MICRO

Alder Geotechnical Services

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July 24, 2008
Project No 568-2

Ms Terri Silvis, Ph D
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

08-177308-CO

GEOTECHNICAL INVESTIGATION REPORT
CATHOLIC CHARITIES SERVICES CENTER
2740 SE POWELL BOULEVARD
PORTLAND, OREGON

Dear Ms Silvis

This report presents the results of a geotechnical investigation for your proposed services center building at 2740 SE Powell Boulevard (Figure 1) The purpose of the investigation was to evaluate soil and groundwater conditions on the site and provide design and construction recommendations for site excavating and shoring, foundations, retaining walls, and seismic ground shaking Our scope of services included performing field explorations, laboratory and field tests, and engineering analyses

This work was performed in general accordance with our agreement dated September 23, 2005

PROJECT DESCRIPTION

The project consists of demolishing a two-story commercial building with a basement on the 17,740 square-foot site and building a new, four-story commercial building with basement parking level The new building will be concrete construction with some CMU block and steel framing Maximum dead plus live column loads are anticipated to range between about 325 and 400 kips Maximum dead plus live loads on perimeter wall footings are anticipated to be about 14 to 17 kips per lineal foot Maximum dead plus live loads on interior core wall footings are anticipated to be about 22 to 26 kips per lineal foot Horizontal seismic forces will be resisted by concrete shear walls arranged around north and south elevator and stairwell shafts

The proposed 12,000 square foot footprint is approximately 4,000 square feet larger than the existing building footprint All of the old building will be demolished except for the north basement wall, which will be incorporated into the shoring scheme along SE Powell Boulevard Excavations up to a maximum of about 12 to 15 feet deep are anticipated along SE Powell Boulevard and SE 28th Avenue The design finish floor of the new parking level is 99 feet

Stormwater will be collected and discharged into several drywells installed south of the building

FIELD AND LABORATORY INVESTIGATIONS

The field investigation was performed in October and November 2005 as part of a larger investigation of former St Vincent de Paul property located south of SE Powell Boulevard between SE 26th and SE 28th Avenues The complete results of that investigation were presented in a report titled "Preliminary Geotechnical Report, Proposed Housing and Office Development, St Vincent de Paul Site, Between SE 26th and 28th Avenues on SE Powell Boulevard, Portland, Oregon," dated December 15, 2005

Three soil borings were drilled on and near the subject parcel The borings were advanced 11½ and 36½ feet deep Soil samples were collected from the borings at regular intervals for examination and laboratory testing The approximate locations of the explorations are shown on Figure 2

The field investigation is described in Appendix A Final logs of the Borings 8, 9 and 16 are presented in Appendix A The descriptions on the logs are based on field logs, sample inspection and laboratory testing Results of laboratory moisture content tests and percent passing the No 200 sieve are shown at the corresponding sample locations on the exploration logs

SITE CONDITIONS

Surface Conditions

The trapezoidal-shape property is approximately 108 feet wide and 160 feet to 206 feet long A two-story commercial building with a basement currently occupies the east two-thirds of the property and an asphalt paved parking lot occupies the west third The existing basement floor is located at about elevation 99 75 feet The ground surface outside the building slopes down to the south, with elevations ranging from about 112 feet in the northeast corner to 95 feet in the southwest corner

Subsurface Conditions

Fine- and coarse-grained flood deposits underlie the site These silty, sandy and gravelly sediments were deposits at least 13,000 years ago during repeated, massive glacial flooding of the ancient Columbia River A generalize geologic cross-section drawn north-south and looking east is shown in Figure 3

The near surface soils are primarily brown, interlayered, silts and fine sandy silts With increasing depth, the silty soils become increasingly gray and sandy The deeper layers are typically fine silty sands Dense to very dense gravelly soils were encountered in Boring 8 at a depth of 36 feet below the existing ground surface and in Boring 9 at a depth of 28 feet

Standard penetration test blow counts (N-values) recorded in the silty and sandy soils ranged from 9 to 23, and averaged about 13 blows per foot The N-values indicate relative densities ranging from loose to medium dense and averaging medium dense Measured moisture contents ranged from 11 to 29 percent, and averaged 20 percent

Dense to very dense gravels interlayered with fine sands and silts are present 28 to 36 feet below the existing ground surface at elevations of 68 to 70 feet

Groundwater
Groundwater was encountered in Boring 9 at a depth of 24 feet below the ground surface and at elevation of approximately 72 feet

CONCLUSIONS AND RECOMMENDATIONS

General

field and laboratory investigations indicate that the site is mantled with 28 to 36 feet of moderately compressible silts, sandy silts and silty fine sands Strong gravel layers with low compressibility underlie the finer grained soils Groundwater was found 24 feet below the ground surface and at about elevation 72 feet in October 2005

Recommendations are provided in the following sections for supporting the building on shallow wall and column footings bearing on undisturbed silts and sands

Where space allows, the excavation for the building's parking level may be sloped using the guidelines presented in this report The excavation will need to be properly shored where space is not available for construction slopes

Site Liquefaction Potential

Our field exploration program and review of available geotechnical information indicates that the site is not subject to liquefaction damage and possess a low potential for soil densification and ground surface settlement during strong seismic shaking The soil profile consists of at least 28 feet of loose to medium dense silts and sands The upper 24 feet of these soils are located above the water table and not subject to liquefaction Dense to very dense gravels are present below 28 feet which also are not subject to liquefaction Medium dense silty sands located between a depth of 24 feet and 28 feet are potentially liquefiable, but are located at such a depth that they will not cause shallow foundations to lose bearing capacity The potential for significant ground surface settlement resulting from the liquefaction of this thin layer is low

Site Preparation and Earthwork

<u>Building Pad Excavation and Slopes</u>

The surface elevation of the parking level floor slab is anticipated to be about 99 feet The soil subgrade will be excavated at least 1 to 1½ feet lower, assuming an approximately 5 inch thick concrete floor slab and 6 inches to 12 inches of gravel base rock Given the existing site grades, the maximum depth of excavation will range from 10 to 14 feet deep along the north property line Digging footings will increase the maximum excavation depth to 12 to 16 feet The proposed depth of excavation along the south property line ranges from 0 to 5 feet The southwest corner of the building will actually require up to 3 feet of structural fill

Temporary construction slopes and/or shoring will be necessary to construct the parking level The owner and the Contractor should be familiar with applicable local, state and federal regulations for both temporary construction slopes, and shoring, including the current OSHA Excavation and Trench Safety Standards The Contractor should be solely responsible for the design, construction and performance of temporary shoring

Temporary excavations should be designed assuming Type "B" soils will be exposed in the side slopes OSHA requires that Type "C" soil slopes be excavated no steeper than 1 horizontal to 1 vertical The on-site soils are classified as Type "B" because of their silty and sandy compostion and moderate strength

All excavated slopes must be protected with plastic sheeting during wet weather Surface water runoff must be directed way from the top of slopes

Construction Shoring

Unsupported, temporary construction slopes should not be excavated in areas where adjacent improvements are located within a horizontal distance less than or equal to half the depth of the excavation (measured from the top of the excavation) Excavation shoring will be required when the recommended maximum excavation slope inclination cannot be maintained, particularly in areas adjacent to existing improvements, including structures, roadways, and underground utilities

The contract should select a shoring system appropriate for the site and soil conditions Suitable shoring systems include (1) bracing and using the north basement wall of the existing building, (2) combining 1H 1V construction slopes with temporary walls constructed using 2-foot square, pre-cast concrete blocks and (3) installing steel H-pile and timber lagging walls

The geotechnical engineer should be consulted for specific design recommendations and parameters when selecting and designing the appropriate shoring systems

Structural Fill

Imported crushed gravel should be used to construct all structural fills in the building pad and behind the basement walls The fill should consist of 1-inch minus crushed gravel or similar size gravel product

Structural fill for the building pad should be placed in horizontal lifts that are no more than 9 inches thick before compaction Each lift should be compacted to at least 90 percent of the maximum dry density determined in accordance with ASTM Test Method D 1557 (Modified Proctor)

Wall backfill should be placed in horizontal lifts that are no more than 12 inches thick before compaction Each lift should be compacted while at or above the optimum moisture content and to 90 percent of the maximum dry density determined in accordance with ASTM Test Method D

