



April 10, 2024

Attachment E

Kulshan Community Land Trust
1715 C Street
Bellingham, WA 98225

SUBJECT: Coal Mine Hazard Evaluation for a Subdivision & Residential Improvements
2912 Birchwood Avenue (Parcel 380223 562531)
Bellingham, Washington

Dear Dean Fearing:

This report presents the results of our coal mine hazard evaluation for the proposed subdivision and associated residential improvements to be located at the above-referenced address. Our services were completed in general accordance with our proposal dated August 8, 2022.

PURPOSE

We understand that there are plans to subdivide the 2.8 acre property located at 2912 Birchwood Avenue in Bellingham, Washington into eight residential lots and a 2.07 acre Tract A. The project



The photo above was taken from Birchwood Avenue and faces to the northeast toward the southern end of the site.

also includes constructing four single-family buildings that contain two primary units and two accessory dwelling units (ADU) per building, plus an additional two Americans with Disabilities Act (ADA) residences, for a total of eighteen units. New driveways, parking areas, and stormwater management facilities are also planned for the development. The northwestern portion of the property will be used for the City Sprouts farm. Please refer to the Vicinity Map (Figure 1) for the approximate location of the project site and the Site Plan (Figure 2) for the locations of the proposed improvements.

The project site is located above the Bellingham Coal Mine (Bellingham No.1 Mine) shown on the City of Bellingham’s Geologic Hazards Map and therefore may be at risk from subsidence or other potential mine hazards. The purpose of our evaluation was to identify any mine hazard areas, as defined by Bellingham Municipal Code (BMC) 16.44.420, within the vicinity of the project site, to evaluate potential risks and recommend appropriate mitigation, if necessary, to prevent adverse impacts to life or property.

BACKGROUND

In 1984, Tetra Tech, Inc. performed a mine hazard study titled *Final Report Bellingham Abandoned Mine Land Survey* for the United States Department of Interior, Office of Surface Mining. The purpose of their evaluation was to identify and evaluate all potential hazards to life, health and property as a result of underground coal mining in the Bellingham area. Tetra Tech’s study included evalua-

tions of the Sehome Mine (Bellingham Bay Mine) and the Bellingham No. 1 Mine. The subject property is located above the Bellingham No. 1 Mine.

According to the Tetra Tech report, the Bellingham Coal Mine Company operated the Bellingham No. 1 Mine from 1918 until 1955 and produced over 5.5 million tons of coal. The mine entries are at an elevation of approximately 94 feet above sea level and are located approximately 1/4 mile to the northeast of the Birchwood Avenue and Northwest Avenue intersection. The entries were backfilled upon closing the mine and are currently covered by a parking lot and shopping center. The coal seam has an average thickness of approximately 14 feet and approximately 8 to 9 feet of it was mined. This coal seam dips down generally to the southwest at approximately 10 degrees down to a maximum depth of approximately 1,000 feet below sea level. It is estimated that there are approximately 200 to 300 feet of unconsolidated glacial deposits that overlie the coal-bearing Chuckanut Formation bedrock. Drilling and blasting were used to mine until that technique was replaced by continuous miners in 1952. The Bellingham No. 1 Mine was developed using a bord and pillar configuration. Miners would extract the coal through tunnels (bords) and the coal between the bords would act as pillars to hold up the roof. The outer pillars could then be mined to control the collapse of the roof.

There is only one known case of subsidence above the Bellingham No. 1 Mine that caused damage to houses. A 2.4 acre area approximately centered on the Maplewood Avenue and Walnut Street intersection experienced settlement issues that included large cracks and fissures, heaving of pavement and damage to several houses on April 22, 1930. Tetra Tech proposed that the mine workings in this area may have been too close to the subcrop (contact between the bedrock and overlying glacial deposits) which caused eventual subsidence from roof collapse and glacial materials flowing into the mine.

The mine workings are at depths ranging from approximately 700 to 760 feet below the elevation of the project site, and the area of historic subsidence is approximately 3/4 mile to the east-southeast of the site. Please refer to the Mine Hazard Map (Figure 3) to review the approximate location of the subsidence near the Maplewood Avenue and Walnut Street intersection.

