GeoEngineers

March 7, 2003

City of Longview
c/o ARC Architects
1101 East Pike Street
Seattle, Washington 98122

Attention: Mr. Stan Lokting
Mr. Dan Podoll

GeoEngineers is pleased to submit six copies of our geotechnical engineering report for the proposed Regional Conference Center located in Longview, Washington. Our services have been provided in accordance with our proposal dated January 22, 2003. This report summarizes our field and laboratory programs and provides geotechnical engineering recommendations for design and construction of the proposed conference center.

We appreciate the opportunity to be of service to ARC Architects and the City of Longview. Please call if you have questions regarding this report or if we can be of further assistance.

Yours very truly,

GeoEngineers, Inc.

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED REGIONAL CONFERENCE CENTER
LONGVIEW, WASHINGTON
FOR
THE CITY OF LONGVIEW
C/O ARC ARCHITECTS

INTRODUCTION

This report summarizes GeoEngineers' geotechnical engineering evaluation of the proposed site for the planned Regional Conference Center located southeast of the intersection of Seventh Avenue and Washington Street in Longview, Washington. This report presents the results of our field and laboratory programs and provides geotechnical engineering design and construction recommendations for the proposed conference center.

Figure 1 shows the site location relative to surrounding topographic features. Figure 2 shows the approximate site boundaries, existing structures, and the approximate locations of our field explorations completed for this project.

PROJECT DESCRIPTION

The site is currently developed and occupied by several structures of various types. We understand that the existing kiosks and commercial building will be preserved and likely remodeled as part of the project. Several other structures and existing pavement sections will be demolished to accommodate the new construction. General development includes cuts and fills for site grading of less than 2 feet each. Foundation loads were not available at the time of this proposal, but are expected to be typical for the types of structures proposed. We anticipate that floor loads will be less than 250 pounds per square foot (psf). A two-phase construction approach is planned for the development and includes the specific components as described below.

PHASE 1

The first construction phase consists of an event center/gymnasium building that adjoins the existing commercial building on the west side. Other structures proposed as part of Phase 1 include a lobby, a reception area, an administration building, a gallery, kitchen, a terrace and an outdoor plaza. Driving lanes and a parking lot with approximately 160 parking spaces are also planned as part of the Phase 1 construction.

PHASE 2

The second phase of construction will include an event center/gymnasium building that adjoins the existing commercial building on the east side. An additional 180 parking spaces and several driving lanes are also planned as part of the Phase 2 construction.

PURPOSE AND SCOPE OF WORK

The purpose of our services is to provide geotechnical engineering recommendations for design and construction of the planned regional conference center. A detailed description of our scope of work is provided in our proposal dated January 22, 2003. Specifically GeoEngineers has performed the following tasks:

1. Explore subsurface conditions by drilling the following borings:
   a. Four borings to depths varying between approximately 20 and 25 feet within the footprint of the proposed Phase 1 and 2 structures.
   b. Four borings to a depth of approximately 10 feet within the footprint of the proposed Phase 1 and 2 parking lots.
2. Perform a geotechnical laboratory testing program which consists of the following laboratory tests:
   a. Eight moisture content and/or density determinations in accordance with American Society for Testing and Materials (ASTM) Test Methods D 2216 and D 2937, respectively, to evaluate the fill suitability of the native soils.
   b. Two particle size analyses in general accordance with ASTM Test Method D 422 to assist in soil classification and for correlation with other engineering soil properties and liquefaction susceptibility evaluation.
3. Provide recommendations for site preparation, grading and drainage, stripping depths, demolition, fill type for imported materials, compaction criteria, cut and fill slope criteria, procedures for use of on-site soils and wet weather earthwork procedures.
4. Provide recommendations for design and construction of shallow spread foundations, including allowable design bearing pressure and minimum footing depth and width.
5. Provide recommendations for design and construction of slab-on-grade floors including a design value for subgrade reaction modulus.
6. Estimate settlement of footings and the floor slabs for the anticipated design loads.
7. Recommend design criteria for retaining walls, including lateral earth pressures, allowable bearing pressure for retaining wall footings, backfill, compaction and drainage.
8. Provide asphalt concrete pavement recommendations for access roads and parking areas. Our pavement design is based on assumed traffic volumes.
9. Recommend the appropriate zone factor and site coefficient for seismic design using conventional equivalent static lateral force methods.
10. Provide six copies of our report summarizing our explorations and recommendations.

SITE CONDITIONS

SURFACE CONDITIONS

The site is located near downtown Longview, Washington. It is bounded to the north by Washington Street, to the east by 3rd Avenue, and to the west by 7th Avenue. Residential properties border the site on all sides. The site has a gentle topographic slope to the southeast and a drainage ditch to the south provides surface drainage for the site.

The site currently comprises the Cowlitz County Fairgrounds. Several wood-framed and metal-framed buildings with concrete floors occupy the northwest portion of the site. Areas adjacent to existing buildings consist of asphalt pavement or landscaped grass and trees. The northeast portion of the site consists primarily of asphalt-paved parking lots. Gravel parking lots are located to the east site boundary.

Topographically, the site is generally flat; site elevations vary between approximately 18 and 22 feet above mean sea level (msl). The Cowlitz River is approximately 0.25 miles to the east and the confluence of the Columbia and Cowlitz Rivers is approximately 3.5 miles to the south.

SUBSURFACE CONDITIONS

We explored subsurface conditions at the site by drilling eight soil borings (B-1 through B-9) at the approximate locations shown in Figure 2. The borings were continuously monitored by a member of GeoEngineers geotechnical staff who maintained a detailed log of the soils encountered. Soil samples were obtained at representative intervals and ground water conditions were observed. Appendix A presents the exploratory logs and a description of the subsurface exploration program. Laboratory test results are provided on the exploration logs and in Appendix B.

Subsurface conditions in the site area consist of deep alluvial deposits associated with the nearby Columbia and Cowlitz rivers. Generally, silty sand and sand with varying silt were encountered to a depth of 25 feet, the maximum depth of our explorations. These soils are described in more detail below.

Silty Sand

Fine silty sand was encountered underlying the site to depths varying between 2 and 8 feet beneath current site grades. Sampling penetration resistance indicates that the silty sand is very loose to loose. The in-place moisture content of the silty sand was determined in the laboratory to be between 20 and 30 percent at the time of our exploration. The dry unit weight was determined to be between 83 and 94 pounds per cubic foot (pcf). Soils of this type and consistency typically exhibit moderate strength characteristics and moderate to high compressibility characteristics.

Sand with Silt

The silty sand was generally underlain by an alluvial sand with silt to a depth of approximately 25 feet, the maximum depth our exploration. Based on penetration resistance, this unit is more dense than the overlying silty sand; generally loose to being medium dense with generally increasing density with depth. Laboratory tests indicate moisture contents in the alluvial sand range from 15 to 27 percent at the time of our exploration. The dry unit weight was determined in the laboratory to vary between 84 and 101 pcf at the time of our exploration. Soils of this type and consistency typically exhibit moderate strength characteristics and moderate compressibility characteristics.

