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GEOTECHNICAL ENGINEERING INVESTIGATION PROPOSED CENCOM FACILITY NEAR PORT LUDLOW, WASHINGTON

JOB NUMBER 102-02113
DECEMBER 11, 2002

Prepared for:

Mr. Joe Blashka Jr.
Adcomm Engineering Company
1461 – 128th Avenue NE
Woodinville, WA 98072

Prepared by:

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GEOTECHNICAL ENGINEERING DIVISION
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Krazan & ASSOCIATES, INC.
SITE DEVELOPMENT ENGINEERS

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

December 11, 2002

KA Project No. 102-02113

Mr. Joe Blashka Jr.
Adcomm Engineering Company
1461 – 128th Avenue NE
Woodinville, WA 98072

RE: GEOTECHNICAL ENGINEERING INVESTIGATION
TEAL LAKE CENCOM FACILITY
NEAR PORT LUDLOW, WASHINGTON

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the referenced site. The results of our investigation are presented in the attached report. This report presents the results of our field exploration, laboratory tests, and engineering analyses.

If you have any questions or if we can be of further assistance, please do not hesitate to contact our office.

Respectfully submitted,

KRAZAN AND ASSOCIATES, INC.

Wesley R. Johnson
Staff Engineer

WRJ

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TABLE OF CONTENTS

INTRODUCTION **1**
SITE LOCATION 1
PROPOSED CONSTRUCTION 1
PURPOSE AND SCOPE **1**
SITE INVESTIGATION **2**
SITE DESCRIPTION 2
GEOLOGIC SETTING 2
SUBSURFACE EXPLORATION 3
Soil *3*
Groundwater *3*
Laboratory Testing *3*
SEISMIC ZONE 4
CONCLUSIONS AND RECOMMENDATIONS **4**
EARTHWORK CONSIDERATIONS 4
Site Preparation *4*
Groundwater Concerns *5*
Excavations *5*
Structural Fill *5*
Utility Trench Backfill *5*
FOUNDATION SUPPORT 6
Mat Foundation *6*
Strip and Spread Footings *6*
Floor Slabs *7*
Estimated Settlement *7*
DRAINAGE 7
EROSION CONTROL 7
TESTING AND INSPECTION 8
LIMITATIONS **8**
SITE VICINITY MAP ..... **FIGURE 1**
SITE PLAN ..... **FIGURE 2**
FIELD AND LABORATORY INVESTIGATIONS ..... **APPENDIX A**

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December 11, 2002

KA Project No. 102-02113

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED CENCOM FACILITY
NEAR PORT LUDLOW, WASHINGTON

INTRODUCTION

SITE LOCATION

The communication tower site is located north of Teal Lake near Port Ludlow, Washington as shown on the attached Vicinity Map, Figure 1. According to the U.S. Geological Survey, 7.5 minute Port Ludlow, Washington topographic quadrangle map, the property is located at Latitude 47.90 degrees north and Longitude 122. 67 degrees west.

PROPOSED CONSTRUCTION

We understand that the proposed construction consists of a one-story building with a slab-on-grade floor, and a communications tower. We further understand that the communications tower is to be supported on a mat foundation with a bottom of footing approximately 5 to 10 feet below planned grade. Specific foundation loads for the tower and the building were not available at the time of this report. However, we anticipate that the building will be lightly loaded and that wind-induced overturning moments will govern foundation design for the tower. From our review of the proposed grading plan, we anticipate cuts and fills of 5 feet or less in the prefabricated building area and excavations of up to 5 to 10 feet for the tower's mat footing area. Please see the Site Plan, Figure 2, for details on the location of the proposed construction.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the soil and groundwater conditions at the site, to develop geotechnical engineering recommendations for use in design of specific construction elements and to provide criteria for site preparation and construction.

Our scope of services was performed in general accordance with our revised proposal for this project, dated November 15, 2002 (KA Proposal No. PG02-210P) and included the following:

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- A field investigation consisting of drilling and sampling one exploratory boring near the area of the proposed communication tower. The exploratory boring reached a depth of 40 feet below the existing site grade.

- Performing laboratory tests on representative soil samples obtained from the boring to evaluate the physical and index properties of the subsurface soils.

- Evaluation of the data obtained from the investigation and completion of engineering analyses to develop recommendations for use in the project design and preparation of construction specifications.

- Preparation of this report summarizing our findings, the results of our analyses and our conclusions and recommendations for this investigation.

SITE INVESTIGATION

SITE DESCRIPTION

The site has several existing features including a water tower, communications tower and two portable buildings. The existing water and communications towers are surrounded by fencing. The area around the site is heavily forested with fir and cedar trees, shrubs and ferns. Areas that are cleared of vegetation include the access road, parking, a 20 by 30 foot drill pad and the fenced areas around the existing communications tower and water tank. The site is relatively level, with a slight slope to the southwest.

GEOLOGIC SETTING

The site lies within the central Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history that includes at least four separate glacial advances/retreats. The Puget Lowland is bounded on the west by the Olympic Mountains and on the east by the Cascade Range. The lowland is filled with glacial and non-glacial sediments consisting of interbedded gravel, sand, silt, till, and peat lenses.

The Washington Division of Geology and Earth Resource (WDGER), Geologic Map of Washington - Northwest Quadrant, dated 2002, indicates that the property is located in an area of Quaternary, continental glacial till deposits. The till deposits generally consist of an unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel and boulders deposited by glacial ice. The deposits may contain interbedded stratified sand, silt and gravel.

