PLANNING DEPARTMENT
CURRENT PLANNING STAFF ANALYSIS
SITE PLAN REVIEW

DATE:	March 6, 2017
CASE NO.:	2017-0017
REPRESENTITIVE:	The Boutet Company, Tony Hoffman
APPLICANT:	Ship Creek Development, LLC
REQUEST:	Site plan approval to construct 28 dwelling units in the PC-SL (Planned Community) District with special limitations in accordance with AO 2006-046 (S).
LOCATION:	Lot 2, Block 122 and a portion of Lot 1, Block 122, United States Survey Number 408.
COMMUNITY COUNCIL:	Downtown, South Addition, Government Hill
TAX NUMBERS:	002-071-27, 001-021-07
GRID:	SW1230
APPLICABLE ZONING CODE:	"Old" Code

ATTACHMENTS:

1. Zoning and Location Maps
2. Reviewing Agency Comments
3. Historical Information
4. Application

RECOMMENDATION SUMMARY: Approval of site plan subject to conditions.

SITE

Acres:	2.62 (Lease Area)
Vegetation:	Existing trees and shrubs along the slope
Current Zoning:	PC per AO 2006-046 (S)
Topography:	Sloping to the north
Existing Use:	Auto Service Garage
Utilities:	Public water and sewer

APPLICABLE ZONING REGULATIONS:

AMC 21.40.250 - PC District regulations.
AMC 21.50.200 - General standards for site plan approval.

Assembly Ordinance 2006-046 (S) - Ordinance governing development of the subject property.

REVIEW AUTHORITY

Per AMC 21.10.015- The Planning and Zoning Commission shall "hear and decide applications for conditional uses in accordance with section 21.15.030." This application is subject to the procedures of AMC 21.15.030.

COMPREHENSIVE PLAN

Classification: Major Redevelopment Area per the *Ship Creek Framework Plan 2014.*

Redevelopment/Mixed Use Area per *Anchorage 2020 Anchorage Bowl Comprehensive Plan.*

SURROUNDING AREA

	NORTH	EAST	SOUTH	WEST
Zoning:	PC	B-2C	B-2C	PC
Land Use:	Industrial	Office	Office	Industrial

PROPERTY HISTORY

07/11/06	AO 2006-46(S)	Ordinance adopting a new PC zoning and new Ship Creek Master Plan for the subject property.

PROPOSAL AND APPLICATION BACKGROUND

Ship Creek Development, LLC is seeking final site plan approval of their condominium project, *Downtown Edge at the Rail*, which is located at the northwest corner of 2nd Avenue and Christensen Drive.

The proposed development is for 28 dwelling units. The buildings will consist of 3 basic floor plans. There will be three (3) four-plex units, one (1) triplex, one (1) 5-unit building, and one (1) 8-unit building. Floor plans will range in size from 1,300 square feet to 1,900 square feet with all being 2 bedroom units. There will be a mix of 1 and 2 car garage units.

The property will be leased from the Alaska Railroad on a long term basis (90 years). With this site plan, the applicant is seeking to re-plat the property from two lots into one lot with vacation of an easement on the north side of the property. The re-plat will facilitate the "cleaning up" of the property with relocation of utilities in anticipation of development.

The applicant received concept approval from the Ship Creek District Review Board on December 22, 2016 per Resolution 2016-001. The applicant will need to present the final site plan to the Ship Creek Review Board following review and approval by the Planning and Zoning Commission.

The property is located in within Seismic Zone #5 based on the 1979 Geotechnical Hazard Assessment Study prepared by Harding-Lawson Associates and is subject to a high susceptibility of seismically induced ground failure. The applicant has presented the project for evaluation by the Geotechnical Advisory Commission (GAC). At the time this report was written, the GAC had not issued formal comments on the report prepared by Northern Geotechnical Engineering, Inc.

SITE PLAN APPROVAL PROCESS

Developments qualifying as Level 1 or 2 (AO 2006-46 (S)) require approval by both the Ship Creek District Review Board and the municipal Planning and Zoning Commission as follows:

1. Developers shall submit a concept site plan to the Ship Creek District Review Board for a non-public hearing.

2. Upon concept site plan approval by the Ship Creek District Review Board, a public hearing before the municipal Planning and Zoning Commission is required. In addition to the standards and procedures of [AMC] sections 21.15.030 and 21.50.200, the Planning and Zoning Commission shall consider the following:

    a. An evaluation of the proposal by the Geotechnical Advisory Commission.

    b. A traffic impact analysis with suggested mitigation proposals to correct any issues found in the site plan or deficiencies m the street system serving the proposed project.

    c. Compliance of the submitted plans with the District's land use requirements and Design Guidelines.

3. Following site plan approval of the concept site plan by the Commission, the applicant shall submit final plans for approval at a non-public hearing with the Ship Creek District Review Board. Applicants shall illustrate compliance with the Planning and Zoning Commission findings and shall address requirements of the Design Guidelines.

AGENCY COMMENTS

<u>Fire Plan Review Comments:</u>

Fire recommends not to approve.

a. Street off W. 2nd in excess of 150 ft. and provides no required emergency vehicle turn around. IFC D103.4

b. Street off W. 2nd measures 24 ft. wide, requires 26 ft. wide if any structure is 30 ft. or higher. Unable to determine structure height from submittal, but photo rendition shows 3 stories which typically are 30+. IFC D105.3

c. Street off Christensen requires additional emergency vehicle turn around at West end. IFC D103.4

d. Access off Christensen shall have an interior exterior turning radius of 40ft/60ft. Show on plans. IFC D103.3

e. All portions of the buildings shall be within 150 ft. access of an approved fire lane, North West building is greater than 150 ft from fire lane. IFC 503.1.1

f. No grade shown or access to north side of units 1 thru 11. Show emergency vehicle access. IFC 503.1.1

Long Range Planning Comments:

Long Range Planning comments are summarized as follows:

Long-Range Planning supports the proposed housing development concept, but has the following reservations:

a. Geotechnical assessment issues have yet to be resolved per GAC review.

b. Site connectivity (interior to the site and exterior).

c. Open space.

FINDINGS

AMC 21.50.200 – General standards for site plan approval.

The authority reviewing a site plan shall approve the site plan only if it finds that the site plan:

A. *Meets the criteria for this approval established under this title; and*

B. *Will not have a permanent negative impact on the items listed below substantially greater than that anticipated from permitted development.*

1. *Pedestrian and vehicular traffic circulation and safety.*

The development of 28 dwelling units on this property is anticipated to have minimal impact on pedestrian and vehicular circulation and safety. As outlined in the Kinney Engineering Traffic Impact Analysis; "the additional traffic will not reduce the level of service at the adjacent intersection below the existing level of service. The proposed driveway locations meet the MOA corner clearance and sight distance requirements."

2. *The demand for and availability of public services and facilities.*

The site is within the ARDSA, Building Safety Service Area, and Fire Service Area. Connections to public water and sanitary sewer (deep utilities) are available adjacent to this development. Likewise, connections to electric, gas, and communications (shallow utilities) are available adjacent to this development.

3. *Noise, air, water or other forms of environmental pollution.*

The development of 28 dwelling units is not expected to create additional environment pollution. Traffic patterns will not change additional traffic is not anticipated to reduce the level of service. Drainage will be collected onsite and directed to the existing storm drain system to the north.

4. *The maintenance of compatible and efficient development patterns and land use intensities.*

This proposed development appears to conform to the development patterns outlined in the Ship Creek Master Plan adopted by the Assembly as OA 2006-46 (S).

Conformance with Assembly Ordinance 2006-46 (S).

A. ***Minimum Lot Requirements**: None*

Standard is met

B. ***Minimum Yard Requirements**: None*

Standard is met

C. ***Maximum Height of Structures:** West of the centerline of H Street right-of-way extended and east of the centerline of Cordova Street right-of-way extended, the maximum structure height from mean sea level shall be eighty-five (85) feet, with a maximum height up to one hundred twenty (120) feet through the conditional use permit process; and between the centerline of H Street right-of-way extended and the centerline of Cordova Street right-of-way extended, the maximum height structure height from mean sea level shall be one hundred twenty (120) feet, with*

a maximum height up to one hundred fifty (150) feet through the conditional use process.

Standard is met. The maximum height of any structure will not exceed 120 feet from mean sea level. The petitioner estimates that the structures will not exceed 90 from mean sea level.

D. ***Bulk regulations and maximum lot coverage:*** *Buildings may be constructed within the full limits of the lot, up to three (3) stories in height. Building construction above three stories in height shall conform to the bulk requirements under [AMC] section 21.40.160H.*

Standard is met. The proposed buildings will not exceed three stories. Therefore, there is no maximum lot coverage.

E. ***Total Dwelling Units:*** *The allowable, but not probable, maximum number of housing units is four hundred (400) and may include:*

1. *Urban multiple-family dwellings; 2. Row-houses built to a common wall at side lease lines; 3. Combined living quarters and work studios; 4. Upper story residential units above office, street level retail, and off-street parking structures; or 5. Other types of dwellings consistent with the intent of the District.*

Standard is met. This proposal is to construct 28 dwelling units. The maximum allowed by AO 2006-46 (S) is 400.

F. ***Maximum limit for Commercial, Industrial, Office Floor Area:*** *The allowable but not probable floor area for new commercial, industrial, and office development is 3.5 million square feet, not counting floor area obtained through tower development under conditional use permits.*

Standard is met. This is a request for 28 residential dwelling units with no commercial, industrial, or office.

G. ***Parking:*** *No off-street parking need be provided, but any off-street parking provided shall be landscaped in accordance with the design guidelines. Individual projects creating office space of 15,000 square feet or larger shall address whether parking existing within the District and areas within walking distance (1000 feet) are sufficient to meet occupancy demands as part of the Site Plan Review.*

Standard is met. Total off-street parking requirement is 55 spaces. The proposed plan shows 79 total spaces.

H. ***Site Plan Review:*** *Projects, including construction or substantial alteration, shall be submitted to the Department of Community Planning and Development consistent with [AMC] section 21.15.030. Plans shall be subject to a Level 1 or Level 2 development review, as required by this ordinance. Prior to the issuance of any building permits, persons proposing development of areas within the District shall submit for approval a site plan as defined by [AMC] section 21.35.020, prepared by a licensed architect or landscape architect.*

Standard is met. This development qualifies as a level 2 site plan review before the Planning and Zoning Commission.

DEPARTMENT RECOMMENDATION

The Department recommends Approval of the amended site plan for vehicle and container storage, subject to the following conditions:

1. A notice of zoning action and the resolution, along with a corrected and updated site plan shall be filed with the District Recorder's Office, and proof of such shall be submitted to the Planning Division.

2. All construction and improvements related to this approval shall be substantially in conformance with the plans and application submitted and on file with the Department, except as modified by these conditions of approval.

3. Resolve the following comments with Fire Plan Review:

    a. Street off W. 2nd in excess of 150 ft. and provides no required emergency vehicle turn around. IFC D103.4

    b. Street off W. 2nd measures 24 ft. wide, requires 26 ft. wide if any structure is 30 ft. or higher. Unable to determine structure height from submittal, but photo rendition shows 3 stories which typically are 30+. IFC D105.3

    c. Street off Christensen requires additional emergency vehicle turn around at west end. IFC D103.4

    d. Access off Christensen shall have an interior/exterior turning radius of 40ft/60ft. Show on plans. IFC D103.3

    e. All portions of the buildings shall be within 150 ft. access of an approved fire lane, northwest building is greater than 150 ft. from fire lane. IFC 503.1.1

    f. No grade shown or access to north side of units 1 thru 11. Show emergency vehicle access. IFC 503.1.1

4. Resolve with Addressing the following comments:

i. Units 1-20 will need a unique private street name. Code defined street type is "Lane".

ii. Units 21-28 will need a unique private street name. Code defined street type is "Lane".

Advisory Comment:

The petitioner is alerted to the pending requirement to provide project specific full drainage analysis and calculations to Private Development under land use and/or building permit processes. An analysis will be required to address storm runoff as a result of the proposed changes to infrastructure and to permeable / impermeable surface treatments. Final plans with appropriate details will be required prior to approval of building plans. The analysis and plans shall present and illustrate respectively how drainage from this facility is being managed in relation to peripheral properties and right of way; demonstrate that post development drainage will not adversely impact adjacent properties or rights of way; and, measures to be taken in the event that excavation associated with the build-out of the property exposes subsurface flows. Drainage analysis and design shall conform to the Municipality of Anchorage Design Criteria Manual (DCM) and the Drainage Design Guidelines (DDG).

Reviewed by:

for Hal H. Hart, AICP
Director

Prepared by:

Dave Whitfield
Senior Planner/Platting Officer

(Parcel ID: 002-071-27, 001-021-07)

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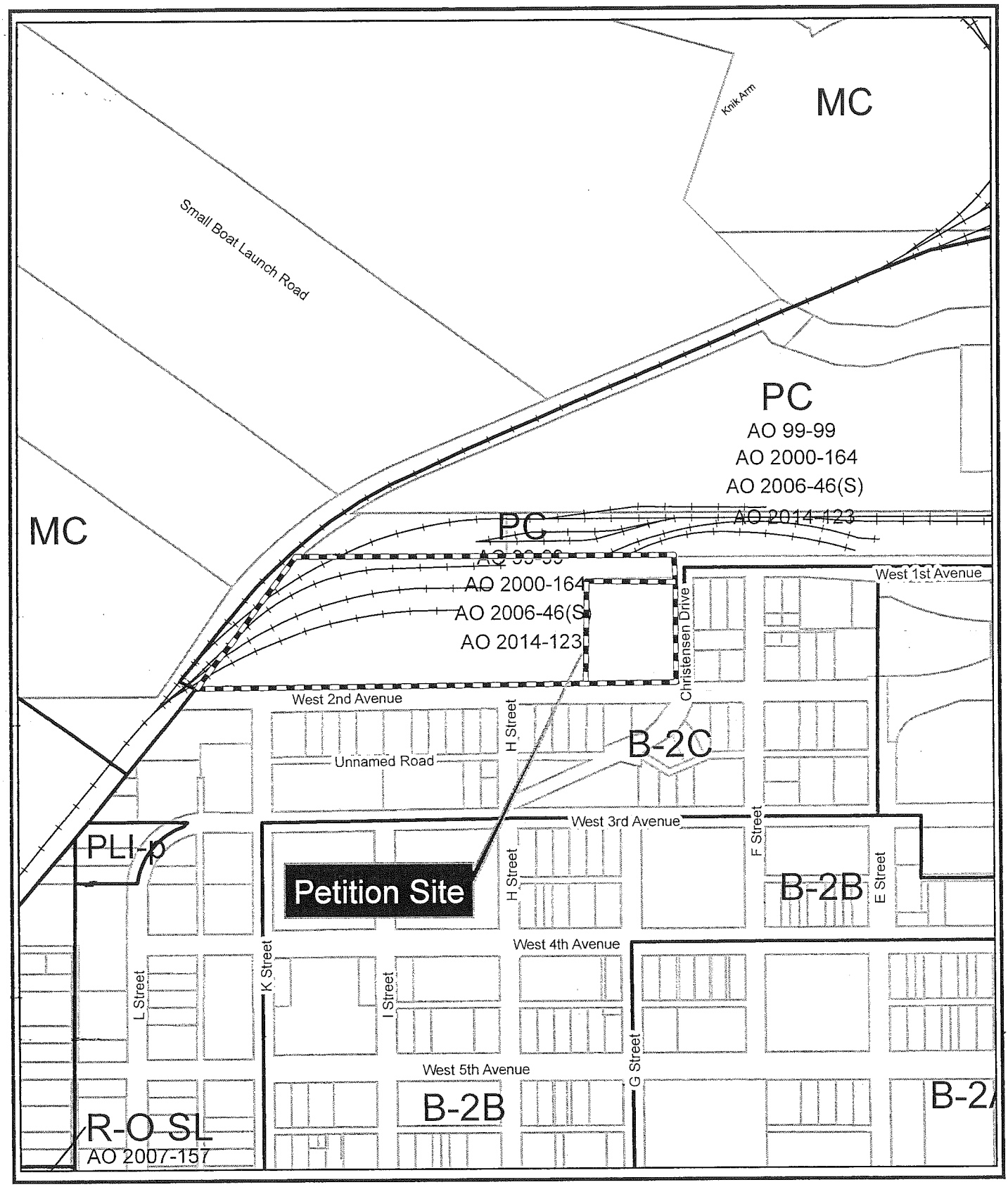
ZONING & LOCATION MAPS

2017-0017



Municipality of Anchorage
Planning Department

Date: January 13, 2017

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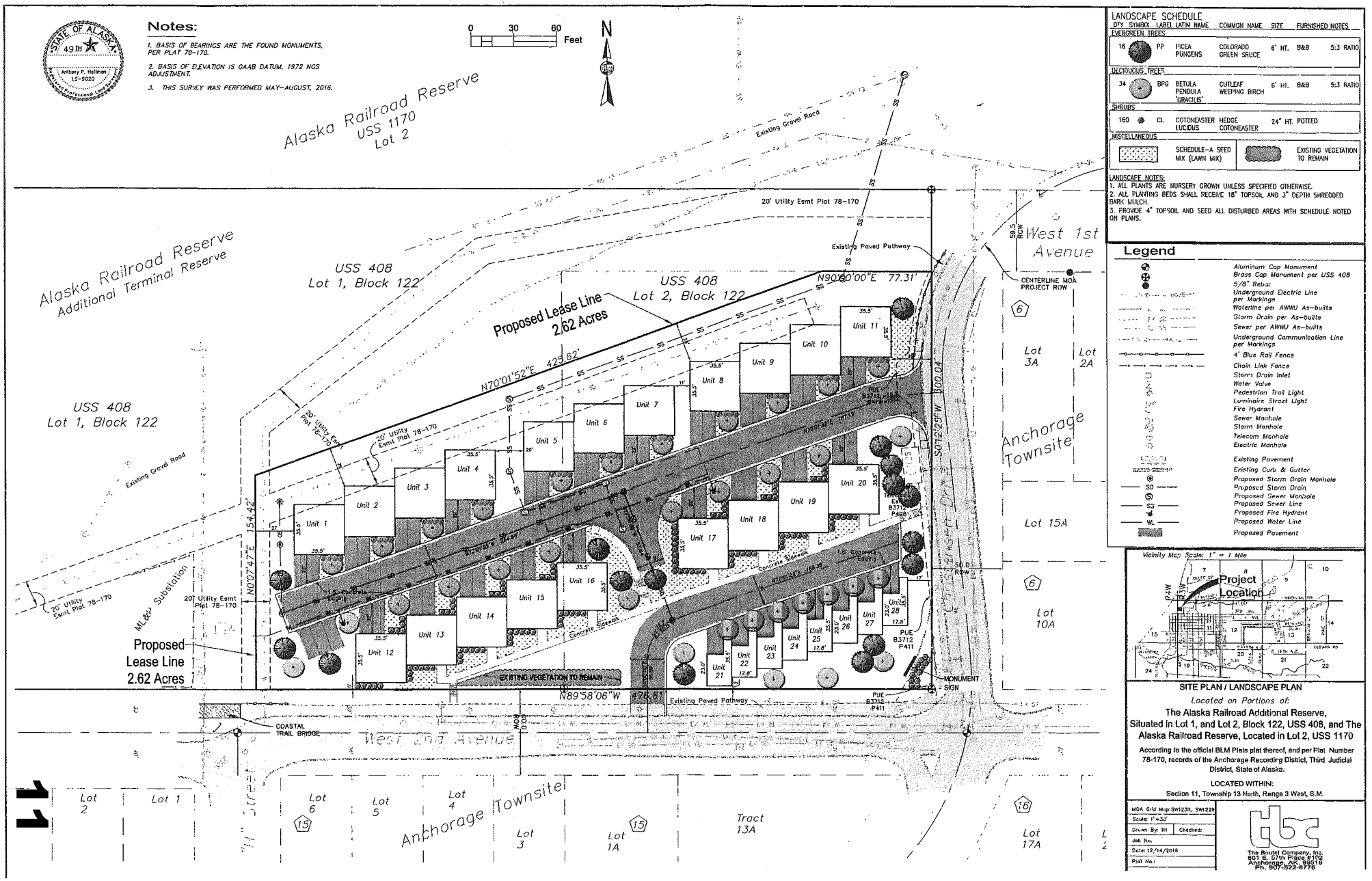

LANDSCAPE SCHEDULE

QTY	SYMBOL	LABEL	LATIN NAME	COMMON NAME	SIZE	FURNISHED	NOTES
EVERGREEN TREES							
16		PP	PICEA PUNGENS	COLORADO GREEN SPRUCE	6' HT.	B&B	5:3 RATIO
DECIDUOUS TREES							
34		BPG	BETULA PENDULA 'GRACILIS'	CUTLEAF WEEPING BIRCH	6' HT.	B&B	5:3 RATIO
SHRUBS							
160		CL	COTONEASTER LUCIDUS	HEDGE COTONEASTER	24" HT.	POTTED	
MISCELLANEOUS							
			SCHEDULE-A SEED MIX (LAWN MIX)				
				EXISTING VEGETATION TO REMAIN			

LANDSCAPE NOTES:
1. ALL PLANTS ARE NURSERY GROWN UNLESS SPECIFIED OTHERWISE.
2. ALL PLANTING BEDS SHALL RECEIVE 18" TOPSOIL AND 3" DEPTH SHREDDED BARK MULCH.
3. PROVIDE 4" TOPSOIL AND SEED ALL DISTURBED AREAS WITH SCHEDULE NOTED ON PLANS.

Legend

- Aluminum Cap Monument
- Brass Cap Monument per USS 408
- 5/8" Rebar
- Underground Electric Line per Markings
- Waterline per AWWU As-builts
- Storm Drain per As-builts
- Sewer per AWWU As-builts
- Underground Communication Line per Markings
- 4' Blue Rail Fence
- Chain Link Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light
- Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Existing Pavement
- Existing Curb & Gutter
- Proposed Storm Drain Manhole
- SD — Proposed Storm Drain
- Proposed Sewer Manhole
- SS — Proposed Sewer Line
- Proposed Fire Hydrant
- W — Proposed Water Line
- Proposed Pavement

SITE PLAN / LANDSCAPE PLAN

Located on Portions of:

The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
Section 11, Township 13 North, Range 3 West, S.M.

MOA Grid Map: SW1230, SW1229	
Scale: 1"=30'	
Drawn By: TH	Checked:
Job No.	
Date: 12/14/2016	
Plat No.:	

The Boutet Company, Inc.
501 E. 67th Place #102
Anchorage, AK. 99518
Ph. 907-522-6776

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AGENCY COMMENTS

Municipality of Anchorage

Planning Department
Long-Range Planning Division

MEMORANDUM

RECEIVED
FEB 06 2017
PLANNING DEPARTMENT

Date: February 6, 2017

To: Dave Whitfield, Senior Planner
Zoning and Platting Section
Corliss Kimmel, Office Associate,
Current Planning

Thru: Carol Wong, Planning Manager
Long-Range Planning Section

From: Jon Cecil, Senior Planner
Long-Range Planning Section

Subject: Case 2017-0017; Major Site Plan Review per AMC 21.15.030 (Old Code) for a Condominium Development ("Downtown Edge at the Rail") in the Planned Community (PC) District.
(X-Ref: S12330)

The Long-Range Planning section has reviewed the plans submitted for a proposed condominium development to be located at Alaska Railroad Additional Reserve Lot 2, Block 122, and a portion of Lot 1, Block 122, U.S. Survey No. 408. The physical address is described as 701 and 761 West Second Avenue, Anchorage. The subject property is governed by AO 2006-0046(S), which provides for property design guidelines and restrictions. The applicant seeks Major Site Plan Review under Title 21 "Old Code" provisions 21.15.030 and 21.50.200. A subdivision plat and utility easement vacation (see PZC Case S12330) are being reviewed concurrently with this Master Site Plan Review (MSPR) by the Planning and Zoning Commission. The subject property is zoned Planned Community (PC) District.

The condominium residential use is a permitted use in the PC Zoning District with an approved site plan review. AO 2006-046(S) also requires a review by the Ship Creek District Review Board, and the Geotechnical Advisory Commission (GAC). The GAC heard presentations from the consulting geotechnical engineer with Northern Geotechnical Engineering, and Triad Engineering, about the project at the GAC meetings of December 27, 2016, and January 24, 2017 to address the geotechnical implications of the project site. The GAC expressed a number of concerns about the geotechnical analysis regarding the soil strength slope profile, ground motions, and slope stability analysis. The GAC plans to meet again on February 28, 2017, to address the applicant's responses to a detailed request (see attachment) by the GAC. At the time of this writing, staff is unable to precisely determine what the GAC's final recommendations will be regarding the geotechnical assessment. Given this uncertainty, and due to the timing of the public hearing (March 6th) and the GAC's next regular meeting (February 28th) it is likely that staff will have to bring a final recommendation on date of the public hearing.

Relevant Comprehensive Plan Elements, Plans and Studies
The overarching comprehensive plan is the *Anchorage 2020 – Anchorage Bowl Comprehensive Plan.* The subject property is located within the Northwest Subarea which the Plan recognizes as having the

greatest potential for renewal and redevelopment. In general, vacant and older and under-used properties are targeted for redevelopment. (See pp. 59-60).

Anchorage 2020 – Anchorage Bowl Comprehensive Plan policies applicable to this Major Site Plan Review application include:

Policy #7 Avoid incompatible uses adjoining one another.

The residential uses envisioned under the MSPR are compatible as described in the *Ship Creek Framework (2014) and Ship Creek/Waterfront Land Use Study (1991)* and Planned Community zoning designation (AO 2006-046(S)). In addition, the proposed Land Use Plan map (pending) includes a definition of "City Center" that include the Planned Community zoning district in Ship Creek (see p. 34 of the A*nchorage 2040 Land Use Plan* – Public Hearing Draft).

Policy #8 Urban residential density, defined as greater than 1 dwelling unit per acre, is the optimum standard in the urban service area; …

The subject property is located within the urban service area. The project site is 2.62-acres and will contain 28 units, and meets the criteria of greater than 1 DUA.

Policy #14 Conservation of residential lands for housing is a high community priority. New residential development at densities less than identified in the Neighborhood or District Plans is discouraged. No regulatory action under Title 21 shall result in conversion of dwelling units or residentially zoned property into commercial or industrial uses unless consistent with an adopted plan.

The proposed residential housing development envisioned under this MSPR meets the goals of *Anchorage 2020 – Anchorage Bowl Comprehensive Plan, Downtown Anchorage Comprehensive Plan, Ship Creek Framework Plan,* and *Ship Creek/Waterfront Land Use Study and associated master plans*, and the proposed *Anchorage 2040 Land Use Plan* (pending 2017).

Policy #16 Adopt standards to ensure that new residential development provides for a variety of lot sizes and housing types for a range of households and age groups.

The residential development proposed for the "Downtown Edge at the Rail" is for a 28-unit condominium development that is expected to be phased over time. This project will provide market-rate, upscale housing in Downtown which has had little or no new housing products in several decades.

Policy #18 Strengthen the Central Business District's role as the regional center for commerce, services, finance, arts and culture, government offices, and medium- to high-density residential development.

Increased housing densities within the CBD should address walking and use of transit that has the potential to positively impact Anchorage's long-term economic vitality and quality of life. This development fits under the category of medium-density residential. The CBD is inclusive of the City Center land use designation of the proposed *Anchorage 2040 Land Use Plan.*

Policy #20 Medium- to high-density residential development, as well as commercial mixed use, is encouraged in aging and underutilized areas within and adjacent to Major Employment Centers as shown on the Land Use Policy Map.

Downtown Anchorage is one of three Major Employment Centers identified in the *Anchorage 2020 - Anchorage Bowl Comprehensive Plan*. The development lease site is underutilized and has remained largely vacant for some extended length of time. Now, the land owner (ARRC) seeks to redevelop this parcel under a proposed 99-year lease arrangement for a medium-density condominium development project that is part of a much larger mixed-use development envisioned in the *Ship Creek Framework Plan* (2014) and the *Ship Creek/Waterfront Land Use Plan* (1991). Residential use is also consistent with the land use designation as proposed in the *Anchorage 2040 Land Use Plan* map update.

An obsolete federal government (GSA) building that was transferred from the Federal government to the Alaska Railroad will be demolished and removed as part of this development.

Policy #23 Major Employment Centers, shown on the Land Use Policy Map, exist as the Downtown, Midtown, and University/Medical areas. Characteristics of these centers are as follows:

...

f) A pedestrian-oriented environment including expanding sidewalks, crosswalks, street furniture, bus shelters, and landscaping.

Relevant planning documents applicable to this platting case encourage development that is pedestrian-oriented with sidewalks, crosswalks, street furniture, bus shelters, and landscaping. Inclusion of these features is addressed in the *Ship Creek Master Plan* Design Guidelines (AO 2006-046(S)). Please also see *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* Policy #55 regarding interior and exterior subdivision accessibility. A lack of sidewalks has been noted based on the Site Plan/Landscape Plan both within and adjacent to the project site, particularly on the Christensen Drive Right-of-Way. Given the site's proximity to the Coastal Trail as well as Downtown there needs to be a strong connection for pedestrians, bicyclists and recreational enthusiasts.

Policy #35 Major new residential, commercial, industrial, and institutional development shall be assessed for traffic impacts such as congestion and air pollution.

The Applicant acknowledges that the project will add additional traffic impacts to the Second Avenue and Christensen Drive area but anticipates that it will have "generally low levels" impacts based on a Traffic Impact Analysis (TIA) submitted to the Traffic Department by Kinney Engineering, dated 11/14/16. The TIA was not attached to the MSPR application. Air quality issues are implemented through Department of Health and Human Services programs.

Policy #38 Design, construct, and maintain roadways or rights-of-way to promote and enhance physical connectivity within and between neighborhoods.

Roads within the development will be improved to full Municipal standards (30 feet wide, with curb and gutter and concrete sidewalks) but will be privately owned and maintained. Two access points will be constructed into the project, one from Christensen Drive, and the other from West Second Avenue. Road construction is anticipated to accommodate drainage for roads and driveways. Parking and other development standards will be addressed under Old Code.

Policy #46 The unique appeal of individual residential neighborhoods shall be protected and enhanced in accordance with applicable goals, policies, and strategies.

The proposed 28-unit condominium development will be stepped down into the slope because of the steepness of the terrain. Please see Policy #72 relating to natural hazards discussed below.

Policy #48 Subdivision plats and site development plans shall be designed to enhance or preserve scenic views and other significant natural features in accordance with applicable goals, policies, and strategies.

The site plan and design is formatted in such a manner that the units will be staggered and tiered to provide views for each of the units. Design features will include an industrial motif that incorporates elements in recognition of the areas' industrial history and relationship to railroad-related development along Ship Creek. The *Anchorage Downtown Comprehensive Plan* states:

> Ship Creek is distinguished from adjacent Downtown districts by its historic and industrial uses. The area is well-positioned for medium density, residential development, … New development should reflect the industrial history of the area, incorporate live-work units and maximize Ship Creek as a recreational resource, which adhering to seismic constraints. The Ship Creek Master Plan and recently adopted Planned Community zoning district design standards further articulate planning and design parameters for the area. (p. 51)

In addition,

> "New projects should be designed to preserve views outward to the natural environments, as well as views inward to useable outdoor public space within the city center." (p. 65).

The *Anchorage Downtown Comprehensive Plan* discusses design guidelines (p. 99) that are relevant to this MSPR application. Enhancement of the public realm and public view protection includes, preservation of visual connections to surrounding natural scenery; encourages creation of new vantage points; protects view corridors on east-west oriented avenues, such as West Second Avenue, that discourages view obstructions; and, identifies specific vantage points and priority viewsheds for protection such as those located on the bluff with views of Denali and the Alaska Range and Cook Inlet to the west, and vantage points overlooking the Port and Ship Creek basin.

The proposed development concept will have unparalleled connections to nature and open spaces via the Coastal Trail and other open spaces as well as stunning views that make this area of downtown like no other urban environment.

Policy #49 The site plan layout and building design for new development shall consider the character of adjacent development. The Municipality may require layouts and designs to incorporate the functional and aesthetic character of adjacent development.

The lease-site area is subject to the *Ship Creek Framework Plan,* the *Ship Creek/Waterfront Land Use Plan, and* PC design guidelines. The MSPR acknowledges the areas' industrial character and the residential design will incorporate materials and other design features in the development.

Policy #50 Healthy, mature trees and forested areas shall be retained as much as possible.

The site is heavily wooded with alders and cottonwoods on the north and west sides of the subject property. Large spruce trees are located along the north and south sides of West Second Avenue. The applicant is encouraged but not required to retain as many of the existing healthy, mature trees that positively contribute to Anchorage's northern climate and sub-arctic environment. The Landscape Plan (Sheet 1 of 1) indicates that most of the existing trees and vegetation will be removed and replaced by 50 immature (6-feet tall) Colorado green spruce and birch trees, and 160 shrubs. A small vestige of existing vegetation is expected to remain on the south perimeter adjacent to West Second Avenue.

Policy #52 Site and design residential development to enhance the residential streetscape and diminish the prominence of garages and paved parking areas.

The applicant intends to provide 79 parking spaces (48 garage, 28 driveway, and 3 outside stalls) which exceeds the parking standards under Old Code (21.45.080.2.d). The parking requirement is for a total of 55 parking spaces. The amount of parking contemplated under this MSPR conflicts with parking standards discussed in *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* which encourages more efficient parking especially given the surplus surface parking available in downtown. This strategy "seeks to encourage alternatives to surface parking such as parking garages, shared parking agreements …". The MSPR application should include a more robust discussion of alternative parking strategies.

Policy #53 Design, construct, and maintain roads to retain or enhance scenic views and improve the general appearance of the road corridor.

See discussion under Policy #48 above.

Policy #54 Design and construct neighborhood roads and walkways to ensure safe pedestrian movement and neighborhood connectivity, and to discourage high-speed, cut-through traffic.

Given the proposed roadway design of this development high-speed, cut-through traffic is unlikely to occur because of the dead end roadway configuration within the subdivision as currently configured. Regarding neighborhood connectivity and safe pedestrian movement the Site Plan indicates a concrete pavement that accesses one row of the condominiums. A comprehensive sidewalk treatment should be included as part of this development to ensure a safe pedestrian environment as well as creating neighborhood connectivity to downtown. Pedestrian accessibility is one of the hallmarks of the *Downtown Anchorage Comprehensive Plan,* which states:

> "A safe and attractive pedestrian environment supported by an efficient bicycle and transit network is a key component of the economic health and social viability of Downtown." *(p. 84)*

Policy #55 Provide pedestrian and trail connections within and between residential subdivisions in new plats, including replats.

The MSPR is under concurrent review with a replat and vacation of a utility easement (PZC Case 12330). A concrete sidewalk will connect the two private roadways giving pedestrian connection within the proposed subdivision. Additional sidewalk connectivity outside of the development fronting on Christensen Drive should be encouraged to create a more pedestrian-friendly and accessible form of development.

Policy #65 Promote and encourage the identification and conservation of open spaces, including access to greenbelts, Chugach State Park, Anchorage Coastal Wildlife Refuge, and Far North Bicentennial Park.

Open space is not identified on the Site Plan/Landscape Plan and should be addressed by the applicant. The project site is adjacent to the Tony Knowles Coastal Trail. Three Municipal plans address the subject of neighborhood connectivity; The *Areawide Trails Plan*, the *Anchorage Bicycle Plan*, and the *Anchorage Pedestrian Plan*. Together these plans comprise the non-motorized element of the *Comprehensive Plan.* The *Areawide Trails Plan* calls for a multi-use paved trail along 1st Avenue, connecting to the Tony Knowles Coastal Trail at 2nd Avenue. The *Anchorage Bicycle Plan* calls for a connection of trails, as well as a "shared use roadway" along Christensen Drive, 1st Avenue, and Ocean Dock Road and a shared use connection from Cordova Street to the Ship Creek Trail.

Anchorage Pedestrian Plan:

Policy 4.2 Require all development to provide direct on-site pedestrian connections between the adjacent street and entrances to places of business such as streets, restaurants, and banks" (p. 54).

Policy 6.1 Promote land use and site design that makes walking convenient and enjoyable" (p. 56).

Policy 6.2 Review automobile oriented facilities to ensure that they complement the pedestrian environment" (p. 57).

One potential hazard identified by the Downtown Community Council as noted within the *Areawide Pedestrian Plan* states, "2nd and Christensen identifies that a crosswalk is needed for a link from E Street Pedestrian Corridor to Coastal Trail Downtown" (see Appendix D-Community Council Summaries and Maps).

High Natural Hazard Areas

Policy #72 The Municipality shall minimize the incidence of new developments for human occupancy in high natural hazard areas.

The *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* clearly states that one of the primary goals of the Plan is "Harmony with Nature: An urban place that develops in harmony with its natural setting and is mindful of its natural hazards" (p. 39). Furthermore, the Plan acknowledges that there are significant natural hazards in the Anchorage Bowl, which are to be coordinated by the Municipality through proactive public policies, emergency plans and procedures, and educational programs that minimize the risk to the community from natural hazards and disasters.

The Municipality has adopted several plans that include discussions about the risk of seismic hazards in Downtown and the Ship Creek Basin. Several of these plans contain specific policy statements while others include general goals and objectives. A brief discussion of the relevant plans are noted below.

The *Downtown Anchorage Comprehensive Plan* addresses the issue of seismic hazard in Chapter 4, Section 8, "Land Use and Economic Development" (pp. 70-71). A Seismic Hazard Diagram identifies the subject property location within the Seismic Hazard Zone 5 including the so called Buttress Area,

> "which was established to stabilize adjacent downtown lands from sliding when the next major earthquake occurs. Development restrictions were established for the buttress area, including restrictions on building height and weight, and limits regarding excavation and fill. These conditions were included in restrictive covenants which were in place until sunsetting in 2005. ..."

A geotechnical assessment prepared by Northern Geotechnical Engineering, Inc. (NGE), on behalf of the applicant addresses the buttress area as follows:

> "At the toe of the slope is the former tidal flats area of Ship Creek that flows east to west, north of the project site. Following the 1964 Good Friday Earthquake, the toe of this slope was reinforced with a compacted sand and gravel buttress, with the intent to improve stability of the slope. Currently, the area is devoid of vegetation and is being used as a vehicle parking lot. As discussed later in this report, the project site has a high to very high ground failure susceptibility (MOA Seismic Hazard Zones 4 to 5). While the project site did not slide during the 1964 earthquake, the areas surrounding the project site did slide (L Street Slide and 4th Avenue Slide)..." (p. 2 of 24)

The Geotechnical Advisory Commission discussed this very issue, among others at two of its regular meetings in late 2016 and early 2017. The GAC has asked the engineer of record to prepare additional analysis that will show whether the minimum static and dynamic stability of the slope has been met. A response by NGE on this, and several other issues related to ground motions, soil strength and slope profile, and slope stability analysis are forthcoming. Unfortunately, this information is not anticipated to be completed at the earliest until February 28th, the next regular meeting of the GAC. If this is the case staff will bring forward the GAC's recommendation at the March 6, 2017 PZC Public Hearing.

The *Ship Creek Framework Plan* (2014) addresses the issue of seismic hazards, stating:

> "The study area includes lands that range from low to very high and some very high seismic risk. Most land within the Plan area in the Ship Creek basin bottomlands are of low-moderate to moderate risk seismic zones (zones 2 and 3). Lands that are at or near the bluffs range from high to very high (zones 4 and 5), with those areas east of A Street and west of F Street, along the south bluff of Ship Creek, being of very high seismic risk." (p. 14).

The *Framework Plan* further notes that the "Downtown Anchorage Seismic Risk Assessment and Land Use Regulations to Mitigate Seismic Risk recommended that an overlay be provided in downtown to minimize development in areas with "'Very High Vulnerability and High Vulnerability.'" It proposes to restrict ... certain types of construction of large multifamily residential occupancies. (p. 14). The GAC is currently reviewing a proposed a seismic hazard overlay district ordinance as discussed and recommended in the *Downtown Anchorage Comprehensive Plan*, as well as the 2013 Downtown Anchorage Seismic Risk Assessment and Land Use Regulations to Mitigate Seismic Risk report prepared by MMI Engineering, Inc. A final version of the ordinance is expected to be submitted to the PZC by the summer of 2017.

The 1991 *Ship Creek/Waterfront Land Use Study* also addressed seismic risk in the Ship Creek basin. Chapter III discusses the surficial geology and seismic safety of the basin. A brief discussion about the Bootlegger Cove Formation is relevant given the geotechnical conditions found at the project site:

> "The Bootlegger Cove Formation, composed of varying levels of silts and clays, is responsible for most of the ground failure experienced during severe earthquakes. With a loss of strength in the Bootlegger Cove Formation during a seismic event, gravity comes into play, particularly near slopes and bluffs. This layer is unable to support the weight of other deposits above it. Consequently, some form of ground failure results. ... The concern of this practice [introduction of fill materials] is the potential to cause problems with settlement and the amplification of some frequencies of seismic accelerations during earthquakes. With stricter regulations of fill in tidal areas via the Corps of Engineers' permitting requirements, the use of proper fill material and more desirable preparation practices can be expected.
>
> "Poor drainage is a concern because excess subsurface water can exacerbate potential ground-failure problems during earthquakes. Essentially, excess water makes the sensitive silty clay layers of the Bootlegger Cove Formation more prone to liquefaction under seismic duress."

Ship Creek/Waterfront Land Use Study (1991)

Relevant goals and objectives from this Study include:

Goal #5: To promote and protect the natural resources of Ship Creek and the waterfront.

Objective 8. Limit development on slopes greater than 25 percent and those which present high seismic hazards. Provide adequate drainage systems to seismically sensitive slopes. Develop policies prohibiting the steepening and load of existing slopes without adequate stabilization measures.

The issue of sensitive soils, among others, are to be addressed in the geotechnical assessment being prepared and currently being revised by Northern Geotechnical Engineering, Inc.

Goal #6: To integrate the waterfront and Ship Creek into the fabric of the Municipality.

Objective 1. Construct a direct and pleasant link between the Downtown and Ship Creek to promote more intensive use of Ship Creek.

Objective 2. Provide a continuous pedestrian/bicycle facility along Ship Creek from the coast to Reeve Boulevard with connections to nearby neighborhoods and the coastal trail. This should provide a link between the various development opportunities.

One recommendation included in the Study states:

> The Coastal Trail should be extended to the tip of Ship Creek Point and connect with the Ship Creek Greenbelt. There should be a connection to the current coastal trail at Second Avenue with a grade-separated crossing (p. 49).

Geotechnical Advisory Commission

The nine-member Geotechnical Advisory Commission serves as an advisory body to the PZC, heads of municipal departments, and the Assembly. The Commission makes recommendations or gives advice on geotechnical matters, makes special studies on geotechnical matters from time to time, and acts in an advisory capacity to the Platting Board and PZC. (AMC 4.50.050)

The project site under review by the GAC is located within Seismic Hazard Zone 5, the highest risk category for an earthquake event. A geotechnical assessment was prepared by Triad Engineering, (dated August 2016) on behalf of the applicant. The geotechnical assessment is currently under review by the GAC at the time of this writing. A review by the GAC of the "2017 Preliminary Geotechnical Report of the Proposed Ship Creek Development" prepared by Northern Geotechnical Engineering is required by AO 2006-046(S).

The Planning and Zoning Commission shall consider the recommendations from the GAC as part of its deliberative process as it evaluates the merits of the MSPR. The GAC received an initial presentation by applicant's representatives on December 27, 2016, and heard a second updated presentation on January 24, 2017. The outcome from these meetings resulted in a GAC request for additional information and clarification about soil strengths and slope profile, ground motions, and slope stability analysis (see Attachment). These matters are expected to be taken up by the GAC on February 28, 2017. A copy of the GAC's findings in this matter will be provided to the PZC upon their availability. A resolution from the GAC is also expected to be forthcoming.

Long-Range Planning supports the proposed housing development concept, but has the following reservations:

1. Geotechnical assessment issues have yet to be resolved per GAC review
2. Site connectivity (interior to the site and exterior)
3. Open space, if applicable

Attachment: Letter from GAC Chair Kyle Brennan to David Grenier, Triad Engineering, dated 2/3/2017

Attachment

MUNICIPALITY OF ANCHORAGE

Planning Department
Long-Range Planning Division

Phone: 907-343-7921
Fax: 907-343-7927

Ethan Berkowitz

GEOTECHNICAL ADVISORY COMMISSION

February 3, 2017

DELIVERED VIA ELECTRONIC MAIL AND FIRST CLASS MAIL

Mr. David A. Grenier, P.E.
Triad Engineering
1300 East 68th Avenue, Suite 210
Anchorage, AK 99518

Dear Mr. Grenier:

This letter presents comments by the Municipality of Anchorage (MOA) Geotechnical Advisory Commission (GAC) on the Northern Geotechnical Engineering's (NGE) January 2017 *Preliminary Geotechnical Report for the Proposed Ship Creek Development.* We understand that this project consists of the development of several multi-story, multi-family residential structures within a Seismically Induced Ground Failure Zone 5 on the north end of Downtown Anchorage, Alaska. The report includes a summary of geotechnical explorations and laboratory testing, along with geotechnical engineering recommendations for the development to include site grading, building foundations, retaining walls, road/utility development, and an evaluation of the stability of the slope on which the development will be situated.

At the request of the project developer, the report findings were originally presented to the GAC during our regular December 2016 meeting to satisfy a local ordinance for development at this site. During our December meeting, verbal comments were provided to the developer and his engineer in response to the provided report. A revised report was presented during the regular January 2017 meeting. This letter documents a compiled list of GAC comments that should be addressed so that the GAC can provide an opinion regarding the geotechnical work conducted at the site and the conclusions/findings presented in the report.

It should be noted that it is not the responsibility of the GAC to instruct the engineer of record on how they should perform the engineering evaluation of the site or dictate what soil properties should be used for evaluation. However, it is our intent to comment on contents of the report and whether the work meets the state of the practice and meets requirements established in the adopted codes. It is up to the consultant and the MOA to determine if it should be accepted as presented or if more analyses should be performed. Addressing these comments will not guarantee a "favorable" finding from the GAC, but it will allow the GAC to advise the MOA Planning and Zoning Commission as to whether or not we agree with the findings included therein.

General Report Comments:

The comments presented in this letter primarily focus on the work associated with soil strengths and slope profile, ground motions, and slope stability analysis. It is apparent that a great deal of the analysis is predicated on the past performance of the slope. Furthermore, there appears to be significant deviation from code requirements in the analysis performed. As discussed at our last

meeting, it is useful to evaluate past performance as part of the analysis; however, caution should be used when predicting future performance of this slope. The minimum code still needs to be met regardless of past performance. When evaluating the impact on life-safety and property, code deviations should be highlighted, described in detail, and justified through sound engineering practice. Deviations from the code do not automatically prevent a project from going forward, but it should occur within the realities of the site and full consideration of the potential slope displacements and resulting impacts to the proposed structures.

Soil Strengths and Slope Profile:

In general, there appear to be discrepancies between the factual data presented on the boring logs and laboratory testing results and the subsurface stratigraphy and soil strengths presented on the evaluated slope profile.

1. The general soil cross sections in Figure 3 and Figures 7 through 13 are not supported by the logs for NGE explorations at the site. Please address or correct the apparent discrepancies listed below:
    a. Figures 3, 7 through 9, 11 and 13 show four or more distinct general soil strata within the depths drilled in Borings B-1 and B-5; while the logs for those two borings only illustrate two general soil units.
    b. The fine-grained soil unit encountered below the surface fill in Borings B-1 and B-5 is described on the respective logs as a single unit of "soft to medium Silt"; however, that single unit is divided into two discrete units on the cross sections described as "medium soft clay" and "soft clay".
    c. The cross sections illustrate a layer of "sensitive clay" underlying the entire site, and within the depth of ground penetrated by Boring B-5, although no such material is described on that log.
2. The report describes the site as being a "prehistoric landslide". As such, one could reasonably expect that the native soils would be a heterogeneous and jumbled mix of materials. However, as stated above, the native soils under the site and within the depths explored were modeled instead as occurring in several distinct horizontal layers – contrary to what would be expected in a "landslide". It is clear that a stability analysis of this slope will need to assume generalized soil conditions, however, the report should explain how potential heterogeneity could potentially impact the results of your evaluation.
3. The undrained shear strength of the presumed multiple and discrete strata of fine-grained soils underlying the site were apparently estimated by a back-calculation assuming (i) the site experienced peak ground accelerations of 0.19g during the 1964 earthquake, and (ii) did not fail, but was on the brink of failing. Based on the laboratory data included in the report and historic data on soil strengths from the area it appears that the soil strengths assumed in this report are significantly higher than what would be expected. Please provide an explanation/justification for the selection of soil strengths that are higher than expected and contradict testing conducted specifically for this project.

4. It is state-of-practice to assume cohesive soils will or could reasonably be expected to experience some temporary reduction in undrained shear strength under earthquake loading, associated with increased pore pressure, and/or cyclic strain softening. The report specifically says the undrained strength of the fine-grained soils was not reduced for such effects. Please provide justification for not including strength reductions in the slope stability evaluation.
5. Similarly, liquefaction of shallower soils is not addressed in the report. At the time of explorations, it appears that shallower soils are unsaturated, however, is this a reasonable assumption for the long-term condition of the slope after construction of this project? Please clarify if measures are to be incorporated in the project design to ensure that groundwater levels within the slope do not increase throughout the life of the project. Please provide justification or an explanation in the report as to why liquefaction of granular soils are not anticipated to experience liquefaction.

Ground Motions

The report includes results of one-dimensional numerical modeling apparently intended to define the peak ground acceleration expected at the site to be used in the seismic slope stability analysis. However, this analysis is based entirely on guesstimates of the deep soil conditions underlying the site, an assumed shear wave profile, and assumed dynamic soil properties. Further, the procedure NGE followed to determine the surface ground response did not follow the 2012 IBC (which refers to several methods detailed in ASCE 7-10).

The seismic ground response analysis needs to be revisited and a ProShake (or similar) analysis should be performed in accordance to general engineering processes where ground motions are input at engineering bedrock (Vs = 2,500 fps). Significant care should be used in the selection of all of the soil properties and rock motions used in the analysis. A high amount of scrutiny should be anticipated over the results of this analysis because the MOA amendments to the IBC (i.e., pseudostatic coefficients) are based on the results of numerous and similar studies for Seismically Induced Ground Failure Zones 4 and 5.

1. Revisit the site response model and provide strong justification (using a more conventional analytical approach) for using ground motions that are less than those required by code.
2. A two-dimensional model should be used to evaluate the sloping ground, or an explanation and justification for using the one dimension model should be presented.
3. The shear wave velocities included in Table 1 in the report appear to be significantly lower than those compared to comparable studies in the Anchorage Bowl. Please provide justification for the values assumed in the report.
4. ASCE 7 requires the mean values from a site-specific ground response be multiplied by 1.5 for design purposes if less than seven different earthquake time-histories are used. If seven or more are used, the mean values can be used for the design. Please justify why it is not appropriate to use the 50 percent increase in PGA for this study.
5. Please provide an explanation and justification for the time-histories of displacement used in the analysis.

Slope Stability Analysis

The report states "the project site has the potential for both slope failure and large lateral movements...under strong seismic motions." The report then goes on to demonstrate using analytical methods that the site is stable, which presents a significant internal contradiction. Furthermore, the report deviates significantly from locally adopted code requirements. The minimum standard of care or baseline consideration should be established using the local amendments to the code. Therefore, an analysis should be performed to show whether the minimum static and dynamic stability is met. This should be done regardless of whether this process yields stable or unstable results. If the minimum stability is not met, then the engineer should provide analyses or evaluations describing why the code values are not applicable to the project.

Alternatively, the engineer can perform displacement analysis to evaluate the anticipated ground movements resulting from the slope "failure" and provide the horizontal and vertical displacement estimates to the structural engineer to accommodate in design. Given that this site is located on a historic slide mass and its close proximity to other slide features, displacement analyses should also include a discussion of the potential for formation of grabens and pressure ridges above and below the slide mass, respectively.

Note that the comments below address the report which posits that the slope is stable and meets the factor of safety requirements. A displacement analysis was presumably not performed by the engineer as it was not included in the reviewed report.

1. Additional failure planes should be evaluated and discussed in the report. For example, a circular-type failure mechanism (as would be reasonable in an old landslide mass); or a translational-type failure forced through the shallow portion of the "soft" silt which was encountered in all of the borings below the surface fill. The only surface discussed in the report is a translational/block-like failure forced through the presumed, "sensitive clay" layer under the entire site.
2. Please clarify the assumed soil strengths used in the modelling.
    a. It appears the static analysis used undrained conditions and the pseudostatic analysis used drained strengths, is this correct? If so, it is counter to standard practice and should be explained/justified in the report.
    b. Please justify not accounting for potential strength reductions due to seismic shaking at the site. The aforementioned "sensitive clay layer" suggests that strength reductions in the seismic and/or post-seismic condition would be justified at this site.
    c. Please perform a sensitivity analysis on the various soil strengths assumed in the model.
3. Please revisit the model and ensure that a large enough extent is evaluated. One of the models (Figure 12) shows a failure plane beginning at the edge of the model. This is not good modeling practice, and the modeler needs to consider the program's search algorithm and verify the appropriateness of the model extents.

4. Because the project specific borings were not advanced to adequate depths to characterize the sensitive Bootlegger Cove soil, a sensitivity analysis should be conducted for the layer geometry/thickness because of the layer's importance in the presented model.
5. The report appears to use peak ground acceleration (PGA) and site seismic coefficient (k_h) interchangeably. A clear explanation of the use of these values should be presented on the modelling figures and in the report text.

Thank you for the opportunity to review the geotechnical work performed for this proposed development project. Please feel free to contact me with questions regarding the comments provided.

Sincerely,

GEOTECHNICAL ADVISORY COMMISSION

Kyle Brennan, P.E.
Chair

cc: Geotechnical Advisory Commission Members
Brandon Marcott, Triad Engineering
Hal H. Hart, AICP, Planning Director

MUNICIPALITY OF ANCHORAGE

Development Services Department
Addressing
Addressing email: addressing@muni.org

Fax: 907 249-7868

Mayor Ethan Berkowitz

RECEIVED
JAN 26 2017
PLANNING DEPARTMENT

Case No. 2017-0017
Major Site Plan Review; Downtown Edge At the Rail, Condo Development

a. Project needs new, unique street names
   i. Units 1-20 will need a unique private street name, code defined street type LANE
   ii. Units 21-28 will need a unique private street name, code defined street type will be LANE
   iii. You may email MOA Addressing or call to inquire on street names; you may also access the Street Name Master List through our website, http://streetnamesmasterlist.muni.org/
   iv. Street name is NOT Christensen Dr north of 2nd Ave, it is W 1st Ave (weird yes, but true)

Thanks,

Karleen Wilson
Addressing Official

MUNICIPAL LIGHT & POWER
ENGINEERING DIVISION
MEMORANDUM

DATE: January 30, 2017

TO: MOA Planning Division, Planning Section

THRU: Victor Willis, Line Design & Planning Supervisor, ML&P VW 1-30-17

FROM: Jake Moe, P.E., Line Design Engineer, ML&P JM 1-30-17

SUBJECT: Major Site Plan Review for a Condominium Development (Downtown Edge at the Rail): 701 & 761 West 2nd Avenue, Case No. 2017-0017 (ML&P Project Review **17-03**)

Municipal Light and Power (ML&P) has received and reviewed the Major Site Plan Review for the proposed condominium development, Downtown Edge at the Rail.

Please see the comments listed below:

- *The development documents fail to detail any electrical plans, therefore it is unknown at this time what kind of electric utility impact there may be.*
- *Most likely there would need to be new transformers set on property to power the new condominiums which would result in new Electric Easements being acquired.*
- *All drawings submitted incorrectly label the existing easement on the east side of the property as just a telecommunications easement. This easement (acquired by Book 3712, Page 408) is actually an electric and telecommunications easement. Please make the appropriate corrections to your drawings.*
- *Inside this electric and telecommunications easement are two transformers and a load center. Please be aware that the transformer doors require ten (10) feet of clearance space to operate.*

Should you have any questions, I may be contacted at **263-5407.**

cc: Steve McElroy, ML&P Line Extension Coordinator

L:\pub\linedesn\Project Reviews\PR17-**PR17-03**

MUNICIPALITY OF ANCHORAGE
PUBLIC WORKS DEPARTMENT
4700 Elmore Road
Anchorage AK 99507

Project Review Form

Project Name:	Major Site Plan Review for Downtown Edge at The Rail & Platting Case for same, 701 & 761 W 2nd Ave, A/A	Project No: Case No:	2017-0017, S12330
Project Status:	☐ Design Study ☐ 35% ☐ 65% ☐ 95% ☒ Other		
Name/Title:	Andrew Watts/Transit Planning Technician; Randy Bergt/Capital Project Engineer		
Organization / Department:	Public Transportation Dept / People Mover		
Phone Number:	343-8496 (Andrew) or 343-8285 (Randy)	Date:	30 Jan 2017

	Page/ Sheet No.	Reviewer	Comment	Response
1)		AW	Thank you for the opportunity to review. MoA Public Transportation does not currently provide service to the subject area and has no plans to do so in the future. Therefore, PTD has no objection to granting the request.	
2)				
3)				
4)				
5)				
6)				
7)				
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11)				
12)				
13)				

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JAN 30 2017
PLANNING DEPARTMENT

30

Municipality Of Anchorage
ANCHORAGE WATER & WASTEWATER UTILITY

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FEB 03 2017
PLANNING DEPARTMENT

MEMORANDUM

DATE: February 3, 2017

TO: Terry Schoenthal, Planning Manager, Planning Section, Planning Division

FROM: Paul Hatcher, Engineering Technician III, AWWU Planning

SUBJECT: **Zoning Case Comments**
Hearing Date: March 6, 2017
Agency Comments Due: February 6, 2017

AWWU has reviewed the materials and has the following comments.

2017-0017 ALASKA RAILROAD ADDITIONAL RESERVE LOT 2, BLOCK 122 AND A PORTION OF LOT 1, BLOCK 122, UNITED STATES SURVEY NO. 408, Major Site Plan Review in accordance with AMC 21.15.030 (Old Code) for a Condominium Development (Downtown Edge at The Rail) in the PC (Planned Community) District, Grid SW1229, 1230

1. AWWU water and sewer is available to this parcel.
2. AWWU has no objection to this site plan review.

2017-0019 T16N R1E SEC 29 S2; S2NE4, Review and Recommendation by the Planning and Zoning Commission (PZC) to the Assembly of a request in accordance with AMC 21.03.070C.2 to amend land use classification in the Chugiak-Eagle River Comprehensive Plan from "Residential" to "Community Facility" for approximately 16 acres located in Eklutna Valley off of Eklutna Lake Road, the subject of concurrent PZC Platting Case S12327 and PZC Rezone Case 2017-0020, Grid NE1802, 1803, 1903

1. AWWU water and sewer are not available to these parcels.
2. AWWU has no objection to this land use reclassification.

2017-0020 T16N R1E SEC 29 S2; S2NE4, Request to Rezone approximately 16 acres located in Eklutna Valley off of Eklutna Road (proposed lots 1, 2 & 3 Yageli Tinitun Subdivision in PZC Platting Case S12327) from CE-R-10SLI (Low-Density Residential, Alpine/Slope) District with Special Limitations (AO 86-43) to CE-PLI (Public Lands and Institutions) with Special Limitations, Grid NE1802, 1803, 1903

1. AWWU water and sewer are not available to these parcels.
2. AWWU has no objection to this rezone.

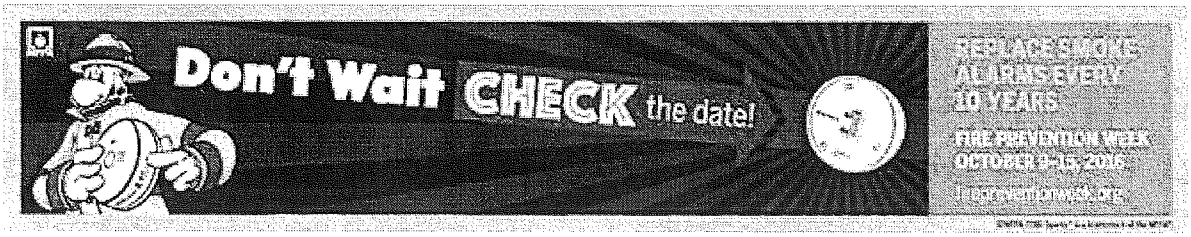
Kimmel, Corliss A.

From:	Hill, Cleo C.
Sent:	Monday, February 6, 2017 10:44 AM
To:	Kimmel, Corliss A.; Blake, Lori A.; Stewart, Gloria I.
Cc:	Ribble, Randon A.
Subject:	2017-0017 701 & 761 W. 2nd Avenue Site plan review

Site plan review comments: Fire recommends **not** to approve.

1. Street off W. 2nd in excess of 150 ft. and provides no required emergency vehicle turn around. IFC D103.4
2. Street off W. 2nd measures 24 ft. wide, requires 26 ft. wide if any structure is 30 ft. or higher. Unable to determine structure height from submittal, but photo rendition shows 3 stories which typically are 30+. IFC D105.3
3. Street off Christensen requires additional emergency vehicle turn around at West end. IFC D103.4
4. Access off Christensen shall have an interior exterior turning radius of 40ft/60ft. Show on plans. IFC D103.3
5. All portions of the buildings shall be within 150 ft. access of an approved fire lane, North West building is greater than 150 ft from fire lane. IFC 503.1.1
6. No grade shown or access to north side of units 1 thru 11. Show emergency vehicle access. IFC 503.1.1

Cleo Hill
Fire Marshal
Anchorage Fire Department
267-4911



THE STATE
of ALASKA
GOVERNOR BILL WALKER

Department of Transportation and Public Facilities

DIVISION of PROGRAM DEVELOPMENT
Anchorage Field Office

4111 Aviation Avenue
P.O. Box 196900
Anchorage, Alaska 99519-6900
Main Phone: (907)269-0520
Fax: (907)269-0521
Web site: dot.state.ak.us

February 6, 2017

Terry Schoenthal, Current Planning Section Manager
MOA, Community Development Department
Planning Division
P.O. Box 196650
Anchorage, Alaska 99519-6650

RE: MOA Zoning Review

Dear Mr. Schoenthal:

The Alaska Department of Transportation and Public Facilities (DOT&PF), Central Region Planning Division has comments on the following zoning case:

- **2017-0017: 701 & 761 W. 2nd Avenue**
  - Units 1-12 and 21-28 lack sidewalks.
  - Plan does not accommodate pedestrian connectivity shown in Downtown Edge Master Plan.
  - Consider requiring greater pedestrian/bicycle connectivity between the residential units and the commercial/retail/restaurant/local brewery to the north, particularly along Christiansen Drive.
  - Multiple planned stairways inhibit bike and ADA connectivity.

Sincerely,

James Starzec
Anchorage Area Planner

Cc: Tucker Hurn, Right of Way Agent, Right of Way, DOT&PF
Morris Beckwith, Right of Way Agent II, Right of Way, DOT&PF
Scott Thomas, P.E., Regional Traffic Engineer, Traffic Safety and Utilities, DOT&PF
Jim Amundsen, P.E., Highway Design Group Chief, DOT&PF

MUNICIPALITY OF ANCHORAGE

Planning & Development Services Dept.
Development Services Division

Building Safety

RECEIVED
FEB 06 2017
PLANNING DEPARTMENT

MEMORANDUM

Comments to Miscellaneous Planning and Zoning Applications

DATE: February 6, 2017

TO: Terry Schoenthal, Manager, Current Planning

FROM: Ron Wilde, P.E
Structural Plan Reviewer
Building Safety
343-8371

SUBJECT: Comments for Case 2017-0017
Condominium project – Downtown Edge At The Rail

This area is subject to ground failure during an earthquake.

As per page 4 of the narrative, the Geotechnical Advisory Commission has been, and is continuing to review the soil conditions at this site. The geotechnical report has not shown the soils to be stable during a design earthquake. See minutes of the GAC meetings for December 27, 2016 and January 27, 2017. See also emails from GAC commissioners to Planning staff giving their concerns about development in this area.

Although buildings may be able to be designed and constructed to resist collapse, even with ground failure, the utilities are at risk.

This development should not proceed unless the utilities can be designed so they will not fail due to seismic ground failure. Rupture of gas lines can cause fires and possibly explosions. Rupture of waterlines can prevent adequate water to extinguish fires. Lateral ground spreading can prevent fire and rescue personnel from access to distressed structures.

Kimmel, Corliss A.

From: Park, Clara H.
Sent: Wednesday, February 8, 2017 8:25 AM
To: Blake, Lori A.; Freemon, Melinda L.; Kimmel, Corliss A.
Cc: Nesheim, Janine R.
Subject: CUP Comments - No Comment

CUP 2017-0015, 0017, S12330, 0019, 0020, S12327, 0021, 0025, & 0028

FYI.

Clara Park, Sr. Office Associate
Municipality of Anchorage
Department of Health & Human Services
PO Box 196650
Anchorage, AK 99519-6650
Phone: 907-343-4244
ParkCH@muni.org

DHHS 80 YEARS
Protecting Your Health

MUNICIPALITY OF ANCHORAGE

Development Services Division
Right of Way Section
Phone: (907) 343-8240 Fax: (907) 343-8250

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FEB 14 2017
PLANNING DEPARTMENT

DATE: February 13, 2017

TO: Planning Division, Current Planning Section

THRU: Jack L. Frost, Jr., Right of Way Supervisor

FROM: Lynn McGee, Senior Plan Reviewer

SUBJ: Comments on Planning and Zoning Commission case(s) for March 6, 2017.

Right of Way Section has reviewed the following case(s) due February 6, 2017.

2017-0017 **Alaska Railroad Additional Reserve, Block 122, Lot 1, portion of USS #408, Block 122, Lot 1, and USS 1170, Lot 2, grid 1230.**
(Major Site Plan Review, Condominium Development.)
Resolve with the Traffic Section the need for turnarounds at the ends of the interior roads/driveways.
Obtain approval from the MOA Traffic Section for the number, location, and the size of the driveway entry points.
Review time 30 minutes.

2017-0019 **Section 29, South ½, and the South ½ of the NE ¼, grid NE1803 and NW1903**
(Amendment to Land Use Classification, Residential to Community Facility.)
Right of Way Section has no comments at this time.
Review time 15 minutes.

2017-0020 **Section 29, T16N, R1E, South ½, and the South ½ of the NE ¼, grid NE1803 and NW1903**
(Rezone from CE-R-10 SL to CE-PLI SL)
Right of Way Section has no comments at this time.
Review time 15 minutes.

2017-0021 **Section 32, T13N, R3W, W2SW4SE4SE4 S494' Portion Remnant, grid SW1933**
(Rezone from I-1 to B-3.)
Right of Way Section sees the lot as only 424' from north to south, not 495.7'.
Review time 15 minutes.

S12327 **Yagheli Tinitun Tracts A7B, and Lots 1-3, grids NE1803 and NW1903**
Show the types and boundaries of the wetlands in and abutting the parcels.
Show the easement for the existing driveway across the northeast corner of proposed Tract A. If no easement exists, provide an easement or enter into an

Access Agreement for the current access.
Provide existing topographical data for the entire parcels.
Provide plat notes as approved by the SOA Traffic Department Section addressing the number, location, and size of driveway entry points to the proposed parcels.
Review time 30 minutes.

S12330 **USS 408, Block 122, Lot 1A, grid SW1230**

Verify there is a Block 122 in USS 408, as we do not detect one.
Obtain written non-objection from MOA Street Maintenance and Watershed Management for the proposed vacation of the 20' Utility Easement containing the storm drain system.
Provide notes as approved by the MOA Traffic Section addressing the number, location, and the size of the driveway entry points.
Review time 15 minutes.

Municipality of Anchorage
Project Management and Engineering
MEMORANDUM

DATE: February 8, 2017

RECEIVED
FEB 09 2017
PLANNING DEPARTMENT

TO: Terry Schoenthal

FROM: Steven Ellis

SUBJECT: Comments from Watershed Management Services

Watershed Management Services (WMS) has the following comments for the March 6, 2017, Planning and Zoning Commission Meeting.

2017-0017 Major site plan review for a condominium development; WMS has no comment. Storm water issues will be resolved during building permit reviews.

MUNICIPALITY OF ANCHORAGE

Development Services Department

Private Development Section

Mayor Ethan Berkowitz

MEMORANDUM

Comments to Planning and Zoning Commission Applications/Petitions

DATE: February 9, 2017

TO: Terry Schoenthal, Current Planning Section Supervisor

FROM: Brandon Telford, Plan Review Engineer

SUBJECT: Comments for Planning and Zoning Commission
Public Hearing date: March 06, 2017

Case 2017-0017 – Major Site Plan Review in accordance with AMC 21.15.030 (Old Code) for a Condominium Development (Downtown Edge At The Rail) in the PC (Planned Community) District

Drainage:

The petitioner is alerted to the pending requirement to provide project specific full drainage analysis and calculations to Private Development under land use and/or building permit processes. An analysis will be required to address storm runoff as a result of the proposed changes to infrastructure and to permeable / impermeable surface treatments. Final plans with appropriate details will be required prior to approval of building plans. The analysis and plans shall present and illustrate respectively how drainage from this facility is being managed in relation to peripheral properties and right of way; demonstrate that post development drainage will not adversely impact adjacent properties or rights of way; and, measures to be taken in the event that excavation associated with the build-out of the property exposes subsurface flows. Drainage analysis and design shall conform to the Municipality of Anchorage Design Criteria Manual (DCM) and the Drainage Design Guidelines (DDG).

Department Recommendations:

The Private Development Section has no objection to the Major Site Plan Review.

Case 2017-0019 – Review and Recommendation by the Planning and Zoning Commission (PZC) to the Assembly of a request in accordance with AMC 21.03.070.C.2 to amend land use classification in the Chugiak-Eagle River Comprehensive Plan from "Residential" to "Community Facility" for approximately 10 acres located in Eklutna Valley off of Eklutna Lake Road, the subject of concurrent PZC Platting Case S12327 and PZC Rezone Case 2017-0020.

3

HISTORICAL INFORMATION

Submitted by: Chair of the Assembly at the Request of the Mayor

Prepared by: Department of Law

For reading: July 11, 2006

CLERK'S OFFICE
APPROVED
Date: 7-11-06

ANCHORAGE, ALASKA
AO 2006-46 (S)

AN ORDINANCE REPEALING ORDINANCE AO 93-183 (S-1) CONCERNING PC (PLANNED COMMUNITY ZONING) AND MASTER PLAN AND ADOPTING A NEW PC (PLANNED COMMUNITY) ZONING AND NEW SHIP CREEK MASTER PLAN FOR A PORTION OF A.R.R. RESERVATION LOCATED IN THE LOWER SHIP CREEK, APPROXIMATELY 102 +/- ACRES, FOR A.R.R. RESERVATION PROPERTY LOCATED AT THE LOWER WEST END OF SHIP CREEK; AND AMENDING THE ZONING MAP AND PROVIDING FOR THE REZONING OF A.R.R. ANCHORAGE TERMINAL RESERVE, LOT 103, WHITNEY ROAD INDUSTRIAL LEASE LOT CONSISTING OF 20,815 SQUARE FEET FROM PC (PLANNED COMMUNITY) TO I-1 (LIGHT INDUSTRIAL); AND AMENDING THE ZONING MAP AND PROVIDING FOR THE REZONING OF SHIP CREEK CROSSING, LOT 3, CONSISTING OF 109, 932 SQUARE FEET FROM PC (PLANNED COMMUNITY) AND I-2 (HEAVY INDUSTRIAL) TO I-2 (HEAVY INDUSTRIAL; AND AMENDING THE ZONING MAP AND PROVIDING FOR THE REZONING OF SHIP CREEK CROSSING, LOT 4, CONSISTING OF 209,068 SQUARE FEET FROM PC (PLANNED COMMUNITY) AND I-2 (HEAVY INDUSTRIAL) TO I-2 (HEAVY INDUSTRIAL); GENERALLY LOCATED AT THE LOWER WEST END OF SHIP CREEK SOUTH OF THE RAILROAD MAINLINE TO SECOND AVENUE AND WEST GAMBELL STREET.

(GOVERNMENT HILL, DOWNTOWN, FAIRVIEW)(PLANNING CASE 2005-080)

THE ANCHORAGE ASSEMBLY ORDAINS:

Section 1. Anchorage Ordinance 93-183 (S-1)(am) concerning portions of Sections 7 and 18, T13N, R3W, S.M. Alaska, and Section 13, T13N, R4W, S.M. Alaska, generally located in the lower Ship Creek valley between the railroad yards and downtown Anchorage, containing 127 acres more or less, is hereby repealed.

Section 2. The zoning map shall be amended by designating the following described property as PC (Planned Community District):

A portion of A.R.R. Reservation, located with the Seward Meridian, Township 13 North, Range 3 West, and includes southern portions of Section 7, northeast quarter of Section 13, and northern portions of Section 18, by substituting a new PC (Planned Community zoning and master development plan, consisting of approximately 102 +/- acres, as shown on Exhibit A attached, and as described in Exhibit B, listing of legal description and parcel tax identification numbers.

