation of the wedge, compared to mechanical removal (Alt. 4).	• Accessing the rock face with drilling equipment. • Multiple shots there is risk of further destabilizing the rock/wedge making subsequent shots unsafe or less feasible. • Potential for back shatter or over-breakage into rock mass not intended for removal. • Significant effort required to temporarily protect the building during blasting.	• Current contractor **deemed blasting unfeasible / unsafe**, without significant effort to protect the building, workers, and blast area.	2	2	3	3	4	4	5	27
Alternative 4 – Mechanical Rock Removal (in combination with protecting the building)	• Rock excavation by various mechanical tooling; pneumatic demolition hammers, rock drills, and hydraulic breakers. • Chemical or mechanical/hydraulic splitters or air bags. • Specialized heavy equipment from the ground, such as: long-reach excavator with breaker or crane assist. • Or hand-operated tooling suspended on the slope.	• Primary benefit is avoiding the challenges with blasting. • Lower risk of uncontrolled rockfall and destabilizing unintended rock during construction, compared to blasting. • Especially beneficial if mechanical excavation could somehow be conducted with specialized equipment from the ground (e.g. large long-reach excavator with breaker). • Removing the wedge greatly reduces the hazard.	• Moderate potential for uncontrolled rock fall during construction. • **Requires measures to protect the building during construction.** • Mechanical excavation by hand-operated tooling is labor intensive, and may not remove as much rock as heavier equipment.	• Best alternative to **reduce the rockfall hazard** while also **not being overly challenging or risky** for construction. • Opportunity to use stacked tire bales (6a) as barrier.	2	2	3	3	3	3	3	23
Alternative 5a – Barrier: Concrete Wall	• L-shaped wall at corner of the building. • Height ~15 ft. • Length ~45 ft. • Wall thickness to be determined based on structural design. • Cantilever wall with toe slab and counterforts. • Estimated ~50 CY concrete.	• Primary benefit is avoiding the construction difficulties associated with work happening up on the rock slope. • Relatively straight-forward construction. • Concrete wall has narrower profile than MSE embankment (Alt. 5b) allowing for more catchment space at the base of the slope.	• The main drawback to building a barrier is that it only serves to protect the building, but the rockfall potential remains unmitigated.	• Opportunity to use stacked tire bales (6a) as impact buffer. • **Amongst all barrier types, Concrete Wall is most effective at protecting the building**.	4	3	3	2	1	2	1	21
Alternative 5b – Barrier: MSE Embankment	• Same height, length, and configuration as concrete wall. • Est. min. dim. 15 ft height, 9 ft width at base, 5 ft at top, and 45 ft length. • Gabion-faced MSE Wall, battered faces. Or other facing options. • Core is gravel fill reinforced with layers of geosynthetic fabric wrapped behind gabion.	• Same as Alt. 5a. • MSE Wall has the benefit over the concrete wall (Alt. 5a) given its flexibility, greater mass, and potential cost savings. • Locally available fill materials. • Internal reinforced core of embankment is intrinsically stable, in case of damage suffered to the facing.	• Same as Alt. 5a. • Width of MSE reduces catchment space for rockfall impact, and may hinder equipment access for cleanout.	• Opportunity to use stacked tire bales (6b) as impact buffer. • **High effectiveness to cost ratios, along with Experiment 6b**.	4	3	2	2	1	2	1	20
Experimental Options 6 – Use of Re-Purposed Tires:	• Tire bales roughly 5 x 5 x 2.5 ft (~50 to 70 tires hydraulically pressed then wrapped w/ cable ties).	• Cost effective. • Locally available materials and methods.	• **Performance, behavior, & stability unknown/unproven**.	• CoDOT feasibility report=> viable and effective. • Case study research needed to evaluate behavior during impact and engineering parameters. • Trial configurations could be built and tested on the grounds of the landfill for evaluation. • **Experiment 6b provides highest effectiveness to cost ratio.** • **6a and 6b are preferred over 6c**.	--	--	--	--	--	--	--	--
6a – Tire Bales Stacked In Front of a Concrete Wall (Integrated with Alt. 5a)	• Tire bales placed to augment Alt. 5a. • Single stack, 5 bales tall, placed in a "brick fashion". • 50 foot length. • Roughly 45 bales.	• Offers **impact buffer to reduce impact energy** onto the wall and thereby **reduce strength demand on the concrete and reduce wall thickness**. • No specialized equipment. Local materials & contractor. • Provides adequate protection for building.	• Experimental, unproven. • Rockfall hazard remains unmitigated.		4	2	3	2	1	2	1	20
6b – Tires Bales Used as Impact Face of MSE Embankment (Integrated with Alt. 5b)	• Single stack of tire bales on impact side of the MSE reinforced embankment. Gabion-faced non-impact side. • Built integrated with the layers of geosynthetic reinforced embankment described in Alt. 5b. • Est. min. dim. 15 ft height, 13 ft wide base, 9 ft at top, and 45 ft length. Roughly 45 bales.	• Cost effective. • No specialized equipment. Local materials & contractor. • Provides adequate protection for building.	• Experimental, unproven. • **Internal and External stability needs to be verified**. • Behavior of tire bales in this application unknown. • Wide base (13 ft) takes up catchment space. • Rockfall hazard remains unmitigated.		4	2	2	2	1	2	1	18
6c – Tire Bales Stacked as Stand-Alone Barrier	• Two rows of stacked bales built as a trapezoidal prism. • Inner core filled with angular gravel fill reinforced with geosynthetics. • Est. min. dim. 15 ft height, 15 ft wide base, 10 ft at top (two bales wide), and 50 ft length. • Roughly 100 bales.	• Cost effective. • No specialized equipment. Local materials & contractor. • Provides adequate protection for building.	• Experimental, unproven. • **Internal and External stability needs to be verified**. • Behavior of tire bales in this application unknown/ unproven. • **Widest base (~15 ft) takes up key catchment space**. • Rockfall hazard remains unmitigated.		4	3	1	3	1	2	1	19

NOTES: A) Costs are relative. Estimated actual costs for construction were not completed for this exercise.
B) Unintended destabilizing of rock refers to inadvertently altering the rock mass behind the targeted wedge. Also encompasses the potential for poor rock conditions at the backwall of the rock cuts. Each scenario could necessitate unforeseen additional mitigation.
C) Lower total score represents better ranking. Weighting factors above unity reflect priority categories and also consider that construction risk was discerned into multiple categories.

KEY:						
Relative Risk:	1 = Lowest Risk	2 = Minor Risk	3 = Moderate Risk	4 = Substantial Risk	5 = Severe Risk / Fatal Flaw	Lower = better.
Relative Cost:	1 = Lowest Cost	2 = Minor Cost	3 = Moderate Cost	4 = Substantial Cost	5 = Severe Cost / Fatal Flaw	