SITE GEOLOGY

According to the *Geologic Map of Western Whatcom County, Washington* (Easterbrook, 1976), the central and southern portions of the subject property are mapped as Outwash Sand and Gravel (Qso) of the Sumas Stade. This soil unit is a former glacial outwash plain consisting of gravel with cobbles and boulders near the Canadian border and grades southwestward to sand near Lynden. Outwash Sand and Gravel deposits are generally well-sorted and stratified with a unit thickness that may exceed 50 feet.

The northern portion of the property is mapped by Easterbrook as Bellingham Drift (Qb) of the Everson Interstade. Bellingham Drift is described to consist of blue-gray, unsorted, unstratified, pebbly, sandy silt and pebbly clay, and locally contains marine mollusks and wood. Bellingham Drift was derived from rock debris melted out of floating ice and deposited on the sea floor, and has a maximum thickness of approximately 70 feet. Outwash Sand and Gravel deposits overlie the Bellingham Drift deposits.

The Bellingham No. 1 Mine followed a coal seam within Chuckanut Formation (TKc) bedrock of the Paleocene and Upper Cretaceous. The Chuckanut Formation generally consists of sandstone, con-

glomerate, shale and coal deposits, is strongly folded, and originated as alluvial flood plain deposits which may have accumulated to more than 10,000 feet in thickness.

Easterbook identified at least three soil units between the Bellingham Drift and the Chuckanut Formation bedrock. Deming Sand (Qd) of the Everson Interstade lies below Bellingham Drift and consists of brown, stratified, well-sorted, medium to coarse sand with occasional layers of silt, clay and gravel, and has a unit thickness of approximately 30 feet. Kulshan Drift (Qk) of the Everson Interstade lies below Deming Sand and consists of blue-gray, unsorted and unstratified mixture of sand, silt, clay and pebbles, and has a unit thickness ranging from approximately 15 to 25 feet. Vashon Till (Qvt) of the Vashon Stage lies below Kulshan Drift and consists of a compact, poorly sorted matrix of silt, clay and sand with occasional pebbles and cobbles, and has a unit thickness ranging from approximately 10 to 30 feet.

SURFACE OBSERVATIONS

At the time of our site investigation on October 26, 2022, the southern portion of the property was developed with two buildings, an old concrete foundation and concrete driveway/parking areas. The



The photo was taken from the central portion of the property and faces to the north-northeast.

remaining portions of the property were undeveloped and included the City Sprouts gardens. The adjacent properties included residential development. Site vegetation within the undeveloped areas consisted of scattered trees, shrubs, blackberries and grass. The topography within most of the property appeared to slope down generally to the southeast at grades estimated to range from approximately 3 to 8 percent. The far southern portion of the property was flatter with grades typically less than 2 percent. Surface water was not observed on the property during our fieldwork.

We did not observe any obvious evidence of subsidence within the vicinity of the project site based on our fieldwork or review of aerial photos and Light Detection and Ranging (LiDAR) imagery. Geomorphic features that could indicate the presence of subsidence may include but are not necessarily limited to: sinkholes; subsidence troughs and basins; portal collapse; cracks and fissures; linear sinks; and hummocky or uneven terrain (Johnson, 2013). In addition, we did not observe any large settlement cracks in the existing building foundations or road surface.

CONCLUSIONS

Based on the results of our evaluation, it is our opinion that there appears to be a low potential for subsidence from the Bellingham No. 1 Coal Mine to adversely affect the proposed improvements.

Bellingham Municipal Code (BMC) 16.55.410 states that, “*geologically hazardous areas include areas susceptible to erosion, landslide, rock fall, subsidence, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard.*”

The subject property is located above the Bellingham No. 1 Mine and therefore lies within a potential mine hazard area. According to BMC 16.55.420, a potential mine hazard area is defined as follows:

Mine hazard areas are those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings. Specific areas of known and suspected historical mining activity and hazards include:

1. Areas depicted as coal mine hazard areas within the Geologic Hazard Areas Map Folio, Bellingham, Washington, 1991. [Ord. 2016-02-005, 28; Ord. 2010-08-050; Ord. 2008-04-037; Ord. 2005-11-092].