Section 3. The zoning map shall be amended by designating the following described property as I-1 (Light Industrial) District:

A.R.R. Anchorage Terminal Reserve, Lot 103, Whitney Road Industrial Lease Lot (York Steel Lease) consisting of 20,815 square feet from PC (Planned Community) to I-1 (Light Industrial) District, as shown on Exhibit A attached (Planning and Zoning Commission Case 2005-080)

Section 4. The zoning map shall be amended by designating the following described property as I-2 (Heavy Industrial) District:

Ship Creek Crossing, Lot 3 (Wrightway Auto lease) consisting of 109,932 square feet as shown on exhibit A attached (Planning and Zoning commission Case 2005-080)

Section 5. The zoning map shall be amended by designating the following described property as I-2 (Heavy Industrial) District:

Ship Creek Crossing, Lot 4(Power Plant lease) consisting of 209,068 square feet as shown on exhibit A attached (Planning and Zoning commission Case 2005-080)

Section 6. The zoning map amendment designating property as PC (Planned Community), described in section 2 above, shall be subject to the following listed restrictions and design standards. Except as otherwise provided in this ordinance, all development shall comply with the Anchorage Municipal Code:

A. Intent. This ordinance sets forth allowable and prohibited land uses, special limitations, and a design review process for the Alaska Railroad's Ship Creek District. These regulations are intended to:

1. Implement the Alaska Railroad Corporation's goals and policies addressing the District.

2. Support broader community re-development and multi-modal transportation goals and policies.

3. Create a pedestrian and transportation-oriented mixed-use development.

4. Attract private investment in commercial and residential development.

5. Provide for predictability in the expectations for development projects.

6. Provide design and infrastructure development standards serving the District and downtown multi-modal users.

7. Make Ship Creek a mixed-use pedestrian-oriented development and visitor destination and enhance the District's build-out capacity with the following uses:

   a. *Commercial Mixed Use*. The area should predominantly feature commercial uses (retail, office, entertainment, hotel, tourism) of an intensity producing a concentration of jobs, shops, meeting facilities, entertainment and restaurants within close proximity to each other.

   b. *Residential*. Appropriate urban residential development should [SHALL] be encouraged, including upper story units above street level businesses.

   c. *Government/Informational Uses*. The District should [SHALL] accommodate governmental and informational services, especially those with walk-in service-orientation, and major civic and public facilities.

   d. *Warehouse/Light Industrial Use*. The District should [SHALL] continue[, AS REQUIRED,] to accommodate a mixture of industrial, commercial and residential uses, with a particular emphasis on workplaces, galleries and dwellings for artists, craftspeople and artisans.

   e. *Kiosks and Vendors*. The District should [SHALL] allow kiosks, outdoor restaurants, mobile vendors, drive-in businesses or coffee shops, or similar uses in order to facilitate incremental growth in the area, where such uses do not negatively impact circulation, safety, or neighboring uses.

   f. *Permitted Accessory Uses*. Uses and structures customarily accessory and clearly incidental to permitted uses and structures should [SHALL] be allowed, including outdoor storage of trolleys, small-tour vehicles, and staging of horses and carriages overnight.

   g. *Railroad Uses*. This ordinance is not intended to apply to permanent or temporary railroad operations within the District.

      [IT IS RECOGNIZED ALASKA RAILROAD CORPORATION MAY HAVE NEEDS REQUIRING INTERIM AND TEMPORARY USE OF VACANT LANDS WITHIN THE DISTRICT AND THERE SHALL BE ALLOWANCE FOR THESE USES, AS WELL AS FOR ROUTINE RAILROAD OPERATIONS AND MAINTENANCE ACTIVITIES.]

B. Applicability. The provisions and restrictions of Section 6 of this ordinance shall apply to all uses and development in the Ship Creek District, depicted on the Master Development Plan (Exhibit A, attached). The site is located within the Township 13 North, Range 4 West, Seward Meridian, and includes southern portions of Section 7, northern portions of Section 18 and the northeast quarter

of Section 13. Areas north of Ship Creek included in AO 93-183 (s-1) are hereby redesignated I-2.

C. Definitions. As used in Section 6 of this ordinance, unless context dictates otherwise, the following definitions shall apply:

1. ***Alteration*** means a physical change to a structure or a site. Alteration does not include normal maintenance and repair or total demolition. Except as otherwise provided in this ordinance, alteration does include any of the following:

   a. Changes to the facade of a building;
   b. Changes to the interior of a building;
   c. Increase or decrease to floor area of a building;
   d. Changes to other structures, including parking garages, on the site or the development of new structures; and/or
   e. Changes to landscaping, off-street parking spaces, and other improvements on a site.

2. ***Development*** means all improvements on a site, including buildings, other structures, parking and loading areas, landscaping, paved or graveled areas, and areas devoted to exterior display, storage, or activities. Development includes improved open areas such as plazas and walkways, but does not include natural geologic forms or unimproved land.

3. ***Excessive*** means uses injurious to an unreasonable degree to the public health, safety, welfare or convenience or exceeding the customary manner of operation.

4. ***Normal maintenance*** means physical changes keeping a building, structure, or site, or a portion thereof, in a sound condition and in operation.

5. ***Railroad operations*** means all activities and operations commonly associated with operating and maintaining a railroad but excluding those activities commonly also performed by other, non-railroad enterprises. Activities such as operating or constructing warehouses, repair shops, loading and unloading facilities, docks, yards, and facilities for storage, handling and interchange of passengers and cargo, are railroad operations, if the facility is used exclusively for, and by, the railroad. Facilities used in part for railroad activities and in part for non-railroad related activities are not railroad operations for purposes of this ordinance.

6[5]. ***Repair*** means physical changes to a building, structure, or site, or a portion thereof, to fix or restore to sound condition after damage or deterioration.

7[6]. ***Replacement value*** means the value of a building as calculated using the latest "*Evaluation Table*" printed in the Building Standards magazine, published by the International Conference of Building Officials, based on existing occupancy and the most closely appropriate type of construction.

8[7]. ***Substantial alteration*** means alterations within a two (2) year period where:

a. The total cost, excluding purchase costs of the building, exceeds fifty percent (50%) of the replacement value of a building or structure;
b. The total cost exceeds fifty percent (50%) of the replacement value of site improvements;
c. The gross square footage increases by more than fifty percent (50%) of buildings and structures; or
d. The gross square footage increases by more than fifty percent (50%) of a surface parking lot.

9[8]. ***Temporary*** means limited in time and extent to less than twelve (12) months and excludes permanent construction, substantial improvements, or substantial alteration of the land.

10. ***Total cost*** means all costs associated with an alteration incurred from project initiation to project completion, excluding the purchase costs for the building.

D. Permitted Principal Uses and Structures. The following principal uses and structures are allowed in the District:

1. ***Railroad Operations and Temporary Uses***. All railroad operational uses, including staging of customers' materials and preparation for transport, temporary storage, and short-term railroad permitted uses are allowed.

2. ***Retail***:

a. Grocery stores, delicatessens and food specialty shops, including open air markets;

b. Meat and seafood markets, including open air markets;

c. Retail bakeries or wholesale bakeries with a storefront;

d. Department or variety stores;

e. Hardware stores;

f. Electrical or electronic supply stores;

g. Furniture stores;

h. Music and record stores;

i. Shoe repair and tailor shops;

j. Bookstores, book binderies, stationery stores and newsstands;

k. Drugstores;

l. Beauty shops;

m. Barber shops;

n. Restaurants, cafes, and other places serving food and beverages, including sale and dispensing of alcoholic beverages in accordance with [AMC] section 21.50.160;

o. Photography, dance, music, and other art studios;

p. Florists;

q. Tobacco stores;

r. Clothing, apparel and shoe stores;

s. Jewelry stores;

t. Sporting goods stores;

u. Cameras and photographic stores;

v. Hobby stores;

w. Knit shops, yarn shops, fabric shops, dressmaking and notions stores;

x. Gift, novelty, and souvenir stores;

y. Picture framing shops;

z. Art galleries and sales;

aa. Crafts shops;

bb. Antique stores;

cc. Furriers;

dd. Garden supply stores and nurseries;

ee. Travel agencies and ticket brokers;

ff. Motion picture theaters;

gg. Banking and financial institutions;

hh. On-site film processing;

ii. Marine equipment sale;

jj. Hotels and lodging including bed and breakfasts;

kk. Aquarium/marine fisheries centers and the like;

ll. Art and craft studios;

mm. Farmers markets;

nn. Outdoor concessionaires including kiosks, restaurants, mobile vendors or similar uses; and

oo. Laundry and dry cleaning establishments and outlets except large commercial industrial laundry and dry cleaning plants shall be prohibited.

3. ***Offices***:

a. Insurance and real estate services;

b. Banking and financial institutions;

c. Business and professional offices;

d. Medical, health and legal services;

e. Post offices; and

f. Government and quasi-government offices.

4. ***Light Industrial Uses***:

a. Alcoholic and non-alcoholic beverage manufacturing;

b. Cabinet and furniture building;

c. Blacksmith and metal working shops;

d. Woodworking, pottery, weaving, leather and other craft production;

e. Retail distribution operations;

f. Manufacture, service or repair of light consumer goods, such as appliances, furniture, garments and tourist related items; and

g. Outdoor storage of carriages, trolleys, and small-tour vehicles.

h. All light industrial uses shall be encouraged to provide public tours or public viewing of operations without charge.

5. ***Other Uses***:

a. Multi-family dwellings;

b. Dwellings in non-residential structures;

c. Parks and playgrounds;

d. Historic and cultural centers and exhibits;

e. Day care;

f. Public libraries;

g. Museums;

h. Interior galleries connecting two or more buildings;

i. Convention centers;

j. Car, bike, or other transportation rental agencies;

k. Parking structures and multi-modal transfer facilities;

l. Arenas;

m. Exhibition centers;

n. One transmission tower less than seventy-five (75) feet in height;

o. Kiosks, outdoor restaurants, mobile vendors, or similar uses on railroad land or in a public right-of-way; and

p. Stabling of horses in support of retail, entertainment, or transportation purposes.

E. Permitted accessory uses and structures. Uses and structures customarily accessory and clearly incidental to permitted principal uses and structures are allowed.

F. Conditional uses. Subject to the requirements of the conditional use standards and procedures of this ordinance, the following uses may be permitted:

1. Commercial recreation establishments, including pool halls, amusement arcades, and the like;

2. Liquor or package stores, in accordance with [AMC] section 21.50.160;

3. Drive-in banks;

4. Utility substations and telephone exchanges;

5. Quasi-institutional houses as defined in [AMC] section 21.35.020; or

6. Heliports.

G. Nonconforming Uses. Existing uses at the time this ordinance is adopted shall be grandfathered until such a time as the existing use changes and/or substantial alterations to a structure, site, or use are proposed.

H. Prohibited Uses. The following uses are expressly prohibited:

1. Adult-oriented retail and entertainment;

2. Jails and correctional facilities;

3. Work release facilities;

4. Plumbing and heating services and dealers;

5. Building material sales;

6. Gasoline service stations;

7. Automotive parts and equipment sales;

8. Automotive display lots;

9. Mobile home display lots;

10. Car washes;

11. Outdoor storage and display of any scrap, junk, salvaged or secondhand materials, or any salvage yard or salvage operation excepting temporary storage by ARRC;

12. Manufacture or packaging of cement products, feed, fertilizer, glue, paint, petroleum products, soap, turpentine, varnish, or charcoal;

13. Manufacture, service, or repair of trucks, automobiles or aircraft;

14. Open storage of cinders, coal, feed, grain, gravel, manure, peat, sand, or topsoil, except the use of community gardens and landscape nursery operations or in railroad operations;

15. Any use causing or reasonably expected to cause, excessive noise, vibrations, smoke, dust, or other particulate matter, toxic or noxious matter, humidity, heat or glare; and

16. Community correctional residential centers.

I. Minimum Lot Requirements: None

J. Minimum Yard Requirements: None

K. Maximum Height of Structures.

1. West of the centerline of H Street right-of-way extended and east of the centerline of Cordova Street right-of-way extended, the maximum structure height from mean sea level shall be eighty-five (85) feet, with a maximum height up to one hundred twenty (120) feet through the conditional use permit process; and

2. Between the centerline of H Street right-of-way extended and the centerline of Cordova Street right-of-way extended, the maximum height structure height from mean sea level shall be one hundred twenty (120) feet, with a maximum height up to one hundred fifty (150) feet through the conditional use process.

[A MAXIMUM BUILDING HEIGHT FROM MEAN SEA LEVEL (MSL) TO ROOF TOP OF STRUCTURES SHALL BE ONE HUNDRED TWENTY (120) FEET, WITH A PROCEDURE FOR A MAXIMUM BUILDING HEIGHT OF ONE HUNDRED FIFTY (150) FEET MSL, THROUGH A CONDITIONAL USE PERMIT PROCESS.]

L. Bulk regulations and maximum lot coverage. Buildings may be constructed within the full limits of the lot, up to three (3) stories in height. Building construction above three stories in height shall conform to the bulk requirements under [AMC] section 21.40.160H.

M. Total Dwelling Units. The allowable, but not probable, maximum number of housing units is four hundred (400) and may include:

1. Urban multiple-family dwellings;
2. Row-houses built to a common wall at side lease lines;
3. Combined living quarters and work studios;
4. Upper story residential units above office, street level retail, and off-street parking structures; or
5. Other types of dwellings consistent with the intent of the District.

N. Maximum limit for Commercial, Industrial, Office Floor Area. The allowable but not probable floor area for new commercial, industrial, and office development is 3.5 million square feet, not counting floor area obtained through tower development under conditional use permits.

O. Parking. No off-street parking need be provided, but any off-street parking provided shall be landscaped in accordance with the design guidelines. Individual projects creating office space of 15,000 square feet or larger shall address whether parking existing within the District and areas within walking distance (1000 feet) are sufficient to meet occupancy demands as part of the Site Plan Review.

P. Site Plan Review. Projects, including construction or substantial alteration, shall be submitted to the Department of Community Planning and Development consistent with [AMC] section 21.15.030. Plans shall be subject to a Level 1 or Level 2 development review, as required by this ordinance. Prior to the issuance of any building permits, persons proposing development of areas within the

District shall submit for approval a site plan as defined by [AMC] section 21.35.020, prepared by a licensed architect or landscape architect.

1. There shall be a Ship Creek District Review Board with the following responsibilities:

   a. Advise the mayor and assembly regarding matters affecting the Ship Creek District.

   b. Review and make recommendations to the Planning and Zoning Commission on land use matters where the Commission has purview.

   c. Review and make findings regarding land use matters where the Board has purview.

   d. Review and make recommendations to the Planning and Zoning Commission for the update of design guidelines as appropriate to maintain currency with respect to land use trends.

2. The Ship Creek District Review Board shall consist of:

   a. Three individuals appointed by the Alaska Railroad Corporation with professional qualifications in real estate, design or a relevant field.

   b. One MOA planning staff member, appointed by the MOA planning Director; and

   c. One member of the Anchorage Planning and Zoning Commission.

3. Development Approval Procedures. Projects in the Ship Creek District requiring construction or substantial alteration shall be subject to a Level 1 or Level 2 Development Review, according to the following procedures:

   a. Level 1 Development Review. Level 1 applies to construction or substantial alteration projects of permitted uses and generally lower construction values. The Ship Creek District Review Board maintains authority for approval of Level 1 development through a non-public hearing site plan review process. Approval may be provided by the Ship Creek District Review Board during review if:

      i. The Board finds the application is complete; and

      ii. The proposed development addresses and complies with the applicable requirements of this ordinance, including the Design Guidelines.

iii. The Board may choose to provide concept level approval and require re-submittal of plans for final approval. Upon the Review Board's approval of the applicant's plans, developments may proceed by right and shall not require further municipal Planning and Zoning Site Plan Review.

iv. Unless appealed, the approval of the Ship Creek District Review Board shall be final. Development shall be consistent with the findings of the Board determined at the final site plan review.

v. Ship Creek District Review Board resolutions of approval and accompanying site plans shall be given a reference number and filed with the District Recorder's Office and a copy provided to the municipal Planning Department.

b. Level 2 Development Review. Projects meeting any one or more of the three criteria below are subject to Level 2 Development site review and application requirements, as outlined in this subsection:

i. Projects with a construction value in excess of two (2) million dollars as defined in 2006 [2004] dollars, adjusted annually per the Anchorage Consumer Price Index;

ii. Conditional uses; and

iii. An appeal of the Ship Creek District Review Board findings.

iv. Developments meeting i. or ii. of the above criteria require approval by both the Ship Creek District Review Board and the municipal Planning and Zoning Commission as follows:

(1) Developers shall submit a concept site plan to the Ship Creek District Review Board for a non-public hearing.

(2) Upon concept site plan approval by the Ship Creek District Review Board, a public hearing before the municipal Planning and Zoning Commission is required. In addition to the standards and procedures of [AMC] sections 21.15.030 and 21.50.200, the Planning and Zoning Commission shall consider the following:

(a) An evaluation of the proposal by the Geotechnical Advisory Commission.

(b) A traffic impact analysis with suggested mitigation proposals to correct any issues found in the site plan or

deficiencies in the street system serving the proposed project.

(c) Compliance of the submitted plans with the District's land use requirements and Design Guidelines.

(3) Following site plan approval of the concept site plan by the Commission, the applicant shall submit final plans for approval at a non-public hearing with the Ship Creek District Review Board. Applicants shall illustrate compliance with the Planning and Zoning Commission findings and shall address requirements of the Design Guidelines.

4. The Planning and Zoning Commission and the Ship Creek District Review Board may impose conditions as required for the proposed development to be compatible with District, adjacent land uses, and Design Guidelines. Conditions imposed by the Board may be more stringent than those of the Commission, but may not be less stringent. In no event is the Board authorized to overturn findings of the Commission.

5. The Planning and Zoning Commission shall hear appeals from decisions of the Ship Creek District Review Board regarding the disapproval or conditions of approval of a development in the District. The decision of the Board may not be reversed unless the Commission finds all of the following are supported by substantial evidence:

a. Special circumstances make strict adherence to the requirements of the Board clearly impractical, unreasonable, or undesirable to the general public.

b. The granting of an exception to the Board-imposed conditions is not detrimental to Alaska Railroad Corporation operations.

c. The granting of an exception does not nullify the intent of the Design Guidelines for the Ship Creek District; and

d. Undue hardship results from strict compliance with the specific provisions of the Board's findings.

Q. Design Guidelines. Projects submitted for review shall comply with the Design Guidelines for the Ship Creek District.

R. Tenants Association. All new tenants within the District are required to become members of a maintenance association prescribed by ARRC. The Association's duties shall include:

1. Maintaining and repairing all recreational facilities, paths, fences and other property whose construction was funded by the Association or its members for recreational or other community purposes;

2. Planting or caring for trees, shrubbery or flowers and cutting of grass on parkways; and

3. Doing such other things as may be determined by the Association as necessary, advisable or proper to keep the District in neat and good order and to promote the attractiveness of the District.

4. The Association may also include special programs, marketing strategies, special events and festivals. The Association may finance its maintenance work by establishing a dues structure for each tenant within the District.

S. Effective Date and Severability. This ordinance shall be effective upon passage and approval, and the Director of the Department of Community Planning and Development shall amend the zoning map accordingly. In the event any section, clause, or provision of this ordinance is declared by a court of competent jurisdiction to be invalid, the same shall not affect the validity of the ordinance as a whole or any part thereof, other than the part declared to be invalid.

Section 7. The amendments referenced in Sections 2, 3, 4, 5, and 6 above shall become effective immediately upon passage and approval.

Section 8. The Director of the Planning Department shall amend the zoning map accordingly.

PASSED AND APPROVED by the Anchorage Assembly this 11th day of July, 2006.

Daniel A. Sullivan
Chair of the Assembly

ATTEST:

Barbara S. Gruenstein
Municipal Clerk

(Planning Case Number 2005-080)
(Tax Identification Numbers attached)

Content Information

Content ID : 004133
Type: Ordinance - AO
Title: AN ORDINANCE REPEALING ORDINANCE AO 93-183 (S-1) CONCERNING PC (PLANNED COMMUNITY ZONING) AND MASTER PLAN AND ADOPTING A NEW PC (PLANNED COMMUNITY) ZONING AND NEW SHIP CREEK MASTER PLAN FOR A PORTION OF A.R.R. RESERVATION LOCATED IN THE LOWER SHIP CREEK,
Author: fehlenrl
Initiating Dept: Legal
Review Depts: MuniManager
Description: AO 2006-46(S)- MOA and ARRC negotiated amendments, and repeal of AO 93-183(S-1)
Keywords: Alaska Railroad, Ship Creek Master Plan, Ship Creek Rezone, AO 93-183(S-1)
Date Prepared: 7/6/06 4:19 PM
Director Name: Frederick H. Boness
Assembly Meeting Date MM/DD/YY: 7/11/06
Public Hearing Date MM/DD/YY: 7/11/06

Workflow History

Workflow Name	Action Date	Action	User	Security Group	Content ID
Legal_SubWorkflow	7/6/06 4:23 PM	Approve	fehlenrl	Public	004133
AllOrdinanceWorkflow	7/6/06 4:23 PM	Checkin	fehlenrl	Public	004133
MuniManager_SubWorkflow	7/7/06 12:58 PM	Approve	leblancdc	Public	004133
MuniMgrCoord_SubWorkflow	7/7/06 4:42 PM	Approve	abbottmk	Public	004133

Addendum – OLD BUSINESS

CC

ALASKA

2017-001467-0

Recording District 301 Anchorage

01/12/2017 11:45 AM Page 1 of 6

Return to:

Alaska Railroad Corporation
Erin E. Ealum
Real Estate Department
P.O. Box 107500
Anchorage, AK 99510-7500

STATE BUSINESS-NO CHARGE

Anchorage Recording District

MUNICIPALITY OF ANCHORAGE
SHIP CREEK DISTRICT REVIEW BOARD RESOLUTION NO. 2016-001

A RESOLUTION RECOMMENDING APPROVAL TO THE PLANNING AND ZONING COMMISSION OF A CONCEPT SITE PLAN FOR THE CONSTRUCTION OF "DOWNTOWN EDGE AT THE RAIL" IN THE ALASKA RAILROAD PC (PLANNED COMMUNITY) DISTRICT ON A PORTION OF LOTS 1 AND 2, BLOCK 122, U.S. SURVEY 408.

(P&Z Case 2017-017) (Tax I.D. Nos. 001-02-107 and 002-07-127)

WHEREAS, Under Municipal Ordinance 2006-46 (S), Section 6(P)(1)(c), the Ship Creek District Review Board has the responsibility to:

> Review and make findings regarding land use matters where the Board has purview.

WHEREAS, a request has been received from Ship Creek Development LLC for a condominium project proposed as "Downtown Edge at The Rail" located on land owned and managed by the Alaska Railroad Corporation. The property is governed by the Anchorage Assembly Zoning Ordinance AO 2006-046 (S), which provides for property design guidelines and restrictions.
(S)

WHEREAS, the Ship Creek District Review Board reviewed this item on December 22, 2016 in a non-public hearing.

NOW, THEREFORE, BE IT RESOLVED, by the Ship Creek District Review Board that:

A. The Board makes the following findings of fact:

1. *Ship Creek Development LLC proposes to construct a condominium project under A.S. 34.08.170 generally consisting of 28 residential units. The buildings consist of 3 basic floor plans. The site plan comprises one 3-unit building, three 4-unit buildings, one 5-unit building and one 8-unit building. Floor plans range in size from 1,300 to1,900 sq.ft. of living area, and all are 2 bedroom units. There are a mix of 1 and 2 car garage units.*

2. *The anticipated construction value is in excess of two (2) million dollars as defined in 2006 dollars, as adjusted annually per the Anchorage Consumer Price Index and the project is therefore appropriate for a Level 2 Development Review, as provided in Section 6(P)(3)(b)(iv)* of Municipal Ordinance 2006-46 (S).

3. *The land will be leased from the Alaska Railroad on a long-term basis. The legal description for the lease is a portion of Lots 1 and 2, Block 122, U.S. Survey 408, comprising approximately 2.62 acres.*

4. *This application is for a concept plan that is part of a phased project of an overall master development plan that will include clear pedestrian linkages to downtown as well as to lower portions of Ship Creek where additional housing, commercial uses, public gathering places and trail connections are envisioned. With this application, consideration of these issues is given to provide guidance for the type and location of the linkages for future phases of construction so as not to interfere with the privacy of the phase 1 neighborhood, while at the same time ensuring that pedestrian connections are there for both the broader public and phase 1 residents.*

5. *The project requires the following be vacated through Municipal Action:*
(A) A 20' utility easement, located on the north side of the lease parcel, which was dedicated on Plat 78-170.

(B) The existing lot lines between Lot 1 and Lot 2 of Block 122 on U.S. Survey 408.

Ship Creek Development LLC may also request that a unique legal description of the lease parcel be created through the same action.

6. *The site abuts the North Right of Way of West 2nd Avenue, and the west Right of Way of Christensen Drive. Both roads are improved to full Municipal standards (30 feet wide, with curb and gutter and concrete sidewalks). To the north are railroad tracks and facilities located within the Alaska Railroad Anchorage Terminal Reserve, and to the west is an ML&P substation. The north side of the site is steeply sloped, and the 11 units situated on the north side will be terraced into the slope.*

7. *The project storm drainage will be collected on site and directed to existing storm drain lines to the west, making the existing on-site storm drain and associated easement superfluous and appropriate for abandonment and vacation. Sanitary sewer will be collected on site and directed northward to an existing sewer main line at an existing sewer manhole via 150' of new sewer main to be owned by Anchorage Water & Wastewater Utility. A water main is available immediately adjacent to the property on the west side. All on site utilities will be privately owned and maintained.*

8. *The construction/development of the property will be governed by A.M.C.R. 21.90 and the applicable standards of the DCM. The roads will be privately owned and maintained.*

9. *The project developer and applicant is Ship Creek Development LLC. The project architect is Lumen Design. The project engineer is Triad Engineering, and the surveyor/planner is The Boutet Company.*

10. A motion to approve the concept site plan was approved by unanimous vote.

B. The Board APPROVES the above referenced concept site plan, subject to the following conditions:

1. Upon concept site plan approval by the Ship Creek District Review Board, a public hearing before the municipal Planning and Zoning Commission is required. In addition to the standards and procedures of [AMC] sections 21.15.030 and 21.50.200, the Planning and Zoning Commission shall consider the following:

   i. An evaluation of the proposal by the Geotechnical Advisory Commission.
   ii. A traffic impact analysis with suggested mitigation proposals to correct any issues found in the site plan or deficiencies in the street system serving the proposed project.
   iii. Compliance of the submitted plans with the District's land use requirements and Design Guidelines.

2. Following site plan approval of the concept site plan by the Commission, the applicant shall submit final plans for approval at a non-public hearing with the Ship Creek District Review Board. Applicants shall illustrate compliance with the Planning and Zoning Commission findings and shall address requirements of the Design Guidelines.

PASSED AND APPROVED by the Ship Creek District Review Board on the 22nd day of December, 2016.

ADOPTED by the Ship Creek Design Review Board this 22nd day of December, 2016.

The Planning and Zoning commission shall hear appeals from decisions of the Ship Creek District Review Board regarding the disapproval or conditions of approval of a development in the District. The decision of the board may not be reversed unless the Commission finds all of the circumstances outlined in the Ship Creek District Review Board guidelines for such a reversal apply.

James W. Kubitz
Chair

Dave Whitfield
Vice Chair

(P&Z Case No. 2007-017), (Tax I.D. Nos. 001-02-107 and 002-07-127)

Ship Creek District Review Board

Minutes of December 22, 2016

Attendees: Tyler Robinson, Dave Whitfield, Jim Kubitz, Erin Ealum, Doug Stephens, Paul Farnsworth, Andy Donovan, Glenn Gellert, Brandon Marcott, Petra Sattler-Smith, Trevor Edmondson

- Completed introductions

- Appointed officers to the Ship Creek District Review Board (SCDRB)
  - Jim Kubitz, Chairman
  - Dave Whitfield, Vice Chairman
  - Erin Ealum, Secretary & Parliamentarian
  - Tyler Robinson, Board Member
  - Doug Stephens, Board Member

- Discussed Board responsibilities and history

- Presentation- Downtown Edge at the Rail
  - Trevor Edmondson introduced team and provided General Overview – Phase 1 Downtown Edge is the conceptual plan before the board for approval
  - Project Details
    - 28 – 1,300-1,900 sq.ft townhome units
    - 2 Phases; market driven
    - Land lease component is a challenging aspect of project as it relates to securing bank financing, but 90 year lease is believed to be sufficient to satisfy lender.
      - Jim Kubitz notified the team that the ARRC team had met and is drafting response on issues related to ground lease would provide those to Jim McCollum, attorney for project team
        - Glenn Gellert notified the ARRC team that they had two additional issues to bring forward and will do in the next few days.
    - Site Plan and Design; units are staggered and tiered to provide views – embracing location and plans are to incorporate industrial elements to design including metal and ballast. Also to incorporate open areas and pedestrian access to Master Plan amenities, but still offering privacy.
    - Site plan, landscaping, drainage plan and traffic plans have been addressed with MOA staff.
      - Parking discussed as the sidewalk and curb/gutter removed between second and lower tier units to

prevent crowding and maximize view and buffer- variance discussed and cleared by traffic along with approving TIA which addressed sight distance and traffic and project is adequate to support levels.
    - Tyler mentioned that although only Ph 1 is in for concept plan approval providing the concept for the Master Plan to illustrate eventual connections to amenities and pedestrian movement to neighboring downtown areas would be important

- Municipal action will be necessary to vacate the utility easement and existing lot lines between Lots 1 & 2 of Block 122 on USS 408; long plat will be required since it is regarding government-owned parcel- discussion as to whether the site plan submittal and plat submittal could be submitted simultaneously. Trevor mentioned lease area could be surveyed for a legal description or plat if desired.
    - Dave and Tyler consulted and believe that under the old code they may be able to combine the actions for a cleaner process-they will be looking into that and notifying development team as to the path they recommend

- ARRC mentioned discussions with ML&P removal of poles in the next five years. AWWU and ARRC have a process to provide permits to have non-exclusive use rather than granting easements, but talks are on-going and no issues anticipated with this project.
- Timeline of project was discussed and submittal is anticipated by the end of the year, Planning & Zoning hearing is anticipated in March 17 with foundation starts anticipated in Sept. 17 for construction to begin Spring 2018.

- Unanimous approval of the conceptual site plan was made by the Board
- Adjourn

Jim Kubitz, Chairman, SCDRB

Date: 1/10/2017

4

APPLICATION

Application for a Site Plan Review

Municipality of Anchorage
Planning Department
PO Box 196650
Anchorage, AK 99519-6650

PETITIONER*	PETITIONER REPRESENTATIVE (IF ANY)
Name (last name first) Ship Creek Development, LLC	Name (last name first) Hoffman, Tony (The Boutet Company)
Mailing Address 1113 West Fireweed Lane	Mailing Address 601 E. 57th Place
Anchorage, AK., 99503	Anchorage, AK., 99518
Contact Phone: Day: 907-351-7825 Night:	Contact Phone: Day: 907-522-6776 Night:
FAX:	FAX:
E-mail: tmedmondson@thepetersengroup.biz	E-mail: thoffman@tbcak.com

*Report additional petitioners or disclose other co-owners on supplemental form. Failure to divulge other beneficial interest owners may delay processing of this application.

PROPERTY INFORMATION

Property Tax #(000-000-00-000): 002-071-27-000, 001-021-07-000

Site Street Address: 761 W. 2nd Ave, Anchorage, AK., 99501

Current legal description: (use additional sheet if necessary)

Lot 2, Block 122 and a portion of Lot 1,Block 122, United States Survey Number 408, as shown on the official U.S. Department of Interior, Bureau of Land Management supplemental plat filed March 22, 1985.

Zoning: PC SL	Acreage: 2.62	Grid # SW1230

SITE PLAN APPROVAL REQUESTED

☐ Special limitation ☐ Public facility ☐ Public facility project landscaping
☒ Other: Site plan approval

I hereby certify that (I am)(I have been authorized to act for) owner of the property described above and that I petition for a site plan review in conformance with Title 21 of the Anchorage Municipal, Code of Ordinances. I understand that payment of the application fee is nonrefundable and is to cover the costs associated with processing this application, and that it does not assure approval of the site plan. I also understand that assigned hearing dates are tentative and may have to be postponed by Planning Department staff, the Planning and Zoning Commission or Urban Design Commission for administrative reasons.

12/15/16	Tony Hoffman
Date	Signature (Agents must provide written proof of authorization)

Application for site plan review continued

Accepted by:	Poster & Affidavit:	Fee:	Case Number
FM	2 + affidavit	$3,400	2017-0017

SPR (Rev. 03/09)*Front

COMPREHENSIVE PLAN INFORMATION

Anchorage 2020 Urban/Rural Services: ☒ Urban ☐ Rural

Anchorage 2020 West Anchorage Planning Area: ☐ Inside ☒ Outside

Anchorage 2020 Major Urban Elements: Site is within or abuts:

☒ Major Employment Center ☒ Redevelopment/Mixed Use Area ☐ Town Center
☐ Neighborhood Commercial Center ☐ Industrial Center
☐ Transit - Supportive Development Corridor

Eagle River-Chugiak-Peters Creek Land Use Classification:

☐ Commercial ☐ Industrial ☐ Parks/opens space ☐ Public Land Institutions
☐ Marginal land ☐ Alpine/Slope Affected ☐ Special Study
☐ Residential at _____ dwelling units per acre

Girdwood- Turnagain Arm

☐ Commercial ☐ Industrial ☐ Parks/opens space ☐ Public Land Institutions
☐ Marginal land ☐ Alpine/Slope Affected ☐ Special Study
☐ Residential at _____ dwelling units per acre

ENVIRONMENTAL INFORMATION (All or portion of site affected)

Wetland Classification:	☒ None	☐ "C"	☐ "B"	☐ "A"	
Avalanche Zone:	☒ None	☐ Blue Zone	☐ Red Zone		
Floodplain:	☒ None	☐ 100 year	☐ 500 year		
Seismic Zone (Harding/Lawson):	☐ "1"	☐ "2"	☐ "3"	☒ "4"	☐ "5"

RECENT REGULATORY INFORMATION (Events that have occurred in last 5 years for all or portion of site)

☒ Rezoning - Case Number: A.O. 2014-123
☐ Preliminary Plat ☐ Final Plat - Case Number(s):
☐ Conditional Use - Case Number(s):
☐ Zoning variance - Case Number(s):
☐ Land Use Enforcement Action for
☐ Building or Land Use Permit for
☐ Wetland permit: ☐ Army Corp of Engineers ☐ Municipality of Anchorage

DOCUMENTATION

Required:
☐ Original application with signature(s), 35 copies of application, plus 35 sets of:
☐ Site plan to scale depicting: building footprints; parking areas; vehicle and pedestrian circulation; lighting; grading; landscaping; signage; drainage and project location.
☐ Building plans to scale depicting: floor plans; building elevations; exterior colors and textures.
☐ Application and narrative: explaining the project; planning objectives; construction and operation schedule; final ownership
☐ Assembly Ordinance enacting zoning special limitations, if applicable.
☐ Watershed sign off form, completed

Required if indicated:
☐ Air quality impact ☐ Traffic impact analysis ☐ Economic impact analysis
☐ Soils analysis ☐ Noise impact analysis ☐ Holding capacity of the land analysis
☐ Shadow impact analysis

Application for site plan review continued

PUBLIC FACILITY PROJECT LANDSCAPING REVIEW STANDARDS (if applicable)
The Urban Design Commission shall consider the following criteria in reviewing public facility project landscaping under this section. Each standard must have a response in as much detail as it takes to explain how your project satisfies the standard. The burden of proof rests with you. Use additional paper if needed.:
Cost. N/A
Feasibility.

Explain how planning and design criteria are met by the proposed landscape plan:
The external impacts generated by the public facility project on adjacent areas. The landscape elements of the public facility project should complement, maintain or improve the landscape quality of adjacent neighborhoods and areas. N/A
The degree to which the landscape elements contribute to on-site use of the public facility project. The landscape elements of the public facility project should enhance safe, efficient and comfortable public use. N/A
The visual attractiveness of the landscaping and its enhancement of the architecture of the public facility project, including the integration of internal and exterior architectural themes. N/A

Application for site plan review continued

PUBLIC FACILITY STANDARDS (if applicable)

The Planning and Zoning Commission shall review a proposed site plan for consistency with the goals, policies and land use designations of the comprehensive development plan and other municipal plans adopted by the assembly, conformity to the requirements of this title, and the effects of the proposal on the area surrounding the site.

N/A

SPECIAL LIMITATION STANDARDS (if applicable)

The Planning and Zoning Commission shall review the proposed site plan governed by special limitation for consistency with the special limitations, goals, policies and land use designations of the comprehensive development plan and other municipal plans adopted by the assembly, conformity to the requirements of this title, and the effects of the proposal on the area surrounding the site. Each special limitation standard must have a response in as much detail as it takes to explain how your project satisfies the standard. The burden of proof rests with you. Use additional paper if needed.:

N/A

GENERAL SITE PLAN REVIEW STANDARDS (AMC 21.50.200) (if applicable)
The Planning and Zoning Commission shall review the proposed site plan governed by the general site plan review standards for consistency with conformity to the requirements of this title, and the effects of the proposal on the area surrounding the site. Each standard must have a response in as much detail as it takes to explain how your project satisfies the standard. The burden of proof rests with you. Use additional paper if needed.:
Explain how the proposed site plan meets the criteria for its approval established under this title.
See attached narrative, section titled Conformance with Assembly Zoning Ordinance AO 2006-046.

Explain how the proposed conditional use will not have a permanent negative impact on the items listed below substantially greater than that anticipated from permitted development:
1. Pedestrian and vehicular traffic circulation and safety. N/A
2. The demand for and availability of public services and facilities. N/A
3. Noise, air, water or other forms of environmental pollution. N/A
4. The maintenance of compatible and efficient development patterns and land use intensities. N/A

Downtown Edge at The Rail

A Condominium Development

Site Plan Application-Narrative

Table of Contents

Downtown Edge at The Rail
Condominium Development Narrative

Introduction:

The proposed Downtown Edge at The Rail project is a condominium project, located at the northwest corner of Second Avenue and Christensen Drive. The property is located on Alaska Railroad Terminal Property, and is owned and managed by the Alaska Railroad. The property is governed by Anchorage Assembly Zoning Ordinance AO 2006-46, which provides for property design guidelines and restrictions. Per that zoning ordinance, we are requesting FINAL SITE PLAN review and approval of the attached site plan and other development plans under A.M.C. 21.15.030 and 21.50.200 (Old Code). Also, we are submitting a subdivision plat of the property, which will also proceed under "Old Code", and will be heard by the Planning and Zoning Commission at the same time as this site plan.

The proposed development is for 28 units. The buildings consist of 3 basic floor plans. The site is comprised of (3) four-plex units, (1) tri-plex, (1) 5-unit building and (1) 8-plex building. Floor plans range in size from 1,300 s.f. to 1,900 s.f. of living area, and all are 2 bedroom units. There is a mix of 1 and 2 car garage units.

The property will be leased from the Alaska Railroad on a long-term basis (90 years). The current legal description for the property is a portion of Lots 1 and 2, Block 122, U.S. Survey 408. The property is also referred to as *"Alaska Railroad Reserve, Additional Terminal Reserve"*. The development lease site will be approximately 2.62 acres. Additionally, the site is being re-platted together with this site plan application. The plat will combine the two lots into one lot, and will include an easement vacation / relocation to remove and relocate the storm drain easement on the north side of the property. The individual dwellings will be condominium units, created under A.S. 34.08.170.

The construction / development of the property will be governed by A.M.C.R. 21.90 and the applicable standards of the DCM. The roads will be privately owned and maintained. As this application is governed by the Old Code, those development standards regarding parking and other development features will be applied.

The property developer and applicant is Ship Creek Development LLC. The project architect is Lumen Design. The project engineer is Triad Engineering, and the surveyor/planner is The Boutet Company.

Grading, site utilities and road construction is anticipated to be done in 2017-2018, with building construction starting in 2017.

This 28-unit development is part of an ongoing master plan effort being undertaken by the developers of this phase, the Alaska Railroad and other parties. See attached master plan.

Also, while the Old Code doesn't necessarily require Community Council presentations, the Development Team presented the project to the Downtown Community Council on 1/4/2017. Generally, the feedback was favorable to the development.

Downtown Edge at The Rail
Condominium Development Narrative

Property Overview and Planning Process:

This property is part of the Ship Creek Framework Plan, which was initially implemented in 1991 as the "Ship Creek Waterfront/Land Use Plan" (A.O. 91-88) then it was updated in 2014 as A.O. 2014-79. The actual zoning ordinance 2006-046 actually establishes the zoning in the individual areas. Part of this proposed developments lease area (Lot 2, Block 122 of U.S. Survey 408) was actually excluded from the initial zoning ordinance (that area is also referred to as "GSA Property per PLO 3532"). After the General Services Administration of the Federal Government transferred ownership to the Alaska Railroad, that portion of the land was rezoned to match the surrounding land under A.O. 2004-123. The GSA building on site will be removed as site construction commences. The existing zoning to the east and south is B-2C.

Per the zoning ordinance 2006-046, the project plan must be conceptually approved by the "Ship Creek District Review Board" before it can be presented to the Planning and Zoning Commission. That Review Board is comprised of personnel from the Alaska Railroad Corporation, the MOA Planning Staff and a representative of the P&Z Commission. That review was held December 22, 2016.

This narrative, site plans and other drawings are meant to supplement the initial Planning and Zoning application.

Utility, Road Improvements and Drainage:

The site abuts the North Right of Way of West 2nd Avenue, and the west Right of Way of Christensen Drive. Both roads are improved to full Municipal standards (30 feet wide, with curb and gutter and concrete sidewalks). To the north are the railroad tracks, and to the west is an ML&P substation. The north side of the site is steeply sloped, and the 11 units situated on the north side will be terraced into the slope.

The project drainage will be collected onsite and directed to existing storm drain lines to the north. There's an existing sewer main line available approximately 150 feet north of the property. Water main is available immediately adjacent to the property on the west side.

Because Christensen Drive was recently improved in 2000, it is desirable to minimize construction in the ROW. The utility configurations adjacent to the north and west of the property make that possible.

There will be 2 access points into the project, one from Christensen, the other from West 2nd Avenue. The road/driveway construction will be an "inverted" section, 24 and 26 feet wide (refer to grading and utility plan). This type of road construction allows for efficient drainage of the roads and driveways.

All shallow utilities (gas, electric and communications) are available immediately adjacent to the property.

Downtown Edge at The Rail
Condominium Development Narrative

Traffic, Parking and Pedestrian Circulation Considerations:

Traffic: While the new development will add additional traffic to the intersection, the traffic study performed for the project indicates that the development of 28 units will generate relatively low levels. Additionally, the proposed locations of the driveway access points exceed the minimum driveway clearances required by MOA design standards and have adequate site distance along both 2nd Avenue and Christensen Drive (refer to TIA Report by Kinney Engineering dated November 14, 2016).

Pedestrian circulation for the site is provided by a 5-foot sidewalk off both West 2nd Avenue and Christensen.

The ***parking standards*** for "old code" (21.45.080.2.d) are met, per the following calculation:
28 two bedroom units: 1.75 X 28 =49 +15% overflow (21.90 F.4) = **55 Total Required.**
79 parking provided (48 garage, 28 driveway and 3 outside stalls).

Because of the terrain drop on the north tier of the property, the units have been stepped into the slope. To keep the buildings from pushing too far over this slope, the driveways into the buildings have properties that may require formal design variances. These will be addressed when the construction plans are brought in for review. This issue has been discussed with and acknowledged by the Municipal Traffic Engineer. Refer to traffic memo dated 6/21/2016.

Geotechnical Considerations:

As required by the zoning ordinance, an evaluation of the project by the Geotechnical Advisory Commission (GAC) is required. Because of the project location within the MOA Seismic Zones 4/5 as well as the zoning ordinance requirement, an in depth Geotechnical Assessment was performed by Northern Geotechnical Engineering (NGE) this past summer, and it includes engineering recommendations for building foundation design. The project report was presented for review at the GAC's December 27th meeting. Based on feedback from the Committee at that meeting, the NGE report is in the process of being revised and will be presented to the GAC at their 1/24/17 meeting.

Landscaping:

Currently, the property is heavily wooded on the north and west sides by alders and cottonwood. There are existing large spruce trees along the north side of West 2nd Avenue on the south side of the property, some of which may be retained.

Refer to the development site plan-landscape plan for proposed landscaping.

Building Construction:

The building construction will be conventional wood style condominiums. As previously mentioned, the buildings in the north tier will be terraced down the slope, and will have engineered foundations specific to that area. See building plans for more details.

Downtown Edge at The Rail
Condominium Development Narrative

Submitted Project Plans and Documents:

- Site Plan / Landscape Plan, dated 12/14/2016 (full size and 8 ½" X 11")
- Existing site conditions map (with and without imagery) dated 11/21/2016
- Utility and grading plan, dated Nov., 2016 by Triad Engineering
- Building plans and elevations from Lumen Design, dated 12/15/2016
- Kinney Engineering Traffic Study dated 11/14/2016
- Street section acknowledgement memo from Kent Kohlhase and Stephanie Mormilo dated 12/2/2016
- Geotechnical report "Geotechnical Assessment of the site of the proposed Ship Creek Development, Anchorage, AK. by NGE/TFT dated 8/9/16
- Traffic memo regarding driveway configuration, prepared by Triad Engineering and acknowledged by Stephanie Mormilo, dated 6/7/2016.
- "The Rail" Concept Master Plan Map by KPB.

Conformance with Assembly Zoning Ordinance AO 2006-046:

Land Use (Section D.5.a): Multi Family use is an allowed PERMITTED use.
Lot and yard requirements (Sections I and J): There are no minimum lot or yard requirements.
Building height (Section K.2.): Building heights from mean sea level (m.s.l.) shall not exceed 120 feet. Conservatively, the maximum building height of these buildings will not exceed 90 feet m.s.l.
Total dwelling units (Section J): The maximum number of housing units is 400 units. As this development is the first housing project under this ordinance, the 28 units are far beneath this standard.
Site plan review (Section P): This project is subject to a Level 2 Development Review process, which triggers a review by the Ship Creek District Review Board. That review has been accomplished. This application is the final required site plan review under the ordinance.

Compliance with Ship Creek Framework Plan, Assembly Ordinance 2014-79:

This development conforms to the land use laid out in the Framework plan, in the area identified as Phase II-B. More specifically, the unit design in the plan is characterized as "residences which fit into the steep topography of the bluff, and feature attractive stepping masses and great views". The design and building orientation depicted on the Framework plan (page 67-68) are very similar in character to the proposed development.

Compliance with A.M.C. 21.15.030, Approval of site plans and conditional uses:

B. Pre-application conference was held with Municipal staff on 4/12/2016
C. Application.

1. Written documents
    a. Legal Description: *(see narrative)*
    b. Statement of planning objectives: *(see narrative)*
    c. Projected dates: *(see narrative)*
    d. Traffic and pedestrian circulation: *(see narrative)*
    e. Landscaping: *(see narrative)*
    f. Zoning map amendment: *N/A*
2. Application maps:
    2. Site conditions map: *(attached)*
    3. Plot Plan / Landscape plan: *(attached)*

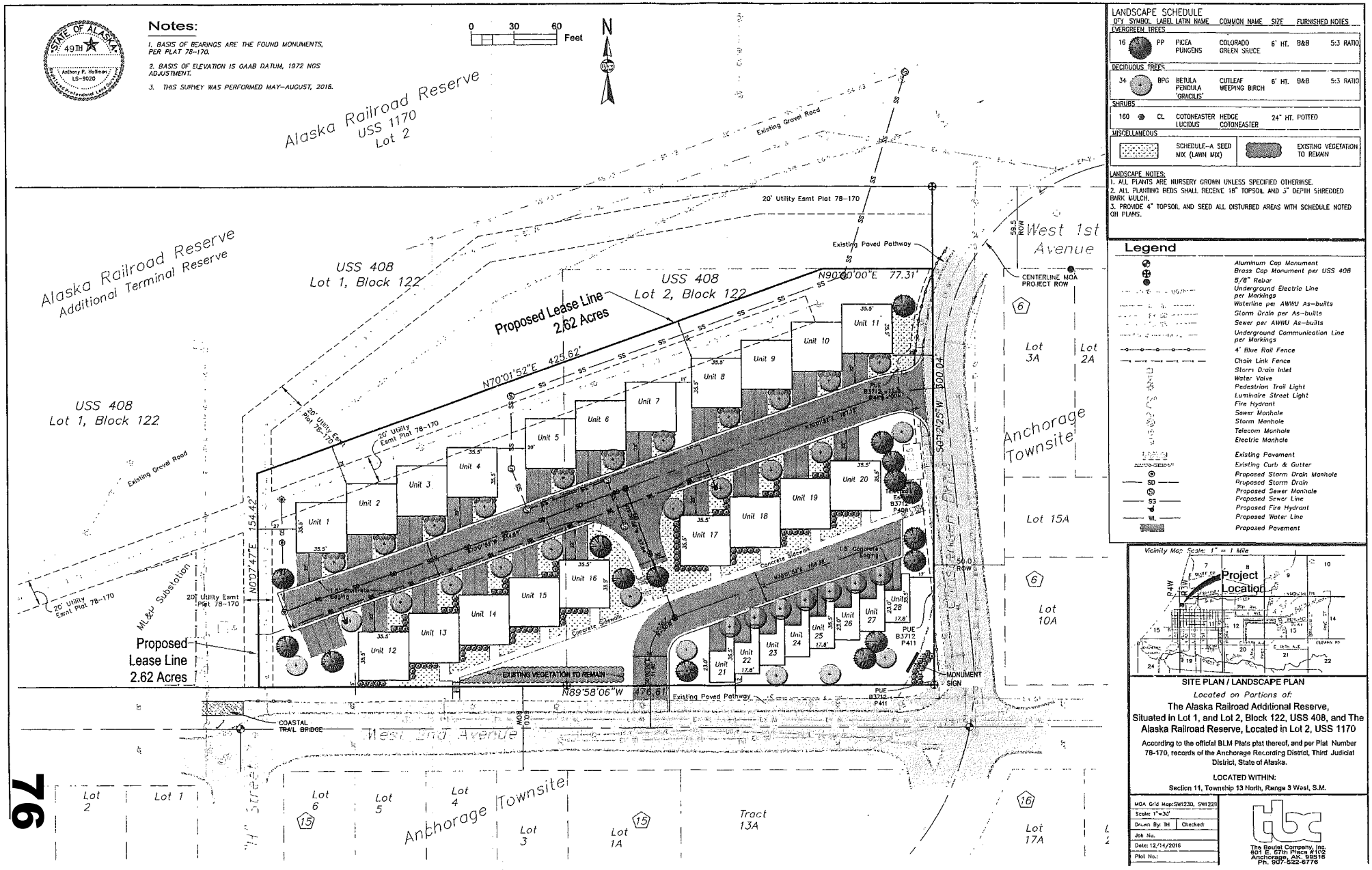
D-E. N/A

F. Final Approval
1. This site plan is submitted and subject to approval as a FINAL SITE PLAN.
2. Required Information:
    a. Landscape plan: *(attached)*
    b. Preliminary grading and drainage plan: *(attached)*

Compliance with A.M.C. 21.50.200, General Standards for Site Plan:

A. Meet the criteria for its' approval: *The development of this property is governed by A.O. 2006-46, which specifies the approval criteria is approval and compliance with 21.15.130. Compliance to 21.15.130 is demonstrated above.*

B. Will not have a permanent negative impact on those items listed in this subsection substantially greater than that anticipated from permitted development: *It should be noted that this is a permitted use as outlined in the A.O. 2006-46, and that the proposed development follows the Ordinance and the Ship Creek Master Plan. However, individual responses have been prepared for each of the items.*
    1. Pedestrian and vehicular traffic circulation and safety: *The development of 28 housing units will not have a negative impact on the on the traffic circulation, and the increase in traffic is minimal. The impact and design of the proposed 2 driveways is discussed in the Kinney Engineering Traffic Study.*
    2. The demand and availability of public services and facilities: *Connections to all the deep underground utilities (water, sewer and storm sewer) are available adjacent to the development. There is plenty of capacity in all utilities. Shallow utilities (electric, communications and gas) are all available adjacent to the site. Refer to the utility and grading plan prepared by Triad Engineering.*
    3. Noise, air, water or other forms of environmental problems: *The development of 6 buildings will create minimal environmental impacts.*
    4. The maintenance of compatible and efficient development patterns and land use densities: *Again, this proposed development follows the development scenario as outlined in the adopted Ship Creek Master Plan. As such, it is maintaining the development patterns envisioned by the Municipality when it approved the plan.*



LANDSCAPE SCHEDULE

QTY	SYMBOL	LABEL	LATIN NAME	COMMON NAME	SIZE	FURNISHED	NOTES
EVERGREEN TREES							
16		PP	PICEA PUNGENS	COLORADO GREEN SPRUCE	6' HT.	B&B	5:3 RATIO
DECIDUOUS TREES							
34		BPG	BETULA PENDULA 'GRACILIS'	CUTLEAF WEEPING BIRCH	6' HT.	B&B	5:3 RATIO
SHRUBS							
160		CL	COTONEASTER LUCIDUS	HEDGE COTONEASTER	24" HT.	POTTED	
MISCELLANEOUS							
			SCHEDULE-A SEED MIX (LAWN MIX)				EXISTING VEGETATION TO REMAIN

LANDSCAPE NOTES:
1. ALL PLANTS ARE NURSERY GROWN UNLESS SPECIFIED OTHERWISE.
2. ALL PLANTING BEDS SHALL RECEIVE 18" TOPSOIL AND 3" DEPTH SHREDDED BARK MULCH.
3. PROVIDE 4" TOPSOIL AND SEED ALL DISTURBED AREAS WITH SCHEDULE NOTED ON PLANS.

Legend

- Aluminum Cap Monument
- Brass Cap Monument per USS 408
- 5/8" Rebar
- Underground Electric Line per Markings
- Waterline per AWWU As-builts
- Storm Drain per As-builts
- Sewer per AWWU As-builts
- Underground Communication Line per Markings
- 4' Blue Rail Fence
- Chain Link Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light
- Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Existing Pavement
- Existing Curb & Gutter
- Proposed Storm Drain Manhole
- Proposed Storm Drain
- Proposed Sewer Manhole
- Proposed Sewer Line
- Proposed Fire Hydrant
- Proposed Water Line
- Proposed Pavement

Vicinity Map Scale: 1" = 1 Mile

SITE PLAN / LANDSCAPE PLAN

Located on Portions of:

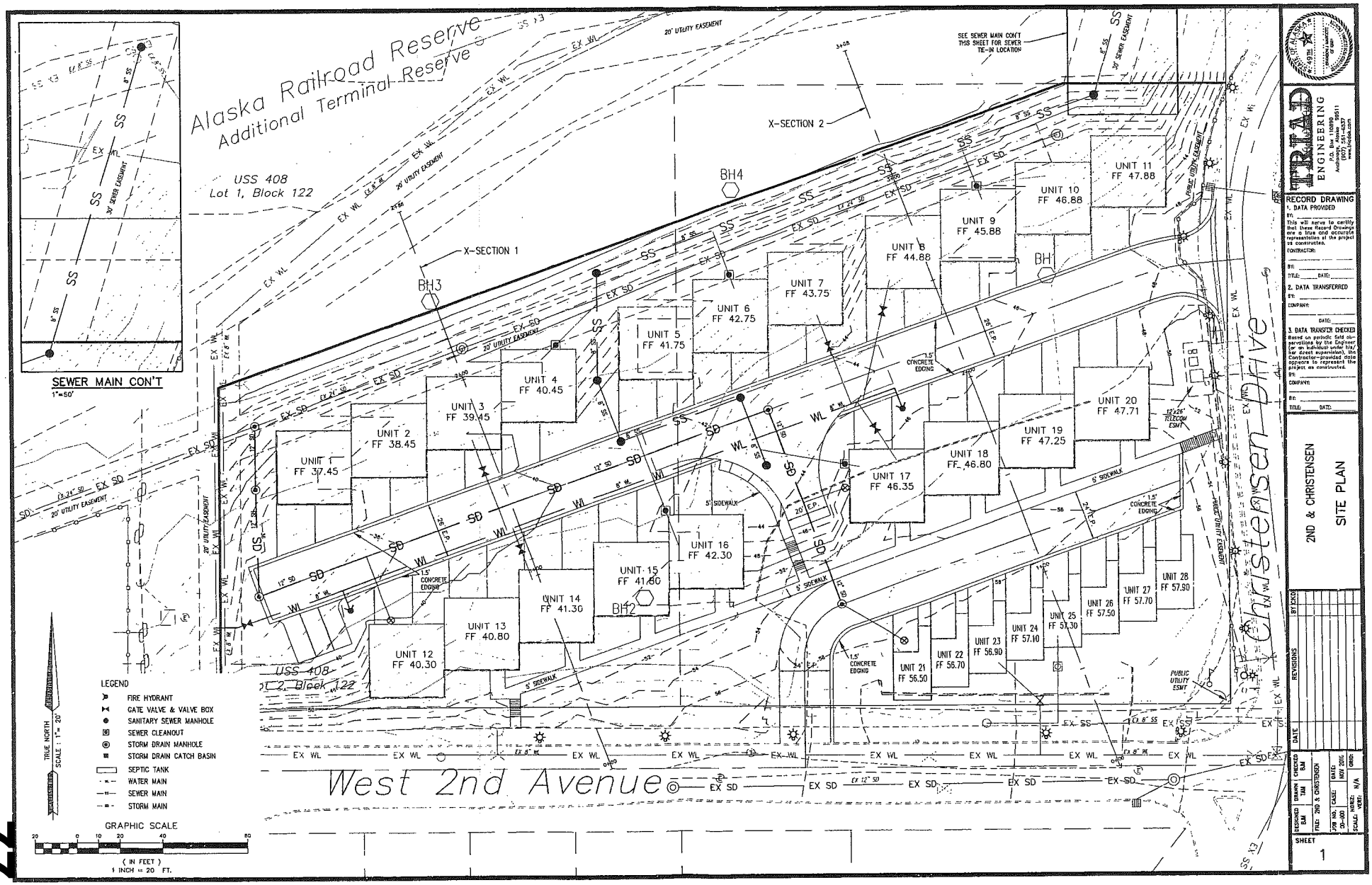
The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
Section 11, Township 13 North, Range 3 West, S.M.

MOA Grid Map:	SW1230, SW1229
Scale:	1"=30'
Drawn By:	TH
Checked:	
Job No.	
Date:	12/14/2016
Plat No.:	

The Boutet Company, Inc.
601 E. 67th Place #102
Anchorage, AK. 99518
Ph. 907-522-6776



RECORD DRAWING
1. DATA PROVIDED
BY:
This will serve to certify that these Record Drawings are a true and accurate representation of the project as constructed.
CONTRACTOR:
BY:
TITLE: DATE:
2. DATA TRANSFERRED
BY:
COMPANY:
DATE:
3. DATA TRANSFER CHECKED
Based on periodic field observations by the Engineer (or an individual under his/her direct supervision), the Contractor-provided data appears to represent the project as constructed.
BY:
COMPANY:
BY:
TITLE: DATE:

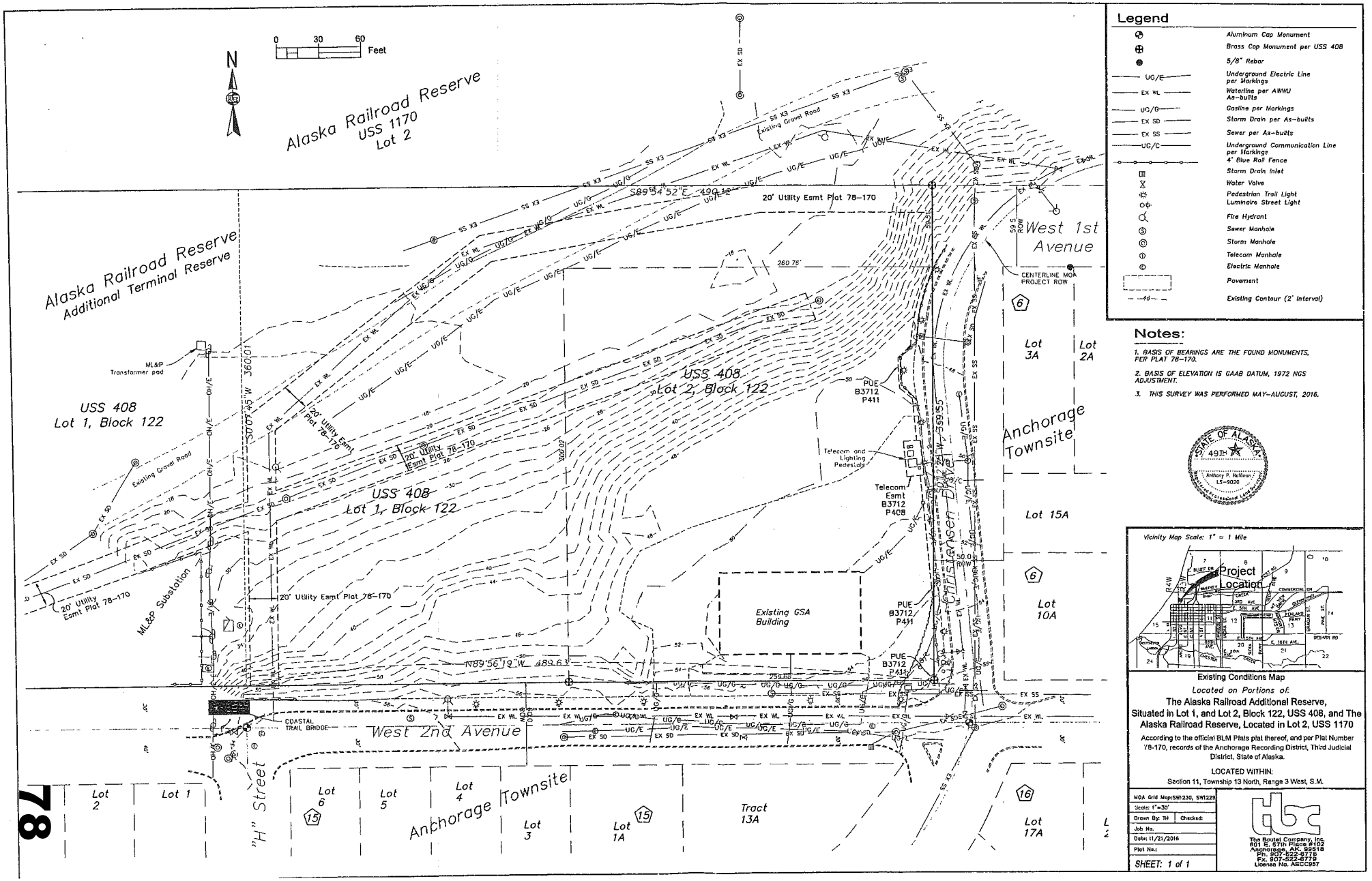
2ND & CHRISTENSEN
SITE PLAN

BY	DATE
REVISIONS	

DESIGNED: BJM
DRAWN: TAM
CHECKED: BJM
FILE: 2ND & CHRISTENSEN
JOB NO.: 20-000
CASE:
DATE: NOV 2020
SCALE: NOTED
VERT: N/A
GRID:

SHEET 1

77



Legend

- Aluminum Cap Monument
- Brass Cap Monument per USS 408
- 5/8" Rebar
- UG/E — Underground Electric Line per Markings
- EX WL — Waterline per AWWU As-builts
- UG/G — Gasline per Markings
- EX SD — Storm Drain per As-builts
- EX SS — Sewer per As-builts
- UG/C — Underground Communication Line per Markings
- 4' Blue Rail Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light / Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Pavement
- Existing Contour (2' Interval)

Notes:

1. BASIS OF BEARINGS ARE THE FOUND MONUMENTS, PER PLAT 78-170.
2. BASIS OF ELEVATION IS GAAB DATUM, 1972 NGS ADJUSTMENT.
3. THIS SURVEY WAS PERFORMED MAY-AUGUST, 2016.

STATE OF ALASKA 49TH — Anthony P. Hoffman LS-9020

Vicinity Map Scale: 1" = 1 Mile

Existing Conditions Map

Located on Portions of:

The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

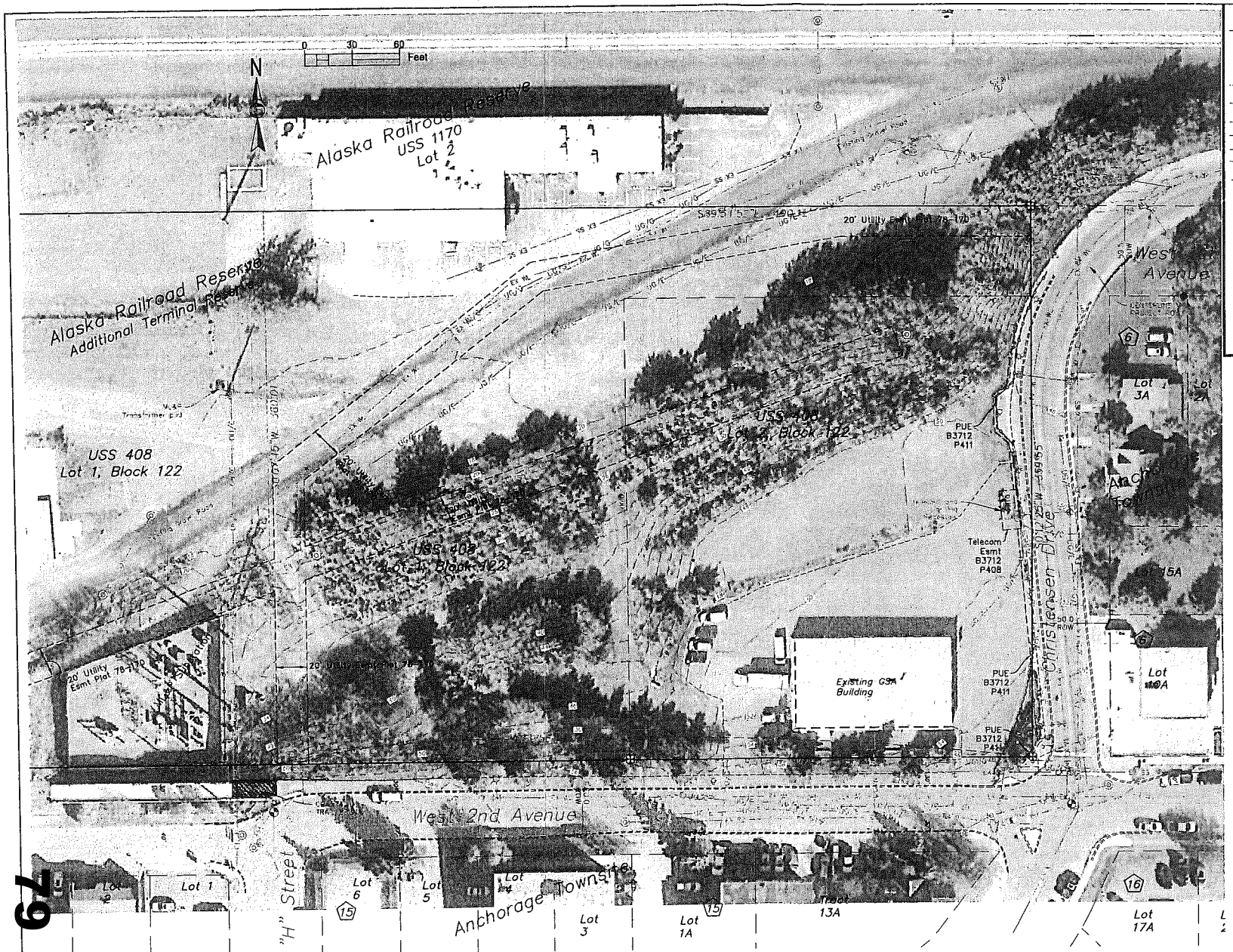
According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
Section 11, Township 13 North, Range 3 West, S.M.

MOA Grid Map: SW1230, SW1229	
Scale: 1"=30'	
Drawn By: TH	Checked:
Job No.	
Date: 11/21/2016	
Plat No.:	
SHEET: 1 of 1	

The Boutet Company, Inc.
601 E. 57th Place #102
Anchorage, AK 99518
Ph: 907-522-8779
Fx: 907-522-8779
License No. AECC957

78



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- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Pavement
- 48 — Existing Contour (2' Interval)

Notes:

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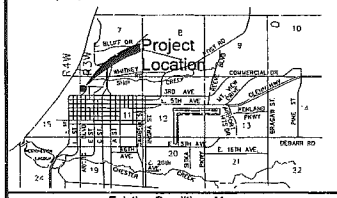
3. THIS SURVEY WAS PERFORMED MAY-AUGUST, 2016.

STATE OF ALASKA
49TH
Anthony P. Holmes
LS-9720

Vicinity Map Scale: 1" = 1 Mile



Existing Conditions Map

Located on Portions of:

The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
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MOA Grid Map: SW1230, SW1229	
Scale: 1"=30'	
Drawn By: TH	Check'd:
Job No.	
Date: 11/21/2016	
Plat No.:	
SHEET: 1 of 1	

The Boutet Company, Inc.
601 E. 57th Place #102
Anchorage, AK 99518
Ph: 907-522-6776
Fx: 907-522-6779
License No. AECC957

Authorization Certificate

Date: December 14, 2016

Current Project Legal: The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

Proposed Legal: Same

Type of Authorization: Preliminary Plat and Site Plan Applications

Statement:

I hereby authorize Tony Hoffman of The Boutet Company Inc. to represent me in the Municipality of Anchorage Platting and Site Plan Applications of the above described property.

Thank you,

Ship Creek Development:

The Rail
at ship creek

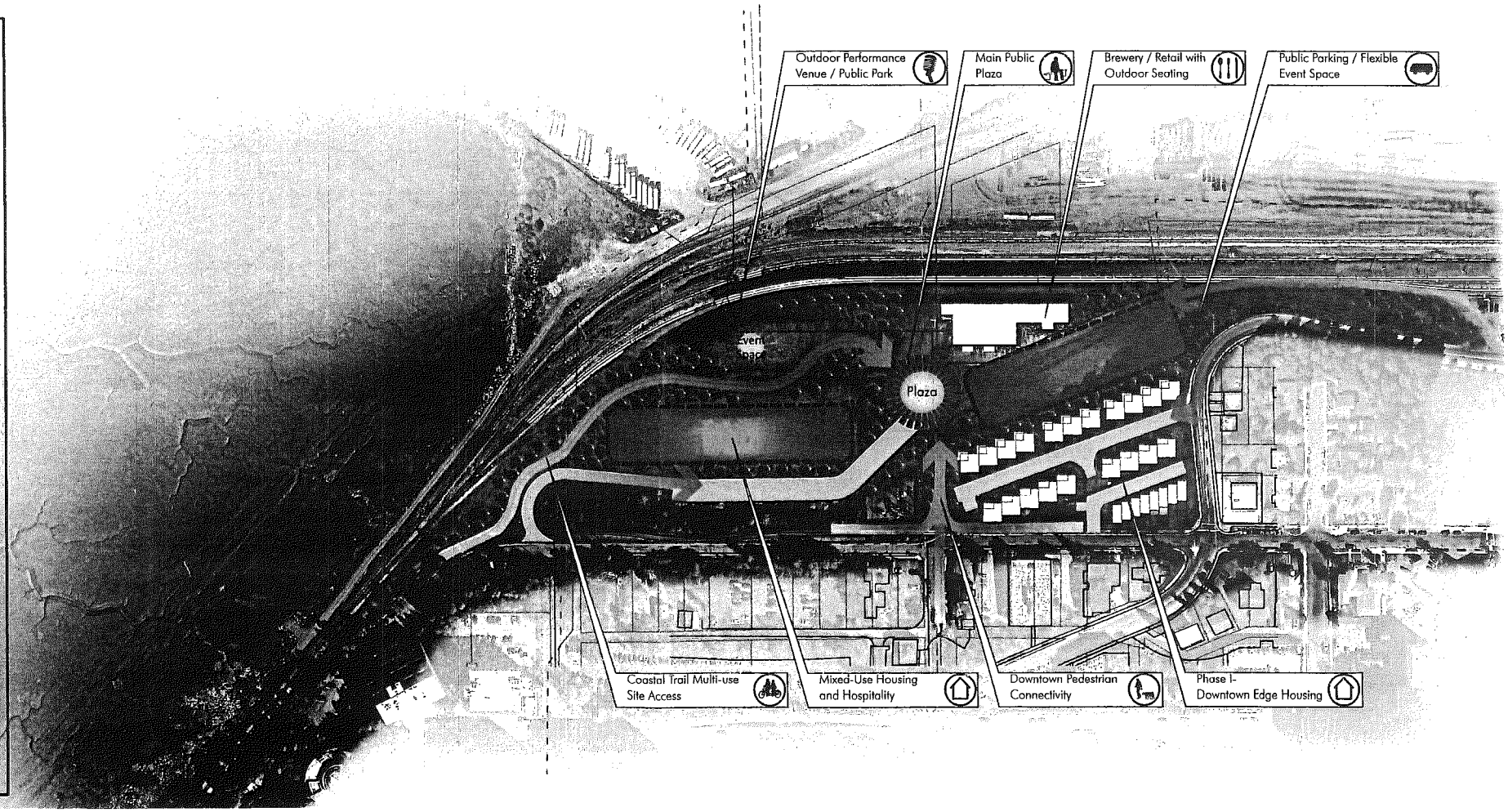
Concept Master Plan

HBC

Swell, LLC

petersen
BUILDING & DEVELOPMENT

DLR ARCHITECTS



August 9, 2016 NGE-TFT Project # 4385-16(G)

John McGrew
9831 Main Tree Drive
Anchorage, Alaska

RE: GEOTECHNICAL ASSESMENT OF THE SITE OF THE PROPOSED SHIP CREEK DEVELOPMENT, ANCHORAGE, AK.

John,

We (Northern Geotechnical Engineering, Inc. *d.b.a.* Terra Firma Testing) have completed a geotechnical engineering assessment of the aforementioned project. We have provided details of our findings along with our conclusions and engineering recommendations in the following report.

The project site has the potential for both slope failure and large lateral movements (cyclical movements of the order of two feet) under strong seismic motions. The purpose of this report is to help design building foundations that will remain intact enough to minimize the risk to human life of the occupants during a strong seismic event. It is not economically feasible at this site to design a foundation that will not move during a large seismic event. Therefore, our approach is to design foundations that will move as a whole during a large seismic event, and as such, we have recommended a thickened edge concrete structural slab foundation. *Again, it is important to note that this foundation is designed to help reduce the potential for catastrophic collapse of the building and loss of life during a strong seismic event, it is not designed to prevent movement or damage to the building. After such an event, the building may be displaced from its original location and/or be un-inhabitable.*

In addition, the project site has a significant amount of fill material which has been placed over the past several decades. We cannot be certain of the vertical and horizontal extents of this fill across the project site, nor can we be certain of the level of compaction effort (if any) that was applied to the fill during placement. These factors have led us to be more conservative with our design recommendations.

We greatly appreciate the opportunity to provide you with our professional service. Please contact us directly with any questions or comments you may have regarding the information that we present in this report, or if you have any other questions, comments, and/or requests.

Sincerely,
Northern Geotechnical Engineering, Inc. *d.b.a.* Terra Firma Testing,

Andrew L. Fortt
Project Engineer

Keith F. Mobley
President

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1.0 INTRODUCTION

In this report, we (Northern Geotechnical Engineering, Inc. *d.b.a.* Terra Firma Testing) present the findings of our geotechnical assessment that we conducted at the proposed Ship Creek Development; hereafter referred to as "the project site". We provided our professional service in accordance with our service fee proposal (#16-078G) which we submitted to you on April 7, 2016. You authorized our proposed scope by signed fee proposal on April 20, 2016.

We were contracted to characterize the subsurface conditions across the project site in an effort to provide geotechnical design criteria and engineering recommendations for the proposed improvements.