The USDA Soil Conservation Services (SCS) Soil Survey for Jefferson County, Washington maps native soils in the project vicinity as Sinclair gravelly sandy loam with 0 to 15 percent slopes. This soil formed on glacial terraces, has moderately rapid permeability above the cemented layer (20-40 inches), and the hazard

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of water erosion is slight to moderate. A perched water table is on top of the cemented layer during the rainy season.

SUBSURFACE EXPLORATION

A field investigation, consisting of drilling 1 boring to a maximum depth of 40 feet below the existing ground surface was performed to evaluate the subsurface soil conditions at the project site. Drilling was performed on October 1, 2002, utilizing a limited access tracked drill rig provided by Davies Drilling, as a subcontractor. The boring location is indicated on Figure 2.

During drilling operations, standard penetration tests (SPT) were performed at regular intervals to evaluate the soil consistency and to obtain information regarding the engineering properties of the subsurface soils. Soil samples were retained for laboratory testing at our Poulsbo Laboratory. The soils encountered were continuously examined and visually classified in accordance with the Unified Soil Classification System.

Soil

The site soils consist of dense to very dense silty sands, and poorly graded sand with silt with variable amounts of gravel observed to the maximum depth explored in our boring. The upper 2 to 5 feet of soil is loose to medium dense. Note that the upper two feet of soil is fill used to form the drilling pad. Please see the boring logs in Appendix A for more information.

Groundwater

Groundwater was not encountered during our subsurface exploration. Water table elevations fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

Laboratory Testing

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. Details of the laboratory test program and results of the laboratory tests are summarized in Appendix A. This information, along with the field observations, was used to prepare the final boring log presented in Appendix A.

Samples of the fill and native soils were obtained near the ground surface in the area of boring 1 for resistivity testing. The test results indicate a minimum resistivity of 10,000 ohm-cm (100 ohm-meters) for the fill material and minimum resistivity of 16,000 ohm-cm (160 ohm-meters) for the native soil.

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SEISMIC ZONE

According to the *Seismic Zone Map of the United States* contained in the 1997 *Uniform Building Code,* the project site lies within Seismic Risk Zone 3. The overall soil profile generally corresponds to seismic soil profiles S_C as defined by Table 16-J of the 1997 *Uniform Building Code (UBC).* Soil profile S_C applies to a profile consisting primarily of very dense soils within the upper 100 feet of the profile. The United States Geologic Survey, Earthquake Hazards Program, National Seismic Hazard Mapping Project website indicates that the peak ground acceleration for the site with a probability of exceedence of 10 percent in 50 years is 0.29 g. For a soil profile S_C in seismic zone 3, the UBC recommends that the seismic coefficients, C_a and C_v, be 0.33 and 0.45, respectively.

CONCLUSIONS AND RECOMMENDATIONS

EARTHWORK CONSIDERATIONS

During wet weather conditions, typically October through April, subgrade stability problems and grading difficulties may develop due to high moisture content in the soil, disturbance of sensitive soils and/or the presence of perched groundwater. We therefore recommend that site grading activities and foundation construction occur during the dry season, if possible.

If earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated. These soils may "pump," and the materials may not respond to densification techniques. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with drier materials; removing and replacing the soil with an approved fill material. A qualified geotechnical engineering firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Site Preparation

General site clearing should include removal of vegetation, trees and associated root systems, wood, pavement, retaining walls, rubble, and rubbish. Site stripping should extend to a minimum depth of 4 inches, or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas. These materials will not be suitable for use as fill for parking or building areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas.

Buried structures encountered during construction should be properly removed and backfilled. Excavations, depressions, or soft and pliant areas extending below planned finish subgrade level should be cleaned to firm undisturbed soil, and backfilled with structural fill to planned finish subgrade. In general, any septic tanks, underground storage tanks, debris pits, cesspools, or similar structures should be entirely removed. Concrete footings should be removed to an equivalent depth of at least 3 feet below proposed footing elevations or as recommended by the Geotechnical engineer. The resulting excavations should be backfilled with structural fill to planned finish subgrade.

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Groundwater Concerns

Groundwater was not encountered during our field investigation. Perched ground water may exist above the level of the till with more perched ground water present during, or just after wet weather conditions. This perched groundwater develops where vertical infiltration of surface precipitation is impeded by a relatively impermeable soil layer, resulting in horizontal migration of the groundwater within overlying more permeable soils. Design of temporary dewatering systems to remove groundwater should be the responsibility of the contractor.

Excavations

It is our opinion that the site soils are a Type B material as defined by the Washington Industrial Safety and Health Act's (WISHA) regulations on excavation, trenching and shoring. Temporary slopes excavated in Type B material should be inclined no steeper than 1H:1V (horizontal:vertical). Permanent cut and fill slopes (non reinforced) should be inclined no steeper than 2H:1V. A representative of our firm should evaluate temporary and permanent slopes to insure that they are appropriate for the soils encountered during construction.

In areas where it is not possible to maintain the recommended slopes due to space constraints, temporary shoring will be required. The contractor should be responsible for design and construction of the temporary system. We recommend that a structural engineer and Krazan & Associates review the proposed shoring system prior to construction.

Structural Fill

The on-site native soils are generally suitable for use as structural fill. The relatively high fines content of the near surface soils may result in difficulty achieving required compaction especially during wet weather.

Imported structural fill material should consist of well-graded gravel or a sand and gravel mixture with a maximum grain size of 1½ inches and less than 5 percent fines. All Structural fill material should be submitted for approval to the Geotechnical Engineer at least 48 hours prior to delivery to the site.