Silty Gravel

Silty gravel was encountered at a depth of approximately 17 feet in boring B-5. Based on a single standard penetration test, the gravel is very dense. Soils of this type typically exhibit moderate to high strength characteristics and low compressibility.

GROUND WATER

Several of the borings were left open for several hours after drilling to observe the depth of groundwater. Groundwater was measured at a depth of approximately 9 to 10 feet beneath current site grades. The depth to ground water may fluctuate due to the water level in the Cowlitz and Columbia Rivers, rainfall, irrigation, change in surface topography and other factors not observed in our borings.

CONCLUSIONS

Based on the results of our subsurface explorations, field and laboratory tests, and analyses, it is our opinion that the site is suitable for support of the proposed Regional Conference Center, provided the recommendations provided in this report are carefully incorporated into the project design and implemented during construction. The following conditions will likely have the greatest affect on the proposed construction:

1. Excavations should be possible with conventional heavy earthmoving equipment in proper working condition. Groundwater was encountered at a depth of 10 feet and dewatering will be required in excavations that extend below the groundwater table. The sandy soils are prone to raveling and excavation sidewalls should be slope at an inclination of 1.5H:1V or flatter, or shored.
2. The loose to medium dense sand encountered below the groundwater table is susceptible to liquefaction and several inches of settlement can be expected during the design seismic event.
3. The moisture content of the near-surface soils was approximately 10 to 15 percent above optimum for soils of this type. The use of on-site soils for structural fill is possible provided they could be properly moisture conditioned. Drying operations would require a relatively large area, persistent dry weather, and tilling equipment to turn the moist soil up to the surface.

EARTHWORK RECOMMENDATIONS

SITE PREPARATION

We recommend that existing structures, foundations, concrete floor slabs and pavements within areas planned for development be demolished and completely removed from site. Materials generated from demolition operations should be transported off site for disposal. If concrete and/or rock materials can be separated from other debris, they can be processed for use as fill for some applications and we can provide recommendations if you request.

All utilities in the construction area should be identified prior to excavation. Live utility lines identified beneath proposed structures will need to be relocated. Abandoned utility lines beneath structural components should be completely removed or grouted full in order to minimize

potential settlement of new structures. Soft or loose soil encountered in utility line excavations should be removed and replaced with structural fill where it is located within structural areas.

Excavations resulting from the demolition of foundations, utilities, or other subsurface elements should be replaced with structural fill. The bottoms of the excavations should be excavated to expose firm subgrade, as approved in the field by a qualified geotechnical engineer. All structural fill used during site preparations should meet the criteria in the Structural Fill section of this report.

Most of the site has been previously developed and will not require stripping. However, we recommend that localized areas of vegetation and topsoil be removed from beneath planned building and pavement areas. Where vegetation and topsoil exist, we anticipate a stripping depth of approximately 3 to 4 inches. Stripped materials should be transported off site for disposal or used for landscaping purposes. The primary root systems of trees and other vegetation within proposed structural areas should be removed. Any resulting voids should be backfilled with structural fill.

SUBGRADE EVALUATION

After site preparation has been completed, the suitability of the exposed subgrade should be evaluated by proofrolling with a fully loaded dump truck or similar heavy rubber-tire construction equipment. Proofrolling should be observed by a qualified geotechnical engineer or field technician. Areas of excessive yielding may indicate underlying soft, loose or unsuitable soil. The site should be proofrolled only during dry weather. Probing should be used to evaluate the subgrade during periods of wet weather and in areas not accessible by heavy equipment.

EXCAVATION

Conventional earthmoving equipment in proper working condition should be capable of making necessary excavations for pavement, foundations and utilities. We recommend that excavation be performed by a track-mounted excavator using a smooth-blade bucket.

Excavations in the sandy surface soils will be prone to raveling, and caving is expected for excavations below the water table. Raveling and caving of sidewalls into excavations will result in undermining of adjacent utilities or structures. We recommend that excavations in granular soils be laid back at an inclination of 1.5H:1V (horizontal:vertical) or flatter. Shoring will be required where flat excavation sideslopes are not possible. The contractor should be responsible for selecting the appropriate shoring system.

The depth to ground water was determined to be approximately 10 feet beneath current site grades during our subsurface investigation. We anticipate that ground water levels will fluctuate somewhat based on the season, and the water levels in the nearby rivers. Dewatering will be required in excavations that extend below the water table. Dewatering can consist of sumps or pumps in the base of the excavations or dewatering wells installed outside of the excavations depending on the required excavation depth and water level at the time. If ground water is present in the excavations, we recommend placing at least 1 foot of stabilization material at the base of the excavation. Stabilization material should consist of well-graded gravel, crushed

gravel or crushed rock with a minimum particle size of 4 inches and less than 5 percent passing the U.S. No. 4 Sieve. The material should be free of organic matter and other deleterious material. Stabilization material should be placed in one lift.

Excavations should be made in accordance with applicable Occupational Safety and Health Administration (OSHA) and state regulations. While this report describes certain approaches to excavation and dewatering, the contractor should be responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required to protect personnel and adjacent utilities and structures.

WET WEATHER CONSIDERATIONS

Trafficability of the near surface silty soils can be expected to be poor during periods of wet weather or when the moisture content of the material is more than a few percentage points above optimum. This will likely be the case in all but mid-summer through early fall. When wet, the on-site silty soils are susceptible to disturbance and generally will provide inadequate support for construction equipment.

If site grading and fill placement must occur during wet weather conditions, we recommend that stripping be accomplished using track-mounted equipment and modified construction methods. For example, a track-mounted excavator equipped with a smooth-edged bucket working from a granular working pad could be used. Trucks used to haul the excavated material should be supported on granular haul roads on the existing pavement sections where feasible. However, the pavement may be damaged due to construction traffic and repair may be required if they are to remain in place.

A surface water control plan should be in place prior to construction. The plan should consider routing stormwater to temporary control facilities where foundation slab and pavement subgrade will not be affected. The plan should be consistent with the site erosion control plan and local ordinances.

During wet weather, the subgrade should be evaluated by probing with a steel rod, rather than by proofrolling. Soil that is disturbed during site preparation activities during wet weather, as well as soft or loose zones identified during probing, should be removed and replaced with compacted structural fill.

HAUL ROAD GUIDELINES

The use of granular haul roads will be necessary for support of construction traffic during most of the year, with the possible exception of the mid-summer to early fall period (typically from early July to mid-October). Haul roads should consist of a minimum 18-inch-thick layer of imported granular material placed over the undisturbed subgrade. A 12-inch-thick layer of imported granular material should be sufficient for light staging areas and the basic building pad.

