City of Port Orchard

City Hall Building Improvements

ADDENDUM #2

April 21, 2023

TO ALL BIDDERS:

The Bid Documents issued April 7, 2023 for the project noted above are amended by this Addendum #2.

Receipt of this addendum shall be acknowledged by inserting its number in the space provided on the bid form.

PROJECT MANUAL ITEMS

ITEM 1. Geotech Report is attached.

END OF ADDENDUM #2

GEOTECHNICAL ENGINEERING REPORT
SOLAR PANEL ARRAY
DEEP FOUNDATION ASSESSMENT
216 PROSPECT STREET
PORT ORCHARD, WA 98366
PORT ORCHARD, WA

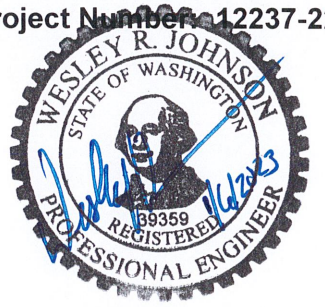
CLIENT:

Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

BY:

N.L. OLSON AND ASSOCIATES, INC.
2453 BETHEL AVE. SE
PORT ORCHARD, WA 98366
(360) 876-2284

Project Number: 12237-22



JANUARY 2023

N.L. OLSON & ASSOCIATES, INC.

ENGINEERING, PLANNING AND SURVEYING

January 6, 2023 Project Number: 12237-22

Attn: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

Subject: **Geotechnical Engineering Report**
Solar Panel Array
Deep foundation Assessment
216 Prospect Street
Port Orchard, WA 98366
Parcel Numbers: 4650-008-001-0106

Mr. Ritter-Lopatowski;

The scope of N.L. Olson and Associates, INC. (NLO)'s work included a review of available site information (including air photos, and geologic maps), engineering analyses, subsurface exploration data, and report preparation.

We appreciate the opportunity to be of service to you on this and potential future projects. If we can be of further assistance or if you have any questions regarding this project, please contact our office.

Sincerely,

Wesley R. Johnson, P.E.
Geotechnical Engineering Services Manager

TABLE OF CONTENTS

P.O. Box 637• 2453 Bethel Avenue • Port Orchard, Washington 98366
Phone: 1(800) 755-1282 • Fax: (360) 876-1487

GEOTECHNICAL ENGINEERING REPORT
SOLAR PANEL ARRAY
DEEP FOUNDATION ASSESSMENT
216 PROSPECT STREET
PORT ORCHARD, WA 98366
PORT ORCHARD, WA

INTRODUCTION

NLO's scope of work included a review of available geological site information, subsurface exploration program, deep foundation engineering, and construction recommendations as presented in this report.

SITE LOCATION

The property is located by the address of 216 Prospect Street, Port Orchard WA 98366, and situated in Section 26, of Township 24 North Range 1 East, Willamette Meridian, Kitsap County Washington. The site location is shown on the Vicinity Map, Figure 1.

EXISTING CONDITIONS

The project area is rectangular in shape and extends roughly 130 feet north of Kitsap Street and bound by Prospect Street to the east, to the south by Kitsap Street, by Cline Street SW and Bay Street to the west. The subject area currently houses a generator within a detached 500 sf building with paved parking and an access drive residing to the west, north, and east. The site's existing conditions are illustrated on the Site Plan, Figure 2.

The site's topography is relatively level across the subject area that was previously benched into a hillside for placement of the parking area and detached buildings that support courthouse.

The area the perimeters the project area has been vegetated with deciduous trees and other landscaping to the west, south and east.

PROPOSED CONSTRUCTION

NLO understands that the new solar panel array structure is 20 feet by 40 feet with the long dimension trending east to west. For foundation support, the proposed structure will utilize six (6) pile caps each supported by four pin piles. The desired allowable axial capacity is 60 kips for of each pile cap location. The site's proposed building area is illustrated on the Site Plan, Figure 3. The proposed pile cap configuration is provided on Figure 4.

FIELD INVESTIGATION

The site soil conditions were explored on July 14, 2022, by drilling one (1) boring to a maximum depth of 76.5 feet below ground surface (bgs). Advanced Drill, Inc., was subcontracted and performed drilling operations with a D50 track mounted Drill Rig. The approximate boring location is shown on the attached Site Plan, Figure 2. The boring log is included in Appendix A of this report.

Site Soil Conditions

Fill soil were encountered that ranged down to about five (5) feet below ground surface (bgs). The fill consisted of a medium dense silty sand with gravel underlain by a lean clay (CL). The clay was saturated with a consistency that was very soft to medium stiff to a depth of 15 bgs. Around 20 feet bgs, elastic silt (MH) was encountered that extended down to roughly the termination depth of this boring. The consistency of the elastic silt ranged from stiff to hard and was underlain by a wet, dense sandy silt (ML) at the boring termination of 76.5 feet.

Subsurface Water

during drilling operations, saturated soils were encountered 5 feet to 15 feet bgs and again at 75 feet bgs.

Laboratory Testing

To aid in classifying the soils and to determine general soil gradation, laboratory tests were performed on selected representative samples. Phoenix Soil Research in Kingston, Washington was retained to provide geotechnical laboratory analysis. The results of the laboratory testing have been presented in Appendix A.

AVAILABLE GEOLOGIC INFORMATION

Washington Division of Geology and Earth Resource

The Washington Division of Geology and Earth Resource (WDGER), Geologic Map of Washington – Northwest Quadrant, dated 2002, indicates that the site is mapped as Quaternary sediments, dominantly glacial drift and includes alluvium. Glacial till consists of an unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel and boulders deposited by glacial ice.

USDA Soil Conservation Service

The USDA Soil Conservation Service (SCS) classifies the site's native soils as (16) Harstine gravelly ashy sandy loam, 6 to 15 percent slopes and (63) Urban Land – Alderwood Complex, 0-8 percent slopes. We have discussed the soil types comprising the surface soils in the following and provided the SCS mapping of the area on Figure 5.

(16) Harstine gravelly ashy sandy loam, 6 to 15 percent slopes, Permeability of this Harstine soil is moderate to the hardpan and very slow through the pan. The available water capacity is low. The effective rooting depth ranges from 25 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. A perched water table develops for short periods during the rainy season in winter and spring. However, the seasonal perched water table is of short duration because water flows laterally above the cemented pan and seeps at the bottom of slopes.

63) Urban Land – Alderwood Complex, 0-8 percent slopes, Permeability of this Alderwood soil is moderately rapid above the hardpan and very slow in the pan. The available water capacity is low. The effective rooting depth ranges from 20 to 40 inches. Matting of the roots directly above

the hardpan is common. Runoff is slow, and the hazard of water erosion is slight. A perched water table is at a depth of 2.5 to 3 feet during the rainy season in winter and spring.

Kitsap County Washington, Geologic Map Unit

NLO has reviewed Kitsap County Washington, Geologic Map Unit, Washington State Department of Natural Resources, open file Report 2005-3 dated 2005, that indicates the project area is underlain by Quaternary Alluvium.

Quaternary Alluvium (Qa), is unconsolidated or semi-consolidated alluvial clay, silt, sand, gravel, and (or) cobble deposits; locally includes peat, muck, and diatomite; locally includes beach, dune, lacustrine, estuarine, marsh, landslide, lahar, glacial, or colluvial deposits; locally includes volcaniclastic or tephra deposits; locally includes modified land and artificial fill.

SEISMIC

Seismic Ground Shaking Parameters

NLO has reviewed the seismic design criteria per 2018 International Building Code (IBC) for seismic zone, **Site Class D,** Risk Category I/II/III, "Stiff Soil". The probabilistic ground motion values (PGA) is based on the Site Coordinates 47.53345366°N, -122.60019919°W and the interpolated PGA and spectral acceleration are as provided in Table 1.

Seismic Ground Shaking Summary
Table 1

Probability Of exceedance	Approximate Return Period	Spectral Acceleration (g), Site Class C Period (sec)	
	years	0.2 sec	1.0 sec
2% in 50 years	**2475**	**1.633**	**0.565**

International Building Code (IBC) NLO has reviewed the 2018 IBC to provide a design peak ground acceleration value for the proposed construction based on a seismic zone, Site Class **D**.