Structural fill should be placed in lifts approximately 6 to 8 inches thick, moisture-conditioned as necessary, (moisture content of soil should be within ±2 percent of optimum moisture) and compacted to 95 percent of the maximum density based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

Utility Trench Backfill

Utility trenches should be excavated according to accepted engineering practice following WISHA standards by a contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the contractor. Traffic and vibration adjacent to trench walls should be minimized. Cyclic wetting and drying of excavation side slopes should also be avoided.

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All utility trench backfill should consist of structural fill. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 2 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 2 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

FOUNDATION SUPPORT

It is our opinion that the proposed tower can be adequately supported on shallow foundations bearing on the dense to very dense native soils and the prefabricated building can be placed on properly compacted structural fill or dense native soil. We understand that the communications tower will be supported on a mat foundation. We assume that the building will be supported on strip footings, spread footings or a combination of strip and spread footings. All allowable bearing pressures given below may be increased by 1/3 to resist transient loading conditions such as wind or seismic loads. Note that, based on our understanding of the proposed construction and the very dense nature of the site soils, all allowable bearing pressures presented below are governed by our estimation of tolerable settlements for the structures. It is our opinion that an actual bearing capacity type failure is extremely unlikely for the proposed construction at this site. Therefore, increases in the allowable bearing pressures may be possible if higher settlements can be tolerated. Please contact us for more information if needed.

Mat Foundation

We recommend that the mat foundation for the communication tower be supported by the very dense native sands and gravels encountered at a depth of about 7.5 feet below existing grade. An allowable bearing pressure of 7,500 pounds per square foot (psf) may be used for design of the mat foundation. Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.45 acting between the base of foundation and the supporting subgrade and an allowable equivalent fluid passive pressure of 330 pounds per cubic foot acting against the appropriate vertical footing faces. Note that the equivalent fluid passive pressure may also be used to resist overturning moments.

Strip and Spread Footings

From our review of the grading plan, we anticipate that the building footings will be supported on both the native soils and structural fill. For simplicity, we recommend that all footings for the building be designed using an allowable bearing pressure of 2,500 psf. All footings should have a minimum embedment depth of 18 inches below adjacent grade and a minimum width of 12 inches. Resistance to lateral footing

displacement can be computed using an allowable friction factor of 0.35 acting between the base of foundations and the supporting subgrade and allowable equivalent fluid passive pressure of 250 pounds per cubic foot acting against the appropriate vertical footing faces.

Floor Slabs

For interior floor slabs or other floor slabs where moisture migrating through the slab may be an issue, we recommend that concrete slab-on-grade floors be underlain by a water vapor retarder system. The water vapor retarder system should be installed in accordance with ASTM Specification E1643-94 and Standard Specifications E1745-97. According to ASTM Guidelines, the water vapor retarder system should consist of a vapor retarder sheeting underlain by a minimum of 4-inches of compacted clean, open-graded coarse rock of ¾-inch maximum size.

Estimated Settlement

We estimate that settlements for the mat foundation under the anticipated maximum load of 7,500 psf will be less than ¾ of an inch. For the strip and spread footings, we estimate that the settlements will be less than 1 inch. The settlements will be elastic in nature and should occur essentially as the loads are applied. Note that our estimates of settlements are based on assumed dimensions for the footings. We have assumed a 35 by 35 foot square mat foundation for the tower and 2-foot wide strip footings for the building. If the final design of the foundations results in footing with larger dimensions than those given above, we should be contacted so that we can revise our settlement estimates.

DRAINAGE

The ground surface should slope away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices. We recommend that adjacent exterior grades be sloped a minimum of 2 percent for a minimum distance of 5 feet away from structures. Roof drains should be tightlined away from foundations. Subgrade soils in pavement areas should be sloped a minimum of 1 percent and drainage gradients maintained to carry all surface water to collection facilities. These grades should be maintained for the life of the project. Footing drains should be placed around the perimeter of the building.

EROSION CONTROL

Erosion and sediment control (ESC) is used to minimize the transportation of sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. As the site is not directly adjacent to surface waters, we anticipate that standard erosion and sediment control measures (such as silt fences at the perimeter of the construction area, and protection for any existing storm sewer inlets that may be affected by the construction) for this site will be sufficient.

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TESTING AND INSPECTION

A representative of our firm should be present during all earthwork activities to confirm that actual subsurface conditions are consistent with the subsurface investigation. This testing and observation is an integral part of our service as the performance of earthwork construction is dependent upon the compaction of fill soil and the suitability of native soil. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction.

LIMITATIONS

Geotechnical engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences improves. Although your site was analyzed using the most appropriate current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to improvements in the field of Geotechnical engineering, physical changes in the site either due to excavation or fill placement, new agency regulations or possible changes in the proposed structure after the time of completion of the soils report may require the soils report to be professionally reviewed. In light of this, the Owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that two years be considered a reasonable time for the usefulness of this report.

Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. If any variations or undesirable conditions are encountered during construction, the Geotechnical engineer should be notified so that supplemental recommendations can be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The Geotechnical engineer should be notified of any changes so the recommendations can be reviewed and reevaluated.