1557 Only manually guided compactors should be used within 3 feet of retaining walls Over compaction of the wall backfill should be avoided, especially behind tall walls

Foundations
The proposed building can be supported on conventional foundations bearing on native silty and sandy soils The bottom of the footing excavations should be protected from disturbance during wet weather by 2 to 3 inches of compacted crushed gravel

Spread and continuous footings should be designed for a maximum allowable soil bearing pressure of 3,000 psf (dead plus live loads) A one-third increase in the allowable bearing pressure is allowed for loading conditions that include wind and seismic forces

The bottoms of all footings should be located at least 18 inches below lowest adjacent grade and the basement floor slab Continuous and spread footings should have minimum widths of 24 inches All footings should be reinforced as specified by the structural engineer

A geotechnical engineer should review the foundation plans to verify that these recommendations have been properly interpreted and incorporated into the project documents

In addition, a geotechnical engineer should observe all footing excavations before the contractor places reinforcing steel or concrete The purpose of this work is to evaluate whether actual soil conditions are similar to those encountered in the borings and backhoe test pits or whether different conditions are present that require design changes

Seismic Site Coefficient
Based on our interpretation of site geology, the soil conditions at this site are most similar to 2007 OSSC Site Class D

Retaining Walls
Geotechnical design recommendations for retaining walls are provided in the following paragraphs The recommended static equivalent fluid weights and seismic resultant thrusts assume that (1) the wall backfill is level and fully drained by a foundation drain system, (2) the recommended earth pressures act horizontally (normal to the wall) because friction between the wall and backfill will be prevented by drainage membranes or impervious wall coatings, and (3) the backfill has a maximum wet, compacted unit weight of 135 pcf and consists of imported crushed gravel

<u>Static Design</u>
Retaining walls that are free to rotate, such as free-standing cantilever or segmental block walls, should be designed to resist static, horizontal earth pressure forces calculated using an equivalent fluid weight of 32 pcf This fluid weight was calculated using the Rankine earth pressure theory

Retaining walls that are restrained at the top and bottom, such as basement walls, should be designed to resist static, horizontal earth pressure forces calculated using an equivalent fluid weight of 52 pcf This fluid weight was calculated using the Jaky equation for normally consolidated soils

A friction coefficient of 0 5 times the vertical load may be used to evaluate the frictional resistance along the bottom of concrete foundations in direct contact with either the undisturbed weathered basalt bedrock or at least 3 inches of 1½-inch minus crushed gravel The structural plans for all retaining wall footings should include a note stating that the foundation subgrade must consist of either undisturbed weathered basalt or 3 inches of imported crushed 1½-inch minus gravel The structural note should also state that geotechnical special inspection of all retaining wall footing excavations is required before constructing forms

Passive pressure may be used to resist sliding if the ground in front of the foundation is level for at least 10 feet or three times the height of the surface generating passive resistance The static horizontal passive resistance may be calculated using an equivalent fluid weight of 500 pcf This passive equivalent fluid weight was calculated using the Coulomb earth pressure theory with $\delta=\frac{1}{2}\Phi'$

Only two-thirds of the passive resistance should be used if friction and passive resistance are combined to resist lateral forces

Seismic Design

Ground accelerations during earthquakes temporarily increase lateral earth pressures on retaining walls The resultant horizontal seismic thrust should be added to the horizontal static force calculated using the equivalent fluid weights listed above Seismic thrusts have been calculated assuming a 2007 Oregon Structural Specialty Code peak ground acceleration a_{max} of 0 3g

Unrestrained walls should be designed to resist a seismically-induced resultant horizontal thrust of $6H^2$ pounds, where H is the height of the wall in feet The resultant seismic thrust acts 0 6H above the base of the wall This thrust was calculated using the Mononobe-Okabe method assuming the unrestrained walls are free to displace and assuming a pseudostatic horizontal acceleration equal to ½ a_{max}

Restrained basement walls should be designed to resist a seismic resultant horizontal thrust of $13H^2$ pounds, where H is the height of the wall in feet The resultant seismic thrust acts 0 6H above the base of the wall This thrust was calculated using the Mononobe-Okabe method and assuming a pseudostatic horizontal acceleration equal to a_{max}

A friction coefficient of 0 5 times the vertical load may be used to evaluate the frictional resistance along the bottom of concrete foundations in direct contact with either the undisturbed weathered basalt bedrock or at least 3 inches of 1½-inch minus crushed gravel The structural plans for all retaining wall footings should include a note stating that the foundation subgrade must consist of either undisturbed weathered basalt or 3 inches of imported crushed 1½-inch minus gravel The structural note should also state that geotechnical special inspection of all retaining wall footing excavations is required before constructing forms

Passive pressure may be used to resist sliding during seismic loading if the ground in front of the foundation is level for at least 10 feet or three times the height of the surface generating passive resistance The seismic passive resistance may be calculated using an equivalent fluid weight of 350 pcf This seismic passive equivalent fluid weight was calculated using the Mononobe-Okabe method with $\delta=\frac{1}{2}\varphi'$ and a pseudostatic horizontal acceleration equal to a_{max}

Only two-thirds of the passive resistance should be used if friction and passive resistance are combined to resist lateral forces

The minimum recommended factors of safety for seismic design of sliding, overturning and bearing capacity are taken as 75% of the values recommended for statically loaded structures Therefore, the minimum static factors of safety for sliding, overturning, and bearing capacity of 1 5, 1 5, and 2 0 are reduced to 1 1, 1 1, and 1 5, respectively, when evaluating seismic stability

Drainage

The entire back (soil face) of basement walls should be covered with appropriate waterproofing Retaining walls must include foundation and backfill drainage provisions Perforated foundation drainpipes should be located below the finish floor elevation of the interior floor slab The perforated drainpipes should be at least 4 inch diameter and surrounded by at least 1-foot of 1½"-3/4" crushed drain rock that has been completely wrapped in a non-woven geotextile Prefabricated foundation drains such as *ezflow* (www ezflowlp com) may be installed as an alternative to drain rock The *ezflow* system consists of a flexible, perforated pipe surrounded by expanded polystyrene (EPS) aggregate A geotextile wrap holds the lightweight aggregate around the drain pipe The system is sold in 10-foot long lengths that snap together Drainpipes should outlet to an appropriate drainage facility

Floor Slab and Parking Slab

We recommend that the slab-on-grade floor be designed using an allowable modulus of subgrade reaction of up to 150 pci The subgrade soils must be in a firm, non-yielding condition at the time of slab construction Any soft areas encountered should be excavated and replaced with structural fill Concrete slabs supporting car traffic should be at least 5 inches thick Floor slabs in building areas should be at least 4 inches thick

A capillary break consisting of at least 6 inches of gravel should be placed underneath the concrete slabs This minimum gravel thickness may need to be increased to 12 inches depending on construction traffic use and whether construction occurs during the wet winter and spring months

If the slab will be covered by moisture-sensitive material, we recommend placing a vapor barrier on top of the gravel capillary break and below the slab

CLOSURE

Geotechnical review is of paramount importance in engineering practice The poor performance of many foundations has been attributed to inadequate construction review On-site grading and earthwork should be observed and, where necessary, tested by a qualified geotechnical engineering firm to verify compliance with the recommendations contained in this report Foundation excavations should also be observed to compare the generalized site conditions assumed in this report with those found on the site at the time of construction If the plans for site development are changed, or if variations or undesirable geotechnical conditions are encountered during construction, the geotechnical engineer should be consulted for further recommendations

Geotechnical engineering is characterized by uncertainty Professional judgments presented are based partly on an understanding of the proposed construction, and partly on general experience The engineering work performed and judgments rendered for this study meet current professional standards ordinarily provided by members of the engineering profession in this area practicing under similar conditions at this time No other warranties, either expressed or implied, are made