The imported granular material should be placed in one lift over the prepared subgrade and compacted using a smooth-drum roller without the use of vibratory action. Imported granular material should consist of crushed rock or crushed gravel that is well-graded between coarse and

fine sizes, contain no deleterious materials or rock particles larger than 3 inches, and have less than 5 percent by weight passing the U.S. No. 200 Sieve.

A geotextile fabric can be placed between the subgrade and crushed rock for additional support. If geotextile is used, the crushed rock sections can be reduced by 3 inches. The geotextile should have a minimum Mullen burst strength of 500 pounds per square inch (psi) and an apparent opening size (AOS) between a U.S. Standard No. 70 and U.S. Standard No. 100 Sieve to reduce migration of fines into the rock. Amoco 2000 and Mirafi 500x are two fabrics that meet these specifications.

Where feasible the existing pavement sections can be used as haul roads and staging area. However, a special construction sequence will be required to accommodate the demolition of the existing pavement structures. If any pavements will remain, excessive construction traffic may damage them.

STRUCTURAL FILL

Structural areas include areas beneath foundations floor slabs, pavements or any other areas intended to support structures or within the influence zones of structures. Suitable fill for structural areas may consist of on-site soils or imported granular fill. Recommendations for suitable fill materials are provided in the following sections.

Recycled Materials

Asphalt concrete, cement concrete and over-sized materials may be used as structural fill provided the recommendations below are followed.

Processed Fill Materials. Asphalt concrete, cement concrete or over-sized rock can be used as structural fill provided they are processed by crushing and screening, grinding in place, or other methods to meet the structural fill recommendations in this report. They may be used as structural fill in all areas except within 3 feet of foundations.

Unprocessed Fill Materials. Asphalt concrete, cement concrete or over-sized rock fragments which have a maximum particle size of 4 inches in nominal diameter, may be mixed with on-site sand or imported fill to create a uniform, well-graded material and used in pavement and landscape areas. If used beneath pavements we recommend that at least 2 feet of other processed or impacted structural fill overlie the unprocessed fill material blend.

On-site Soils

The native sand is suitable for use as structural fill. Depending on the time of year, the on-site sand may require moisture conditioning to achieve a soil-moisture content that is near optimum. Laboratory testing indicates that these soils contain less than 5 percent by weight passing the U.S. No. 200 Sieve. Consequently, site soils will be moderately sensitive to moisture, and will be difficult to use as fill during prolonged periods of wet weather. The material used as structural fill should be free of clay balls, roots, organic matter and other deleterious materials and particles larger than 3 inches in diameter. The materials should be placed in lifts with a

maximum uncompacted thickness of 12 inches and compacted to not less than 95 percent of the maximum dry density as determined by ASTM Test Method D 1557.

Select Granular Fill

Granular material for structural fill should be pit or quarry run rock, crushed rock, or crushed gravel and sand that is fairly well-graded between coarse and fine, contain no deleterious materials, have a maximum particle size of 3 inches, and have less than 5 percent by weight passing the U.S. No. 200 Sieve. Organic matter, debris, frozen particles or other deleterious material should not be present. Granular fill used during periods of prolonged dry weather may have up to 12 percent passing a U.S. No. 200 Sieve provided it is properly moisture-conditioned as described later.

Pipe Bedding

Utility trench backfill for bedding and in the pipe zone should consist of well-graded granular material with a maximum particle size of 3/4 inch and less than 5 percent passing the U.S. No. 200 Sieve. The material should be free of roots, organic matter, frozen materials and other unsuitable materials.

Crushed Rock

Crushed rock as base material under footings, floor slabs, and pavements should consist of rock that is fairly well-graded between coarse and fine, contains no roots, organic matter and other deleterious materials, has a maximum particle size of 1 inch, and has less than 5 percent passing the U.S. No. 200 Sieve. The granular material should be compacted to 95 percent of the maximum dry density as determined by ASTM Test Method D 1557. Crushed rock fill should consist of imported clean, durable, crushed angular rock that meets the requirements of the "Floor Slabs" and "Pavement Design Recommendations" sections of this report.

FILL PLACEMENT AND COMPACTION

Fill soils should be compacted at a moisture content that is near optimum. The maximum allowable moisture content varies with the soil gradation, and should be evaluated during construction.

Fill and backfill material should be placed in uniform, horizontal lifts, and densified with appropriate compaction equipment. The maximum lift thickness will vary depending on the material and compaction equipment used, but should generally not exceed the loose thicknesses provided in Table 1. Fill material should be compacted in accordance with the compaction criteria provided in Table 2.

Table 1
Recommended Uncompacted Lift Thickness

Compaction Equipment	Recommended Uncompacted Fill Thickness (inches)		
	Silty Soils	Granular and Crushed Rock Maximum Particle Size ≤ 1 1/2 inch	Crushed Rock Maximum Particle Size > 1 1/2 inch
Hand Tools: Plate Compactors and Jumping Jacks	4 – 8	4 – 8	Not Recommended
Rubber-tire Equipment	6 – 8	10 – 12	6 – 8
Light Roller	8 – 10	10 – 12	8 – 10
Heavy Roller	10 – 12	12 – 18	12 – 16
Hoe Pack Equipment	12 – 16	18 – 24	12 – 16

Note: The above table is based on our experience and is intended to serve as a guideline. The information provided in this table should not be included in the project specifications.

Table 2
Compaction Criteria

Fill Type	Compaction Requirements in Structural Zones Percent Maximum Dry Density Determined by ASTM Test Method D 1557 at ± 3% of Optimum Moisture		
	0 to 2 Feet Below Subgrade	> 2 Feet Below Subgrade	Pipe Zone
Embankment Fill	95%	92%	-----
Aggregate Bases	95%	95%	-----
Trench Backfill[1]	95%	92%	90%
Retaining Wall Backfill	95%	92%	-----

Area Fills and Bases (Embankment)

Imported fill placed to raise site grades should be placed on a prepared subgrade that consists of firm, inorganic site soils or compacted fill. Embankment fill material should be placed in uniform horizontal lifts as outlined in Table 1 and compacted to the recommended minimum density provided in Table 2.

Aggregate Bases

Aggregate base materials under foundations, floor slabs and pavements should be placed on a prepared subgrade that consists of firm, inorganic native soils or compacted fill. Aggregate base

[1] Trench backfill above the pipe zone in nonstructural areas should be compacted to at least 85 percent of the maximum dry density as determined by ASTM Test Method D 1557.

material should be placed in uniform horizontal lifts as outlined in Table 1 and compacted to the recommended minimum density provided in Table 2.

Trench Backfill

Trench backfill in structural areas should consist of select granular fill processed recycled fill, or crushed rock as described in the "Structural Fill" section of this report, be placed in uniform horizontal lifts as recommended in Table 1, and compacted to the minimum density provided in Table 2. Pipe bedding and fill in the pipe zone should be compacted to the minimum density presented in Table 2 or as recommended by the pipe manufacturer.