In this report, we provide a summary of our subsurface exploration and laboratory testing programs, as well as provide our conclusions regarding the suitability of the project site for the proposed improvements. We also provide design and construction recommendations for the proposed improvements.

2.0 SITE AND PROJECT DESCRIPTIONS

As we detail in Figure 1 of this report, the project site is located in the ARRC Additional Terminal Reserve area in Anchorage, Alaska. The project site consists of two adjacent parcels, which are:

1. 701 West 2nd Ave; and
2. the southeast portion of 801 West 2nd Avenue.

The proposed improvements to the project site include the demolition of the existing structures and the construction of a series of residential, multi-unit dwellings, and associated utilities, parking areas, and driveways. A conceptual site plan was not available at the time we issued this report.

We believe (based upon our field exploration, previous geotechnical reports and a study of the available aerial photography) that there has been a significant amount of fill placed at the project site at various intervals since at least 1960. Based upon the information available to us at the time of this report, we cannot be certain of the horizontal and vertical extents of this fill. Appendix A of this report contains aerial photographs of the project site taken over a timespan of several decades. As can be seen from the photograph in Appendix A-1, fill placement was occurring during May of 1960. By July of 1970 (Appendix A-2) the original slope had been re-graded and a pad and building (General Services Administration (GSA) building) constructed in the southeast corner of the lot. Sometime between 2000 (a report entitled "*GSA Parking, Slope Stability Study, Anchorage, AK* by Shannon & Wilson was produced) and 2002 (see image in Appendix A-3 and A-4) the parking lot for the GSA building was increased in area and the slope

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to the north was re-graded. The project site appears to be relatively unchanged since 2002 (see image taken in May 2015 in Appendix A-5).

Currently, from the GSA building parking area, the project site slopes downwards to the north and west (approximately 4H:1V), with a vertical relief of approximately 30 feet. The slope is currently vegetated with small trees and brush.

At the toe of the slope is the former tidal flats area of Ship Creek that flows east to west, north of the project site. Following the 1964 Good Friday Earthquake, the toe of this slope was reinforced with a compacted sand and gravel buttress, with the intent to improve stability of the slope. Currently, this area is devoid of vegetation and is being used as a vehicle parking lot.

As we discuss in detail later in this report, the project site has a high to very high ground failure susceptibility (MOA Seismic Hazard Zones 4 to 5). While the project site did not slide during the 1964 earthquake, the areas surrounding the project site did slide (L Street Slide and 4th Avenue Slide). Therefore we have customized our geotechnical recommendations to help protect the proposed improvements from catastrophic failure during a large seismic event.

3.0 PREVIOUS EFFORTS

Shannon & Wilson, Inc. (S&W) prepared a geotechnical report entitled "*Preliminary Geotechnical Study, Ship Creek Development Plan, Additional Terminal Reserve, Anchorage, Alaska*" in September of 2015. The S&W report discusses and summarizes the different subsurface exploration activities that they (and others) have conducted in the vicinity of the project site at various dates in the past. Two S&W borings (drilled in 2000 for their geotechnical report entitled "*GSA Parking, Slope Stability Study, Anchorage, AK*") are located on the project site. S&W's report provides some useful information, however their report was intended to be used in the conceptual-level design stages and does not provide the complete information necessary for a geotechnical engineering design for the project site.

4.0 CURRENT SUBSURFACE EXPLORATION

We coordinated and directed subsurface explorations at the project site on May 5, 2016. We contracted Discovery Drilling (DD), who in turn mobilized a truck-mounted CME-75 drill rig and two-man drill crew to the project site to perform the necessary drilling, sampling, and borehole backfill activities. DD advanced a total of five boreholes at the project site, designated B1 through B5, using 3.25-inch I.D. (6.625-inch O.D.) hollow-stem augers with center drill rods. We have plotted the approximate location of the five boreholes on Figure 2 of this report. The boreholes were advanced to depths of between 32 feet to 52 feet below the existing ground surface (bgs). A representative from our firm was present on-site during the entire drilling program to direct the drilling activities, which included: determining the final location of each borehole; logging the geology of each borehole; collecting and preparing representative soil samples; and directing borehole backfill activities.

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Under our direction, DD performed a Modified Penetration Test (MPT) at regular intervals during the drilling of each borehole. A MPT can be used to assess the consistency of a soil interval and to collect representative soil samples. A MPT is performed by driving a 3.0-inch O.D. (2.4-inch I.D.) split-spoon sampler at least 18 inches past the bottom of the advancing augers with blows from a 340-lb drop-hammer, free-falling 30 inches onto an anvil attached to the top of the drill rod stem. Our field representative recorded the hammer blows required to drive the modified split-spoon sampler the entire length of each sample interval, or until sampler refusal was encountered. We have provided the field blow count data for each sample interval (in six-inch increments) on the graphical borehole logs in Appendix B of this report.

We corrected the field blow count data for all five boreholes for standard confining pressure, drill rod length, and drop-hammer operation procedure to estimate a standard $(N_1)_{60}$ value for each sample interval. $(N_1)_{60}$ values are a measure of the relative density (compactness) and consistency (stiffness) of cohesionless or cohesive soils, respectively. Our estimate of the $(N_1)_{60}$ values is based on the drop-hammer blows required to drive the spilt-spoon sampler the final 12-inches of an 18-inch MPT. We have provided our estimated $(N_1)_{60}$ values for each sample interval on the graphical borehole logs in Appendix B of this report. The automatic drop-hammer that DD used for this project is not standard, so we applied a correction factor of 1.1 to the $(N_1)_{60}$ values to account for the efficiency of the automatic drop-hammer that DD used for the project. We have provided a graphical plot of the field blow count corrections for confining pressure and drill rod length in Figure 3 of this report.

Our field representative photographed each split-spoon sample that they collected during the exploration program. A photograph of each split-spoon sample that we collected during our subsurface exploration program is provided in Appendix B of this report. We sealed each split-spoon sample that was collected during our subsurface exploration program inside of air-tight bags, to help preserve the moisture content of each sample, and then submitted each sample to our laboratory for further identification and analysis.

Under our direction, DD performed thin-walled Shelby tube sampling at specified intervals during the drilling of each borehole. Shelby tube sampling methods are used to collect undisturbed samples of soft, fine-grained (cohesive) soils in an effort to recover intact samples which are representative of the in-situ soil density and water content; two factors which are essential for evaluating engineering properties such as the strength, compressibility, permeability, and density of fine-grained soils. DD collected each Shelby tube sample by advancing a 3.0-inch O.D. seamless steel tube (constructed from either 16-gauge or 18-gauge steel) past the bottom of the advancing augers by applying constant downward pressure directly to the drill rod stem using the vertical hydraulic feed system of the drill rig. We recorded the average hydraulic feed pressure (in psi) required to advance each Shelby tube sampler 24 inches (in six-inch increments).

DD allowed each Shelby tube sample to rest (in-place) for at least five minutes prior to sampler retrieval, which increases the potential for complete sample recovery by allowing the soil sample to adhere to the inside of the Shelby tube sampler. Following the rest period, DD manually

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rotated the drill rod stem (using a large pipe wrench) approximately 180 to 360 degrees in an attempt to shear the end of the soil sample from the in-situ soils and relieve any suction pressures, thus reducing the potential for the soil sample to be pulled from the Shelby tube sampler upon sampler retrieval. Our field representative sealed, labeled, stored, and transported each Shelby tube sample from the project site to our laboratory in a manner consistent with the standard practices outlined in ASTM D1587-08.

Once the exploration activities were complete, we directed DD to backfill the annulus of each exploration with its respective drill cuttings

5.0 LABORATORY TESTING

We collected a total of 56 soil samples from the five boreholes that DD advanced at the project site and submitted all of the soil samples to our laboratory for further identification and geotechnical analysis. We tested select soil samples in general accordance with the respective ASTM standard test methods including:

- moisture content analysis (ASTM D-2216);
- grain size sieve and hydrometer analysis (ASTM D-6913 & D-422);
- organic content (ASTM D2974);
- Atterberg limits (ASTM D-4318);
- Determination of fines content (a.k.a. P200 – ASTM D-1140);
- Consolidated Undrained (CU) triaxial compressive strength (ASTM D4767)

It is important to note that ASTM test method D-6913 requires that any soil sample specimen which is to be submitted for gradational analysis (by ASTM D-422 or other methods) must satisfy a minimum mass requirement based on the maximum particle size of the sample specimen. Split-spoon sampling techniques (standard or modified), as well as other small-diameter soil sampling techniques (e.g., macro-core, etc.), typically recover anywhere from approximately 1 to 10 pounds of sample specimen. The amount of sample specimen recovered can be influenced by (amongst other variables) the soil gradation, soil density, sample interval, sampler tooling, and soil moisture content. As a result, samples of coarse-grained soils (with individual soil particles greater than approximately 0.75 inches in diameter) collected with small-diameter sampling methods (e.g., split-spoons, macro-core, etc.) may not meet the minimum mass requirement specified by Table 2 of ASTM D-6913. This may result in inaccurate gradational and frost classification results. The use of small-diameter sampling devices in coarse-grained soils (e.g., sand and gravel) can result in the collection of unrepresentative samples due to: the exclusion of oversized particles (larger than the opening of the sampler) from the sample; and the mechanical breakdown/degradation of coarse-grained particles by the sampling process (producing an unrepresentative increase in smaller-diameter particles in the sample). Both of these sampling biases can skew laboratory test results towards the fine-grained end of the gradational spectrum.

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The laboratory test results, along with the observations we made during our subsurface exploration efforts, aid in our evaluation of the subsurface conditions at the project site and help us to assess the suitability of the subsurface materials located at the project site to support the proposed improvements. The results of our geotechnical laboratory analyses are provided on the graphical exploration logs contained in Appendix B of this report and on the laboratory data sheets contained in Appendix C of this report.

6.0 DESCRIPTION OF SUBSURFACE CONDITIONS

We compiled our field observations with the results from our laboratory analyses to produce graphical logs of each subsurface exploration (Appendix B). The graphical exploration logs depict the subsurface conditions that we identified at each exploration location and help us to interpret/extrapolate the subsurface conditions for areas adjacent to, and immediately surrounding, each exploration location across the project site.

We positioned the boreholes in an effort to sample subsurface conditions across the entire project site. Borehole B1 is located at the uppermost elevation of approximately +50 feet (reference elevation taken from Figure 2). Borehole B2 is located to the southwest of borehole B1 at an elevation of approximately +45 feet. Boreholes B3, B4 and B5 are all located along the toe of the existing slope, at elevations ranging from +18 feet to +20 feet.

6.1 General Subsurface Profile

In general, our subsurface exploration identified two predominant material types at the project site. The first, a sand/gravel fill material, was encountered directly below the ground surface and was of varying thickness. The second predominant material type was a silt/clay (locally known as the Bootlegger Cove Formation) that extended to depths of at least 52 feet bgs. Previous explorations in the general area (S&W's 2015 report) has demonstrated that the silt/clay is underlain by a sand and gravel material, at an elevation of approximately -120 to -130 feet, that is likely to be glacial till.

At the top of the slope, we encountered approximately 25 feet of loose to medium dense sand/gravel fill material at borehole B1, before encountering the underlying native silt layer. This silt layer ranged from soft to medium stiff in density. In borehole B2 we encountered approximately 8 feet of loose sand/gravel fill material before encountering soft silt.

At the toe of the slope, we encountered approximately eight feet of loose to medium dense sand/gravel fill material before encountering the soft to medium dense underlying native silt. In boreholes B4 and B5 we observed a thin layer (approximately 1-2 feet in thickness) of peat between the sand/gravel and underlying silt.

The near surface materials (sand/gravel) were moderately frost susceptible (Frost classification F1 to F3).

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6.2 Groundwater

Groundwater depth varied across the project site. At the top of the slope, we were not able to determine the exact location of groundwater in borehole B1, but we observed groundwater at a depth of approximately 6.5 feet bgs in borehole B2.

At the toe of the slope, we observed groundwater between 6 feet bgs to 18 feet bgs.

6.3 Frozen Soils

We did not encounter any frozen soil (seasonal or permafrost) at the project site at the time of our subsurface exploration, and we do not expect permafrost to exist at any depth across the project site.

7.0 SEISMIC GROUND RESPONSE ANALYSIS

We used a computer program known as ProShake (from EduPro Civil Systems, Inc,) to perform a seismic response analysis for the soil column above the bedrock at the project site.

Table 1: Proshake Analysis Soil Profile

LAYER DEPTH BGS (ft)	MATERIAL TYPE	UNIT WEIGHT (pcf)	G_{MAX} (ksf)	Vs (fps)
0-10	Sand & Gravel	120	3613	984
10-50	Soft Bootlegger Clay	110	368	328
50-80	Medium Stiff Bootlegger Clay	110	575	410
80-200	Stiff Bootlegger Clay	110	828	492
200-700	Glacial Till	150	72263	3937
700	Bedrock	165	141315	5249

We used borehole logs from the project site to create a soil profile for the analysis (as shown in Table 1). The analysis requires values for unit weight and shear wave velocity for each soil layer. We estimated shear wave velocities using the correlation equations of Pitilakis et al. [1999] and the corrected blow count data listed on the logs contained in Appendix B. Unit weights for each material type are estimated based upon the material descriptions shown on the boring logs contained in Appendix B.

We used the ground motion record for the 2016 Iniskin Earthquake from the Glen Alps recording station [we obtained the data from the Center for Engineering Strong Motion Data (CESMD)] as the bedrock acceleration input motion and then scaled the motion to a maximum acceleration of 0.63 g (2475 year return interval at the project site) and 0.41 g (⅔ of the 2475 year return interval).

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We have provided plots of the input motions, surface displacement time history, and peak accelerations throughout the soil column in Figure 4 of this report.

The results from the analysis suggest that the ground surface accelerations during large seismic events at the project site are relatively insensitive to the bedrock acceleration. The soft silt/clay layers tend to attenuate any bedrock accelerations and it is unlikely that any ground surface accelerations will exceed 0.2 g. However, the ground surface displacements calculated by the program are, of the order of two feet during large seismic events (such as the scaled Iniskin earthquake in the this analysis).

8.0 SLOPE STABILITY ANALYSIS

We conducted a slope stability analysis to evaluate the existing slope stability with the proposed improvements.

8.1 SLOPE/W (GeoStudio 2012)

SLOPE/W is one component in a complete suite of geotechnical modeling software known as GeoStudio (produced by Geo-Slope International).

There are various methods available in SLOPE/W for calculating the factor of safety for a modeled slope. We used the Morgenstern-Price method in our slope stability analysis as it generally results in a lower (more conservative) calculated factor of safety than other analysis methods. The Morgenstern-Price method allows for various user-specified interslice force functions, including both shear and normal interslice forces, and satisfies both moment and force equilibrium.

SLOPE/W (by default) utilizes the half-sine interslice force function for the Morgenstern-Price method. The half-sine function tends to concentrate the interslice shear forces towards the middle of the sliding mass and diminishes the interslice shear forces in the crest and toe areas of the slope model.

SLOPE/W uses the concept of regions to define the model geometry. In basic terms, this means that a line (or boundary) is drawn around a soil unit or stratigraphic layer to indicate a distinctive soil profile and soil properties. For this project, we modeled the soil properties using the Mohr-Coulomb model.

SLOPE/W allows for the application of surcharge loads to simulate a pressure applied over a portion of the soil surface (e.g., to model a structure on the ground surface). The magnitude of the surcharge load applied is computed by multiplying the unit weight of the surcharge material by the vertical distance between the surcharge load and the ground surface.

We simulated Seismic loads using a pseudo-static approach where a seismic coefficient (k) is defined to generate a destabilizing horizontal force. The seismic loading is equal to the seismic

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coefficient (k) times the weight of the assumed failure wedge. We assumed the shear strength of the soil to be unaltered by seismic forces.

8.2 Model Configuration

We have presented a topographic map of the project site (provided by the client) in Figure 2 of this report which details the approximate location and orientation of the subsurface profiles that we modeled as a part of our slope stability analysis. We selected two cross sections and estimated the soil parameters based on our field explorations and laboratory testing results. We have presented both cross section profiles in Figures 5 and 6 of this report. The proposed structure locations are estimated and subject to change. We can re-conduct all analyses once the building layout is finalized.

The project site is located at the boundary of MOA Seismic Hazard Zones 4 and 5. We, therefore, used a seismic coefficient of 0.2g, as recommended by the MOA for Seismic Hazard Zones 4 and 5. Our Proshake analysis shows this value to be slightly conservative, but a reasonable assumption.

8.3 Analysis Results

In an effort to assess the slope stability with the proposed improvements at the project site, we ran analyses for four different loading conditions:

1) cross section A-A' under static conditions;
2) cross section B-B' under static conditions;
3) cross section A-A' under a pseudo-static seismic load of 0.2g; and
4) cross section B-B' under a pseudo-static seismic load of 0.2g.

We have provided graphical plots of all analyses in Figures 7 to 10 of this report. Our modeling and analysis efforts suggest that:

- The existing slope (at cross section A-A') appears to be stable under static conditions with a minimum factor of safety of 2.5 for the soil parameters used and the slope angle as shown on Figure 7;
- The existing slope (at cross section B-B') appears to be stable under static conditions with a minimum factor of safety of 1.7 for the soil parameters used and the slope angle as shown on Figure 8;
- The existing slope (at cross section A-A') appears to be stable under a pseudo-static seismic load of 0.2g, for the soil parameters used with a minimum factor of safety of 1.1 (Figure 9);
- The existing slope (at cross section B-B') appears to be stable under a pseudo-static seismic load of 0.2g, for the soil parameters used with a minimum factor of safety of 1.1 (Figure 10).

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9.0 ENGINEERING CONCLUSIONS

9.1 General Site Conclusions

Based on the findings of our field efforts, laboratory testing and computer modeling, it is our conclusion that the current subsurface materials which we observed across the project site are generally suitable to support the proposed improvements; provided that our concerns and recommendations that we present in this report are addressed by the design and construction processes.

The three primary concerns for the project site that should be considered during all stages of development are:

- Fill material – There is an unknown quantity of fill material at the site that has been placed over an unknown timeframe. We cannot be certain of the extent (both horizontal and vertical) of this fill. Nor, do we know the level of compactive effort (if any) that was applied to the fill during placement. The soil bearing capacities that we provide for the project site (as given in Section 10.2.1) have been adjusted accordingly to compensate for this uncertainty.
- Ground failure susceptibility – Although our slope stability analysis yielded a factor of safety greater than, or equal to 1.1, in our opinion, the project site has a moderate to high susceptibility for slope failure during a large seismic event, due to the soft Bootlegger Cove Silt/Clay present at depth (moisture content greater than the liquid limit in areas), the vertical relief across the project site and the land slide history of the surrounding areas. The project site will also likely experience large amplitude cyclical lateral movements during large seismic events. During these large cyclical movements, some lateral spreading may occur. Our recommendations for a foundation design are not intended to stop any structures from sliding or moving during such an event (such a design would not be economically feasible). Instead our design is intended to hold the structure together during any movements, such that the structure moves as a whole, thus limiting structural failure and catastrophic collapse.
- Peat/organic layer – We observed a 1 to 2 feet thick peat layer at approximately 5 to 6 feet bgs at the toe of the existing slope. Any peat located within the footprint of any pavement, foundations and/or gravity-fed utilities will need to be removed to its horizontal and vertical extents prior to construction.

9.2 Earthworks

In general, the primary earthworks planned for this project will likely consist of: 1) underground utility installation; 2) fill pad and site grading; and 3) pavement section construction. All earthworks should be completed with quality control inspection, including: bottom-of-hole inspections; fill gradation classification; and in-situ compaction testing. A bottom-of-hole inspection should be conducted by a qualified geotechnical engineer, geologist, or special

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inspector following site excavation activities (and before any underground utility construction begins) in order to visually confirm the findings of this report and provide recommendations for any non-conforming conditions encountered during the excavation activities.

Any peat/organic soil which is located within the footprint of the proposed foundations and/or gravity-fed utility alignment will need to be removed to its horizontal and vertical extent prior to construction.

9.3 Slope Stability

The computer analyses we conducted (as we describe in Section 7.0 and 8.0 of this report) generally supports our professional opinion, that while the project site did not undergo large transitional (sliding) movements in the 1964 Good Friday earthquake, the project site may experience large displacements during future large earthquakes. The magnitude of the movement will be a function of the earthquake magnitude and location, site-specific soil conditions, and groundwater conditions. If the site does not 'slide' then we expect horizontal ground movements (due to the soft silt layers) during a large seismic event to be of the order of two feet.

9.4 Foundations

As we discuss in Section 9.3 of this report and due to the risk for movement of the project site during a large seismic event, the most suitable foundation construction approach will be a shallow foundation utilizing a thickened edge reinforced concrete structural slab. Thickened edge reinforced concrete structural slabs are better suited for tolerating large motions than strip/spread footings.

Again, it should be noted that, it will not be economically feasible to design a foundation system for the project site that will not move during a large seismic event. Instead, the thickened edge reinforced concrete structural slab foundation is intended to move as a whole in order to prevent catastrophic failure of the building and loss of life. After such an event the building may be displaced from its original location, and/or be un-inhabitable. We provide more detailed recommendations for shallow foundation design in Section 10.2 of this report.

9.5 Underground Utilities

In general, the soils in which deep, gravity-fed utility trenches (6 to 10 feet bgs) are to be constructed consist of gravel/sand and/or silt. Buried utilities can be founded directly onto the native soils or properly placed and compacted structural fill. As mentioned above, the peat/organic soils that we observed at depths of approximately 5 to 6 feet bgs are not suitable for supporting gravity-fed utilities and, if encountered should be removed to the vertical and horizontal extent of the utilities. We provide more detailed recommendations for underground utility design in Section 10.4 of this report.

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9.6 Pavement

The existing near surface materials that we encountered during our exploration program are moderately frost susceptible (MOA Frost Classifications F1 to F3). The frost classification, combined with the relatively shallow groundwater table, leads us to expect a moderate risk of ice lens development at the site. Therefore, an appropriately designed pavement section will be required to help reduce the potential for pavement damage and extend the life of the pavement surface. We provide pavement section design recommendations in Section 10.5 of this report.

9.7 Settlements

Settlements for shallow foundations should be within tolerable limits, provided that they are placed directly onto the undisturbed sand/gravel material (or properly placed structural fill located directly above the undisturbed sand/gravel material We anticipate a total settlement for any thickened edge concrete structural slab foundation placed on either the undisturbed sand/gravel material and/or or structural fill placed above the undisturbed sand/gravel material (as we discuss in Section 10.1 of this report) to be less than three-quarters (3/4) of an inch, with differential settlements comprising about one-half (1/2) of the total anticipated settlement. Settlement amounts could increase substantially if the structural fill material used to bring any foundation pads to grade is not properly compacted. Most of the settlements should occur as the building loads are applied, such that additional long-term settlements should be relatively small and within tolerable limits.

Settlements under driveways and parking areas are expected to be vary more than under any buildings, especially where utility trenches are located. Proper earthwork is necessary to help reduce the settlement potential. The settlement potential can be reduced by performing all utility excavation and backfill efforts as early in the construction schedule as possible and placing any pavement as last in the construction schedule as possible.

9.8 Seismic Design Parameters

We have assumed that the International Building Code (IBC) 2012 will be used for the design of the proposed structure. Per IBC 2012, the site classification should be determined based on the average soil strength in the top 100 feet of the soil column. In our professional opinion, the seismic site classification for the project site is *E*. However, as is typical for geotechnical evaluation for project of this magnitude, our boreholes were advanced to a maximum depth of 52 feet bgs. Therefore, we used our local knowledge of this portion of the Anchorage Bowl (in assuming the strength of the materials present in the lower 48 feet) to come to a conclusion on the classification. Because of the assumption, we have calculated parameters for both site class D and also site class E, as depending upon the design of the buildings (see below), one site class will lead to a more conservative design than the other.

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We utilized the United States Geological Survey (USGS) Seismic Design Maps tool (http://earthquake.usgs.gov/designmaps/us/application.php) to calculate the seismic design parameters for the project site for both site class D and also E, which are:

Site Class D: F_a = 1.000 (S_s = 1.500) and Fv = 1.500 (S_1 = 0.676)

Site Class E: F_a = 0.900 (S_s = 1.500) and F_v = 2.400 (S_1 = 0.676)

A copy of the USGS Design Maps reports for both site class D and E for the project site is contained in Appendix D of this report. Appendix D also contains a figure (D-1) which compares the design response spectrum for both site class D and E. Should the fundamental frequency of the building be lower than 0.75 seconds, then the parameters for site class D should be used. Should the fundamental frequency of the building be greater than 0.75 seconds, then the parameters for site class E should be used. This approach will lead to the most conservative design (regarding seismic site classification).

Based on our findings, we expect there to be a low potential for soil liquefaction at the project site due to the subsurface materials present.

10.0 DESIGN RECOMMENDATIONS

We have presented our design recommendations in the general order that the project site will most likely be developed. Our design recommendations can be used in parts (as needed) for the final design configuration.

10.1 Earthworks

Our recommendations assume that any shallow foundations (i.e., poured-concrete footings) will be founded either directly onto the undisturbed sand/gravel material or compacted structural fill pads constructed directly above the undisturbed sand/gravel material. If the foundations are to be founded upon the silt material, a geofabric should be placed above the silt for separation, and two feet of gravel placed above that. The first foot of gravel should be compacted to 90% of the modified Proctor density, after that the gravel should be compacted to 95% of the modified Proctor density. Any other structural fill materials used on-site should be compacted to a minimum of 95 % of the modified Proctor density.

Any material removed during the initial site grading and excavation activities, which does not contain any organic/deleterious material, and has relatively low silt content (less than 15 percent passing the #200 sieve), can be re-used on-site as structural fill. Proper placement and compaction techniques need to be applied during the backfill process (see Section 11.1 of this report for more details). Additional laboratory testing may be required to verify the frost susceptibility of any excavated soil for use in shallow fill applications.

All earthworks should be completed with quality control inspection, including: bottom-of-hole inspections; fill gradation classification; and in-situ compacting testing. A bottom-of-hole

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inspection should be conducted by a qualified geotechnical engineer, geologist, or special inspector following site excavation activities (and before any foundation construction begins) in order to visually confirm the findings of this report and provide recommendations for any non-conforming conditions encountered during the excavation activities.

10.1.1 Shallow Foundations

As we mention in Section 9.4 of this report, we recommend a thickened edge reinforced concrete structural slab foundation to support any structures at the project site. The foundation should be capable of tolerating a two-foot cantilever load and two feet of lateral movement. Again, any peat/organic soil which is located within the footprint of the proposed foundations will need to be removed to its horizontal and vertical extent prior to construction.

10.1.2 Soil Bearing Capacity

Thickened edge concrete structural slab foundations placed on either the undisturbed sand/gravel material or on structural fill pads (constructed directly above the undisturbed sand/gravel material) may be designed for an allowable soil bearing capacity of 1,500 pounds per square foot (psf). The soil bearing capacity may be increased by one-third (1/3) to accommodate short-term wind and/or seismic loads.

10.1.3 Thickened Edge Foundations and Floor Slabs

Thickened edge concrete structural slab foundations and/or floor slabs can be founded directly onto the undisturbed sand/gravel material or properly placed structural fill located directly above the undisturbed sand/gravel material. As described in Section 10.1, if the foundation is to be placed on silt, then a geofabric and two feet of structural fill should be added.

Our recommended insulation and footing configurations for various shallow foundation and floor slab combinations is presented in Figure 11 of this report. For the project site, we recommend using configurations B or C (Figure 11) for a heated shallow foundation. Insulation may be placed beneath of the floor slab. However, no insulation should be placed under the thickened edge of any perimeter footings, as this can promote freezing of the foundation soils by preventing adequate heat transfer from the interior of the building to the foundation soils. Alternatively, insulation should be placed along the exterior of the thickened edge concrete structural slab to prevent freezing (and the associated frost heaving) of the foundation soils along the perimeter of the foundation.

As we mention in Section 10.1 of this report, the upper structural fill material (at or above the footing grade) used to construct the structural pad for a heated building should be relatively free draining (sands and gravels) with less than 15% of the fill material passing through a #200 sieve. Furthermore, the top six inches of the structural pad located beneath the slabs should be free draining, with less than 3% passing the #200 sieve. This "blanket" will serve as a capillary break to help maintain a dry slab.

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Slabs constructed directly on the undisturbed sand/gravel or on properly constructed granular fill pads (located directly above the undisturbed sand/gravel), as we described above, may be designed using a modulus of subgrade reaction of k_1=150 pci (k_1 is the value for a 1-ft x 1-ft rigid plate). For this project, the following equations can be used (with standard English units) to calculate the appropriate modulus of subgrade reaction for slabs bearing on the undisturbed sand/gravel or on properly placed granular structural fill located directly above the undisturbed sand/gravel:

$$k_{(B\,x\,B)} = k_1 \left(\frac{B+1}{2B}\right)^2 \quad (1)$$

Where:

B = the slab width of a square slab in feet
k_1 = the modulus of subgrade reaction for a 1ft × 1ft rigid plate in pci
$k_{(B\,x\,B)}$ = the modulus of subgrade reaction for a square slab of width B in pci

The following equation (2) can be used for a rectangular slab having the dimensions $B \times L$ (in feet) with similar bearing soils as the equation above (1).

$$k_{(B\,x\,L)} = \frac{k_{(B\,x\,B)}\left(1+0.5\frac{B}{L}\right)}{1.5} \quad (2)$$

Where:

$k_{(B\,x\,B)}$ = the modulus of subgrade reaction for a $B \times B$ square slab
$k_{(B\,x\,L)}$ = the modulus of subgrade reaction for $B \times L$ rectangular slab
B = the least horizontal dimension of a rectangular slab
L = the larger horizontal dimension of a rectangular slab

10.1.4 Cold (Unheated) Shallow Foundations

It is difficult to predict the depth of frost penetration and extent of ice lens formation at any given site. Therefore, we do not recommend the construction of cold (unheated) shallow foundations as the formation of ice lenses beneath of a foundation can result in deformation to the overlying foundation.

Cold (unheated) shallow foundations should be placed on granular structural pads constructed of NFS fill material with a minimum thickness of five feet (NFS material should have less than 6% of the material passing a #200 sieve). Insulation may be incorporated into the foundation design to help protect the foundation soils from freezing. Insulation may be used in lieu of some of the NFS backfill. In terms of insulating properties, one inch of rigid board insulation can be considered equivalent to one foot of NFS fill. Our recommended insulation and footing configurations for cold shallow foundations are provided in Figure 11 of this report (configuration A).

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10.1.5 Lateral Loads for Foundation and Retaining Walls

Retaining walls (such as perimeter foundation stem walls for buildings with basements or crawl spaces) must be designed to resist lateral earth pressures. The magnitude of the pressure exerted on a retaining wall is dependent upon several factors, including:

1) whether the wall is allowed to deflect after placement of backfill;
2) the type of backfill used;
3) compaction effort; and
4) wall drainage provisions.

An active-earth pressure condition will prevail (under static loading) if a retaining wall is allowed to deflect or rotate a minimum of 0.001 times by the wall height. An at-rest pressure condition will prevail if a retaining wall is restrained at the top and cannot move at least 0.001 times the wall height. Lateral forces exerted by wind or seismic activity may be resisted by passive-earth pressures against the sides of the foundation footings, exterior walls (below grade), and grade beams.

In order to prevent water accumulation against the outside of any foundation or retaining wall, the wall must have a perimeter drainage system connected to an outlet that will not freeze closed at any time of the year. The top of the drainage piping must be located below the top of the footing for the foundation and/or retaining wall. Backfill used against the wall (and extending a minimum of one foot beyond the wall) must be free-draining with less than three percent fines. The top one-foot of backfill against the outside of a foundation and/or retaining wall should consist of relatively impermeable (fine-grained) material and be tightly compacted such that surface water is directed away from the foundation and/or retaining wall. A permeable geotextile fabric may be useful to prevent mixing of the impermeable (fine-grained) overburden and underlying free-draining (coarse-grained) backfill. Furthermore, the finished surface should slope away from any foundation and/or retaining wall with a minimum grade of 2 %, such that surface water is directed away from the foundation and/or retaining wall.

Seismic loading on foundation and/or retaining walls generally increases the lateral pressures on the wall and decreases the passive resistance. For foundation systems where the building foundation is continuous, the differential lateral movement between the soil and foundation is very small, and as such, essentially no excess lateral loading on the foundation wall is experienced. Foundation walls with a differential in backfill heights of over six feet (basements, crawl spaces, etc.) will experience seismic lateral loading from the inertial effects of seismic waves passing through the foundation.

The lateral soil pressures can be represented by equivalent fluid pressures. The pressure distribution is a function of wall restraint, seismic loading, and drainage conditions. Figure 12 presents the distribution diagrams for various loading conditions (for retaining walls less than eight feet high). Table 2 presents the unit weights to be used with Figure 12 for this project.

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Any foundation stem walls that are not designed to carry lateral loads should be backfilled on both sides simultaneously to prevent differential lateral loading of the foundation stem wall. We developed the unit weights provided in Table 2 of this report assuming that structural fill (containing less than ten percent fines) is used as backfill, and that the fill is compacted to at least 90 percent of the Modified Proctor density.

Table 2: Equivalent Fluid Specific Weight for Lateral Loading Design
Equations only valid for units of pcf (t_1-t_8) and ft (H and H_1).

LOADING CONDITION	DRAINED EQUIVALENT FLUID SPECIFIC WEIGHT		UN-DRAINED EQUIVALENT FLUID SPECIFIC WEIGHT	
	SPECIFIC WEIGHT (pcf)	SYMBOL USED IN FIGURE 12	SPECIFIC WEIGHT (pcf)	SYMBOL USED IN FIGURE 12
ACTIVE	40	t_1	28	t_2
AT-REST	55	t_3	38	t_4
PASSIVE	300	t_5	225	t_6
SEISMIC	16	t_7	9	t_8

Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

For restrained walls higher than eight feet, the methods used to calculate the unit weights in Table 2 become non-conservative. The calculations and methodology for determining the pressure loads and distribution for walls greater than eight feet in height are presented in Appendix E. As an example, we have included the calculation for a nine feet high restrained wall (Appendix E and Figure 13). We can recalculate the pressure distribution after the restrained retaining wall height is determined.

10.2 Insulation

Any subsurface insulation should consist of extruded polystyrene such as DOW Styrofoam™ Highload or UC Industries Foamular. Any subsurface insulation used under pavement sections or structural slabs should be closed cell, board stock with a minimum compressive strength of 60 psi at five percent deflection. Subsurface insulation around not subject to structural or lvehicular loading, should have a minimum compressive strength of 25 psi at five percent deflection. The insulation should not absorb more than two percent water per ASTM Test Method C-272. The thermal conductivity (k) of the insulation should not exceed 0.25 BTU-in/hr-ft^2-°F when tested at 75 °F.

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10.3 Underground Utilities

In general, the soils in which deep utility trenches (6 to 10 feet bgs) are to be constructed are composed of sand/gravel or silt. Any gravity-fed utility trenches extending into the sand/gravel or silt should be a minimum of three feet wide at the bottom with the utility piping located in the center of the trenches. Any peat/organic soil which is located within the footprint of the proposed gravity-fed utility alignment will need to be removed to its horizontal and vertical extent prior to construction. If the utilities are to be founded upon the silt material, a geofabric should be placed above the silt for separation, and two feet of gravel placed above that. The first foot of structural fill should be compacted to 90% of the modified Proctor density, after that the structural fill should be compacted to 95% of the modified Proctor density. Structural fill should be used to bring the gravity-fed utilities to the proper installation grade. Utilities that are not sensitive to settlement may be placed in the existing sand/gravel material.

Underground utilities which are susceptible to damage from freezing need to be frost-protected by sufficient amounts of backfill, insulation, and/or active freeze protection systems (e.g., heat tape, thaw wire, etc.); or some combination of the above. Any utilities which are susceptible to damage from freezing that are planned to be constructed less than eight feet below the planned finished grade should contain some level of additional frost-protection (e.g., insulation, active freeze protection systems, or a combination of both).

Any insulation used should conform to the specifications detailed in Section 10.3 of this report and should extend a minimum of two feet (and a maximum of four feet) perpendicular to either side of the proposed utility alignment. The thickness of the insulation used will be a function of the burial depth. In general one inch of insulation is equal to approximately 12 inches of compacted NFS backfill. Underground utilities which are susceptible to damage from freezing should not be constructed within four feet of the planned finished grade (regardless of insulation measures or active freeze-protection systems).

10.4Pavement Section

Construction of the pavement section will be guided in part by the amount of cut/fill needed to achieve the final grade. The existing near surface materials are moderately frost susceptible (MOA frost classification F1-F3). This will require an appropriately engineered pavement section in order to help reduce the potential for future pavement damage and prolong the life of the proposed parking areas. In addition, all peat/organic soil should be removed to the vertical and horizontal extents of any pavement sections, if any fill is required it should be structural fill with a frost classification of F2 or better and placed according to Section 10.1 of this report. Confirmation testing of the subgrade soils along the proposed pavement section should be conducted after the completion of utility installation in order to confirm the frost classification of the subgrade soils. We present two recommended pavement sections in Tables 3 and 4 of this report. Table 3 provides an appropriate pavement section if a curb, gutter, and storm drain

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system is present on-site. Table 4 provides an appropriate pavement section if those systems are not on-site.

Table 3: Suitable Pavement Section Construction with Curb, Gutter and Storm Drain Present On-site

Section Thickness	Material
2 inches min.	Asphalt (concrete pavement thickness will be a function of reinforcement)
2 inches max.	NFS leveling course (RAP or "D-1")
12 inches	Type II A
12 inches	Type II
N/A	F2 or better Structural Fill
N/A	Existing frost susceptible soils (F1 or F3)

The leveling course, Type IIA, and Type II used should conform to the MOA specifications we provide in Figure 14 of this letter. The Type II material should not be placed within eight inches of any leveling course surface, as it may affect the long-term smoothness of the asphalt surface. As the Type II material settles/consolidates (from vehicle traffic, etc.), larger particles (3-8 inches in diameter) can protrude into the overlying leveling course and produce a lumpy or dimpled asphalt surface. Therefore, a layer (at least eight inches in thickness) of Type IIA material (which has a maximum particle size of three inches) should always be used to separate the leveling course from underlying coarse-grained (e.g., Type II) materials.

Table 4: Suitable Pavement Section Construction without Curb, Gutter and Storm Drain Present On-site

Section Thickness	Material
2 inches min.	Asphalt (concrete pavement thickness will be a function of reinforcement)
2 inches max.	NFS leveling course (RAP or "D-1")
12 inches	Type II A
18 inches	Type II
N/A	F2 or better Structural Fill
N/A	Existing frost susceptible soils (F1 or F3)

Any leveling course used should be NFS in order to maintain a low potential for ice lens development within the leveling course. It is our experience that the "D1" leveling course material currently available in the Anchorage area may not be NFS following compaction, because compaction with a vibratory compactor may increase the frost susceptibility of the

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leveling course by increasing the percentage of fine-grained material (due to degradation of the soil particles from the impact of the compaction equipment). As such, the leveling course thickness should be kept to two inches or less to reduce the potential for ice lens formation in the leveling course. All of these materials should be placed in thin lifts and each lift should be compacted to a minimum of 95 % of the modified Proctor density. As an alternative to "D1", recycled asphalt pavement (RAP) can be used. The residual oil in the RAP greatly reduces the frost susceptibility.

10.5 Surface Drainage

After the property is brought to grade it should be relatively flat, such that storm water will tend to accumulate and flow off the project site slowly. Water accumulation will have a detrimental effect on foundations, retaining structures, and pavement sections. Provisions should be included in the design to collect runoff and divert it away from any foundations, retaining structures, and pavement sections. The ground surface surrounding the proposed developments should be graded such that surface runoff is channeled away from foundations, retaining walls, and pavement sections. The soils on the surface should be tightly compacted to help reduce surface runoff infiltration. Roof, parking lot, and driveway drainage should be directed away from foundations. If storm sewer is available, tight-line connections from roof drain collectors should be made.

11.0 CONSTRUCTION RECOMMENDATIONS

We have presented our construction recommendations in the general order that the project site will most likely be developed. Our construction recommendations are intended to aid the construction contractor(s) during the construction process.

11.1 Earthwork

The first lift of fill material placed directly upon the underlying silt can be compacted to 90 percent of the modified Proctor density (unlikely to achieve 95 percent without disturbing underlying silt), as determined by ASTM D-1557. Subsequently, any and all fill material used should be placed at 95 percent of the modified Proctor density, unless specifically stated otherwise in other sections of this report. The thickness of individual lifts will be determined based on the equipment used, the soil type, and existing soil moisture content. Typically, fill material will need to be placed in lifts of less than one-foot in thickness. All earthworks should be completed with quality control inspection.

In our professional experience, structural fill should have less than approximately 15 percent passing the #200 sieve for ease of placement. Soils with higher silt contents can be used within the foundation footprint. However, the effort required to achieve proper compaction of silt-rich soils may be more costly than purchasing better grade materials. The time of year, existing moisture content, rainfall, air temperature, and fill temperature can all have an impact on the effort required to adequately compact silt-rich material.

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Any excavated fill or on-site soils (which are free of organic material and have relatively low silt contents) which are stockpiled on-site (for later use as structural backfill) should be protected from additional moisture inputs (precipitation, etc.) through the use of plastic tarps, etc. Additional moisture inputs can have detrimental effects on the effort needed to achieve proper compaction rates.

11.2 Heated Shallow Foundations

Care should be taken during foundation excavation activities to limit the disturbance of the bottom of any foundation excavations. The bottom of any foundation excavation should be moisture conditioned and proof-rolled as necessary to return the exposed soils to their original in-situ density.

In general, the soils in which the proposed foundation pads are to be constructed consist primarily sand/gravel material. As such, any surface water (*e.g.,* from precipitation, snowmelt, etc.) that enters into foundation excavations will tend to dissipate relatively quickly. Excess water will have a negative impact on any backfill and compaction efforts. Therefore, if surface water does accumulate in any open foundation excavations it can be controlled by excavating a shallow drainage trench around the perimeter of the excavation. The drainage trench will collect surface water and direct it to a sump area, which should be located outside of the foundation footprint. The excess water can then be pumped from the sump area and be discharged at an appropriate location away from the excavation and any other existing foundations.

It is imperative that shallow building foundations for heated structures remain in a thawed state for the entire construction period; even when dealing with soils that have little to no frost susceptibility. Foundation soils that are allowed to freeze during the initial construction (before the building is enclosed and heated) may be compromised by the development of ice lenses. Upon thawing, which may take several weeks or months, potential differential settlements could distort the structure resulting in damaged foundations, cracked sheetrock, skewed door frames, and broken windows. If construction extends into the winter months, temporary enclosures should be constructed which completely enclose warm foundations and heat should be applied to the enclosure to prevent freezing of the soils located beneath any warm foundation and/or floor slab.

11.3 Unheated Shallow Foundations

The frost susceptibility of the foundation soils range from F1 to F3. Therefore, the existing frost susceptible soils are unsuitable to support any cold (unheated) shallow foundations without freeze protection, as they may experience ice lens development and/or thaw-weakening, which could result in damages to the proposed foundations. As we mention in Section 10.2.3 of this report, cold foundations should be placed on a five-foot thick structural pad constructed of NFS fill. The NFS structural pad thickness may be reduced by using insulation at a rate of one inch of insulation to one foot of NFS material.

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11.4 Insulation

The satisfactory performance of any subsurface insulation is in part controlled by the details of construction including: 1) the care taken to ensure that the board stock lies flat on a smooth, level surface; and 2) the adjoining ends of the insulation are closely butted together. Any vertical joints should be staggered where more than one layer of insulation is used.

11.5 Underground Utilities

We expect that utility trench wall stability in the sand/gravel material will be poor, especially where utility trenches extend below the groundwater table. The contractor should be responsible for trench safety and regulation compliance. If groundwater is encountered during utility trench excavation then dewatering efforts may be required to facilitate proper utility installation and trench backfill.

All piping should be bedded per the manufacturer's recommendations, with the bedding material compacted to provide pipe support. Above the bedding materials, the backfill should be similar to, and compacted to the approximate density of, the surrounding soils.

11.6 Pavement

All of the earthwork within any areas to be paved should be completed as early in the construction schedule as possible, and the pavement placed as late in the construction schedule as possible. This will give the subgrade soils time to settle, compress, and stabilize prior to placement of the pavement. Any structural fill used should be placed in thin lifts (less than one foot in thickness) and each lift should be compacted to a minimum of 95 % of the modified Proctor density. Prior to paving, any surface fill material should be re-leveled and re-compacted. All backfill and paving materials should be inspected and tested for material specification compliance and compaction.

Underground utility piping should be installed prior to construction of any pavement sections such that trenching is done through the subgrade soils only. This will help ensure that a uniform pavement section is maintained, which will reduce the potential for differential settlements along underground utility trench alignments.

The minimum thickness for any asphalt pavement surfaces is two inches. The minimum thickness of any concrete pavement surfaces will be a function of the reinforcement required. All applicable ACI and IBC standards should be followed.

11.7 Winter Construction

Proper placement and compaction of structural fill is not possible when fill material is frozen, and as such, frozen fill material should never be used for structural support unless it has been subsequently thawed and compacted to 95 % of the modified Proctor density (throughout its vertical extent). Furthermore, subgrade soils (fill or native) need to be completely thawed prior

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to the placement and compaction of additional lifts of thawed fill material. In our professional experience, ambient soil temperatures need to be above 37 °F in order to achieve efficient compaction. It is extremely difficult to achieve compaction levels equal to 95 percent of the modified Proctor density in fill material that is between 32 °F to 37 °F. We discuss the risks associated with winter foundation construction in more detail in Sections 11.2 of this report

12.0 THE OBSERVATIONAL METHOD

A comprehensive geoprofessional service (e.g., geotechnical, geological, civil, and/or environmental engineering, etc.) should consist of an interdependent, two-part process comprised of:

Part I - pre-construction site assessment, engineering, and design; and

Part II - continuous construction oversight and design support.

This process, commonly referred to in the geoprofessional industry as "The Observational Method", was developed to reduce the costs required to complete a construction project, while simultaneously reducing the overall risk associated with the design and construction of the project.

In geotechnical engineering, Part I of the Observational Method (OM) begins with a geotechnical assessment of the site, which typically consists of some combination of literature research, site reconnaissance, subsurface exploration, laboratory testing, and geotechnical engineering. These efforts are usually documented in a formal report (e.g., this report) that summarizes the findings of the geotechnical assessment, and presents provisional geotechnical engineering recommendations for design and construction. Geotechnical assessment reports (and the findings and recommendations contained within) are considered provisional due to the fact that their contents are typically based primarily on limited subsurface information for a site. Most conventional geotechnical exploration programs only physically characterize a very small percentage of a given site, as it is typically cost prohibitive to conduct extensive (i.e. high density/frequency) exploration programs. As an alternative, geoprofessionals use the subsurface information available for a site to extrapolate subsurface conditions between exploration locations and develop appropriate provisional recommendations based on the inferred site conditions. As a result, the geoprofessional of record cannot be certain that the provisional recommendations will be wholly applicable to the site, as subsurface conditions other than those identified during the geotechnical assessment may exist at the site which could present obstacles and/or increased risk to the proposed design and construction.

Part II of the OM is employed by geoprofessionals to help reduce the risk associated with unidentified and/or unexpected subsurface conditions. Geoprofessionals accomplish Part II of the OM by providing construction oversight (e.g., construction observation, inspection, and testing). Part II of the OM is a valuable service, as the geoprofessional of record is available if unexpected conditions are encountered during the construction process (e.g., during excavation,

fill placement, etc.) to make timely assessments of the unexpected conditions and modify their design and construction recommendations accordingly; thus reducing considerable cost resulting from potential construction delays and reducing the risk of future problems resulting from inappropriate design and construction practices.

Oftentimes, a client may be persuaded to use an alternative geoprofessional firm to conduct Part II of the OM for a given project; as some geoprofessional firms offer the same services at discounted prices in order to help them obtain the overall construction materials engineering and testing (CoMET) commission. The geoprofessional industry as a whole recommends against this practice. An alternative geoprofessional firm cannot provide the same level of service as the geoprofessional of record. The geoprofessional of record has (amongst other things) a unique familiarity with the project including; an intimate understanding of the subsurface conditions, the proposed design, and the client's unique concerns and needs, as well as other factors that could impact the successful completion of a construction project. An alternative geoprofessional firm is not aware of the inferences made and the judgment applied by the geoprofessional of record in developing the provisional recommendations, and may overlook opportunities to provide extra value during Part II of the geoprofessional service.

Clients that prevent the geoprofessional of record from performing a complete service can be held solely liable for any complications stemming from engineering omissions as a result of unidentified conditions. The geoprofessional of record may not be liable for any resulting complications that occur, as the geoprofessional of record was not able to complete their services. Furthermore, the replacement geoprofessional firm may also be found to have no liability for the same reasons.

We are available at any time to discuss the OM in more detail, or to provide you with an estimate for any additional construction observation and testing services required.

13.0 CLOSURE

We (Northern Geotechnical Engineering, Inc. d.b.a. Terra Firma Testing) prepared this report exclusively for the use of John McGrew and his consultants/contractor/etc. for use in the design and construction of the proposed improvements. We should be notified if significant changes are to occur in the nature, design, or location of the proposed improvements in order that we may review our conclusions and recommendations that we present in this report and, if necessary, modify them to satisfy the proposed changes.

Due to the natural variability of earth materials, variations in the subsurface conditions across the project site may exist other than those we identified during the course of our geotechnical assessment. Therefore, we recommend that a qualified geotechnical engineer, geologist, and/or special inspector be on-site during construction activities to provide corrective recommendations for any unexpected conditions revealed during construction (see our discussion of the Observational Method in Section 12.0 of this report for more detail). Furthermore, the

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construction budget should allow for any unanticipated conditions that may be encountered during construction activities.

We conducted this evaluation following the standard of care expected of professionals undertaking similar work in the State of Alaska under similar conditions. No warranty, expressed or implied, is made.

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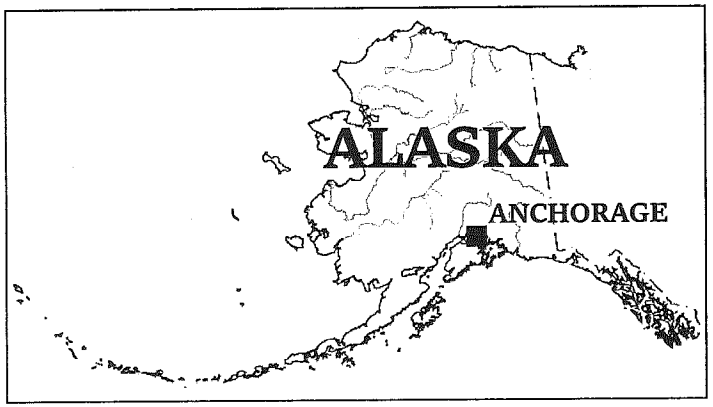
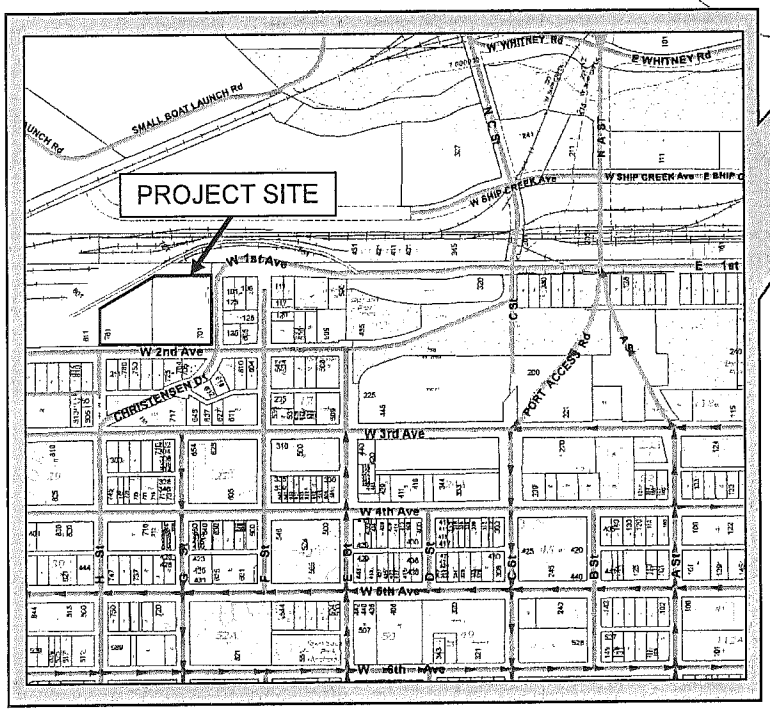
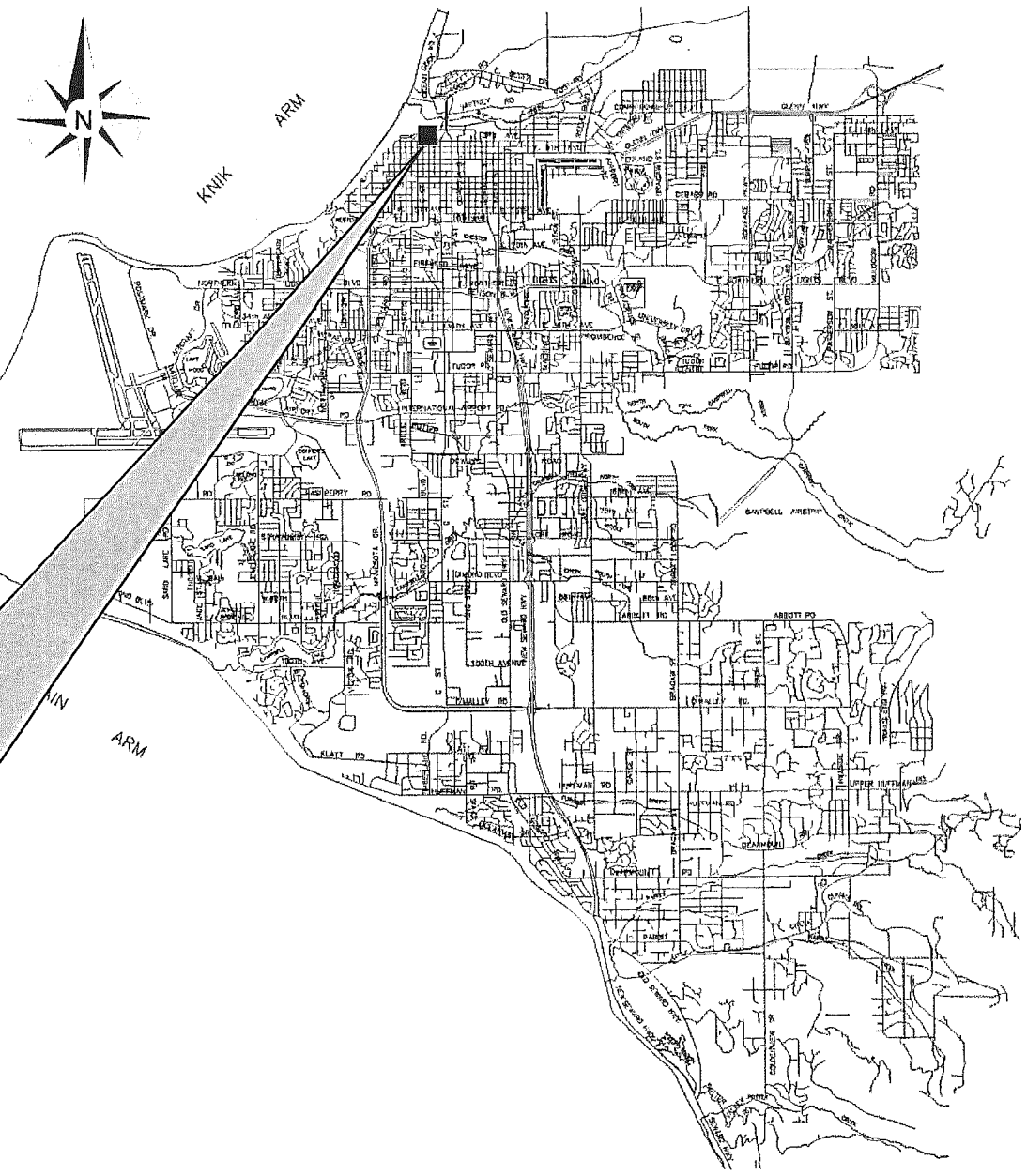
REPORT
FIGURES

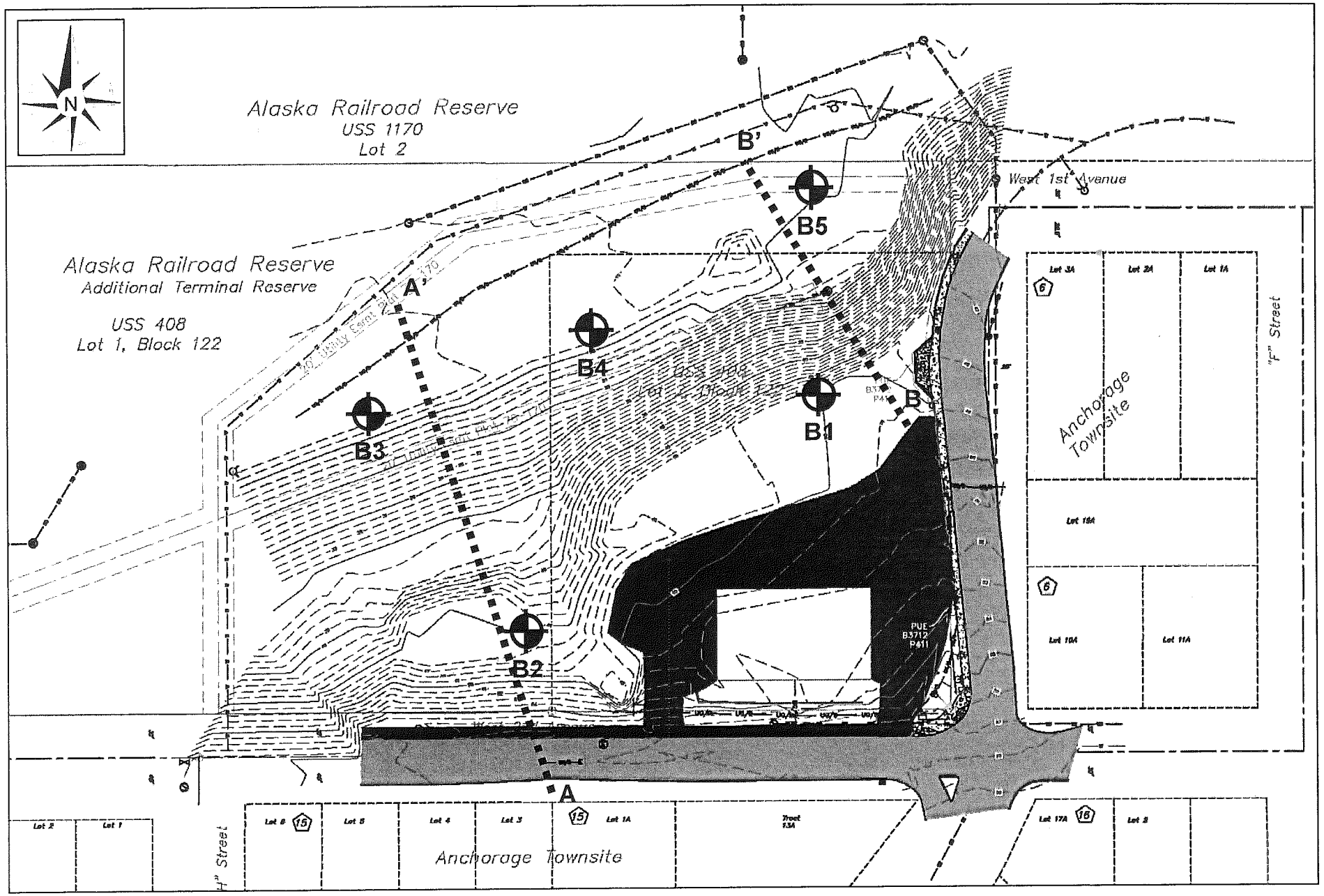






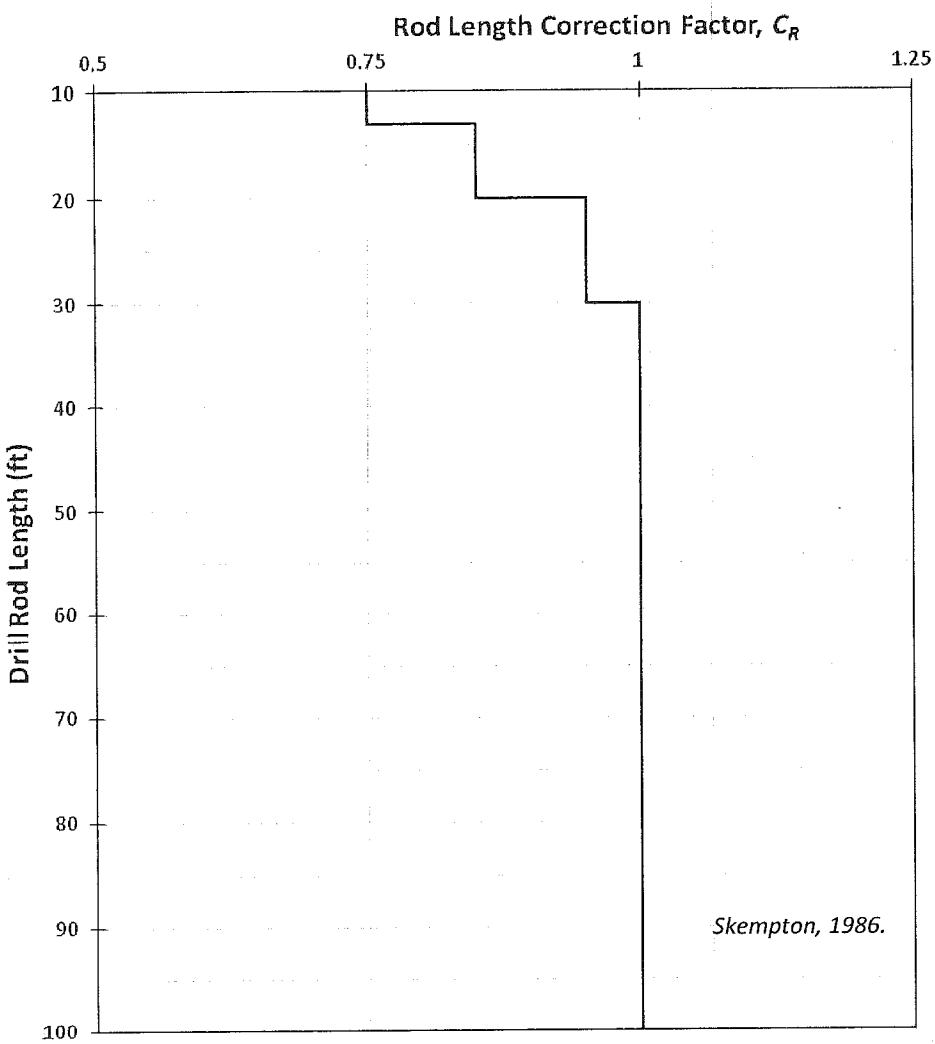
NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

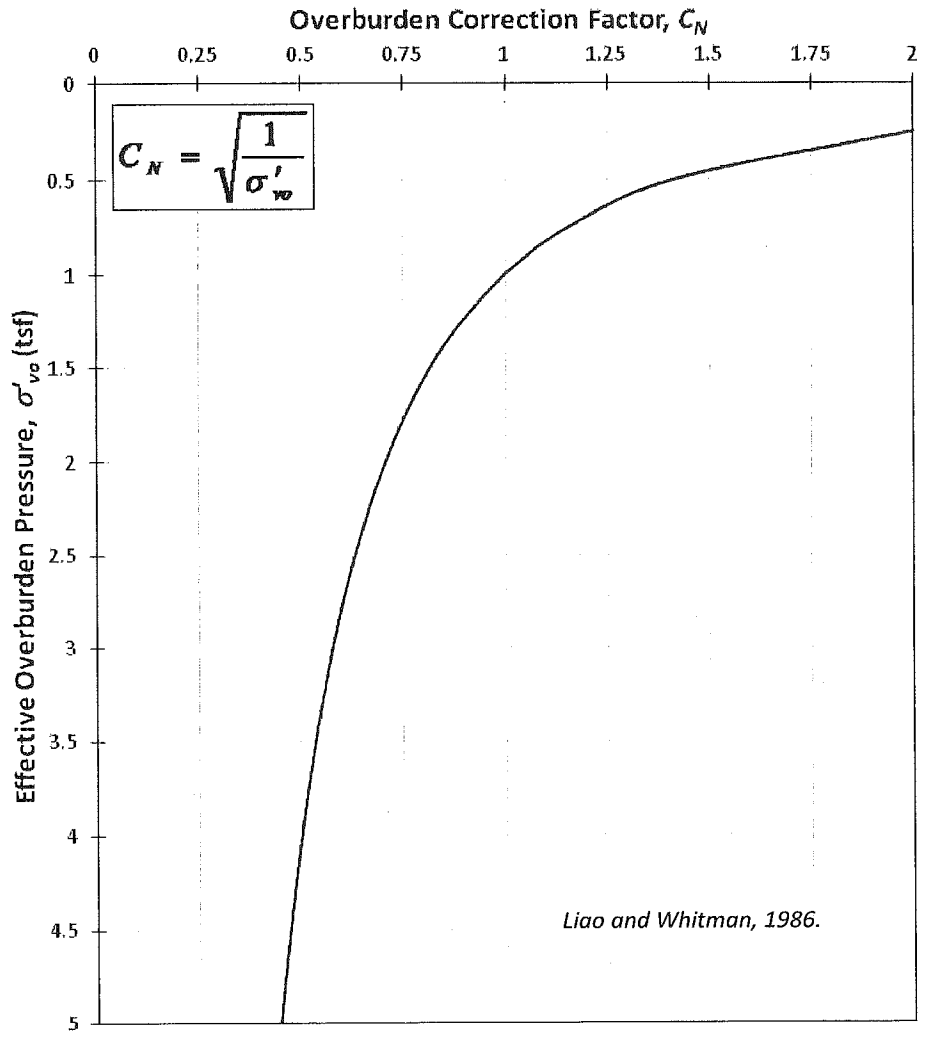
FIGURE TITLE: PROJECT SITE LOCATION MAP	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 1



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: EXPLORATION LOCATION MAP	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 2



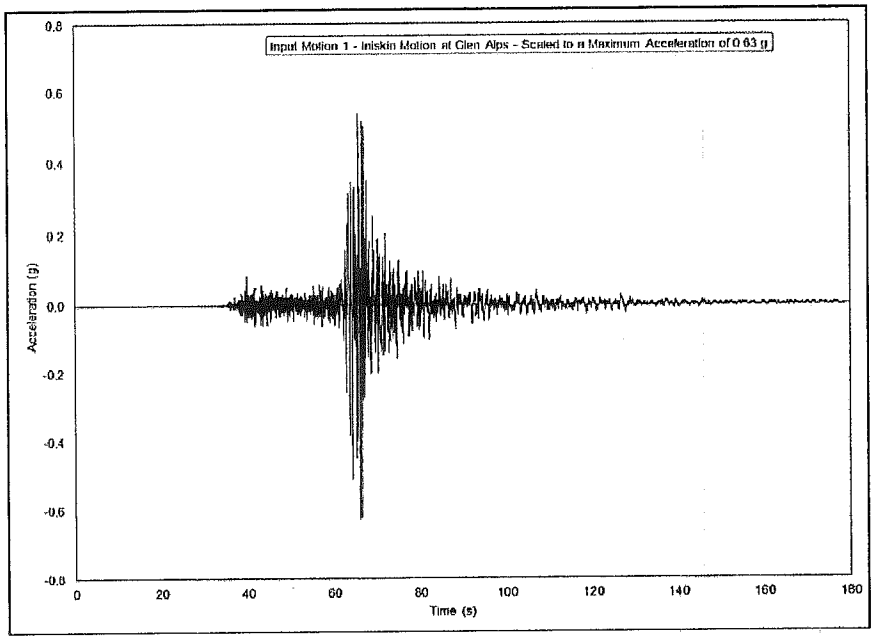


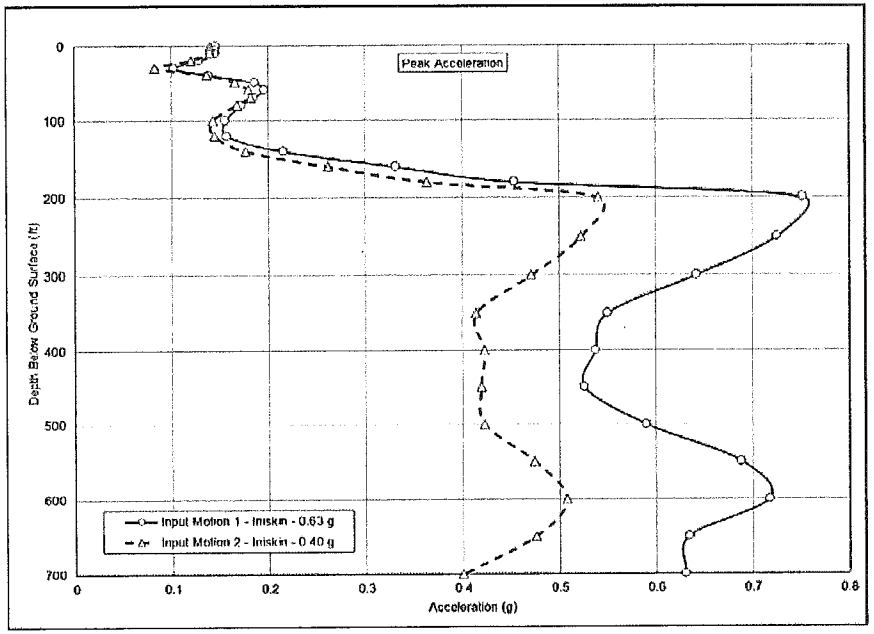
Notes:

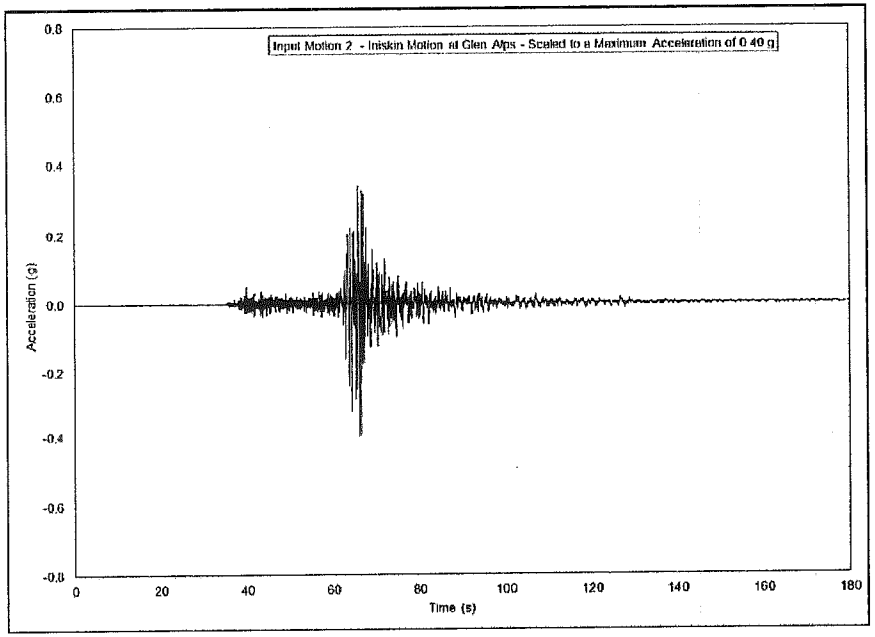
- Overburden correction factor is used only for cohesionless soils
- C_N is the ratio of the measured blow count to what the blow count would be at an overburden pressure of 1 ton/ft^2
- σ'_{vo} is the effective oberburden pressure at the point of measurement (ton/ft^2)

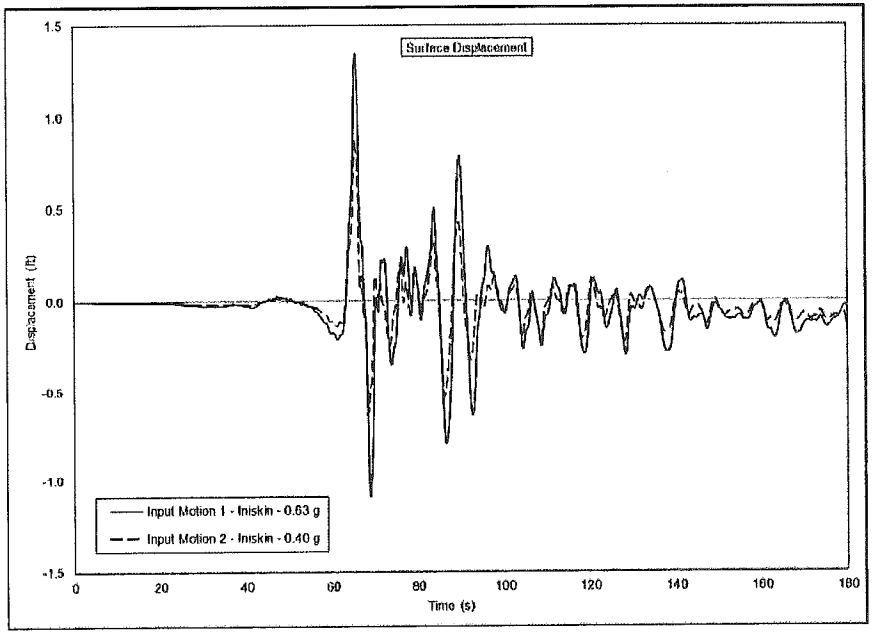
NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: BLOW COUNT CORRECTIONS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 3