Sincerely,

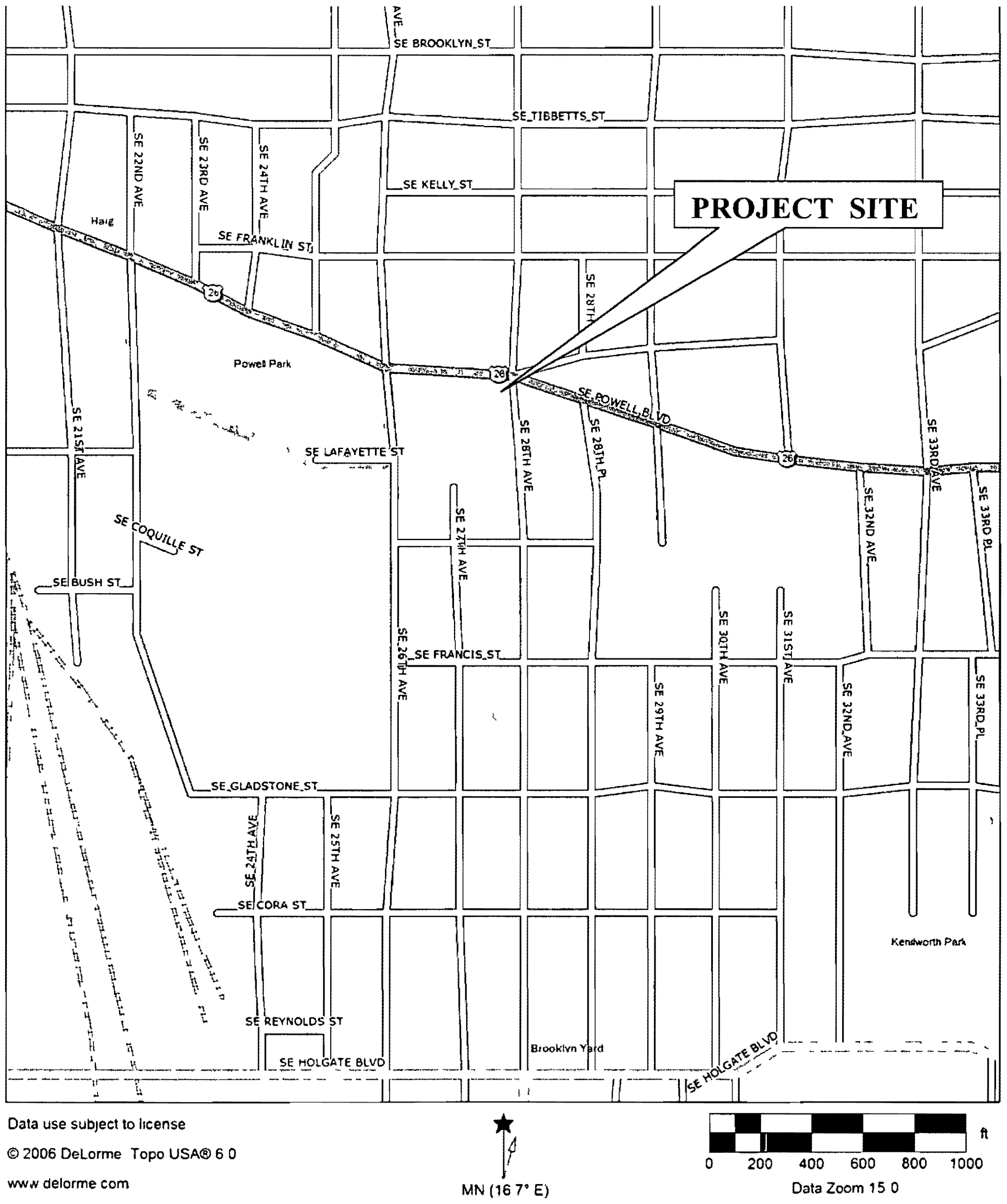
ALDER GEOTECHNICAL SERVICES, LLC

REGISTERED PROFESSIONAL ENGINEER
13507
John N Cunningham
OREGON
March 19, 1987
JOHN N CUNNINGHAM

EXP 12-31-09

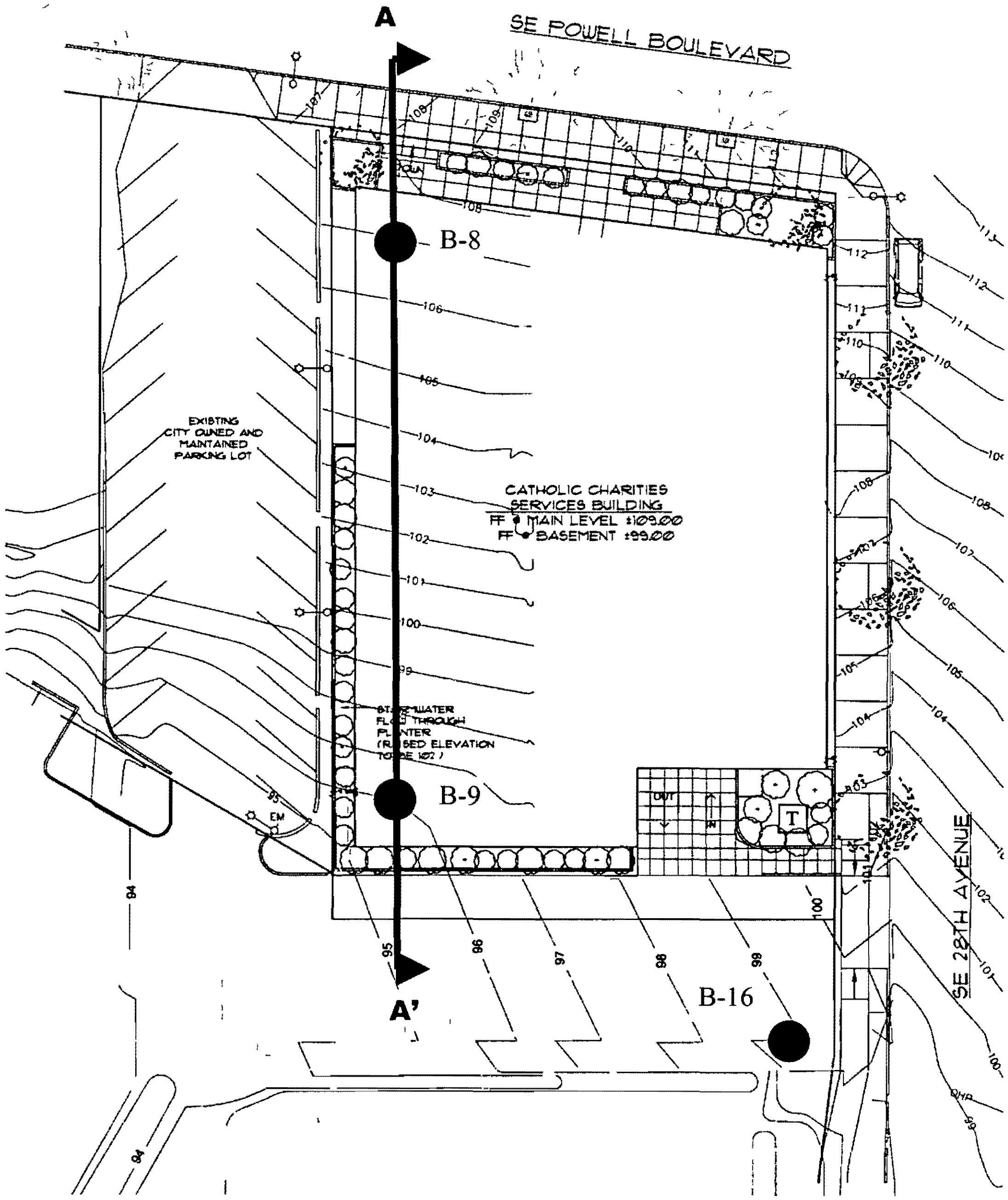
John N Cunningham, P E , G E
Oregon Geotechnical Engineer No 13,507

(1) Addressee via pdf
(1) Lundin Cole Architects via pdf
(1) WDY, Inc via pdf



Alder Geotechnical Services, LLC

Job # 568-2 Catholic Charities Services Center Figure 1
July 2008 Portland, OR Vicinity Map



Site Plan from Lundin Cole Architects

Legend

B-8 Approx location of soil boring

A Geologic Cross-Section, See Fig 3 A'