Retaining Wall Backfill

Retaining wall backfill should be compacted like embankment fill, as described above, except that fill within 3 horizontal feet of the wall should be placed in uniform horizontal lifts and compacted to a lesser density of 92 percent of the maximum dry density as determined by ASTM Test Method D 1557 to reduce the potential for excessive pressure against the wall. Within 2 feet of subgrade, the fill can be compacted to 95 percent using light equipment.

Settlement of up to 1 percent of the wall height commonly occurs immediately adjacent to retaining walls as the walls rotate and develop lateral active earth pressures. Consequently, we recommend that flat works (slabs, sidewalks or pavement) placed within a distance adjacent to retaining walls equal to the wall height be postponed at least 4 weeks following wall construction, unless survey data indicates that settlement is complete prior to that time.

PERMANENT CUT AND FILL SLOPES

Permanent cut and fill slopes should not exceed 2 1/2H:1V. We recommend that slopes that are to be mowed should not exceed 3H:1V. Buildings, access roads and pavements should be set back a minimum of 5 feet from the slope crest. Slope surfaces should be protected from erosion by suitable vegetation or other measures. We do not anticipate cuts or fills greater than 2 feet high. If higher cuts or fills are planned, we should be contacted to make further recommendations.

DRAINAGE

We recommend that roof drains, and other subsurface drains be connected to non-perforated pipes leading to storm drain facilities. Access road, parking and open space areas should be sloped such that surface water runoff is collected and routed to suitable discharge points. We recommend that ground surfaces within 10 feet of the building foundations be sloped at least 2 percent away from the building.

EROSION CONTROL

Soils at the site are moderately susceptible to erosion by surface water. Slopes and stockpiles should be covered with an appropriate erosion-control product if construction occurs during periods of wet weather. Surface water runoff should be collected and directed away from slopes

to prevent water from running down the slope face. Erosion control measures such as straw bales, sediment fences and temporary detention/settling basins should be used in accordance with local ordinances.

FOUNDATION SUPPORT RECOMMENDATIONS

The proposed structures can be supported on continuous wall or isolated column footings founded on the undisturbed native sand or on structural fill placed over the undisturbed native sand. We recommend that isolated column and continuous wall footings have minimum widths of 24 and 18 inches, respectively. The bottom of exterior footings should be founded at least 18 inches below the lowest adjacent grade. Interior footings should be founded at least 12 inches below the top of the floor slab. The recommended minimum footing depth is greater than the anticipated frost depth.

Footing excavations in the sandy surface soils will be prone to raveling. We recommend that the footing excavations in granular soils be laid back at an inclination of 1.5H:1V or flatter if necessary. Consequently, it will not be possible to pour footings neat against the adjacent subgrade and footing forms will be required.

Footing Subgrade Preparation

Loose or disturbed materials should be removed or compacted adequately before placing crushed rock, reinforcing steel, and concrete. We recommend that a 4- to 6-inch thick layer of compacted 3/4-inch minus crushed rock be provided in the base of the footing excavation to protect the subgrade from foot traffic during wet conditions.

Foundation bearing surfaces should not be exposed to standing water. Should water infiltrate and pool in the excavation, it should be removed and the suitability of the subgrade reviewed before placing crushed rock fill or reinforcing steel.

We recommend that an experienced geotechnical engineer observe all foundation excavations before placing the crushed rock or reinforcing steel in order to confirm that adequate bearing surfaces have been achieved and that the soil conditions are as anticipated.

Bearing Capacity

We recommend that conventional wall and column foundations founded on the native soils be proportioned using a maximum allowable bearing pressure of 2,000 pounds per square foot (psf). This bearing pressure applies to the total of dead and long-term live loads and may be increased by one-third when considering earthquake or wind loads. This is a net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing sizes.

Foundation Settlement

The native sand soils are loose, and soils of this type exhibit moderate to high compressibility behavior. Shallow foundations constructed in accordance with the recommendations provided in this report should experience settlements of less than 1 inch. Differential settlements of up to

one-half of the total settlement magnitude can be expected between adjacent footings with similar loads. We expect that the settlement will mostly occur as loads are applied.

Lateral Resistance

Lateral loads on footings can be resisted by passive earth pressure on the sides of footings and by friction on the base of the footings. We recommend that passive earth pressures be calculated using an equivalent unit weight of 350 pcf provided that the footings are confined by structural fill. This will require compacted structural fill between the excavations and footings if passive pressure is relied upon for lateral resistance. We recommend a friction coefficient of 0.60 for footings in contact with compacted crushed rock. The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total.

The passive earth pressure value is based on the assumptions that the adjacent confining structural fill is level and that static groundwater remains below the base of the footing throughout the year. The top 1-foot of soil should be neglected when calculating passive lateral earth pressures unless the adjacent area is covered with pavement or is inside a building.

The lateral resistance values do not include safety factors. We recommend a safety factor of 3 when designing for dead loads plus frequently applied live loads and a safety factor of 2 when considering transitory loads such as wind and seismic forces.

RETAINING STRUCTURES

Retaining structures free to rotate slightly around the base should be designed for active earth pressures using an equivalent fluid unit weight of 35 pcf. This value is based on the following assumptions:

1. The walls will not be restrained against rotation when the backfill is placed.
2. The areas above and below the wall are level.
3. The backfill consists of free-draining granular material.
4. Adequate drainage is provided behind the wall to control hydrostatic pressures.
5. The walls are less than 10 feet high.

If retaining walls are restrained against rotation during backfilling, they should be designed for an at-rest equivalent fluid unit weight of 55 pcf.

Surcharge loads applied closer than one-half of the wall height should be considered as uniformly distributed horizontal pressures equal to one-third of the distributed vertical surcharge pressure. Footings for retaining walls should be designed as recommended for shallow foundations. Backfill for retaining walls should be placed and compacted as recommended in the "Structural Fill" section of this report.

SLABS-ON-GRADE

A modulus of subgrade reaction of 150 pounds per cubic inch (pci) can be used for design of the floor slabs provided that the subgrade is prepared in accordance with the recommendations given in the following paragraphs. The design modulus of subgrade reaction is based on a loaded

area of 1 by 1 foot and assumes that the subgrade consists of undisturbed native soils or structural fill.

Short-term (elastic) settlements for the floor slab are estimated to be less than 1 inch for a floor load of 250 psf. The native soils are non-expansive so heave is not anticipated beneath the floor slab.

We recommend that the floor slab be supported on at least 6 inches of imported granular material to provide uniform support and to aid as a capillary break. The imported granular material should consist of crushed rock that is fairly well-graded between coarse and fine, contain no roots, organic matter and other deleterious materials, have a maximum particle size of 1 inch, and have less than 5 percent passing the U.S. No. 200 Sieve. The granular material should be compacted to 95 percent of the maximum dry density as determined by ASTM Test Method D 1557.