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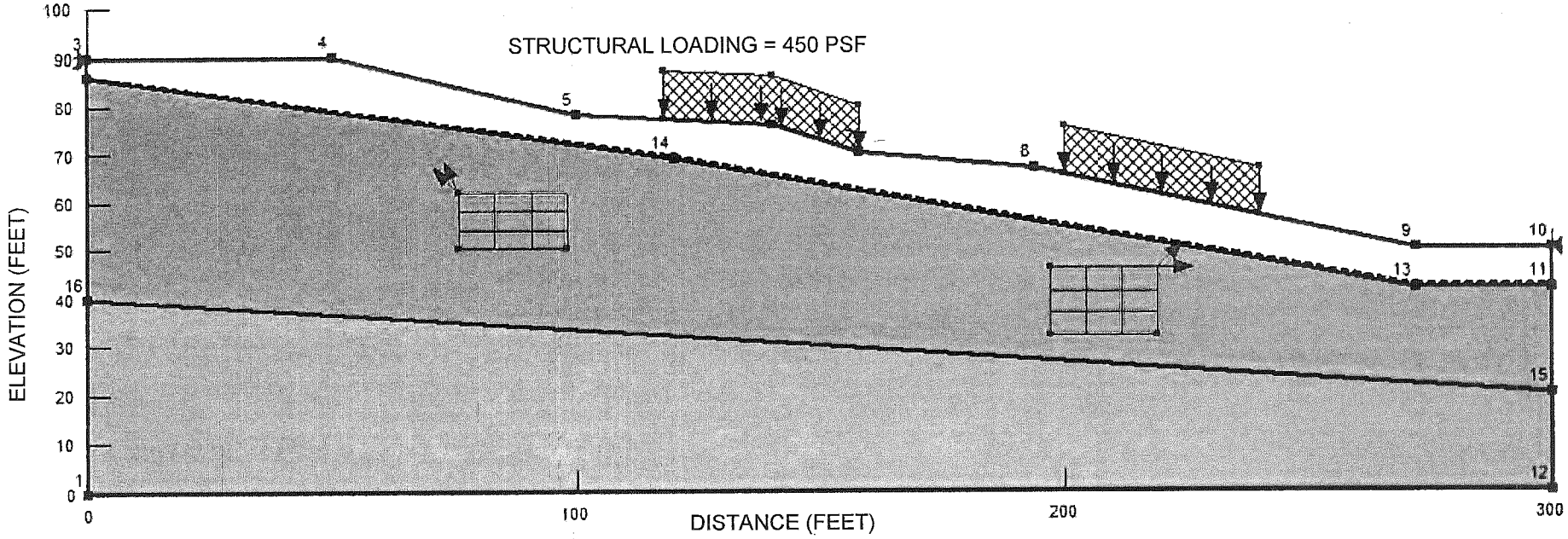
TERRA FIRMA TESTING

FIGURE TITLE: PROSHAKE ANALYSIS RESULTS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 4



PIEZOMETRIC LINE

SAND/GRAVEL

SOFT SILT

MEDIUM STIFF SILT

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: A-A' SLOPE CROSS SECTION PROFILE	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 5

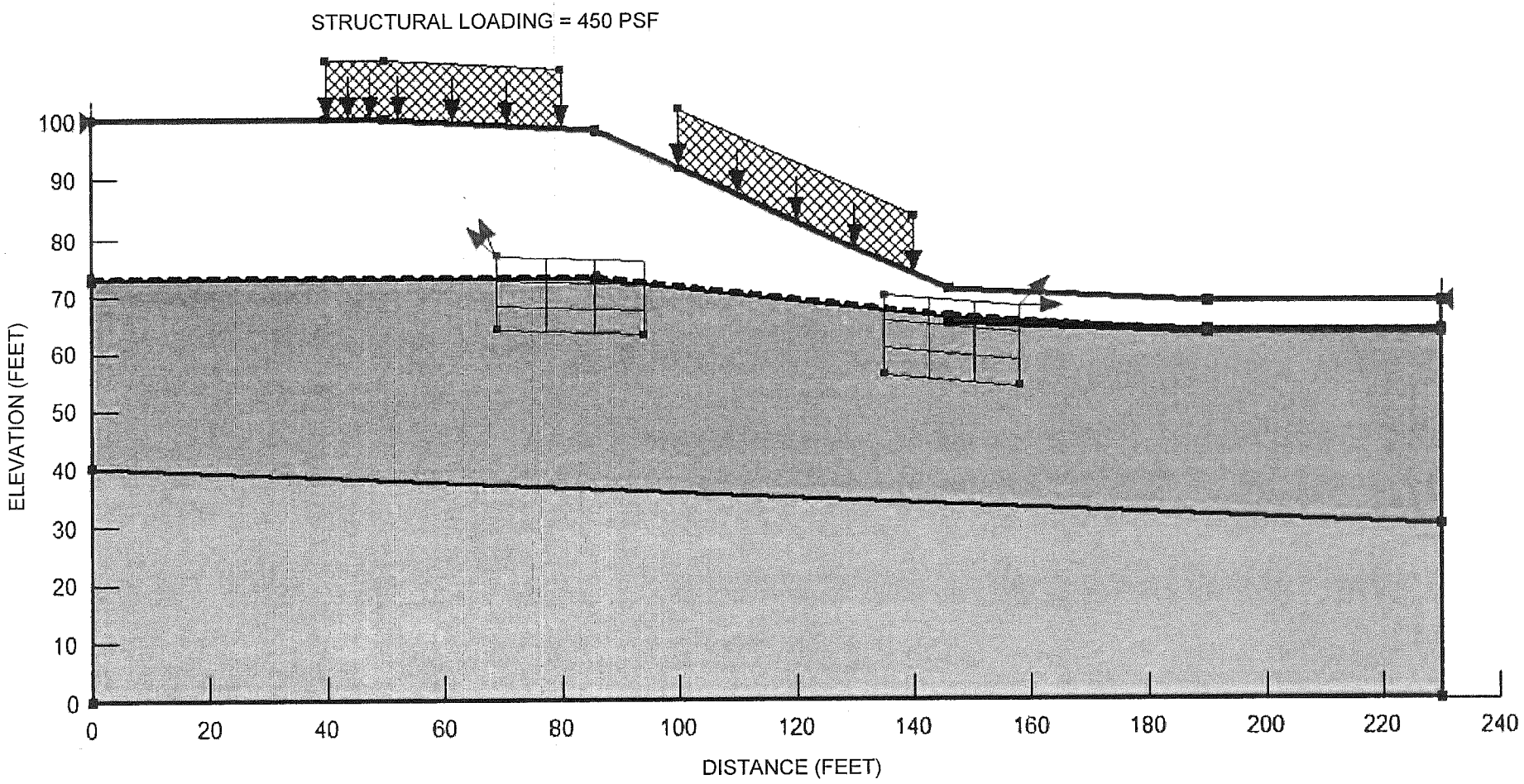


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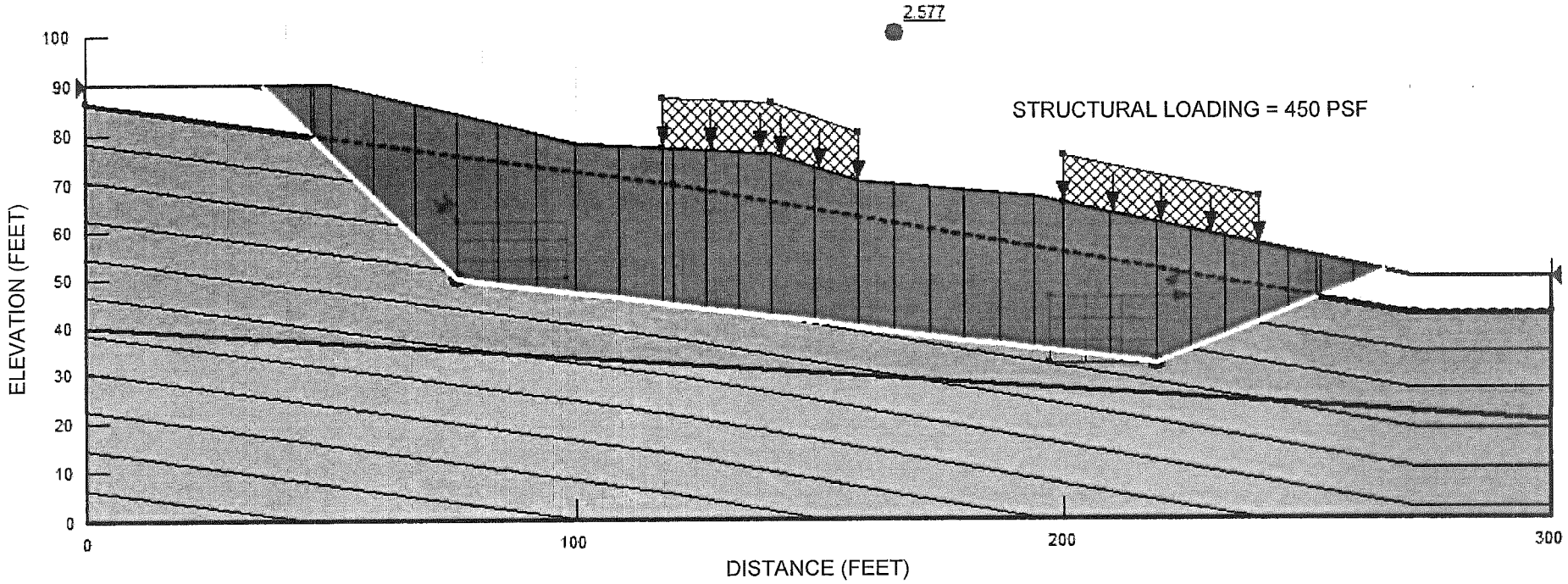
FIGURE TITLE: B-B' SLOPE CROSS SECTION PROFILE	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 6



PIEZOMETRIC LINE

SAND/GRAVEL: UNIT WEIGHT=125 PCF; COHESION=0 PSF; PHI=32°

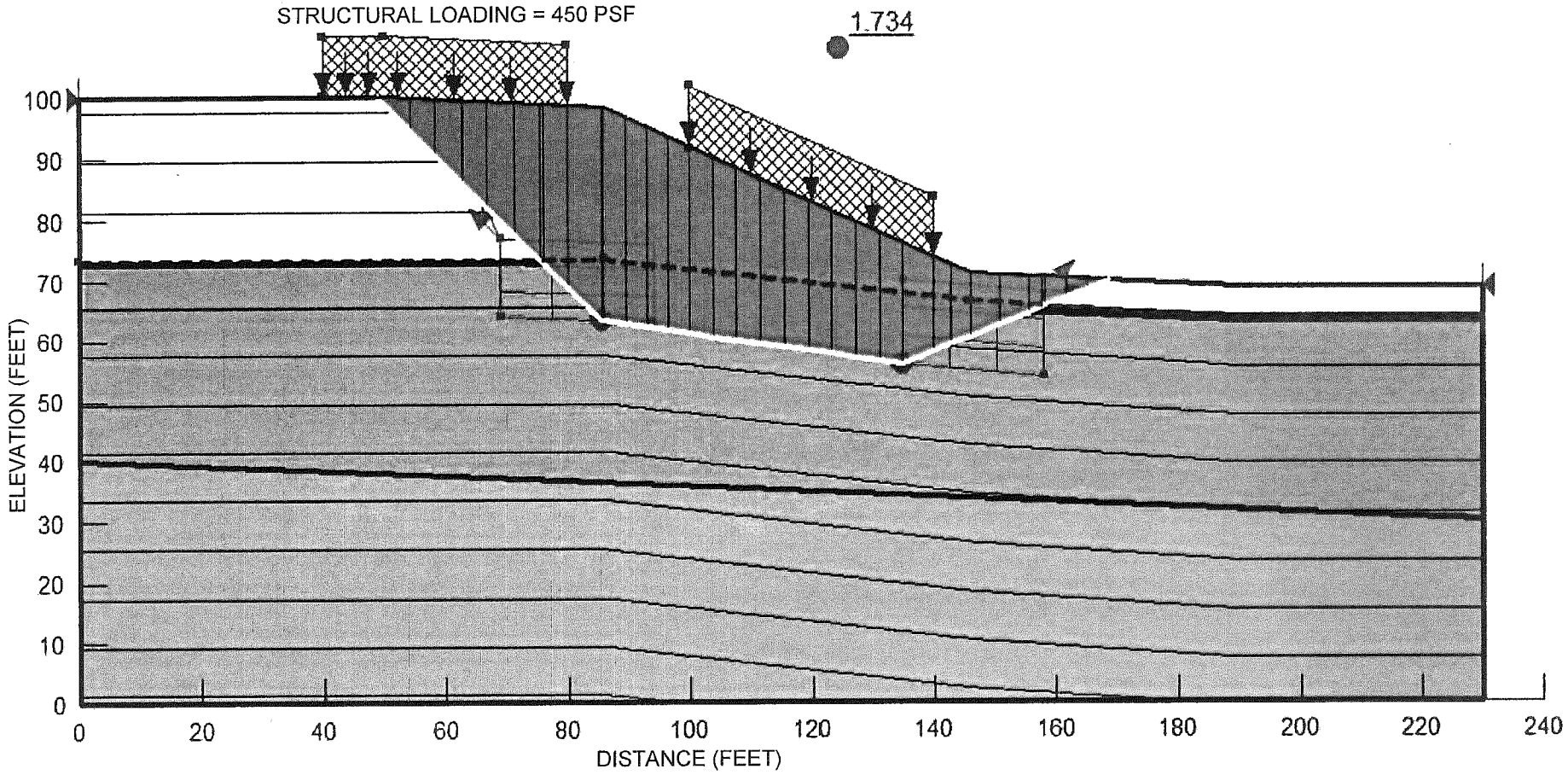
SOFT SILT: UNIT WEIGHT=110 PCF; COHESION=800 PSF; PHI=8°

MEDIUM STIFF SILT: UNIT WEIGHT=110 PCF; COHESION=1000 PSF; PHI=0°

* SILT FRICTION ANGLE TENDS TO BE RELATIVELY LOW AT A LOW STRAIN RATE.

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: A-A' STATIC SLOPE STABILITY ANALYSIS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 7



PIEZOMETRIC LINE

SAND/GRAVEL: UNIT WEIGHT=125 PCF; COHESION=0 PSF; PHI=32°

SOFT SILT: UNIT WEIGHT=110 PCF; COHESION=800 PSF; PHI=8°

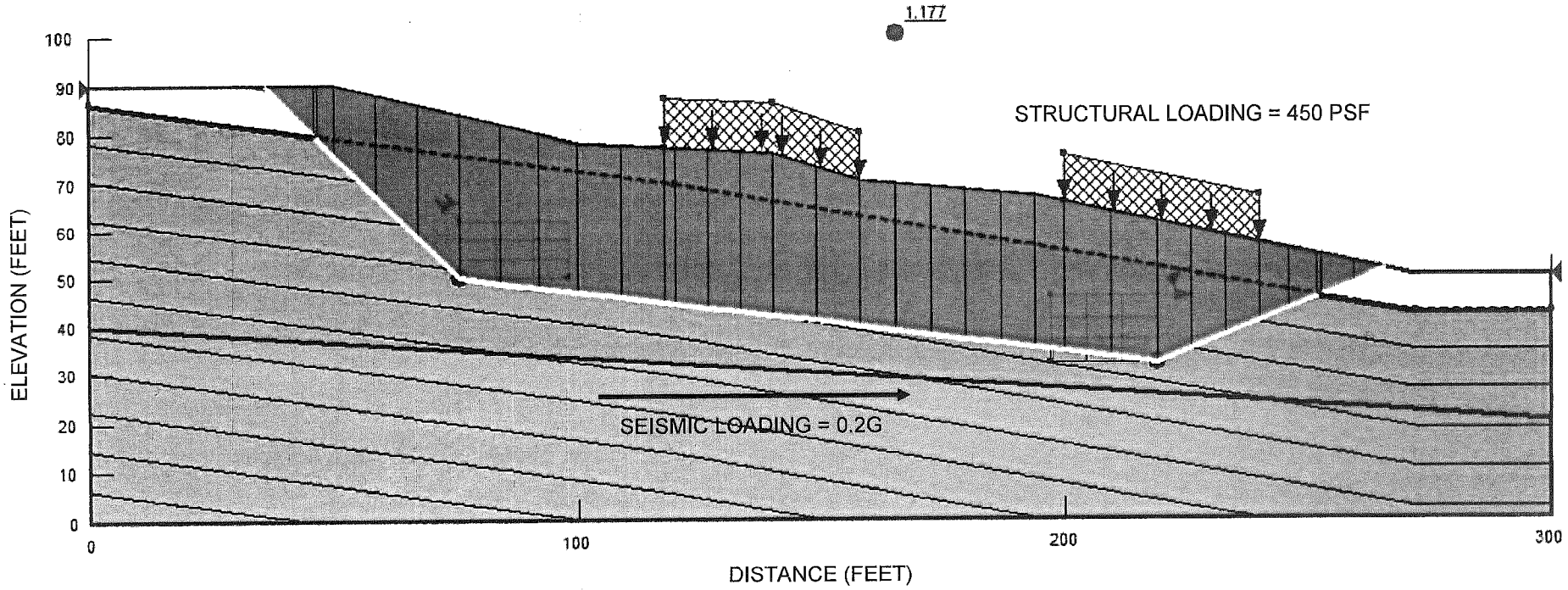
PEAT: UNIT WEIGHT=90 PCF; COHESION=0 PSF; PHI=28°

MEDIUM STIFF SILT: UNIT WEIGHT=110 PCF; COHESION=1000 PSF; PHI=0°

* SILT COHESION TENDS TO BE RELATIVELY LOW AT A LOW STRAIN RATE.

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: B-B' STATIC SLOPE STABILITY ANALYSIS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 8



PIEZOMETRIC LINE

SAND/GRAVEL: UNIT WEIGHT=125 PCF; COHESION=0 PSF; PHI=32°

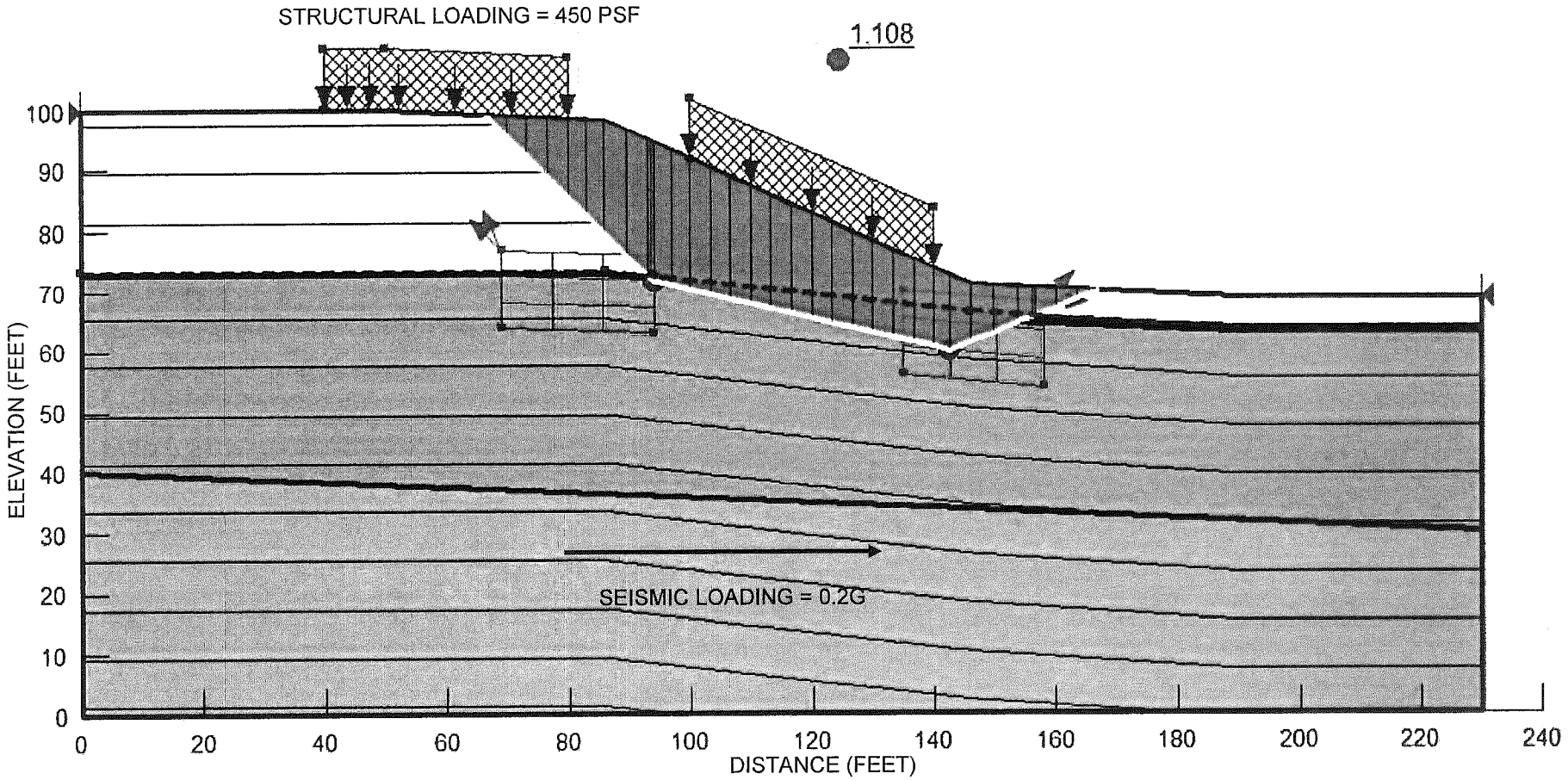
SOFT SILT: UNIT WEIGHT=110 PCF; COHESION=0 PSF; PHI=28°

MEDIUM STIFF SILT: UNIT WEIGHT=110 PCF; COHESION=0 PSF; PHI=30°

* SILT COHESION TENDS TO BE RELATIVELY LOW AT A HIGH STRAIN RATE.

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: A-A' PSEUDO-STATIC SLOPE STABILITY ANALYSIS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 9



PIEZOMETRIC LINE

SAND/GRAVEL: UNIT WEIGHT=125 PCF; COHESION=0 PSF; PHI=32°

SOFT SILT: UNIT WEIGHT=110 PCF; COHESION=0 PSF; PHI=28°

PEAT: UNIT WEIGHT=90 PCF; COHESION=0 PSF; PHI=28°

MEDIUM STIFF SILT: UNIT WEIGHT=110 PCF; COHESION=0 PSF; PHI=30°

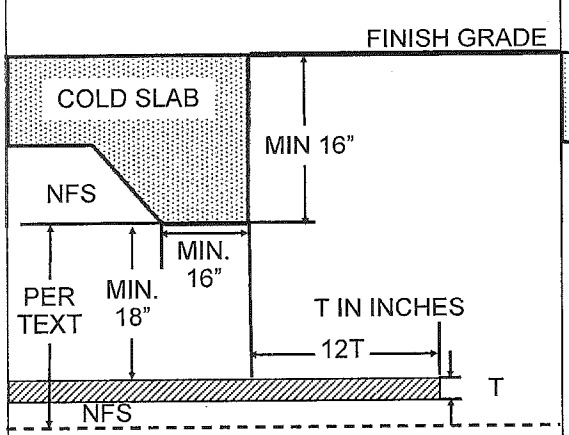
* SILT COHESION TENDS TO BE RELATIVELY LOW AT A HIGH STRAIN RATE.

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: B-B' PSEUDO-STATIC SLOPE STABILITY ANALYSIS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 10

SLABE ON GRADE

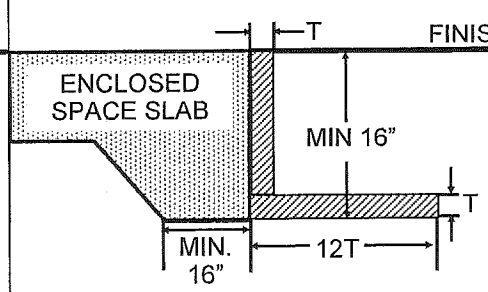
COLD SLAB



NOTE: MUST BE PLACED ON NFS MATERIAL
INSULATION OPTIONAL TO REDUCE DEPTH OF NFS

CONFIGURATION A

ENCLOSED (HEATED) SPACE SLAB

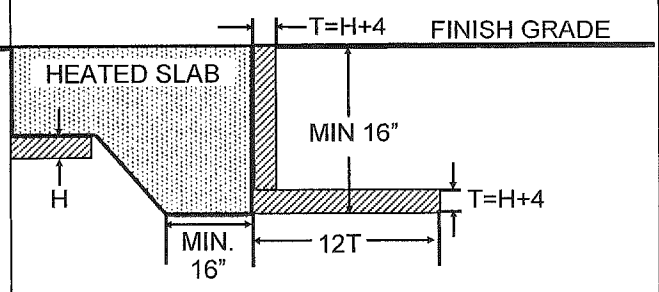


T IN INCHES. T≥2"

SOILS PREPARED AS DESCRIBED IN TEXT

CONFIGURATION B

HEATED (RADIANT) SLAB



T AND H IN INCHES

SOILS PREPARED AS DESCRIBED IN TEXT

NOTE: DO NOT INSULATE FOOTING SURFACES BELOW SLAB
THE THICKNESS OF INSULATION "H" CAN BE CHANGED
TO OBTAIN DESIRED INSULATION BENEATH SLAB

CONFIGURATION C

= FOOTING / STEM WALL / SLAB = INSULATION

CONFIGURATIONS NOT TO SCALE

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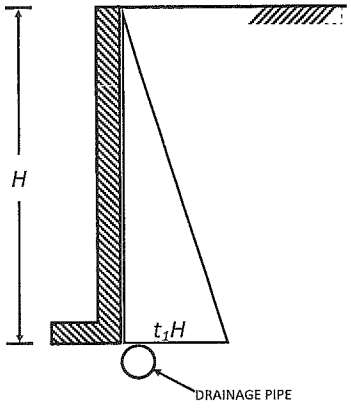
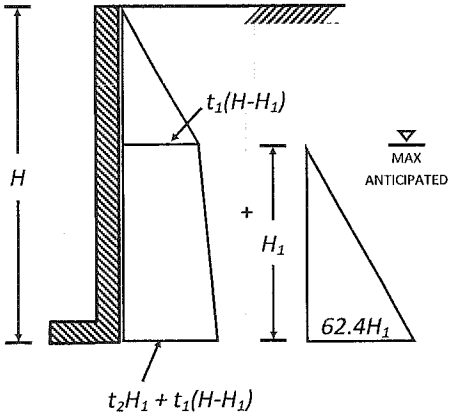
NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: FOUNDATION INSULATION CONFIGURATIONS	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 11

ACTIVE PRESSURE CONDITION

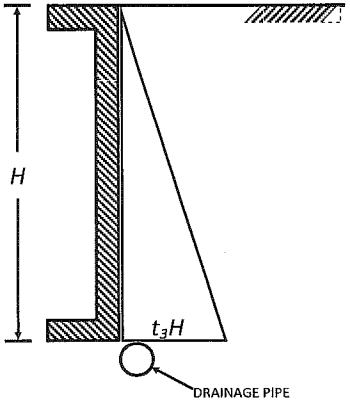


WITH DRAINAGE

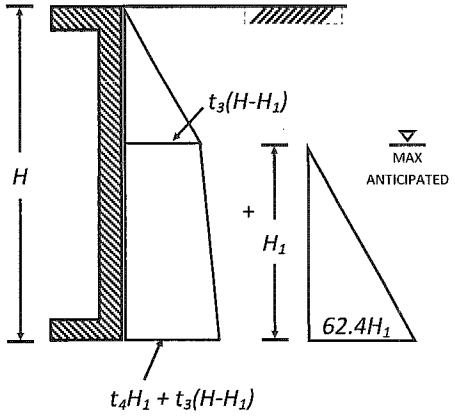


WITHOUT DRAINAGE

AT-REST PRESSURE CONDITION

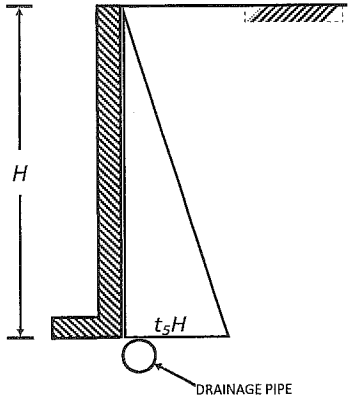


WITH DRAINAGE

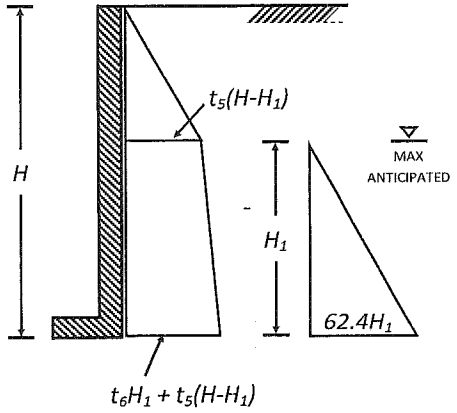


WITHOUT DRAINAGE

PASSIVE PRESSURE CONDITION



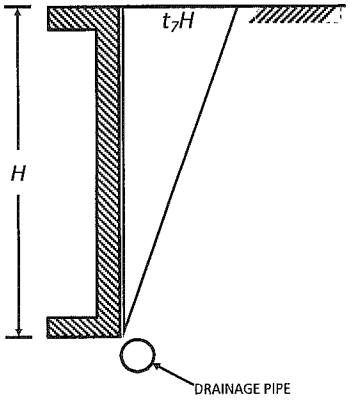
WITH DRAINAGE



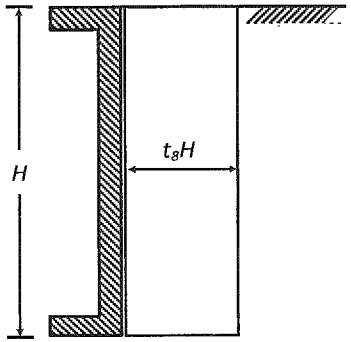
WITHOUT DRAINAGE

NOTE: WALLS CAN BE EITHER FREE OR RESTRAINED AT THE TOP FOR THE PASSIVE PRESSURE CONDITION. EQUATIONS ARE VALID FOR UNITS OF $t_{1\text{-}8}$ (PCF) AND $H\text{-}H_1$(FT).

SEISMIC



ACTIVE



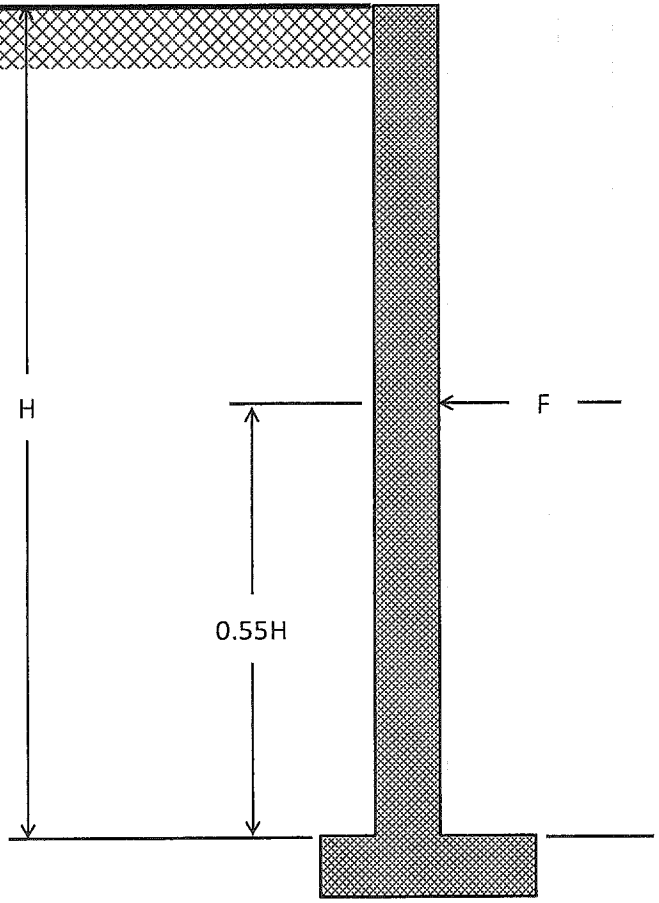
AT-REST

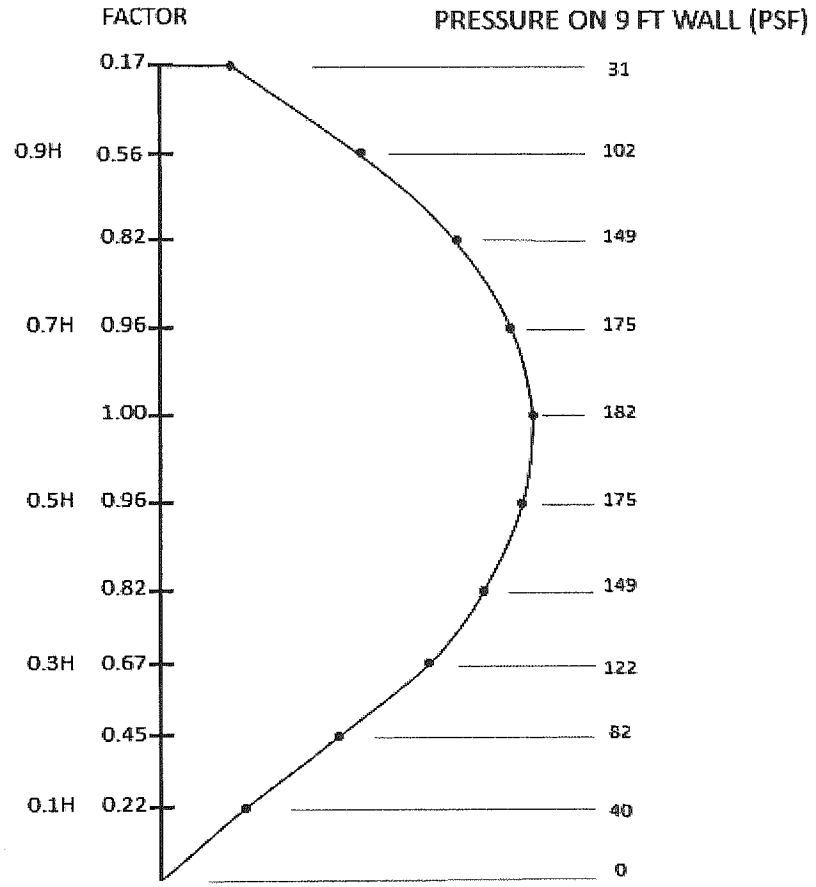
NOTE: SEISMIC LOADS ARE VALID FOR WALLS RETAINING LESS THAN 8 FEET VERTICAL OF EARTH. THE SEISMIC LOAD IS ADDED TO ACTIVE & AT-REST CONDITIONS AND IS SUBTRACTED FROM PASSIVE CONDITIONS.

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: LATERAL RETAINING WALL PRESSURES	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 12

RESTRAINED WALL ONLY





RESULTANT F: 9' WALL 1038 PLF (9 FT SOIL RETAINED)

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: RESTRAINED WALL SEISMIC PRESSURE DISTRIBUTION	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4389-16
PROJECT LOCATION: ANCHORAGE, AK	FIGURE NUMBER: 13

LEVELING COURSE

SIEVE SIZE	% BY MASS PASSING
1"	100
3/4"	70-100
3/8"	50-80
#4	35-65
#8	20-50
#50	8-28
#200	2-6
0.02	0-3

TYPE II

SIEVE SIZE	% BY MASS PASSING
8"	100
3"	70-100
1-1/2"	55-100
3/4"	45-85
#4	20-60
#10	12-50
#40	4-30
#200	*2-6
0.02	0-3

*IN ADDITION TO THE GRADING LIMITS LISTED ABOVE, THE FRACTION OF MATERIAL PASSING THE #200 SIEVE SHALL NOT BE GREATER THAN FIFTEEN PERCENT (15 %) OF THAT FRACTION PASSING THE #4 SIEVE.

TYPE II - A

SIEVE SIZE	% BY MASS PASSING
3"	100
3/4"	50-100
#4	25-60
#10	15-50
#40	4-30
#200	*2-6
0.02	0-3

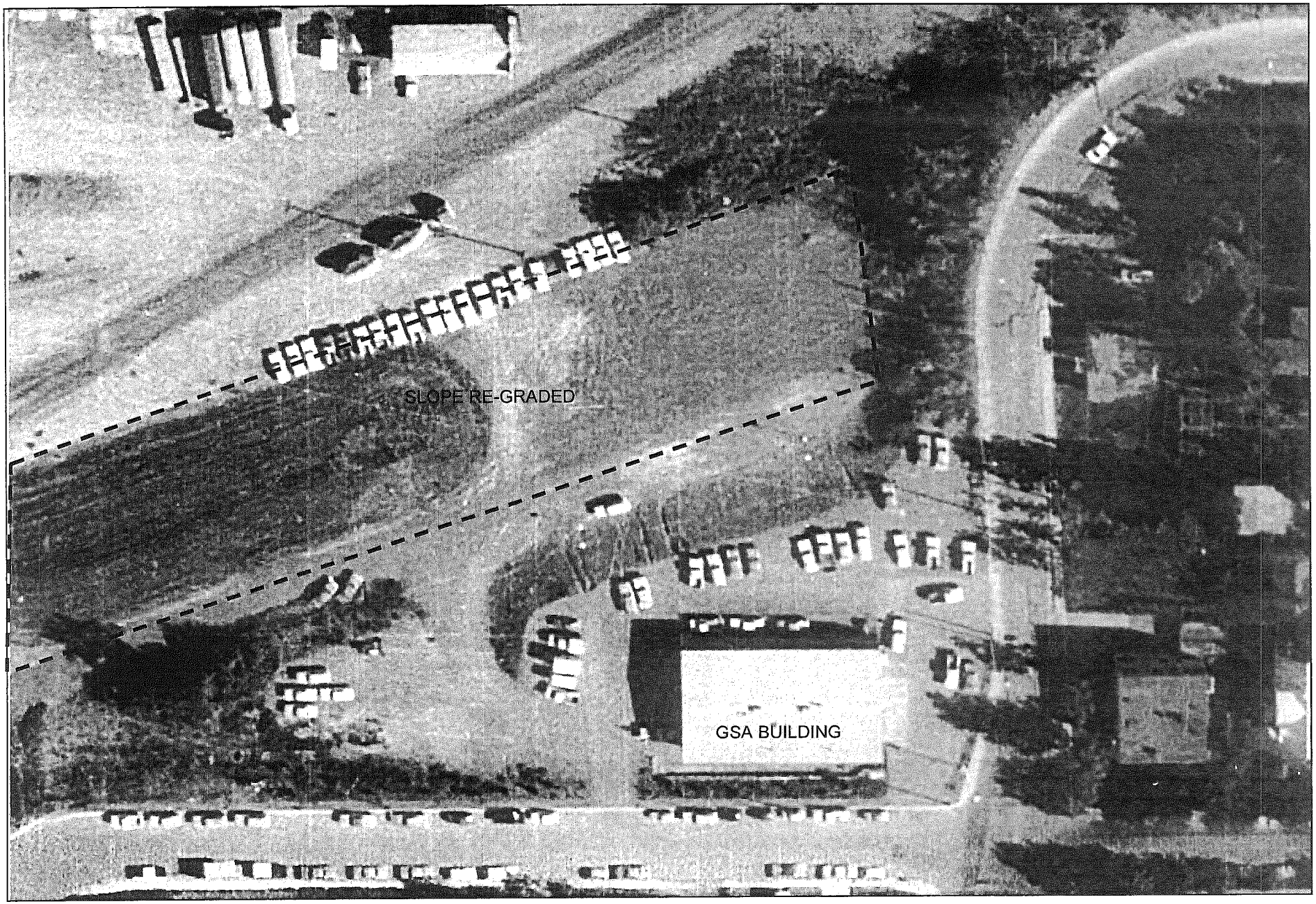
*IN ADDITION TO THE GRADING LIMITS LISTED ABOVE, THE FRACTION OF MATERIAL PASSING THE #200 SIEVE SHALL NOT BE GREATER THAN TWENTY PERCENT (20 %) OF THAT FRACTION PASSING THE #4 SIEVE.

APPENDIX A

AERIAL PHOTOGRAPHS OF PROJECT SITE

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: AERIAL PHOTOGRAPHS OF PROJECT SITE— MAY 5, 1960	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	APPENDIX NUMBER: A-1



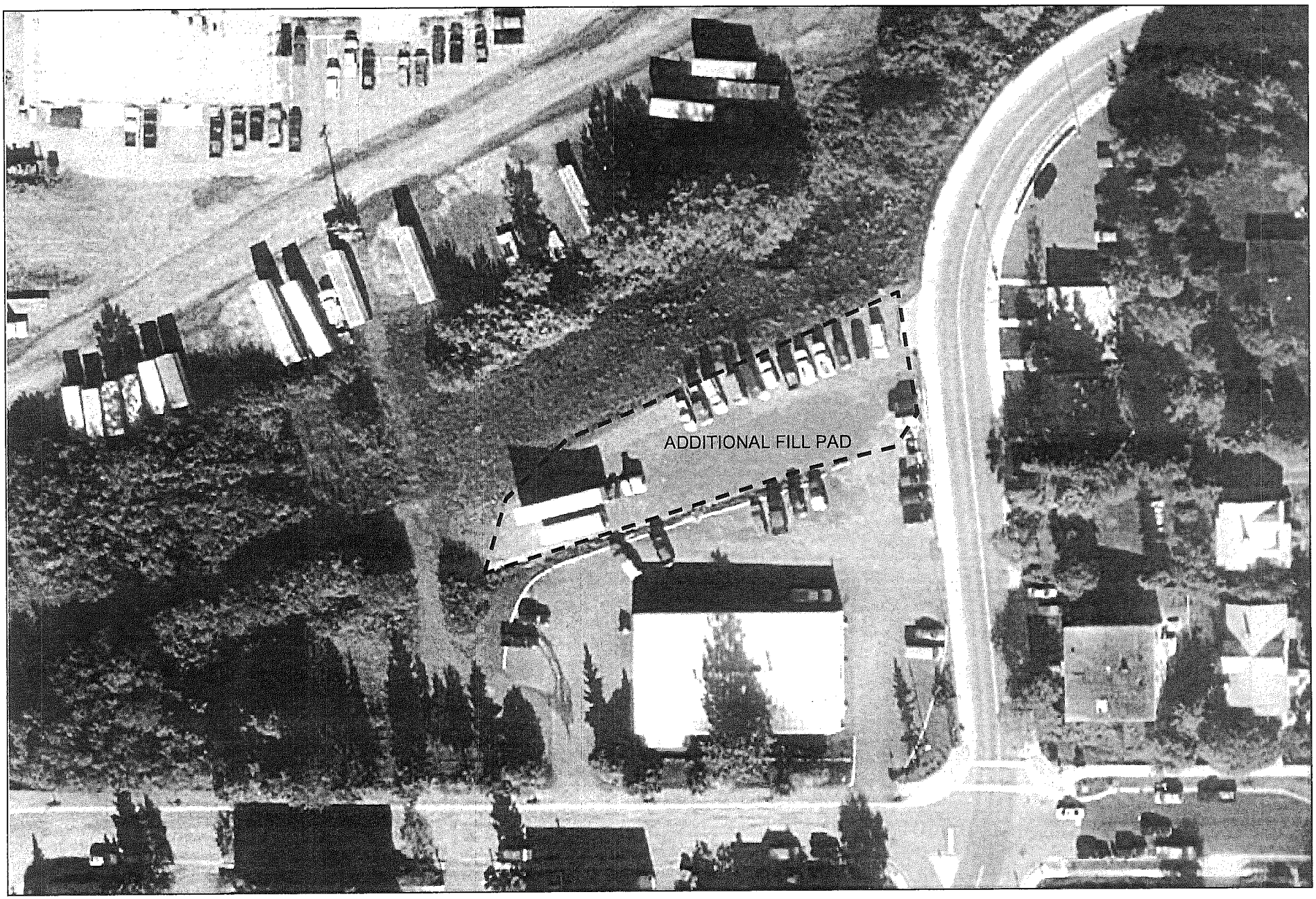
126

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: AERIAL PHOTOGRAPHS OF PROJECT SITE— JULY 7, 1970		
PROJECT NAME: SHIP CREEK DEVELOPMENT		PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK		APPENDIX NUMBER: A-2

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: AERIAL PHOTOGRAPHS OF PROJECT SITE— JUNE 3, 1990	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	APPENDIX NUMBER: A-3



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: AERIAL PHOTOGRAPHS OF PROJECT SITE— SEPTEMBER 10, 2002	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	APPENDIX NUMBER: A-4

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: AERIAL PHOTOGRAPHS OF PROJECT SITE— MAY 1, 2015	
PROJECT NAME: SHIP CREEK DEVELOPMENT	PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK	APPENDIX NUMBER: A-5

APPENDIX B

GEOTECHNICAL BOREHOLE LOGS

Northern Geotechnical Engineering Inc.
d.b.a. Terra Firma Testing
11301 Olive Lane
Anchorage, AK 99515
Telephone: 907-344-5934
Fax: 907-344-5993

EXPLORATION B-1

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 50 ft above mean sea level
▽ GROUNDWATER (ATD): N/E
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
0			**GRAVEL** (GP-GM), loose to dense, gray to dark brown, dry to damp, FILL		S1	N/A	N/A	N/A	N/A	MC = 1.0%	
					S2	12	3 7 11	30	N/A	MC = 4.7% 44.2% gravel, 44.0% sand, 11.8% silt P0.02 = 8.4% FC = F1	
5					S3	14	3 3 4	9	N/A	MC = 7.3%	Increased sand content at approx. 5' bgs.
					S4	12	3 5 4	10	N/A	MC = 7.2% 31.0% gravel, 56.3% sand, 12.7% silt	
10					S5	12	4 6 3	8	N/A	MC = 8.2%	
15					S6a S6b	16	2 7 12	16	N/A	MC = 3.7% (S6a) MC = 11.1% (S6b) 26.4% gravel, 47.7% sand, 25.9% silt P0.02 = 20.1% FC = F3	Increased silt content at approx. 15' bgs.
20											

(Continued Next Page)

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EXPLORATION B-1

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 50 ft above mean sea level
▽ GROUNDWATER (ATD): N/E
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
20			**GRAVEL** (GP-GM), loose to dense, gray to dark brown, dry to damp, FILL *(continued)*		S7	14	3 18 19	31	N/A	MC = 3.5%	Decreased sand and silt content at approx. 20' bgs.
25			**SILT** (ML), with sand, soft to medium stiff, brownish gray to blueish gray, lensed, moist to wet, low-medium plasticity, occasional sand lenses		S8	14	2 2 3	5	N/A	MC = 14.0% P200 = 67.8%	
30					S9	16	2 3 3	6	N/A	MC = 20.4% LL = 28 PL = 24 PI = 4	
35					S10	18	2 1 1	2	N/A	MC = 20.8%	
40											

(Continued Next Page)

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EXPLORATION B-1

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 50 ft above mean sea level
▽ GROUNDWATER (ATD): N/E
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
40			**SILT** (ML), with sand, soft to medium stiff, brownish gray to blueish gray, lensed, moist to wet, low-medium plasticity, occasional sand lenses *(continued)*		S11	18	1 1 1	2	N/A	MC = 37.1% P200 = 45.2%	
45					S12	24 N/A N/A	N/A	N/A	400 450 450 500		PP @ 45.83' bgs = 0.5 tsf TV @ 45.83' bgs = 0.4 tsf. PP @ 46.66' bgs = 0.25 tsf TV @ 46.66' bgs = 0.45 tsf.
50					S13	24 N/A N/A	N/A	N/A	400 450 500 500	MC = 29.2% 0.0% gravel, 1.3% sand, 98.7% silt P0.02 = 88.3% LL = 38 PL = 23 PI = 13 FC = F4 P0.002 = 55.4% SG = 2.694	PP @ 51.66' bgs = 0.5 tsf TV @ 51.66' bgs = 0.45 tsf. PP @ 51.91' bgs = 0.125 tsf TV @ 51.91' bgs = 0.3 tsf.

Bottom of borehole at 52.0 feet bgs.

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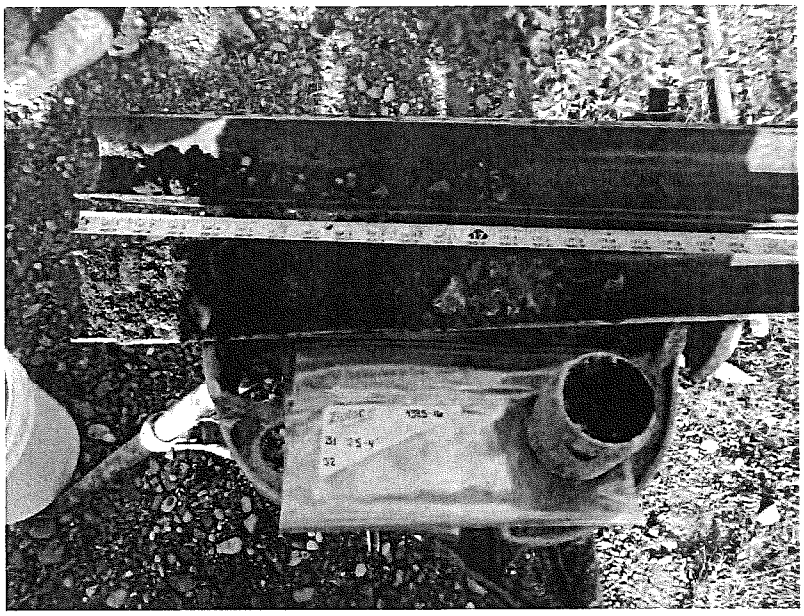
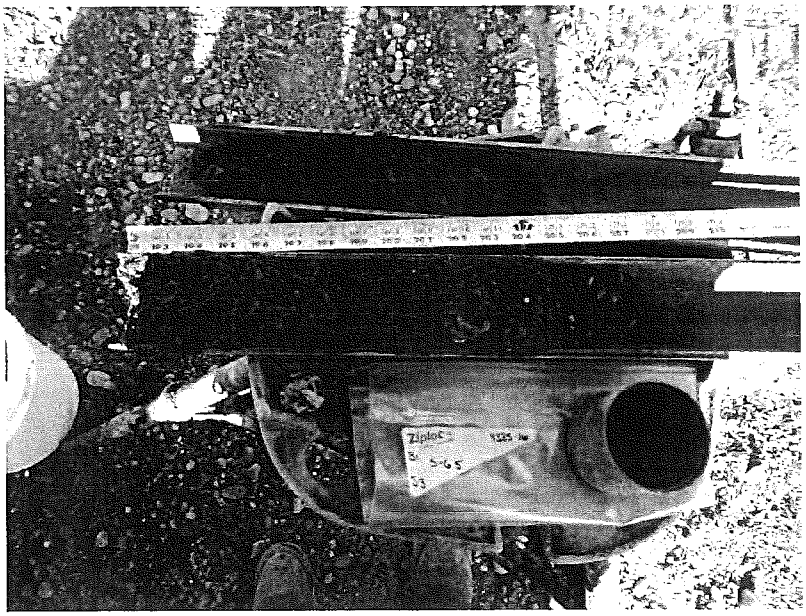
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B1 Sample S2
Sample Interval 2.5'-4' bgs



Exploration B1 Sample S3
Sample Interval 5'-6.5' bgs

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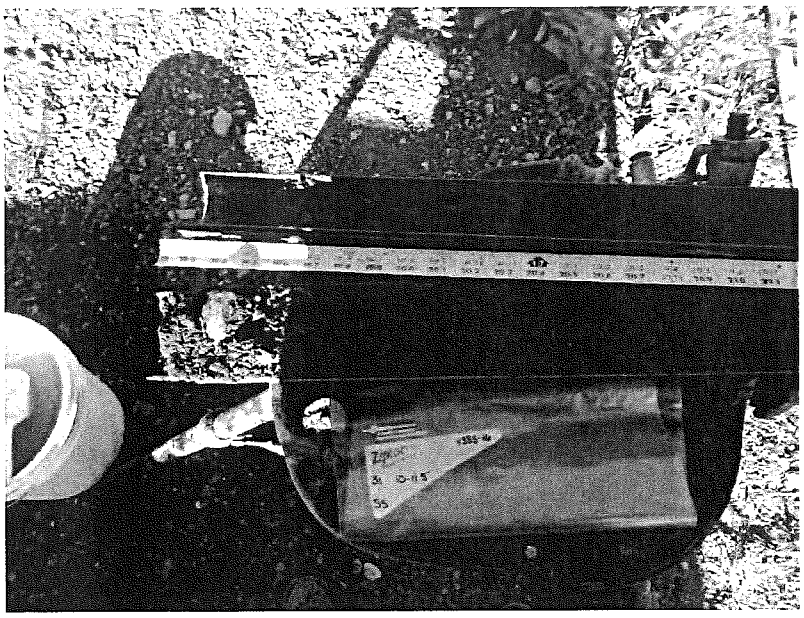
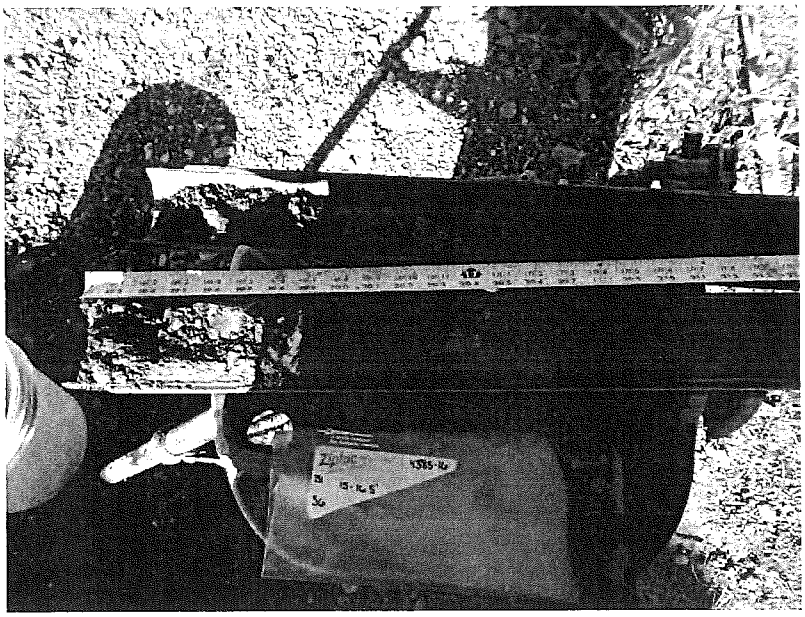
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B1 Sample S5
Sample Interval 10'-11.5' bgs



Exploration B1 Sample S6
Sample Interval 15'-16.5' bgs

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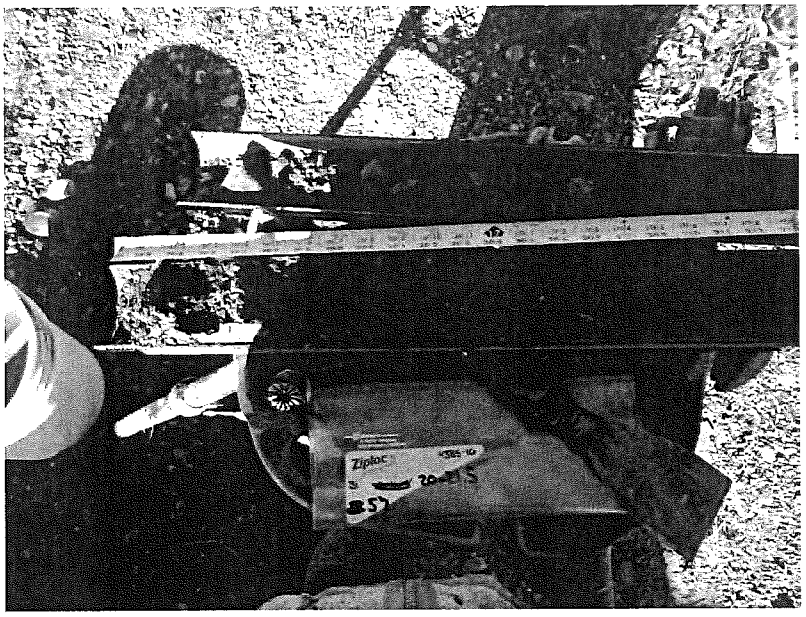
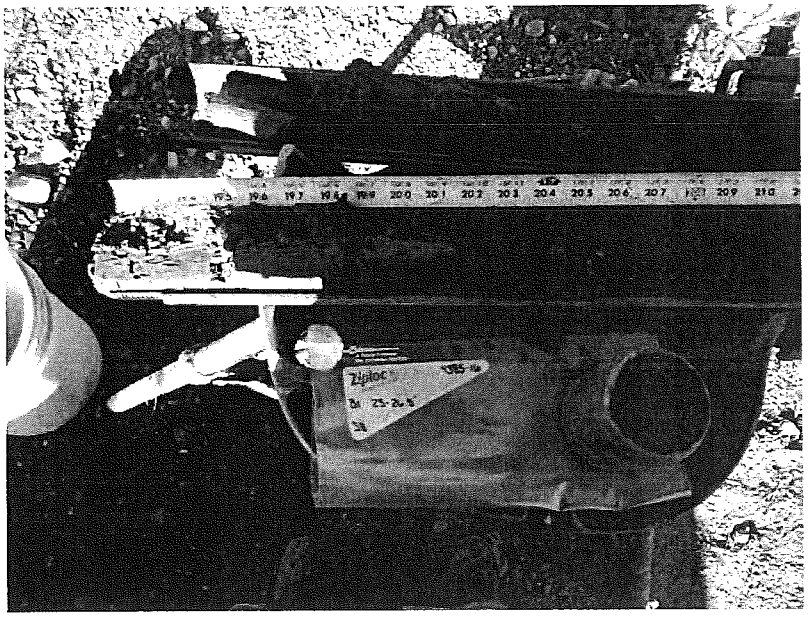
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B1 Sample S7
Sample Interval 20'-21.5' bgs



Exploration B1 Sample S8
Sample Interval 25'-26.5' bgs

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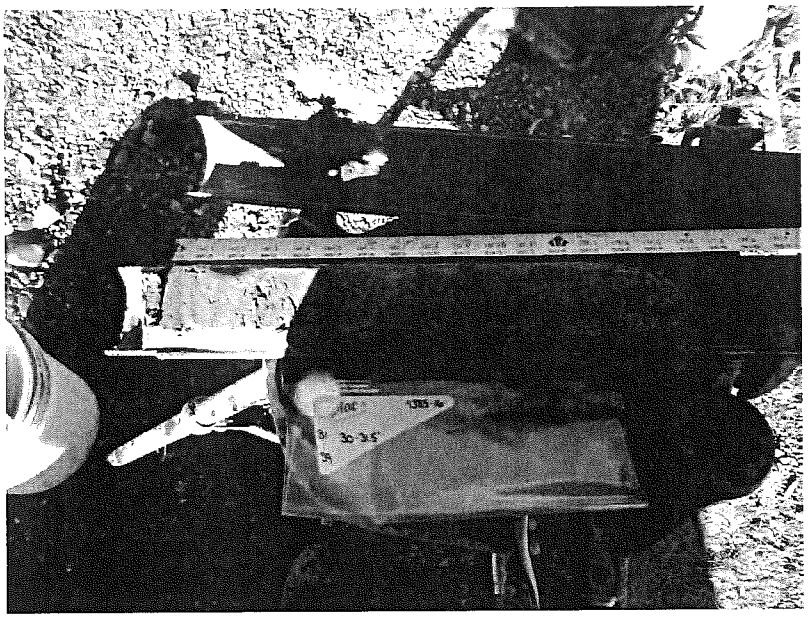
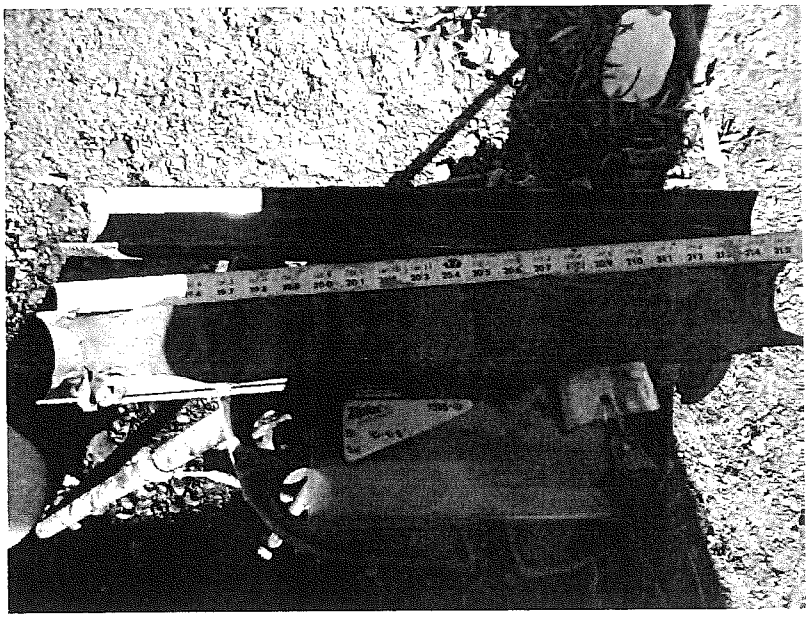
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B1 Sample S9
Sample Interval 30'-31.5' bgs



Exploration B1 Sample S11
Sample Interval 40'-41.5' bgs

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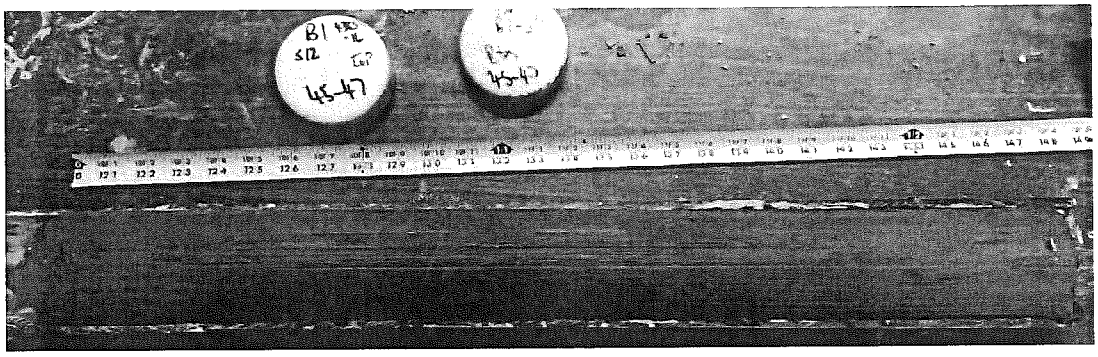
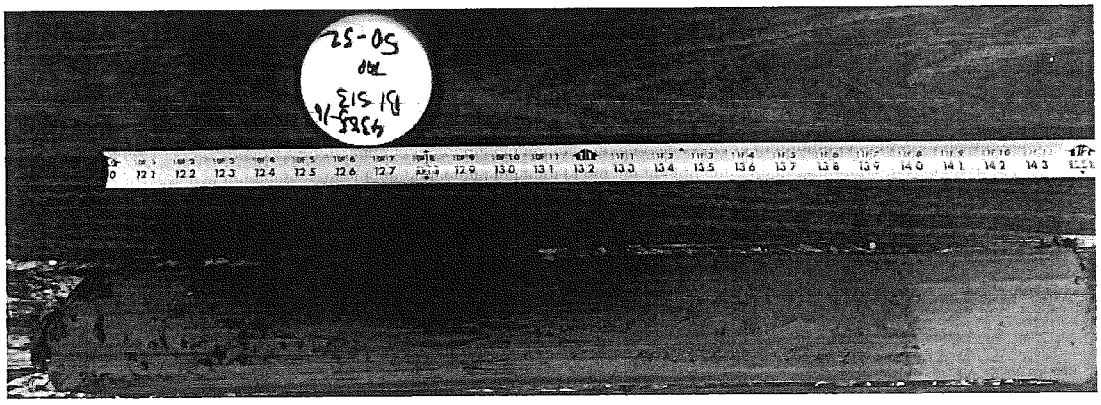
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B1 Sample S12
Sample Interval 45'-47' bgs
Extracted Shelby Tube



Exploration B1 Sample S13
Sample Interval 50'-52' bgs
Extracted Shelby Tube

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EXPLORATION B-2

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 45 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 6.5 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
0			**GRAVEL WITH SAND** (GP-GM), some organics, loose, dark brown to brown, damp to moist, FILL		S1	N/A	N/A	N/A	N/A	MC = 3.1%	
					S2	12	3 3 3	10	N/A	MC = 16.0% 36.9% gravel, 40.3% sand, 22.8% silt OC = 3.0%	
5			**SILT WITH SAND** (SM), loose, dark brown, moist		S3	14	2 3 2	6	N/A	MC = 13.6% 14.7% gravel, 56.2% sand, 29.1% silt P0.02 = 16.4% FC = F3	Increased silt content at approx. 4.7' bgs. Increased sand and silt content at approx. 5.3' bgs.
			▽ **SILT TO LEAN CLAY** (ML/CL), with sand, soft, gray, lensed, moist to wet, low plasticity, occasional sand lenses		S4	16	1 2 2	3	N/A	MC = 33.2% LL = 28 PL = 27 PI = 1	
10					S5b S5a	16	1 3 5	7	N/A	MC = 17.5% (S5b)	
15					S6	18	1 1 1	2	N/A	MC = 28.2% P200 = 97.4%	
20											

(Continued Next Page)

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EXPLORATION B-2

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
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EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
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SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 45 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 6.5 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
20			**SILT TO LEAN CLAY** (ML/CL), with sand, soft, gray, lensed, moist to wet, low plasticity, occasional sand lenses *(continued)*		S7	18	1 1 1	2	N/A	MC = 31.6%	
25					S8	18	1 1 1	2	N/A	MC = 36.6%	
30					S9	18	1 2 2	4	N/A	MC = 29.2%	
35					S10	18	1 2 2	4	N/A	MC = 30.2%	
40											

(Continued Next Page)

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EXPLORATION B-2

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EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/6/2016
DATE COMPLETED: 5/6/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 45 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 6.5 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
40			**SILT TO LEAN CLAY** (ML/CL), with sand, soft, gray, lensed, moist to wet, low plasticity, occasional sand lenses *(continued)*		S11	18	1 2 2	4	N/A	MC = 26.1% P200 = 99.6%	
45					S12	24	N/A	N/A	250 350 400 450	MC = 28.9% 0.0% gravel, 0.1% sand, 99.9% silt P0.02 = 95.0% LL = 34 PL = 28 PI = 6 FC = F4 P0.002 = 53.1% SG = 2.681	PP @ 46.25' bgs = 0.25 tsf TV @ 46.25' bgs = 0.325 tsf. PP @ 46.75' bgs = 0.25 tsf TV @ 46.75' bgs = 0.35 tsf.
50					S13	24	N/A	N/A	250 350 400 400	MC = 28.5% 0.0% gravel, 0.2% sand, 99.8% silt P0.02 = 84.7% LL = 29 PL = 21 PI = 8 FC = F4 P0.002 = 36.4% SG = 2.633	Very thin sand layer at approx. 50.33' bgs. Very thin sand layer at approx. 50.58' bgs. PP @ 51.58' bgs = 0.25 tsf. PP @ 51.83' bgs = 0.75 tsf TV @ 51.83' bgs = 0.3 tsf.

Bottom of borehole at 52.0 feet bgs.