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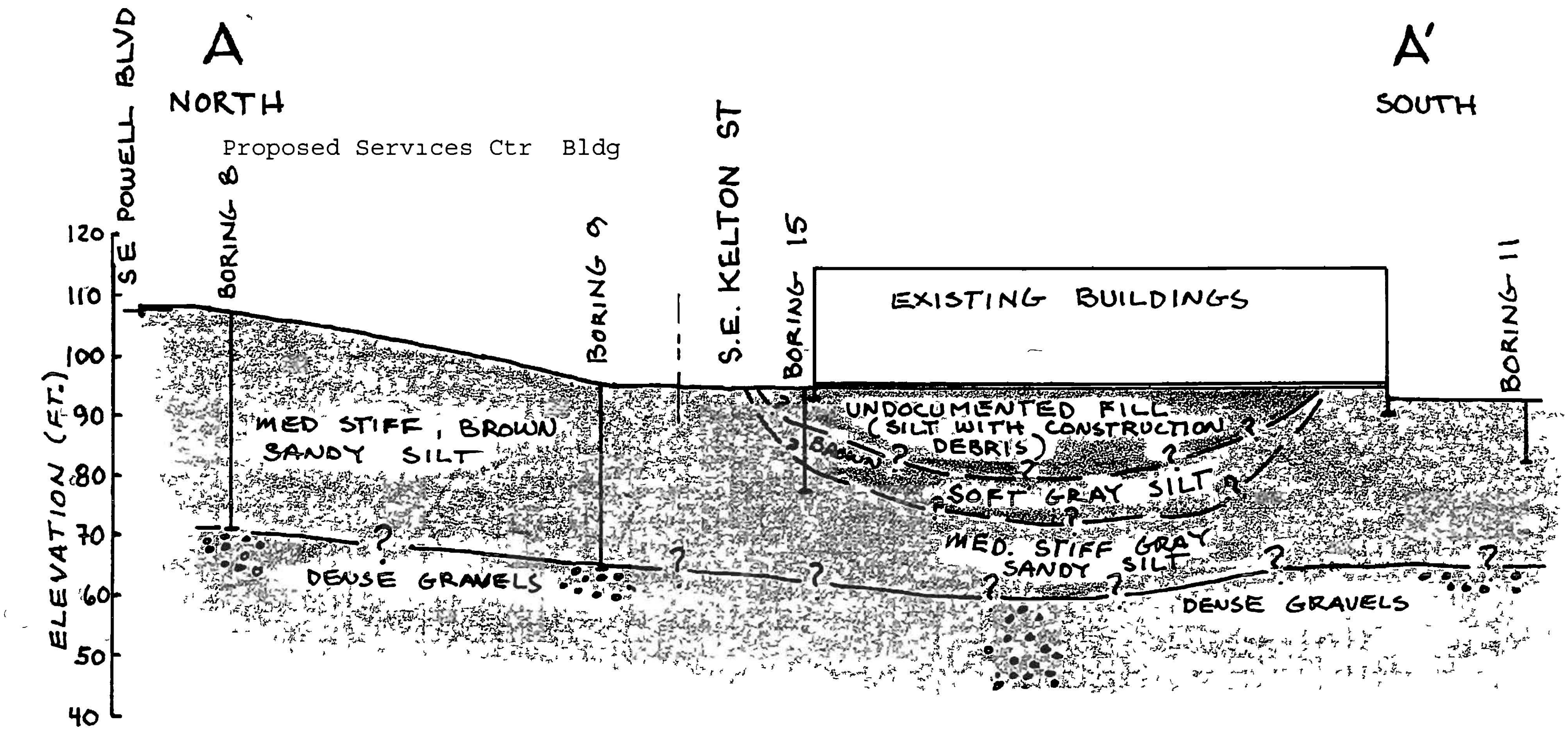
Alder Geotechnical Services, LLC

Job 568-2	Catholic Charities Services Center	Figure 2
July 2008	Portland, OR	Site Plan



A
NORTH
A'
SOUTH
Proposed Services Ctr Bldg
SE POWELL BLVD
BORING 8
BORING 9
S.E. KELTON ST
BORING 15
EXISTING BUILDINGS
BORING 11
ELEVATION (FT.)
120
110
100
90
80
70
60
50
40
MED STIFF, BROWN SANDY SILT
UNDOCUMENTED FILL (SILT WITH CONSTRUCTION DEBRIS)
BROWN
SOFT GRAY SILT
MED. STIFF GRAY SANDY SILT
DENSE GRAVELS
DENSE GRAVELS

APPENDIX A

FIELD INVESTIGATION

Sixteen soil borings and six backhoe test pits were drilled and excavated on St Vincent de Paul property in October and November 2005 Borings B-8, -9 and 16 were located on the subject site The borings were drilled about 11½ to 36½ feet deep

The approximate locations of the explorations are shown on Figure 2

The borings were drilled using truck-mounted drill rigs equipped with 8-inch hollow stem augers Disturbed samples were collected from the power auger borings using a standard split spoon sampler (2" outside diameter, 1 675" inside diameter) The sampler was generally driven 18 inches into the material at the bottom of the boring by a 140-pound hammer falling 30 inches The collected soil samples were sealed in plastic bags, and brought to our office for examination and testing

The locations and elevations of the explorations are approximate The location of each exploration was estimated by using the site topographic plan prepared by W B Wells and Associates, Inc

The soils encountered in the explorations were generally described using the Unified Soil Classification System A Key to Logs is presented as Page 1 Final logs of the explorations are attached

BORING:

BORING:	**Surface Elev** **Logged By**	**Drilling Date** **Drilling Method**

DEPTH	STRATA	GWT	MATERIAL DESCRIPTION	SAMPLE NO	TYPE	SPT-N	SPT, blow/ft / MOISTURE % (0 20 40 60 80 100)	MOISTURE (%)
0			STANDARD PENETRATION SAMPLER Sample with recorded blows per foot was obtained using a standard split spoon sampler (1 675" inside dia , 2" outside dia) The sampler was generally driven into the soil with a 140 lb hammer falling 30 inches	1-1				
5			SHELLBY TUBE SAMPLER Sample was obtained using a Shelby tube sampler (2 875" inside diamter, 3 0" outside diameter) The sampler was generally pushed 12" to 30" into the soil using the exploration equipment hydraulic system	1-2				
10			Soil sample not recovered from sampler	1-3				
15			DISTURBED SAMPLE LOCATION Sample was obtained by collecting auger cuttings or backhoe excavated materials in a plastic bag	1-4				
			PP = pocket penetration index strength test, in tons per square foot					
		1030a	Groundwater level and time of measurement					
20			FILL					
			SILT (ML)					
			LEAN CLAY (CL)					
			FAT CLAY (CH)					
			WELL GRADED SAND (SW)					
25			POORLY GRADED SAND (SP)					
			SILTY SAND (SM)					
			CLAYEY SAND (SC)					
			WELL GRADED GRAVEL (GW)					
			POORLY GRADED GRAVEL (GP)					
30			SILTY GRAVEL (GM)					
			CLAYEY GRAVEL (GC)					
			ORGANICS / FOREST DUFF/ PEAT					
			BEDROCK					
35								

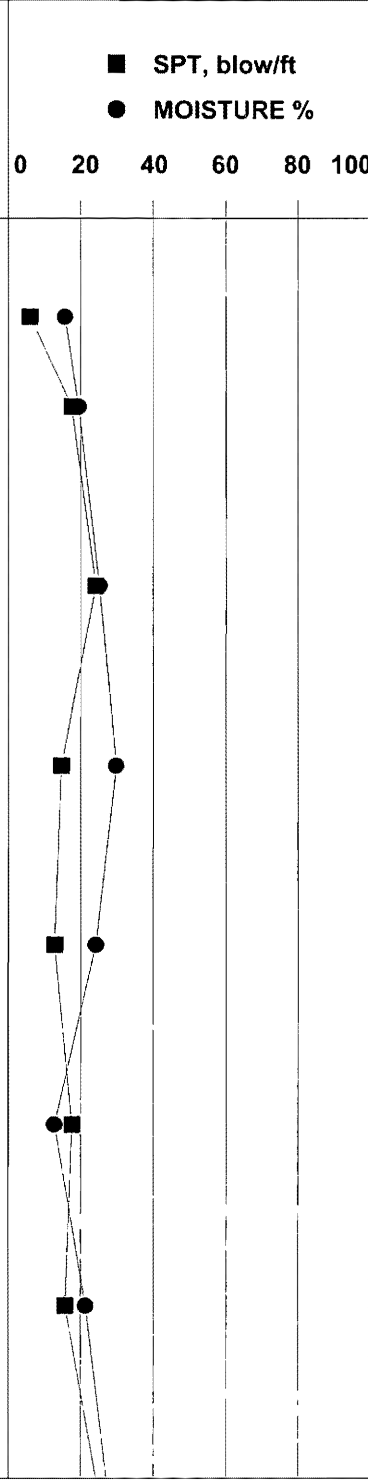
SuperLog V2 6 CivilTech Software USA www civiltech com File C \Documents and Settings\John\My Documents\Forms\LOGKEY log Date 9/28/2005