Please refer to the Mine Hazard Map (Figure 3) for the approximate locations and elevations of the mine workings for the Bellingham No. 1 Mine, entrances, subcrop line, and the approximate area of historic subsidence at the Maplewood Avenue and Walnut Street intersection. The 2007 City of Bellingham's Coal Mine Plan Layout and Depth Profile Map was used for the base map.

The Tetra Tech report includes a subsidence analysis used to develop Subsidence Classification Maps that identify zones of potential subsidence. Their subsidence analysis concluded that most of the Bellingham No. 1 Mine is stable. They identified two areas of possible subsidence: 1) mine areas which can have glacial till in-wash into the mine; and, 2) mine areas of possible pillar instability. The mine areas which can have glacial till in-wash were determined by including any area of the mine that approaches the subcrop, areas where the solid rock overburden is less than the estimated variation in glacial till thickness, and areas where the solid rock overburden is less than the pressure arch height. The mine areas defined by possible pillar instability were determined by an analysis that showed the pillars not capable of supporting the overburden (depths greater than 790 feet). More than one pillar would need to fail in this area to cause surface disturbance.

Based on our review of Tetra Tech's Subsidence Classification Maps, it appears that the project site is mapped within a 'Mine Area of Possible Pillar Instability'. This is an area where Tetra Tech's analysis showed that the pillars are not capable of supporting the overburden; however, it would require the failure of more than one pillar for surface disturbance to occur.

The project site does not appear to lie within a 'Mine Area Which Can Have Glacial Till In-Wash into Mine' or within 'Surface Areas of Possible Property Damage Due to Till In-Wash', or within a 'Surface Area Affected By Till In-Wash (No Property Damage Expected)'.

It is our opinion that the construction of the proposed residential development is feasible because there appears to be a relatively low risk of damage and low risk to life from the Bellingham No. 1 Coal Mine based on the following observations:

1. The only known case of historic subsidence above the Bellingham No. 1 Mine that damaged houses is located approximately 3/4 mile to the east-southeast of the site at the Maplewood Avenue and Walnut Street intersection.
2. We did not observe any geomorphic indicators of subsidence within the vicinity of the project site.
3. The Tetra Tech report does not map the project site within areas that are at a significant risk of being adversely affected from subsidence resulting from glacial till in-wash.

4. Although the project site is mapped within a 'Mine Area of Possible Pillar Instability', Tetra Tech defined these areas using an analysis that showed the pillars not capable of supporting the overburden (depths greater than 790 feet). The mine workings at the site are shallower than 790 feet, with depths ranging from approximately 700 to 760 feet. In addition, it would require the failure of more than one pillar for surface disturbance to occur.

Due to the relatively low potential for subsidence to occur from the Bellingham No. 1 Coal Mine, it is our opinion that mitigation is not needed for structural damage from potential coal mine hazards for the project.

Alteration Requirements

According to BMC 16.55.450 Performance standards - General requirements, A., *alterations of geologically hazardous areas or associated buffers may only occur for activities that:*

1. *Will not increase the threat of the geological hazard to adjacent properties beyond predevelopment conditions;*
2. *Will not adversely impact other critical areas;*
3. *Are designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than predevelopment conditions; and*
4. *Are certified as safe as designed and under the anticipated conditions by a qualified engineer or geologist, licensed in the state of Washington.*

According to BMC 16.55.460 Performance Standards - Specific Hazards, C, 1., *alteration of a mine hazard area and/or buffer are allowed, as follows:*

- a. *All alterations are permitted within a mine hazard area with a low potential for subsidence.*
- b. *Within a mine hazard area with a moderate potential for subsidence and at coal mine byproduct stockpiles, all alterations are permitted subject to a mitigation plan to minimize risk of structural damage using appropriate criteria to evaluate the proposed use, as recommended in the hazard analysis.*
- c. *Within a mine hazard area with a severe potential for subsidence, no structural activities shall be permitted without an effective settlement mitigation strategy.*

Based on the results of our evaluation, and due to the relatively low potential for subsidence to occur from the Bellingham No. 1 Coal Mine, it is our opinion that the project will meet BMC 16.55.450 Performance standards - General requirements.

In addition, because it is our opinion that there is a low potential for subsidence, alterations to the mine hazard area from the project should be permitted.