This report is a geotechnical engineering investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any environmental site assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater or atmosphere, or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring log regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposed and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical developments. We emphasize that this report is valid for this project as outlined above, and should not be used for any other site.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (360) 598-2126.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Wesley R. Johnson
Staff Engineer

Todd S. Parkington, P.E.
Senior Geotechnical Engineer

WRJ/TSP

TSP

TODD S. PARKINGTON
STATE OF WASHINGTON
36073
REGISTERED
PROFESSIONAL ENGINEER
12/12/02
EXPIRES 5/01/04

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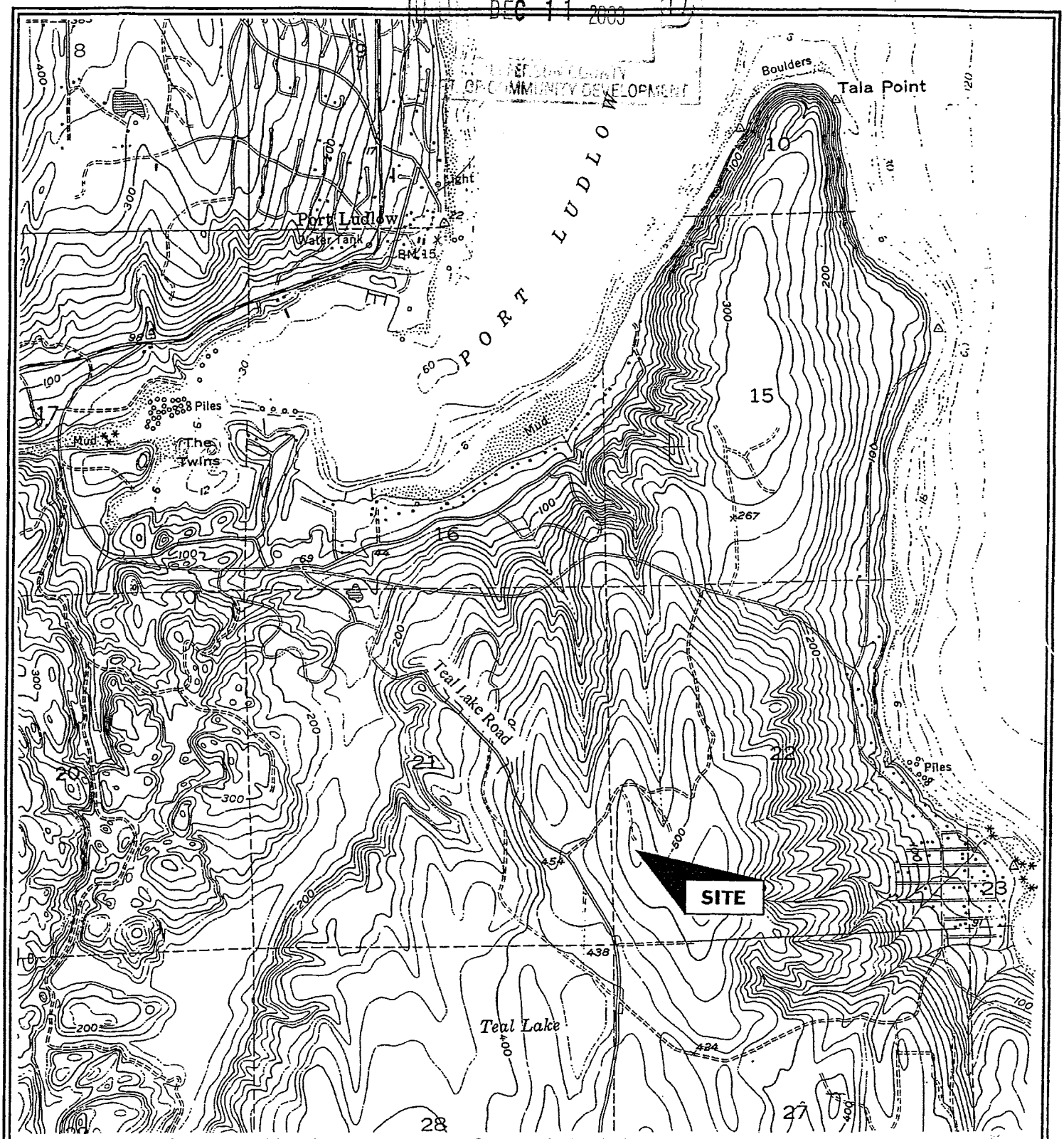

Note Map adapted from the USGS 7.5' Port Ludlow, WA. Quadrangle dated 1953, photorevised 1973

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Poulsbo, WA 98370
360-598-2126

FIGURE 1 – SITE VICINITY MAP

Job name: Teal Lake Tower
Location: Port Ludlow, Washington
Job No. : 102-02113
Client: CenCom
Date: 12-09-2002