Exploration: B-8

Surface Elev 107'
Logged By BWG

Drilling Date 10-5-05
Drilling Method 8" HSA

DEPTH	MATERIAL DESCRIPTION	SAMPLE NO	SPT-N	MOISTURE (%)
0	2" Asphalt pavement over minimal crushed gravel base			
	SILTY SAND (SM), brown, moist, loose, fine grained with occasional gravel (FILL) P200= 33%	8-1	4	14
5	SILTY SAND (SM), brown, moist, medium dense, fine grained (FLOOD DEPOSITS)	8-2	16	18
10	SANDY SILT and SILT (ML), brown, moist, medium dense, with fine grained sand, interbedded layers of silt and sand (FLOOD DEPOSITS)	8-3	23	24
15		8-4	13	29
20		8-5	11	23
25	SILTY SAND (SM), brown, moist, medium dense, fine grained (FLOOD DEPOSITS) P200 = 45%	8-6	16	11
30		8-7	14	20
35				



Exploration: B-8

Surface Elev 107'
Logged By BWG

Drilling Date 10-5-05
Drilling Method 8" HSA

DEPTH	STRATA	GWT	MATERIAL DESCRIPTION	SAMPLE NO	TYPE	SPT-N	SPT, blow/ft / MOISTURE % (0 20 40 60 80 100)	MOISTURE (%)
35			SILTY SAND (SM), brown, moist, medium dense, fine grained (FLOOD DEPOSITS)	8-8		23		26
			gravel in tip of sampler					
			Boring completed at depth of 36 5 feet					
			Groundwater not encountered					
40								
45								
50								
55								
60								
65								
70								

Exploration: B-9

Surface Elev 96'
Logged By BWG

Drilling Date 10-4-05
Drilling Method 8" HSA

DEPTH	STRATA	GWT	MATERIAL DESCRIPTION	SAMPLE NO	TYPE	SPT-N	MOISTURE (%)
0			Asphalt pavement over gravel base rock				
			SILT (ML), brown, moist, medium dense, some fine sand (FLOOD DEPOSITS)	9-1		15	32
5			SILTY SAND (SM), brown, moist, medium dense, fine grained (FLOOD DEPOSITS)	9-2		10	25
10				9-3		11	20
15			P200 = 45%	9-4		11	17
20			P200 = 21%	9-5		9	15
25		▽	trace gravel @ 24', fine to medium grained sand, free water encountered	9-6		10	26
30			POORLY GRADED GRAVEL (GP), brown, moist, dense to very dense, rounded, in a matrix of fine to coarse sand and trace silt (FLOOD DEPOSITS)	9-7		59	7
35			Boring completed at depth of 31 5 feet Groundwater encountered at 24 feet				

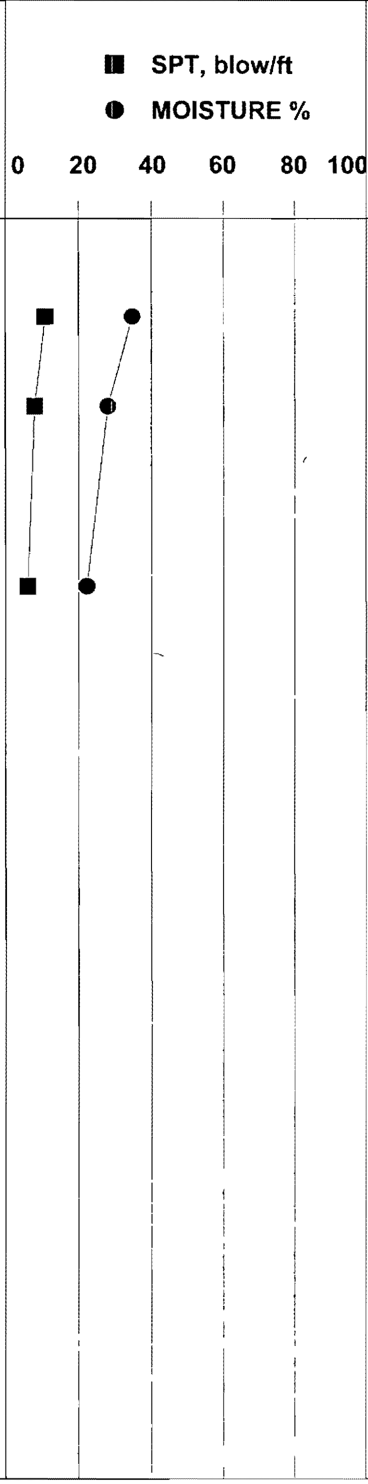
■ SPT, blow/ft
● MOISTURE %
0 20 40 60 80 100

Exploration: B-16

Surface Elev 97'
Logged By BWG

Drilling Date 11-10-05
Drilling Method 8" HSA

DEPTH	STRATA	GWT	MATERIAL DESCRIPTION	SAMPLE NO	TYPE	SPT-N	MOISTURE (%)
0			2" Asphalt concrete over 4" crushed gravel base rock				
			SILT (ML), brown, moist, firm to medium stiff, with some to much fine sand (FLOOD DEPOSITS)	16-1		9	34
5				16-2		6	27
10			SILTY FINE SAND (SM) brown, moist, loose, fine grained (FLOOD DEPOSITS)	16-3		4	21
			Boring completed at depth of 11 5 feet				
15							
20							
25							
30							
35							



Alder Geotechnical Services

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August 25, 2008
Project No 568-2

Ms Susan Lind
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

FINAL DRYWELL SIZE RECOMMENDATIONS FOR INFILTRATION OF ROOF RUNOFF PROPOSED CATHOLIC CHARITIES SERVICE CENTER BUILDING 2740 SE POWELL BOULEVARD, PORTLAND, OREGON

Dear Ms Lind

As requested by Lundin Cole Architects, I am providing the project team with final recommendations for the size and number of drywells needed to infiltrate the roof runoff from the proposed Service Center building My final recommendations are based on combining conventional hydrology analyses with site-specific infiltration data obtained from three dry well tests performed for the adjacent Esperanza Court apartment project in 2007

SIZE RECOMMENDATIONS

Based on my analyses, I recommend constructing three drywells on the south side of the building The drywells should have the following minimum dimensions, volume of drain rock, and center-to-center spacing

- Depth of excavation — 14 feet
- Width of excavation — 11 feet square
- Thickness of drain rock on bottom of excavation — 2 feet
- Inside diameter of perforated concrete pipe — 4 feet
- Height of perforated concrete pipe — 10 feet
- Approximate volume of drain rock — 47 cubic yards
- Minimum edge-to-edge spacing between drywells — 28 feet

Each drywell has been sized to infiltrate runoff from 4,500 ft^2 of impervious surface

DESIGN ASSUMPTIONS

The following assumptions were used to estimate the required size of the drywells

- Service Center roof area of 12,000 ft^2
- Design rainfall is 3 9 inches (25-year, 24-hour storm)
- Drain rock porosity is 40 percent

- Seasonal high groundwater level is at least 24 feet below the existing ground surface The 2008 City of Portland Stormwater Manual includes a map showing the estimated depth to groundwater on the site at 40 to 50 feet
- The soil infiltration rate varies with the height of water in the drywell and is based on average values measured from three drywell tests performed for Esperanza Court apartments on October 19 and 26, 2007
- A factor of safety of 2 0 was used to reduce the measured soil infiltration rates to design infiltration rates