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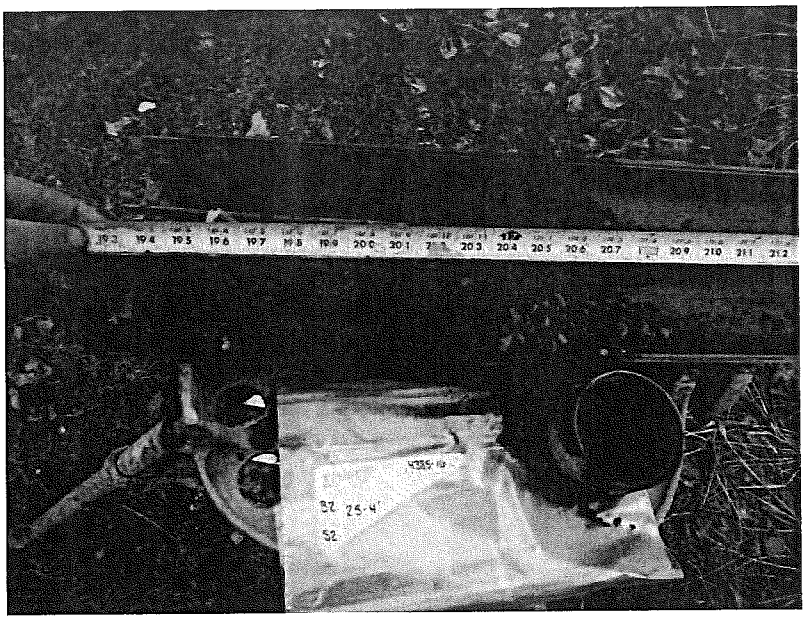
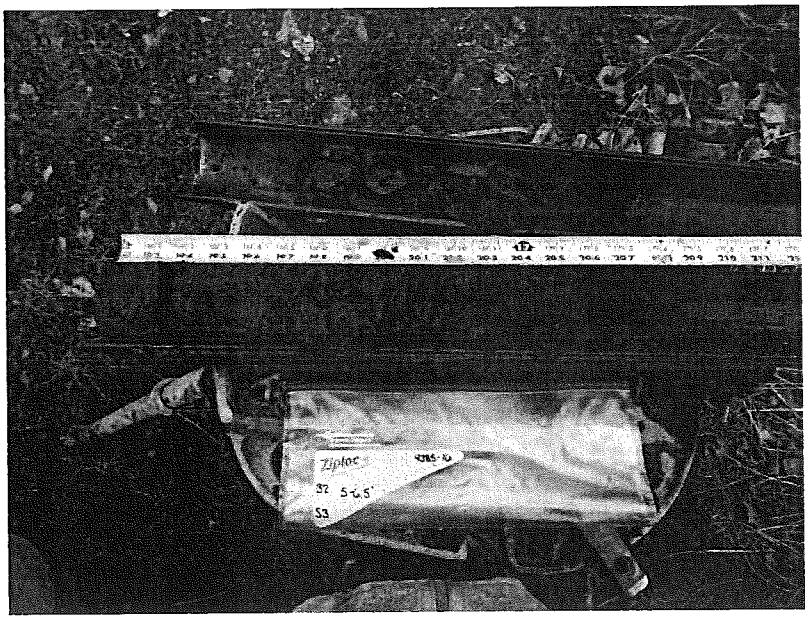
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exporation B-2 Sample S2
Sample Interval 2.5'-4' bgs



Exporation B-2 Sample S3
Sample Interval 5'-6.5' bgs

Northern Geotechnical Engineering Inc. d.b.a. Terra Firma Testing
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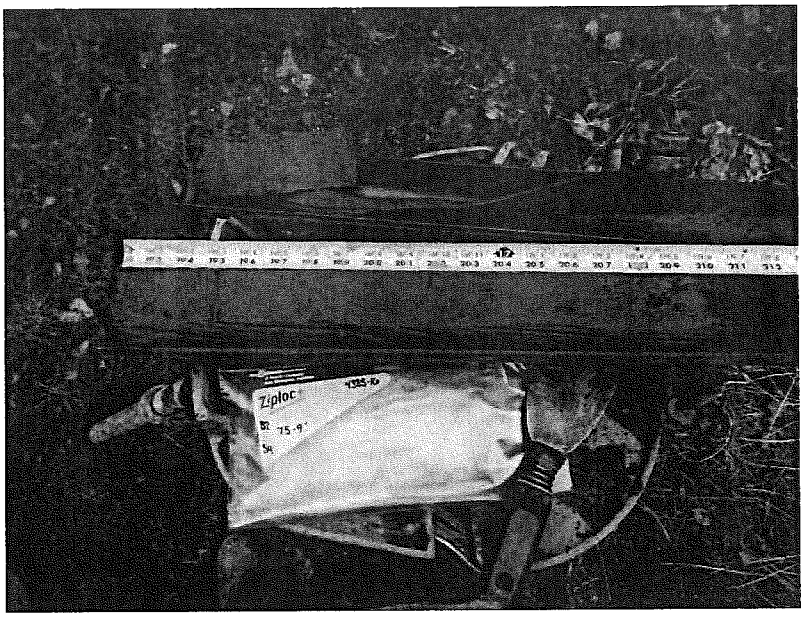
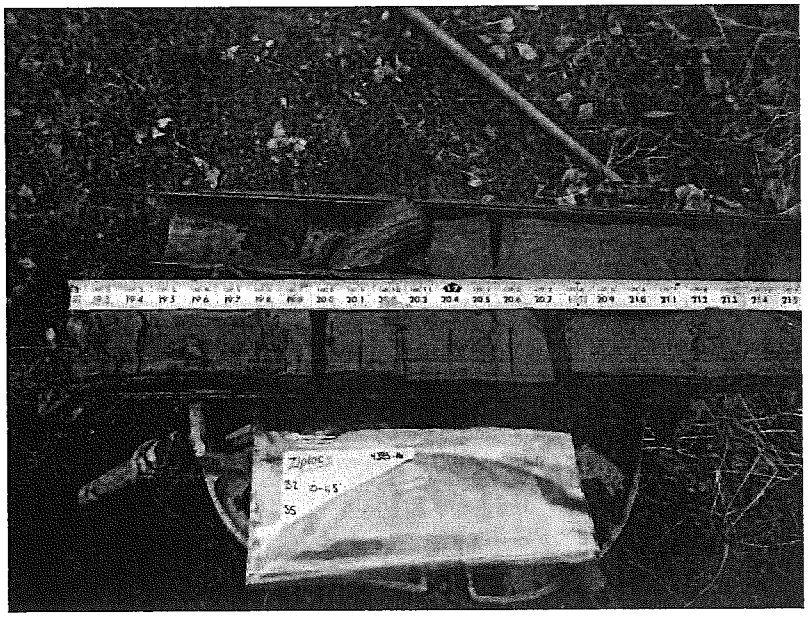
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exporation B-2 Sample S4
Sample Interval 7.5'-9' bgs



Exporation B-2 Sample S5
Sample Interval 10'-11.5' bgs

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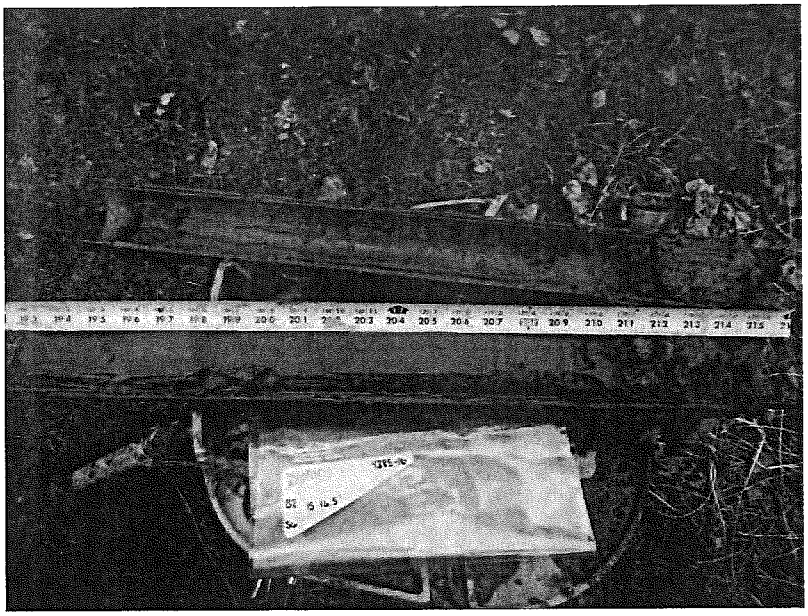
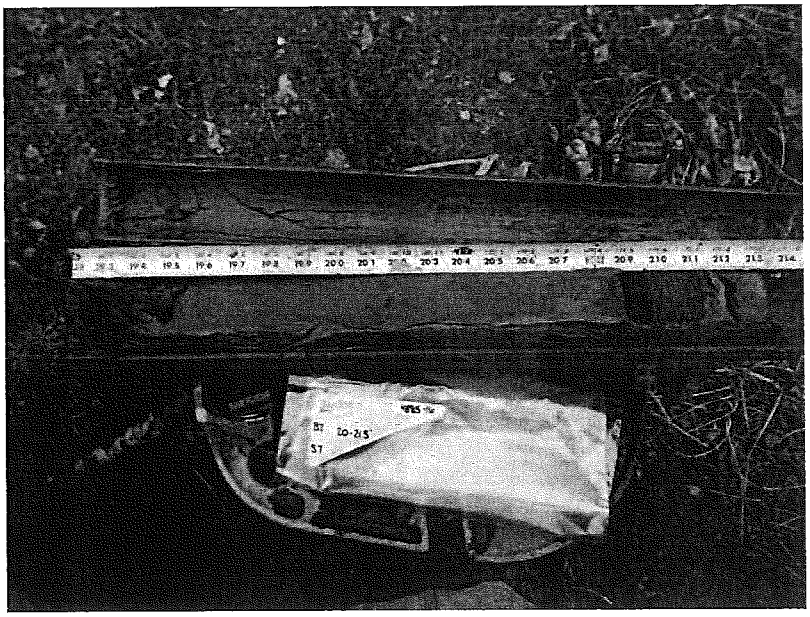
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exporation B-2 Sample S6
Sample Interval 15'-16.5' bgs



Exporation B-2 Sample S7
Sample Interval 20'-21.5' bgs

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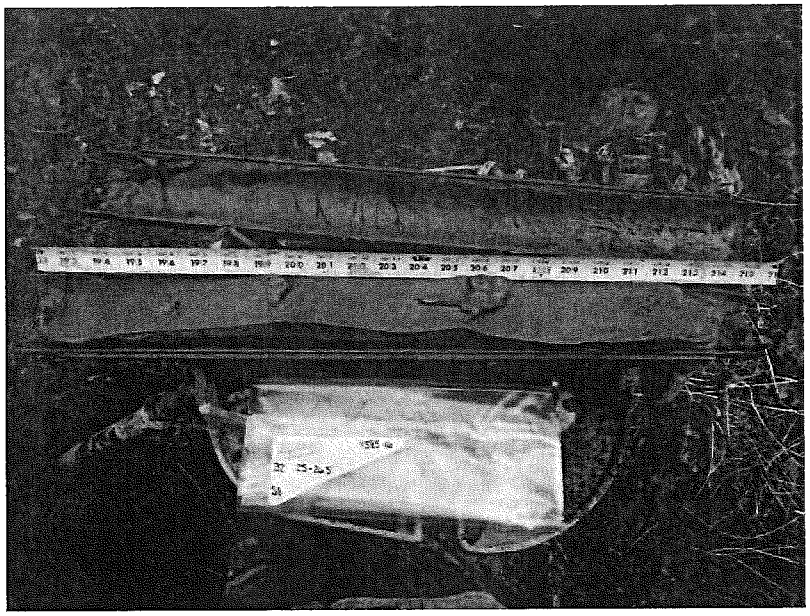
11301 Olive Lane
Anchorage, AK 99515
Telephone: 907-344-5934
Fax: 907-344-5993

PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exporation B-2 Sample S8
Sample Interval 25'-26.5' bgs

Exporation B-2 Sample S9
Sample Interval 30'-31.5' bgs

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Anchorage, AK 99515
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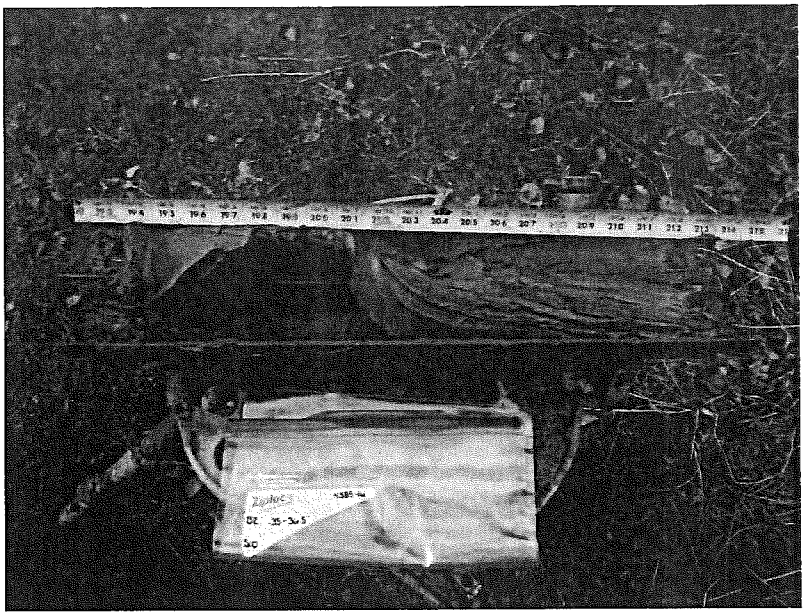
Fax: 907-344-5993

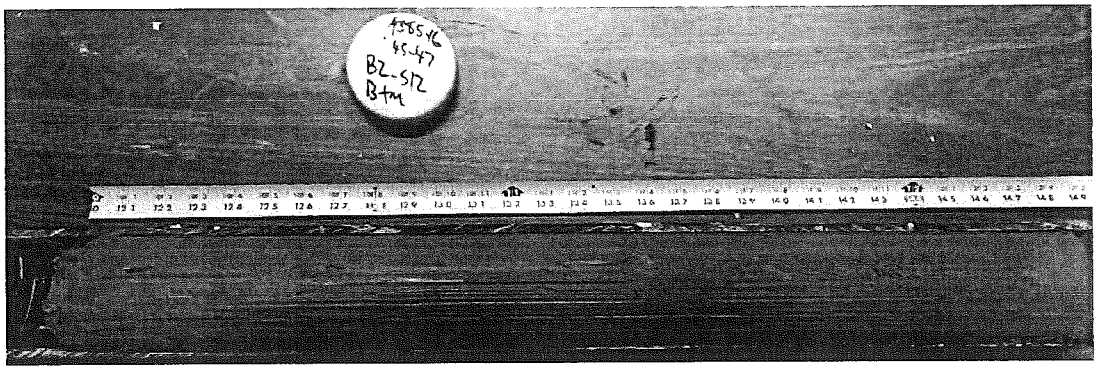
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exporation B-2 Sample S10
Sample Interval 35'-36.5' bgs



Exploration B2 Sample S12
Sample Interval 45'-47' bgs
Extracted Shelby Tube

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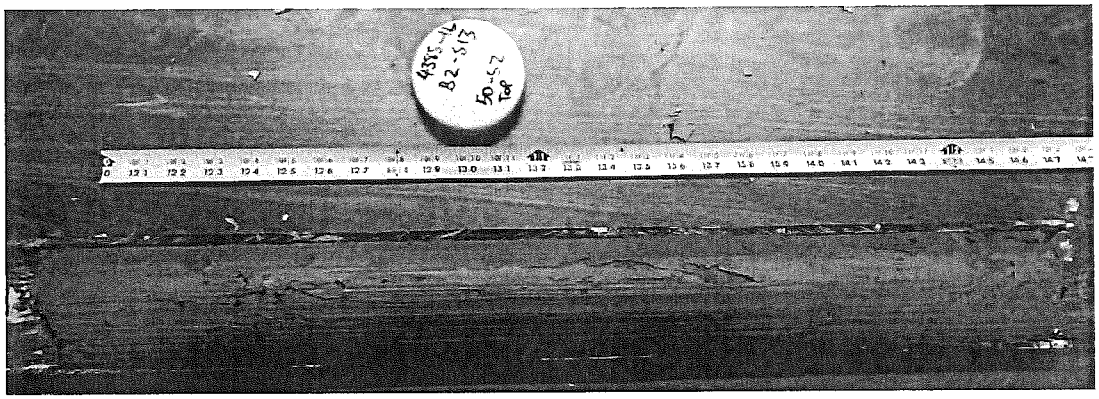
Fax: 907-344-5993

PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B2 Sample S13
Sample Interval 50'-52' bgs
Extracted Shelby Tube

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EXPLORATION B-3

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 18 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 18.0 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
0			**SILTY GRAVEL** (GM), some organics, medium dense, brown, moist, FILL		S1	N/A	N/A	N/A	N/A	MC = 7.0% 37.5% gravel, 39.9% sand, 22.6% silt OC = 3.9%	
			SILT WITH SAND AND GRAVEL (SM), medium stiff, brown, moist to wet		S2	15	1 3 4	12	N/A	MC = 17.1%	
5					S3	14	3 3 4	6	N/A	MC = 27.3% 13.1% gravel, 43.7% sand, 43.2% silt P0.02 = 28.8% FC = F3	
			SILT (ML), trace organics, very soft to soft, brown to blueish gray, moist to wet, low plasticity, occasional sand lenses		S4	10	3 3 4	6	N/A	MC = 22.3% OC = 6.2%	
10					S5	10	2 3 4	6	N/A	MC = 25.0%	
15			▽		S6	9	1 1 2	3	N/A	MC = 30.6% LL = 28 PL = 28 PI = 0	
20					S7	15	1 1 1	2	N/A	MC = 36.2%	

(Continued Next Page)

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EXPLORATION B-3

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 18 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 18.0 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
25			**SILT** (ML), trace organics, very soft to soft, brown to blueish gray, moist to wet, low plasticity, occasional sand lenses *(continued)*								
					S8	24	N/A	N/A	150 350 300 300		PP @ 25.66' bgs = 0.6 tsf TV @ 25.66' bgs = 0.375 tsf.
30					S9	18	1 1 1	2	N/A	MC = 26.2% P200 = 97.4%	
35					S10	24	N/A	N/A	300 400 450 500	MC = 31.0% 0.0% gravel, 2.4% sand, 97.6% silt P0.02 = 94.0% LL = 37 PL = 29 PI = 8 FC = F4 P0.002 = 52.1% SG = 2.671	PP @ 36' bgs = 0.75 tsf. PP @ 36.5' bgs = 0.5 tsf TV @ 36.5' bgs = 0.4 tsf.
			Bottom of borehole at 37.0 feet bgs.								

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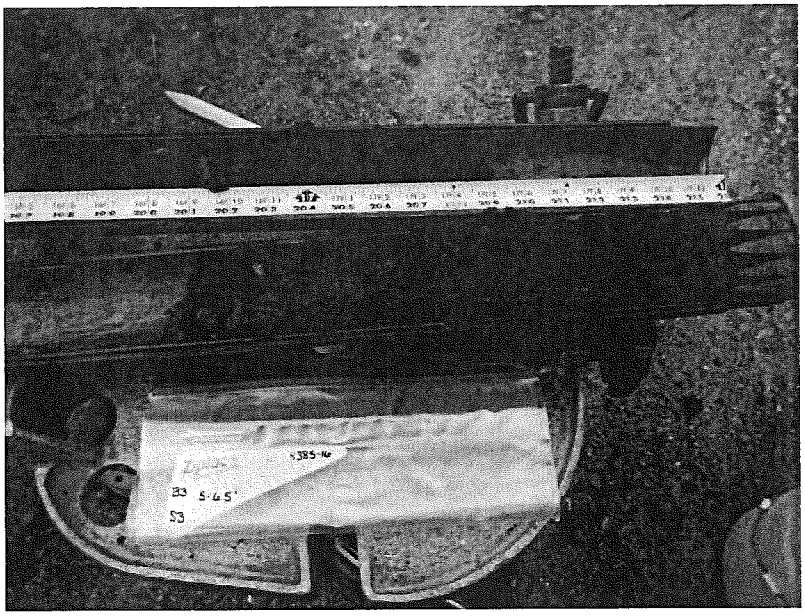
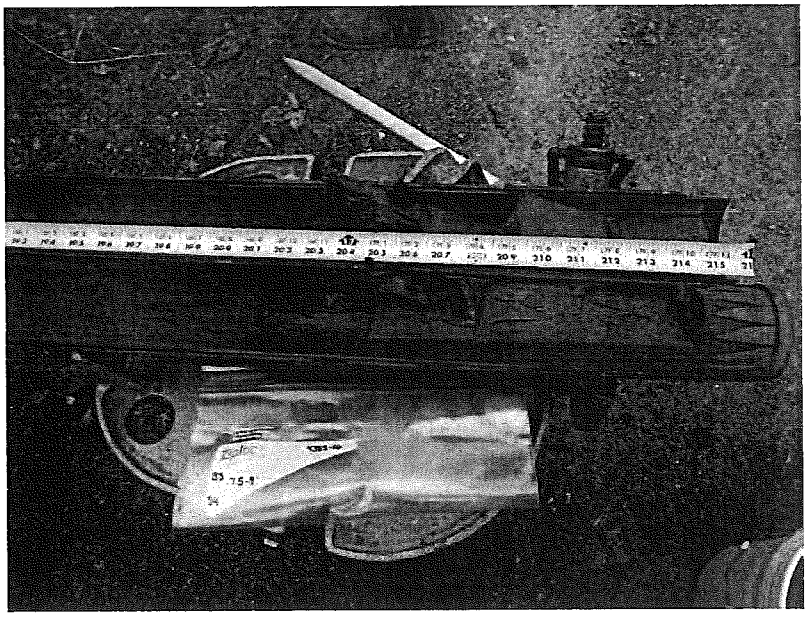
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-3 Sample S3
Sample Interval 5'-6.5' bgs



Exploration B-3 Sample S4
Sample Interval 7.5'-9' bgs

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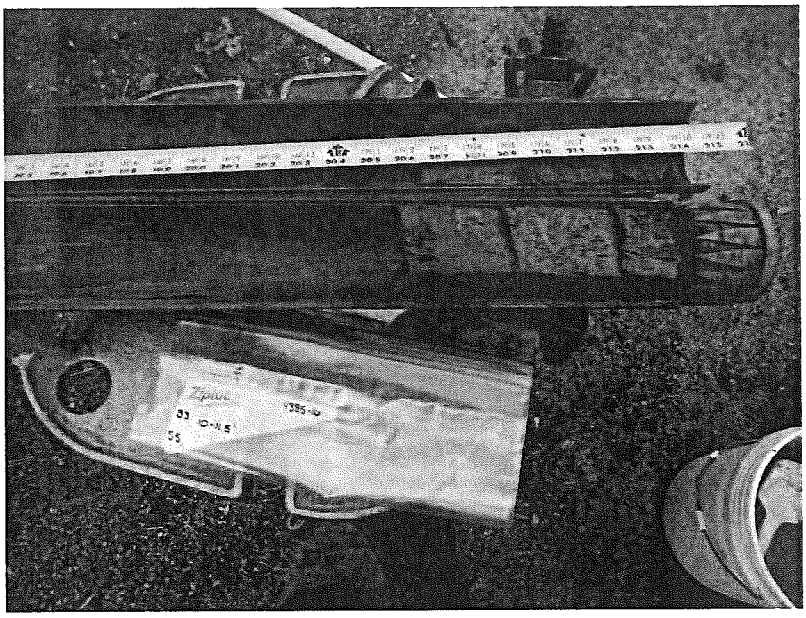
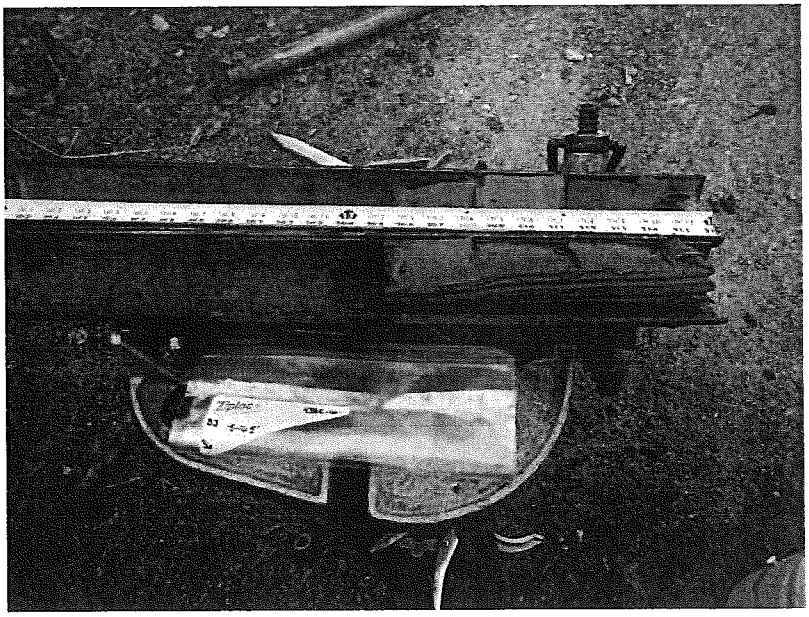
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-3 Sample S5
Sample Interval 10'-11.5' bgs



Exploration B-3 Sample S6
Sample Interval 15'-16.5' bgs

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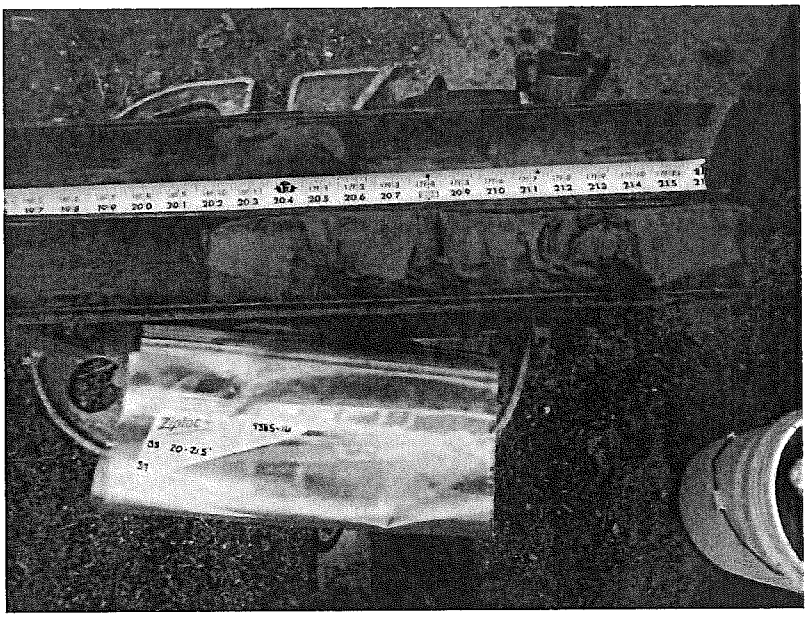
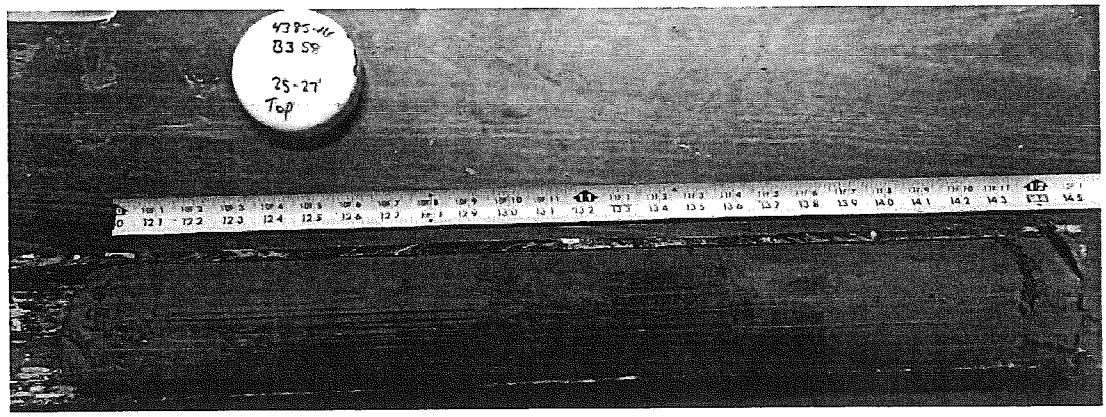
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-3 Sample S7
Sample Interval 20'-21.5' bgs



Exploration B3 Sample S8
Sample Interval 25'-27' bgs
Extracted Shelby Tube

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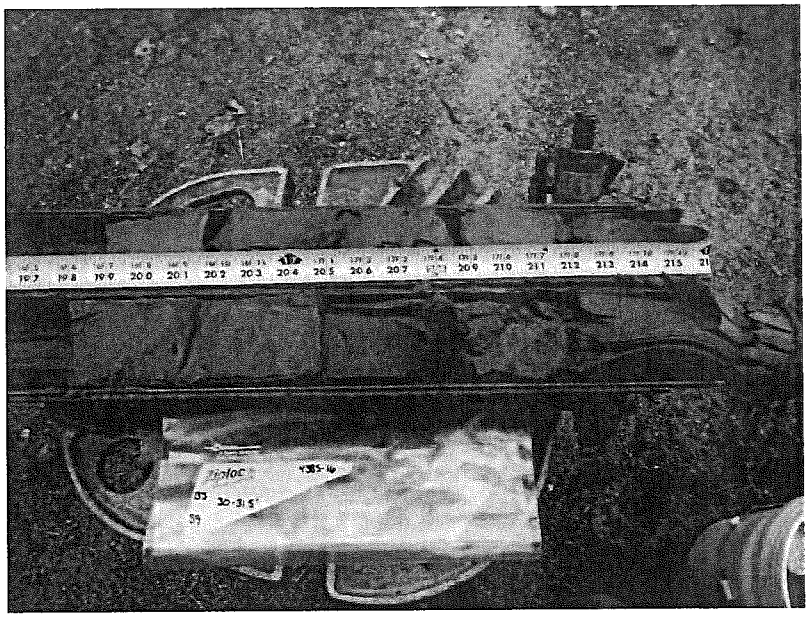
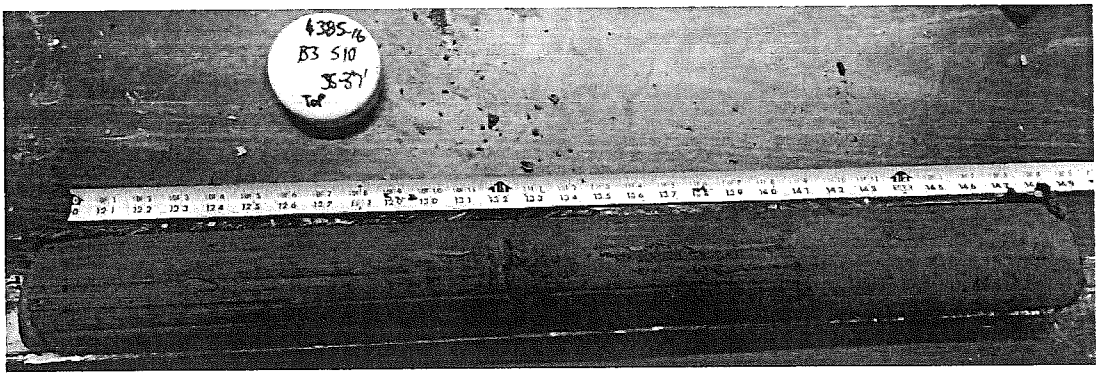
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-3 Sample S9
Sample Interval 30'-31.5' bgs



Exploration B3 Sample S10
Sample Interval 35'-37' bgs
Extracted Shelby Tube

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EXPLORATION B-4

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 19 ft above mean sea level
GROUNDWATER (ATD): Approx. 6.5 ft bgs
GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
0			**GRAVEL WITH SILT AND SAND** (GP-GM), some organics, loose, brown to black, damp to moist, FILL		S1	N/A	N/A	N/A	N/A	MC = 7.0% 62.1% gravel, 24.0% sand, 13.9% silt OC = 4.1%	
					S2	13	3 3 3	10	N/A	MC = 13.3%	Increased silt content at approx. 2.5' bgs.
5			**PEAT** (PT), loose, dark brown to black		S3	14	2 2 2	6	N/A	MC = 41.9%	
			▽ **SANDY SILT WITH GRAVEL** (SM), loose, brownish gray, moist to wet		S4	12	1 2 3	6	N/A	MC = 24.2% 4.0% gravel, 47.8% sand, 48.2% silt P0.02 = 31.9% FC = F3	
10			**SILT** (ML), with sand, and gravel, soft, brown to gray, lensed, moist to wet, low plasticity, occasional sand lenses		S5	16	1 1 10	9	N/A	MC = 29.3%	
15					S6	16	2 2 1	3	N/A	MC = 26.9%	

(Continued Next Page)

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EXPLORATION B-4

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 19 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 6.5 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
			SILT (ML), with sand, and gravel, soft, brown to gray, lensed, moist to wet, low plasticity, occasional sand lenses *(continued)*								
20					S7	16	1 1 1	2	N/A	MC = 31.5% P200 = 91.4% LL = 28 PL = 26 PI = 2	
25					S8	24	N/A	N/A	150 200 250 250	MC = 21.9% 0.0% gravel, 0.8% sand, 99.2% silt P0.02 = 70.5% LL = 23 PL = 20 PI = 3 FC = F4 P0.002 = 31.1% SG = 2.657	PP @ 26' bgs = 0.625 tsf TV @ 26' bgs = 0.4 tsf. PP @ 26.5' bgs = 0.5 tsf TV @ 26.5' bgs = 0.35 tsf.
30					S9	24	N/A	N/A	250 400 450 500		PP @ 31.08' bgs = 0.625 tsf TV @ 31.08' bgs = 0.2 tsf. PP @ 32' bgs = 0.25 tsf TV @ 32' bgs = 0.3 tsf.

Bottom of borehole at 32.0 feet bgs.

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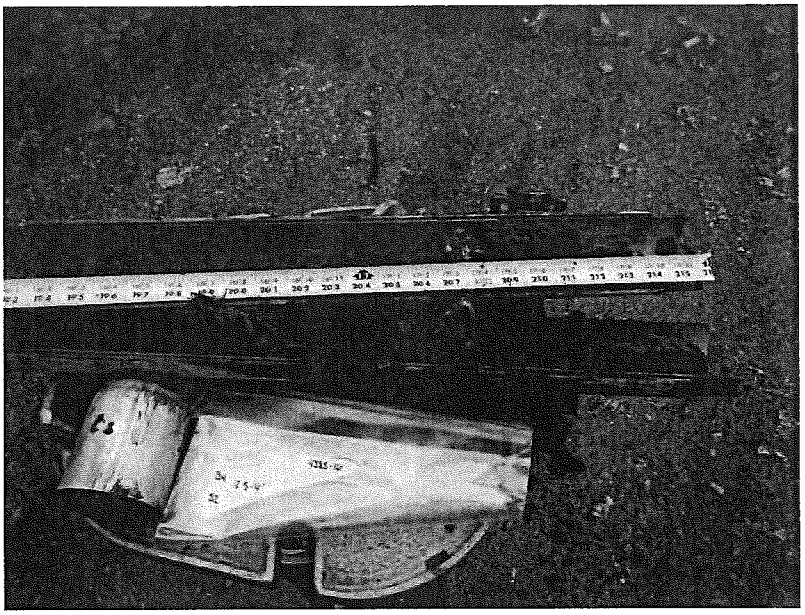
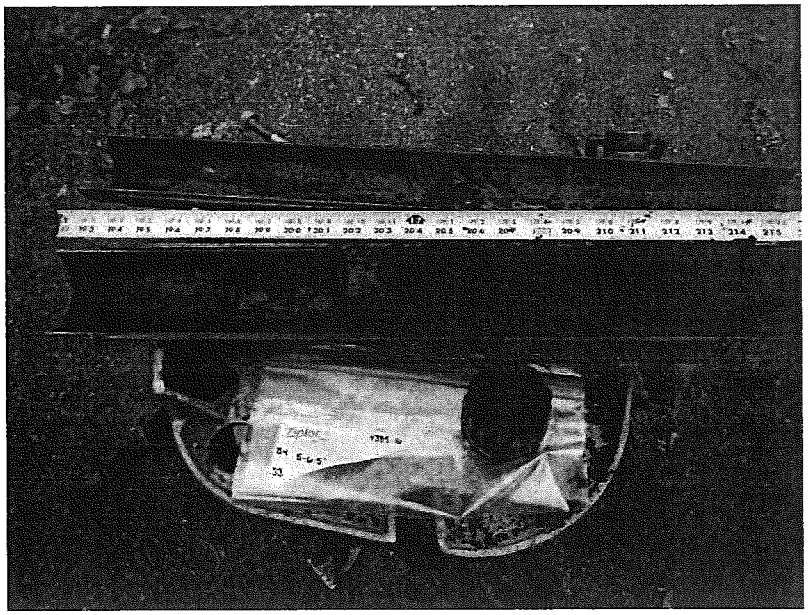
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-4 Sample S2
Sample Interval 2.5'-4' bgs



Exploration B-4 Sample S3
Sample Interval 5'-6.5' bgs

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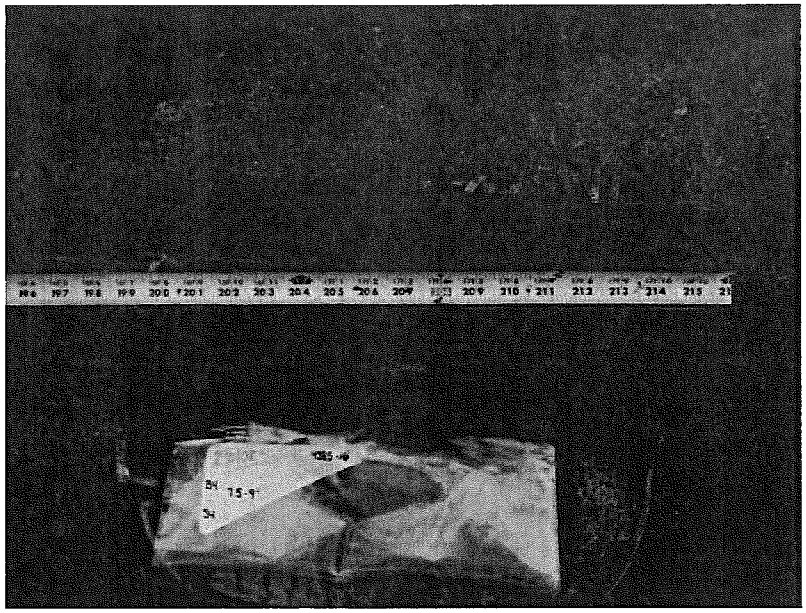
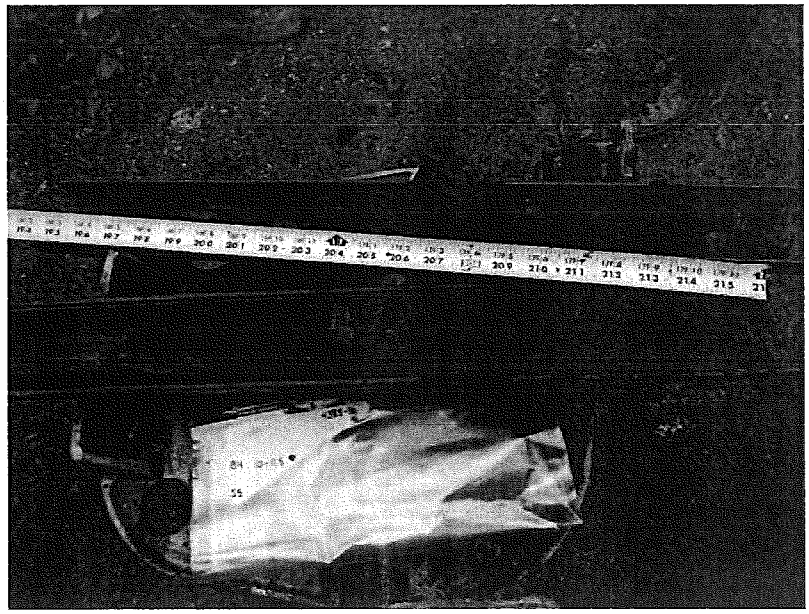
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-4 Sample S4
Sample Interval 10'-11.5' bgs



Exploration B-4 Sample S5
Sample Interval 10'-11.5' bgs

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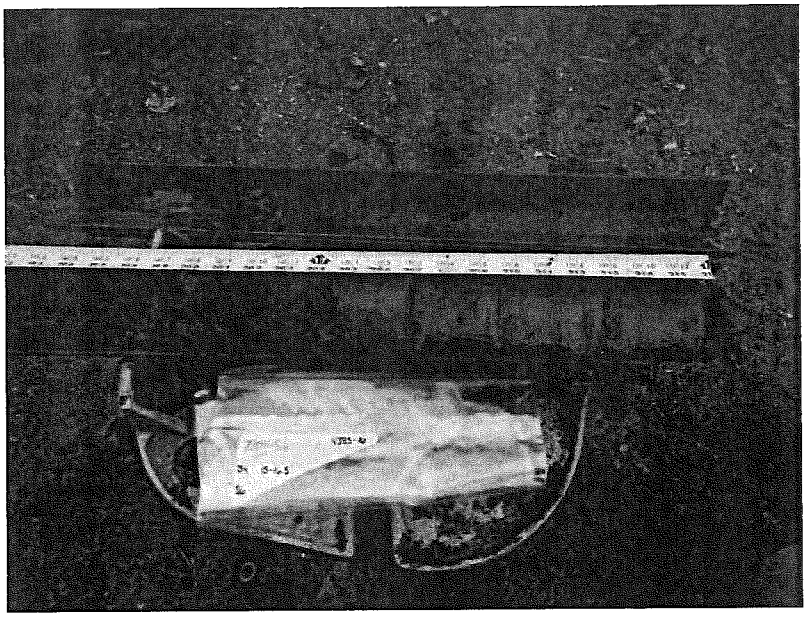
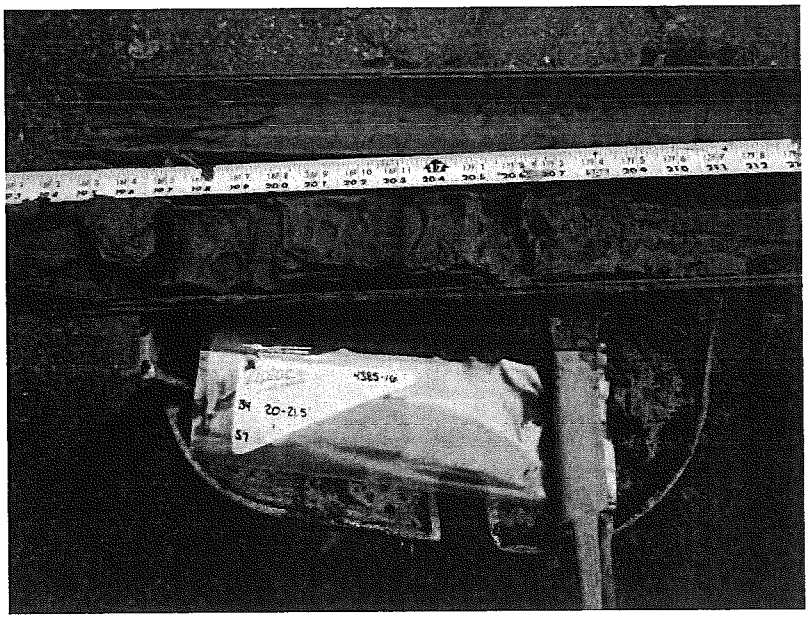
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-4 Sample S6
Sample Interval 15'-16.5' bgs



Exploration B-4 Sample S7
Sample Interval 20'-21.5' bgs

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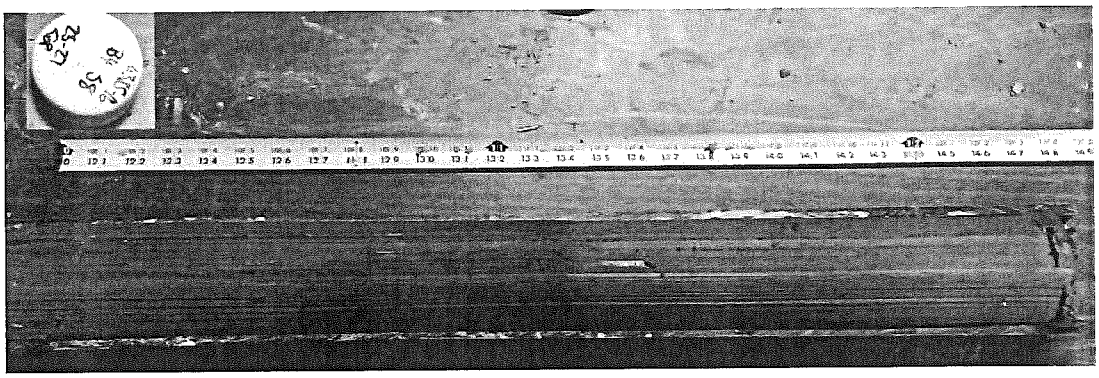
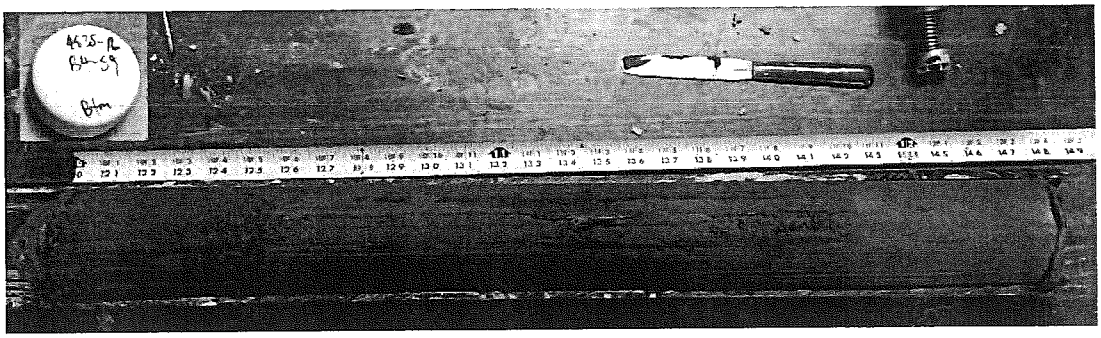
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B4 Sample S8
Sample Interval 25'-27' bgs
Extracted Shelby Tube



Exploration B4 Sample S9
Sample Interval 30'-32' bgs
Extracted Shelby Tube

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Telephone: 907-344-5934
Fax: 907-344-5993

EXPLORATION B-5

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 20 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 15.0 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
0			**GRAVEL WITH SILT** (GP-GM), medium dense, dark brown to gray, damp to moist, FILL		S1	N/A	N/A	N/A	N/A	MC = 9.3%	
					S2	14	3 4 5	15	N/A	MC = 14.9% 3.5% gravel, 39.5% sand, 57.0% silt	Increased silt content at approx. 2.5' bgs.
5			**SILT** (ML), with sand, with gravel, medium stiff, brownish gray, FILL		S3	11	2 2 5	6	N/A	MC = 43.8% 8.1% gravel, 47.0% sand, 44.9% silt P0.02 = 35.9% FC = F3	
			PEAT (PT), loose, dark brown, moist		S4	14	2 1 4	4	N/A	MC = 24.5%	
10			**SILT** (ML), with sand, with gravel, soft to medium stiff, gray to dark gray, moist to wet, low plasticity		S5	14	2 4 4	7	N/A	MC = 17.9% LL = 28 PL = 24 PI = 4	
15		▽			S6	12	2 2 3	5	N/A	MC = 18.0% P200 = 88.8%	
20											

(Continued Next Page)

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EXPLORATION B-5

NGE-TFT PROJECT NAME: Ship Creek Condo Development
NGE-TFT PROJECT NUMBER: 4385-16
PROJECT LOCATION: Anchorage, AK
EXPLORATION CONTRACTOR: Discovery Drilling, Inc.
EXPLORATION EQUIPMENT: CME-75 w/ 340lb autohammer
EXPLORATION METHOD: Hollow Stem Auger w/ center drill rods
SAMPLING METHOD: Modified Split-spoon/Thin-walled Shelby Tube
LOGGED BY: E. Boatwright
DATE STARTED: 5/5/2016
DATE COMPLETED: 5/5/2016
EXPLORATION LOCATION: See report figure 2
GROUND ELEVATION: Approx. 20 ft above mean sea level
▽ GROUNDWATER (ATD): Approx. 15.0 ft bgs
▼ GROUNDWATER (AD): N/A
EXPLORATION COMPLETION: Backfilled with cuttings.
WEATHER CONDITIONS: Overcast

DEPTH (ft)	GRAPHIC LOG	FROZEN SOILS	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (in)	FIELD BLOWS	$(N_1)_{60}$	SHELBY DOWN PRESSURE (psi)	LAB RESULTS	REMARKS/NOTES
20			**SILT** (ML), with sand, with gravel, soft to medium stiff, gray to dark gray, moist to wet, low plasticity *(continued)*		S7	16	2 2 1	3	N/A	MC = 24.7%	
25					S8	24 N/A N/A	N/A	N/A	250 300 350 450		PP @ 25.66' bgs = 0.625 tsf TV @ 25.66' bgs = 0.35 tsf. PP @ 26.13' bgs = 0.5 tsf TV @ 26.13' bgs = 0.45 tsf.
30					S9	24 N/A N/A	N/A	N/A	300 400 450 500	MC = 33.4% 0.0% gravel, 0.4% sand, 99.6% silt P0.02 = 97.5% LL = 37 PL = 34 PI = 3 FC = F4 P0.002 = 65.7% SG = 2.652	PP @ 30.79' bgs = 0.5 tsf TV @ 30.79' bgs = 0.45 tsf. PP @ 31.66' bgs = 0.375 tsf TV @ 31.66' bgs = 0.40 tsf.
			Bottom of borehole at 32.0 feet bgs.								

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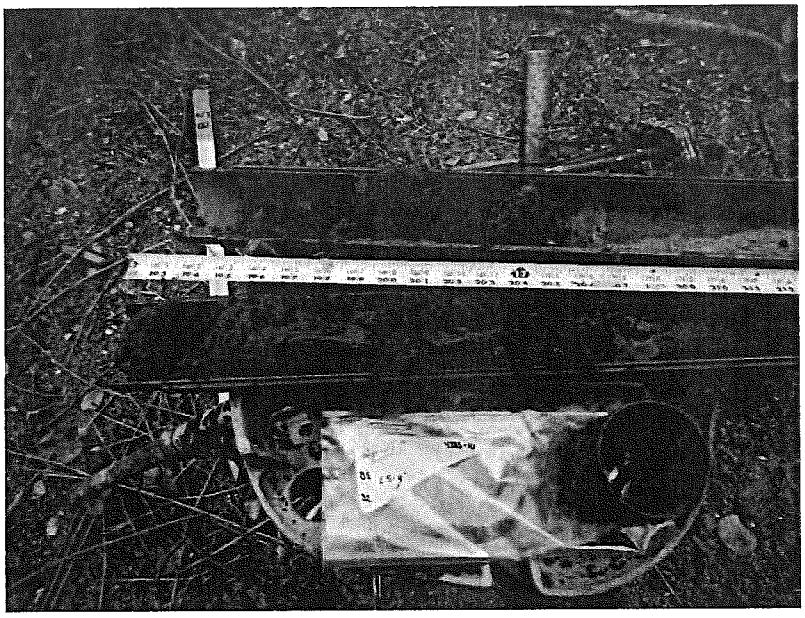
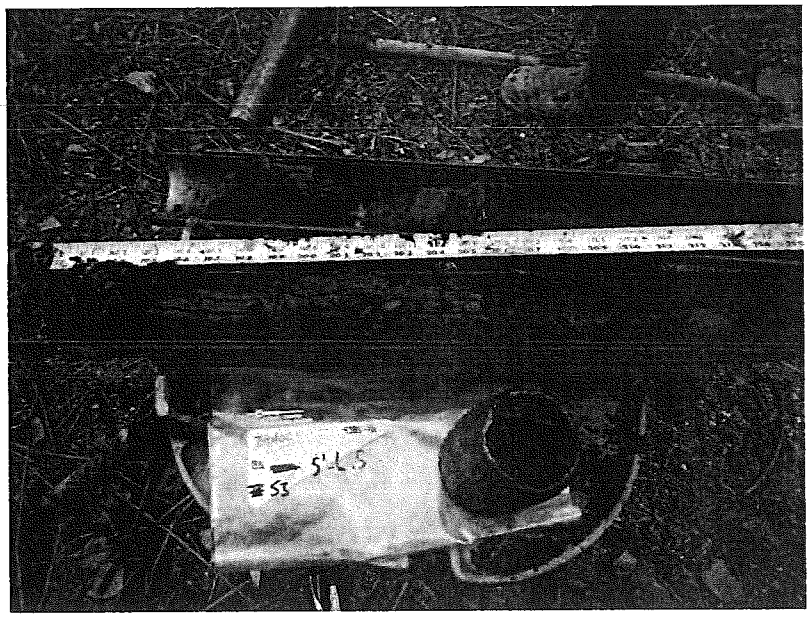
PHOTO APPENDIX

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-5 Sample S2
Sample Interval 2.5'-4' bgs



Exploration B-5 Sample S3
Sample Interval 5'-6.5' bgs

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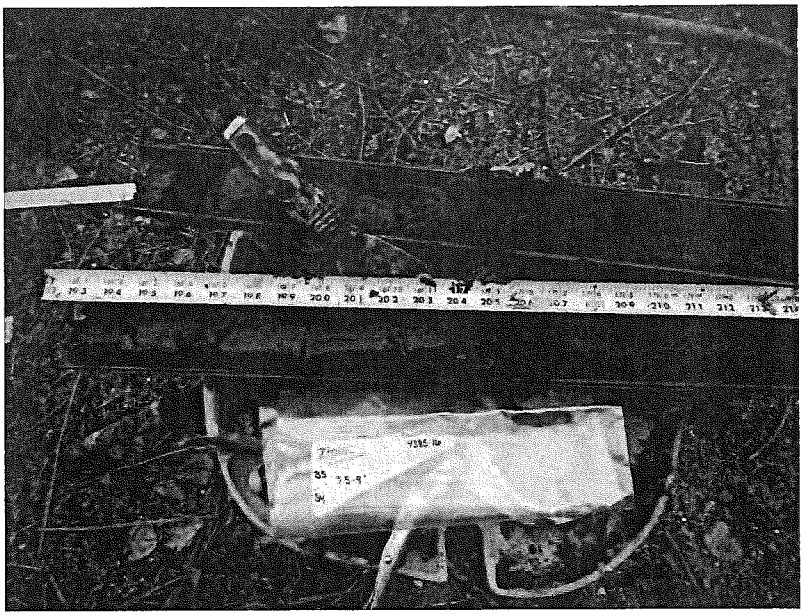
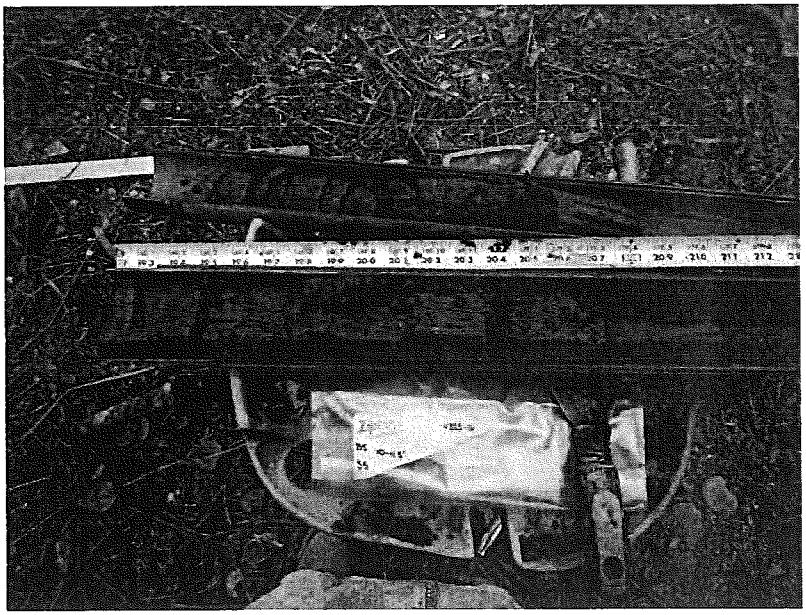
CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-5 Sample S4
Sample Interval 7.5'-9' bgs



Exploration B-5 Sample S5
Sample Interval 10'-11.5' bgs

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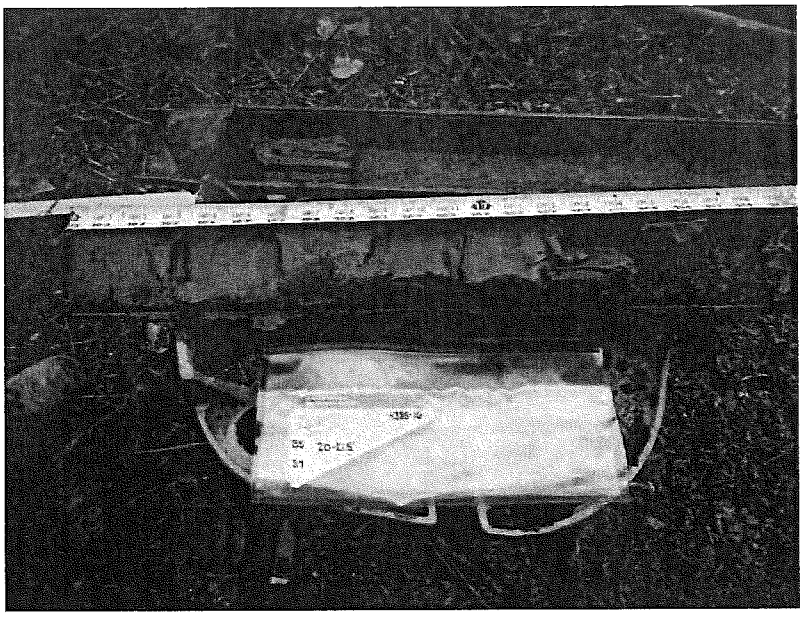
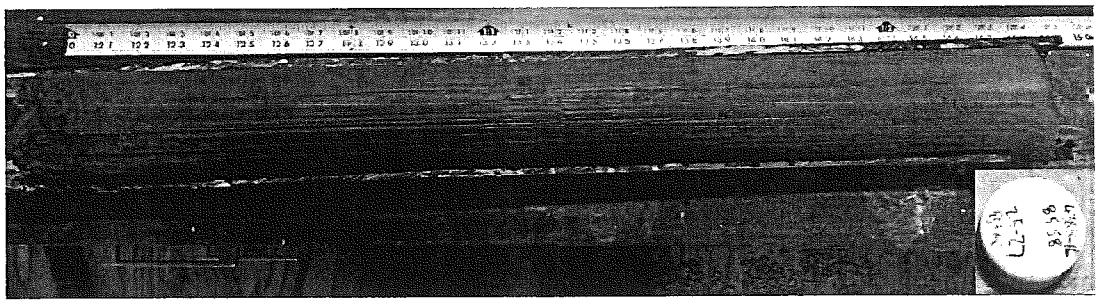
PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK



Exploration B-5 Sample S7
Sample Interval 20'-21.5' bgs



Exploration B5 Sample S8
Sample Interval 25'-27' bgs
Extracted Shelby Tube

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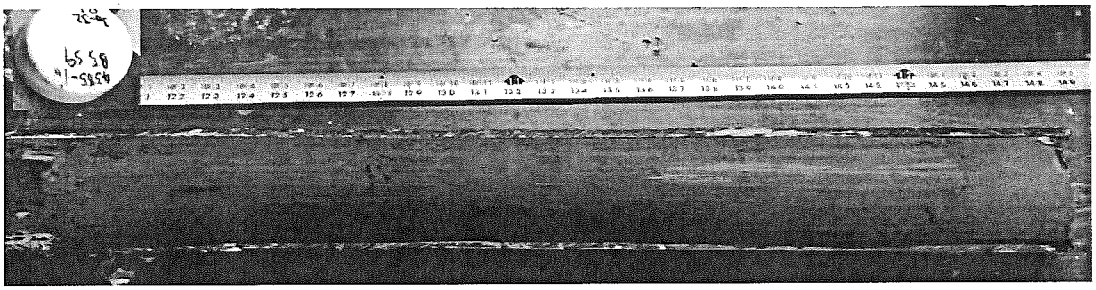

Exploration B5 Sample S9
Sample Interval 30'-32' bgs
Extracted Shelby Tube

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EXPLORATION LEGEND

CLIENT John McGrew

NGE-TFT PROJECT NAME Ship Creek Condo Development

NGE-TFT PROJECT NUMBER 4385-16

PROJECT LOCATION Anchorage, AK

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)


GM: USCS Silty Gravel


GP: USCS Poorly-graded Gravel


GP-GM: USCS Poorly-graded Gravel with Silt


GPS: Sandy Gravel


ML: USCS Silt


PT: USCS Peat


SM: USCS Silty Sand

SAMPLER SYMBOLS


Grab Sample


Modified Penetration Test


Shelby Tube

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
MC - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
P200 - PERCENT PASSING NO. 200 SIEVE
P0.02- PERCENT PASSING 0.02mm SIEVE
PP - POCKET PENETROMETER (TSF)
S/U - CASING STICK-UP

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION
▽ Water Level at Time Drilling, or as Shown
▼ Water Level After 24 Hours, or as Shown

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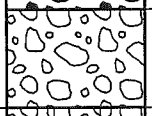
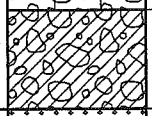
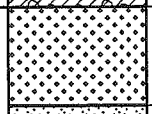
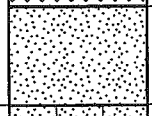
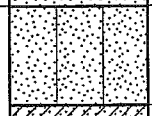
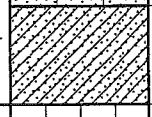
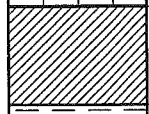
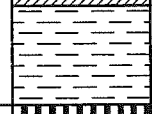
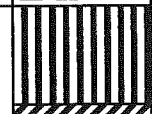
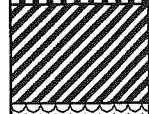
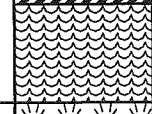
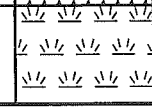
SOIL CLASSIFICATION CHART

CLIENT John McGrew
PROJECT NAME Ship Creek Condo Development
NGE-TFT PROJECT NUMBER 4385-16
PROJECT LOCATION Anchorage, AK

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.
DIAGONAL LINES INDICATE UNKNOWN DEPTH OF SOIL TRANSITION.

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EXPLORATION LOG KEY

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

NGE-TFT PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK

SAMPLER SYMBOLS

- SPT w/ 140# Hammer 30" Drop and 2.0" O.D. Sampler
- Modified SPT w/ 340# Hammer 30" Drop and 3.0 O.D. Sampler
- Grab Sample
- Shelby Tube Sample
- Rock Core Sample
- Direct Push Sample
- No Recovery
- **N/E** Not Encountered

WELL SYMBOLS

- 1" Slotted Pipe Backfilled with Silica Sand
- 1" PVC Pipe Backfilled with Auger Cuttings
- 1" PVC Pipe with Bentonite Seal
- Capped Riser

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No. 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No. 4 (4.5 mm)
Sand	No. 4 (4.5 mm) to No. 200
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1-5%
Few	5-10%
Little	10-20%
Some	20-35%
And	35-50%

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
DENSITY	N (BLOWS/FT)	APPROXIMATE RELATIVE DENSITY (%)	CONSISTENCY	N (BLOWS/FT)	APPROXIMATE UNDRAINED SHEAR STRENGTH (PSF)
VERY LOOSE	0-4	0-15	VERY SOFT	0-1	< 250
LOOSE	5-10	15-35	SOFT	2-4	250-500
MEDIUM DENSE	11-25	35-65	MEDIUM STIFF	5-8	500-1000
DENSE	26-50	65-85	STIFF	9-15	1000-2000
VERY DENSE	> 50	85-100	VERY STIFF	16-30	2000-4000
			HARD	> 30	> 4000

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EXPLORATION LOG KEY

CLIENT John McGrew **PROJECT NAME** Ship Creek Condo Development

NGE-TFT PROJECT NUMBER 4385-16 **PROJECT LOCATION** Anchorage, AK

FROST DESIGN SOIL CLASSIFICATION

FROST GROUP (USACOE)	FROST GROUP (M.O.A.)	SOIL TYPE	% FINER THAN 0.02mm BY MASS	TYPICAL SOIL TYPES UNDER UNIFIED SOIL CLASSIFICATION SYSTEM
NFS*	NFS*	(A) GRAVELS CRUSHED STONE CRUSHED ROCK (B) SANDS	0 - 1.5 0 - 3	GW, GP SW, SP
PFS+	NFS*	(A) GRAVELS CRUSHED STONE CRUSHED ROCK	1.5 - 3	GW, GP
	F2	(B) SANDS	3 - 10	SW, SP
S1	F1	GRAVELLY SOILS	3 - 6	GW, GP, GW-GM, GP-GM
S2	F2	SANDY SOILS	3 - 6	SW, SP, SW-SM, SP-SM
F1	F1	GRAVELLY SOILS	6 - 10	GM, GW-GM, GP-GM
F2	F2	(A) GRAVELLY SOILS (B) SANDS	10 - 20 6 - 15	GM, GW-GM, GP-GM SM, SW-SM, SP-SM
F3	F3	(A) GRAVELLY SOILS (B) SANDS, EXCEPT VERY FINE SILTY SANDS (C) CLAYS, PI>12	Over 20 Over 15 ------	GM, GC SM, SC CL, CH
F4	F4	(A) ALL SILTS (B) VERY FINE SILTY SANDS (C) CLAYS, PI<12 (D) VARVED CLAYS AND OTHER FINE GRAINED, BANDED SEDIMENTS	------ Over 15 ------ ------	ML, MH SM CL, CL-ML CL & ML; CL, ML, & SM; CL, CH, & ML; CL, CH, ML, & SM

*Non-frost susceptible
+Possibly frost susceptible, but requires lab testing to determine frost design soils classification.

ICE CLASSIFICATION SYSTEM

GROUP	ICE VISIBILITY	DESCRIPTION		SYMBOL	
N	SEGREGATED ICE NOT VISIBLE BY EYE	POORLY BONDED OR FRIABLE		Nf	
		WELL BONDED	NO EXCESS ICE	Nb	Nbn
			EXCESS MICROSCOPIC ICE		Nbe
V	SEGREGATED ICE IS VISIBLE BY EYE AND IS ONE INCH OR LESS IN THICKNESS	INDIVIDUAL ICE CRYSTALS OR INCLUSIONS		Vx	
		ICE COATINGS ON PARTICLES		Vc	
		RANDOM OR IRREGULARY ORIENTED ICE		Vr	
		STRATIFIED OR DISTINCTLY ORIENTED ICE		Vs	
		UNIFORMLY DISTRIBUTED ICE		Vu	
ICE	ICE IS GREATER THAN ONE INCH IN THICKNESS	ICE WITH SOILS INCLUSIONS		ICE + Soil Type	
		ICE WITHOUT SOILS INCLUSIONS		ICE	

APPENDIX C

LABORATORY DATA

Summary of Laboratory Test Results

Ship Creek Condo Development

NGE-TFT Project #:4385-16

Exploration ID	Sample Number	Depth Interval (ft) Top	Depth Interval (ft) Bottom	Moisture Content ASTM D2216 (% By Dry Mass)	Atterberg Limits ASTM D4318 LL	PL	PI	Particle Size Analysis ASTM C136/D422/D6913 (% By Mass) Gravel	Sand	Silt/Clay	Passing #200 ASTM D1140 (% By Mass)	Passing 0.02mm ASTM D422 (% By Mass)	Passing 0.002mm ASTM D423 (% By Mass)	Frost Class. (MOA)	Specific Gravity ASTM D854	Organic Content (ASTM D2974) (% By Mass)	Unified Soil Classification ASTM D2487
B1	S1	0.0	1.0	1.0													
B1	S2	2.5	4.0	4.7				44.2	44.0	11.8		8.4		F1			(GW-GM) Well-graded gravel w/ silt and sand
B1	S3	5.0	6.5	7.3													
B1	S4	7.5	9.0	7.2				31.0	56.3	12.7							(SM) Silty sand w/ gravel
B1	S5	10.0	11.5	8.2													
B1	S6a	15.0	15.8	3.7													
B1	S6b	15.8	16.5	11.1				26.4	47.7	25.9		20.1		F3			(SM) Silty sand w/ gravel
B1	S7	20.0	21.5	3.5													
B1	S8	25.0	26.5	14.0							67.8						
B1	S9	30.0	31.5	20.4	28	24	4										
B1	S10	35.0	36.5	20.8													
B1	S11	40.0	41.5	37.1							45.2						
B1	S13	50.0	52.0	29.2	38	25	13	0.0	1.3	98.7		88.3	55.4	F4	2.694		(ML) Silt
B2	S1	0.0	1.0	3.1													
B2	S2	2.5	4.0	16.0				36.9	40.3	22.8						3.0	(SM) Silty sand w/ gravel
B2	S3	5.0	6.5	13.6				14.7	56.2	29.1		16.4		F3			(SM) Silty sand
B2	S4	7.5	9.0	33.2	28	27	1										
B2	S5a	10.0	10.8	17.5													
B2	S5b	10.8	11.5	31.0													
B2	S6	15.0	16.5	28.2							97.4						
B2	S7	20.0	21.5	31.6													
B2	S8	25.0	26.5	36.6													
B2	S9	30.0	31.5	29.2													
B2	S10	35.0	36.5	30.2													
B2	S11	40.0	41.5	26.1							99.6						
B2	S12	45.0	47.0	28.9	34	28	6	0.0	0.1	99.9		95.0	53.1	F4	2.681		(ML) Silt
B2	S13	50.0	52.0	28.5	29	21	8	0.0	0.2	99.8		84.7	36.4	F4	2.633		(CL) Lean Clay
B3	S1	0.0	1.0	7.0				37.5	39.9	22.6						3.9	(SM) Silty sand w/ gravel
B3	S2	2.5	4.0	17.1													
B3	S3	5.0	6.5	27.3				13.1	43.7	43.2		28.8		F3			(SM) Silty sand
B3	S4	7.5	9.0	22.3												6.2	
B3	S5	10.0	11.5	25.0													
B3	S6	15.0	16.5	30.6	28	28	0										
B3	S7	20.0	21.5	36.2													
B3	S9	30.0	31.5	26.2							97.4						
B3	S10	35.0	37.0	31.0	37	29	8	0.0	2.4	97.6		94.0	52.1	F4	2.671		(SM) Silt
B4	S1	0.0	1.0	7.0				62.1	24.0	13.9						4.1	(GM) Silty gravel w/ sand
B4	S2	2.5	4.0	13.3													
B4	S3	5.0	6.5	41.9													
B4	S4	7.5	9.0	24.2				4.0	47.8	48.2		31.9		F3			(SM) Silty sand
B4	S5	10.0	11.5	29.3													
B4	S6	15.0	16.5	26.9													
B4	S7	20.0	21.5	31.5	28	26	2				91.4						
B4	S8	25.0	27.0	21.9	23	20	3	0.0	0.8	99.2		70.5	31.1	F4	2.657		(ML) Silt
B5	S1	0.0	1.0	9.3													
B5	S2	2.5	4.0	14.9				3.5	39.5	57.0							(ML) Sandy silt
B5	S3	5.0	6.5	43.8				8.1	47.0	44.9		35.9		F3			(SM) Silty sand
B5	S4	7.5	9.0	24.5													
B5	S5	10.0	11.5	17.9	28	24	4										
B5	S6	15.0	16.5	18.0							88.8						
B5	S7	20.0	21.5	24.7													
B5	S9	30.0	32.0	33.4	37	34	3	0.0	0.4	99.6		97.5	65.7	F4	2.652		(ML) Silt

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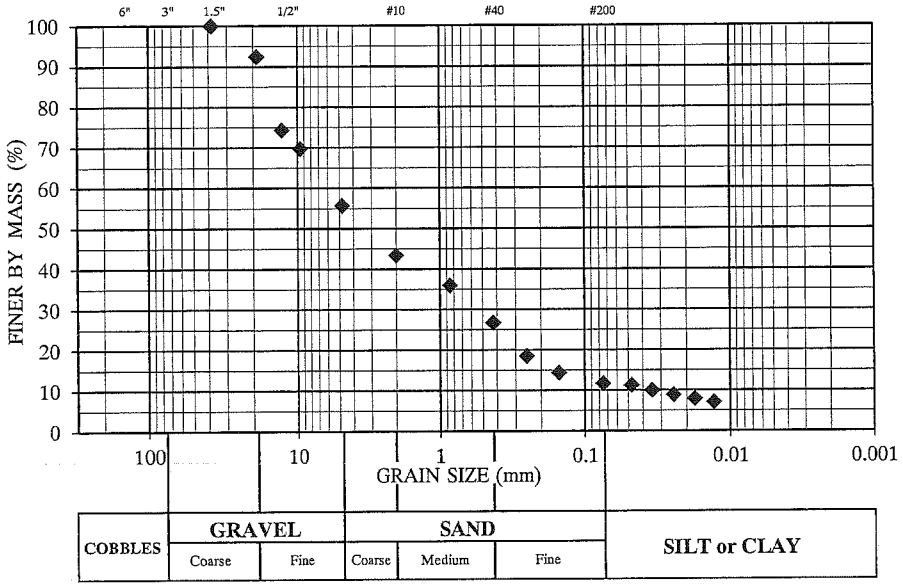
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B1
NUMBER/ DEPTH:	S2 / 2.5 - 4'
DESCRIPTION:	Well-graded gravel w/ silt and sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	44.2	USCS	GW-GM
% SAND	44.0	MOA FC	F1
% SILT/CLAY	11.8	% PASS. 0.02 mm	8.4
% MOIST. CONTENT	5.8	% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	180.7
COEFFICIENT OF GRADATION (C_c)	1.5
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

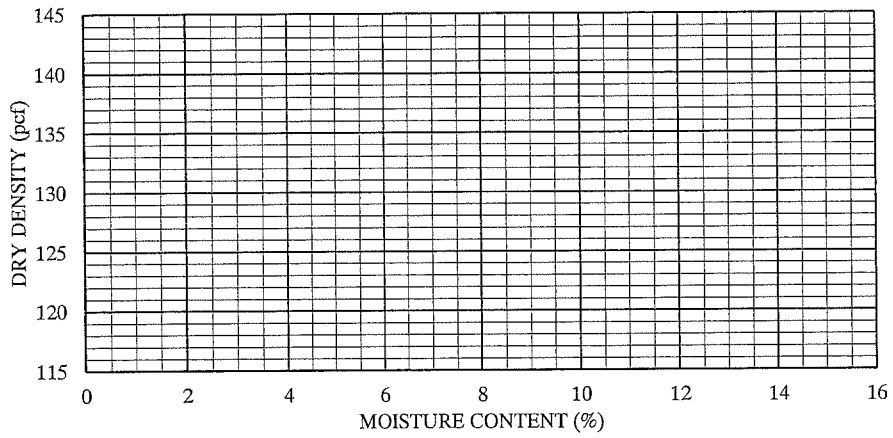
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	92	
12.70	1/2"	74	
9.50	3/8"	70	
4.75	#4	56	
2.00	#10	43	
0.85	#20	36	
0.43	#40	27	
0.25	#60	19	
0.15	#100	14	
0.075	#200	11.8	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0474	11.3
2	0.0344	10.0
4	0.0245	9.0
8	0.0176	8.0
15	0.0130	7.1
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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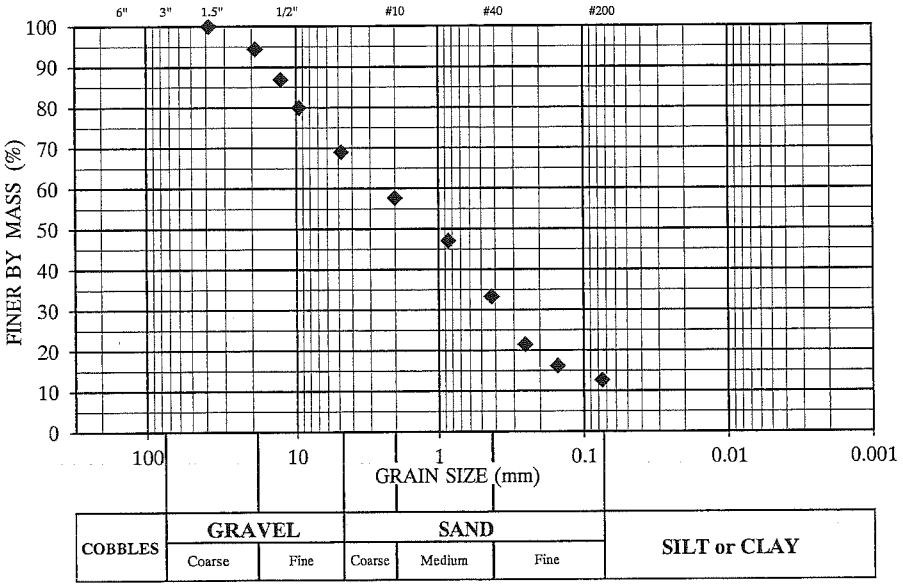
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B1
NUMBER/ DEPTH:	S4 / 7.5 - 9'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	31.0	USCS	SM
% SAND	56.3	USACOE FC	N/A
% SILT/CLAY	12.7	% PASS. 0.02 mm	N/A
% MOIST. CONTENT	7.2	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

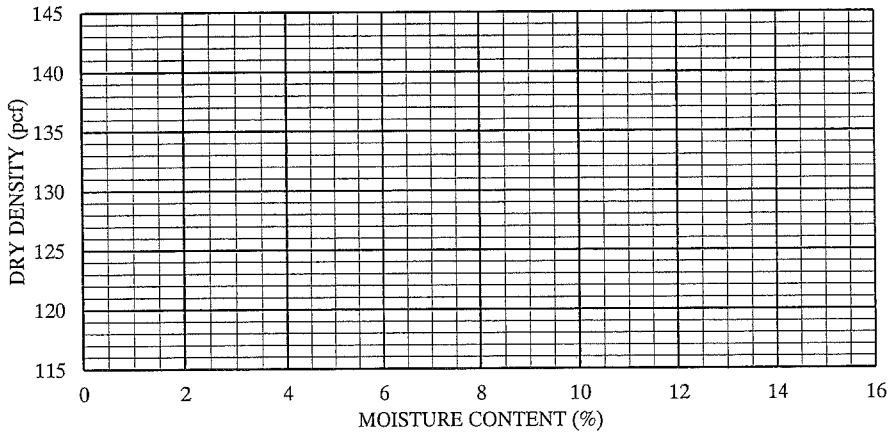
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	94	
12.70	1/2"	87	
9.50	3/8"	80	
4.75	#4	69	
2.00	#10	58	
0.85	#20	47	
0.43	#40	33	
0.25	#60	22	
0.15	#100	16	
0.075	#200	12.7	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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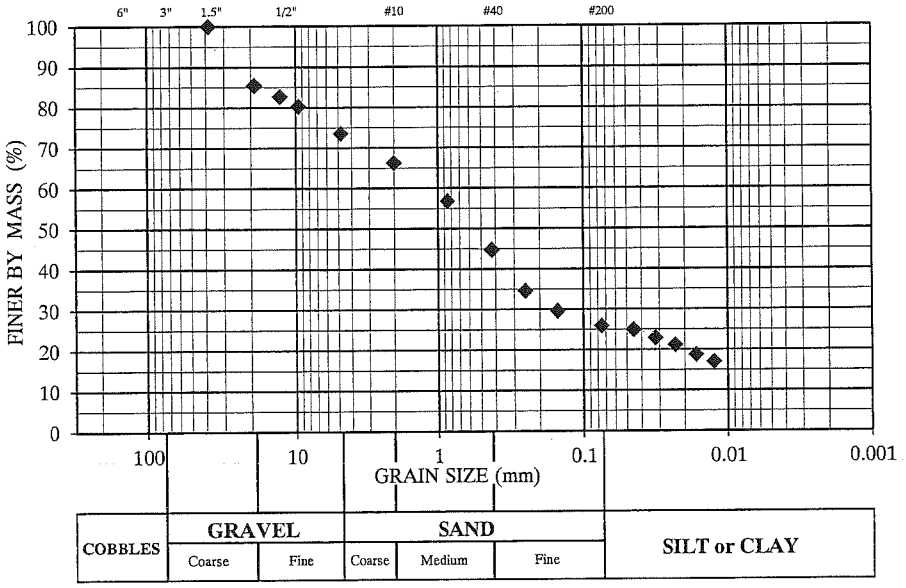
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B1
NUMBER/ DEPTH:	S6b / 15.75 - 16.5'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	26.4	USCS	SM
% SAND	47.7	MOA FC	F3
% SILT/CLAY	25.9	% PASS. 0.02 mm	20.1
% MOIST. CONTENT	11.1	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