Subdivision Requirements

According to BMC 16.55.460 Performance Standards - Specific Hazards, *the division of land in mine hazard areas and associated buffers is subject to the following:*

a. Land that is located within 200 feet of a mine hazard area with severe potential for subsidence may not be subdivided. Land that is located partially within a mine hazard area may be divided; provided, that each resulting lot has sufficient buildable area that is 200 feet away from the mine hazard area with a severe potential for subsidence. Land that is located within a mine hazard area with low or moderate potential for subsidence may be subdivided.

Based on our assessment, it is our opinion that there appears to be a relatively low potential for subsidence from coal mine hazards at the site, so the proposed subdivision of the property for the residential development appears feasible.

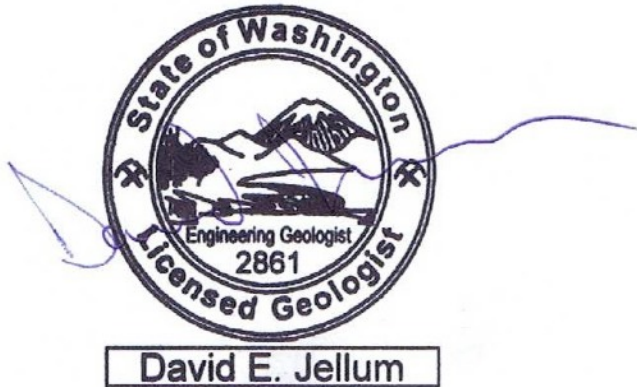
LIMITATIONS

This report was prepared for the sole use of Kulshan Community Land Trust and their authorized agents for the proposed improvements to be located at 2912 Birchwood Avenue in Bellingham, Washington. The conclusions and recommendations contained in this report are based on our visual reconnaissance of the project site in October of 2022, research and map review, and our experience working on similar projects. In the event the scope of the project changes or unanticipated conditions are encountered, we should be contacted to reevaluate our conclusions accordingly.

Our services were accomplished within the generally accepted practices of the geologic profession at the time this report was prepared under the limitations of scope, budget and schedule. It should be understood that no guarantee or warranty, suggested or expressed, is included with the professional opinions or recommendations contained in this report.

Thank you for the opportunity to work on your project. Please contact us at (360) 306-6171 or soundgeology@gmail.com if you have any questions regarding this report or if we can be of further assistance.

Sincerely,
Sound Geology, LLC



David Jellum, LEG
Licensed Engineering Geologist

Attachments

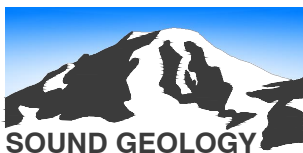
Figure 1 Vicinity Map
Figure 2 Site Plan
Figure 3 Mine Hazard Map

References

- Easterbrook, D.J. 1976. *Geologic Map of Western Whatcom County, Washington*. United States Geological Survey. Map I-854-B.
- Johnson, C.P. 2013. *A Guide to Surface Features Related to Underground Coal Mining*. University of Washington. MESSAGE Technical Report Number: 007.
- Tetra Tech, Inc. 1984. *Final Report Bellingham Abandoned Mine Land Survey*. United States Department of the Interior Office of Surface Mining. Denver, Colorado. TC-3920.