DESIGN METHOD AND RESULTS

The capacity of the drywell to infiltrate the Portland-area 25-year, 24-hour design storm (3 9 inches) was evaluated using a spreadsheet incorporating the Santa Barbara Urban Hydrograph method, the proposed dimensions and volumes of the drywell and drain rock, the contributing roof runoff area, and the measured soil infiltration rates (cfs of infiltration flow per ft^2 of infiltration surface area, expressed in units of inches/hour) from three tests on nearby drywells in the same type of soils

The spreadsheet calculations and graphs are attached The calculations indicate that when a factor of safety of 2 0 is applied to the soil infiltration rates, three drywells of the proposed size are required Each drywell can drain about 4,500 ft^2 of roof area The predicted maximum height of water in each drywell is approximately 10 feet, essentially at the top of the perforated concrete pipe In my analysis, the soil infiltration rate varies with the height of water in the drywells At low head, the minimum design infiltration rate is 0 05 inch per hour At high head, the maximum design infiltration rate is 1¼ inches per hour

I hope this information meets your needs at this time Please call if you have questions

Sincerely,

ALDER GEOTECHNICAL SERVICES, LLC

REGISTERED PROFESSIONAL ENGINEER
13507
John N Cunningham
OREGON
March 19, 1987
JOHN N CUNNINGHAM

EXP 12-31-09

John Cunningham, P E , G E

Oregon Registered Geotechnical Engineer No 13,507

(1) Addressee

(1) Scott Rimmer, Lundin Cole Architects

(1) Cole Presthus, WDY Civil-Structural Engineers

Catholic Charities Service Center Drywell Design
2740 SE Powell Boulevard

DRYWELL DIMENSIONS AND PROPERTIES

Height of Perforated Drywell Pipes	10 0	feet	
Thickness of drain rock on bottom	2 0	feet	
Width of excavation	11 0	feet	square
Inside diameter of drywell pipe	4 0	feet	
Outside diameter of drywell pipe	5 0	feet	
Porosity of drain rock	0 40		

DRYWELL VOLUME AND AREA CALCULATIONS

Storage volume in drywell					
Total	627 9 ft3				
Pipe	125 7 ft3				
Drainrock sides	405 5 ft3				
Drainrock bottom	96 8 ft3	Storage vol per unit height			
Infiltration surface area		of drywell above bottom	53 1 ft3/foot	(drainrock vol +pipe vol)	
Total	649 0 ft2				
Sides	528 0 ft2	Side area per unit of height			
Bottom	121 0 ft2	of drywell	44 0 ft2/foot		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**ALDER GEOTECHNICAL SERVICES**											**Project**	**Catholic Charities Service Center**						
2												**Project #**	**568-2**						
3																			
4	Comment		**Determine Runoff Infiltration and Req Soakage Trench Vol for 25-yr 24-hr Storm**																
5																			
6																			
7	**SANTA BARBARA URBAN HYDROGRAPH METHOD**					**25 YR**	**24 HOUR EVENT**			**DARCY'S LAW INFILTRATION**									
8	(King County WA Surface Water Des gn Manual)																		
9																			
10					PERVIOUS AREA		IMPERVIOUS AREA												
11						**0**	ft2	**4500**	ft2	DESIGN FACTOR OF SAFETY ON INFILTRATION RATE				**2 0**					
12	Rainfall D stribution		IA		Area	0	Area	0 103305785	Acre	MAX ALLOWED INFIL RATE WHEN DRYWELL IS FULL –				**13 5**	in /hr				
13	Total Area (Acres)		0 103305785		CN	**85**	CN	**98**											
14	Prec p Total (Pt) (in)		**3 9**		S	1 7647	S	0 2041					**SUMMARY OF RESULTS**						
15	Tc (minutes)		**5**		0 2S	0 3529	0 2S	0 0408					**Calc Max Required Storage Vol**			**626 5**	**ft3**		
16													**Design Storage Vol**			**627 9**	**ft3**		
17	Design												**Excess Storage Vol**			**1 5**	**ft3**	<=== red and in parentheses when	
18	Factor of Safety		**1 0**										**Calc Max Head in Drywell**			**9 97**	**ft**	design size is too small	
19	(runoff flow rate												**Max Alowable Head in Drywell**			**10 00**	**ft**		
20	nto drywell)												**Excess Available Head**			**0 03**	**ft**		
21																			
22													**Total Runoff Volume**			**1371 6**	**ft3**		
23													**Total Infiltration Volume**			**834 6**	**ft3**		
24													**Storage at end of Storm**			**537 0**	**ft3**		
25													**Peak Storm Inflow**			**0 1055**	**cfs**		
26													**Peak Storm Inflow**			**47**	**GPM**		
27													**Peak Soil Infiltration Outflow**			**8**	**GPM**		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
28					Pervious Area		Impervious Area												
29	Time	Rainfall	Incremental	Accum	Accum	Incremental	Accum	Incremental	Total	Instant	Design	Runoff	Head in	Infiltration	Infiltration	Infiltration	Infiltration	Storage	Time
30	Incre	Distrib	Rainfall	Rainfall	Runoff	Runoff	Runoff	Runoff	Runoff	Hydrograph	Hydrograph	Volume	Drywell	Area	Rate	Hydrograph	Volume	Volume	Incre
31	(dt)	/ of Pt									increased by	into drywell	+ bottom			out of		in drywell	(dt)
32											Design FOS					drywell			
33	Minutes		Inches	Inches	Inches	Inches	Inches	Inches	Inches	CFS	CFS	CF	FT	FT2	IN/HR	CFS	CF	CF	Minutes
34																			
35	10	0 004	0 0156	0 0156	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0	0 00	121 00	0 05	0 0001	0 1	0 0	10
36	20	0 004	0 0156	0 0312	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	0 0	0 00	121 00	0 04	0 0001	0 2	0 0	20
37	30	0 004	0 0156	0 0468	0 0000	0 0000	0 0002	0 0002	0 0002	0 0001	0 0001	0 0	0 00	121 00	0 04	0 0001	0 2	0 0	30
38	40	0 004	0 0156	0 0624	0 0000	0 0000	0 0021	0 0019	0 0019	0 0012	0 0006	0 4	0 00	121 00	0 04	0 0001	0 3	0 1	40
39	50	0 004	0 0156	0 0780	0 0000	0 0000	0 0057	0 0037	0 0037	0 0023	0 0017	1 5	0 00	121 11	0 04	0 0001	0 4	1 1	50
40	60	0 004	0 0156	0 0936	0 0000	0 0000	0 0108	0 0051	0 0051	0 0032	0 0027	3 1	0 02	121 99	0 04	0 0001	0 5	2 7	60
41	70	0 004	0 0156	0 1092	0 0000	0 0000	0 0172	0 0063	0 0063	0 0039	0 0036	5 3	0 05	123 42	0 04	0 0001	0 5	4 7	70
42	80	0 004	0 0156	0 1248	0 0000	0 0000	0 0245	0 0073	0 0073	0 0046	0 0043	7 8	0 10	125 29	0 05	0 0001	0 6	7 2	80
43	90	0 004	0 0156	0 1404	0 0000	0 0000	0 0327	0 0082	0 0082	0 0051	0 0048	10 7	0 15	127 55	0 05	0 0001	0 7	10 0	90
44	100	0 004	0 0156	0 1560	0 0000	0 0000	0 0416	0 0089	0 0089	0 0056	0 0053	13 9	0 21	130 11	0 05	0 0001	0 8	13 1	100
45	110	0 005	0 0195	0 1755	0 0000	0 0000	0 0535	0 0120	0 0120	0 0075	0 0065	17 8	0 27	132 95	0 05	0 0001	0 9	17 0	110
46	120	0 005	0 0195	0 1950	0 0000	0 0000	0 0664	0 0128	0 0128	0 0080	0 0077	22 5	0 35	136 43	0 05	0 0002	1 0	21 5	120
47	130	0 005	0 0195	0 2145	0 0000	0 0000	0 0799	0 0135	0 0135	0 0084	0 0082	27 4	0 44	140 57	0 05	0 0002	1 1	26 4	130
48	140	0 005	0 0195	0 2340	0 0000	0 0000	0 0939	0 0141	0 0141	0 0088	0 0086	32 6	0 54	144 97	0 05	0 0002	1 2	31 4	140
49	150	0 005	0 0195	0 2535	0 0000	0 0000	0 1085	0 0146	0 0146	0 0091	0 0090	38 0	0 65	149 57	0 05	0 0002	1 3	36 7	150
50	160	0 005	0 0195	0 2730	0 0000	0 0000	0 1236	0 0150	0 0150	0 0094	0 0093	43 5	0 76	154 36	0 05	0 0002	1 4	42 1	160
51	170	0 006	0 0234	0 2964	0 0000	0 0000	0 1421	0 0185	0 0185	0 0116	0 0105	49 8	0 87	159 31	0 06	0 0002	1 5	48 3	170
52	180	0 006	0 0234	0 3198	0 0000	0 0000	0 1611	0 0190	0 0190	0 0119	0 0117	56 9	1 00	164 92	0 06	0 0002	1 6	55 2	180
53	190	0 006	0 0234	0 3432	0 0000	0 0000	0 1805	0 0194	0 0194	0 0121	0 0120	64 1	1 14	171 20	0 06	0 0002	1 8	62 3	190
54	200	0 006	0 0234	0 3666	0 0001	0 0001	0 2003	0 0198	0 0198	0 0124	0 0122	71 4	1 29	177 61	0 06	0 0003	1 9	69 5	200
55	210	0 006	0 0234	0 3900	0 0008	0 0007	0 2204	0 0201	0 0201	0 0125	0 0125	78 9	1 44	184 15	0 07	0 0003	2 1	76 8	210
56	220	0 006	0 0234	0 4134	0 0020	0 0012	0 2407	0 0203	0 0203	0 0127	0 0126	86 5	1 59	190 79	0 07	0 0003	2 3	84 2	220
57	230	0 007	0 0273	0 4407	0 0042	0 0022	0 2648	0 0240	0 0240	0 0150	0 0139	94 8	1 74	197 51	0 07	0 0003	2 5	92 3	230
58	240	0 007	0 0273	0 4680	0 0070	0 0029	0 2891	0 0243	0 0243	0 0152	0 0151	103 8	1 91	204 90	0 08	0 0004	2 7	101 1	240
59	250	0 007	0 0273	0 4953	0 0106	0 0036	0 3136	0 0246	0 0246	0 0154	0 0153	113 0	2 08	212 60	0 08	0 0004	2 9	110 1	250
60	260	0 007	0 0273	0 5226	0 0149	0 0043	0 3384	0 0248	0 0248	0 0155	0 0154	122 3	2 25	220 00	0 08	0 0004	3 2	119 1	260