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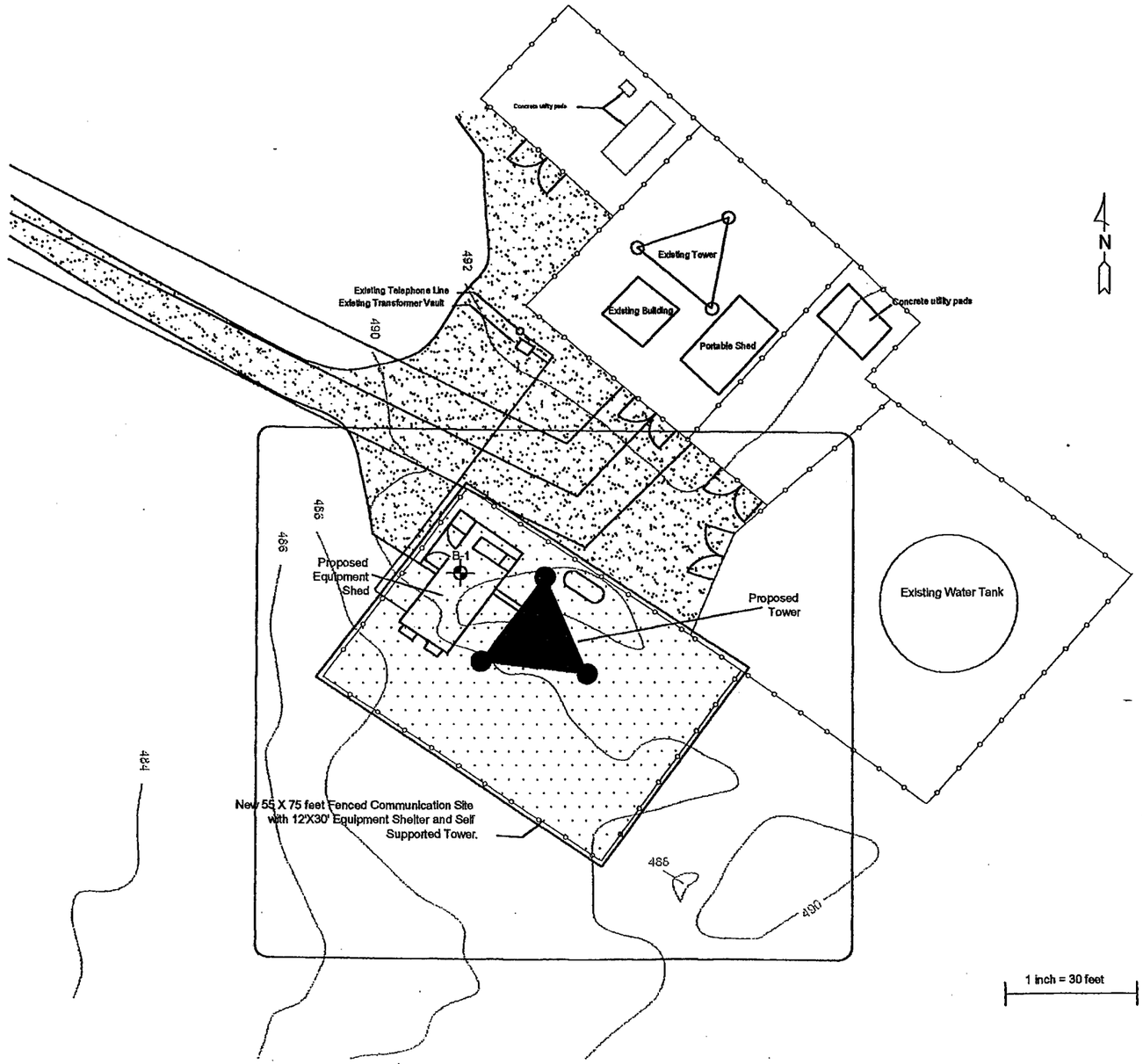

Legend

Project Area

Boring Location B-1

Proposed Tower

Note: Site Plan developed from plans and drawing provided by Michael Aippersbach, Dated November 13, 2002

Site Plan		
Proposed Cencom Facility		Figure 2
1 in = 30 ft	Job Number: 102-02113	Drawn By: WRJ Revised By: WRJ
Date: Decmber 11, 2002	Krazan & Associates, Inc.	Figure No. 2 Drawing Type: Site Map

APPENDIX A

FIELD AND LABORATORY INVESTIGATIONS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploratory program. The exploratory boring was drilled using a limited access, tracked drill rig provided by Davies drilling as a subcontractor. The boring location is shown on the Site Plan, Figure 2.

Disturbed soil samples were obtained by using the Standard Penetration Test (SPT) as described in ASTM: D-1586. The Standard Penetration Test and sampling method consists of driving a standard 2-inch outside-diameter, split barrel sampler into the subsoil with a 140-pound hammer free falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the Standard Penetration Resistance, or N-value. The blow count is presented on the boring log in this appendix. The resistance, or "N" value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils. The soils encountered were logged in the field during the exploration and, with supplementary laboratory test data, are described in accordance with the Unified Soil Classification System. All samples were returned to our Poulsbo laboratory for evaluation.

Laboratory Investigation

The laboratory investigation was performed to estimate the physical and mechanical properties of the soil underlying the site. In situ moisture contents and grain size distribution tests were performed for samples representative of the subsurface material. These tests, supplemented by visual observation, comprised the basis for our evaluation of the site material. The results of the in situ moisture contents are indicated on the boring log. Results of the grain size distributions are indicated on Figures A-2 through A-4.