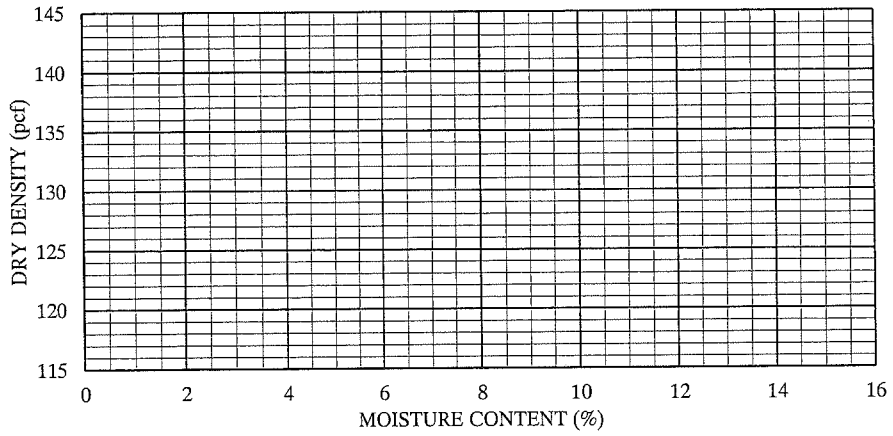
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	**100**	
19.00	3/4"	**86**	
12.70	1/2"	**83**	
9.50	3/8"	**80**	
4.75	#4	**74**	
2.00	#10	**66**	
0.85	#20	**57**	
0.43	#40	**45**	
0.25	#60	**35**	
0.15	#100	**30**	
0.075	#200	**25.9**	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0448	25.0
2	0.0320	22.9
4	0.0232	21.2
8	0.0166	18.8
15	0.0124	17.1
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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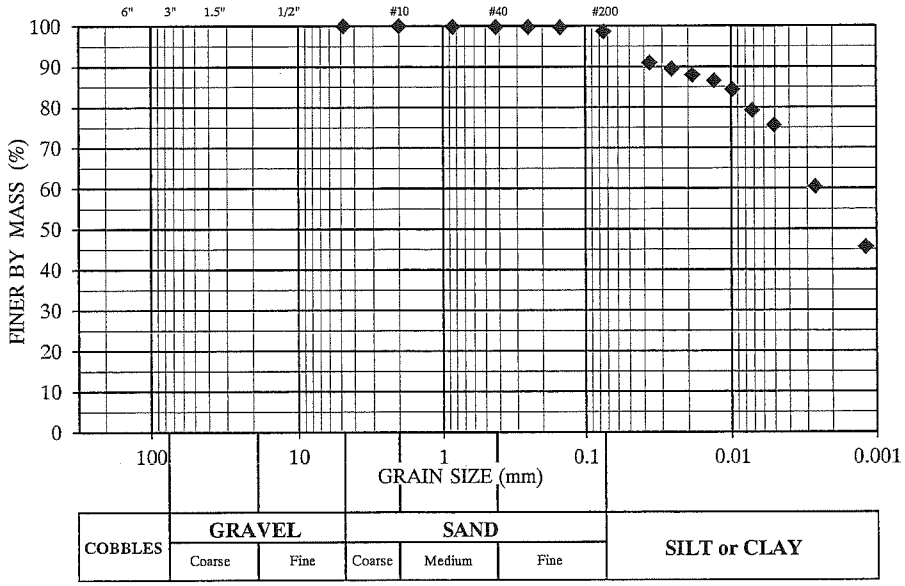
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B1
NUMBER/ DEPTH:	S13 / 50-52'
DESCRIPTION:	Silt
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	ML
% SAND	1.3	MOA FC	F4
% SILT/CLAY	98.7	% PASS. 0.02 mm	88.3
% MOIST. CONTENT	29.2	% PASS. 0.002 mm	55.4
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

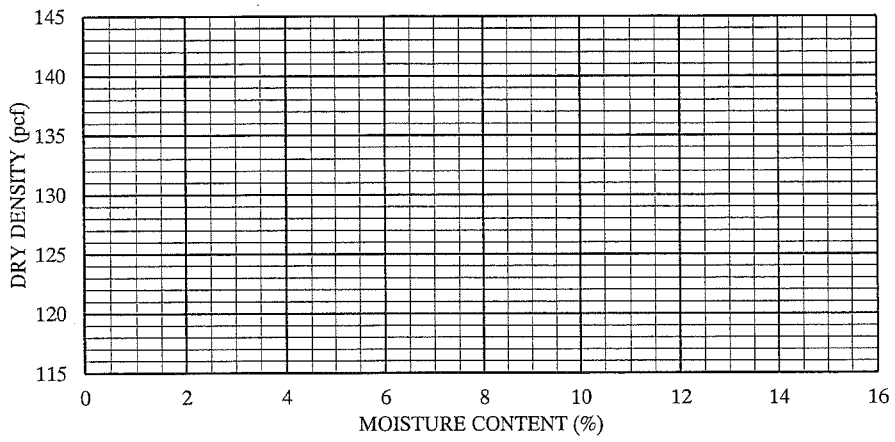
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	100	
0.25	#60	100	
0.15	#100	100	
0.075	#200	98.7	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0366	90.9
2	0.0259	89.5
4	0.0187	88.0
8	0.0132	86.5
15	0.0098	84.4
30	0.0072	79.3
60	0.0050	75.6
250	0.0026	60.5
1440	0.0012	45.7

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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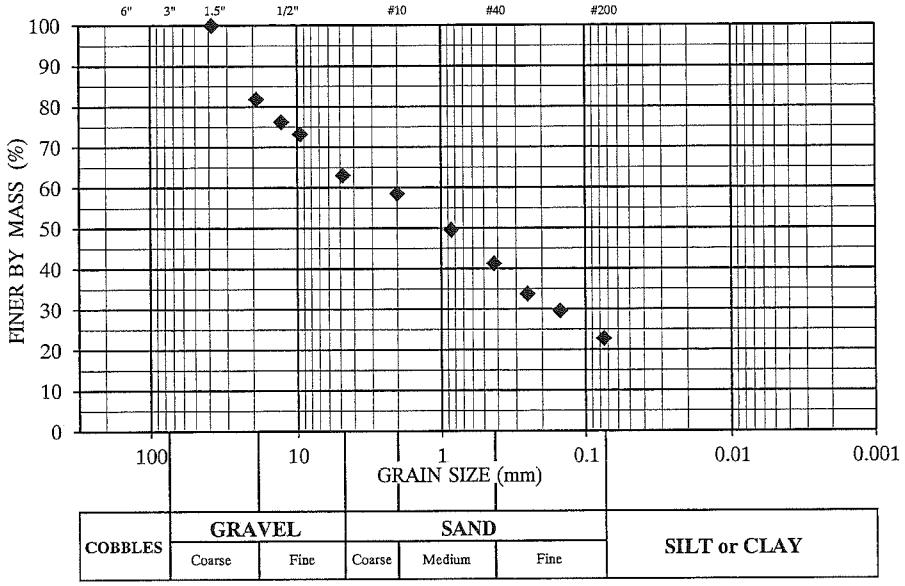
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B2
NUMBER/ DEPTH:	S2 / 2.5 - 4'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	36.9	USCS	SM
% SAND	40.3	USACOE FC	N/A
% SILT/CLAY	22.8	% PASS. 0.02 mm	N/A
% MOIST. CONTENT	16.0	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

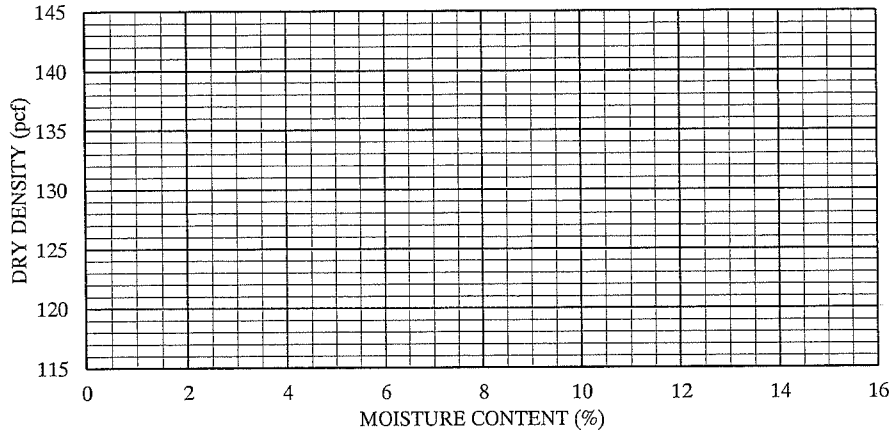
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	82	
12.70	1/2"	76	
9.50	3/8"	73	
4.75	#4	63	
2.00	#10	59	
0.85	#20	50	
0.43	#40	41	
0.25	#60	34	
0.15	#100	30	
0.075	#200	22.8	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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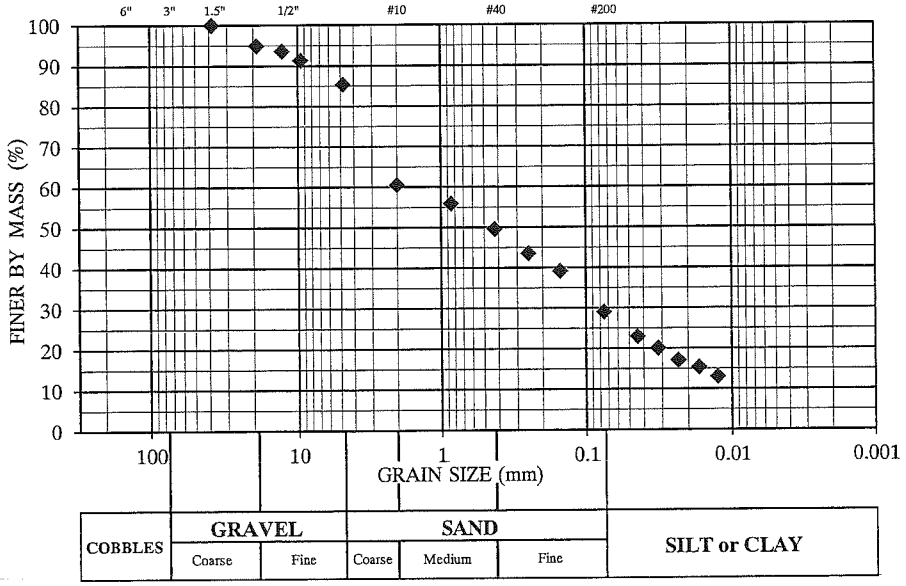
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B2
NUMBER/ DEPTH:	S3 / 5 - 6.5'
DESCRIPTION:	Silty sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	14.7	USCS	SM
% SAND	56.2	MOA FC	F3
% SILT/CLAY	29.1	% PASS. 0.02 mm	16.4
% MOIST. CONTENT	13.6	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

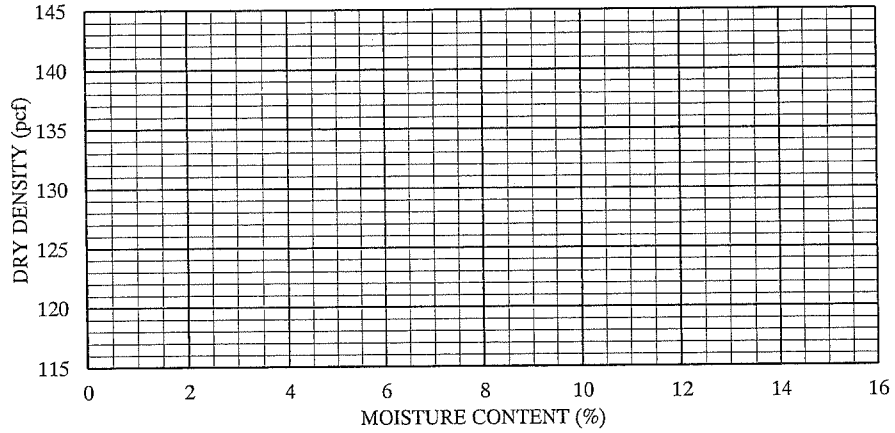
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	95	
12.70	1/2"	94	
9.50	3/8"	91	
4.75	#4	85	
2.00	#10	61	
0.85	#20	56	
0.43	#40	50	
0.25	#60	44	
0.15	#100	39	
0.075	#200	29.1	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0437	23.0
2	0.0320	20.1
4	0.0232	17.2
8	0.0168	15.4
15	0.0125	13.1
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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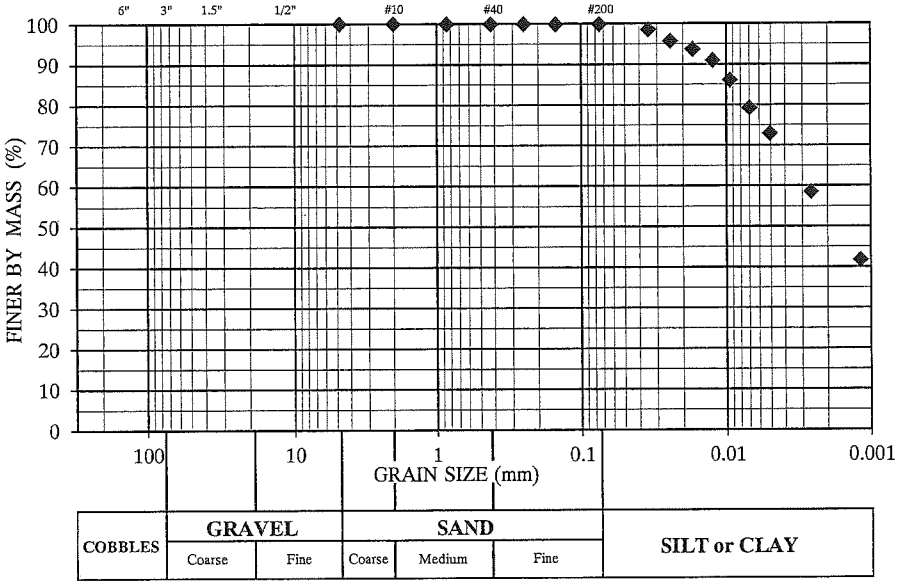
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B2
NUMBER/ DEPTH:	S12 / 45.0'-47.0'
DESCRIPTION:	Silt
DATE RECEIVED:	6/30/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	ML
% SAND	0.1	MOA FC	F4
% SILT/CLAY	99.9	% PASS. 0.02 mm	95.0
% MOIST. CONTENT	28.9	% PASS. 0.002 mm	53.1
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

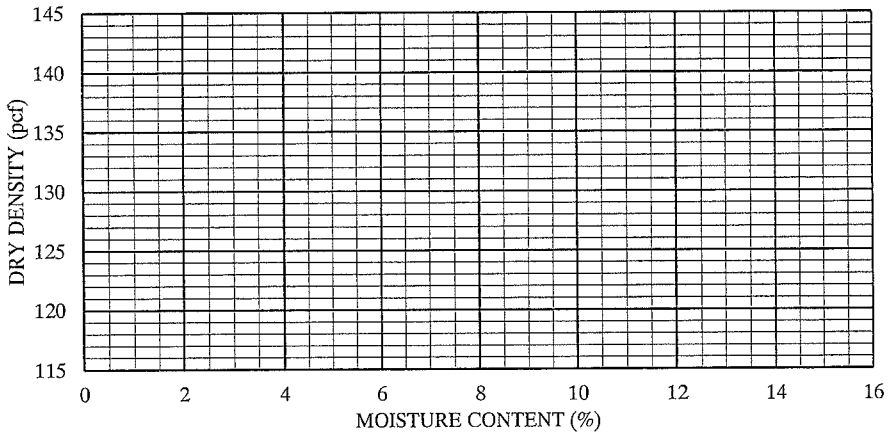
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	100	
0.25	#60	100	
0.15	#100	100	
0.075	#200	99.9	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0344	98.5
2	0.0243	95.7
4	0.0172	93.7
8	0.0125	90.9
15	0.0094	86.1
30	0.0070	79.2
60	0.0050	72.9
250	0.0026	58.6
1440	0.0012	41.8

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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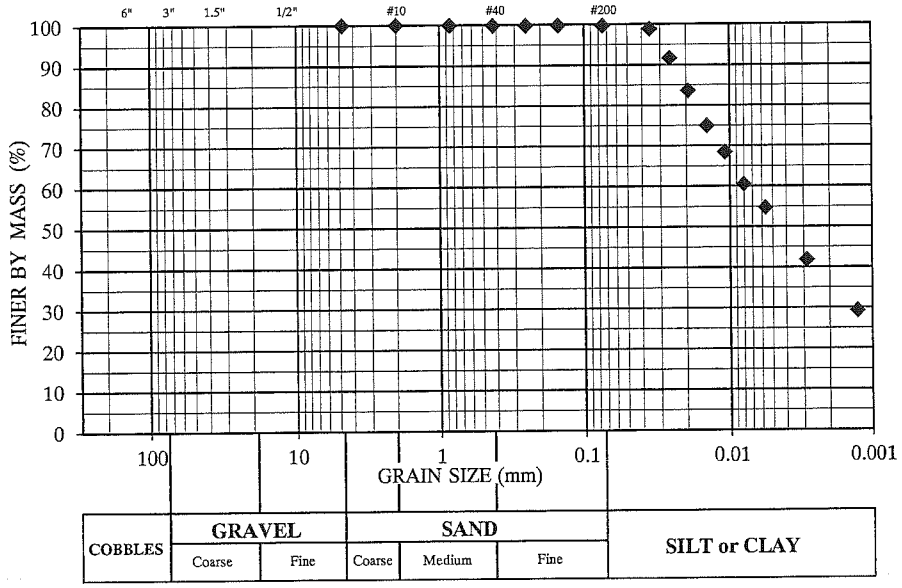
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B2
NUMBER/ DEPTH:	S13 / 50.0'-52.0'
DESCRIPTION:	Lean Clay
DATE RECEIVED:	6/30/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	CL
% SAND	0.2	MOA FC	F4
% SILT/CLAY	99.8	% PASS. 0.02 mm	84.7
% MOIST. CONTENT	28.5	% PASS. 0.002 mm	36.4
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

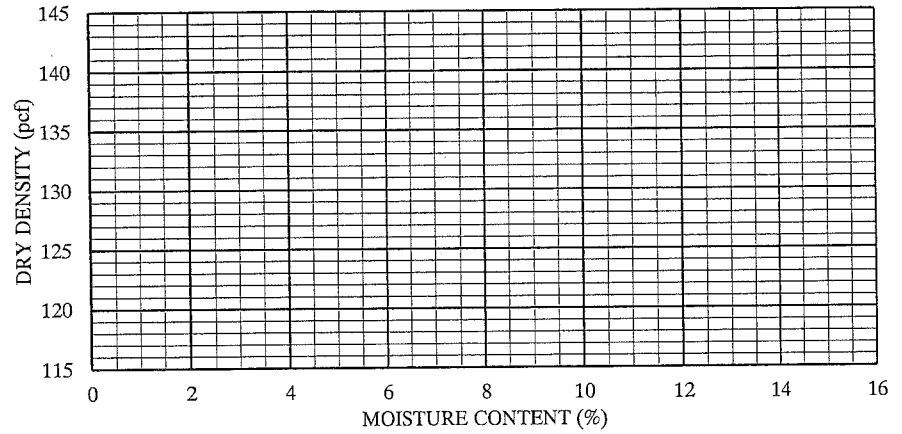
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	100	
0.25	#60	100	
0.15	#100	100	
0.075	#200	99.8	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0349	98.9
2	0.0259	91.7
4	0.0193	83.7
8	0.0144	75.0
15	0.0108	68.5
30	0.0080	60.6
60	0.0056	54.7
250	0.0029	41.9
1440	0.0013	29.4

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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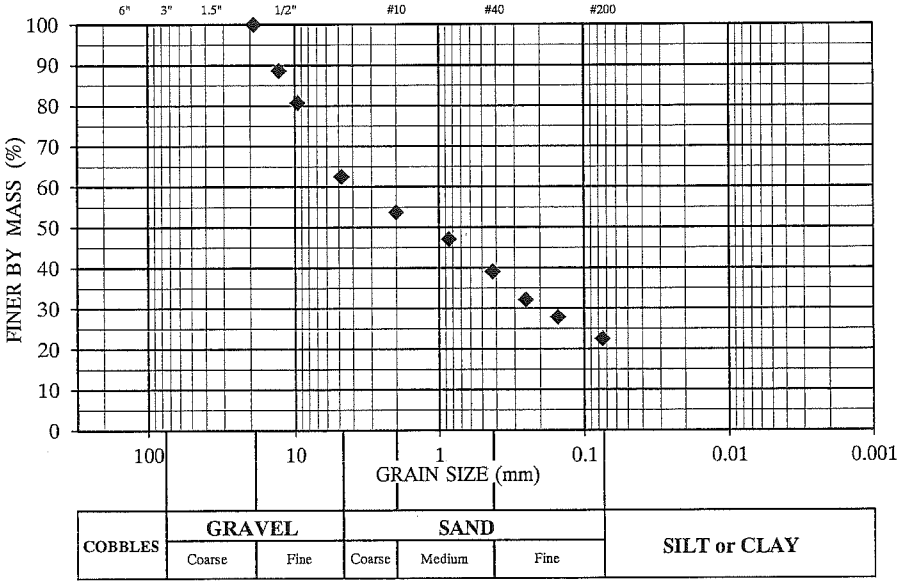
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B3
NUMBER/ DEPTH:	S1 / 0 - 1'
DESCRIPTION:	Silty sand w/ gravel
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	37.5	USCS	SM
% SAND	39.9	USACOE FC	N/A
% SILT/CLAY	22.6	% PASS. 0.02 mm	N/A
% MOIST. CONTENT	7.0	% PASS. 0.002 mm	N/A

UNIFORMITY COEFFICIENT (C_u)	UNKNOWN
COEFFICIENT OF GRADATION (C_c)	UNKNOWN
ASTM D1557 (uncorrected)	N/A
ASTM D4718 (corrected)	N/A
OPTIMUM MOIST. CONTENT. (corrected)	N/A

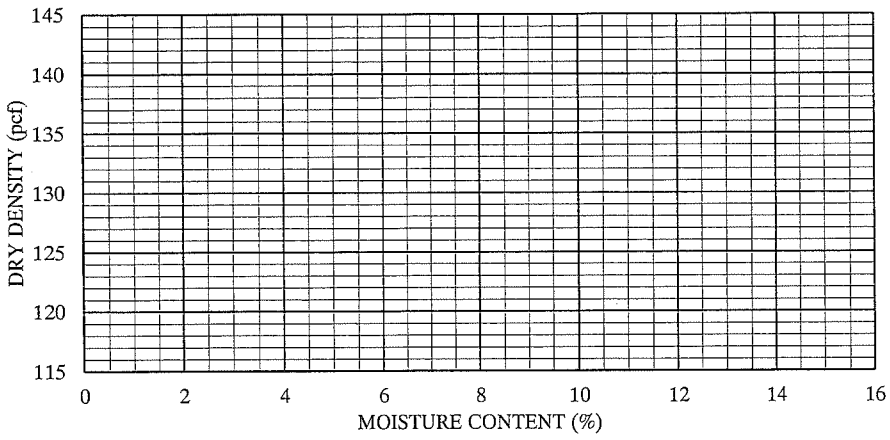
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	89	
9.50	3/8"	81	
4.75	#4	63	
2.00	#10	54	
0.85	#20	47	
0.43	#40	39	
0.25	#60	32	
0.15	#100	28	
0.075	#200	22.6	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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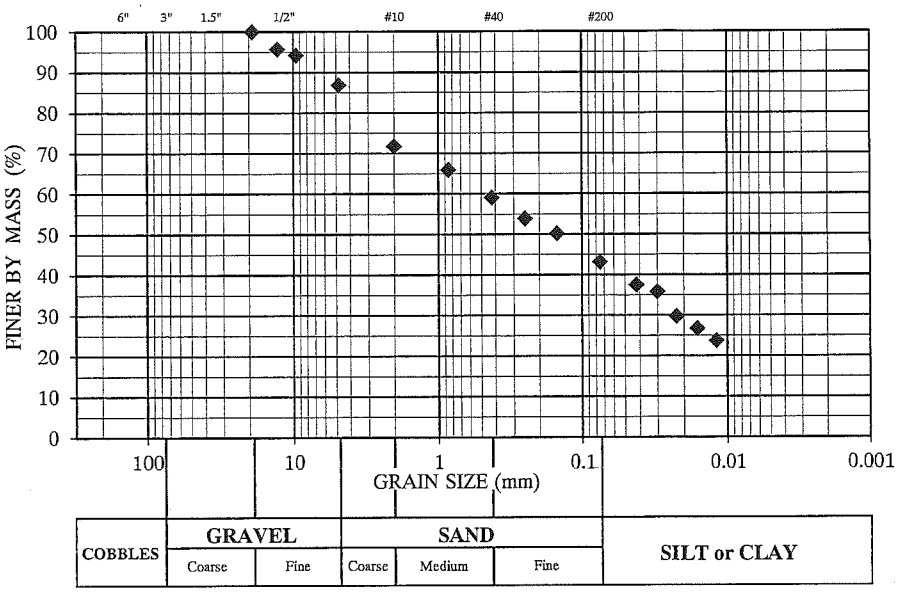
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B3
NUMBER/ DEPTH:	S3 / 5 - 6.5'
DESCRIPTION:	Silty sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	13.1	USCS	SM
% SAND	43.7	MOA FC	F3
% SILT/CLAY	43.2	% PASS. 0.02 mm	28.8
% MOIST. CONTENT	27.3	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

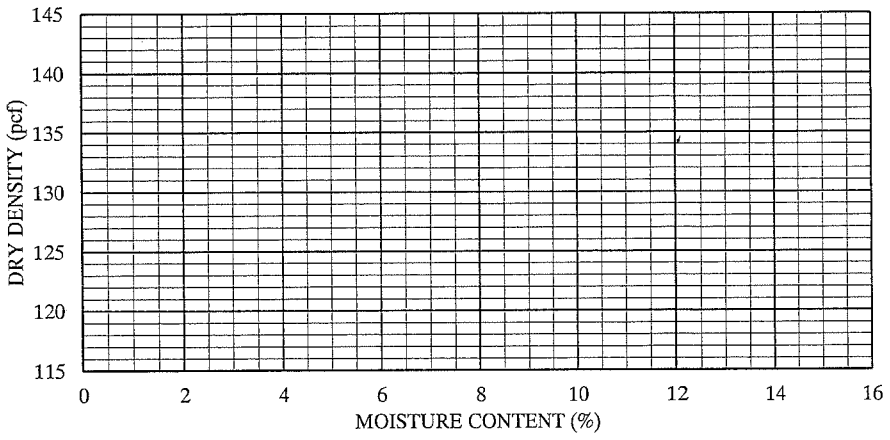
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	96	
9.50	3/8"	94	
4.75	#4	87	
2.00	#10	72	
0.85	#20	66	
0.43	#40	59	
0.25	#60	54	
0.15	#100	50	
0.075	#200	43.2	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0419	37.6
2	0.0301	35.9
4	0.0223	29.8
8	0.0162	26.8
15	0.0120	23.7
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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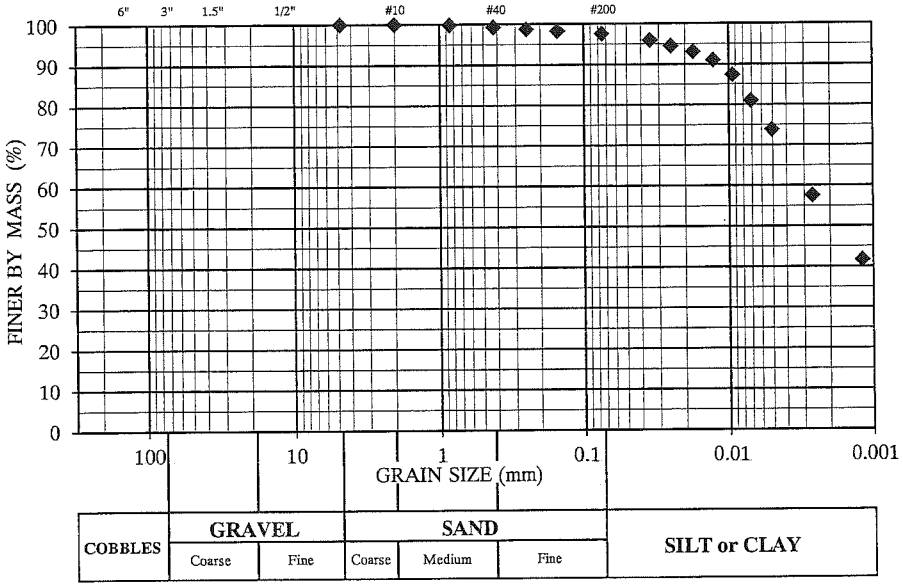
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B3
NUMBER/ DEPTH:	S10 / 35.0'-37.0'
DESCRIPTION:	Silt
DATE RECEIVED:	6/30/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	ML
% SAND	2.4	MOA FC	F4
% SILT/CLAY	97.6	% PASS. 0.02 mm	94.0
% MOIST. CONTENT	31.0	% PASS. 0.002 mm	52.1
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

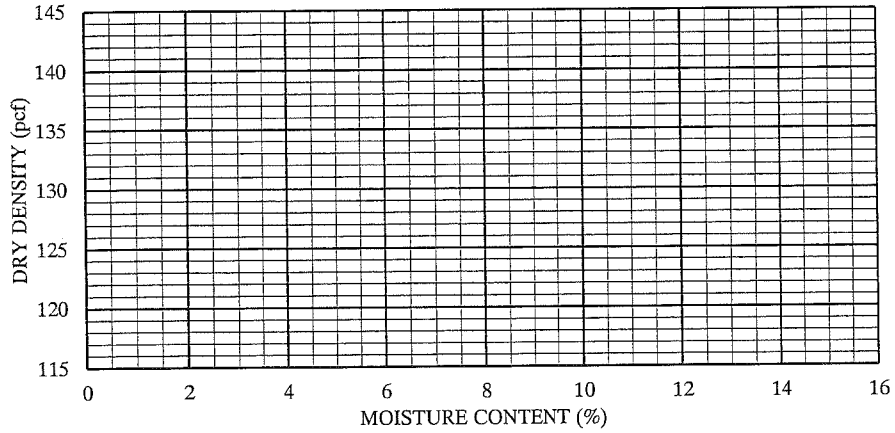
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	99	
0.25	#60	99	
0.15	#100	98	
0.075	#200	97.6	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0344	96.0
2	0.0249	94.5
4	0.0176	93.1
8	0.0127	91.0
15	0.0094	87.4
30	0.0070	81.0
60	0.0050	73.9
250	0.0026	57.6
1440	0.0012	41.8

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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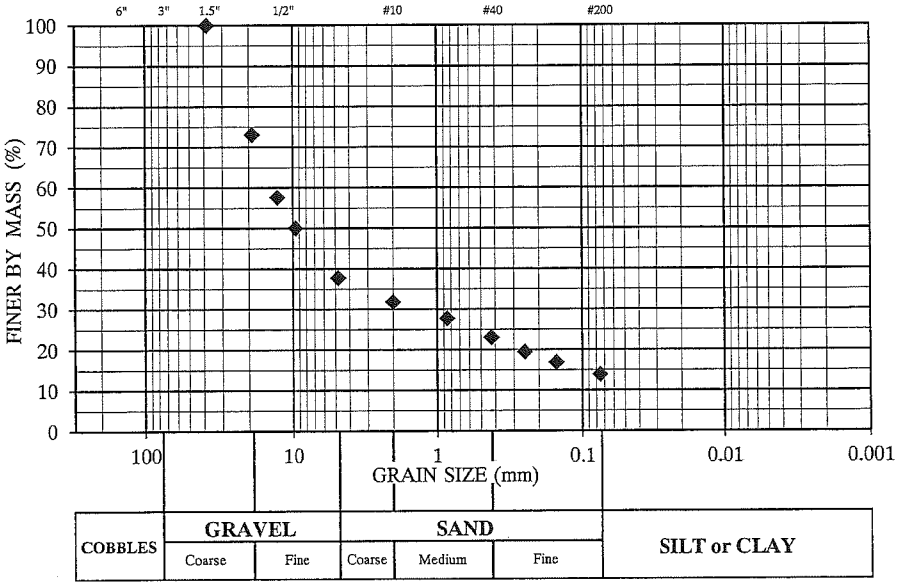
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B4
NUMBER/ DEPTH:	S1 / 0 - 1'
DESCRIPTION:	Silty gravel w/ sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	62.1	USCS	GM
% SAND	24.0	USACOE FC	N/A
% SILT/CLAY	13.9	% PASS. 0.02 mm	N/A
% MOIST. CONTENT	7.0	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

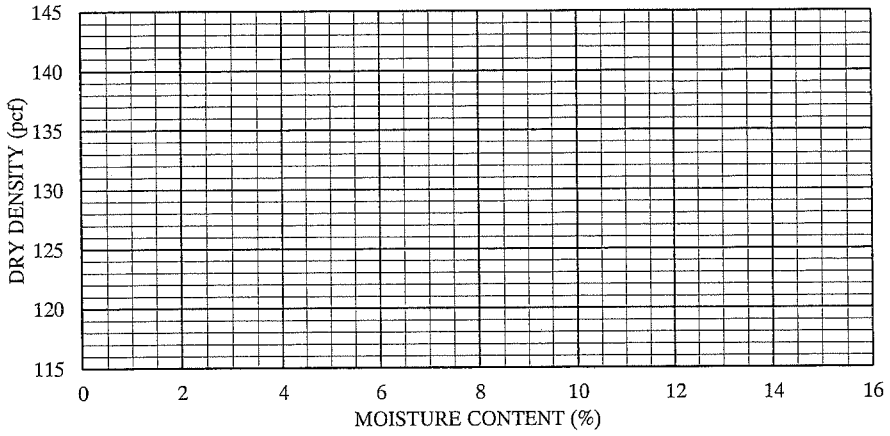
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"	100	
19.00	3/4"	73	
12.70	1/2"	58	
9.50	3/8"	50	
4.75	#4	38	
2.00	#10	32	
0.85	#20	28	
0.43	#40	23	
0.25	#60	19	
0.15	#100	17	
0.075	#200	13.9	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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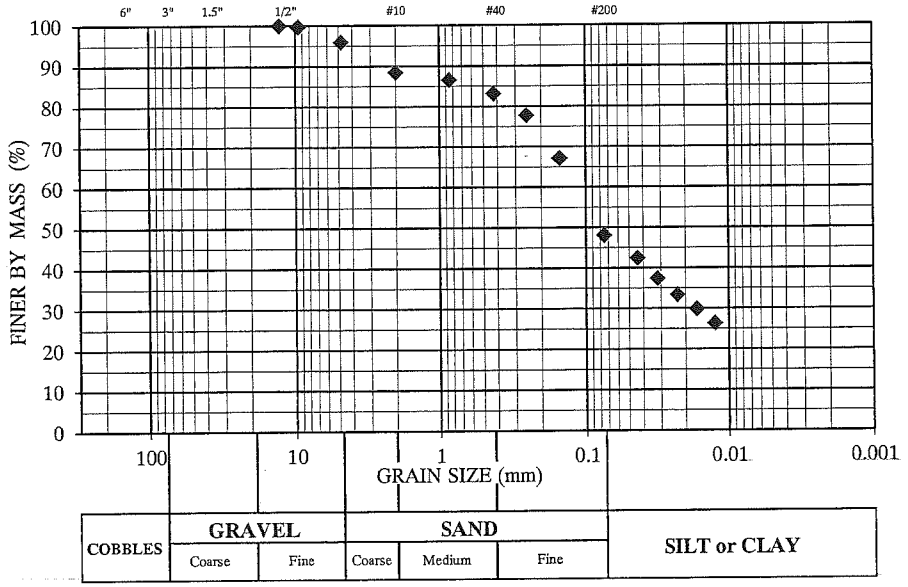
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B4
NUMBER/ DEPTH:	S4 / 7.5 - 9'
DESCRIPTION:	Silty sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	4.0	USCS	SM
% SAND	47.8	MOA FC	F3
% SILT/CLAY	48.2	% PASS. 0.02 mm	31.9
% MOIST. CONTENT	24.2	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

PARTICLE SIZE ANALYSIS ASTM D422 / C136



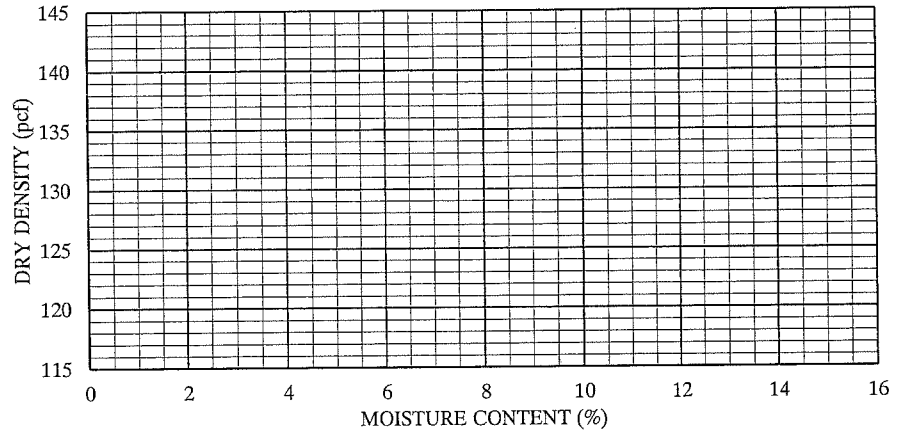
SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"	100	
9.50	3/8"	100	
4.75	#4	96	
2.00	#10	88	
0.85	#20	87	
0.43	#40	83	
0.25	#60	78	
0.15	#100	67	
0.075	#200	48.2	

HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0436	42.5
2	0.0316	37.4
4	0.0229	33.4
8	0.0166	29.9
15	0.0124	26.4
30		
60		
250		
1440		

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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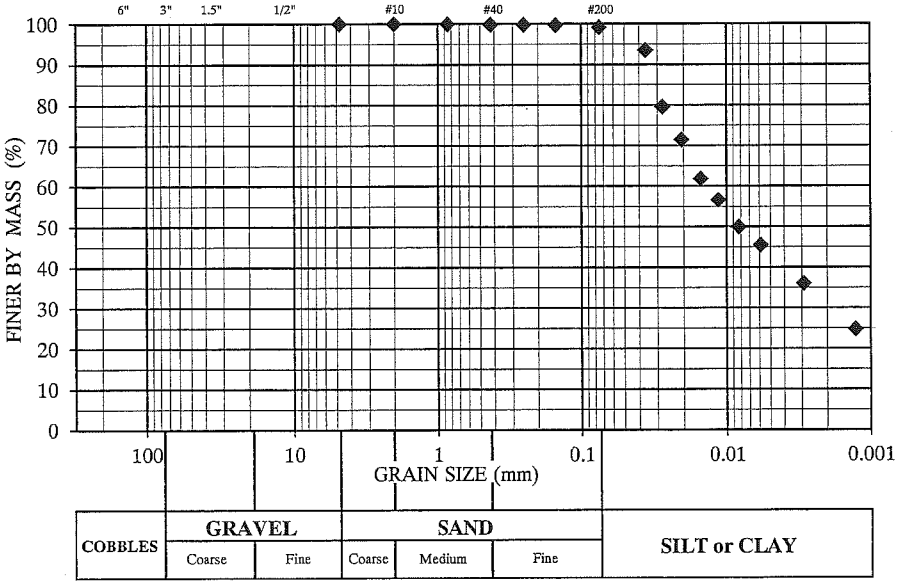
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B4
NUMBER/ DEPTH:	S8 / 25.0'-27.0'
DESCRIPTION:	Silt
DATE RECEIVED:	6/30/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	ML
% SAND	0.8	MOA FC	F4
% SILT/CLAY	99.2	% PASS. 0.02 mm	70.5
% MOIST. CONTENT	21.9	% PASS. 0.002 mm	31.1
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

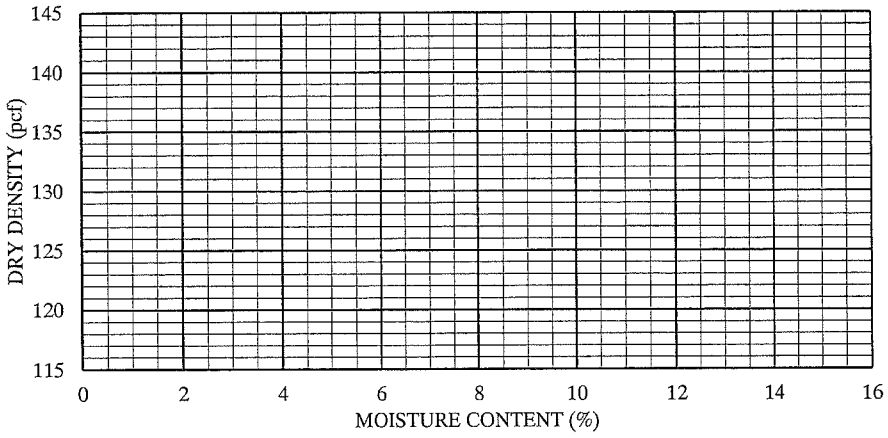
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	100	
0.25	#60	100	
0.15	#100	100	
0.075	#200	99.2	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0360	93.6
2	0.0278	79.6
4	0.0206	71.4
8	0.0152	61.8
15	0.0114	56.7
30	0.0083	50.0
60	0.0058	45.6
250	0.0029	36.1
1440	0.0013	24.8

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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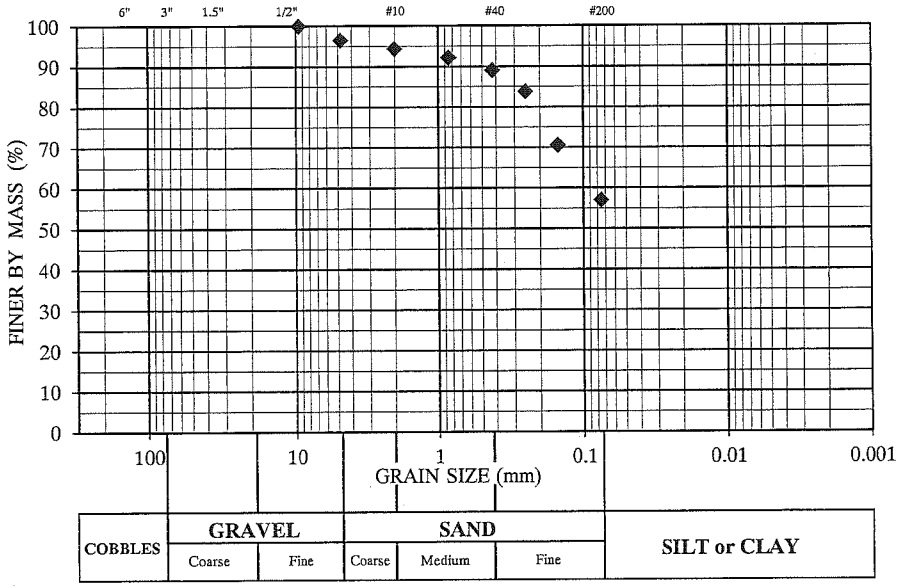
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B5
NUMBER/ DEPTH:	S2 / 2.5 - 4'
DESCRIPTION:	Sandy silt
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	3.5	USCS	ML
% SAND	39.5	USACOE FC	N/A
% SILT/CLAY	57.0	% PASS. 0.02 mm	N/A
% MOIST. CONTENT	14.9	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)			UNKNOWN
COEFFICIENT OF GRADATION (C_c)			UNKNOWN
ASTM D1557 (uncorrected)			N/A
ASTM D4718 (corrected)			N/A
OPTIMUM MOIST. CONTENT. (corrected)			N/A

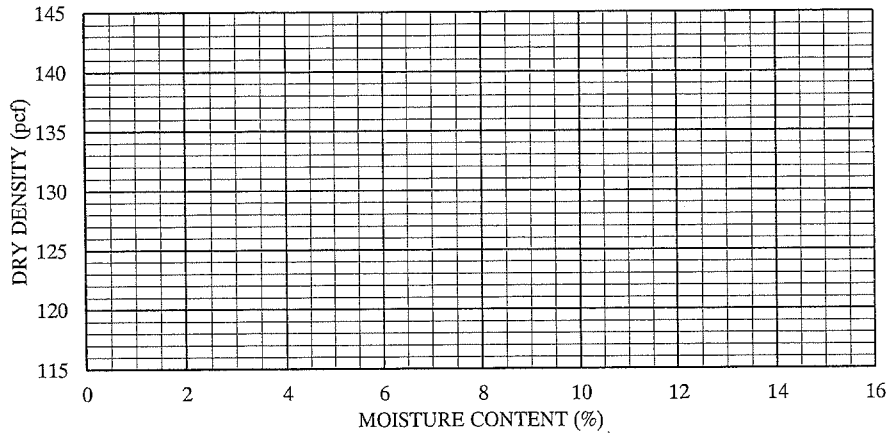
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"	100	
4.75	#4	97	
2.00	#10	94	
0.85	#20	92	
0.43	#40	89	
0.25	#60	84	
0.15	#100	71	
0.075	#200	57.1	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1		
2		
4		
8		
15		
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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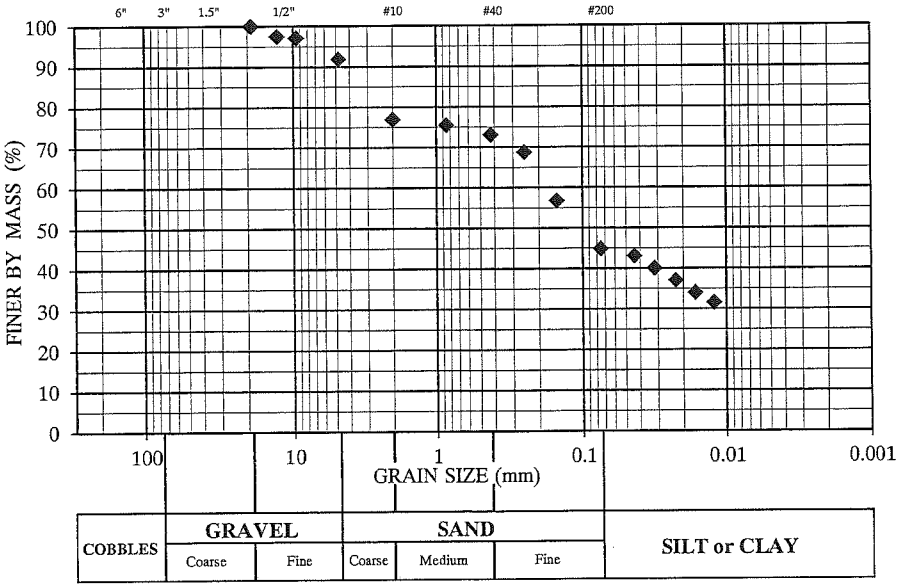
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B5
NUMBER/ DEPTH:	S3 / 5 - 6.5'
DESCRIPTION:	Silty sand
DATE RECEIVED:	5/9/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	8.1	USCS	SM
% SAND	47.0	MOA FC	F3
% SILT/CLAY	44.9	% PASS. 0.02 mm	35.9
% MOIST. CONTENT	43.8	% PASS. 0.002 mm	N/A
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

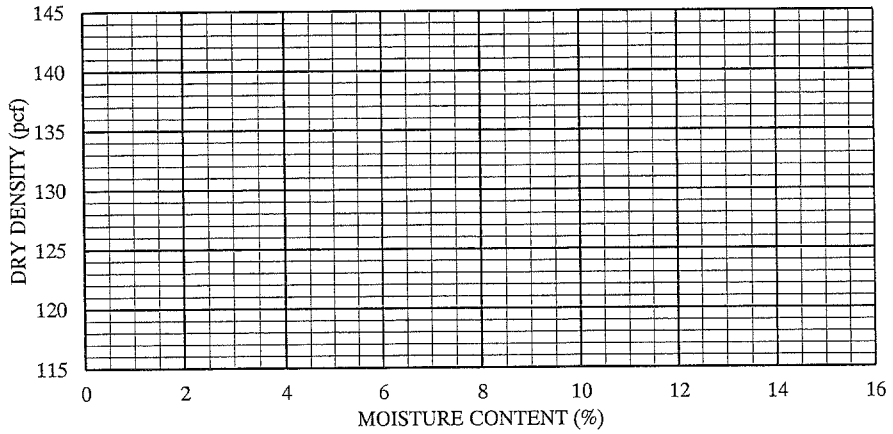
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"	100	
12.70	1/2"	98	
9.50	3/8"	97	
4.75	#4	92	
2.00	#10	77	
0.85	#20	75	
0.43	#40	73	
0.25	#60	69	
0.15	#100	57	
0.075	#200	44.9	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0434	43.1
2	0.0317	40.1
4	0.0226	37.1
8	0.0164	34.1
15	0.0121	31.6
30		
60		
250		
1440		

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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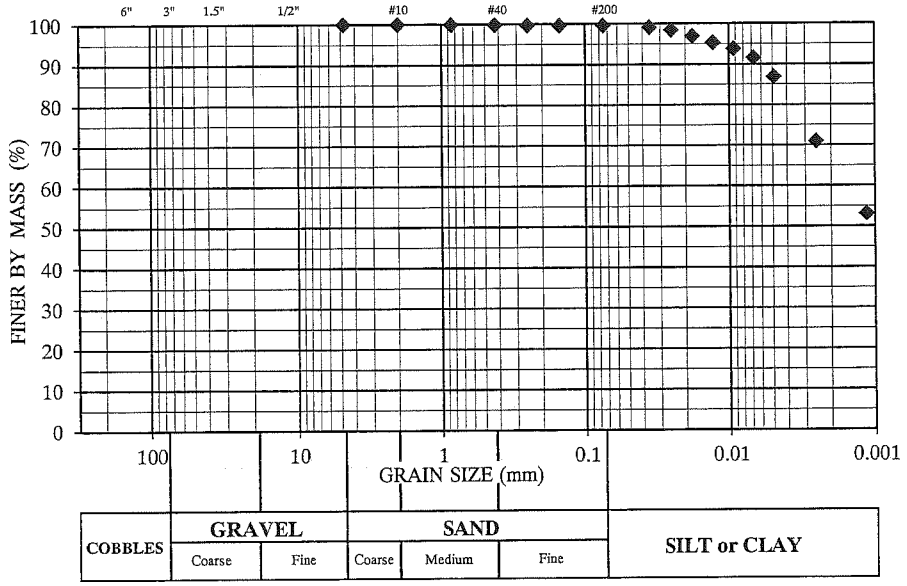
PROJECT CLIENT:	John McGrew
PROJECT NAME:	Ship Creek Condo Development
PROJECT NO.:	4385-16
SAMPLE LOC.:	B5
NUMBER/ DEPTH:	S9 / 30.0'-32.0'
DESCRIPTION:	Silt
DATE RECEIVED:	6/30/2016
TESTED BY:	JA
REVIEWED BY:	ALF

% GRAVEL	0.0	USCS	ML
% SAND	0.4	MOA FC	F4
% SILT/CLAY	99.6	% PASS. 0.02 mm	97.5
% MOIST. CONTENT	33.4	% PASS. 0.002 mm	65.7
UNIFORMITY COEFFICIENT (C_u)		UNKNOWN	
COEFFICIENT OF GRADATION (C_c)		UNKNOWN	
ASTM D1557 (uncorrected)		N/A	
ASTM D4718 (corrected)		N/A	
OPTIMUM MOIST. CONTENT. (corrected)		N/A	

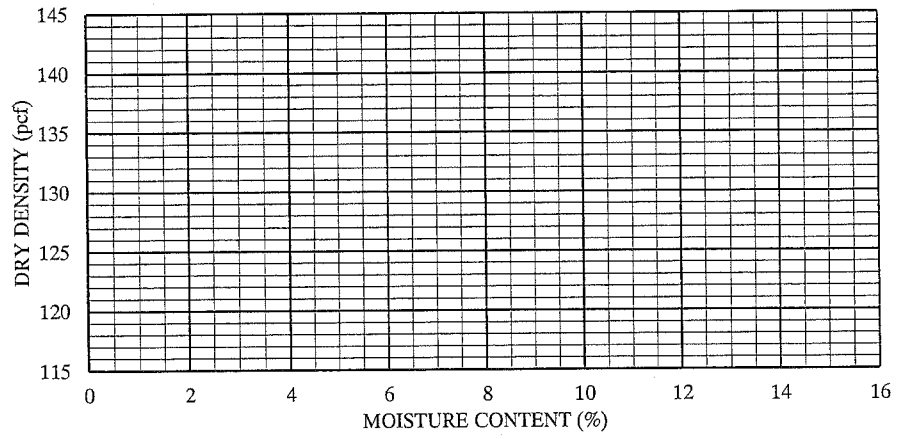
PARTICLE SIZE ANALYSIS ASTM D422 / C136



SIEVE ANALYSIS RESULT

SIEVE SIZE (mm)	SIEVE SIZE (U.S.)	TOTAL % PASSING	SPECIFICATION (% PASSING)
76.20	3"		
38.10	1.5"		
19.00	3/4"		
12.70	1/2"		
9.50	3/8"		
4.75	#4	100	
2.00	#10	100	
0.85	#20	100	
0.43	#40	100	
0.25	#60	100	
0.15	#100	100	
0.075	#200	99.6	

MOISTURE-DENSITY RELATIONSHIP ASTM D1557



HYDROMETER RESULT

ELAPSED TIME (MIN)	DIAMETER (mm)	TOTAL % PASSING
0		
0.5		
1	0.0356	99.2
2	0.0252	98.5
4	0.0178	96.9
8	0.0128	95.4
15	0.0093	93.9
30	0.0067	91.6
60	0.0049	86.8
250	0.0025	71.0
1440	0.0011	53.2

HYDRAULIC COND. (ASTM D2434)	N/A
DEGRADATION (ATM T-313)	N/A
PLASTICITY INDEX ASTM 4318	N/A

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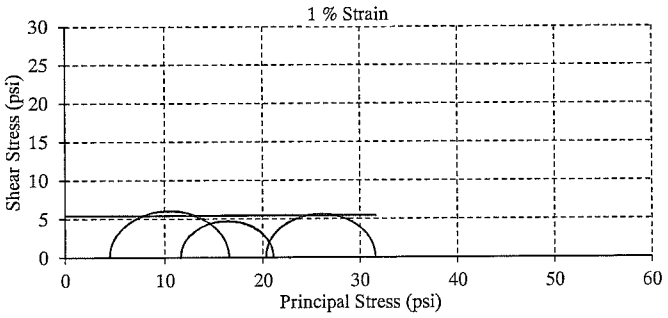
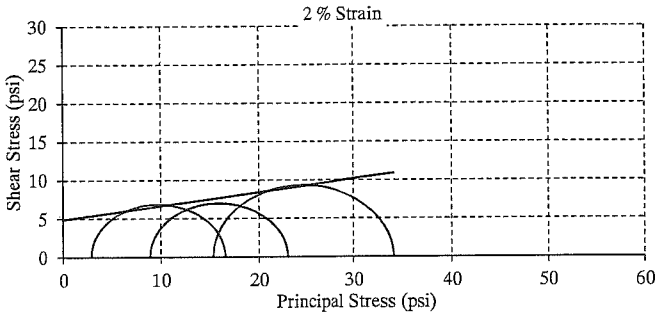
ASTM D4767: Standard Test Method For Consolidated Undrained Triaxial Compression Test

PROJECT NO:	4385-16	SAMPLE A:	B1-S13
PROJECT NAME:	Ship Creek Condo Development	SAMPLE B:	B2-S12
TESTED BY:	AF	SAMPLE C:	B2-S13
CHECKED BY:	AF	DATE RECEIVED:	5/12/16
SAMPLE DESCRIP.:	[ML / CL]	STRAIN RATE:	7.1 % min^{-1}



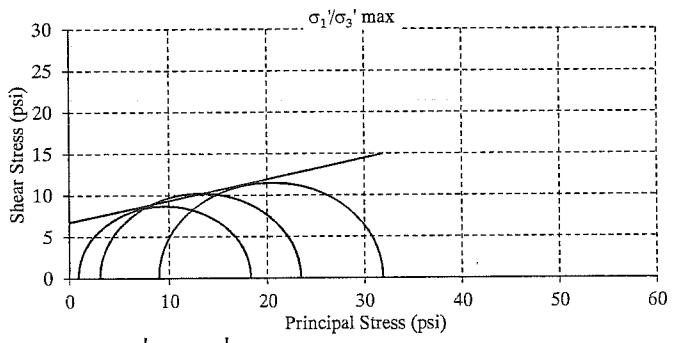
	σ_1' (psi)	σ_3' (psi)	ε (%)
A	21.1	11.6	1.0
B	16.5	4.4	1.0
C	31.6	20.3	1.0
D			
E			

Friction Angle = **0°**
Cohesion = **5 psi**
R^2= **0.03**



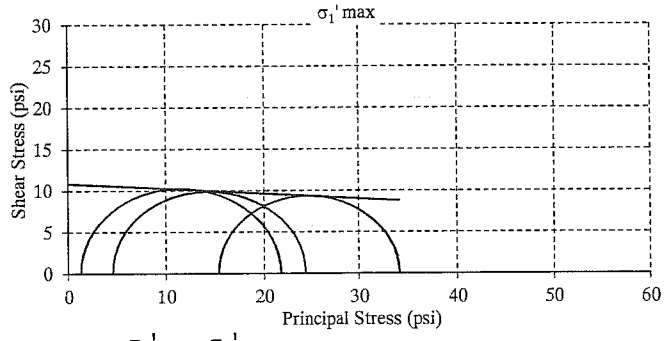
	σ_1' (psi)	σ_3' (psi)	ε (%)
A	22.9	8.9	2.0
B	16.6	2.9	2.0
C	34.0	15.3	2.0
D			
E			

Friction Angle = **10°**
Cohesion = **5 psi**
R^2= **0.86**



	σ_1' (psi)	σ_3' (psi)	ε (%)
A	23.4	3.0	7.6
B	18.2	0.9	6.9
C	31.9	8.9	8.7
D			
E			

Friction Angle = **14°**
Cohesion = **7 psi**
R^2= **0.94**



	σ_1' (psi)	σ_3' (psi)	ε (%)
A	24.2	4.5	5.4
B	21.7	1.3	14.4
C	34.0	15.3	2.2
D			
E			

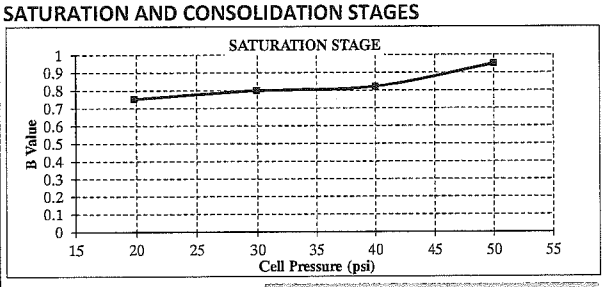
Friction Angle = **-4°**
Cohesion = **11 psi**
R^2= **0.95**

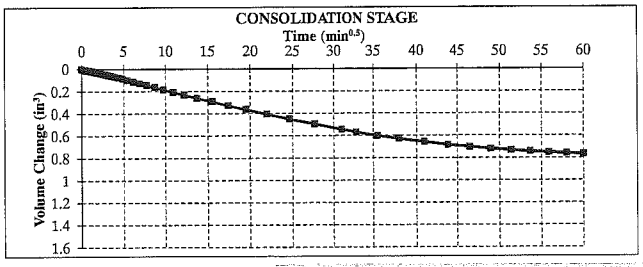
COMMENTS

ASTM D4767: STANDARD TEST METHOD FOR UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

PROJECT NO:	4385-16	BOREHOLE NO.:	B1
PROJECT NAME:	Ship Creek Condo Development	SAMPLE NO.:	S13
CLIENT	John McGrew	SAMPLE DEPTH:	50.3'-50.8'
TESTED & CHECKED BY:	AF	DATE RECEIVED:	5/12/2016
UNITED SOIL CLASS.:	[ML] SILT	STRAIN RATE	7.1 [% min^{-1}]
SAMPLE TYPE:	SHELBY TUBE	PARTICLE SPEC. GRAVITY:	2.69
MOUNTING METHOD:	WET	INITIAL MOIST. CONT.:	34.5 [%]
VARIATIONS FROM PROC.:	N/A	BULK DENSITY:	122.1 [lbf ft^{-3}]
LABORATORY TEMP.:	65 °F	DRY UNIT WEIGHT:	90.8 [lbf ft^{-3}]
INITIAL HEIGHT:	5.6 [inches]	INITIAL VOIDS RATIO:	N/A
INITIAL DIAMETER:	2.8 [inches]	INITIAL DEG. OF SAT.:	N/A [%]

SATURATION AND CONSOLIDATION STAGES

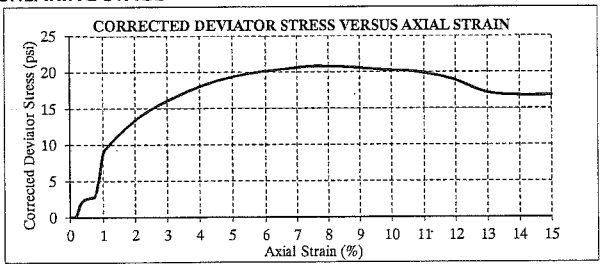


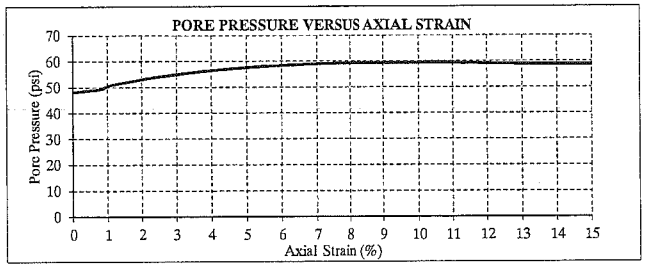


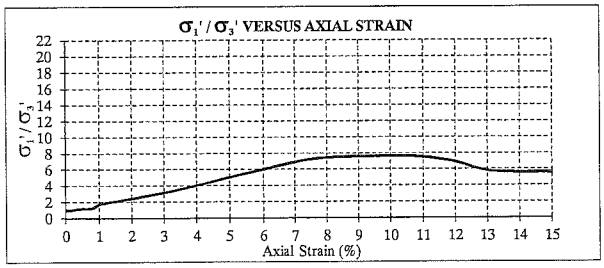
FINAL B VALUE:	0.95	
FINAL BACK PRESSURE:	47.8	[psi]

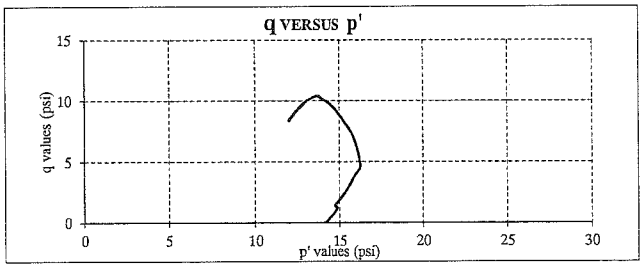
CELL PRESSURE:	63.0 [psi]
TIME TO 50% PRIM. CONS.:	N/A [min]
DRY UNIT WEIGHT:	N/A [lbf ft^{-3}]
VOID RATIO:	N/A
SATURATION:	N/A [%]
MOISTURE CONTENT:	33.3 [%]

SHEARING STAGE

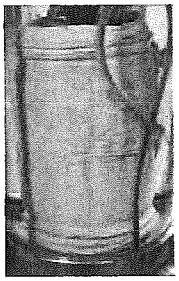








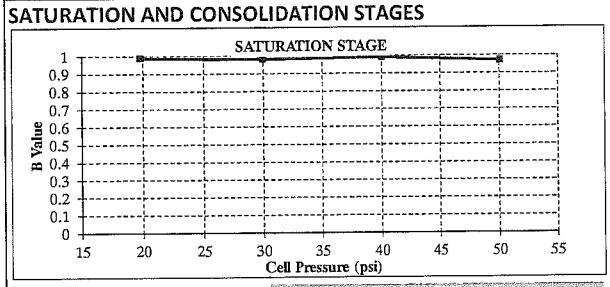
CELL PRESSURE:	62.4	[psi]
INITIAL PORE PRESSURE:	48.3	[psi]
EFF. STRESS AT START:	14.1	[psi]

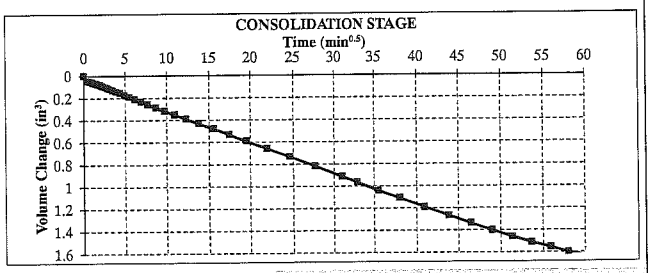


ASTM D4767: STANDARD TEST METHOD FOR UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

PROJECT NO:	4385-16	BOREHOLE NO.:	B2
PROJECT NAME:	Ship Creek Condo Development	SAMPLE NO.:	S12
CLIENT	John McGrew	SAMPLE DEPTH:	45.0'-45.5'
TESTED & CHECKED BY:	AF	DATE RECEIVED:	5/12/2016
UNITED SOIL CLASS.:	[ML] SILT	STRAIN RATE	7.1 [% min^{-1}]
SAMPLE TYPE:	SHELBY TUBE	PARTICLE SPEC. GRAVITY:	2.68
MOUNTING METHOD:	WET	INITIAL MOIST. CONT.:	28.6 [%]
VARIATIONS FROM PROC.:	N/A	BULK DENSITY:	122.9 [lbf ft^{-3}]
LABORATORY TEMP.:	65 °F	DRY UNIT WEIGHT:	95.6 [lbf ft^{-3}]
INITIAL HEIGHT:	5.6 [inches]	INITIAL VOIDS RATIO:	N/A
INITIAL DIAMETER:	2.8 [inches]	INITIAL DEG. OF SAT.:	N/A [%]

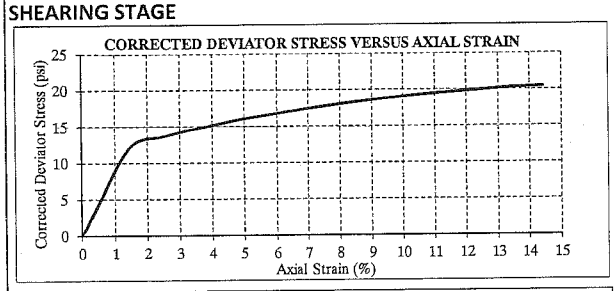
SATURATION AND CONSOLIDATION STAGES

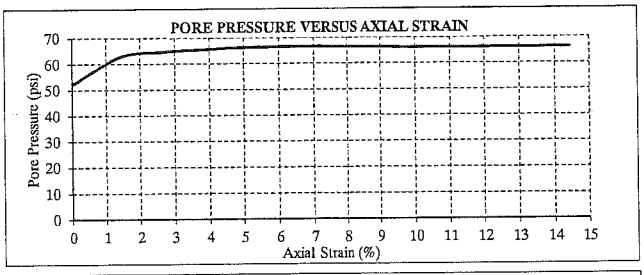


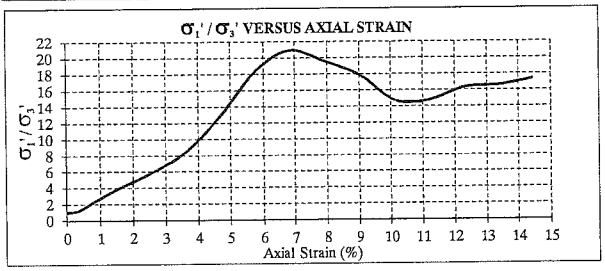


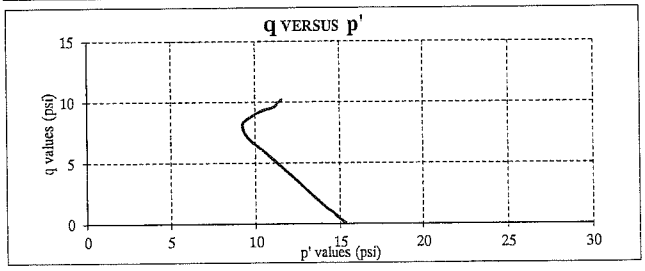
FINAL B VALUE:	0.97	
FINAL BACK PRESSURE:	47.7	[psi]
CELL PRESSURE:	68.1	[psi]
TIME TO 50% PRIM. CONS.:	N/A	[min]
DRY UNIT WEIGHT:	N/A	[lbf ft^{-3}]
VOID RATIO:	N/A	
SATURATION:	N/A	[%]
MOISTURE CONTENT:	24.7	[%]

SHEARING STAGE

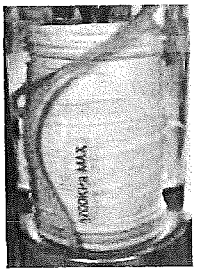








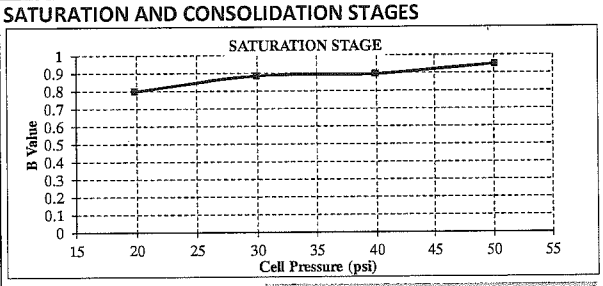
CELL PRESSURE:	62.4	[psi]
INITIAL PORE PRESSURE:	48.3	[psi]
EFF. STRESS AT START:	14.1	[psi]

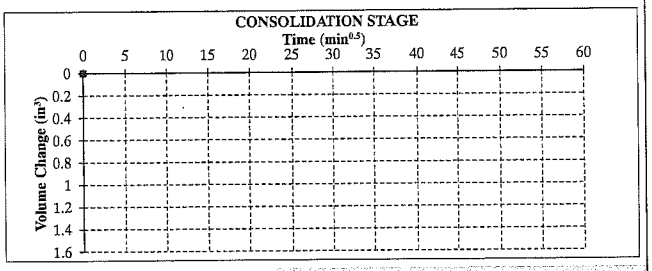


ASTM D4767: STANDARD TEST METHOD FOR UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

PROJECT NO:	4385-16	BOREHOLE NO.:	B2
PROJECT NAME:	Ship Creek Condo Development	SAMPLE NO.:	S13
CLIENT	John McGrew	SAMPLE DEPTH:	51.0'-51.5'
TESTED & CHECKED BY:	AF	DATE RECEIVED:	5/12/2016
UNITED SOIL CLASS.:	[CL] LEAN CLAY	STRAIN RATE	7.1 [% min^{-1}]
SAMPLE TYPE:	SHELBY TUBE	PARTICLE SPEC. GRAVITY:	2.63
MOUNTING METHOD:	WET	INITIAL MOIST. CONT.:	35.6 [%]
VARIATIONS FROM PROC.:	N/A	BULK DENSITY:	120.9 [lbf ft^{-3}]
LABORATORY TEMP.:	65 °F	DRY UNIT WEIGHT:	89.2 [lbf ft^{-3}]
INITIAL HEIGHT:	5.6 [inches]	INITIAL VOIDS RATIO:	N/A
INITIAL DIAMETER:	2.8 [inches]	INITIAL DEG. OF SAT.:	N/A [%]

SATURATION AND CONSOLIDATION STAGES

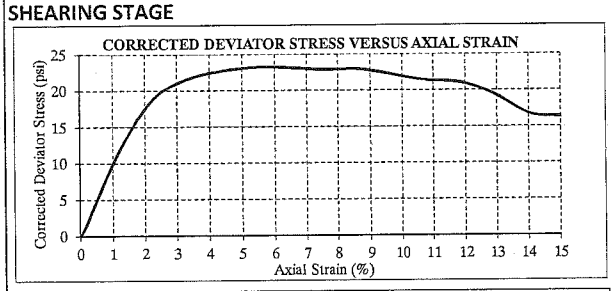


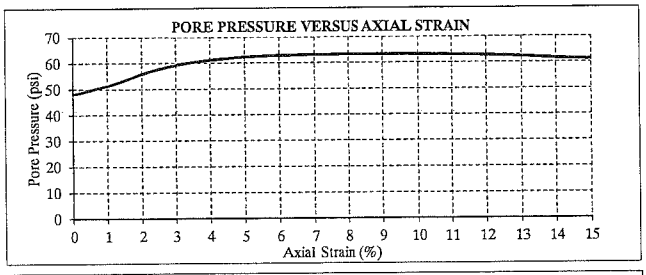


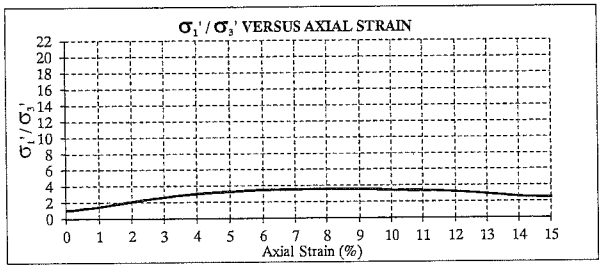
FINAL B VALUE:	0.95	
FINAL BACK PRESSURE:	47.6	[psi]

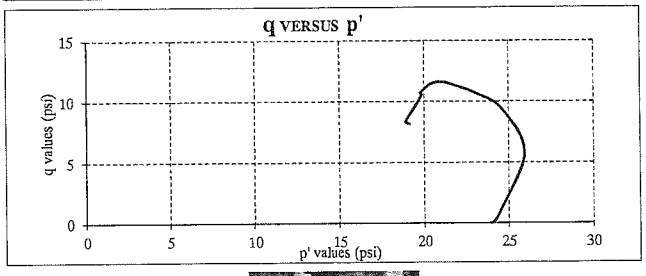
CELL PRESSURE:	72.8 [psi]
TIME TO 50% PRIM. CONS.:	N/A [min]
DRY UNIT WEIGHT:	N/A [lbf ft^{-3}]
VOID RATIO:	N/A
SATURATION:	N/A [%]
MOISTURE CONTENT:	33.8 [%]

SHEARING STAGE

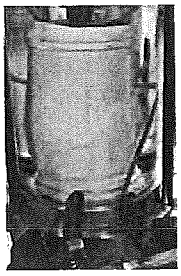








CELL PRESSURE:	72.2	[psi]
INITIAL PORE PRESSURE:	48.2	[psi]
EFF. STRESS AT START:	24.0	[psi]



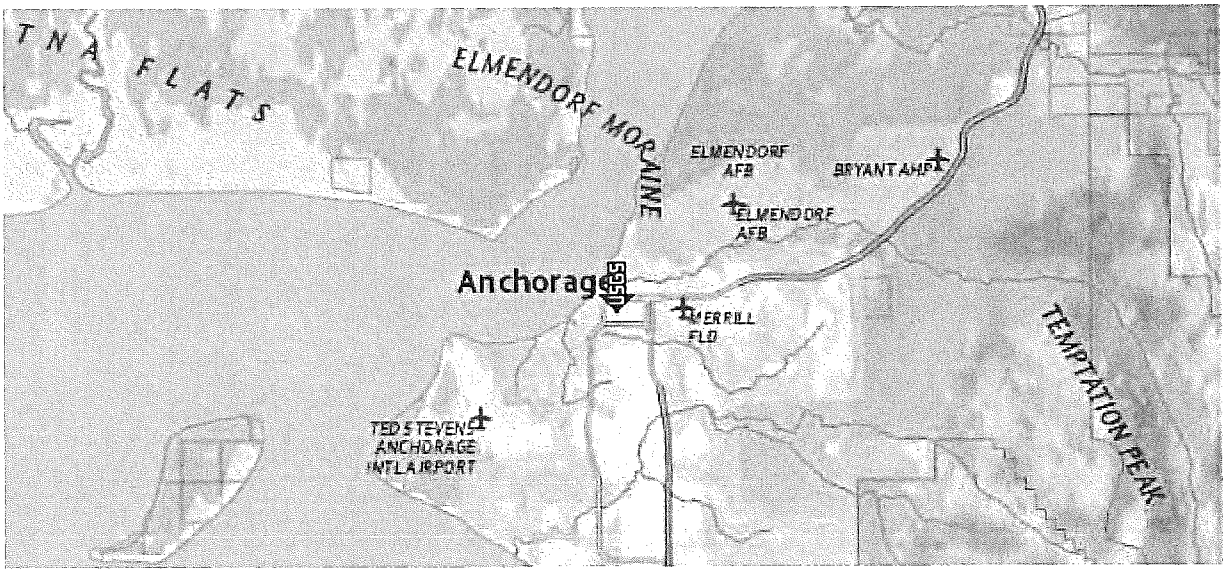
APPENDIX D

USGS SEISMIC DESIGN MAPS SUMMARY REPORT

USGS Design Maps Summary Report

User-Specified Input

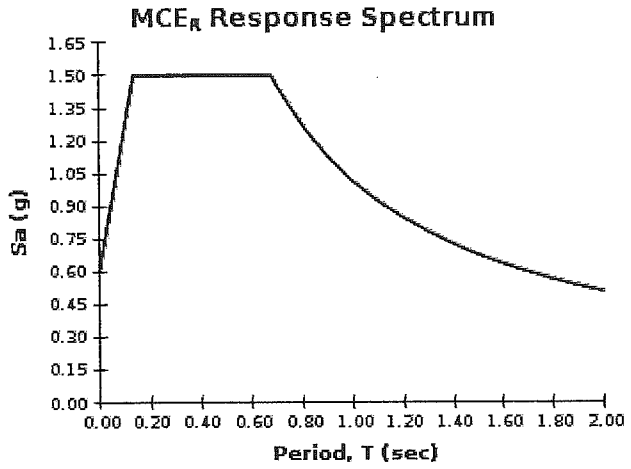
Report Title	4385-16 Ship Creek Development - Site Class D Thu June 9, 2016 20:57:54 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	61.22055°N, 149.89504°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

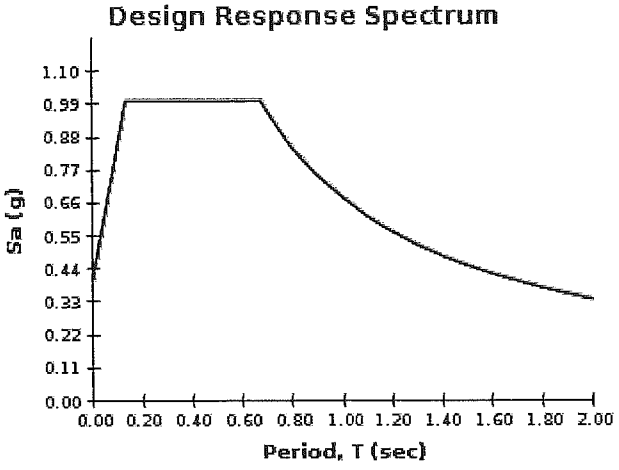


USGS-Provided Output

S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.676 g	S_{M1} =	1.014 g	S_{D1} =	0.676 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





USGS Design Maps Detailed Report

2012 International Building Code (61.22055°N, 149.89504°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(4) [1]	S_S = 1.500 g
From Figure 1613.3.1(5) [2]	S_1 = 0.676 g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.500 g, F_a = 1.000

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.676 g, F_v = 1.500

Equation (16-37): $S_{MS} = F_a S_S = 1.000 \times 1.500 = 1.500$ g

Equation (16-38): $S_{M1} = F_v S_1 = 1.500 \times 0.676 = 1.014$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.500 = 1.000$ g

Equation (16-40): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.014 = 0.676$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.000 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.676 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

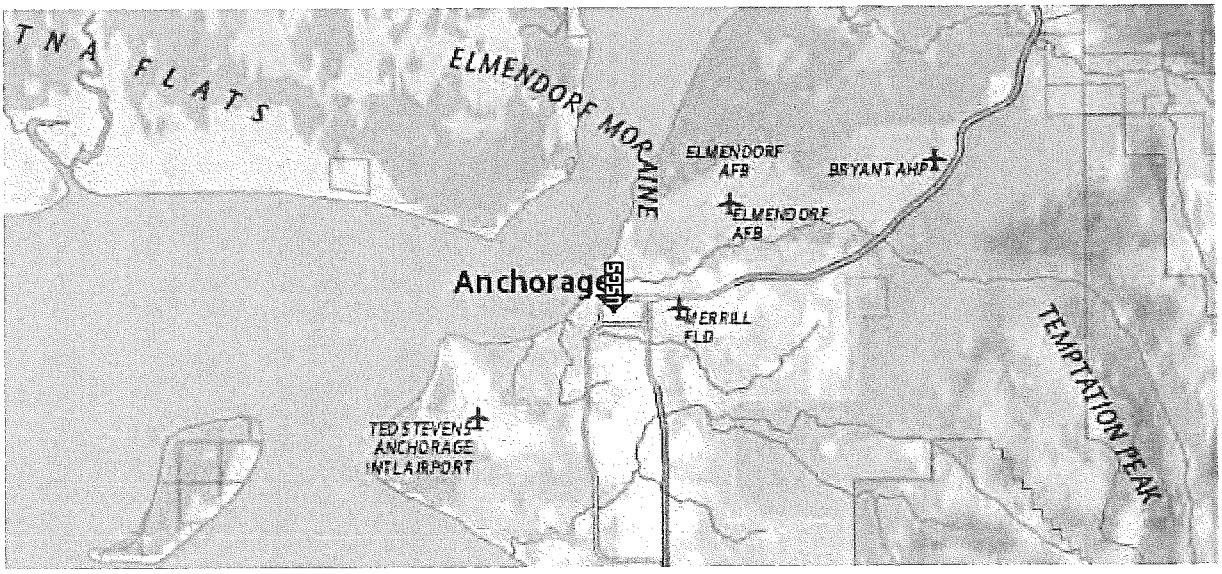
References

1. *Figure 1613.3.1(4)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(4).pdf
2. *Figure 1613.3.1(5)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(5).pdf

USGS Design Maps Summary Report

User-Specified Input

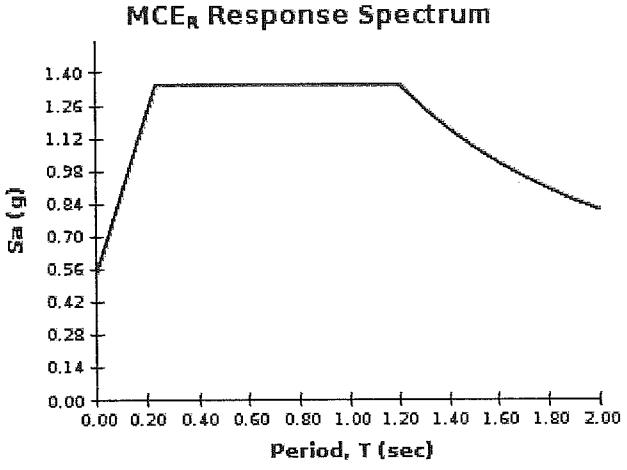
Report Title	4385-16 Ship Creek Development - Site Class E Thu June 9, 2016 20:58:57 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	61.22055°N, 149.89504°W
Site Soil Classification	Site Class E – "Soft Clay Soil"
Risk Category	I/II/III

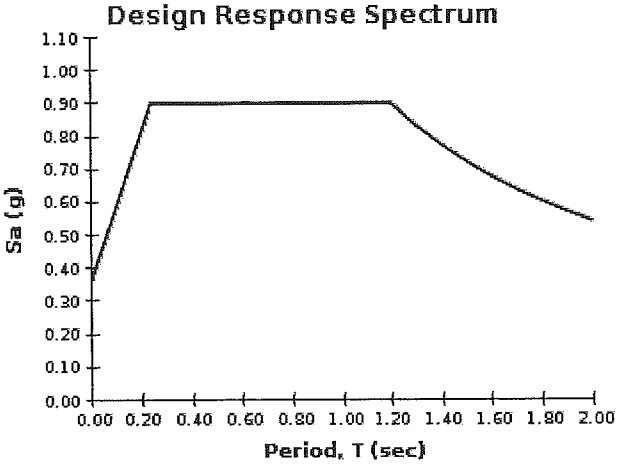


USGS-Provided Output

S_S =	1.500 g	S_{MS} =	1.350 g	S_{DS} =	0.900 g
S_1 =	0.676 g	S_{M1} =	1.623 g	S_{D1} =	1.082 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





USGS Design Maps Detailed Report

2012 International Building Code (61.22055°N, 149.89504°W)

Site Class E – "Soft Clay Soil", Risk Category I/II/III

Section 1613.3.1 — Mapped acceleration parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2012 International Building Code are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 1613.3.3.