Vapor barriers are often required by flooring manufacturers to protect flooring and adhesives. Many flooring manufacturers will warrant their products only if a vapor barrier is installed according to their recommendations. Selection and design of the appropriate vapor barrier, if needed, should be based on discussions among members of the design team. We can provide additional information to assist you with your decision.

PAVEMENT DESIGN RECOMMENDATIONS

The recommended flexible pavement sections are provided in Table 1. Traffic loads were not known at the time this report was written. The pavement sections provided below are based on an assumed California Bearing Ratio of 4 and the assumed traffic volumes provided in Table 2.

Table 1
Recommended Flexible Pavement Sections

Pavement Section Thickness		
	Asphalt Concrete (inches)	Aggregate Base (inches)
Standard Duty	3	6
Heavy Duty	3	12

Table 2
Assumed Traffic Volumes

Pavement Duty		Equivalent Traffic Volume	Design Life
Asphalt Concrete	Standard Duty	200 automobiles/day	20 years
	Heavy Duty	15 3-axle trucks/day	

The recommended pavement sections assume that the subgrade consists of firm, competent native or structural fill soil approved by a qualified geotechnical engineer. The aggregate base

should have a maximum particle size of 1-inch (±) and have less than 5 percent by weight passing the Standard U.S. No. 200 Sieve. Additionally the aggregate should conform to Section 9.03-10 of the latest edition of the Washington State Department of Transportation's (WSDOT) "Standard Specifications for Road, Bridge, and Municipal Construction". Aggregate base should be compacted in one lift to not less than 95 percent of the maximum dry density, as determined by ASTM Test Method D 1557. The asphalt concrete should conform to the pertinent paragraphs of WSDOT Section 5-04 and be compacted to at least 91 percent of the Rice Density

The preceding recommended pavement sections assume that construction will be completed during a period of extended dry weather and that the subgrade has been prepared in accordance with the recommendations in this report. Wet weather construction would likely require an increased thickness of the granular base course and replacement of softened subgrade soils with structural fill in order to support paving equipment.

SEISMIC DESIGN PARAMETERS

We recommend that seismic design be performed using the static lateral force procedure outlined in the Uniform Building Code (UBC), 1997 Edition. The following parameters should be used in computing seismic base shear forces:

Seismic Design Parameters

Parameter		Value
Seismic Zone Factor	Z	0.30
Soil Profile Type	S	S_D
Seismic Coefficient	C_a	0.36
Seismic Coefficient	C_v	0.54

GeoEngineers scope of services did not include a detailed liquefaction analysis. However, based on our experience the loose to medium sands encountered below the water table are susceptible to liquefaction under design levels of ground shaking. We anticipate that surface settlements on the order of several inches are possible. The site is relatively flat and is approximately 0.25 miles west of the Cowlitz River, the closest body of water. Consequently, the risk of lateral spreading at the site is considered low.

Liquefaction and associated settlement, without significant lateral spreading, is generally not considered a life safety hazard provided the structure is ductile and does not collapse. Consequently, we recommend that structural ties be provided between foundation elements to reduce the risk of structural collapse. Surface disruptions associated with liquefaction may cause the facility to become unserviceable principally from differential settlements. GeoEngineers can provide recommendations for liquefaction mitigation if required.

OBSERVATION OF CONSTRUCTION

Satisfactory foundation and earthwork performance depends, to a large degree, on quality of construction. Sufficient monitoring of the contractor's activities is a key part of determining that

the work is completed in accordance with the construction drawings and specifications. We recommend that qualified personnel under the direction of the design engineer be retained to observe excavation and general fill placement and to review laboratory compaction and field moisture-density information.

Subsurface conditions observed during construction should be compared with those encountered during the subsurface exploration and utilized for design. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated.

LIMITATIONS

We have prepared this geotechnical engineering report for use by the City of Longview and ARC Architects for the proposed Regional Conference Center in Longview, Washington in accordance with our proposal dated January 7, 2003.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form or hard copy of this document (email, text, table, and/or figure), if provided, and any attachments are only a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

We appreciate the opportunity to be of service to The City of Longview and ARC Architects. Please call if you have questions concerning this report or if we can be of additional services.

Respectfully submitted,

GeoEngineers, Inc.

BRETT ALAN SHIPTON
STATE OF WASHINGTON
38128
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 3·16·04

Brett A. Shipton, P.E.
Project Engineer

FOR: Timothy W. Blackwood, P.E., C.E.G.
Associate

TNH:TWB:rsd
Document ID: 441901400R.doc

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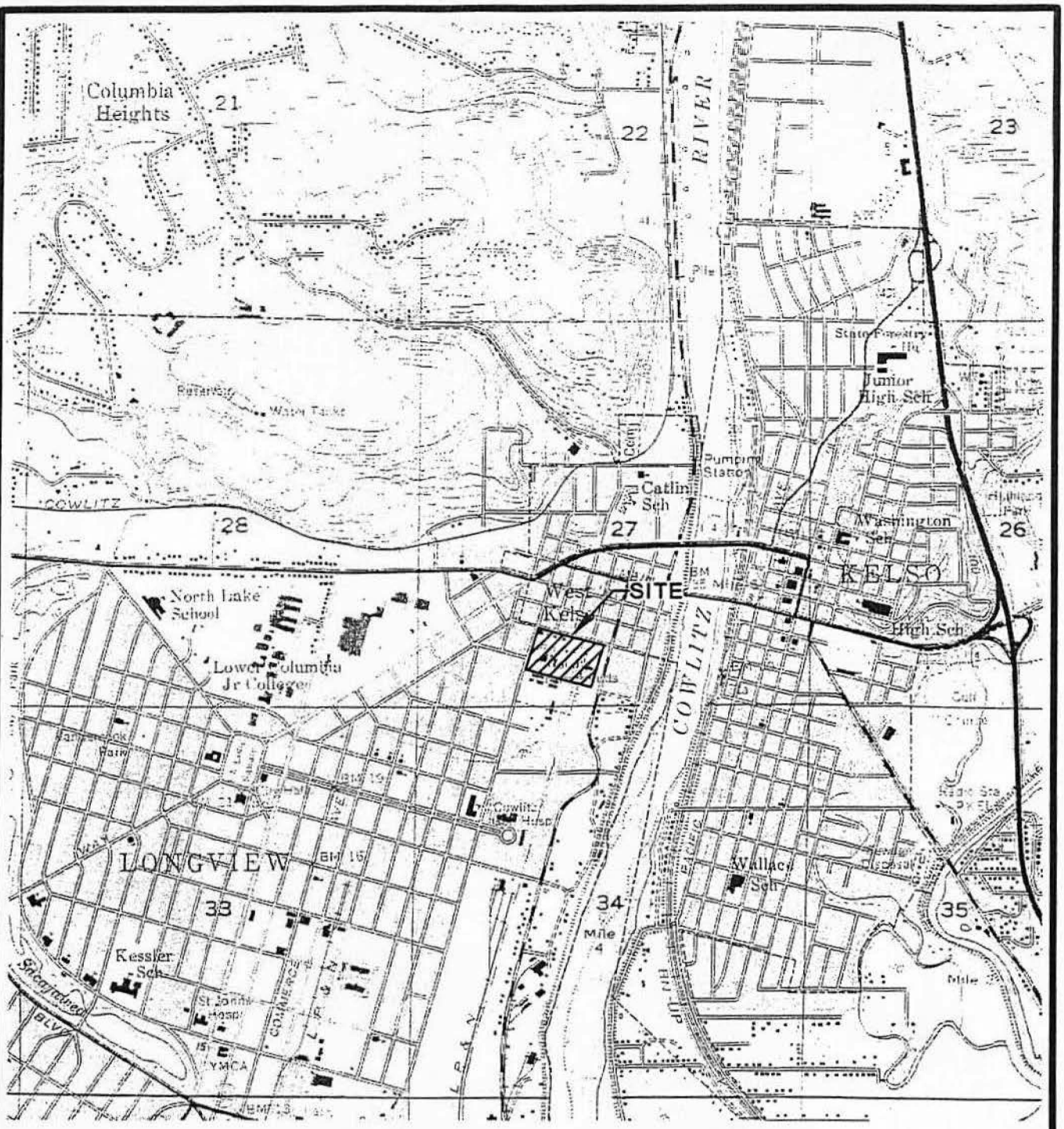