Seismic Parameters	Values
Mapped Spectral Acceleration Short Period (S_S)	1.633
Mapped Spectral Acceleration for One Second (S_1)	0.565
MCE Spectral Response Acceleration for short period ($S_{MS}=S_S x F_a$)	1.633
MCE Spectral Response Acceleration for one second ($S_{M1}=S_1 x F_V$)	0.98
Design Spectral Response Acceleration for Short Period ($S_{DS}=2/3 x S_{MS}$)	1.089
Design Spectral Response Acceleration for one second ($S_{D1}=2/3 x S_{M1}$)	0.654
Peak Ground Acceleration Design Peak M_{CEG}=0.697	**PGA_{MCEG}=0.697/2=0.348**
Site Modified Peak Ground Acceleration Design Peak M_{PGAM}=0.767	**PGA_{PGAM}=0.654/2=0.383**

Soil Liquefaction

NLO has reviewed the "Geologic Hazard Mapping, Seismic Fault Hazards, Kitsap County WA, Map Publish Date Feb 23, 2017". The referenced liquefaction mapping indicated a high susceptibility to liquefaction for this property. The liquefaction susceptibility Map of Kitsap County indicates that the subject property is located along an area with a high potential of liquefaction.

To generate the necessary ground acceleration to initiate liquefaction, an earthquake of magnitude 5.0 or greater is typically needed and the liquefaction process is brought about by seismic waves passing through poorly draining saturated granular soil. As the seismic wave propagates through the stratum, the soil particles at the individual level are packed into a tighter

arrangement decreasing the initial void space. Void space is the region between soil particles where the pore water resides. As a result of the decreased void space, the volume decrease has a corresponding water pressure increase also known as pore pressure increase. If the pore pressure is substantial, and cannot be dissipated, the soil fluidizes (or liquefies) and loses its load carrying ability.

The proposed project area is located within an area indicated as a potentially liquefiable site per Kitsap County's Geologic Hazardous Mapping, Figure 6. NLO has reviewed the subsurface exploration program, and determined that a saturated zone of fine-grained soil exists between 5 to 15 feet below ground surface. Given the high fines content of clay, the likelihood liquefaction is low in this zone of saturated soil.

SEISMIC FAULT LINES REVIEW

NLO has reviewed the Geologic Hazardous Mapping, Kitsap County, WA dated February 23, 2017 that indicates the Seattle Fault is near the subject property. The Seattle Fault resides roughly two (2) miles to the north. The Seattle Fault trends east to west from Hood Canal to the Cascades, passing below Bremerton along the Bremerton ship yard, through Manchester and Bainbridge Island into Seattle. This fault is capable of magnitude 7.1 seismic events with the most recent seismic event occurring roughly 1,100 years ago.

CONCLUSIONS AND RECOMMENDATIONS

Following our review of City of Port Orchard, WA – Critical Areas 18.08.020 Geologically hazardous area categories, (2) Areas of Geologic Concern, (e) Seismic areas subject to liquefaction from earthquakes (seismic hazard areas). It's N.L. Olson's opinion that the soils underlying the site have a low susceptibly to liquefaction.

However, it should be noted that if the proposed structure was constructed on a standard shallow foundation system, the combination of building weight and self-weight of the underlying saturated clay soils will consolidate and result in substantial settlement or cracking of concrete flatwork.

In order to minimize future building settlement, NLO recommends pin pile support of the proposed structure to include the floor slab. NLO has provided pin pile recommendations later in this report.

SITE PREPARATION AND GRADING

All pavement, slab-on-grade, fill and/or building areas should be stripped of all organic soil, existing fill and debris. However, deeper excavations may be required to remove previously placed uncontrolled fill disclosed during proof roll operations. Deeper excavations may also be required to remove large tree root-balls, old foundations, "filled in basement area", septic tanks and associated drain fields. Stripped soils, contaminated with organics or debris, should be wasted off site or used in landscape areas.

After site stripping and previously placed unsuitable fill removed, N.L. Olson recommends the newly exposed subgrade should be proof rolled in parking lot areas. If necessary, compaction may be necessary to achieve a firm, unyielding condition. As a preliminary guideline the

equipment should be of appropriate size and type capable of developing a minimum dynamic compaction effort rating of at least 25,000 pounds with a static smooth drum weight of 13,000 pounds. Compaction of the stripped subgrade should be continued until field density tests indicate a minimum compaction of 95% of the maximum dry density, as determined by ASTM method D-1557, has been achieved in all fill, building, roadway, and parking areas. Soft or weaving areas disclosed during proof rolling shall be excavated and replaced with compacted structural fill. Areas, which are to be filled to bring the pavement grades up to the desired elevation, should be filled with compacted granular material free from roots, trash or other deleterious materials.

AXIAL SUPPORT

Pin piles consist of 3 and 4 inch diameter pipe driven with a jack hammer. We have provided a chart below that provides the allowable capacity for the pin piles and hammer sizes. The 3 in and 4 inch pin piles should consist of schedule 40 galvanized pipe. Pin piles are typically cut in 5 to 10 feet lengths with the ends cut perpendicular to the pipe. As the pin pile is advanced slip couplers are added between the pipe sections.

NLO has assessed the underlying soil conditions and determined each pile cap comprised of four (4) pin piles should provide the desired allowable axial capacity 60 kips. The top of pile was analyzed 4.5 feet below present site grades. The recommended pile will have an inside diameter of 4.0 inches and be of a schedule 40 pipe. Because of additional welding requirements for shorter pipe sections, NLO has recommended that that 21 feet sections should be used to decrease installation cost. For uplift capacity, 21 feet pile sections are recommended to form up the recommended pile length of 37 feet and the pipe splice welded. NLO recommends pile tips, should be fitted at the bottom of pile to maximize pile support.

Pin Pile Hammer Size and Refusal Criteria
Table 2

Pin Pile Diameter	Hammer Size (lbs)	Refusal Criteria.	Allowable Pile Capacity
3 inch (Schedule 40)	850	Less than one inch penetration for ten seconds of continuous driving at one thousand blows a minute for three cycles	7 tons
4 inch (Schedule 40)	850	Less than one inch penetration for ten seconds of continuous driving at one thousand blows a minute for three cycles	10 tons

Slab-on-grade floors rely on non-pliant soil conditions and if a standard floor slab was placed on present site soil conditions, N.L. Olson anticipates extensive cracking and settlement of the concrete flat work. To minimize settlement, we recommend structurally connecting the floor slab to the grade beams and pile caps. In areas that the distance between grade beams is extensive, N.L. Olson is recommending additional slab support between the grade beams with pin piles. For slab support, NLO recommends three (3) inch pin piles placed on a grid pattern between the grade beams and pile caps.

Due to the slenderness of the pin piles, no lateral pile capacity should be assumed. In order to achieve the pin piles allowable capacities please see the refusal criteria in the table below identified as Pin Pile Hammer Size and Refusal Criteria in Table 2.

Note: The soil conditions were based on a single boring drilled 76.5 feet bgs to determine the underlying soil conditions; however, there is a possibility of localized areas of unsuitable bearing soils, i.e. peat or other unforeseen pliant soil conditions could be exist during pile driving operations. If pliant soil conditions are encountered, the pile length recommendation 37 feet may require adjustment, increased in length, to the granular soil conditions encountered at the termination depth of the boring 76.5 feet.

The condition of the soil unit at the base of the pile should be verified by the geotechnical engineer or NLO's designated representative during pile driving operations.

NLO should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

STRUCTURAL FILL

Structural fill is defined as compacted fill placed under buildings or pavements that consist of free draining gravelly sand having a maximum size of 1-1/2 inches and no more than 5.0% fines passing the No. 200 sieve. Soils with a fine content greater than 5 percent passing the 200 sieve will degrade if exposed to excessive moisture and will not meet recommended compaction requirements. All imported fill material should conform to the above recommendation regardless of the site's weather conditions. All structural fill should be placed on a firm, properly prepared subgrade in loose layers approximately 8 inches in thickness, conditioned to a moisture content suitable for compaction, and compacted to 95% of the maximum dry density as determined by ASTM D-1557 (Modified Proctor). All Structural fill material should be submitted for approval to the Geotechnical Engineer at least 48 hours prior to delivery to the site.