	U	V
29	Percolation Test Results October 2007	
30	Esperanza NE NW and SW Drywell perc tests	
31	by BCG Inc	
33	H2O head (ft)	Meas Infil rate (in/hr)
34	1	0 1
35	2	0 125
36	4	0 3
37	6	0 62
38	8	1
39	10	1 6
40	11	1 88
41	12	2 25
42	13	2 6
43	14	3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
29	Time	Rainfall	Incremental	Accum	Accum	Incremental	Accum	Incremental	Total	Instant	Design	Runoff	Head in	Infiltration	Infiltration	Infiltration	Infiltration	Storage	Time		Percolation Test Results October 2007		
30	Incre	Distrib	Rainfall	Rainfall	Runoff	Runoff	Runoff	Runoff	Runoff	Hydrograph	Hydrograph	Volume	Drywell	Area	Rate	Hydrograph	Volume	Volume	Incre		Esperanza NE NW and SW Drywell perc tests		
31	(dt)	% of Pt									increased by	into drywell	+ bottom			out of		in drywell	(dt)		by BCG Inc		
32											Design FOS					drywell							
33	Minutes		Inches	Inches	Inches	Inches	Inches	Inches	Inches	CFS	CFS	CF	FT	FT2	IN/HR	CFS	CF	CF	Minutes		H2O head (ft)	Meas Infil rate (in/hr)	
34																					1	0 1	
61	270	0 007	0 0273	0 5499	0 0198	0 0049	0 3634	0 0250	0 0250	0 0156	0 0155	131 6	2 42	227 45	0 09	0 0005	3 5	128 1	270				
62	280	0 007	0 0273	0 5772	0 0253	0 0055	0 3885	0 0251	0 0251	0 0157	0 0157	141 0	2 59	234 96	0 09	0 0005	3 8	137 2	280				
63	290	0 0082	0 03198	0 6092	0 0325	0 0072	0 4182	0 0297	0 0297	0 0185	0 0171	151 3	2 76	242 50	0 10	0 0005	4 1	147 2	290				
64	300	0 0082	0 03198	0 6412	0 0405	0 0080	0 4480	0 0298	0 0298	0 0186	0 0186	162 4	2 95	250 74	0 10	0 0006	4 4	158 0	300				
65	310	0 0082	0 03198	0 6731	0 0492	0 0087	0 4780	0 0300	0 0300	0 0188	0 0187	173 6	3 15	259 69	0 11	0 0006	4 8	168 8	310				
66	320	0 0082	0 03198	0 7051	0 0586	0 0094	0 5082	0 0301	0 0301	0 0188	0 0188	184 9	3 36	268 67	0 11	0 0007	5 2	179 7	320				
67	330	0 0082	0 03198	0 7371	0 0687	0 0101	0 5385	0 0303	0 0303	0 0189	0 0189	196 2	3 56	277 66	0 12	0 0008	5 7	190 6	330				
68	340	0 0082	0 03198	0 7691	0 0794	0 0107	0 5689	0 0304	0 0304	0 0190	0 0190	207 6	3 77	286 67	0 13	0 0008	6 2	201 4	340				
69	350	0 0095	0 03705	0 8061	0 0926	0 0132	0 6042	0 0353	0 0353	0 0221	0 0205	219 9	3 97	295 68	0 13	0 0009	6 7	213 2	350				
70	360	0 0095	0 03705	0 8432	0 1066	0 0140	0 6397	0 0355	0 0355	0 0222	0 0221	233 2	4 19	305 44	0 14	0 0010	7 3	225 9	360				
71	370	0 0095	0 03705	0 8802	0 1213	0 0147	0 6752	0 0356	0 0356	0 0222	0 0222	246 5	4 43	315 94	0 15	0 0011	8 0	238 5	370				
72	380	0 0095	0 03705	0 9173	0 1367	0 0154	0 7109	0 0357	0 0357	0 0223	0 0223	259 9	4 67	326 42	0 16	0 0012	8 7	251 2	380				
73	390	0 0095	0 03705	0 9543	0 1529	0 0161	0 7467	0 0358	0 0358	0 0224	0 0223	273 3	4 91	336 88	0 17	0 0013	9 6	263 8	390				
74	400	0 0095	0 03705	0 9914	0 1696	0 0168	0 7826	0 0359	0 0359	0 0224	0 0224	286 7	5 14	347 31	0 18	0 0015	10 4	276 3	400				
75	410	0 0134	0 05226	1 0436	0 1943	0 0247	0 8333	0 0507	0 0507	0 0317	0 0270	303 0	5 38	357 70	0 20	0 0016	11 4	291 5	410				
76	420	0 0134	0 05226	1 0959	0 2201	0 0258	0 8841	0 0508	0 0508	0 0318	0 0317	322 0	5 67	370 33	0 21	0 0018	12 5	309 5	420				
77	430	0 0134	0 05226	1 1482	0 2470	0 0269	0 9350	0 0509	0 0509	0 0318	0 0318	341 1	6 00	385 19	0 23	0 0021	13 8	327 3	430				
78	440	0 018	0 0702	1 2184	0 2848	0 0377	1 0036	0 0686	0 0686	0 0429	0 0374	363 5	6 34	399 96	0 26	0 0024	15 2	348 3	440				
79	450	0 018	0 0702	1 2886	0 3242	0 0394	1 0723	0 0687	0 0687	0 0430	0 0429	389 2	6 73	417 34	0 29	0 0028	16 9	372 4	450				
80	460	0 034	0 1326	1 4212	0 4028	0 0786	1 2025	0 1302	0 1302	0 0814	0 0622	426 5	7 19	437 28	0 33	0 0033	18 9	407 7	460				
81	470	0 054	0 2106	1 6318	0 5373	0 1345	1 4101	0 2075	0 2075	0 1297	0 1055	489 9	7 85	466 54	0 39	0 0042	21 4	468 5	470				
82	480	0 027	0 1053	1 7371	0 6084	0 0711	1 5141	0 1040	0 1040	0 0650	0 0974	548 3	9 00	516 89	0 54	0 0065	25 3	523 0	480				
83	490	0 018	0 0702	1 8073	0 6570	0 0486	1 5835	0 0694	0 0694	0 0434	0 0542	580 8	10 07	562 07	0 72	0 0093	30 9	549 9	490				
84	500	0 0134	0 05226	1 8595	0 6938	0 0368	1 6352	0 0517	0 0517	0 0323	0 0379	603 5	10 53	584 37	0 83	0 0112	37 6	565 9	500				
85	510	0 0134	0 05226	1 9118	0 7311	0 0373	1 6870	0 0517	0 0517	0 0323	0 0323	622 9	10 83	597 62	0 90	0 0124	45 1	577 8	510				