0 2000 4000

SCALE IN FEET

N

Reference: USGS 7.5' topographic quadrangle map, "Kelso, WA," photorevised 1970.

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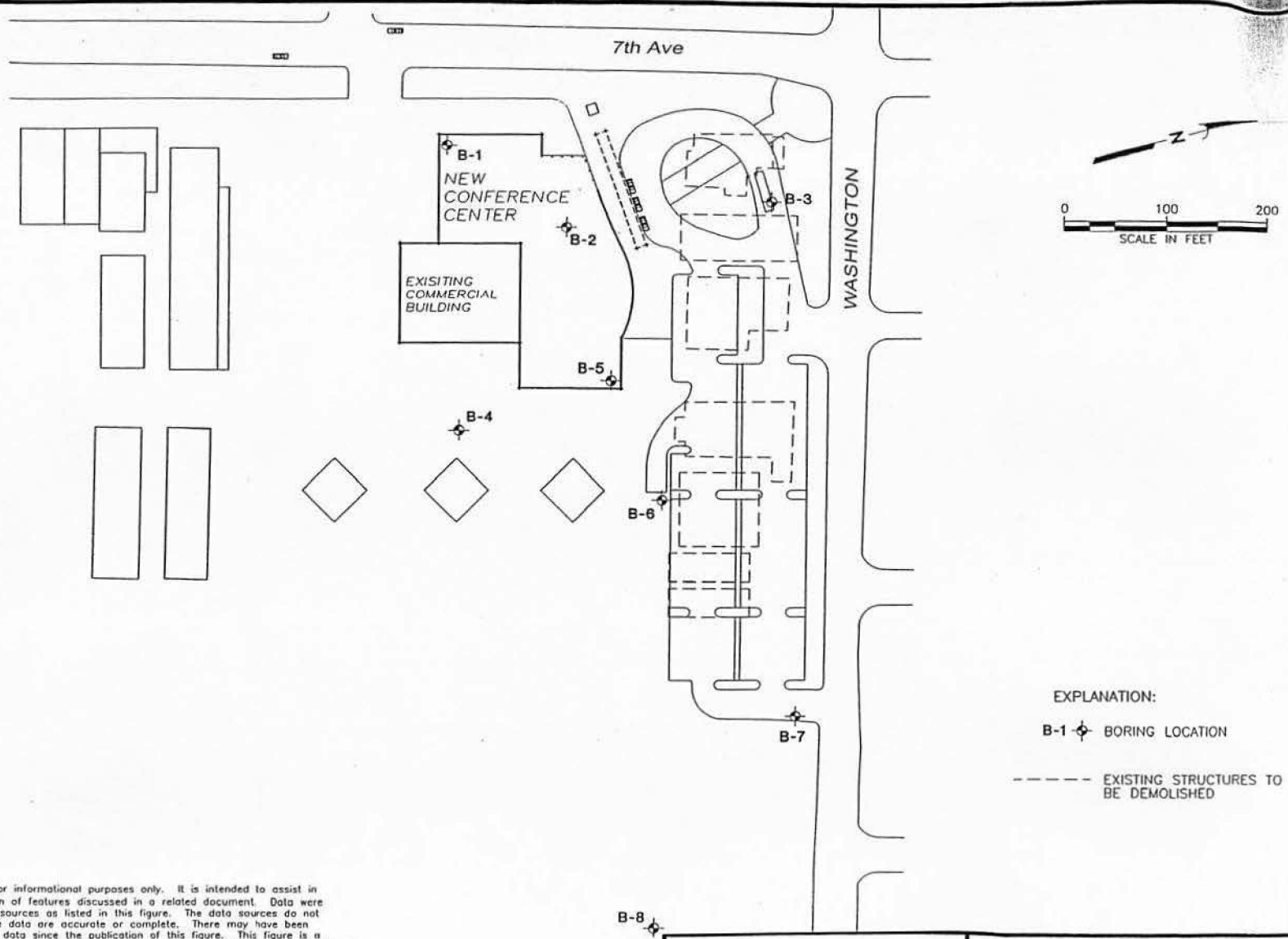
VICINITY MAP

FIGURE 1

Portland\P:\4\419014\00\Cad\Vic.dwg MJW:MWJ 02/25/03



EXPLANATION:

B-1 BORING LOCATION

EXISTING STRUCTURES TO BE DEMOLISHED

Note 1. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: Base drawing was provided by ARC Architects dated 02/24/03.

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SITE PLAN

FIGURE 2

Portland\P:\4\4419014\00\Cad\siteplan.dwg MJW:MWJ 02/25/03

APPENDIX A

FIELD EXPLORATIONS

Subsurface conditions at the site were explored by drilling eight borings using truck-mounted hollow-stem auger drilling equipment. The borings were drilled to depths varying from 11.5 to 26.5 feet. Figure 2 shows the approximate boring locations.

Drilling services were provided by Geo-Tech Explorations, Inc. of Tualatin, Oregon. Field activities were observed by a qualified member of GeoEngineers' staff.