SURFACE RUNOFF AND PERCHED GROUND WATER

Only minor storm water related problems are anticipated if site grading and preparation are undertaken during the normally drier portions of the year. If site work is undertaken during wet weather, it should be expected that the near surface silty and fine-grained soils would become over-saturated and unworkable. If the site work is undertaken during wet weather the contractor should be fully prepared to deal with soil and water problems normally encountered in these materials during wet weather work, including the filtering of runoff, as needed to prevent the siltation of down slope areas. To aid in minimizing potential erosion, it is recommended that the site not be stripped and left without erosion protection for an extended period of time prior to the actual start of construction and/or landscaping. Silt fencing and other erosion control devices and measures may be required to control water runoff over slope areas and sediment transport off the site.

EROSION

It is our experience that this risk of erosion can be mitigated through normal landscaping and the control of surface runoff. During construction and until fully surfaced and/or landscaped, the exposed site soils may be subject to some erosion. Erosion of the exposed soils would be most noticeable during periods of intense rainfall and may be controlled by the use of normal erosion control measures, i.e., silt fences, hay bales, mulching.

In a disturbed condition, the site soils may be eroded by channelized water or storm runoff from sheet flow. Therefore, it is recommended that all site preparation and excavation work be completed during the normally drier portion of the year. During periods of heavy rainfall, ditching should be used to divert water away from stripped areas and visqueen should be used to cover the slopes and soil stockpiles to aid in preventing excessive surface erosion. This covering also aids in preventing infiltration of water into the unprotected soils. All disturbed soil areas and slopes should be replanted with fast-growing, deep-rooted grass, shrubs and other ground cover as soon after final grading as possible. If the vegetation is not fully established prior to the onset of wet weather, the slopes should be covered with visqueen to aid in preventing excessive erosion and water infiltration.

TEMPORARY AND PERMANENT SLOPES

As a preliminary guideline for temporary cuts less than 10 feet in height not including footing subgrade areas, we recommend temporary slopes be made no steeper than 1H:1V for the dense granular soils and no steeper than 2H:1V in medium dense soils or structural fill placed and compacted as outlined above. For temporary cut slopes in existing fill, topsoil, or loose materials exceeding a vertical height of 10 feet, we recommend temporary slopes no steeper than 1 1/2H:1V for the full height of the cut. Temporary slopes or excavations should be benched as required by safety regulations in effect at the time of construction. These temporary slope recommendations are for native soils and fill materials; flatter slopes may be required in wet weather or if soil conditions other than those previously described are encountered. The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations; e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner, the contractor, or the earthwork or utility subcontractors could be liable for substantial penalties. The contractor should be made responsible for the stability of all excavations and slopes during construction because they are continually on site and can observe the stability of the exposed soils. In addition, the contractor should be prepared to shore any unstable slope area and provide shoring as required by local, state, or federal laws or codes. The provision of shoring design recommendations is beyond the authorized scope of this report.

REPORT LIMITATIONS

This report has been prepared for the client regarding the subject property. Information presented in this report has been collected and interpreted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions, and in accordance with sound and generally accepted principles consistent with normal consulting practice. No other warranty, expressed or implied, including (but not limited to) any warranty or merchantability or fitness for a particular use has been made.

In the event that change in the nature, design, or location of the proposed construction is made, or any physical changes to the site occur, recommendations are not be considered valid unless the changes are reviewed by NLO and conclusions of this report are modified or verified in writing.

NLO should be retained to provide geotechnical services during construction. This is to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. We do not accept responsibility for the performance of the foundation or earthwork unless we are retained to review the construction drawings and specifications, and to provide construction observation.

FIGURE 1

REVISIONS					BY	DATE
NO.	DATE	BY	DESCRIPTION	DESIGNED		
				DRAWN		
				CHECKED		
				APPROVED		
				ACCEPTED		

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
(360) 876-2284
2453 Bethel Avenue, P.O. Box 637, Port Orchard, WA 98366

VICINITY MAP
Proposed Solar Panel Array
Deep foundation Assessment
216 Prospect Street
Port Orchard, WA 98366

FOR: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

1" = 80'
DATE: Jan 2023
DRAWING NUMBER
12237-22
SHEET 1 OF 1

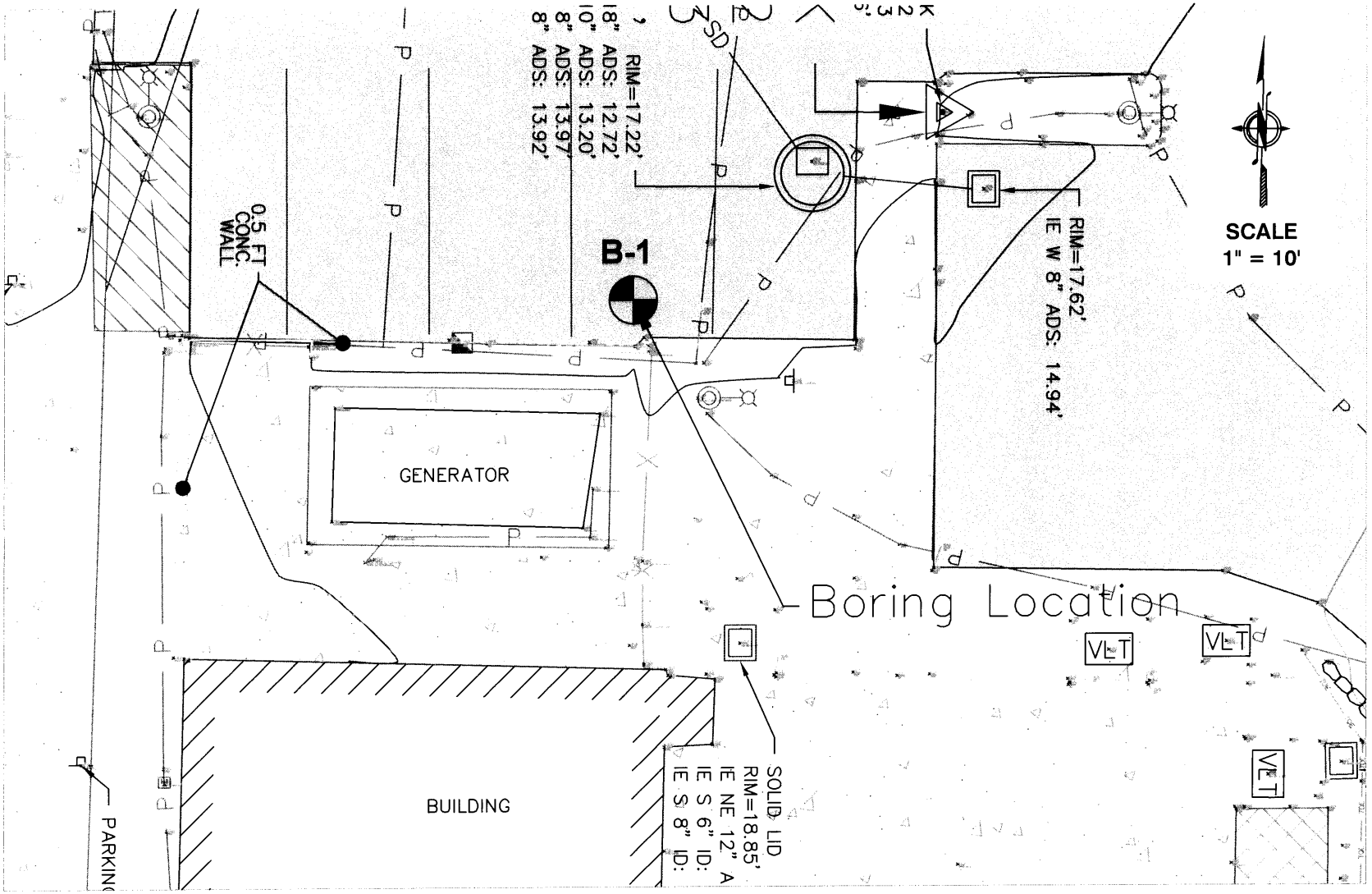


FIGURE 2

REVISIONS					BY	DATE
NO.	DATE	BY	DESCRIPTION	DESIGNED		
				DRAWN		
				CHECKED		
				APPROVED		
				ACCEPTED		

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
(360) 876-2284
3463 Bethel Avenue, P.O. Box 637, Port Orchard, WA 98366