From Figure 1613.3.1(4) [1]	S_S = 1.500 g
From Figure 1613.3.1(5) [2]	S_1 = 0.676 g

Section 1613.3.2 — Site class definitions

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class E, based on the site soil properties in accordance with Section 1613.

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 1613.3.3 — Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

TABLE 1613.3.3(1)
VALUES OF SITE COEFFICIENT F_a

Site Class	Mapped Spectral Response Acceleration at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = E and S_S = 1.500 g, F_a = 0.900

TABLE 1613.3.3(2)
VALUES OF SITE COEFFICIENT F_v

Site Class	Mapped Spectral Response Acceleration at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = E and S_1 = 0.676 g, F_v = 2.400

Equation (16-37): $S_{MS} = F_a S_S = 0.900 \times 1.500 = 1.350$ g

Equation (16-38): $S_{M1} = F_v S_1 = 2.400 \times 0.676 = 1.623$ g

Section 1613.3.4 — Design spectral response acceleration parameters

Equation (16-39): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.350 = 0.900$ g

Equation (16-40): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 1.623 = 1.082$ g

Section 1613.3.5 — Determination of seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.900 g, Seismic Design Category = D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 1.082 g, Seismic Design Category = D

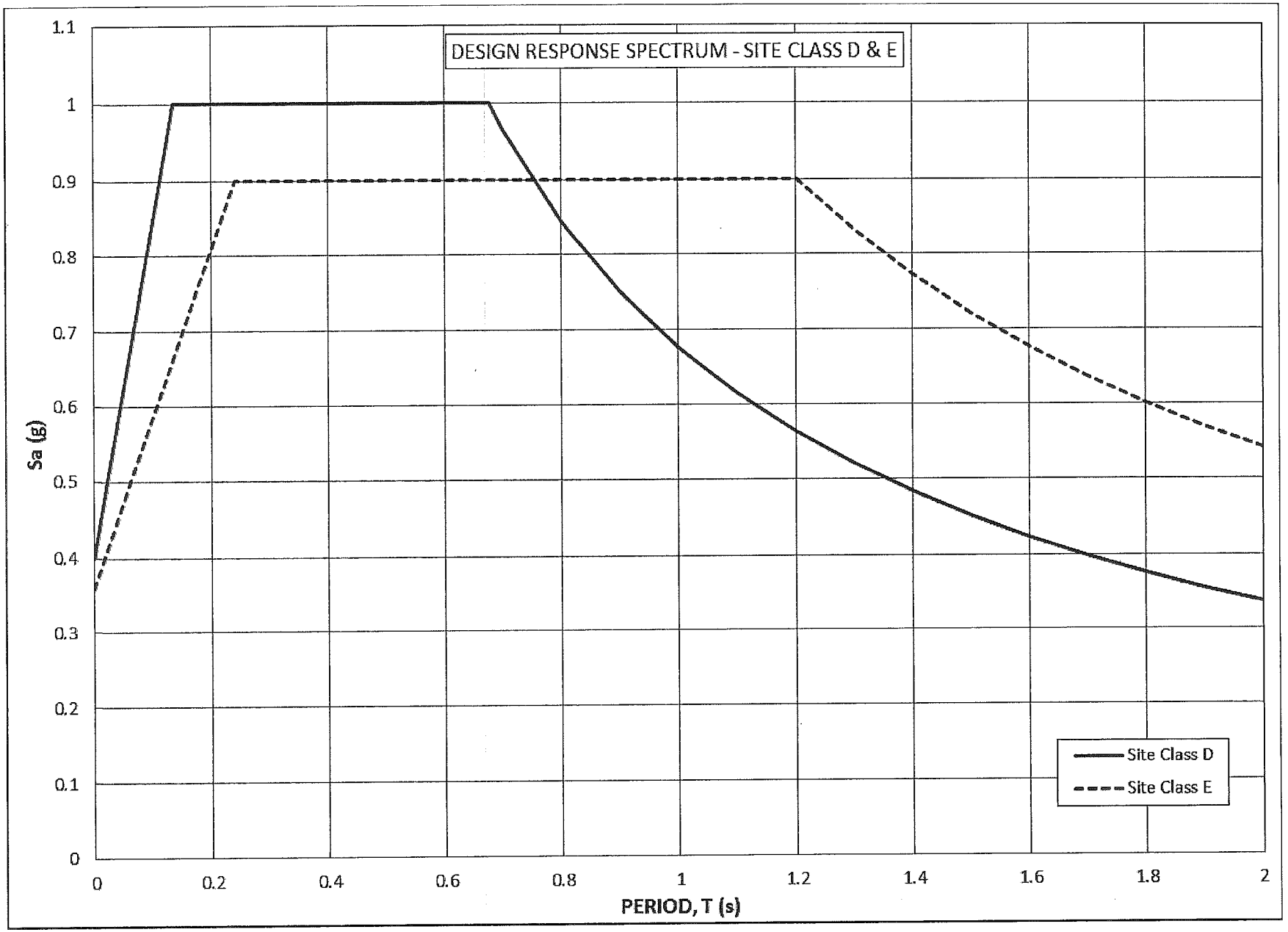
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 1613.3.5(1) or 1613.3.5(2)" = D

Note: See Section 1613.3.5.1 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 1613.3.1(4)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(4).pdf
2. *Figure 1613.3.1(5)*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/IBC-2012-Fig1613p3p1(5).pdf



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

APPENDIX TITLE: DESIGN RESPONSE SPECTRUM—SITE CLASS D & E
PROJECT NAME: SHIP CREEK DEVELOPMENT
PROJECT ID: 4385-16
PROJECT LOCATION: ANCHORAGE, AK
APPENDIX NUMBER: D-1

APPENDIX E

LATERAL SEISMIC SOIL PRESSURE: AN UPDATED APPROACH

Calculations

Wall to be evaluated: 9 ft high wall retains 9 ft earth, and restrained by concrete slab at top

Footing width minimum 16 in, maximum 4.5 ft

To reduce seismic loading, footing should be as small as possible

Slab at base not rigidly connected

Use 0.20 g to match the MOA code amendments for Seismic Hazard Zone 5

Equation reference to "Lateral Seismic Soil Pressure" in Appendix E

Frequency (Equation 1, Page 2-9)

$f = V_s/(4 * H)$

V_s estimated for near surface = 500 ft/sec

For 9 ft wall (9 ft soil retained): $f = 500/(4 * 9)$ = 13.9 Hz > 0.1 Hz

Soil density $\rho = 125/32.2$ = 3.88 slugs/ft^3

Equation 2, page 2-11 $\psi_v = 2/\sqrt{(1-v)(2-v)}$ = 1.90

v = Poisson's Ratio = ⅓

Embedment Ratio 13 ft wall (12.5 ft soil retained) => 1.33/9 = 0.15 < 0.5

Use α = 0.27, maximum footing width: 9 ft wall (9 ft soil retained) = 4.5 ft

General procedure for calculations on page 2-15 (Appendix E)

$F = \alpha * \rho * H^2 * S_A * \psi_v$ (Equation 5, page 2-15)

For 9 ft wall (9 ft soil retained):

$F = (0.27)(3.88)(9^2)(0.20)(32.2)(1.9)$= 1038 lb/lineal ft of wall

13 ft wall Area under curve = 0.632(9) = 5.7

Area also = 1038 lb/lineal ft of wall

Factor for distribution curve = 1038/5.7 = 182

The pressure distribution is presented on Figure 13 of this report

LATERAL SEISMIC SOIL PRESSURE

AN UPDATED APPROACH

By

Farhang Ostadan

William H. White

Bechtel National
San Francisco, California

Presented as part of

US-Japan SSI Workshop
September 22-23, 1998

United States Geological Survey
Menlo Park, California

INTRODUCTION

The effect of ground motion on retaining walls was recognized by Okabe (1924) and Mononobe and Matsuo (1929) following the great Kanto Earthquake of 1923 in Japan. The method proposed by Mononobe and Okabe, currently known as the M-O method, was based on the Coulomb's theory of static soil pressure developed more than 200 years ago. In the last 30 years, a great deal of research work both in the analytical and in experimental areas has been performed to evaluate the adequacy of the M-O method or to extend the method for specific applications. Discussion of the all the research work on the seismic soil pressure is extensive and is beyond the scope of this study. Rather, only the milestones that have influenced the design practice are described below.

Seed and Whitman (1970)

In 1970, the M-O method and the associated analytical relationships were simplified by Seed and Whitman (1970) for design of earth retaining structures for dynamic loads. Using the charts, the designer only needs to know the basic properties of the backfill (the angle of internal friction) and the peak ground acceleration to obtain the seismic soil pressure. As suggested by Seed and Whitman, the basic assumptions used in the development of the M-O method should always be considered in design applications. These assumptions are:

- The backfill materials are dry cohesionless materials.
- The retaining wall yields equally and sufficiently to produce minimum active soil pressure.
- The active soil pressure is associated with a soil wedge behind the wall which is at the point of incipient failure and the maximum shear strength is mobilized along the potential sliding surface.
- The soil behind the wall behaves as a rigid body and the acceleration is uniform in the soil wedge behind the wall.

Whitman et al. (1979, 1990, 1991)

The effect of some of the limiting assumptions used in the M-O method above has been investigated by, among others, Whitman et al. (1979, 1990, 1991) and Nadim and Whitman (1984). The non-yielding wall conditions and the amplifications of the motion in the soil mass were found to be significant in some cases. However, no practical tools were proposed for design applications to circumvent the limiting assumptions used in the M-O method. Judging from the results of model tests by several researchers, Whitman (1990) found that use of the M-O method for design of relatively simple gravity walls up to 30 ft high is acceptable. However, for higher walls and non-yielding walls, he recommended a more careful analysis be performed.

Richards and Elms (1979)

One of the more important recent developments in characterizing the seismic soil pressure for retaining walls was the work performed by Richards and Elms (1979). Using the M-O method and the Newmark's sliding-block analogy, the authors proposed a displacement-controlled method which incorporates basic ground motion parameters (maximum acceleration and maximum velocity) and reduces the seismic soil pressure based on the acceptable amount of the wall movement. In practice, the method is currently used for designing walls for which limiting horizontal displacements are of no concern.

Wood (1973)

While the M-O method was developed for yielding walls, Wood (1973) developed an equivalent static elastic solution for seismic soil pressure for non-yielding walls. The solution is based on finite element analysis of a soil-wall system for a wall resting on a rigid base and a uniform soil layer behind the wall. In general, Wood's solution amounts to a lateral force that acts about 0.63 times the height of the wall above the base of the wall which corresponds approximately to a parabolic distribution of soil pressure unlike M-O's inverted triangular distribution. Wood's solution predicts seismic soil pressure larger (by a factor of 2 to 3) than the pressure predicted by the M-O method. The elastic solution proposed by Wood has been adopted by ASCE Standards for Nuclear Structures (1986) and has been used in many applications. Wood's solution requires knowledge of the maximum ground acceleration along with the density and Poisson's ratio of the soil to obtain the seismic soil pressure behind the wall.

Matsuzawa et al. (1984), Ishibashi et al. (1985)

To address saturated backfill conditions and to include the hydrodynamic forces, the M-O method was extended by Matsuzawa et al. (1984) and Ishibashi et al. (1985). A comprehensive summary of the all the M-O based methods and their applications to various retaining wall conditions are documented in a recent US Army publication (Ebeling and Morrison, 1992).

Veletsos et al. (1994a, 1994b)

More recently, Veletsos and Younan (1994a, 1994b) developed an analytical model to compute seismic soil pressure for rigid vertical walls resting on a rigid base. The proposed model is based on the series of elastically supported semiinfinte horizontal bars with distributed mass to model the soil medium behind the wall. The model was developed for vertically propagating shear waves with the assumption that horizontal variation of vertical displacements in the soil medium is negligible. In this model, contrary to Wood's equivalent static solution, amplification of motion in the soil medium behind the wall is considered. The model highlights the effects of several parameters including the frequency of vibration on the seismic soil pressure magnitude and distribution. The model was subsequently expanded for application to cylindrical vaults and storage buildings (Veletsos and Younan, 1994c; 1995).

Significance of Seismic Soil Pressure in Design

Seed and Whitman (1970) summarized damage to wall structures during earthquakes. Damage to retaining walls with saturated backfills is typically more dramatic and is frequently reported in the literature. However, damage reports of walls above the water table are not uncommon. A number of soil retaining structures were damaged in the San Fernando earthquake of 1971. Wood (1973) reports that the walls of a large reinforced concrete underground reservoir at the Balboa Water Treatment Plant failed as a result of increased soil pressure during the earthquake. The walls were approximately 20 ft high and were restrained by the top and bottom slabs.

Damage has been reported for a number of underground reinforced concrete box-type flood control channels. Richards and Elms (1979) report damage to abutment of bridges after the 1968 earthquake in Inangahua, New Zealand. Out of the 39 bridges inspected, 24 showed measurable movement and 15 suffered damage on bridge abutments. In the Madang earthquake of 1970 in New Guinea, the damage patterns were similar. Out of 29 bridges repaired, some experienced abutment lateral movements as much as 20 inches. Reports on failed or damaged bridge abutments indicate mainly settlement of the backfill and pounding of the bridge superstructure against the abutment in longitudinal and transverse directions.

Nazarian and Hadjian (1979) also summarized damage to soil-retaining structures during past earthquakes. Damage to bridges has also been reported from various earthquakes including 1960 Chilean, 1964 Alaskan, 1964 Nigata, 1971 San Fernando, and 1974 Lima. Most of the reported damage can be attributed to the increased lateral pressure during earthquakes.

Numerous damage reports are available from recent earthquakes which report damage to the embedded walls of buildings. However, contribution of the seismic soil pressure to the damage can not be quantified since the embedded walls often carry the inertia load of the superstructure with cracks extending in all directions in the walls of the buildings. On the other hand, simple structures, such as underground box-type structures, retaining walls, and bridge abutments have suffered damage due to the increased soil pressure. All of these reports and others not mentioned highlight the significance of using appropriate seismic soil pressure in design.

RECENT EXPERIMENTS AND OBSERVATIONS

Lotung Experiment

Soil-structure interaction (SSI) effects play a significant role in the dynamic response of critical structures and internal components. Recognizing these effects, the Electric Power Research Institute (EPRI) with the cooperation from Taiwan Power Company (TPC) and the United States Nuclear Regulatory Commission (NRC) sponsored a large-scale experiment in the earthquake active area of Lotung, Taiwan. The objective

of the experiment was to evaluate the SSI analyses methodologies and to reduce uncertainties in the design. In this experiment, a 1/4-scale containment model was constructed. Instrumentation was installed both in the containment model and at the site. Since completion of the model and its instrumentation in October 1985, a number of recordings from earthquakes ranging in Richter magnitude 4.5 to 7.0 have been made at the site. The information on site condition, soil properties, and structural drawings were distributed to selected teams from the industry and academia (a total of 13 groups one which was Bechtel) to predict the responses on a round-robin basis. The results of this extensive experiment and follow up studies are published in several EPRI reports (EPRI, 1989; EPRI, 1991). The senior author also participated in the studies performed by Bechtel.

The Lotung site is a relatively flat with a relatively soft surface layer with thickness of 200 ft to 260 ft (60 m to 80 m) overlying deep alluvium stratum. The soil properties in terms of low-strain shear and compression wave velocities were measured at the site. The shear wave velocity is about 100 m/sec increasing to 250 m/sec at the depth. In addition cyclic laboratory testing was performed on soil samples and the strain-dependent soil properties were obtained.

The instrumentation for the experiment is extensive and consists of accelerometers and pressure gages in the model and in the free-field. Pressure gages were installed beneath the basemat for monitoring uplifting and bonding/de-bonding of the basemat from the supporting soil layer. In addition, pressure gages were also installed on the perimeter of the containment shell to measure seismic lateral soil pressure.

A number of earthquakes up to magnitude 7 were recorded at the site. For the purpose of this study, only the records from earthquake event LSST07 are used. The LSST07 event occurred on May 20, 1986 at about 40 miles(66.2 km) from the Lotung experiment. This event had a Richter magnitude of 6.5. The peak ground acceleration in the free-field at the ground surface were 0.16g, 0.21g, and 0.04g in the east-west, north-south, and vertical directions, respectively.

A typical recorded rime histories of seismic soil pressure is shown in Figures 1. Most time histories show a drift in the response and substantial residual pressure at the end of the shaking. Some of the pressure time histories have also been examined by Chang et al. (1990). As suggested by Chang et al., the drift in the time history and the residual pressure are attributed to the compaction of the backfill material during shaking and particle re-arrangement of the materials in the soil near the instrument. For this reason the recorded pressure time histories were corrected to eliminate the drift and the residual pressure in order to obtain the peak transient stresses. The corrected pressure time history is also shown in Figure 1 with positive sign indicating pressure and negative sign indicating extension.

The seismic soil pressure shown in Figure 1 is the normal stress component with the direction normal to the body of the containment shell in the North-South direction. The magnitude of the stress is a function of the relative motion of the containment and the surrounding soil and the soil properties. In the Lotung experiment, the relative motion was caused primarily by the rigid body rocking motion of the containment shell. To evaluate the effect of rocking motion on the lateral seismic soil pressure, frequency contents of the rocking motion are compared with the frequency contents of the pressure time history at one location, as shown in Figure 2. Comparison of the pair of spectra shows that, while the nature of the spectral amplitudes are different and are expected to have different amplitudes, the frequency content of the two motions are very similar, particularly at the rocking frequency of the containment shell (2.2 Hz).

The overall comparison of the results (see Ostadan and White, 1997) indicates that the seismic soil pressure is caused by the relative motion of the structure with respect to the surrounding soil and as such it is a SSI response. This implies that the seismic soil pressure will not only be affected by the soil properties and the characteristics of the ground motion, but also the structural properties as well as the size of the structure and its foundation embedment.

Finally, the result of the SSI analysis using the computer program SASSI (Lysmer et al., 1981) in terms of seismic soil pressure was obtained and compared with the recorded pressure in terms of spectral amplitudes in Figure 3

Other Observations From Recent Field and Experimental Data

In recent years, several field and laboratory experiments have been conducted to resolve the complexities associated with the seismic soil pressure and to develop a more realistic design parameter for the design of embedded structures. A summary of the selected recent investigations is presented below.

Case 1 - Deeply Embedded Reactor Building

Hirota et al. (1992) have collected and studied the soil pressure data from instrumented buildings since 1989. Specifically, the data from a deeply embedded reactor building (embedment depth of 120 ft) in a suburb of Tokyo have been presented and evaluated. The data from a total of eight earthquake records are presented. The principal conclusions of the study are as follows:

- The seismic soil pressure is significantly affected by the low-frequency content of the earthquake motion.
- Comparison of the pressure time history with the derived relative displacement time history between the structure and the far-field shows similar characteristics in phase and amplitude.

Case 2 - Deeply Embedded Structure

Matsumoto et al. (1991) and Watakabe et al. (1992) present the results of a study using the recorded data for a deeply embedded building in a suburb of Tokyo. The site consists of a soft alluvial layer with a thickness of 120 ft underlain by a much stiffer formation. The shear wave velocity of the upper layer ranges from 300 ft/sec to 1000 ft/sec. The building foundation rests on the stiff formation. The records from a total of 21 earthquakes have been collected and examined. The main points of the investigation are as follows:

- Frequency content of the soil pressure was examined by comparing the normalized response spectra of the soil pressure with the normalized velocity spectra of the motion in the soil layers at the respective elevations. The shapes of the normalized spectra closely matched.
- The finite element method employed was able to predict the soil-interaction effects. This conclusion confirms the use of finite element and soil-structure interaction techniques to predict seismic soil pressure.

Case 3 - Underground LNG Storage Tanks

Koyama et al. (1988,1992) collected and examined the earthquake and seismic soil pressure records from two large scale Liquid Natural Gas (LNG) underground storage tanks. The instrumented tanks are large diameter concrete tanks (200 ft diameter, 120 ft high). The site soil is a medium dense sand with a shear wave velocity of 1300 ft/sec. Over the 8-year period, records from 70 earthquakes have been collected and examined. The authors concluded that the seismic soil pressure is strongly correlated to the acceleration and the relative displacement of the tank and the ground.

In addition to the field experiments, a number of laboratory tests have been recently performed Kazama and Inatoi (1988) and Itoh and Nogami (1990). Evaluation of the test results showed that:

- The dynamic soil pressure is amplified near the resonant frequency of the backfill sand.
- The effect of soil nonlinearity on the peak dynamic pressure can be observed by increasing the amplitude of the vibration.
- The dynamic soil pressure distribution is consistent with the relative displacement between the ground and the caisson.
- Finite element analysis methods are able to reproduce the measured data.
- At the soil column resonant frequency, the seismic soil pressure acts in the direction of the basement movement to drive the structure, whereas at the structural resonant frequency, the dynamic pressure acts in the opposite direction of the basement movement to restrain the movement of the structure.

Recognition of the Problem and Objective of the Study

In spite of the much better understanding of the soil-wall interaction behavior that have evolved over the years, the M-O method continues to be widely used despite many criticisms and its limitations. As stated above, the method was developed for gravity retaining walls with cohesionless backfill materials. In design applications, however, the M-O method or any of its derivatives is commonly used for below ground building walls. In this regard, the M-O method is one of the most abused methods in the geotechnical practice.

In view of the overwhelming information and evidence on the dynamic behavior of buildings, some of which was outlined above, the United States Nuclear Regulatory Commission (US NRC, 1991) recently issued a position paper on the subject of the seismic soil pressure. Pertinent excerpts are quoted as follows:

> "The use of the M-O method of analysis to compute pressure on embedded walls of structures like the nuclear island (NI) structure of ..... is not considered appropriate since the development of the limit conditions in the soil requires wall movements which are most likely inappropriate for SSI conditions anticipated. The M-O approach will generally lead to a lower bound estimate for soil loads (using active state conditions in the soil) since the soil in the active wedge is assumed to transfer part of the load to the soil below through its own shear strength..."

It is the objective of this study to develop a simple and practical method to predict lateral seismic soil pressure for building walls.

- The walls of the buildings are often of the non-yielding type. The movement of the walls is limited due to the presence of the floor diaphragms, and displacements to allow development of the limit-state conditions are unlikely to develop during the design earthquake.
- The frequency content of the design motion is fully considered. Use of a single parameter as a measure of design motion such as peak ground acceleration may misrepresent the energy content of the motion, at frequencies important for soil amplifications.
- Appropriate soil properties are included in the analysis. For soil dynamic problems, the most important soil property is the shear wave velocity followed by the material damping, Poisson's ratio, and density of the soil.
- The method is flexible to allow for consideration of soil nonlinear effect where soil nonlinearity is expected to be important.
- The interaction between the soil and the building is represented. This includes consideration for the building rocking motion, amplification and variation of the motion in the soil, geometry, and embedment depth of the building.

SIMPLIFIED METHOD TO PREDICT LATERAL SEISMIC SOIL PRESSURE FOR BUILDING WALLS ON ROCK OR FIRM FOUNDATIONS

In this section, the dynamic characteristics of lateral seismic soil pressure for buildings with basemat resting on rock or firm soil layers are examined and a simplified method for predicting seismic soil pressure is presented. It is assumed that the building walls are effectively rigid. The condition that the basemat rests on a firm soil layer also simplifies the problem in that the rocking vibration of the buildings becomes insignificant. With this assumption, the embedment ratio of the building (embedment depth to basemat width) will not play a role in the results. The extension of the method for buildings embedded in deep soil layers is presented in the next section.

To investigate the characteristics of the lateral seismic soil pressure, a series of seismic soil-structure interaction analyses was performed using the Computer Program SASSI. A typical SASSI model of a building basement is shown in Figure 4. The embedment depth is designated by H and the soil layer is identified by the shear wave velocity, Vs, the Poisson's ratio, ν, total mass density, ρ, and the soil material damping, β. The basemat is resting on rock or a firm soil layer. A column of soil elements next to the wall is included in the model in order to retrieve the pressure responses from the results.

For this analysis, the acceleration time history of the input motion was specified at the top of the rock layer corresponding to the basemat elevation in the free-field. In order to characterize the dynamic behavior of the soil pressure, the most commonly used wave field consisting of vertically propagating shear waves was specified as input motion. The frequency characteristics of the pressure response were examined using harmonic shear waves for a wide range of frequencies. For each harmonic wave, the amplitude of the normal soil pressure acting on the building wall at three locations (Elements 2, 10, and 15 in Figure 4) was obtained. The pressure responses are presented in terms of pressure transfer function amplitudes which are the ratio of the amplitude of the seismic soil pressure in the respective element to the amplitude of the input motion (1g harmonic acceleration) in the free-field for each harmonic frequency. The analyses were performed for a building with embedment of 50 ft and soil shear wave velocities of 500, 1000, 1500, and 2000 ft/sec, all with the Poisson's ratio of 1/3. The material damping in the soil was specified to be 5%. The transfer function results for Element 2 (see Figure 4) are shown in Figure 5. As shown in this figure, the amplification of the pressure amplitude takes place at distinct frequencies. These frequencies increase as the soil shear wave velocity increases. The amplitude of soil pressure at low frequency was used to normalize the amplitude of the pressure transfer functions for each element. The frequency axis was also normalized using the soil column frequency which was obtained from the following relationship:

$$f = Vs / (4 \times H) \qquad (1)$$

In the above equation, Vs is the soil shear wave velocity and H is the embedment depth of the building. The normalized transfer functions are shown in Figure 6. As shown in this figure, the amplification of the pressure is about the same for all the shear wave velocities considered. In all cases the maximum amplification takes place at the frequency corresponding to the soil column frequency. Similarly, the results for points in the mid-height and bottom of the wall were examined (Ostadan and White, 1997). These results also showed the same characteristics described above.

Examining the dynamic characteristics of the normalized pressure amplitudes (such as those shown in Figure 6), it is readily evident that such characteristics are those of a single degree-of-freedom (SDOF) system. Each response begins at a value of one and increases to a peak value at a distinct frequency and subsequently reduces to a small value at high frequency. Dynamic behavior of a SDOF system is completely defined by the mass, stiffness and associated damping constant. It is generally recognized that response of a SDOF system is controlled by the stiffness at low frequency, by damping at resonant frequency, and by the inertia at high frequencies.

Following the analogy for a SDOF system and in order to characterize the stiffness component, the pressure amplitude at low frequencies for all elements (Elements 1 through 15 in Figure 4) was obtained and plotted as shown in Figure 7 in terms of the normalized height (Y/H, H=50 ft; Y is the distance from the base of the wall as shown in Figure 4). The pressure amplitudes at low frequency are almost identical for the wide range of the soil shear wave velocity profiles considered. The sudden increase shown at the top of the profile is due to the zero stress boundary condition near the ground surface and can be improved if finer elements are used. However, it is also generally recognized that soils particularly at shallow depths with low confining pressure have low shear strength and are subject to softening during vibration. For this reason, the normalized pressure profile was adjusted to have a vertical tip as shown in Figure 7. The shape of the normalized pressure will be used as a basis to determine seismic soil pressure along the height of the building wall. This will be discussed after the seismic soil pressure is examined for cases in which input motion is specified at the ground surface level.

A similar series of parametric studies were also performed by specifying the input motion at the ground surface level (Ostadan and White, 1997). The results of these studies also showed that the seismic soil pressure in normalized form can be represented by a single degree-of-freedom (SDOF) system. For both cases considered, the low frequency pressure profiles depict the same distribution of the pressure along the height of the wall as shown in Figure 7. This observation is consistent with the results of the analytical model developed by Veletsos and Younan (1994a). Since all the soil-structure interaction analyses were performed for the Poisson's ratio of 1/3, the pressure distribution was adjusted for the soil's Poisson's ratio using the factor recommended by Veletsos and Younan (1994a). The ψ_ν factor is defined by:

$$\psi_\nu = \frac{2}{\sqrt{(1-\nu)(2-\nu)}} \qquad (2)$$

For the Poisson's ratio of 1/3 used in the analysis, ψ_ν is 1.897. Use of ψ_ν in the formulation allows correction of the soil pressure amplitude for various Poisson's ratios. The adjusted soil pressure distribution is also shown in Figure 7. Using the adjusted pressure distribution, a polynomial relationship was developed to fit the normalized pressure curve. The relationship in terms of normalized height, y = Y/H (Y is measured from the bottom of the wall and varies from 0 to H), is as follows:

$$p(y) = -.0015 + 5.05y - 15.84y^2 + 28.25y^3 - 24.59y^4 + 8.14y^5 \qquad (3)$$

The area under the curve can be obtained from integration of the pressure distribution over the height of the wall. The total area is 0.744 in terms of normalized wall height or 0.744H for the wall with the height H.

Having obtained the normalized shape of the pressure distribution, the amplitudes of the seismic pressure can be also obtained from the concept of a SDOF. The response of a SDOF system subjected to earthquake loading is readily obtained from the acceleration response spectrum of the input motion at the damping value and frequency corresponding to the SDOF. The total load is subsequently obtained from the product of the total mass times the acceleration spectral value at the respective frequency of the system.

To investigate the effective damping associated with the seismic soil pressure amplification and the total mass associated with the SDOF system, the system in Figure 4 with wall height of 50 ft and soil shear wave velocity of 1500 ft/sec was subjected to six different input motions in successive analyses. The motions were specified at the ground surface level in the free-field. The acceleration response spectra of the input motions at 5% are shown in Figure 8. The motions are typical design motions used for analyses of critical structures. From the set of six shown in Figure 8, two motions labeled EUS local and distant are the design motions for sites in Eastern US with locations close and far away from a major fault. The ATC S1 motion is the ATC recommended motion for S1 soil conditions. The WUS motion is the design motion for a site close to a major fault in Western US. The RG1.60 motion is the standard site-independent motion used for nuclear plant structures. Finally, the Loma Prieta motion is the recorded motion from the Loma Prieta earthquake scaled to 0.3g maximum acceleration. This motion is used in the analysis as described in later sections. All motions are scaled to 0.30g and limited to frequency cut-off of 20 Hz for use in the analysis. The cut-off frequency of 20 Hz reduces the peak ground acceleration of the EUS local motion to less than 0.30g due to high frequency content of this motion as shown in Figure 8.

The maximum seismic soil pressure values at each depth obtained from the analyses for the various input motions are shown in Figure 9. The amplitudes of the pressure vary from one motion to the other with larger values associated with use of RG1.60 motion. Using the pressure profiles in Figure 9, the lateral force acting on the wall for each input motion was computed. The lateral force represents the total inertia force of a SDOF for which the system frequency is known. The system frequency for the case under consideration is the soil column frequency which is 7.5 Hz based on Eqn (1). The total force divided by the spectral acceleration of the system at 7.5 Hz at the appropriate damping ratio amounts to the mass of the SDOF. To identify the applicable damping ratio, the acceleration response spectrum of the free-field response motions at the depth of 50 ft were computed for all six motions shown in Figure 8 for damping ratios of 5, 10, 20, 30, 40, 50, and 60 percents. Knowing the total force of the SDOF, the frequency of the system, and the input motion to the SDOF system, the relationship in the form proposed by Veletsos and Younan (1994a) was used to compute the total mass and the damping of the SDOF system. For the total mass, the relationship is

$$m = 0.50 \times \rho \times H^2 \times \psi_\nu \qquad (4)$$

where ρ is the mass density of the soil, H is the height of the wall, and ψ_ν is the factor to account for the Poisson's ratio as defined in Eqn (2). In the analytical model developed by Veletsos and Younan, a constant coefficient of 0.543 was used in the formulation of the total mass. Study of the soil pressure transfer functions and free-field response motions at the depth of 50 ft showed that spectral values at the soil column frequency and at 30% damping have the best correlation with the forces computed directly from the SSI analysis. In the Veletsos and Younan's model, a damping of 27.5 + β percent has been proposed where β is the material damping of the soil (%). For the case of 5% soil material damping, the proposed spectral damping amounts to 32.5%. However, as shown by Ostadan and White (1997), the spectral values of the various motions considered are insensitive to the spectral damping ratios at the soil column frequency of 7.5. The various motions, however, have significantly different spectral values at the soil column frequency. This observation leads to the conclusion that while the frequency of the input motion particularly at the soil column frequency is an important component for magnitude of the seismic soil pressure, the spectral damping ratio selected is much less important in terms of pressure amplitudes. The role of soil material damping is discussed by Ostadan and White (1997).

Simplified Method: Computational Steps

To predict the lateral seismic soil pressure for below ground building walls resting on firm foundation and assuming rigid walls, the following steps should be taken:

1. Perform free-field soil column analysis and obtain the ground response motion at the depth corresponding to the base of the wall in the free-field. The response motion in terms of acceleration response spectrum at 30% damping should be obtained. The free-field soil column analysis may be performed using the Computer Program SHAKE (Schnabel et al., 1972) with input motion specified either at the ground surface or at the depth of the foundation basemat. The choice for location of control motion is an important decision that needs to be made consistent with the development of the design motion. The location of input motion may significantly affect the dynamic responses of the building and the seismic soil pressure amplitudes.

2. Use Eqn (4) to compute the total mass for a representative SDOF system using the Poisson's ratio and mass density of the soil.

3. Obtain the lateral seismic force from the product of the total mass obtained in Step 2 and the acceleration spectral value of the free-field response at the soil column frequency obtained at the depth of the bottom of the wall (Step 1).

4. Obtain the maximum lateral seismic soil pressure at the ground surface level by dividing the lateral force obtained in Step 3 by the area under the normalized seismic soil pressure, 0.744 H.

5. Obtain the pressure profile by multiplying the peak pressure with the pressure distribution relationship shown in Eqn (3).

One of the attractive aspects of the simplified method is its ability to consider soil nonlinear effect. The soil nonlinearity is commonly considered by use of the equivalent method and the strain-dependent soil properties. Depending on the intensity of the design motion and soil properties, the effect of soil nonlinearity can be important in changing the soil column frequency and therefore, amplitude of the spectral response at the soil column frequency.

Accuracy of the Simplified Method

The simplified method outlined above was tested for building walls with heights of 15, 30 and 50 ft using up to six different time histories as input motion. The results computed directly with SASSI are compared with the results obtained from the simplified solution. A typical comparison is shown in Figure 10. More extensive validation of the method is presented by Ostadan and White (1997).

Comparison to Other Commonly Used Solutions

The seismic soil pressure results obtained for a building wall 30 ft high embedded in a soil layer with shear wave velocity of 1000 ft/sec using the M-O, Wood and the proposed simplified methods are compared in

Figure 11. For the simplified method, the input motions defined in Figure 8 were used. The M-O method results in the smallest pressure values. This is understood since this method relies on the wall movement to relieve the pressure behind the wall. Wood's solution generally results in the maximum soil pressure and is independent of the input motion as long as the peak acceleration is 0.3 g. The proposed method results in a wide range of pressure profiles depending on the frequency contents of the input motion, particularly at the soil column frequency. For those motions for which the ground response motions at the soil column frequency are about the same as the peak ground acceleration of the input motion, e.g., RG1.60 motion, the results of the proposed method are close to Wood's solution. Similar trend in the results is observed if sum of the lateral forces and the overturning moments from the above three methods are compared (Ostadan and White, 1997).

The simplified method was extended for application to soil layered system and soil deposits with parabolic distribution of the shear modulus. The extended method and its verification are discussed by Ostadan and White (1997).

SIMPLIFIED METHOD TO PREDICT LATERAL SEISMIC SOIL PRESSURE FOR BUILDINGS IN DEEP SOIL SITES

One of the distinct dynamic characteristics of a building in a deep soil site is its rocking vibration which has a significant role on distribution of the pressure depending on the embedment ratio (embedment depth versus plan dimensions), dynamic properties of the soil, and frequency contents of the ground motion under consideration.

Mita and Luco (1989) have reported the harmonic response of an embedded square foundation subjected to vertically propagating shear waves. The results adopted from the authors but modified to reflect the same nomenclature used in this report are shown in Figure 12. The results are for a square foundation with plan dimensions of 2B x 2B and embedment depth H. The halfspace is characterized by the shear wave velocity of Vs. The free-field motion has a unit amplitude at the ground surface at each harmonic frequency. The horizontal translational motion of the foundation (D) at the middle point corresponding to the basemat motion and the normalized rocking motion represented in terms of HxT are shown in terms of dimensionless frequency ratio $a_1 = \omega x H/Vs$ where T is the angle of rocking rotation and ω is the circular frequency at each harmonic frequency under consideration. The dimensionless frequency is a measure of the harmonic shear wave length as compared to the embedment depth H. The free-field motion corresponding to the basemat depth (depth of H) in the free-field shows decreasing amplitude with increasing frequency. At the soil column frequency of $f = Vs/(4xH)$, the dimensionless frequency a1 is 1.57 at which the amplitude of the free-field motion is zero. The foundation motion is a function of the frequency of vibration and the embedment ratio (H/B).

In order to examine the effect of rocking motion on seismic soil pressure, a series of SSI analyses were performed using the soil shear wave velocities of 500, 1000, 1500, and 2000 ft/sec. In all cases, the wall height considered was H=50 ft but the foundation width (2B) was changed successively from 50 ft, to 100 ft, 200 ft, and to 400 ft, resulting in embedment ratios of B/H=0.5, 1, 2, and 4. The input motion was specified at the basemat level in the free-field. A typical result in terms of amplitude of pressure transfer function is shown in Figures 13. For each soil case, the results from all three elements are clustered together with the same peak frequency which leads to the conclusion that (1) the soil column frequency continues to be the most significant frequency for the response in terms of maximum value of the seismic soil pressure, and (2) the frequency of the peak response is not affected by the embedment ratio. However, the distribution of the maximum soil pressure in terms of amplitude of the pressure in Elements 2, 5, and 10 is significantly affected by the rocking motion of the building and thus the embedment ratio. The effects of rocking motion on distribution of maximum seismic soil pressure for four different aspect ratios are shown in Figure 14. As shown, for buildings with narrow width, the rocking motion tends to reduce the amplitude of the soil pressure at top of the wall.

The results of the parametric studies performed for deep soil sites were also examined in detail. Limitation of space prohibits detail discussion of the studies performed. The computational steps for deep soil sites are, however, similar to the rigid case and consist of the following:

1. Perform free-field soil column analysis and obtain the response motion in terms of acceleration response spectrum at 30% damping at the depth corresponding to the basemat elevation in the free-field.
2. Obtain the soil column frequency using Eqn (1) and obtain the spectral value at the soil column frequency using the results of Step 1.
3. Use the following relationship to obtain the lateral force acting on the wall:

$$F = \alpha \times \rho \times H^2 \times Sa \times \Psi_v \qquad (5)$$

where ρ is the mass density of the soil, H is height of the wall, Sa is the spectral value of the free-field response obtained in Step 2, and Ψ_v is the function that considers the effect of soil Poisson's ratio and can be obtained using Eqn (2). In order to represent the effect of the embedment ratio and reduction of soil pressure due to rocking motion as well as its increase beyond the rigid base cases for wide buildings, the parameter α is defined in the equation above. This parameter was determined from back-calculation of the lateral force obtained from soil pressure and the shear stress under the basemat to hold the equilibrium of forces in the horizontal direction. Using the results of the all the parametric studies, the following values were obtained for α:

Embedment Ratio, B/H	Parameter α
0.50	0.27
1.0	0.43
2.0	0.62
4.0	0.92

4. Obtain the maximum soil pressure by dividing the lateral force obtained from Step 3 to the area under the soil pressure curve provided in Eqns(6) through (9) below depending on the embedment ratio. For an embedment ratio that falls in between the ratios considered, use interpolation.

Embedment ratio of B/H=0.50

$p(y) = -2.58y^3 + 0.32\,y^2 + 2.46\,y - 0.03$ (6)

Maximum pressure at the depth y = 0.625

Area under the curve = 0.632H

Point of application for resultant force, Y = 0.55H

Embedment ratio of B/H=1.0

$p(y) = 0.60y^3 - 3.09y^2 + 3.34y - 0.025$ (7)

Maximum pressure at the depth y = 0.625

Area under the curve = 0.77H

Point of application for resultant force, Y = 0.58H

Embedment ratio of B/H=2.0

$p(y) = -1.33y^4 + 4.38y^3 - 5.66y^2 + 3.44y + 0.17$ (8)

Maximum pressure at top of the wall y = 1

Area under the curve = 0.832H

Point of application for resultant force, Y = 0.57H

Embedment ratio of B/H=4.0

$p(y) = -0.085y^2 + 0.47y + 0.61$ (9)

Maximum pressure at top of the wall y = 1

Area under the curve = 0.82H

Point of application for resultant force, Y = 0.54H

5. Multiply the maximum lateral soil pressure from Step 4 by the relationships provided in Eqns (6) through (9) to get the pressure distribution depending on the embedment ratio of the foundation under

consideration. Judgment should be exercised to obtain the distribution for embedment ratios in between the four embedment ratios considered above.

The simplified method for deep soil sites was also tested extensively for a wide range of soil properties and foundation embedment ratios (Ostadan and White, 1997).

A comparison of the simplified method with the M-O and Wood's methods for a building with four different embedment ratios is shown in Figure 15. The results clearly demonstrates the effect of the rocking motion on distribution of the seismic soil pressure.

SUMMARY AND CONCLUSION

The Mononobe-Okabe (M-O) method was developed in the 1920's. Since then, a great deal of research work has been performed to evaluate its adequacy and to improve it. The method is, strictly speaking, applicable to gravity retaining walls which, upon experiencing seismic loading, undergo relatively large movement to initiate the sliding wedge behind the wall and to relieve the pressure to its active state. Unfortunately, the method has been and continues to be used extensively for embedded walls of the buildings as well. Recent field observations and experimental data, along with enhancements in analytical techniques have shown that hardly any of the assumptions used in the development of the M-O method are applicable to building walls. The data and the follow up detail analysis have clearly shown that the seismic soil-pressure is an outcome of the interaction between the soil and the building during the seismic excitation and as such is function of all parameters that affect soil-structure interaction (SSI) response. Some of the more recent observations and experimental data were presented in the paper. The new understanding of the attributes of seismic soil pressure prompted the United Sates Nuclear Regulatory Committee (NRC) to reject the M-O and the M-O based methods for application to critical structures. At this time, while elaborate finite element techniques are available to obtain the soil pressure for design, no simple method has been proposed for quick prediction of the maximum soil pressure, thus hindering the designer's ability to use an appropriate method in practice. To remedy this problem, the current research was conducted to develop a simple method which incorporates the main parameters affecting the seismic soil pressure for buildings.

Using the concept of the single degree-of-freedom, a simplified method was developed to predict maximum seismic soil pressures for buildings resting on firm foundation materials. The method incorporates the dynamic soil properties and the frequency content characteristics of the design motion in its formulation. It was found that the controlling frequency that determines the maximum soil pressure is that corresponding to the soil column adjacent to the embedded wall of the building. The proposed method requires the use of conventionally-used simple one-dimensional soil column analysis to obtain the relevant soil response at the base of the wall. More importantly, this approach allows soil nonlinear effects to be

considered in the process. The effect of soil nonlinearity can be important for some applications depending on the intensity of the design motion and the soil properties. Following one-dimensional soil column analysis, the proposed method involves a number of simple hand calculations in order to arrive at the distribution of the seismic soil pressure for design. The accuracy of the method relative to the more elaborate finite element analysis was verified for a wide range of soil properties, earthquake motions, and wall heights.

The method was extended to include buildings on deep soil sites . The complexity of the seismic soil pressure for such cases is compounded by the rocking motion of the structure. The rocking motion is in turn, a function of soil properties, frequency content of the design motion, and embedment ratio of the structure. A wide range of parametric studies were performed that cover many practical cases. The steps for the analysis are similar to the steps outlined for buildings on rock except that an appropriate pressure distribution curve should be selected to observe the effect of the embedment ratio. Similarly, the accuracy of the proposed method was verified against a more detailed SSI analysis.

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KINNEY
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November 14, 2016

John McGrew
9831 Main Tree Drive
Anchorage, AK 99507

Subject: Christensen Drive and 2nd Avenue Development Traffic Impact Analysis

Dear Mr McGrew:

This letter conveys our investigation of the traffic impacts that can be expected to occur as a result of the proposed development of the Alaska Railroad Corporation parcel on the Northwest corner of the intersection of Christensen Drive and West 2nd Avenue (Christensen and 2nd). Based on a conversation with the Municipality of Anchorage (MOA) Traffic Department in July of 2016, this study focused on validating sight distance at the proposed driveways, measuring clearances from the intersection of Christensen and 2nd, and analyzing the performance of the intersection at Christensen and 2nd with and without the proposed development. This scope of work is consistent with the MOA's Traffic Impact Analysis policy for small developments (<100 vehicles per hour). This study shows that the proposed driveways have adequate sight distance and intersection clearance and the additional traffic generated on the site will have an insignificant impact on the performance of the stopped approaches of Christensen and 2nd, which is currently operating at satisfactory levels of service.

Background

The tract in question is approximately 1.7 acres. In general, the lot is level with a steep grade descending on the north side of the site. The lot frontage extends approximately 470 feet along 2nd Avenue to the west of the intersection, and approximately 250 feet along Christensen Drive to the north of the intersection. The lot is currently developed with a vacant Alaska Railroad structure, which would be removed as a part of this project. There are three existing driveways onto the site, one onto Christensen Drive and two onto 2nd Avenue. The driveway onto Christensen is approximately 90 feet north of the intersection of Christensen and 2nd. The two driveways onto 2nd Avenue are approximately 50 feet and 200 feet west of the intersection.

The Municipality of Anchorage 2014 Official Streets and Highways Plan classifies Christensen Drive as a "Neighborhood Collector" from 3rd Avenue through the entire length of the project site. 2nd Avenue is classified as a "Local Road". Both streets have posted speed limits of 25 miles per hour.

2nd Avenue terminates west of the study site. At the western end of 2nd Avenue is the northern terminus of the Tony Knowles Coastal Trail. This trail is heavily used by pedestrians and bicyclists which then travel adjacent to the project site. Many of the trips on the Coastal Trail travel to or from the Ship Creek Trail, which is north of the study site along Christensen Drive.

The proposed development includes 28 condominium units. The development will access the road network with two separate driveways. The main driveway will serve 22 of the new residential units and access Christensen Drive approximately 230 feet north of the Christensen and 2nd intersection. The second driveway will serve the remaining six residential units and access the road network at a

new driveway onto 2nd Avenue, approximately 230 feet west of the intersection. The site plan used for this analysis is attached.

Figure 1 on page 2 shows a map of the project vicinity.

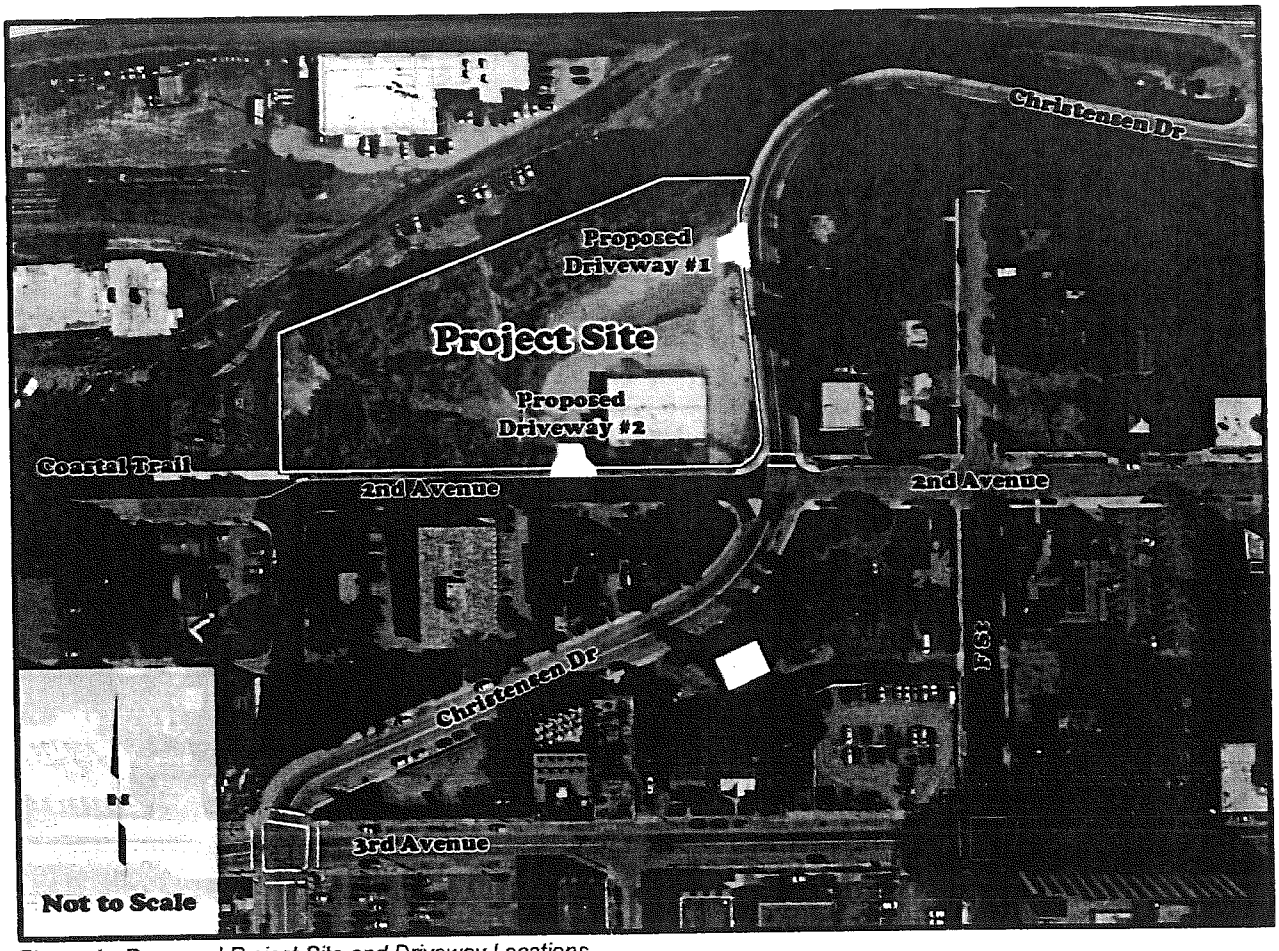


Figure 1 - Proposed Project Site and Driveway Locations

Sight Distance Analysis

The Municipality of Anchorage's *Design Criteria Manual 2007* defines the design parameters for driveways in an attached memo dated December 11, 2006. In this memo, the required sight distance at driveways is intersection sight distance for a vehicle turning left across traffic from a stop, as defined by the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on the Geometric Design of Highways and Streets 2011.*

The sight distance in the required case is contingent on the grade of the major road approach. Grades were measured by Kinney Engineering, LLC (KE) on the various approaches to the proposed driveways and the approaches to the intersection of 2nd and Christensen. The results of the approach grade study are shown in Figure 2 on page 3.

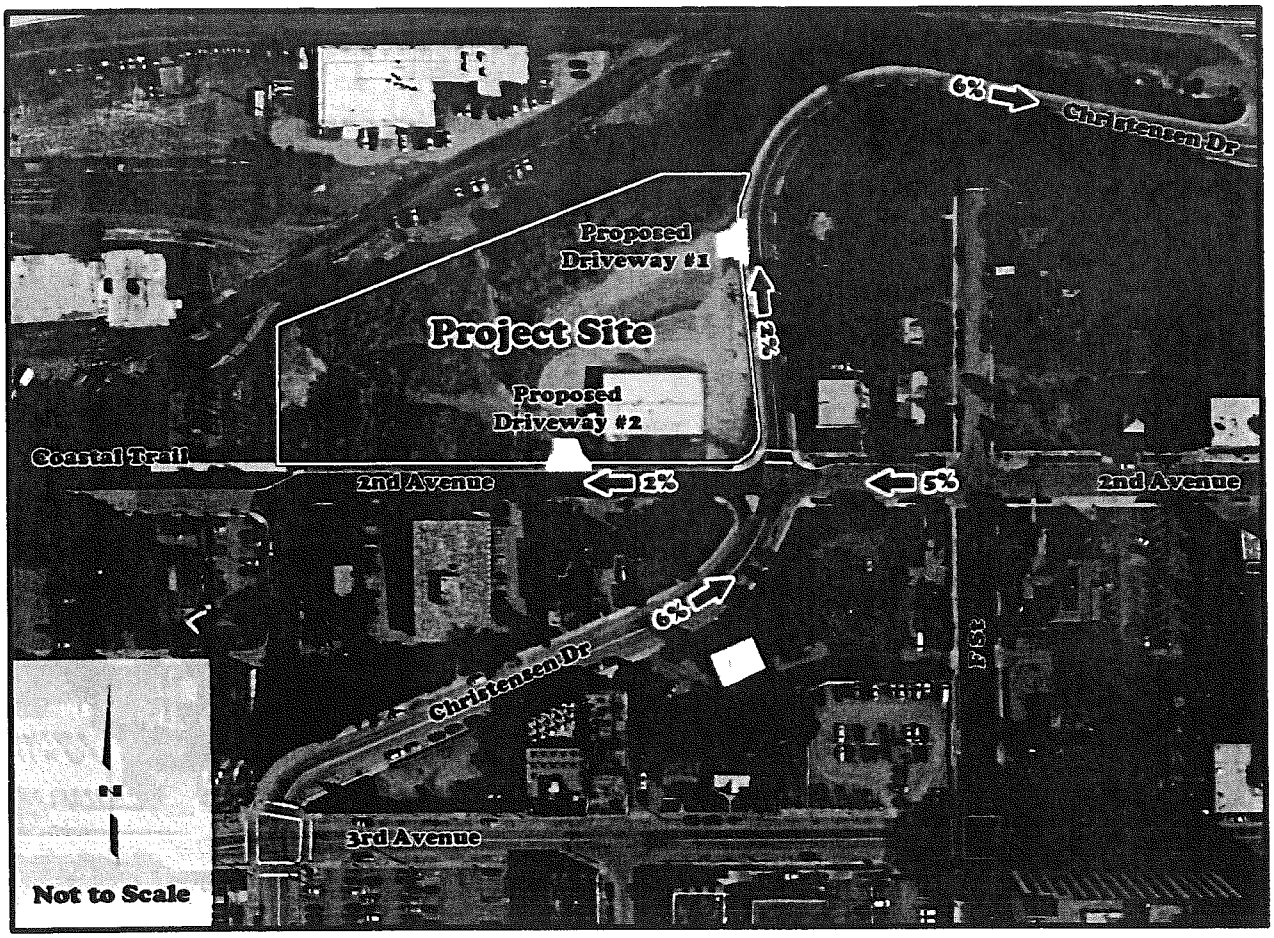


Figure 2 - Road Grades

At 25 miles per hour on a 6% upgrade, the required sight distance is 252 feet. The required sight distance on a downgrade is 308 feet. The sight distance requirement on 2nd Avenue where grades are less than 6% is 280 feet in either direction. Intersection sight distance on the 2nd Avenue driveway is 300 feet to the end of the road to the west, and over 400 feet to the east through the stop controlled intersection.

Curves along Christensen Avenue north and south of the site raised concerns about sight distance at Driveway #1. The available sight distance at the proposed driveways were measured by KE in August of 2016. Sight distance measurements were made using AASHTO green book methodology, which measured the in lane distance from the first point on the approach road where there is unobstructed sight to a point at the driveway 3.5 feet high and 14.5 feet off the traveled way.

The results of the sight distance study are shown in Figure 3 on page 4.

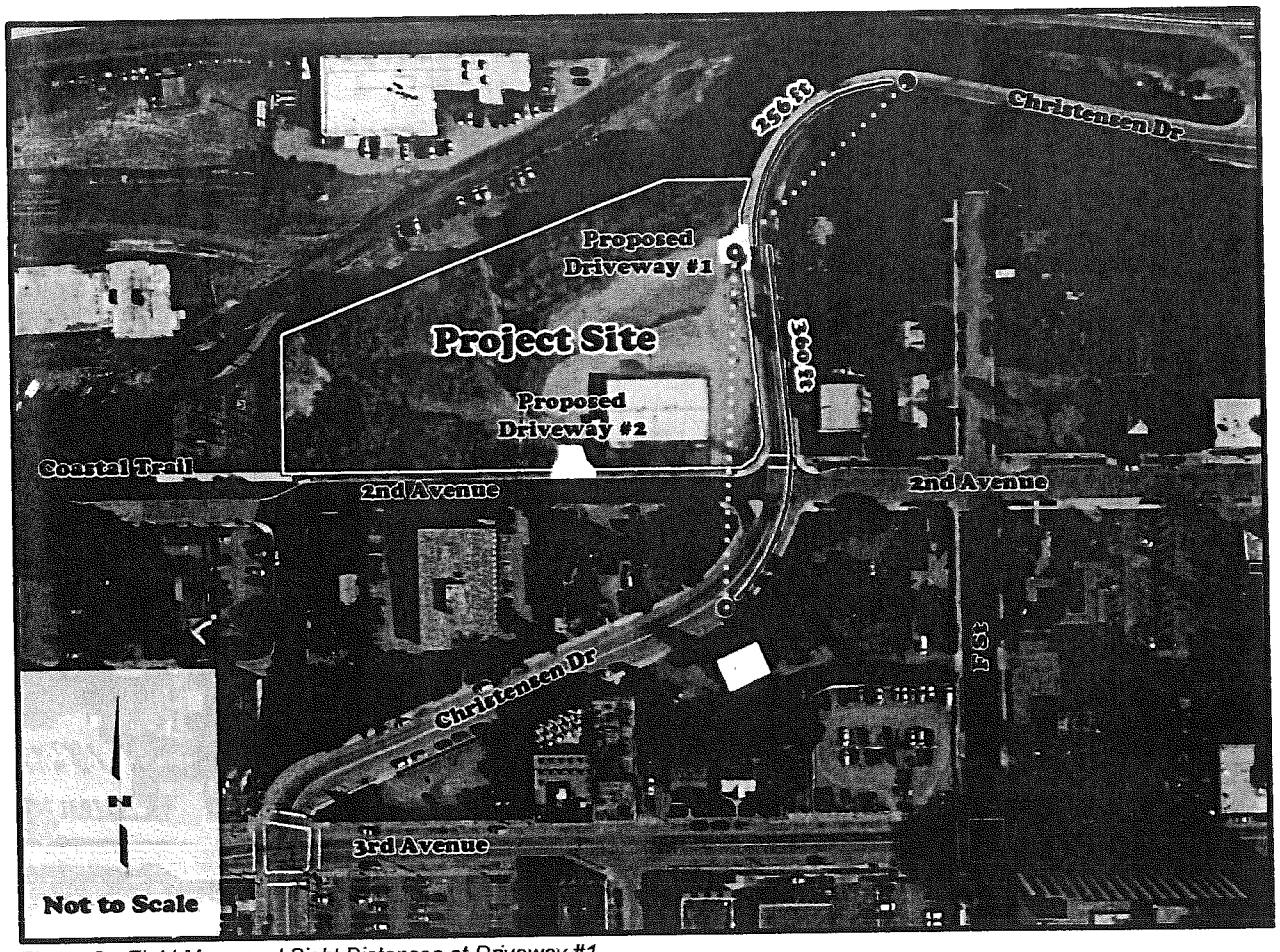


Figure 3 - Field Measured Sight Distances at Driveway #1

The field measured sight distance to the north of driveway #1 is 256 feet, which exceeds the required distance of 252 feet. Note that the sight line is through the parking lot on the south side of Christensen. The sight line was partially obstructed by parked vehicles and a short fence until a distance of 230 feet prior to the driveway. The case of partial obstruction by trees and other objects is allowed in AASHTO.

Note, that the absolute minimum sight distance for the southbound approach, per AASHTO, is stopping sight distance which is 140 feet at 25mph on a 6% upgrade.

Figure 4 on page 5 shows a photo taken at the point near where the driveway is first visible traveling southbound on Christensen Drive.

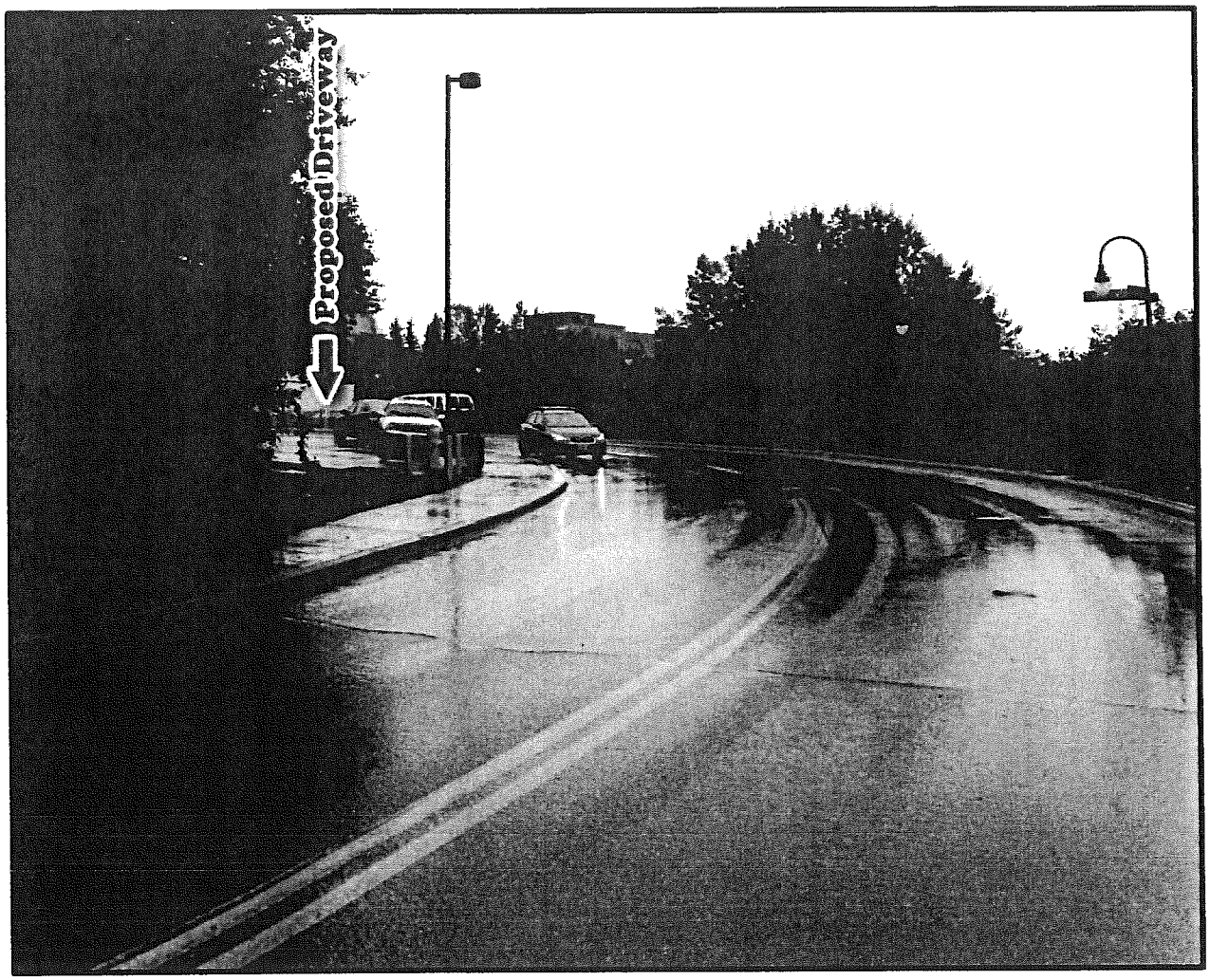


Figure 4 - Sight Distance to Driveway #1 through Parking Lot

The field measured sight distance to the south of driveway #1 is 360 feet, which exceeds the required 308 feet for intersection sight distance and 173 feet for stopping sight distance.

Intersection Performance Analysis

The Christensen and 2nd intersection is two way stop control with free movements along Christensen and stop control for both of the 2nd Avenue approaches. The performance of the intersection was studied by first observing existing turning movement volumes between the hours of 5:00 and 7:00 on Wednesday, August 24, 2016. Performance during the peak hour period was computed using 2010 Highway Capacity Manual methodology in Synchro software.

Figure 5 on page 6 shows the observed turning movement volumes and the performance grades on each of the approaches.