Reference: City of Bellingham Geologic Hazards Map 2022



360.306.6171
www.soundgeology.com

Date 4-9-2024

File No. 22077

Drawn By DEJ

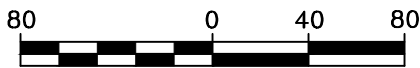
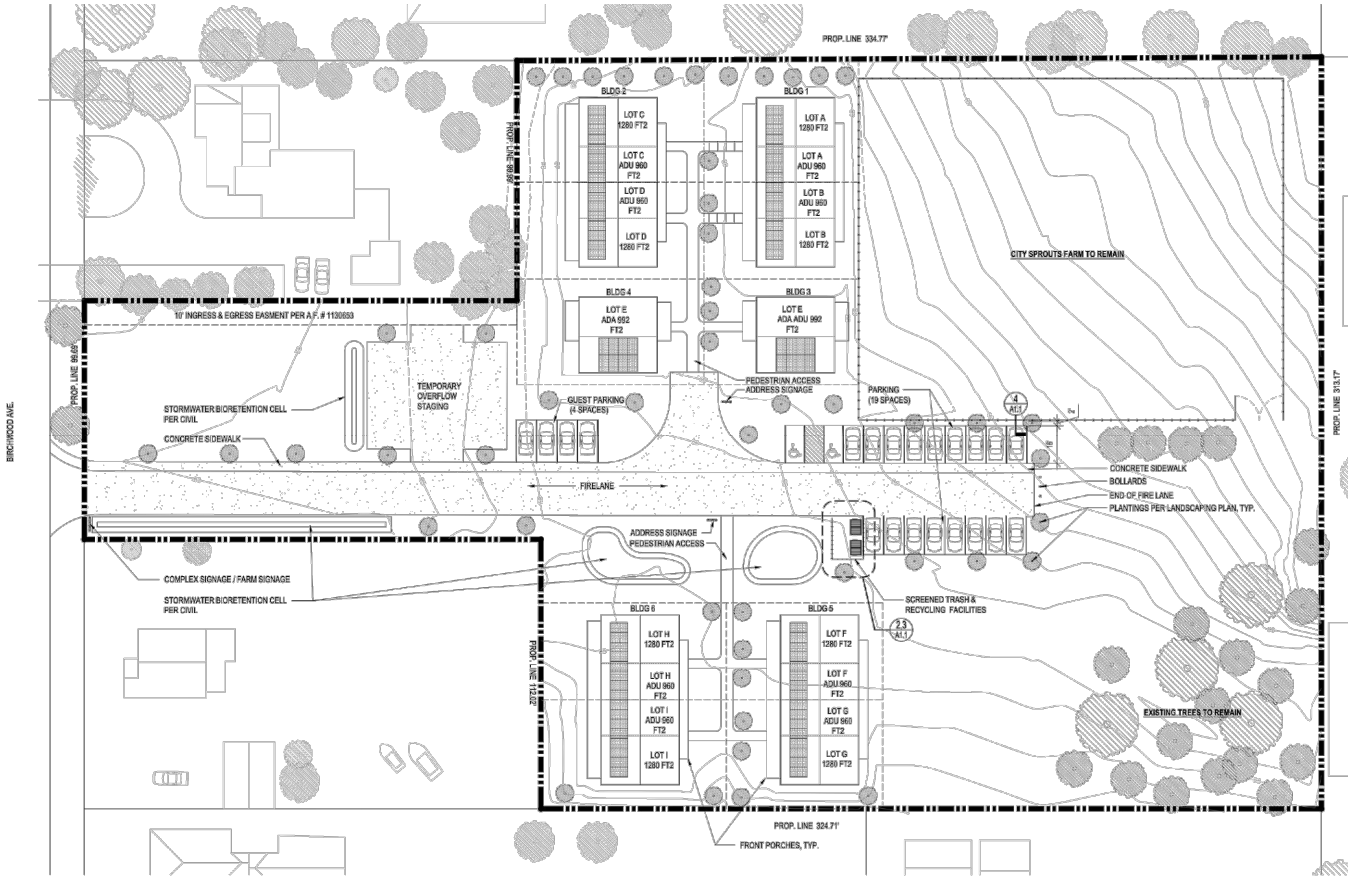
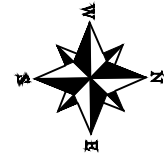
Scale None

Vicinity Map

Proposed Subdivision & Residential Improvements
2912 Birchwood Avenue (Parcel 380223 562531)
Bellingham, Washington

FIGURE

1 of 3



1 inch = 80 feet

Reference: Site plan by [bundle] design studio.