SITE PLAN (EXISTING)
Proposed Solar Panel Array
Deep foundation Assessment
216 Prospect Street
Port Orchard, WA 98366

FOR: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

1" = 10'
DATE: Jan 2023
DRAWING NUMBER 12237-22
SHEET 1 OF 1

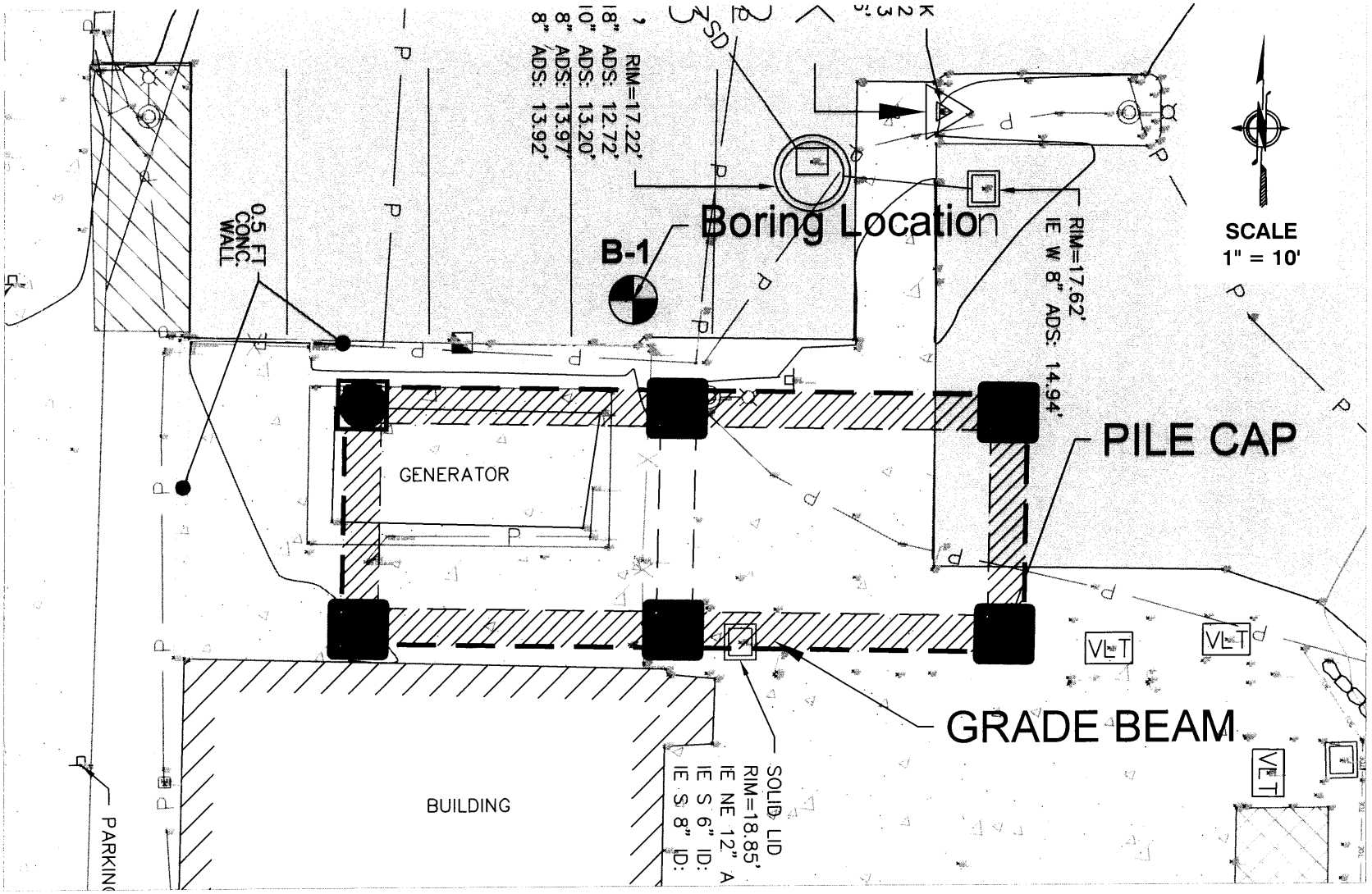


FIGURE 3

REVISIONS					BY	DATE
NO.	DATE	BY	DESCRIPTION	DESIGNED		
				DRAWN		
				CHECKED		
				APPROVED		
				ACCEPTED		

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
(360) 876-2284
2453 Bethel Avenue, P.O. Box 637, Port Orchard, WA 98366

SITE PLAN (PROPOSED)
Proposed Solar Panel Array
Deep foundation Assessment
216 Prospect Street
Port Orchard, WA 98366