Soil samples were obtained from the borings using one of the following methods:

1. Standard Penetration Tests were performed in general conformance with ASTM Test Method D 1586. The sampler was driven with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler 1 foot, or as otherwise indicated, into the soils is shown adjacent to the sample symbols on the boring logs. Disturbed samples were obtained from the split barrel for subsequent classification and index testing.
2. Relatively undisturbed samples were obtained using a Dames & Moore Type-U sampler. The sampler was driven using a 300-pound hammer falling 30 inches, just as with the standard penetration test samples, and the penetration resistance was recorded for general correlation with previous subsurface information. Samples retained from the split barrel consist of up to six, 1-inch-high by 2.48-inch-diameter brass rings. Disturbed rings were generally not retained.

Materials encountered in the borings were classified in the field in general accordance with ASTM Standard Practice D 2488, the Standard Practice for the Classification of Soils (Visual-Manual Procedure), which is described in Figure A-1. Figure A-2 provides a description of the boring log forms. Soil classifications and sampling intervals are shown in the boring logs in this appendix. Inclined lines at the material contacts shown on the logs indicate uncertainty as to the exact contact elevation, rather than the inclination of the contact itself.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-93.
2. Soil classification using laboratory tests is in general accordance with ASTM D2487-98.
3. Descriptions of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

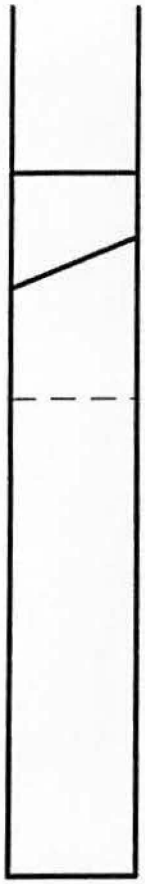
FIGURE A-1

f:\soila-1.doc

LABORATORY TESTS

AL	Atterberg limits
CA	Chemical analysis
CP	Compaction
CS	Consolidation
DS	Direct shear
SA	Sieve analysis
%F	Percent fines
HA	Hydrometer analysis
SK	Permeability
SM	Moisture content
MD	Moisture and density
ST	Swelling test
TX	Triaxial compression
UC	Unconfined compression
OC	Organic Content

SOIL GRAPHICS



SM — Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Approximate Location of Change Within a Soil Strata

Measured groundwater level

Groundwater encountered during drilling

Perched water encountered during drilling

Bottom of Boring

BLOW-COUNT

Blows required to drive sampler 12 inches using a SPT - 140 (lb); D&M - 300-pound hammer falling 30-inches — 15

Blows required to drive sampler 12 inches using a 140-pound hammer falling 30-inches — 15

"P" indicates sampler pushed against with weight of hammer or against weight of drill rig

SAMPLE GRAPHICS

Location of sampling interval with relatively undisturbed recovery

Location of sampling interval with disturbed recovery

Location of sampling interval with no recovery

Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

Location of SPT sampling attempt with no recovery

Location of Grab Sample

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Log Symbols and the exploration logs for a proper understanding of subsurface conditions.
2. Soil classification system is summarized in Figure A-1.

KEY TO LOG SYMBOLS

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Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-2
Sheet 1 of 1

4419-014-00 KEY TO SYMBOLS W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	JJB	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	26.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	Asphalt concrete, approximately 5 inches thick			
							GP	Brown fine angular gravel with trace silt (dense, moist)			
							SM	Brown fine silty sand (loose, moist)			
		1	12	5					20	94	Dames & Moore sampler
5		2	12	5							
							SP-SM	Gray fine to medium sand with silt and occasional fine rounded gravel (loose, wet)			
10		3	12	9	▽				20	101	Dames & Moore sampler
15		4	12	15				Becomes medium dense			
20		5	10	22				Grades with lenses of white coarse sand (pumice) and trace brown organic material sand			
25		6	10	12				Pumice grades out Organic material grades out			

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-1

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-3
Sheet 1 of 1

4419-014-00 GEI GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2 2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	MJW	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	21.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	Asphalt concrete, approximately 5 inches thick			
							GP SM	Brown and gray fine angular gravel with occasional coarse gravel (dense, moist) (crushed rock base course)			
		1	12	3				Brown silty fine sand (very loose, moist)			Dames & Moore sampler
5		2	18	4					30	83	Dames & Moore sampler
							SP-SM	Gray fine to coarse sand with silt and occasional rounded gravel (medium dense, wet)			
10		3	12	16	▽						
15		4	12	11							
20		5	12	38				Grades to dense			

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-2

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-4
Sheet 1 of 1

4419-014-00 GEI GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2 2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	MJW	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	11.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	None observed
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							SM	Brown silty fine sand (loose, moist) (3-inch thick root zone)			
							SP-SM	Brown fine to medium sand with silt (very loose to loose, moist)			
		1	12	4					27	84	Dames & Moore sampler
5		2	12	7							
10		3	12	6							

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-3

GeoEngineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-5
Sheet 1 of 1

Date(s) Drilled	02/19/03	Logged By	JJB	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	21.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9.25
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	Asphalt concrete, approximately 5 inches thick			
							GP	Gray and brown fine angular gravel with coarse gravel (dense, moist) (crushed rock base course)			
							SM	Brown silty fine sand with occasional organic matter (loose, moist)			
	■	1	12	6							Dames & Moore sampler
							SP-SM	Gray fine to medium sand with silt and occasional rounded fine gravel (medium dense, moist)			
5	■	2	10	12					20		SA
					▽			Becomes wet			
10	■	3	10	15							
15	■	4	6	8				Grades with coarse sand consistency decreases to loose			
20	■	5	12	14				Grades with coarse white gravel (pumice) consistency increases to medium density			

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-4

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-6
Sheet 1 of 1

4419-014-00 GEI_GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4\4419014\00\FINALS\4419014.GPJ GEIV2_2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	JJB	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	21.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9.75
Datum/ System					

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	Asphalt concrete, approximately 4 inches thick			
							GP	Gray and brown fine angular gravel with coarse gravel (dense, moist) (crushed rock base course)			
							SM	Brown fine silty sand with orange and gray mottling trace organic matter (very loose to loose, moist)			
		1	18	4							Dames & Moore sampler
							SP	Gray fine to medium sand (loose, wet)			
5		2	12	8							Dames & Moore sampler
10		3	10	12	▽			Consistency increases to medium dense Becomes wet	24		SA
15		4	10	14				Grades with occasional silty rounded gravel			
							GM	Gray and brown silty rounded fine gravel with occasional coarse gravel and sand (very dense, wet)			
20		5	10	62							

Note: See Figure A-2 for explanation of symbols

4419-014-00 GEI GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4\4419014\00\FINALS\4419014.GPJ GEIV2_2.GDT 3/7/03

LOG OF BORING B-5

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-7
Sheet 1 of 1

Date(s) Drilled	02/19/03	Logged By	MJW	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	11.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	None observed
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0						AC	Asphalt concrete, approximately 5 inches thick			
						GP	Gray and brown fine to coarse angular gravel (dense, moist) (crushed rock base course)			
						SM	Brown silty fine sand (loose, moist)			
	1	12	5							Dames & Moore sampler
5	2	12	7			SP-SM	Gray-brown fine to medium sand with silt (loose, moist)	22		
10	3	12	14				Grades to gray, fine to coarse sand, occasional rounded gravel (medium dense)			