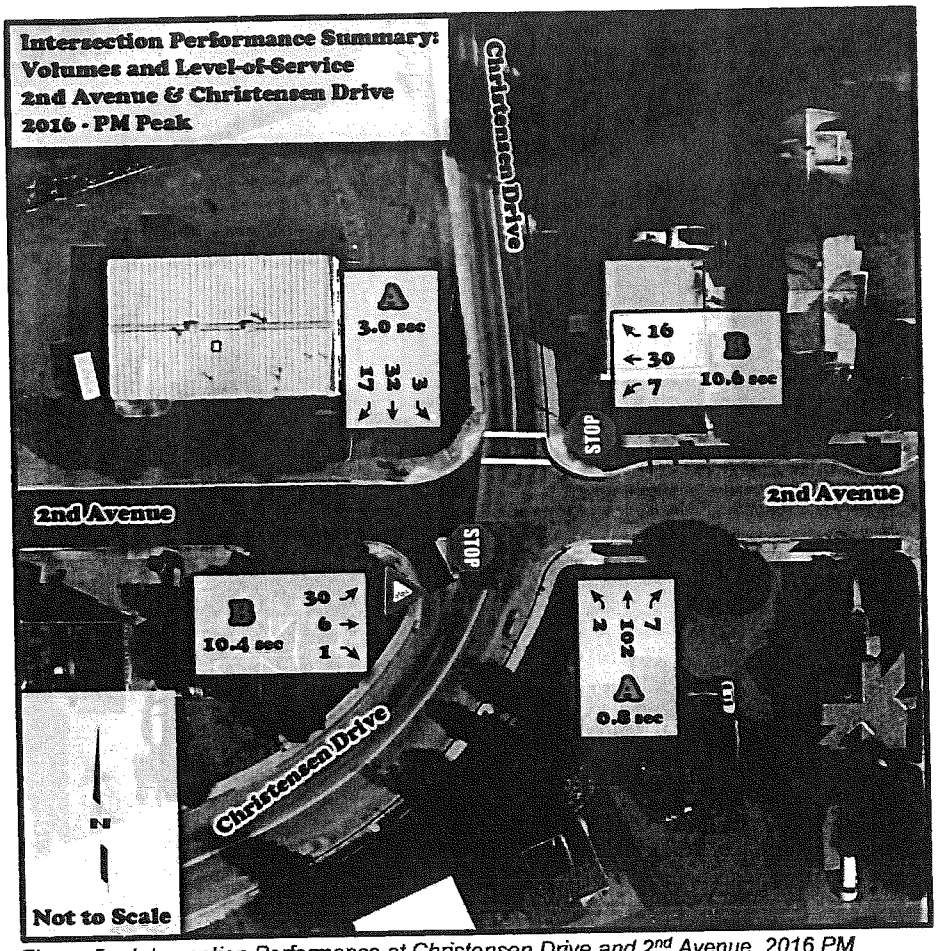


Figure 5 – Intersection Performance at Christensen Drive and 2nd Avenue, 2016 PM

MOA strives to maintain at least LOS D (maximum delay of 35 seconds) at the intersection of a local road and a collector.

The new development will add additional traffic to the intersection. However, the proposed development of 28 condominium units will generate relatively low levels of traffic.

The Institute of Transportation Engineer's (ITE) *Trip Generation* (9th Edition), reports that the average trip generation for residential condominium/Townhouses (land use 230) is as follows:

Land Use and Inputs			Trip Generation by Period						
Land Use No.	Description	Units	Daily Trips	AM Peak Trips	AM in	AM out	PM Peak Trips	PM in	PM out
230	Residential Condominium/Townhouse	28	213	19	4	15	21	14	7

PM peak hour trips are projected to be 65 percent entering and 35 percent exiting. Six out of the total 28 units will share a driveway onto 2nd Avenue with the remaining units using a common driveway onto Christensen Drive. The increased volumes were overlaid onto the observed volumes and the effect of the new volumes were less than a half second of increased delay. None of the performance grades would be diminished as a result of the development.

Intersection Clearance

The MOA design standards for driveways include recommended corner clearance from intersections. The clearances are based on the per hour traffic volumes produced by the generator, the functional classification of the road, and whether the road is curbed or uncurbed.

The conditions on Driveway #1 require 60 feet of separation from the intersecting cross street. The proposed location provides 230 feet of separation. Likewise, the required clearance for Driveway #2 is 40 feet, and the available clearance at the current proposed location is 90 feet. Therefore, the proposed driveway locations exceed the required clearances.

Summary

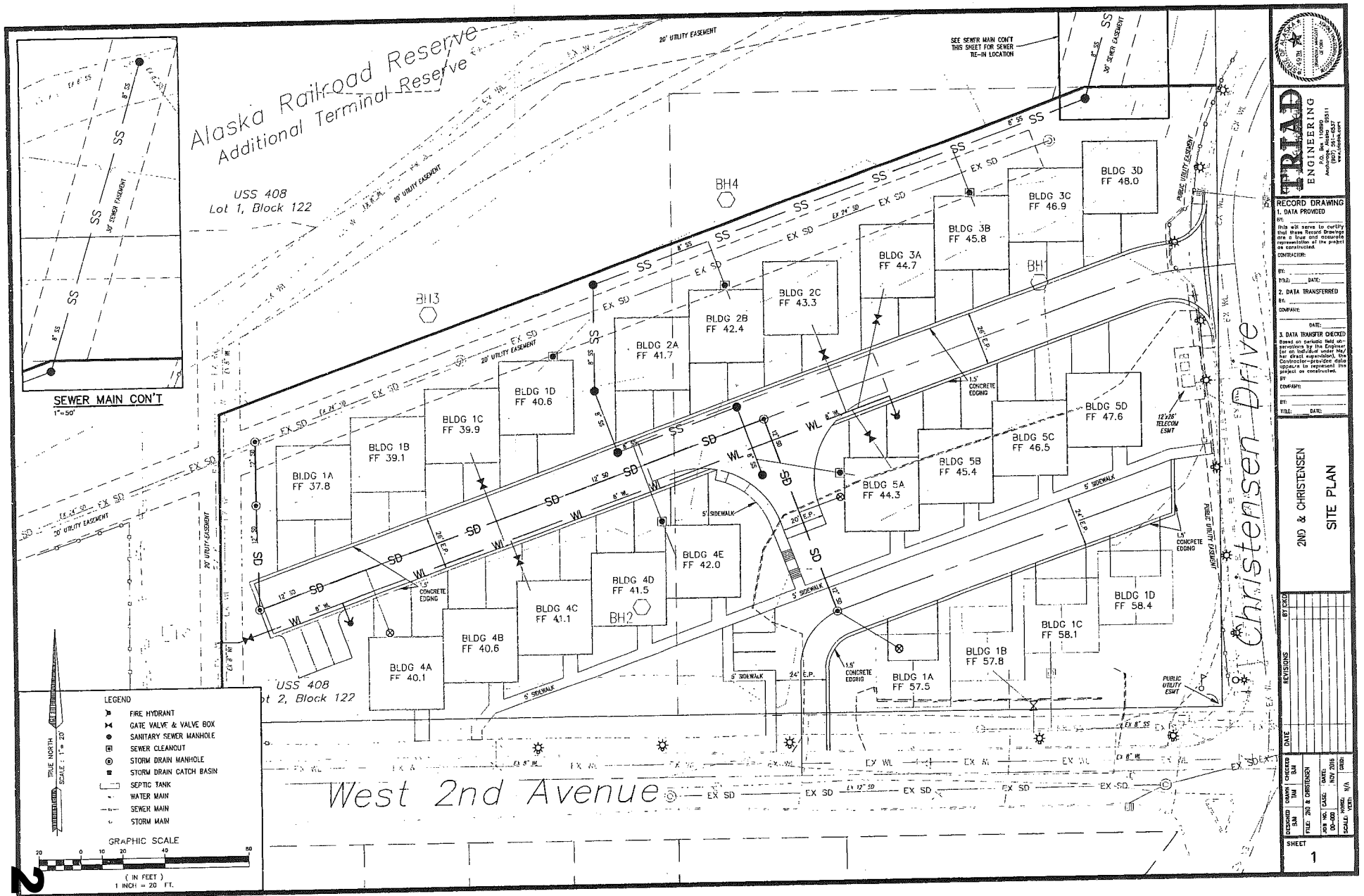
The proposed construction of 28 condominium units northwest of the intersection of Christensen Drive and 2nd Avenue will generate approximately 213 daily vehicle trips, 21 of which will occur in the PM peak hour. This additional traffic will not reduce the level of service at the adjacent intersection below the existing level of service B. In addition, the proposed driveway locations meet MOA corner clearance and sight distance requirements.

Sincerely,

KINNEY ENGINEERING, LLC

Will Webb, P.E., PTOE
Senior Civil Engineer

Attachments: Site Plan



RECORD DRAWING
1. DATA PROVIDED
BY:
this will serve to certify that these Record Drawings are a true and accurate representation of the project as constructed.
CONTRACTOR:
BY:
TITLE: DATE:
2. DATA TRANSFERRED
BY:
COMPANY:
DATE:
3. DATA TRANSFER CHECKED
Based on periodic field observations by the Engineer (or an individual under his/her direct supervision), the Contractor-provider data appears to represent the project as constructed.
BY
COMPANY:
BY:
TITLE: DATE:

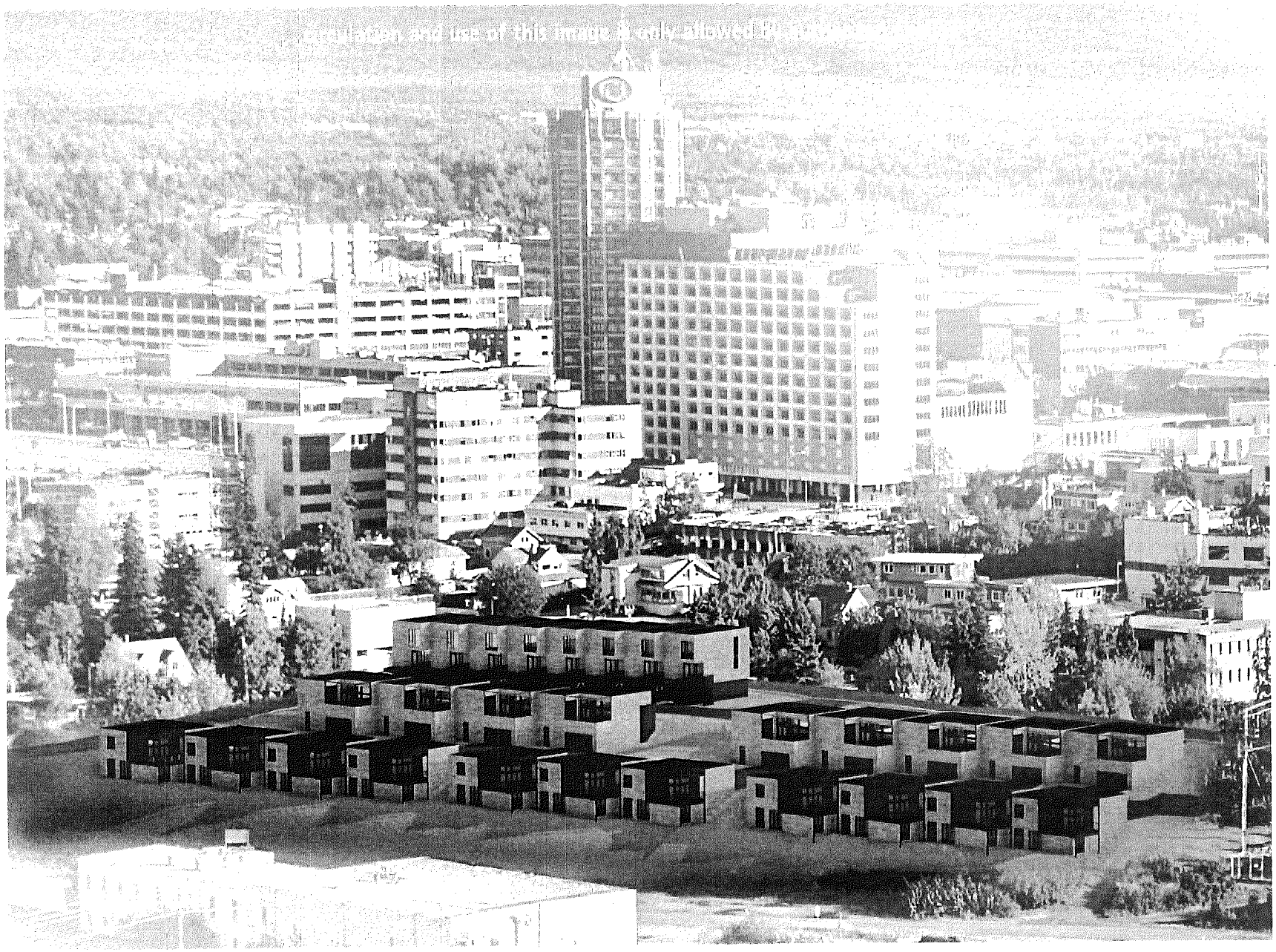
2ND & CHRISTENSEN
SITE PLAN

REVISIONS	BY CKD	DATE

DESIGNED	DRAWN	CHECKED	DATES:
BJM	TJM	BJM	NOV 2016
FILE: 2ND & CHRISTENSEN	JOB NO. 16-000	CASE:	SCALE: 1" = 20'
			HORIZ:
			VERT:
			GRID: N/A

SHEET 1

235



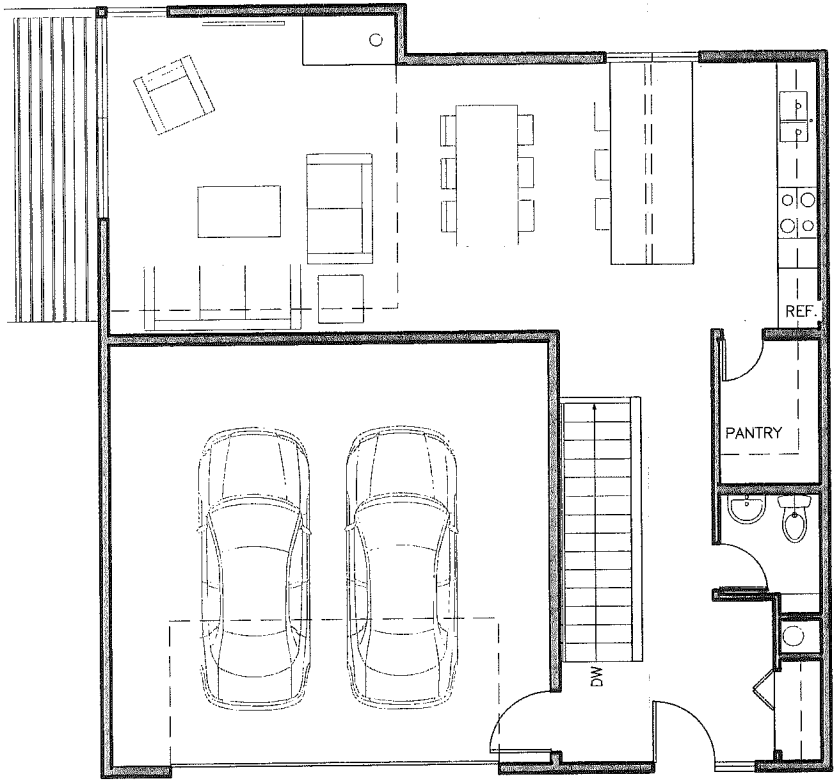
overall aerial view

237

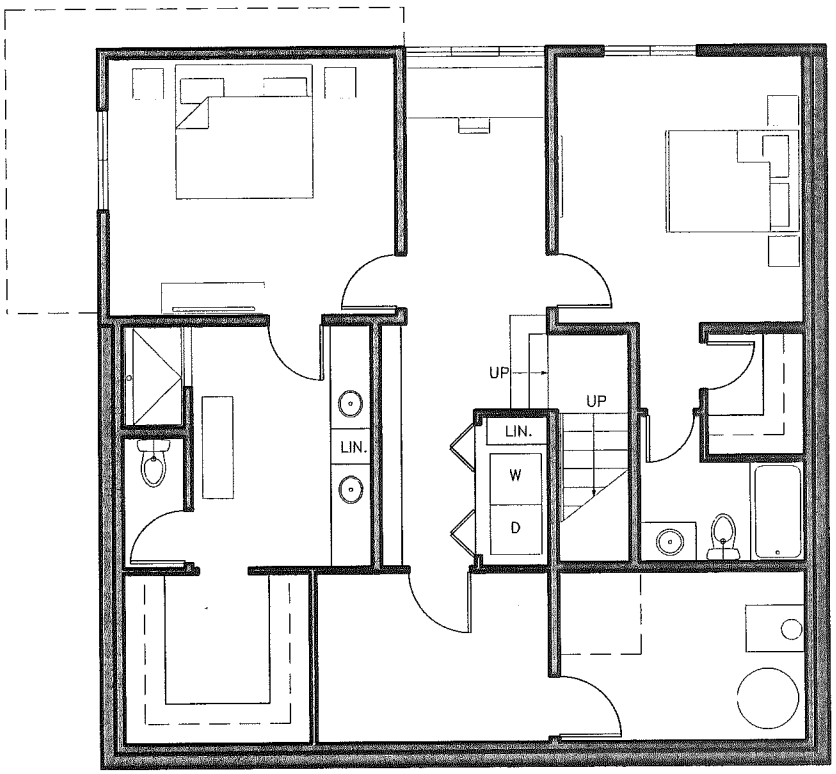
site plan

50' _____

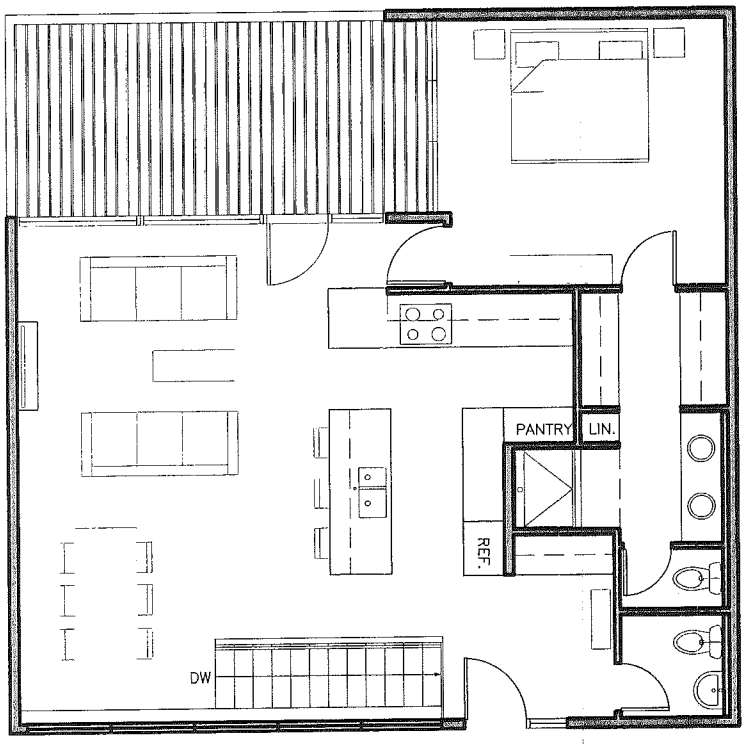
arrc lumen design 12 15 2016



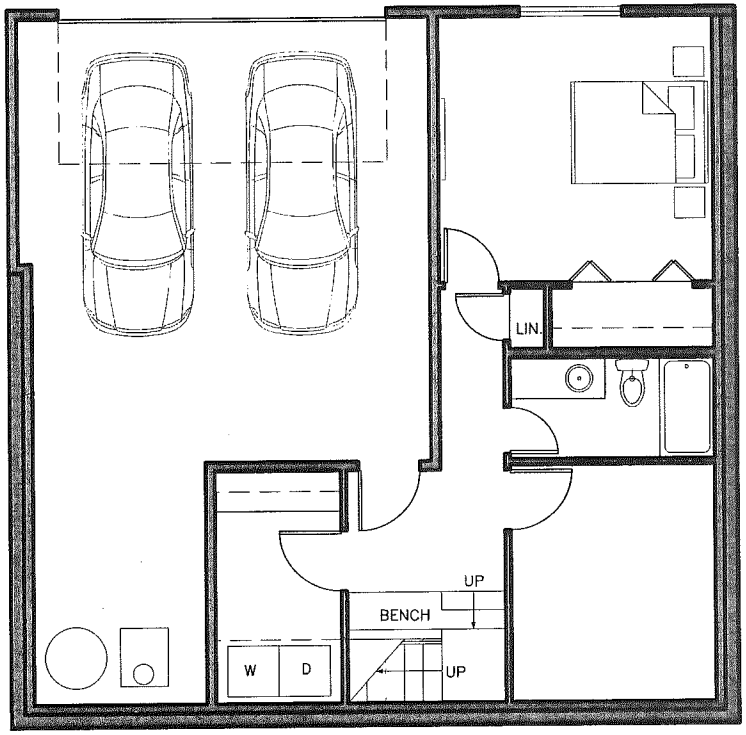
level 2:
821 gross sf living
477 gross sf garage
54 gross sf deck



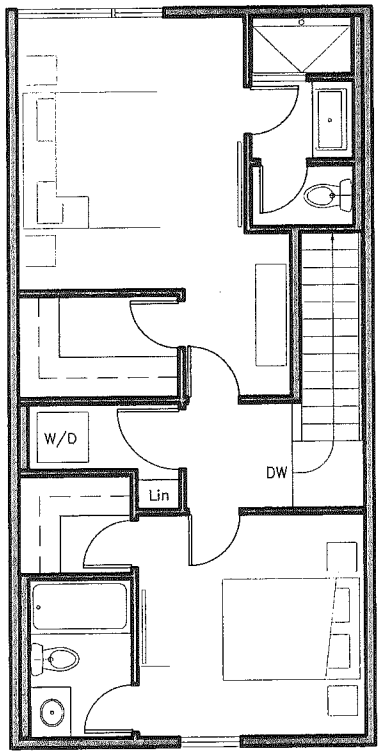
level 1:
1129 gross sf living
131 gross sf utility storage



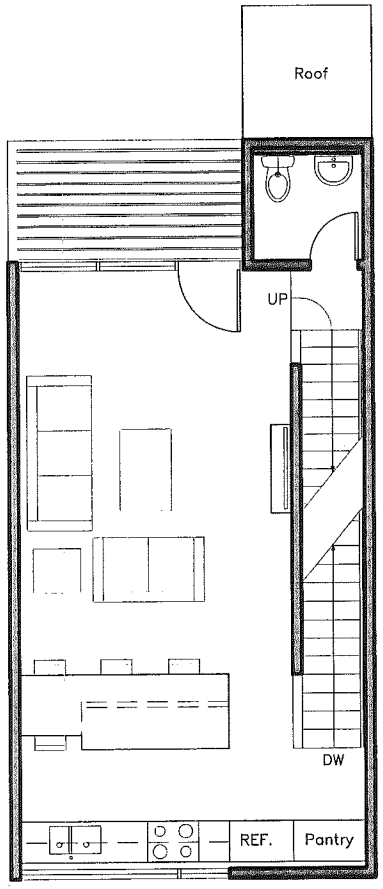
level 2:
1055 gross sf living
205 gross sf deck



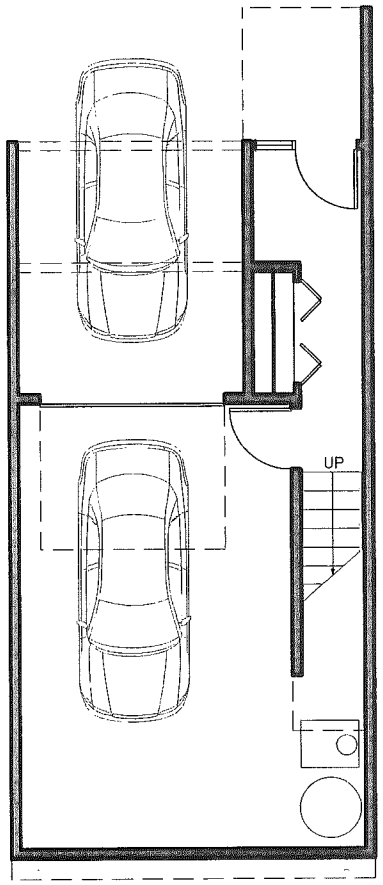
level 1:
670 gross sf living
590 gross sf garage



level 3:
625 gross sf living



level 2:
542 gross sf living
72 gross sf deck



level 1:
141 gross sf living
351 gross sf garage

MUNICIPALITY OF ANCHORAGE

Project Management & Engineering
4700 Elmore Road
Anchorage, AK 99517

Ph: 907.343.8135
Fax: 907.343.8088

Mayor Ethan Berkowitz

December 2, 2016

Mr. Brandon Marcott, P.E.
Triad Engineering
1300 East 68th Avenue, Suite 210
Anchorage, AK 99511

Re: 2nd & Christensen – Street Section Modifications

Dear Mr. Marcott:

We have reviewed your request for our concurrence of alternate street sections for the private streets in this proposed development. For the lower street, you are requesting approval for a 26-foot wide street, measured to edge of pavement. You also propose to eliminate curb and gutter, and install an inverted crown on the lower street. You propose to treat the upper street as a private driveway with a width of 24 feet measured to edge of pavement. You propose to eliminate curb and gutter on one side of this street.

Lower Road:

We have no objection to your proposal to install an inverted crown section.

Regarding elimination of curb and gutter on this street; the site plan you provided shows 1.5-foot wide concrete edging on both sides of the street. The concrete edging is not shown on the typical section included in your letter. We have no objection to eliminating the curb and gutter as long as the concrete edging is installed. This configuration would be in general conformance with AMCR 21.90.003.F.1.a which requires that private streets have a total width of 30 feet to back of curb.

Upper Road/Driveway:

The Fire Marshal will need to approve the proposal to treat this street as a private driveway. Presuming the Fire Marshal has no objection, we would have no objection to your proposal to install a tipped section and eliminate curb and gutter on one side of the street.

Our concurrence for these reduced street sections is contingent on a minimum driveway length of 22 feet at the center of each driveway, measured to the back of the concrete edging.

Your letter includes proposed structural sections for the upper and lower road. You have not requested a variance from the requirements for structural section. Upon initial review, the sections shown in the letter do not comply with the requirements of the DCM, and a variance request would be required.

Our concurrence of your proposed street sections is contingent upon approval by the Fire Marshal. We have not reviewed the submittal for compliance with applicable codes and policies related to fire access.

No other aspects of this project have been reviewed for variances and none are granted. This variance is based on the information submitted and ultimate responsibility for the adequacy of the design solution continues to reside with the design engineer.

Should you have questions regarding this response or wish to discuss it further, please call Kent at 343-8159 or Stephanie at 343-8070.

Sincerely,

Kent Kohlhase, P.E.
Acting Municipal Engineer

Stephanie L. Mormilo, P.E.
Municipal Traffic Engineer

cc: J.W. Hansen, Director – PM&E
Jason Moncrieff, P.E., Private Development Manager
Cleo Hill, Fire Marshal

TRIAD
ENGINEERING

PHYSICAL
1300 E. 68th Ave., Suite 210
Anchorage, AK 99518

MAILING
P.O. Box 110890
Anchorage, AK 99511

OFFICE
907-561-6537

June 7th, 2016

Municipality of Anchorage
Project Management & Engineering
4700 Elmore Rd.
Anchorage, Alaska 99519-6650

Attention: Stephanie Mormilo P.E., Municipal Traffic Engineer
Subject: 2nd & Christensen, Driveway Lengths
Master Fill and Grade Permit Number TBD

Ms. Mormilo,

This letter is a request for your concurrence of the driveway length for the 2nd and Christensen development. The proposed development resides within Alaska Railroad Corporation property located north of 2nd Avenue and west of Christensen Drive in Anchorage, Alaska. The subject development proposes to construct 24 single family units with two associated private drives that provide access. Nearly 40 feet of vertical relief occurs across the site with a high elevation of 56 in the SE corner down to elevation 18 along the NW row of buildings.

As shown in the attached site plan, the topographic relief creates challenges for building placement. The northerly tier of buildings is located along the bluff which consists of 20 to 40% grades. In an effort to keep the units from being placed too far down the slope driveway depth is kept as short as feasible. The proposed orientation of the driveway is roughly 70 degrees to the road centerline as shown in Figure 1.

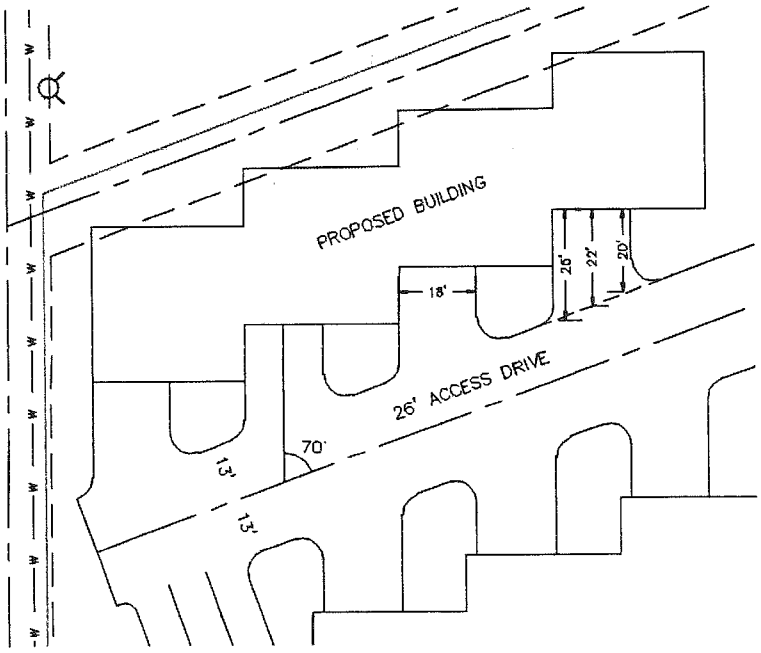


Figure 1

Centerline of the drive will be a minimum length of 22' in compliance with code requirements. The short side of the driveway will maintain a minimum length of 20'. Please note that this side of the driveway is not needed for parking calculations although it is anticipated that it will be used for parking.

In summary the proposed driveway configuration meet the required parking calculations and the intent of code while minimizing negative impacts to the site plan. Triad Engineering respectfully

requests your concurrence of the above design approach prior to submittal of the site plan to Planning with the understanding that a formal variance request will follow as the design plans are finalized.

Thank you for your time and consideration in this matter. If you have any questions or require additional information, please call 344-3114 or email me at brandonmarcott@triadak.com.

Sincerely,

TRIAD ENGINEERING

Brandon Marcott, P.E.

Concur

Stephanie Mormilo, P.E.
Municipal Traffic Engineer

6/21/16
Date

Cc: Dave Grenier, P.E., Triad Engineering
Tony Hoffman, P.L.S., The Boutet Company, Inc.
Petra Sattler-Smith, Lumen Design
John McGrew
Glenn Gellert
Trevor Edmondson
Francis McLaughlin

Authorization Certificate

Date: December 14, 2016

Current Project Legal Description:

A parcel of land located within the Alaska Railroad Anchorage Reserve situated in the Anchorage Recording District, Third Judicial District, State of Alaska and further described as follows:

A portion of Lots 1 and 2, Block 122, East Addition to Anchorage Original Town Site, U.S. Survey 408, Anchorage, Alaska, and;

A portion of Lot 2 U.S. Survey 1170, Anchorage, Alaska.

Proposed Legal: Same

Type of Authorization: Preliminary Plat and Site Plan Applications

Statement:

I hereby authorize Tony Hoffman of The Boutet Company Inc. to represent The Alaska Railroad Corporation in the Municipality of Anchorage Platting and Site Plan Applications of the above described property.

Thank you,

12/15/2016

James Kubitz
Vice President, Real Estate
Alaska Railroad Corporation

date

WMS Archive File Name: 16ARPReserve

WMS WATERCOURSE MAPPING SUMMARY

Per the requirements for watercourse verification outlined in Project Management and Engineering Operating Policy and Procedure #8 and Planning Department Operating Policy and Procedure #1 (*effective June 18, 2007*), MOA Watershed Management Services has inspected the following location for the presence or absence of stream channels or other watercourses, as defined in Anchorage Municipal Code (21.35).

- Project Case Number or Subdivision Name: 2nd and Christensen Site Plan Application
- Project Location, Tax ID, or Legal Description: 002-071-27-000, 001-021-07-000
- Project Area (if different from the entire parcel or subdivision): Project Area includes only portion of parcel # 00102107 shown on the attached figure. -KBC

In accordance with the requirements and methods identified, WMS verifies that this parcel, project area, or application:

_____ **DOES NOT** contain stream channels and/or drainageways, as identified in WMS field or archival mapping information.*

X KBC **DOES** contain stream channels and/or drainageways ***AND*** these are located and identified on submittal documents in general congruence with WMS field and archival mapping information.
*New or additional mapping **IS NOT REQUIRED**.**

_____ Contains stream channels and/or drainageways ***BUT*** one or more streams or other watercourses:
- are ***NOT*** shown on submittal documents, or
- are ***NOT*** depicted adequately on submittal documents for verification, or
- are ***NOT*** located or identified on submittal documents in general congruence with WMS field and archival mapping information.

*New or additional mapping **IS REQUIRED** and must be re-submitted for further review and verification.**

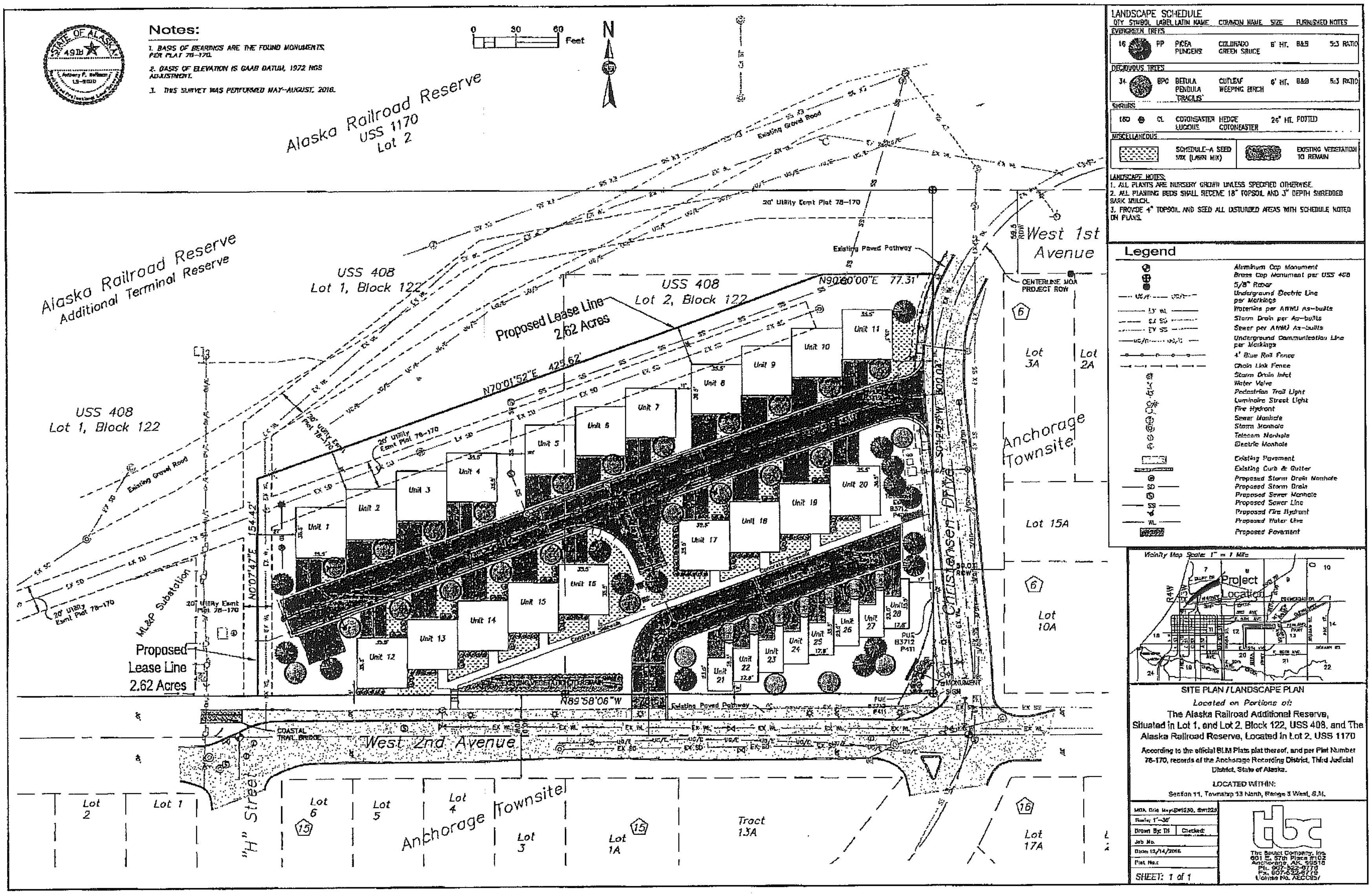
_____ Presence of stream channels and/or drainageways is unknown ***AND*** field verification is not possible at this time. WMS will verify as soon as conditions and prioritized resources allow.

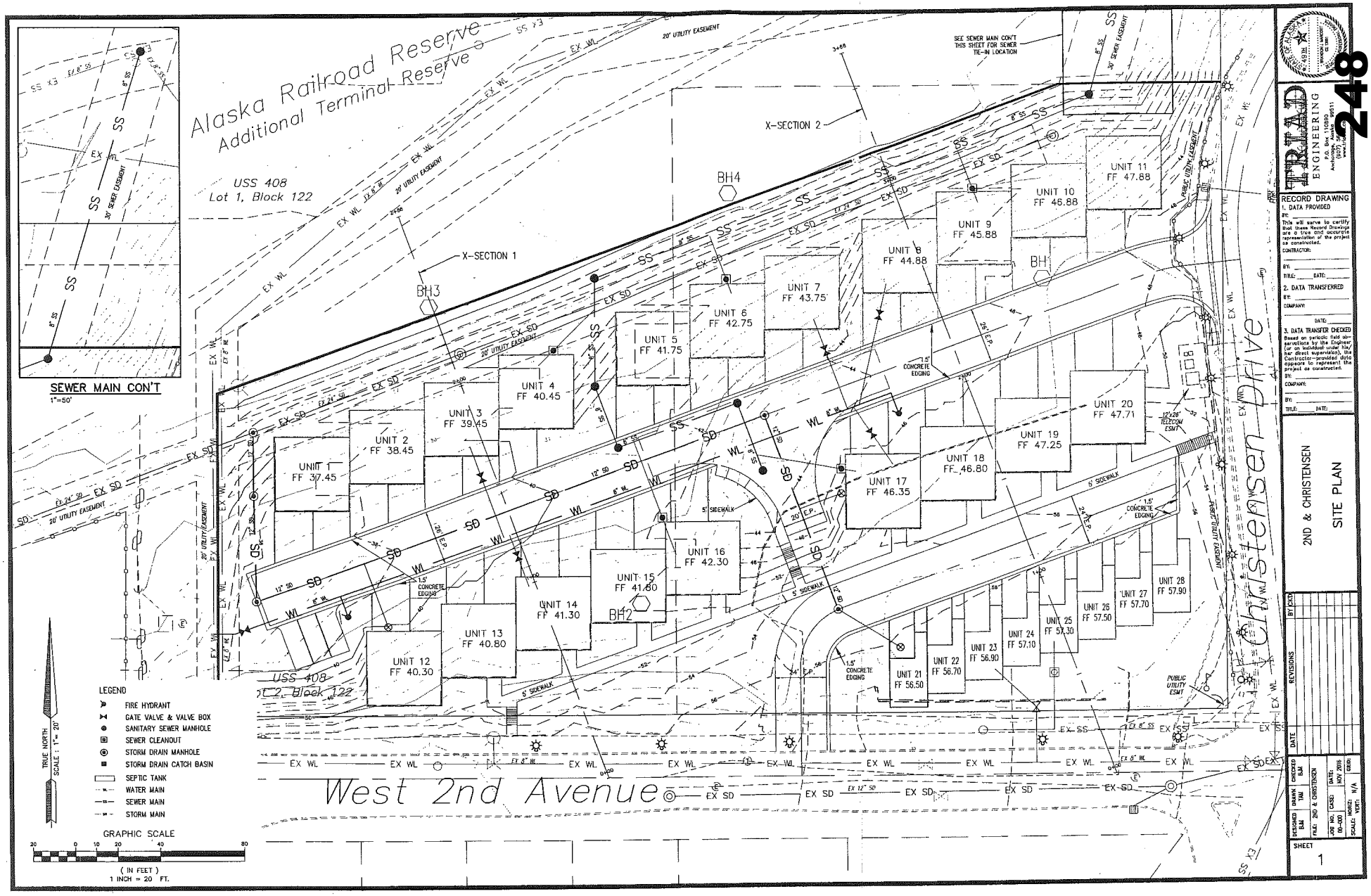
* ***Streams omitted in error by WMS or others remain subject to MOA Code and must be shown in new mapping upon identification of the error.***

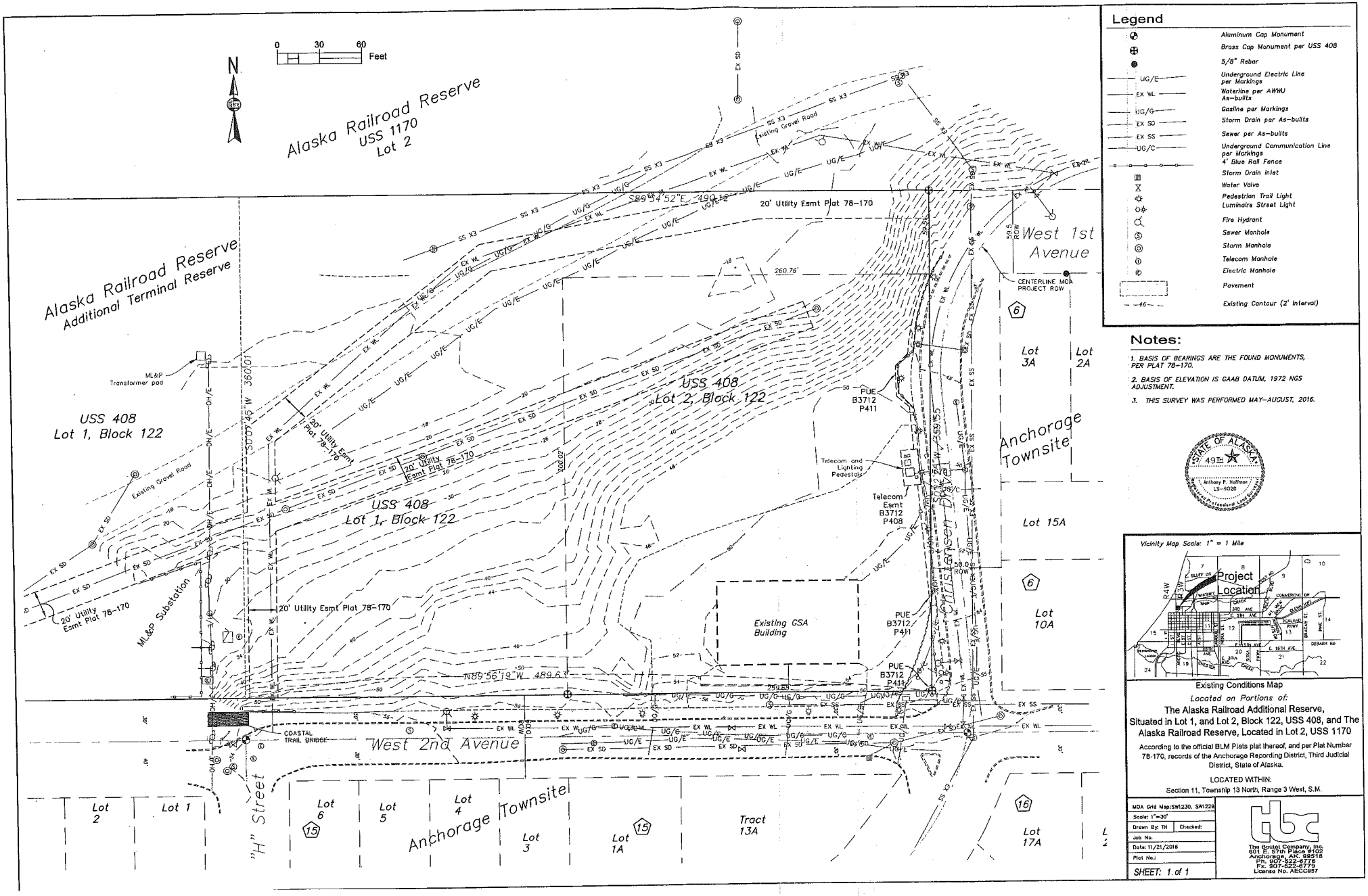
ADDITIONAL INFORMATION:

☐Y ☒N	WMS written drainage recommendations are available.	☐Preliminary	☐Final
☐Y ☒N	WMS written field inspection report or map is available.	☐Preliminary	☐Final
☐Y ☒N	Field flagging and/or map-grade GPS data is available.		

Inspection Certified By: _____ **Date:** 12/19/16


STATE OF ALASKA
49th
Notes:
1. BASIS OF BEARINGS ARE THE FOUND MONUMENTS PER PLAT 78-170.
2. BASIS OF ELEVATION IS GAAB DATUM, 1972 NGS ADJUSTMENT.
3. THIS SURVEY WAS PERFORMED MAY-AUGUST, 2016.
0 30 60 Feet
N
Alaska Railroad Reserve
USS 1170
Lot 2
Alaska Railroad Reserve
Additional Terminal Reserve
USS 408
Lot 1, Block 122
USS 408
Lot 2, Block 122
Proposed Lease Line
2.62 Acres
N90°00'00"E 77.31'
N70°01'52"E 425.62'
N00°07'47"E 154.42'
N89°58'06"W
20' Utility Esmt Plat 78-170
Existing Gravel Road
Existing Paved Pathway
ML&P Substation
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
Unit 6
Unit 7
Unit 8
Unit 9
Unit 10
Unit 11
Unit 12
Unit 13
Unit 14
Unit 15
Unit 16
Unit 17
Unit 18
Unit 19
Unit 20
Unit 21
Unit 22
Unit 23
Unit 24
Unit 25
Unit 26
Unit 27
Unit 28
West 1st Avenue
CENTERLINE MOA PROJECT ROW
Christensen Drive
West 2nd Avenue
"H" Street
COASTAL TRAIL BRIDGE
Anchorage Townsite
Lot 3A
Lot 2A
Lot 15A
Lot 10A
Lot 17A
Tract 13A
Lot 1A
Lot 3
Lot 4
Lot 5
Lot 6
Lot 1
Lot 2
LANDSCAPE SCHEDULE
QTY SYMBOL LABEL LATIN NAME COMMON NAME SIZE FURNISHED NOTES
EVERGREEN TREES
16 PP PICEA PUNGENS COLORADO GREEN SPRUCE 6' HT. B&B 5:3 RATIO
DECIDUOUS TREES
34 BPC BETULA PENDULA 'TRACUS' CUTLEAF WEEPING BIRCH 6' HT. B&B 5:3 RATIO
SHRUBS
180 CL COTONEASTER LUCIDUS HEDGE COTONEASTER 24" HT. POTTED
MISCELLANEOUS
SCHEDULE-A SEED MIX (LAWN MIX)
EXISTING VEGETATION TO REMAIN
LANDSCAPE NOTES:
1. ALL PLANTS ARE NURSERY GROWN UNLESS SPECIFIED OTHERWISE.
2. ALL PLANTING BEDS SHALL RECEIVE 18" TOPSOIL AND 3" DEPTH SHREDDED BARK MULCH.
3. PROVIDE 4" TOPSOIL AND SEED ALL DISTURBED AREAS WITH SCHEDULE NOTED ON PLANS.
Legend
Aluminum Cap Monument
Brass Cap Monument per USS 408
5/8" Rebar
Underground Electric Line per Markings
Waterline per AWWU As-builts
Storm Drain per As-builts
Sewer per AWWU As-builts
Underground Communication Line per Markings
4' Blue Rail Fence
Chain Link Fence
Storm Drain Inlet
Water Valve
Pedestrian Trail Light
Luminaire Street Light
Fire Hydrant
Sewer Manhole
Storm Manhole
Telecom Manhole
Electric Manhole
Existing Pavement
Existing Curb & Gutter
Proposed Storm Drain Manhole
Proposed Storm Drain
Proposed Sewer Manhole
Proposed Sewer Line
Proposed Fire Hydrant
Proposed Water Line
Proposed Pavement
Vicinity Map Scale: 1" = 1 Mile
Project Location
SITE PLAN / LANDSCAPE PLAN
Located on Portions of:
The Alaska Railroad Additional Reserve,
Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170
According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.
LOCATED WITHIN:
Section 11, Township 13 North, Range 3 West, S.M.
SHEET: 1 of 1
tbc
The Boutet Company, Inc.
Anchorage, AK


Alaska Railroad Reserve
Additional Terminal Reserve
USS 408
Lot 1, Block 122
X-SECTION 1
X-SECTION 2
SEE SEWER MAIN CON'T THIS SHEET FOR SEWER TIE-IN LOCATION
SEWER MAIN CON'T
1"=50'
BH1
BH2
BH3
BH4
UNIT 1 FF 37.45
UNIT 2 FF 38.45
UNIT 3 FF 39.45
UNIT 4 FF 40.45
UNIT 5 FF 41.75
UNIT 6 FF 42.75
UNIT 7 FF 43.75
UNIT 8 FF 44.88
UNIT 9 FF 45.88
UNIT 10 FF 46.88
UNIT 11 FF 47.88
UNIT 12 FF 40.30
UNIT 13 FF 40.80
UNIT 14 FF 41.30
UNIT 15 FF 41.80
UNIT 16 FF 42.30
UNIT 17 FF 46.35
UNIT 18 FF 46.80
UNIT 19 FF 47.25
UNIT 20 FF 47.71
UNIT 21 FF 56.50
UNIT 22 FF 56.70
UNIT 23 FF 56.90
UNIT 24 FF 57.10
UNIT 25 FF 57.30
UNIT 26 FF 57.50
UNIT 27 FF 57.70
UNIT 28 FF 57.90
20' UTILITY EASEMENT
30' SEWER EASEMENT
PUBLIC UTILITY EASEMENT
12'x28' TELECOM ESMT
1.5' CONCRETE EDGING
5' SIDEWALK
West 2nd Avenue
Christensen Drive
LEGEND
FIRE HYDRANT
GATE VALVE & VALVE BOX
SANITARY SEWER MANHOLE
SEWER CLEANOUT
STORM DRAIN MANHOLE
STORM DRAIN CATCH BASIN
SEPTIC TANK
WATER MAIN
SEWER MAIN
STORM MAIN
TRUE NORTH
SCALE : 1"= 20'
GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 INCH = 20 FT.
RECORD DRAWING
1. DATA PROVIDED
BY:
This will serve to certify that these Record Drawings are a true and accurate representation of the project as constructed.
CONTRACTOR:
BY:
TITLE: DATE:
2. DATA TRANSFERRED
BY:
COMPANY:
DATE:
3. DATA TRANSFER CHECKED
Based on periodic field observations by the Engineer (or on buildout under his/her direct supervision), the Contractor-provided data appears to represent the project as constructed.
BY:
COMPANY:
BY:
TITLE: DATE:
2ND & CHRISTENSEN
SITE PLAN
REVISIONS
BY
DATE
DESIGNED: BM
DRAWN: BM
CHECKED: MM
DATE: NOV 2015
JOB NO: 00-000
CASE:
FILE: 2ND & CHRISTENSEN
SCALE: 1"=20'
VERT: N/A
SHEET 1



Legend

- Aluminum Cap Monument
- Brass Cap Monument per USS 408
- 5/8" Rebar
- UG/E — Underground Electric Line per Markings
- EX WL — Waterline per AWWU As-builts
- UG/G — Gasline per Markings
- EX SD — Storm Drain per As-builts
- EX SS — Sewer per As-builts
- UG/C — Underground Communication Line per Markings
- 4' Blue Rail Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light
- Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Pavement
- Existing Contour (2' Interval)

Notes:

1. BASIS OF BEARINGS ARE THE FOUND MONUMENTS, PER PLAT 78-170.
2. BASIS OF ELEVATION IS GAAB DATUM, 1972 NGS ADJUSTMENT.
3. THIS SURVEY WAS PERFORMED MAY-AUGUST, 2016.

STATE OF ALASKA 49TH
Anthony P. Hoffman LS-9020
Professional Land Surveyor

Vicinity Map Scale: 1" = 1 Mile

Existing Conditions Map

Located on Portions of:

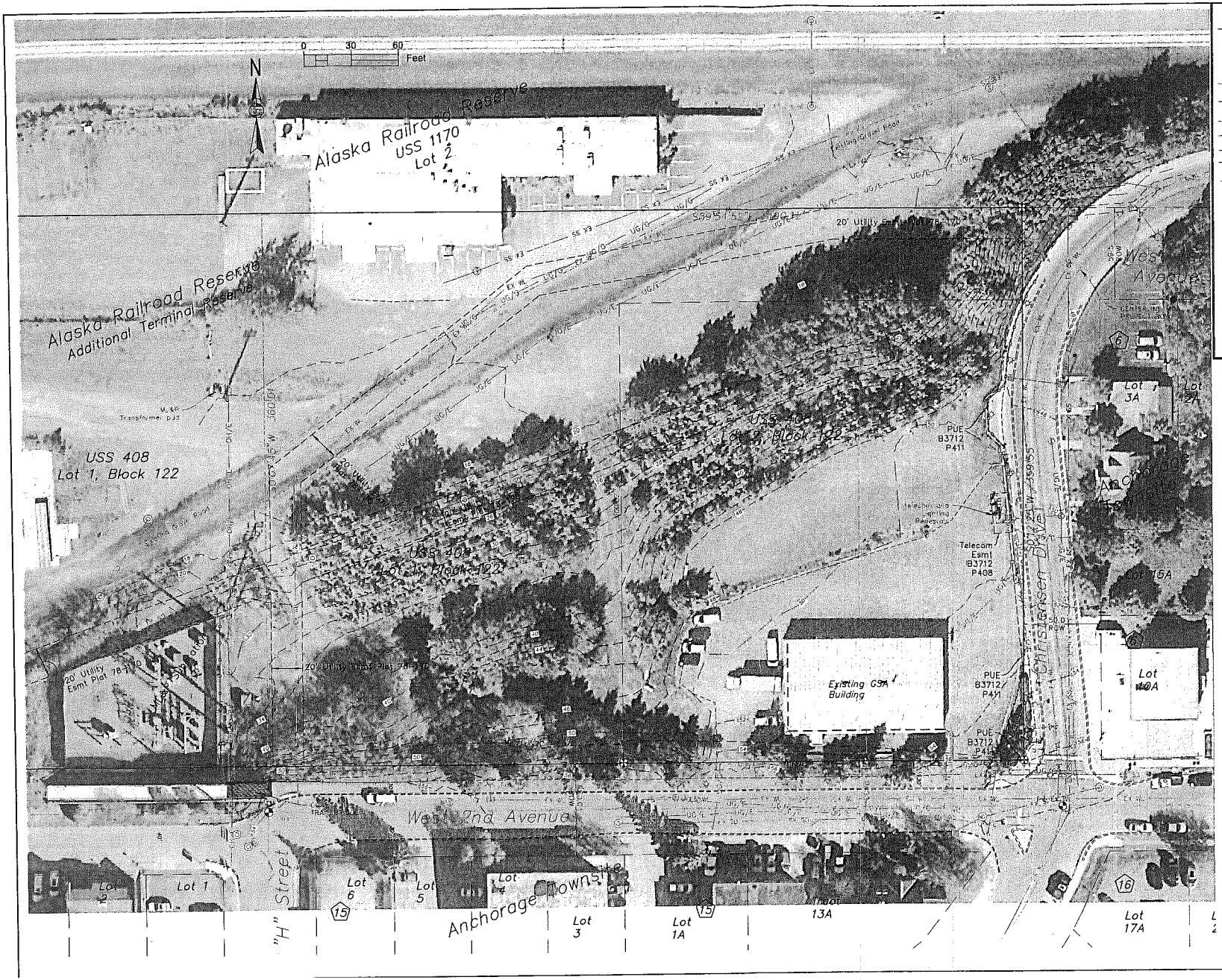
The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
Section 11, Township 13 North, Range 3 West, S.M.

MOA Grid Map: SW1230, SW1229	
Scale: 1"=30'	
Drawn By: TH	Checked:
Job No.	
Date: 11/21/2016	
Plat No.:	
SHEET: 1 of 1	

The Boutet Company, Inc.
501 E. 57th Place, #102
Anchorage, AK 99518
Ph. 907-522-6776
Fx. 907-522-6779
License No. AECC957



Legend

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- UG/G — Gasline per Markings
- Ex SD — Storm Drain per As-builts
- Ex SS — Sewer per As-builts
- UG/C — Underground Communication Line per Markings
- 4' Blue Rail Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light
- Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Pavement
- 46 — Existing Contour (2' Interval)

Notes:

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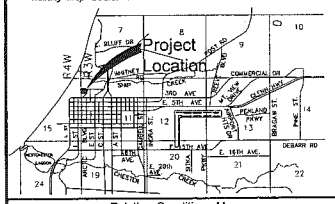
STATE OF ALASKA
49TH
Anthony P. Hoffman
LS-9020
Department of Natural Resources, Land Surveyor

Vicinity Map Scale: 1" = 1 Mile



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STATE OF ALASKA
49TH
Anthony P. Hoffman
LS-9020
Registered Professional Land Surveyor

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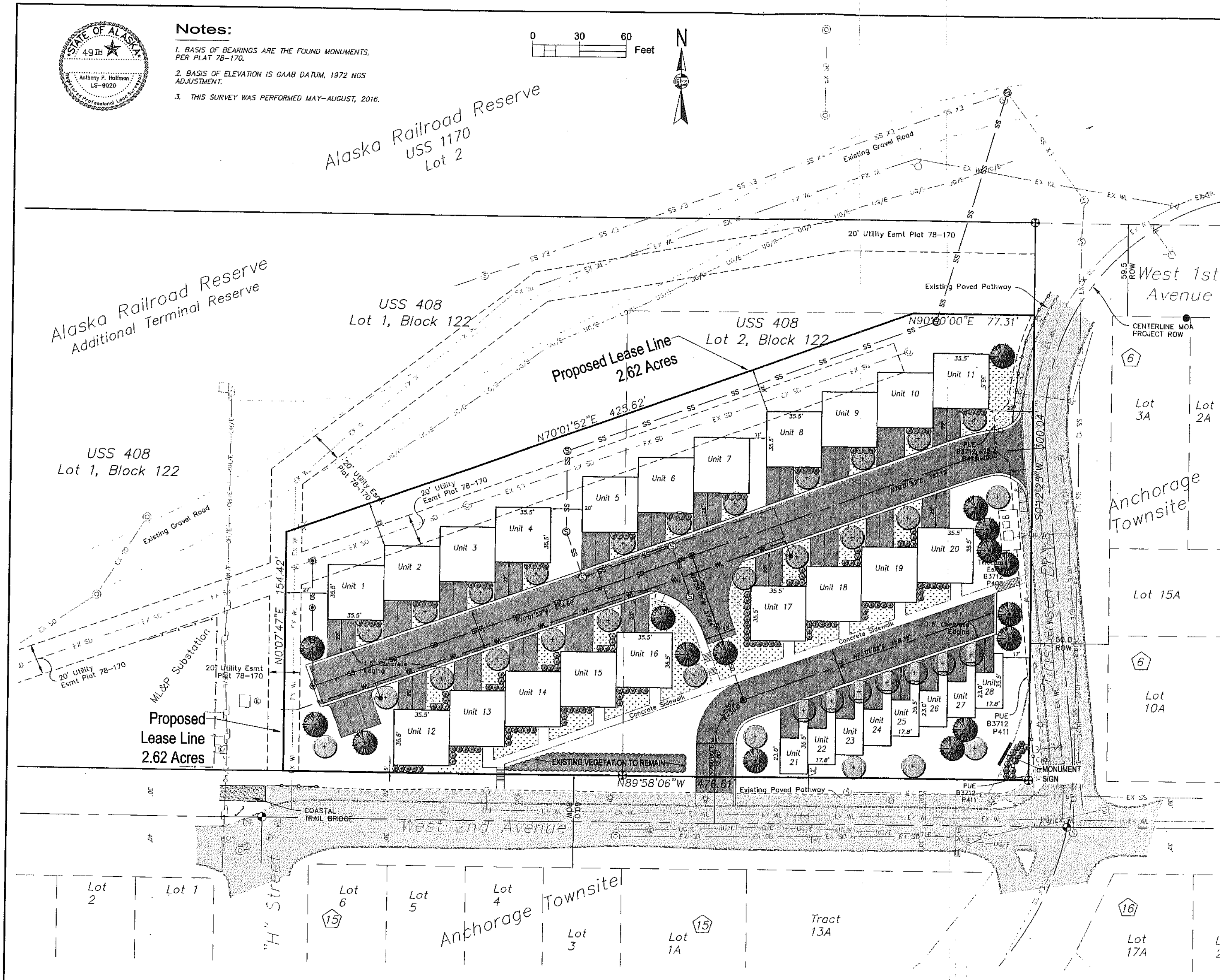


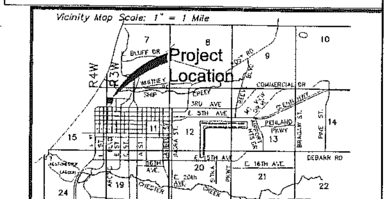
LANDSCAPE SCHEDULE

QTY	SYMBOL	LABEL	LATIN NAME	COMMON NAME	SIZE	FURNISHED	NOTES
EVERGREEN TREES							
16		PP	PICEA PUNGENS	COLORADO GREEN SRUCE	6' HT.	B&B	5:3 RATIO
DECIDUOUS TREES							
34		BPG	BETULA PENDULA 'GRACILIS'	CUTLEAF WEEPING BIRCH	6' HT.	B&B	5:3 RATIO
SHRUBS							
160		CL	COTONEASTER LUCIDUS	HEDGE COTONEASTER	24" HT.	POTTED	
MISCELLANEOUS							
			SCHEDULE-A SEED MIX (LAWN MIX)		EXISTING VEGETATION TO REMAIN		

LANDSCAPE NOTES:
1. ALL PLANTS ARE NURSERY GROWN UNLESS SPECIFIED OTHERWISE.
2. ALL PLANTING BEDS SHALL RECEIVE 18" TOPSOIL AND 3" DEPTH SHREDDED BARK MULCH.
3. PROVIDE 4" TOPSOIL AND SEED ALL DISTURBED AREAS WITH SCHEDULE NOTED ON PLANS.

Legend

- Aluminum Cap Monument
- Brass Cap Monument per USS 408
- 5/8" Rebar
- Underground Electric Line per Markings
- Waterline per AWWU As-builts
- Storm Drain per As-builts
- Sewer per AWWU As-builts
- Underground Communication Line per Markings
- 4' Blue Rail Fence
- Chain Link Fence
- Storm Drain Inlet
- Water Valve
- Pedestrian Trail Light
- Luminaire Street Light
- Fire Hydrant
- Sewer Manhole
- Storm Manhole
- Telecom Manhole
- Electric Manhole
- Existing Pavement
- Existing Curb & Gutter
- Proposed Storm Drain Manhole
- Proposed Storm Drain
- Proposed Sewer Manhole
- Proposed Sewer Line
- Proposed Fire Hydrant
- Proposed Water Line
- Proposed Pavement



SITE PLAN / LANDSCAPE PLAN

Located on Portions of:

The Alaska Railroad Additional Reserve, Situated in Lot 1, and Lot 2, Block 122, USS 408, and The Alaska Railroad Reserve, Located in Lot 2, USS 1170

According to the official BLM Plats plat thereof, and per Plat Number 78-170, records of the Anchorage Recording District, Third Judicial District, State of Alaska.

LOCATED WITHIN:
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MOA Grid Map: SW1230, SW1229
Scale: 1"=30'
Drawn By: TH | Checked:
Job No.
Date: 12/14/2016
Plat No.:
SHEET: 1 of 1

The Boutet Company, Inc.
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Ph. 907-522-6776
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License No. AECC057

The Rail
at ship creek

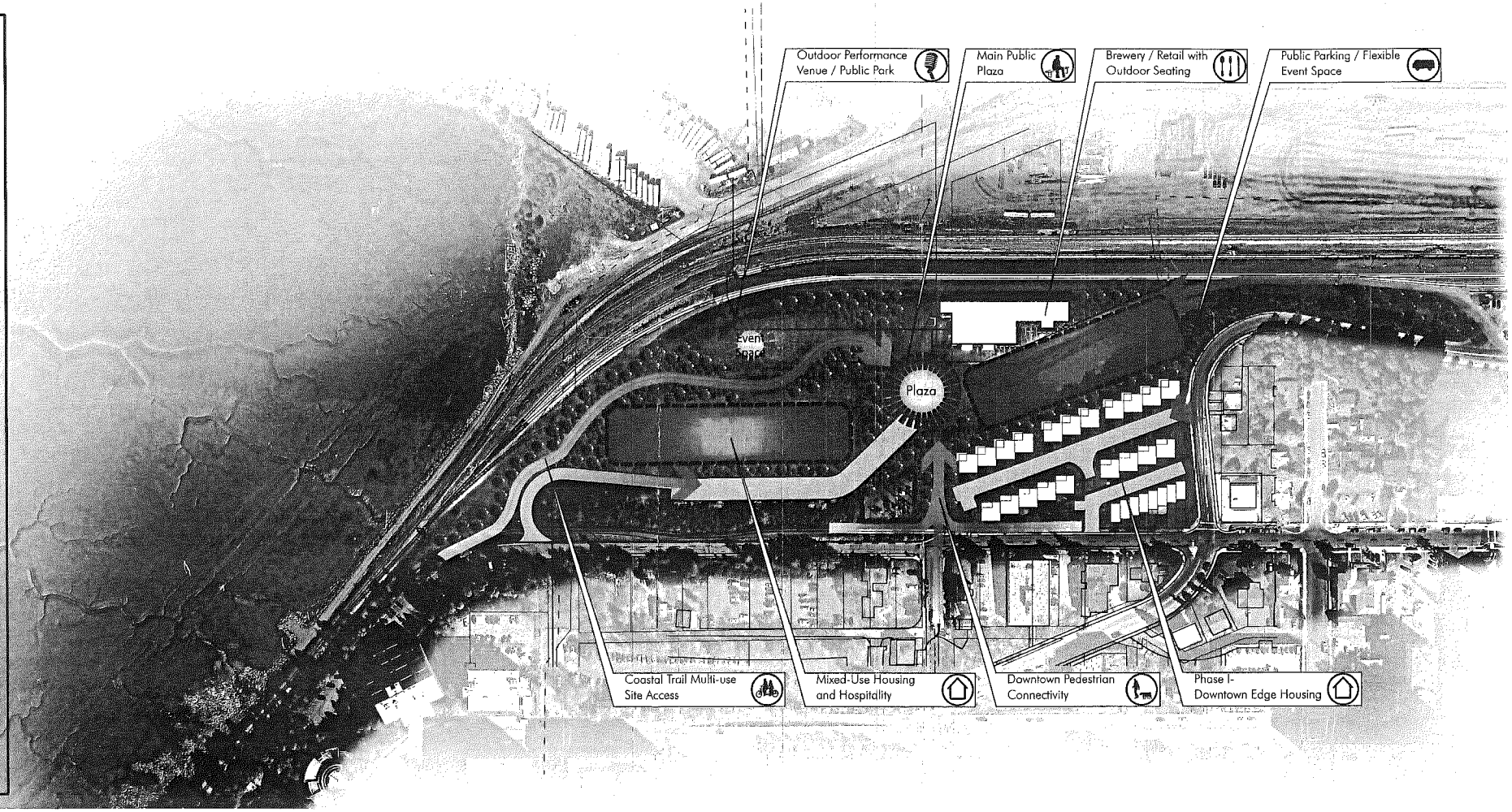
Concept Master Plan

HBC

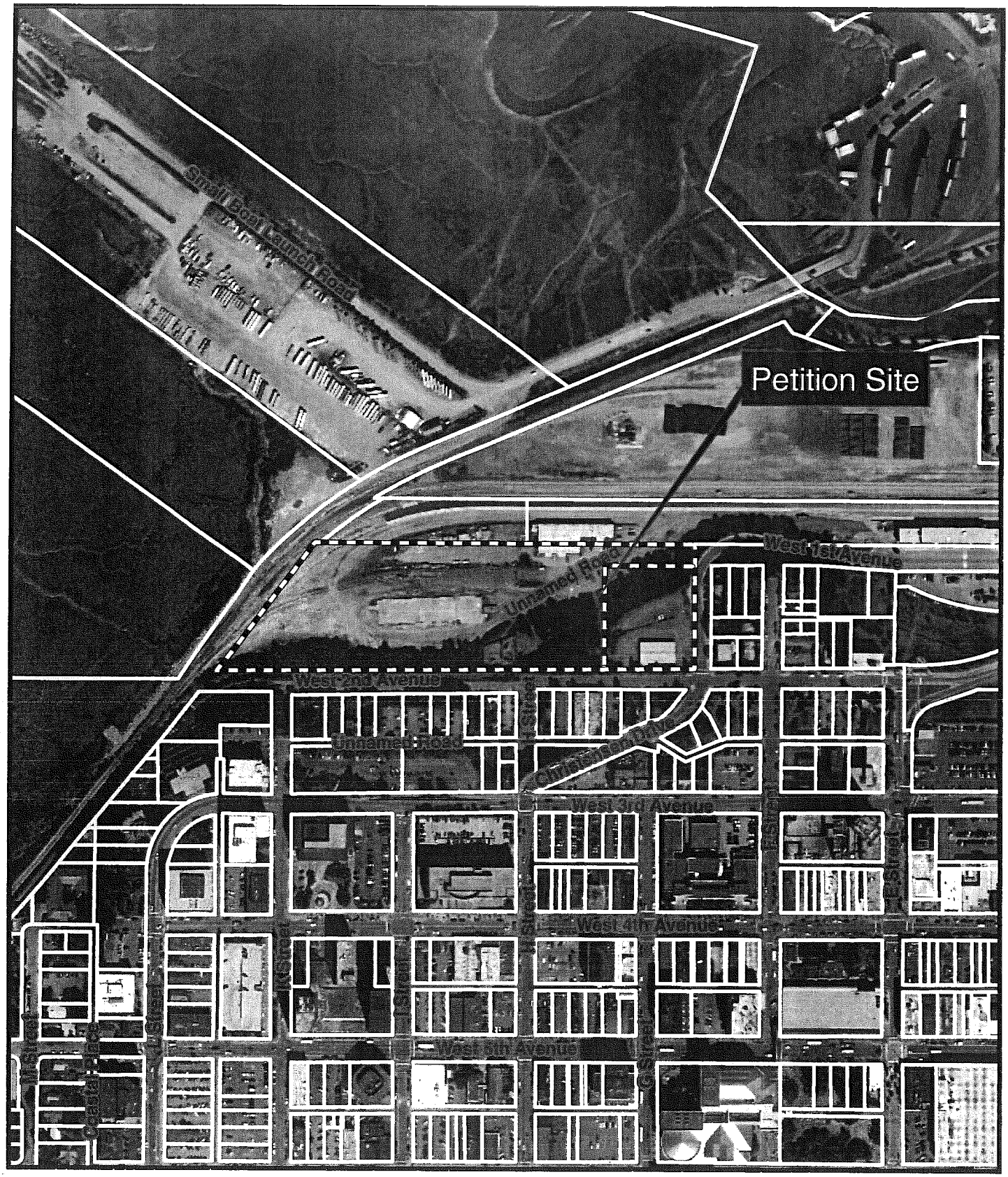
Swell, LLC

petersen
BUILDING & DEVELOPMENT

KPB ARCHITECTS



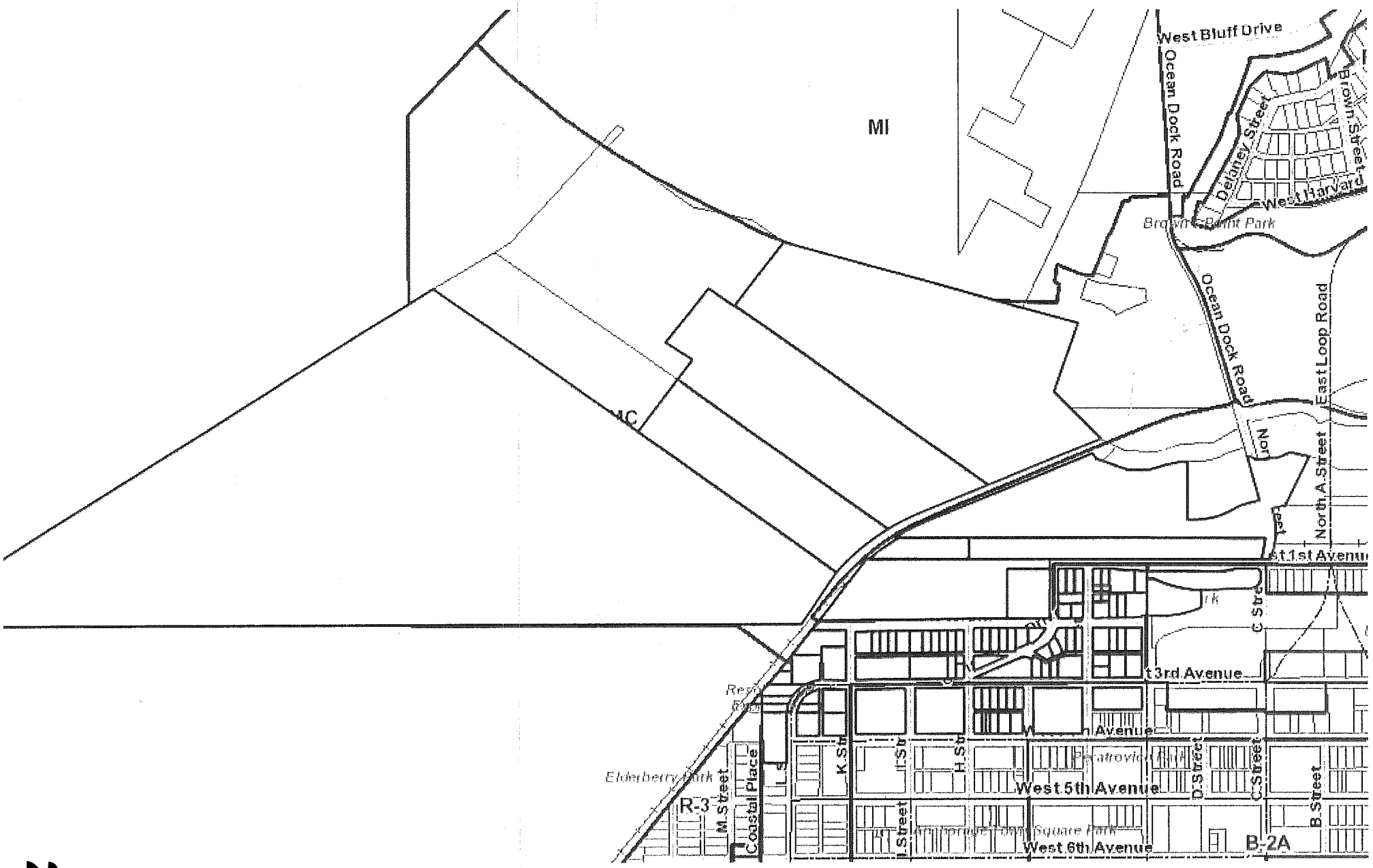
2017-0017



Municipality of Anchorage
Planning Department
Date: January 13, 2017

N

Anchorage



2017-0017 PHN map

Distance = 600' (98 pcls)