FOR: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

1" = 10'
DATE: Jan 2023
DRAWING NUMBER 12237-22
SHEET 1 OF 1

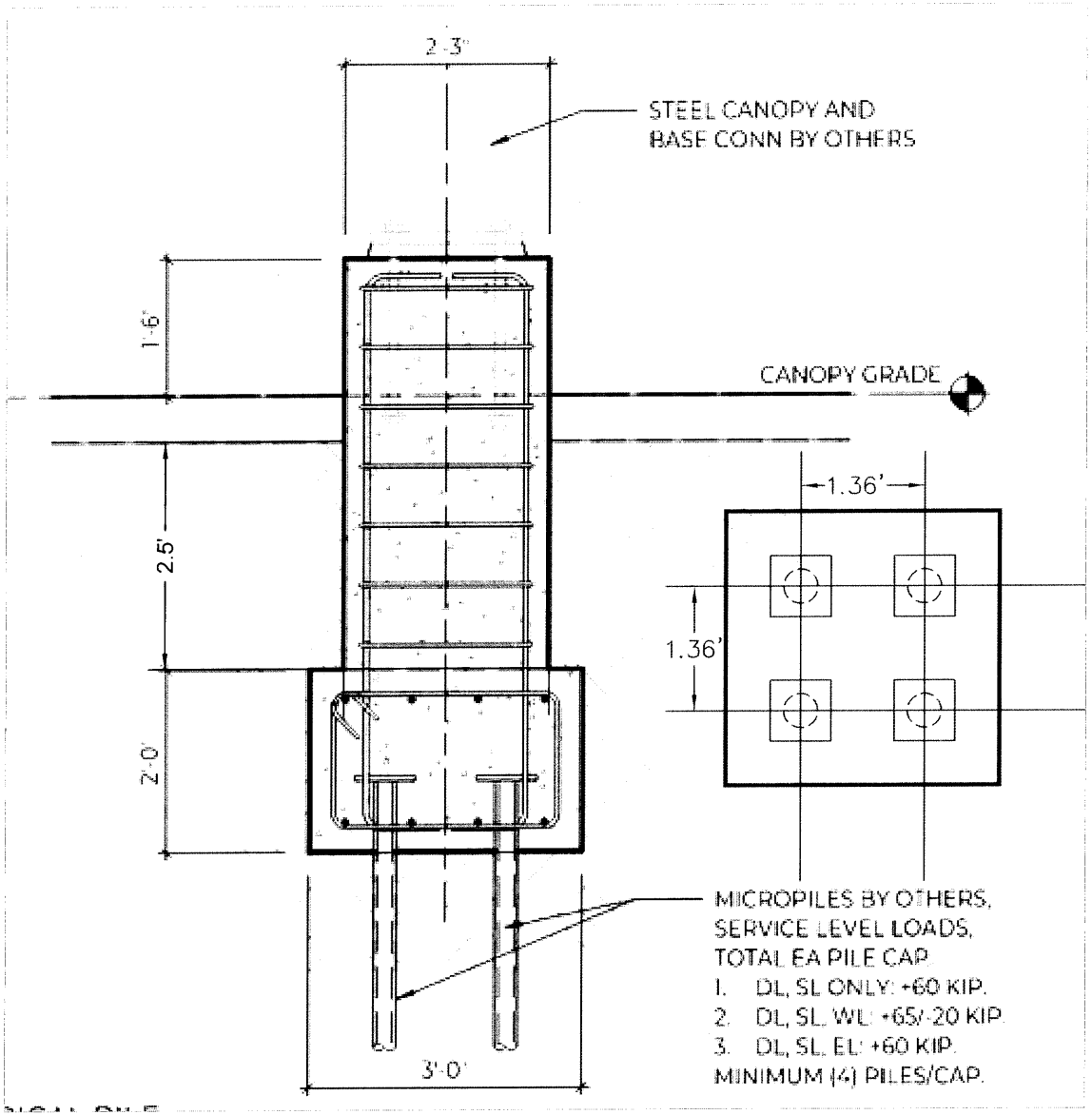


FIGURE 4

REVISIONS					BY	DATE
NO.	DATE	BY	DESCRIPTION	DESIGNED		
				DRAWN		
				CHECKED		
				APPROVED		
				ACCEPTED		

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
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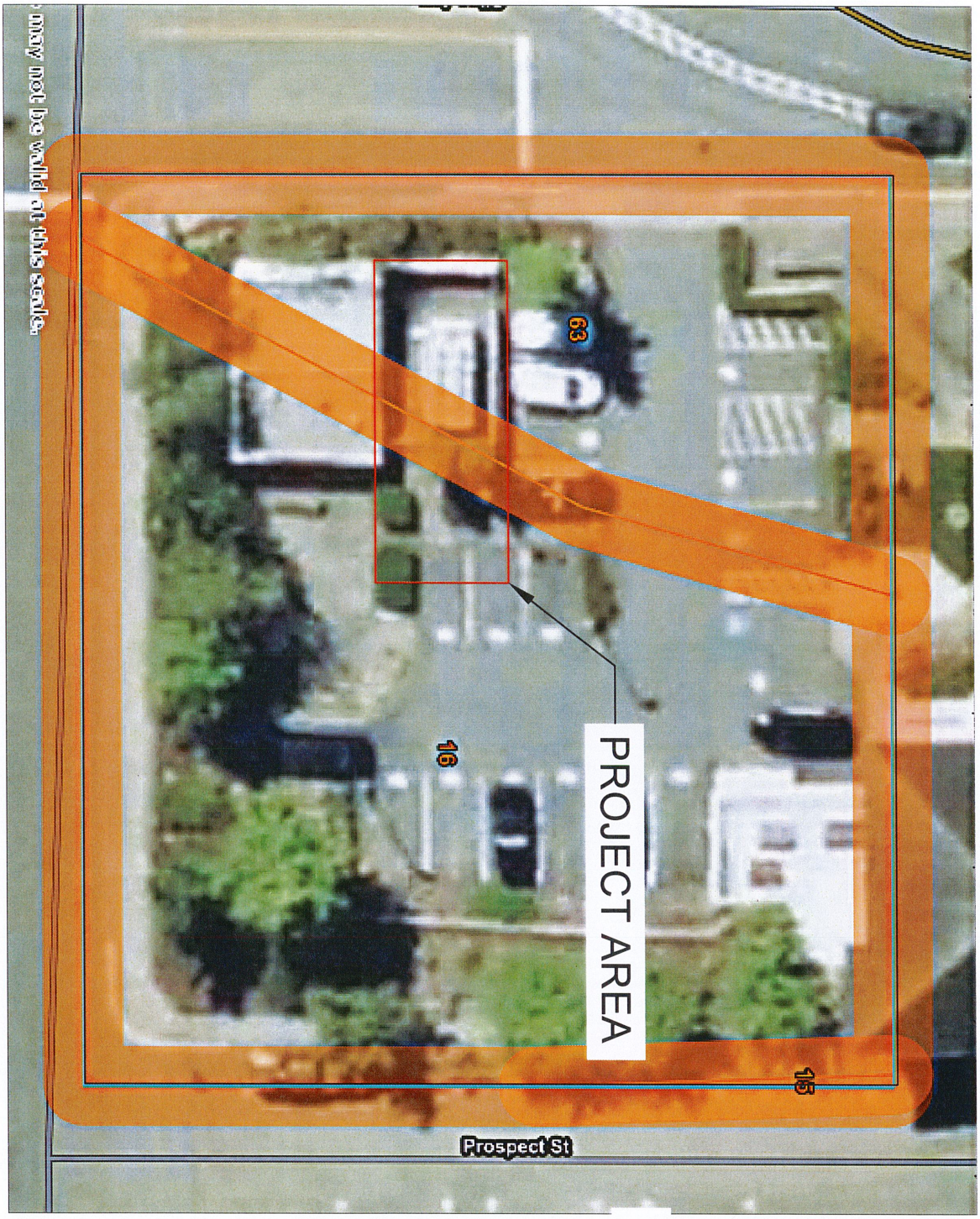
FOUNDATION PLAN
Proposed Solar Panel Array
Deep foundation Assessment
216 Prospect Street
Port Orchard, WA 98366

FOR: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

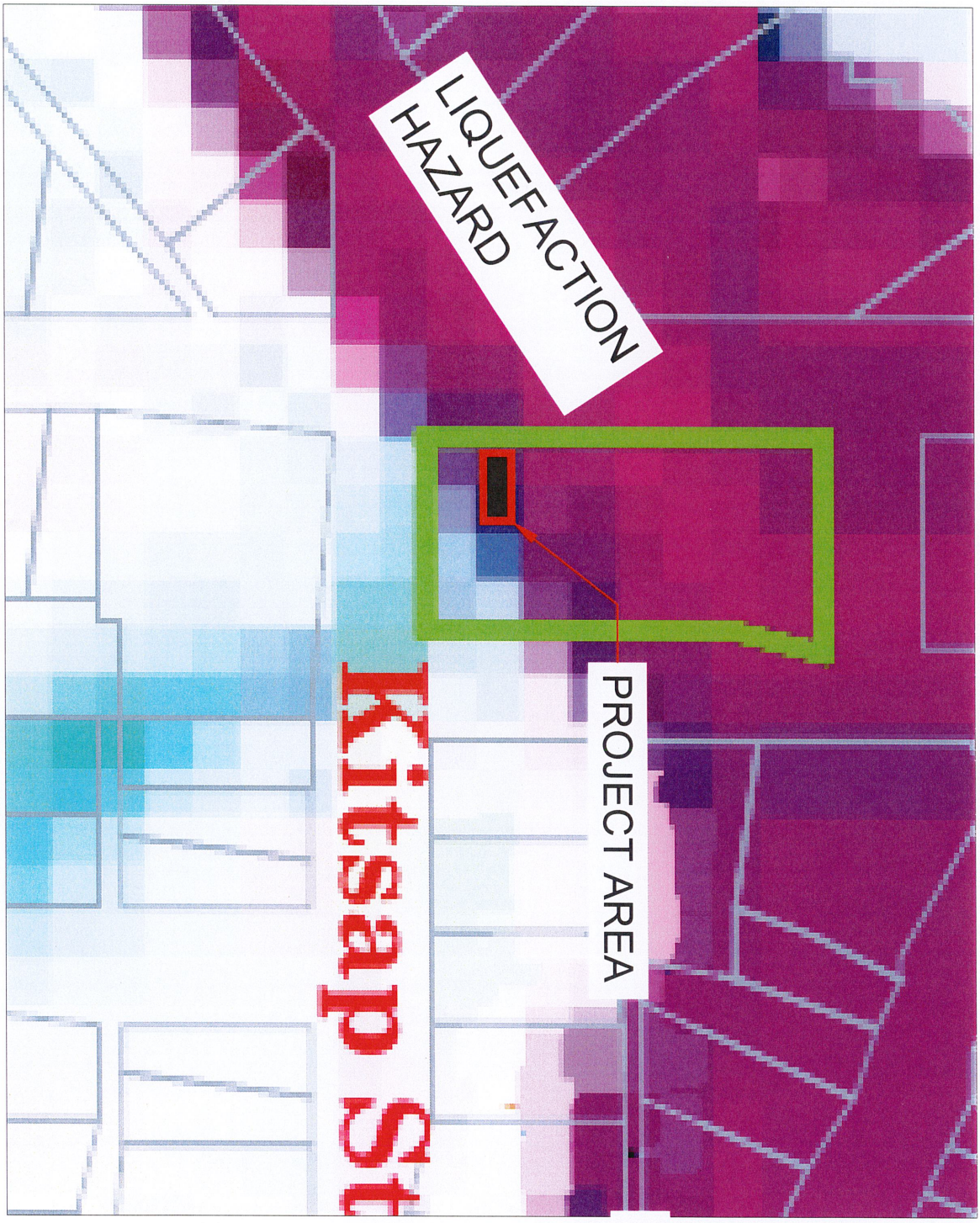
1" = 2'
DATE: *Jan 2023*
DRAWING NUMBER
12237-22
SHEET *1* OF *1*