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Log of Boring B-1

Project: Teal Lake Tower
Client: CenCom
Location: 125' West of Water Tank
Depth to Water: Not Encountered

Project No: 102-02113
Figure No.: A1
Logged By: C. Alferness
Elevation: 498'

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Sample Number	Dry Density (pcf)	Fines Content (%)	Type	N-Value (Blows/Ft.)	Water Content (%) (5 15 25 35 45)
		Ground Surface						
0		***WELL GRADED GRAVEL WITH SILT*** AND SAND (GW) Loose, well graded, brown to gray, moist. (Fill)	S-0			SS	8	6.6
		SILTY SAND (SM) Very dense, fine grained sand, light brown, dry with trace gravel (till). (Native)						
5			S-1		41	SS	58	10
10		Gravel and moisture content increases Becomes gray	S-2			SS	50:2"	7.6
15			S-3			SS	50:6"	7.5
		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) Very dense, fine grained, brown, dry to moist. (Advanced Outwash).						
20			S-4			SS	50:5.5"	8.3

Method: Limited Access Drill Rig
Driller: Davies
Operator: Jeff

Krazan and Associates
20714 State Highway 305 N.E.
Suite 3C
Poulsbo, Washington 98370

Drill Date: 12/2/02
Sample Method: SPT
Sheet: 1 of 2

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Log of Boring B-1

Project: Teal Lake Tower
Client: CenCom
Location: 125' West of Water Tank
Depth to Water: Not Encountered

Project No: 102-02113
Figure No.: A1
Logged By: C. Alferness
Elevation: 498'

SUBSURFACE PROFILE			SAMPLE					
Depth (ft)	Symbol	Description	Sample Number	Dry Density (pcf)	Fines Content (%)	Type	N-Value (Blows/Ft.)	Water Content (%) 5 15 25 35 45
		POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) Very dense, fine grained, brown, dry to moist. (Advanced Outwash).	S-4			SS	50:5.5"	
25			S-5		11.8	SS	50:6"	10.4
30			S-6		11.8	SS	50:1"	9.3
		POORLY GRADED GRAVEL WITH SAND (GP) Very dense, medium to coarse grained sand, gray-brown, moist to wet. Trace of silt. Interbedded medium grained sand.						
35			S-7		0.1	SS	50:1"	5.8
			S-8		0.1	SS	50:7"	4.5
40								

Method: Limited Access Drill Rig
Driller: Davies
Operator: Jeff

Krazan and Associates
20714 State Highway 305 N.E.
Suite 3C
Poulsbo, Washington 98370

Drill Date: 12/2/02
Sample Method: SPT
Sheet: 2 of 2

GRAIN SIZE DISTRIBUTION TEST REPORT

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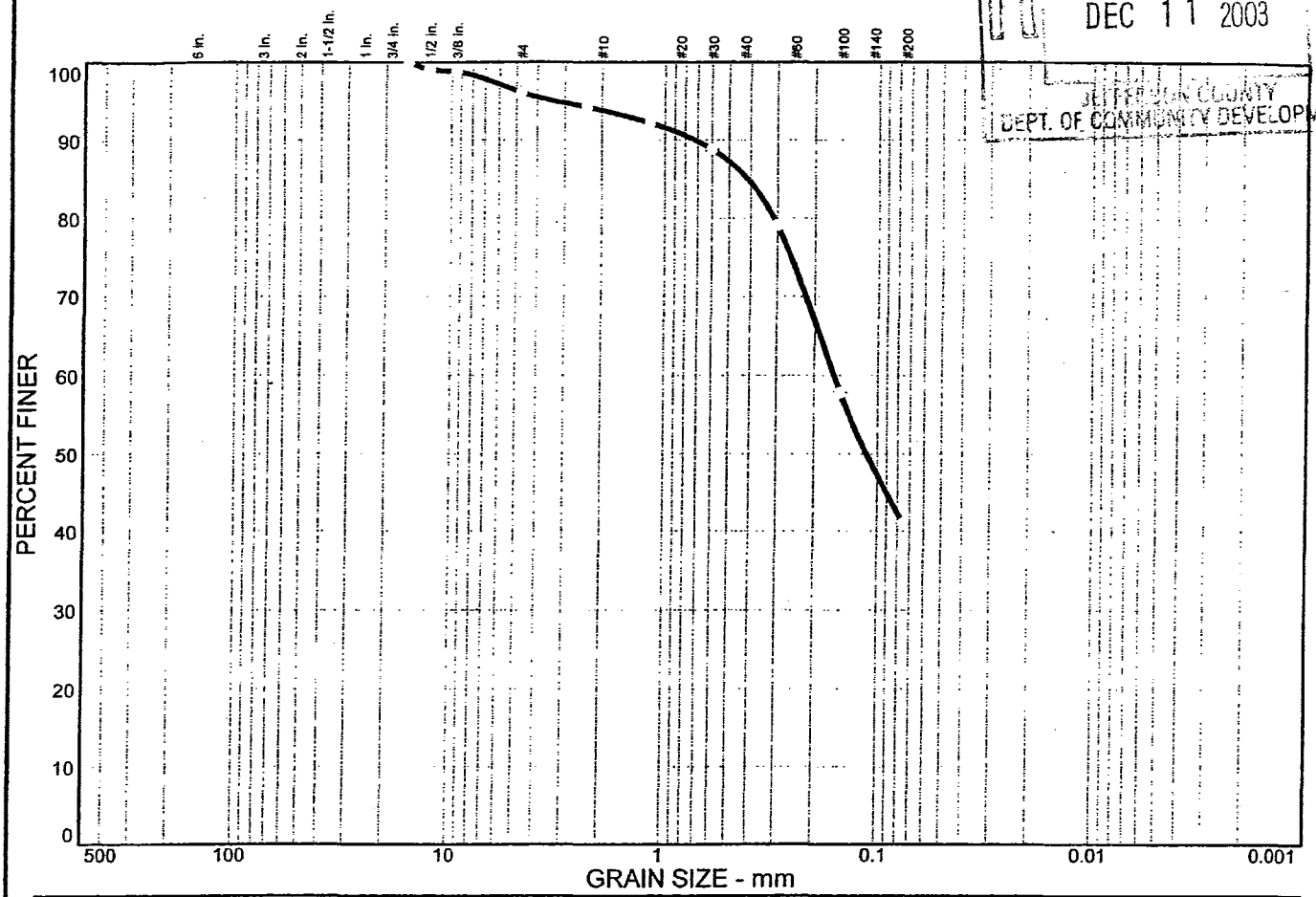

% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.9	55.1	41.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.625 in.	100.0		
0.5 in.	99.1		
0.375 in.	98.8		
#4	96.1		
#8	94.2		
#16	92.2		
#30	88.8		
#50	79.1		
#100	57.8		
#200	41.0		

* (no specification provided)

Soil Description

USCS:SILTY SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.411 D_{60}= 0.161 D_{50}= 0.112
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks —

SAMPLE #: P4294
REPORT #: 9375
DATE: 12-02-2002

Sample No.: P4294 **Source of Sample:** GEO **Date:** 12-02-2002
Location: B-1;S-1 **Elev./Depth:**

KRAZAN & ASSOCIATES, INC.

Client: CEN COM
Project: TEAL LAKE TOWER
Project No: 102-02113 **Figure** A-2

GRAIN SIZE DISTRIBUTION TEST REPORT

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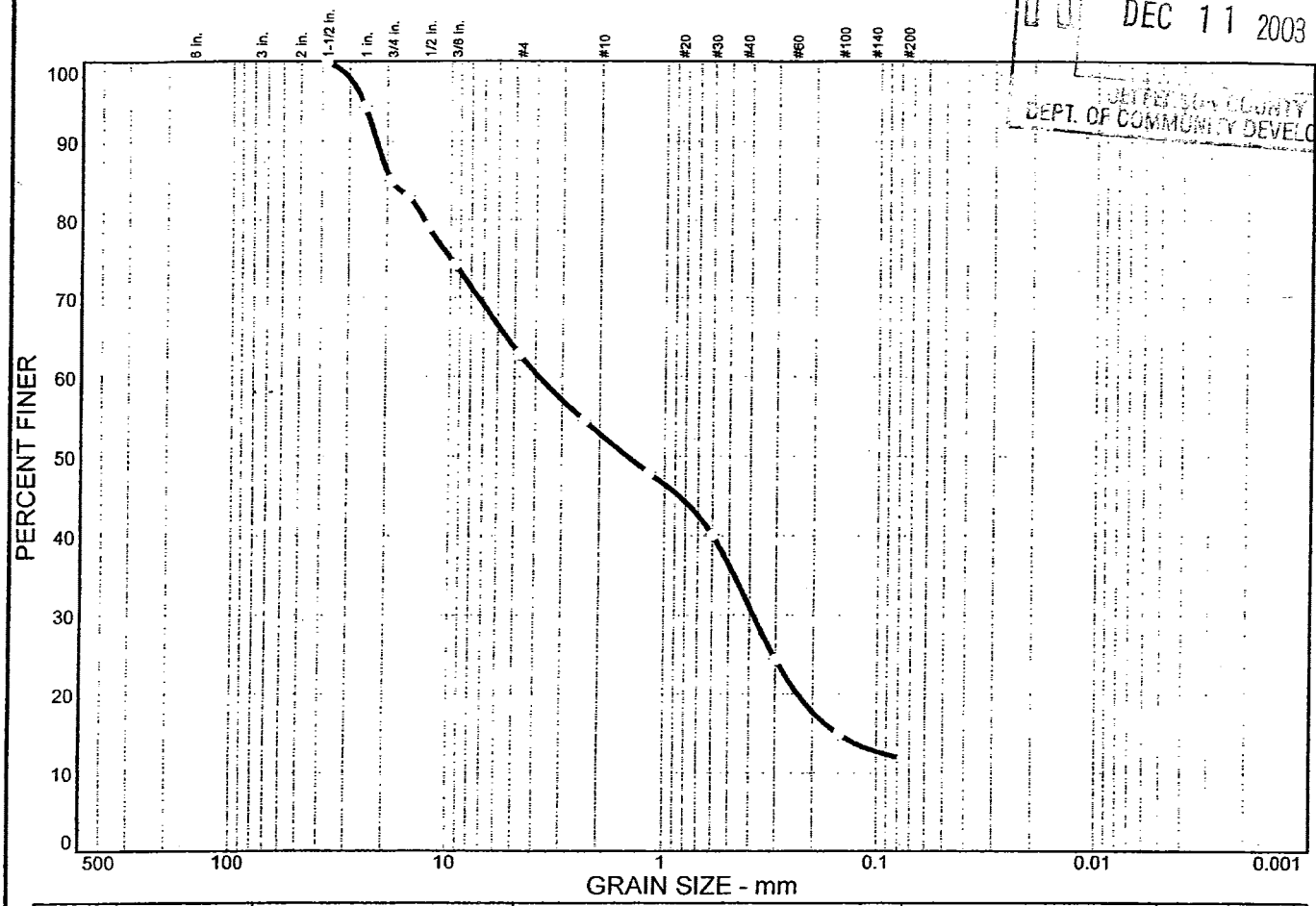

% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	37.1	51.1	11.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1.0 in.	94.3		
0.75 in.	85.0		
0.625 in.	83.0		
0.5 in.	79.1		
0.375 in.	74.3		
#4	62.9		
#8	54.5		
#16	47.9		
#30	40.1		
#50	24.4		
#100	14.9		
#200	11.8		

* (no specification provided)

Soil Description

USCS: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 19.0 D_{60}= 3.84 D_{50}= 1.49
D_{30}= 0.383 D_{15}= 0.152 D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

SAMPLE #: P4295
REPORT #: 9375
DATE: 12-02-2002

Sample No.: P4295 **Source of Sample:** GEO **Date:** 12-02-2002
Location: B-1;S-5,S-6 **Elev./Depth:**

KRAZAN & ASSOCIATES, INC.