Date 4-9-2024

File No. 22077

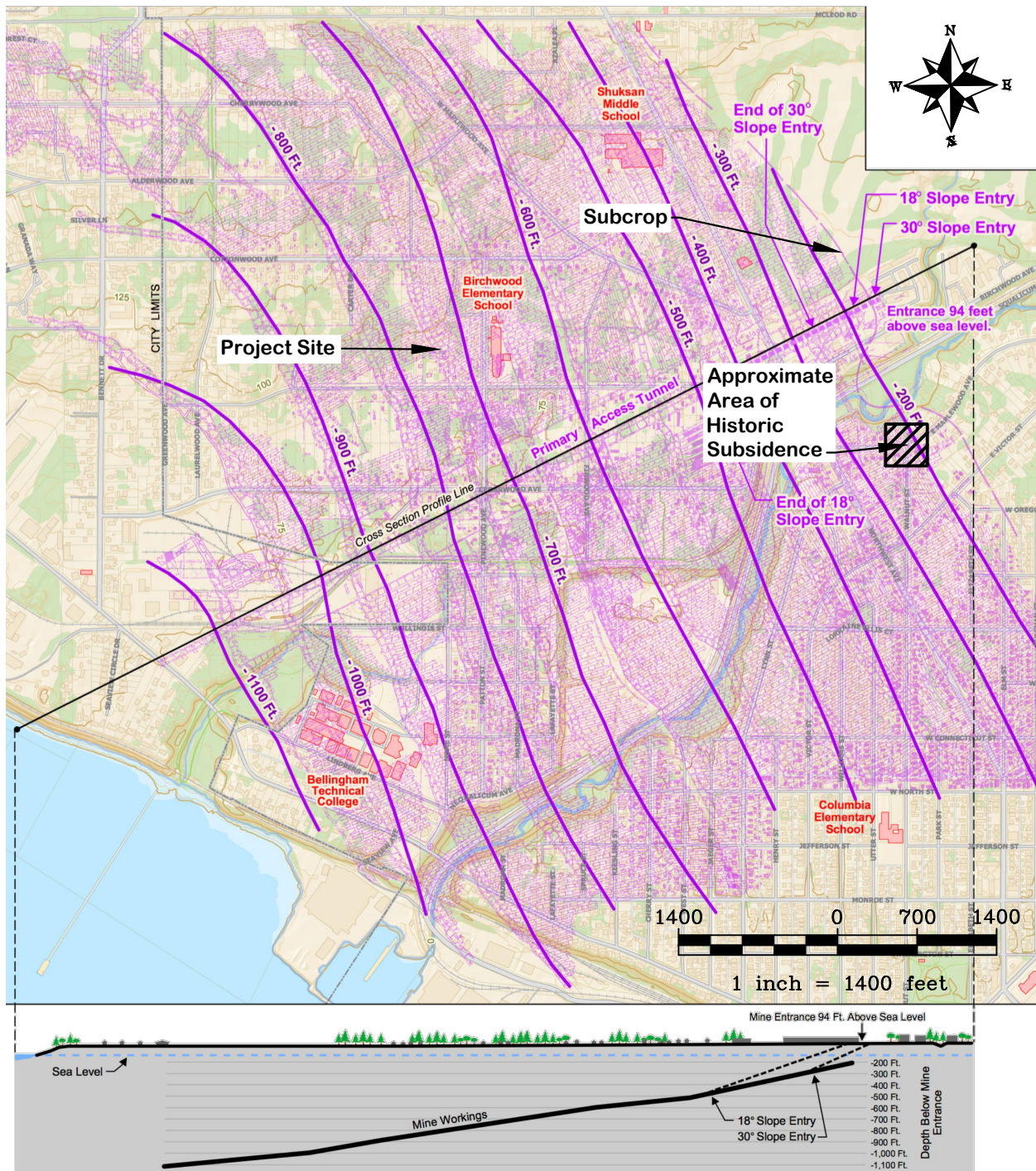
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Scale 1" = 80'

Site Plan
Proposed Subdivision & Residential Improvements
2912 Birchwood Avenue (Parcel 380223 562531)
Bellingham, Washington

FIGURE

2 of 3



Notes: Based upon the 2007 City of Bellingham's Coal Mine Plan Layout and Depth Profile Map. The approximate area of historic subsidence is based upon descriptions from Tetra Tech's 1984 Final Report Bellingham Abandoned Mine Land Survey. The project site is mapped within a 'Mine Area of Possible Pillar Instability' as shown on Figures 7B-1 and 7B-2 of the Bellingham No. 1 Mine - Subsidence Classification Map (Tetra Tech, 1984). No visual indications of subsidence were observed within the vicinity of the project site. Please refer to the report for more details.



Date 4-9-2024

File No. 22077

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Scale 1" = 1400'

Mine Hazard Map

Proposed Subdivision & Residential Improvements
 2912 Birchwood Avenue (Parcel 380223 562531)
 Bellingham, Washington

FIGURE

3 of 3