SCALE NONE

FIGURE 5

N.L.Olson&Associates,Inc. Engineering, Planning and Surveying (360) 876-2284 2453 Bethel Avenue, P.O. Box 637, Port Orchard, WA 98366	**NRCS GEOLOGIC MAPPING** **Proposed Solar Panel Array** **Deep foundation Assessment** **216 Prospect Street** **Port Orchard, WA 98366**	**FOR:** Jason Ritter-Lopatowski Rice Fergus Miller, Inc. 275 5th Street, Suite 100 Bremerton, WA 98337	SCALE: *none* DATE: *January 2022* DRAWING NUMBER *12237-22* SHEET *1* OF *1*



"Geologic Hazard Mapping, Seismic Hazards, Kitsap County WA, Map Publish Date Feb 23, 2017".

FIGURE 6

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
(360) 876-2284
2453 Bethel Avenue, P.O. Box 637, Port Orchard, WA 98366

LIQUEFACTION MAPPING
Proposed Solar Panel Array
216 Prospect Street
Port Orchard, WA 98366

FOR: Jason Ritter-Lopatowski
Rice Fergus Miller, Inc.
275 5th Street, Suite 100
Bremerton, WA 98337

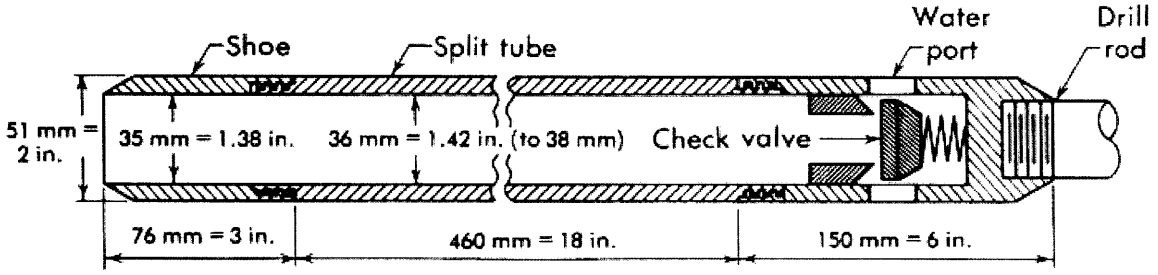
SCALE: *none*
DATE: *January 2022*
DRAWING NUMBER *12237-22*
SHEET *1* OF *1*

APPENDIX A

BORING LOG

The site soil conditions were explored on July 14, 2022, by drilling one (1) boring to a maximum depth of 76.5 feet below ground surface (bgs). Advanced Drill, Inc., was subcontracted and performed drilling operations with a D50 track mounted Drill Rig. The approximate boring location is been shown on the attached Site Plan, Figure 2. The boring log is included in this appendix.

Standard Penetration Test: During drilling operation the split spoon sampler was used to determine soil strength parameters and recover soil samples. The dimension of the split tube sampler is 2" outside diameter x 1 3/8" inside diameter x 18" long. The sampler is driven into the soil with a 140-pound hammer dropped a vertical distance of 30 inches. Soil strength parameters are related to the cumulative number of blows (N-Value) necessary to drive the sampler tube one foot into the soil. Prior to determining the N value, the sampler is driven 6 inches into the undisturbed soil. The samples recovered from the split spoon are suitable for atterberg, gradation, and moisture content tests.



To aid in classifying the soils and to determine general soil gradation, laboratory tests were performed on selected representative samples. Phoenix Soil Research in Kingston was retained to provide geotechnical laboratory analysis. The laboratory results have been included in this appendix.

The subsurface exploration logs and related information depicts conditions only at the specific locations and at the particular time designated on the logs. The passage of time may result in a change of subsurface conditions at these exploration locations. Subsurface conditions at other locations may differ from conditions occurring at the exploration locations. The nature and extent of variations of subsurface conditions between explorations are not known. If variations appear during additional explorations or construction, reevaluation of recommendations in this report may be necessary.

N.L.Olson&Associates,Inc.
Engineering, Planning and Surveying
2453 BETHEL AVENUE
P.O. BOX 637
PORT ORCHARD, WASHINGTON 98366-0637

Boring Log

Courthouse Solar Array
Port Orchard, WA

Job Number	Logged By	Subsurface Exploration Drilling		Ground Surface Elevation	Boring:	Page
12237	SMC	Start Date JUL 14, 2022	End Date JUL 14, 2022	11	B - 1	1 of 3

General Notes	Graphic Symbol	USCS SYMBOL	Recovery (in)	Depth (ft)	Blow per (ft) (N-Value)	Surface Conditions:	Moisture Content (%)
						Pavement thickness 3 inches Top Surfacing Top Course	
B1, 2.5 ft		SM	13"	1 2 3 (3, 4) 4 (3)	7	Fill: Brown Silty SANDwith Gravel, Loose, Moist - Fine to Medium Grained Sand - Subrounded to Subangular Gravel	
B1, 5.0 ft			18"	5 (2) 6 (2, 2)	4	Gray Lean CLAY With Sand and gravel, Soft, Wet - Contains Fine Grained Sand and gravel @ 5 feet, Pocket Pin Reading (PPR) = 437 PSF	
B1, 7.5 ft			18"	7 8 (0, 0)		Note: Saturated and water bearing soils between 5 and 15 feet	
				9 (0)	0	- Becomes very soft and water bearing	
B1, 10.0 ft			12"	10 (2) 11 (2, 1)	3	- Becomes soft	
B1, 12.5 ft		CL	18"	12 13 (2, 2)			
				14 (1)	3		
B1, 15.0 ft			18"	15 (1) 16 (2, 3)	5	- Becomes medium stiff - @ 15 ft, 10.5% gravel, 22.7% sand and 66.8% fines PL=29% LL=62% PI=33%	53.0
				17 18 19			
B1, 20.0 ft				20		Continued on Page 2	

Start Time	End Time	Hammer Type	Drawn By:	Date
0850	1120	140 lb Manual with split chain	SMC	July 15, 2022
Drilling Contractor: Advance Drill	Operators Name: Orrin	Drilling and sampling Method: Standard Split Spoon	Checked By: WRJ	Date
Equipment: d50 tracked drill rig		Groundwater Elevation: Groundwater between 5' - 15'	Revision By:	Date
Job Location				

Hole Completion
- ☐ Monitoring Well
- ☐ Piezometer
- ☒ Abanonded and backfilled
- ☐ Inclinometer