Client: CEN COM
Project: TEAL LAKE TOWER
Project No: 102-02113 **Figure** A-3

GRAIN SIZE DISTRIBUTION TEST REPORT

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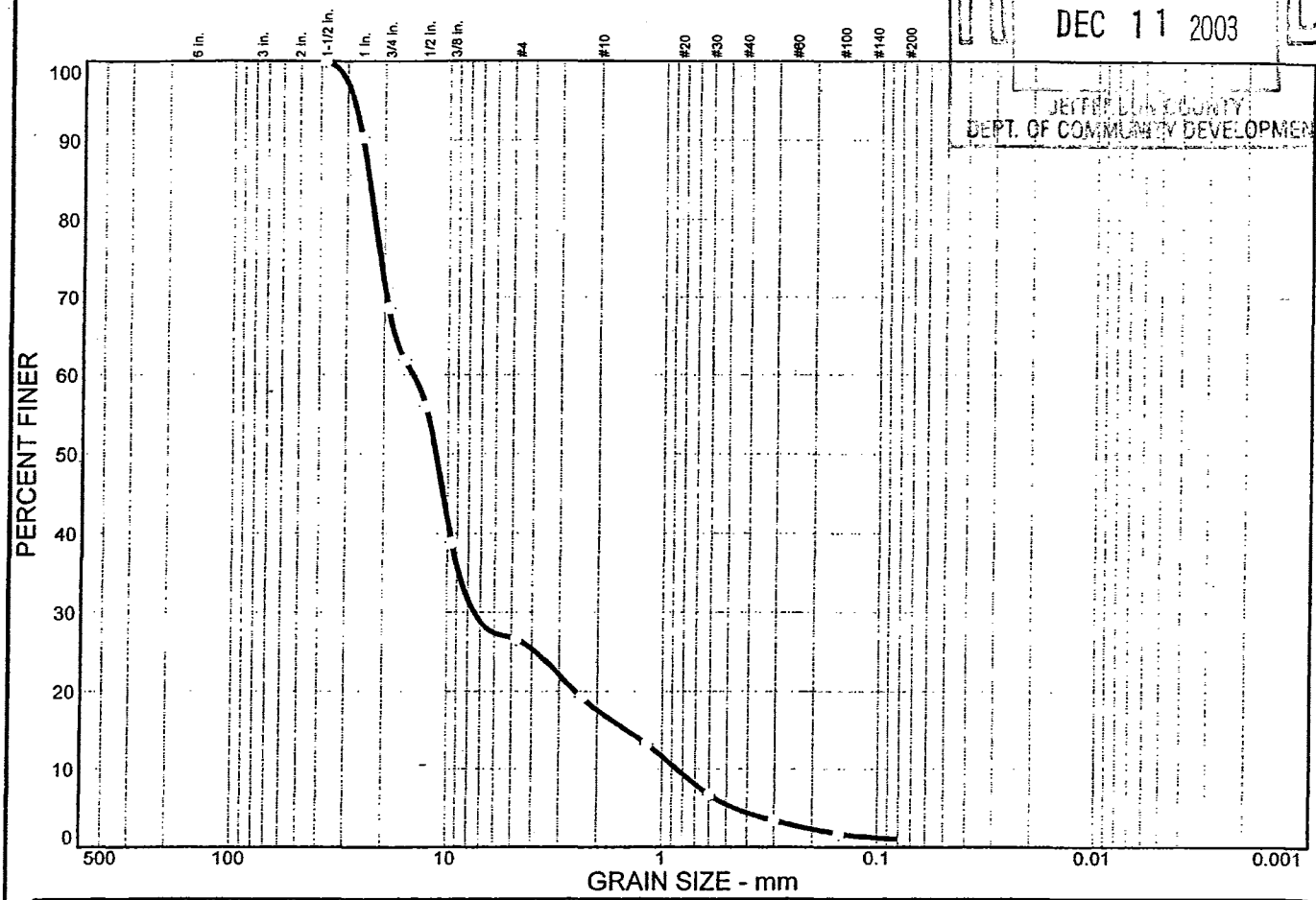

% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	73.4	25.6	1.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1.0 in.	90.3		
0.75 in.	68.5		
0.625 in.	61.8		
0.5 in.	55.9		
0.375 in.	38.8		
#4	26.6		
#8	19.2		
#16	13.2		
#30	6.7		
#50	3.4		
#100	1.7		
#200	1.0		

* (no specification provided)

Soil Description

USCS:POORLY GRADED GRAVEL WITH SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 23.6 D_{60}= 14.6 D_{50}= 11.4
D_{30}= 7.48 D_{15}= 1.46 D_{10}= 0.854
C_u= 17.06 C_c= 4.49

Classification

USCS= GP AASHTO=

Remarks

SAMPLE #: P4293
REPORT #: 9375
DATE: 12-02-2002

Sample No.: P4293 **Source of Sample:** GEO **Date:** 12-02-2002
Location: B-1;S-7,S-8 **Elev./Depth:**

KRAZAN & ASSOCIATES, INC.

Client: CEN COM
Project: TEAL LAKE TOWER
Project No: 102-02113 **Figure** A-4