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-6

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-8
Sheet 1 of 1

4419-014-00 GEI_GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2 2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	MJW	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	11.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	None observed
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0						AC	Asphalt concrete, approximately 5 inches thick			
						GP	Gray and brown fine to coarse angular gravel (dense, moist) (crushed rock base course)			
						SM	Brown silty fine sand (loose, moist)			
	1	12	5							Dames & Moore sampler
5	2	12	9			SP-SM	Gray fine to medium sand with silt (loose, moist)			
10	3	12	22				Grades with occasional rounded gravel consistency increases to medium dense			

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-7

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-9
Sheet 1 of 1

4419-014-00 GEI GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2_2.GDT 3/7/03

Date(s) Drilled	02/19/03	Logged By	MJW	Checked By	TNH
Drilling Contractor	Geotech Explorations	Drilling Method	Hollow-stem Auger	Sampling Methods	SPT, Dames & Moore
Auger Data		Hammer Data	SPT - 140 (lb); D&M - 300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Mud Rotary with Mobile B-59
Total Depth (ft)	11.5	Surface Elevation (ft)		Groundwater Level (ft. bgs)	None observed
Datum/ System	Assumed NGVD 29				

Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							GP	Gray fine to coarse angular gravel with trace silt (dense, moist) (crushed rock parking lot surface)			
							SM	Brown silty fine sand (loose, moist)			
	■	1	13	8			SP-SM	Gray fine to coarse to medium sand with silt and occasional rounded gravel (loose, moist)			Dames & Moore sampler
5	■	2	12	9							
10	■	3	12	11				Consistency increases to medium dense	15		

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-8

Geo Engineers

Project: Regional Conference/Special Events Center
Project Location: Longview, Washington
Project Number: 4419-014-00

Figure: A-10
Sheet 1 of 1

4419-014-00 GEI_GTBORING 2.1.0 W:\PORTLAND\PROJECTS\4419014\00\FINALS\4419014.GPJ GEIV2_2.GDT 3/7/03

APPENDIX B

LABORATORY TEST RESULTS

The following laboratory tests were performed:

1. Eight moisture content and/or density determinations in general accordance with ASTM Test Methods D 2216 and D 2937, respectively, to evaluate the fill suitability of the native soils. The test results are presented on the boring logs in Appendix A.
2. Two particle-size analysis tests were performed in general accordance with ASTM Test Method D 422 to aid us in our soil classification. Figure B-1 presents the test results.

P:/4/4419014/00/ANALYSIS/FIGURE B-1.PPT

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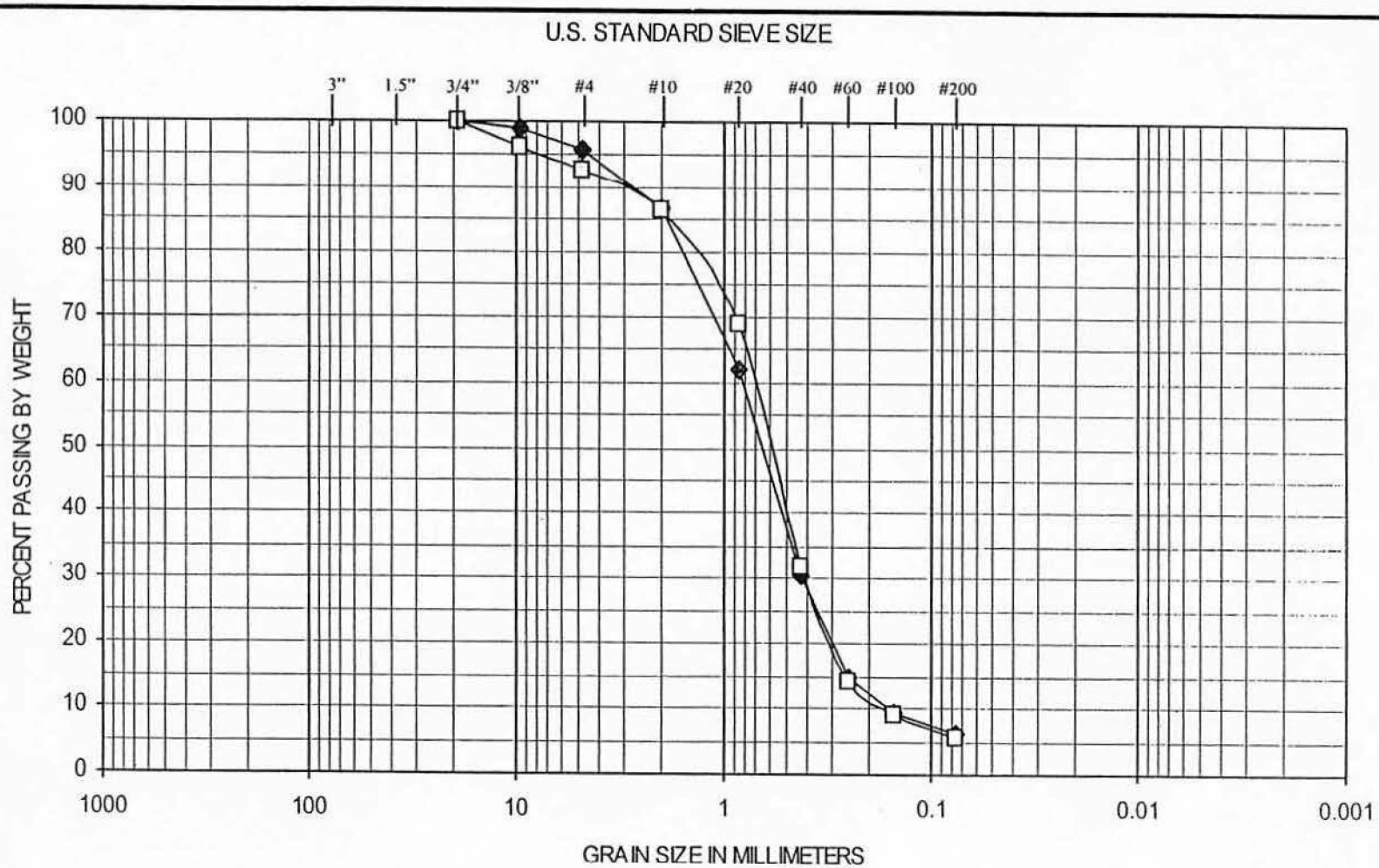

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

KEY	BORING NUMBER	SAMPLE DEPTH (FEET)	SOIL CLASSIFICATION
◆	B-4	5	Gray sand with silt (SP-SM)
□	B-5	10	Gray sand with silt (SP-SM)

SIEVE ANALYSIS RESULTS

FIGURE B-1