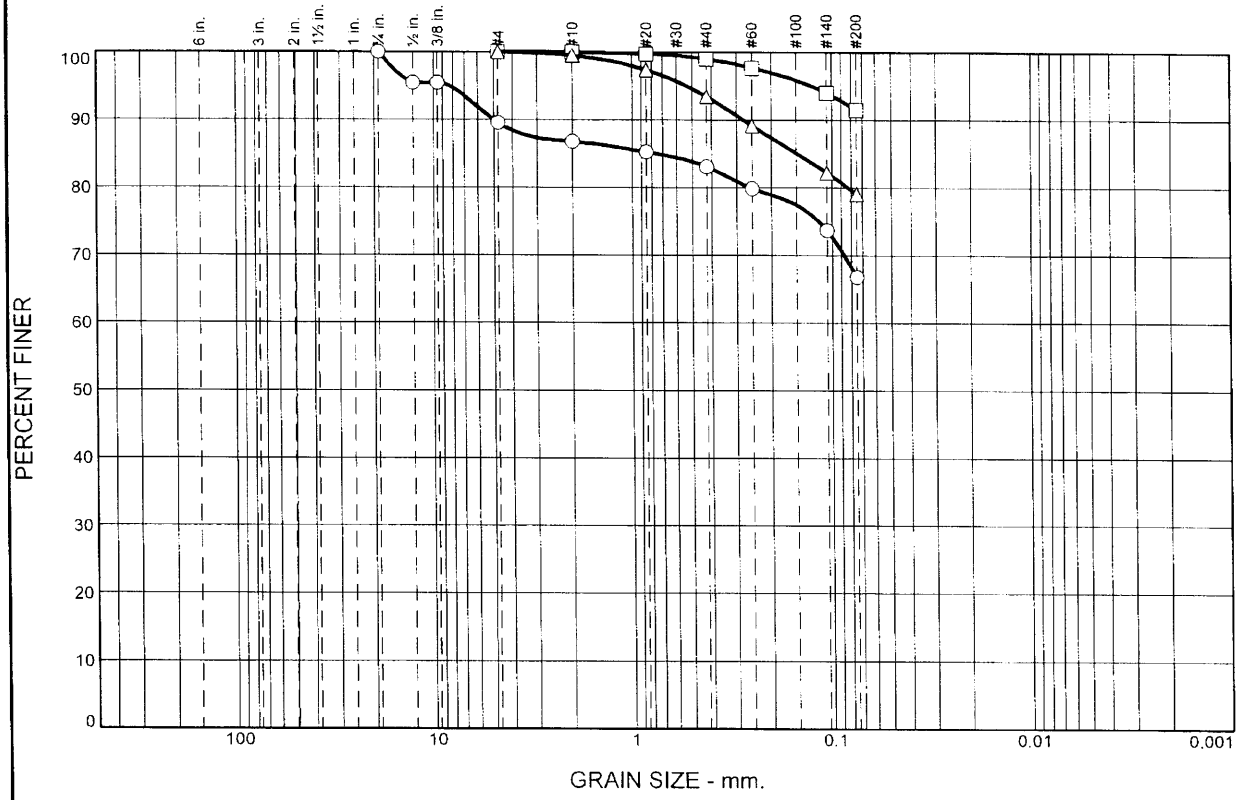
Remarks:

Sampling Method
- Standard Split Spoon — I
- California Sampler — II

General Notes	Graphic Symbol	USCS SYMBOL	Recovery (ft)	Depth (ft)	Blow per (ft) (N-Value)	N.L.Olson&Associates,Inc.				Page	Moisture Content (%)
						Job Number 11746	Job Name Courthouse Solar Array	Logged By SMC	Boring: B - 1	2 of 3	
B1, 20.0 ft			18"	20	14	Gray Elastic Silt, Very Stiff, Moist					56.6
				1	11	- Trace Fine Grained Sand					
					16	25	@20 feet, PPR = 4.25 tsf, PL=41%, LL=73% and PI 32%				
				2							
				3							
				4							
B1, 25.0 ft			18"	25	9	@ 25 feet, PPR =4.5 tsf, 8.5% sand, and 91.5% fines					49.4
				6	11	PL=45%, LL=73 and PI=32					
					16	27					
				7							
				8							
				9							
B1, 30.0 ft			18"	30	8						48.8
				1	10	PPR = 3.25 tsf					
					15	25	@30 ft, PL= 34%, LL=50% and PI=16%				
		MH		2							
				3							
				4							
B1, 35.0 ft			18"	35	10	At 35', Increase in Density					70.3
				6	13						
					32	45	- Becomes very hard				
				7			- Overburden pressure release sampled fractures within sampler				
				8			@35 ft, PL= 64%, LL=103% and PI=39%				
				9							
B1, 40.0 ft			18"	40	13						
				1	32	Proposed Pile Embedment Depth el -30.5					
					50	50-5"					
				2			- overburden pressure release sampled fractures within sampler				
				3							
				4							
B1, 45.0 ft			18"	45	15						
				6	21						
					27	48	- Overburden pressure release sampled fractures within sampler				
				7							
				8							
				9							
				50							
							Continued on Page 3				

General Notes	Graphic Symbol	USCS SYMBOL	Recovery (ft)	Depth (ft)		Blow per (ft) (N-Value)	N.L.Olson&Associates,Inc.				Page	Moisture Content (%)
							Job Number 11746	Job Name Courthouse Solar Array	Logged By SMC	Boring: B - 1	3 of 3	
B1, 50.0 ft			18"	50	14		Gray Elastic SILT, Very Stiff, Moist					
				1	18		- Trace Fine Grained Sand					
					24	42						
				2								
				3								
				4								
B1, 55.0 ft			18"	55	9		At 55', grades to very stiff					
				6	12		encountered sandy silt layer with fine grained sand					
					18	30						
				7								
				8								
				9								
B1, 60.0 ft			18"	60	6		PPR = 4.5 tsf					
		MH		1	9							
					14	23						
				2								
				3								
				4								
B1, 65.0 ft			18"	65	9		PPR = 3.5 tsf					
				6	10							
					13	23						
				7								
				8								
				9								
B1, 70.0 ft			18"	70	8		At 70', Increase in Sand content					
				1	10							
					15	25						
				2								
				3								
				4								
B1, 75.0 ft		ML	18"	75	18		Dark Gray silt with sand, dense, water bearing					
				6	22		- Fine to Medium grained sand grained sand					
					22	44						
				7			End of boring at 76.5 ft bgs					
				8								
				9								
				80								

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PL	PI
○	0.0	10.5	22.7	66.8		CH	62	29	33
□	0.0	0.0	8.5	91.5		MH	74	45	29
△	0.0	0.0	20.9	79.1		MH	103	64	39

SIEVE inches size	PERCENT FINER ○	□	△
0.75	100.0		
0.5	95.4		
0.375	95.4		
	GRAIN SIZE		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	89.5	100.0	100.0
#10	86.8	100.0	99.4
#20	85.2	99.7	97.3
#40	83.0	99.0	93.4
#60	79.8	97.7	89.1
#140	73.7	94.0	82.2
#200	66.8	91.5	79.1

Material Description

○ sandy fat clay

□ elastic silt

△ elastic silt with sand

REMARKS:

○

□

△

○ Depth: 15 Sample Number: B1

□ Depth: 25 Sample Number: B1

△ Depth: 35 Sample Number: B1

Phoenix Soil Research

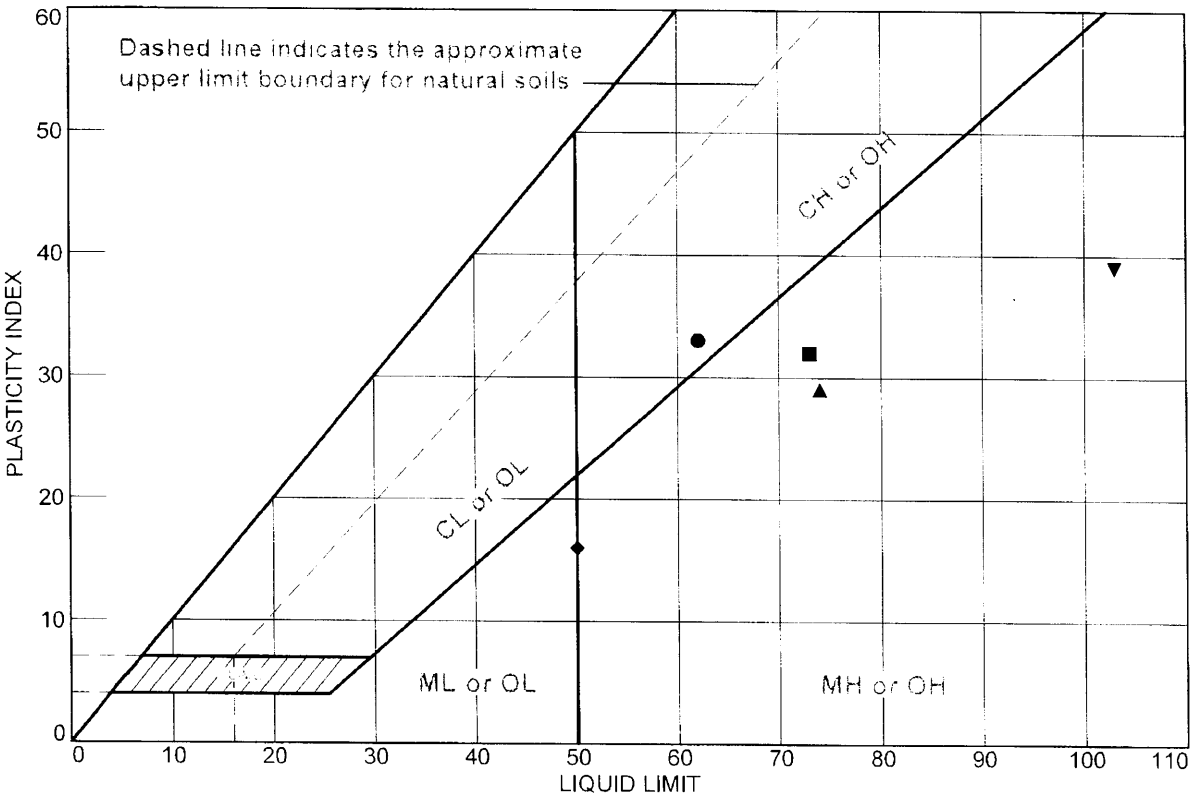
Kingston, WA

Client: N.L. Olson & Associates

Project: Solar Array Foundation 12237

Project No.: PSR22-15-0707 Figure 1

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		B1	15	53.0	29	62	33	CH
■		B1	20	56.6	41	73	32	MH
▲		B1	25	49.4	45	74	29	MH
◆		B1	30	48.8	34	50	16	MH
▼		B1	35	70.3	64	103	39	MH

Phoenix Soil Research

Kingston, WA

Client: N.L. Olson & Associates

Project: Solar Array Foundation 12237

Project No.: PSR22-15-0707 **Figure** 2

APPENDIX B

Supporting Data and Calculations

N.L. Olson has utilized AllPile and liquefypro for our pile and liquefaction analysis. N.L. Olson has provided a summary of each of the programs below.

Allpile is a Windows-based analysis program that handles virtually all types of piles, including steel pipes, H-piles, pre-cast concrete piles, auger-cast piles, drilled shafts, timber piles, jetted piles, tapered piles, piers with bell, micropiles (minipiles), uplift anchors, uplift plate, and shallow foundations. It calculates compression (with settlement), uplift, lateral capacity, and group analysis all together.

The results of our analysis results will be provided at final.

****
ALLPILE 7
VERTICAL ANALYSIS SUMMARY OUTPUT

www.civiltechsoftware.com
****
Licensed to
Date: 1/6/2023 File: E:\Allpile7\Work Folder\11746 solar panel foundation\pile group foundation cl.alp

Title 1: city hall
Title 2: solar panel foundation

ALLPILE INPUT DATA:

---

* Pile Type Page *
Unit: English
Displacement pile: Closed End pipe. Soil is displaced during driving. Higher friction expected. Total area is used in bearing calculation.
Pile Type: Driving Steel Pile (Closed end)

* Pile Profile *
Foundation Depth: 37.0 -ft
Top Height: -4.5 -ft
Slope Angle: 0
Pile Angle: 0

* Pile Properties *

Zs -ft	Width -in	Area -in2	Perim. -in	I -in4	E -kp/i2	Weight -kp/f	Mix %	Out Side	In Side	Other. Par.	Type
0.0	4.474	3.1	14.1	7.0	29000	0.011	80.0	2	2	1.0	Steel (smooth)
37.0	4.474	3.1	14.1	7.0	29000	0.011	80.0	2	2	1.0	Pile Tip

* Group-Head-Loading Conditions *
Head Condition: 1
Vertical Load, Q: 60 -kp
Shear Load, P: 0 -kp
Shear Condition: Static
Number of Cycles: 2
Moment, M: 0-kp-f
Displacement, yt: 0 -in
Slope, St: 0
Stiffness, Kt: 1 -kp-f
Group Type: 2
Top Type: 1

Diameter: 100 -in
Sx: 16.32 -in
Sy: 16.32 -in
Nx: 2
Ny: 2

No Water Table
No Elevation Input

* Soil Properties *

Zs	Gamma	Phi	C	K	E50/Dr	Nspt	Type	Soil
-ft	-lb/f3	o	-kp/f2	-lb/i3	- %			
0.0	110.9	31.3	0.00	26.7	26.74	7	4	Sand/Gravel
5.0	110.8	26.7	0.19	41.5	1.81	3	3	Silt (Phi + C)
20.0	133.9	0.0	3.13	1086.8	0.50	25	2	Stiff Clay
35.0	139.6	0.0	5.63	2199.5	0.35	45	2	Stiff Clay
40.0	139.7	0.0	6.13	2406.2	0.33	49	2	Stiff Clay
45.0	139.7	0.0	6.00	2355.5	0.34	48	2	Stiff Clay
50.0	139.5	0.0	5.38	2092.6	0.36	43	2	Stiff Clay

* Zero Tip Resistance *
The tip resistance is zero
* Zero Friction *
Zero 1 Friction Start: 0 -ft
Zero 1 Friction End: 20 -ft

ALLPILE ANALYSIS AND RESULTS:

TOTAL LOADS:
Vertical Load, Q: 60.0 -kp
Load Factor for Vertical Loads: 1.0
Loads Supported by Pile Cap: 100 %

PILE PROFILE:
Pile Length, L= 37.0 -ft
Top Height, H= -4.5 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0.00 Batter Factor, Kbat= 1.00

GROUP PILES:
Group Configuration:
Fixed Head
Average Pile Diameter= 0.37 -ft
Sx= 16.32 -in
Sy= 16.32 -in
Nx= 2
Ny= 2

1. Single Pile Vertical Analysis (in Group):
Vertical Load in Each Pile= 15.00 -kp
Results:
Total Ultimate Capacity (Down)= 98.85-kp, Total Ultimate Capacity (Up)= 99.25-kp
Total Allowable Capacity (Down)= 32.95-kp, Total Allowable Capacity (Up)= 99.25-kp
At Work Load= 15.00-kp, Settlement= 0.051-in
At Work Load= 15.00-kp, Secant Stiffness Kqx= 295.54-kp/-in
At Allowable Settlement= 1.000-in, Capacity= 99999.00-kp
Work Load, 15.00-kp, OK with the Capacity at Allowable Settlement= 1.00-in, Capacity= 99999.00-kp
Work Load, 15.00-kp, OK with the Allowable Capacity (Down)= 32.95-kp

2. Group Pile Vertical Analysis (in Group):
Vertical Load= 60.00 -kp
Results:
Total Ultimate Capacity (Down)= 395.39-kp, Total Ultimate Capacity (Up)= 397.02-kp
Total Allowable Capacity (Down)= 131.80-kp, Total Allowable Capacity (Up)= 397.02-kp
At Work Load= 60.00-kp, Settlement= 0.07420-in
At Work Load= 60.00-kp Secant Stiffness Kqx= 808.67-kp/-in
At Allowable Settlement= 1.000-in, Capacity= 99999.00-kp
Work Load, 60.00-kp, OK with the Capacity at Allowable Settlement= 1.00-in, Capacity= 99999.00-kp
Work Load, 60.00-kp, OK with the Allowable Capacity (Down)= 131.80-kp

---

FACTOR OF SAFETY:

FSside	FStip	FSuplif	FSweight
3.0	3.0	1.0	1.0

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 9999.

0 1 0 0 1

Fine grain group Effiency

$S_y = S_x = 16.32$

$P\phi = 4.474''$

Pile SPACING

3D — 3.648

4D

5D

6D

Group Effiency

.67 → 0.741

.78

.89

1.00

$\frac{16.32}{4.474} = 3.648$

$= .741(99)$

$= 73\ k/p \times 4$

$= 293\ k$ pilegroup

STEEL 20 k/p Each

Group 80 k/p

STEEL Governs