86	520	0 0134	0 05226	1 9640	0 7689	0 0378	1 7387	0 0518	0 0518	0 0324	0 0323	642 3	11 06	607 51	0 96	0 0135	53 1	589 2	520				
87	530	0 0088	0 03432	1 9984	0 7939	0 0250	1 7727	0 0340	0 0340	0 0213	0 0268	658 4	11 27	616 89	1 02	0 0145	61 8	596 5	530				
88	540	0 0088	0 03432	2 0327	0 8192	0 0252	1 8067	0 0340	0 0340	0 0213	0 0213	671 2	11 41	623 01	1 06	0 0152	71 0	600 2	540				
89	550	0 0088	0 03432	2 0670	0 8446	0 0254	1 8408	0 0340	0 0340	0 0213	0 0213	683 9	11 48	626 01	1 08	0 0156	80 3	603 6	550				
90	560	0 0088	0 03432	2 1013	0 8701	0 0256	1 8748	0 0340	0 0340	0 0213	0 0213	696 7	11 54	628 82	1 10	0 0159	89 9	606 8	560				
91	570	0 0088	0 03432	2 1356	0 8959	0 0257	1 9089	0 0340	0 0340	0 0213	0 0213	709 4	11 60	631 47	1 11	0 0163	99 7	609 8	570				
92	580	0 0088	0 03432	2 1700	0 9218	0 0259	1 9429	0 0341	0 0341	0 0213	0 0213	722 2	11 66	633 95	1 13	0 0166	109 6	612 6	580				
93	590	0 0088	0 03432	2 2043	0 9478	0 0261	1 9770	0 0341	0 0341	0 0213	0 0213	735 0	11 71	636 28	1 15	0 0169	119 8	615 2	590				
94	600	0 0088	0 03432	2 2386	0 9741	0 0262	2 0110	0 0341	0 0341	0 0213	0 0213	747 8	11 76	638 45	1 16	0 0172	130 1	617 6	600				
95	610	0 0088	0 03432	2 2729	1 0004	0 0264	2 0451	0 0341	0 0341	0 0213	0 0213	760 5	11 81	640 48	1 18	0 0175	140 6	619 9	610				
96	620	0 0088	0 03432	2 3072	1 0270	0 0265	2 0792	0 0341	0 0341	0 0213	0 0213	773 3	11 85	642 38	1 19	0 0177	151 2	622 1	620				
97	630	0 0088	0 03432	2 3416	1 0536	0 0267	2 1133	0 0341	0 0341	0 0213	0 0213	786 1	11 89	644 15	1 21	0 0180	162 0	624 1	630				
98	640	0 0088	0 03432	2 3759	1 0804	0 0268	2 1474	0 0341	0 0341	0 0213	0 0213	798 9	11 93	645 79	1 22	0 0182	173 0	625 9	640				
99	650	0 0072	0 02808	2 4040	1 1025	0 0220	2 1753	0 0279	0 0279	0 0174	0 0194	810 5	11 96	647 32	1 23	0 0184	184 0	626 5	650				
100	660	0 0072	0 02808	2 4320	1 1246	0 0221	2 2032	0 0279	0 0279	0 0174	0 0174	821 0	11 97	647 78	1 23	0 0185	195 2	625 8	660				
101	670	0 0072	0 02808	2 4601	1 1468	0 0222	2 2311	0 0279	0 0279	0 0174	0 0174	831 4	11 96	647 25	1 23	0 0184	206 2	625 2	670				
102	680	0 0072	0 02808	2 4882	1 1691	0 0223	2 2590	0 0279	0 0279	0 0174	0 0174	841 9	11 95	646 75	1 23	0 0184	217 2	624 7	680				
103	690	0 0072	0 02808	2 5163	1 1914	0 0224	2 2869	0 0279	0 0279	0 0174	0 0174	852 4	11 94	646 29	1 22	0 0183	228 2	624 1	690				
104	700	0 0072	0 02808	2 5444	1 2139	0 0225	2 3148	0 0279	0 0279	0 0174	0 0174	862 8	11 93	645 87	1 22	0 0182	239 2	623 7	700				
105	710	0 0072	0 02808	2 5724	1 2364	0 0225	2 3428	0 0279	0 0279	0 0175	0 0175	873 3	11 92	645 47	1 22	0 0182	250 1	623 2	710				
106	720	0 0072	0 02808	2 6005	1 2590	0 0226	2 3707	0 0279	0 0279	0 0175	0 0175	883 8	11 91	645 11	1 21	0 0181	261 0	622 8	720				
107	730	0 0072	0 02808	2 6286	1 2817	0 0227	2 3986	0 0279	0 0279	0 0175	0 0175	894 2	11 90	644 77	1 21	0 0181	271 8	622 4	730				
108	740	0 0072	0 02808	2 6567	1 3045	0 0228	2 4266	0 0279	0 0279	0 0175	0 0175	904 7	11 90	644 46	1 21	0 0180	282 6	622 1	740				
109	750	0 0072	0 02808	2 6848	1 3273	0 0228	2 4545	0 0279	0 0279	0 0175	0 0175	915 2	11 89	644 17	1 21	0 0180	293 4	621 8	750				
110	760	0 0072	0 02808	2 7128	1 3502	0 0229	2 4824	0 0279	0 0279	0 0175	0 0175	925 7	11 88	643 90	1 20	0 0180	304 2	621 5	760				
111	770	0 0057	0 02223	2 7351	1 3684	0 0182	2 5045	0 0221	0 0221	0 0138	0 0156	935 1	11 88	643 65	1 20	0 0179	315 0	620 1	770				
112	780	0 0057	0 02223	2 7573	1 3866	0 0182	2 5267	0 0221	0 0221	0 0138	0 0138	943 4	11 85	642 52	1 19	0 0178	325 6	617 7	780				
113	790	0 0057	0 02223	2 7795	1 4049	0 0183	2 5488	0 0221	0 0221	0 0138	0 0138	951 6	11 81	640 56	1 18	0 0175	336 1	615 5	790				
114	800	0 0057	0 02223	2 8018	1 4232	0 0183	2 5709	0 0221	0 0221	0 0138	0 0138	959 9	11 77	638 74	1 17	0 0172	346 5	613 5	800				
115	810	0 0057	0 02223	2 8240	1 4416	0 0184	2 5930	0 0221	0 0221	0 0138	0 0138	968 2	11 73	637 04	1 15	0 0170	356 7	611 6	810				
116	820	0 0057	0 02223	2 8462	1 4599	0 0184	2 6152	0 0221	0 0221	0 0138	0 0138	976 5	11 69	635 46	1 14	0 0168	366 7	609 8	820				
117	830	0 0057	0 02223	2 8685	1 4784	0 0184	2 6373	0 0221	0 0221	0 0138	0 0138	984 8	11 66	633 98	1 13	0 0166	376 7	608 1	830				
118	840	0 0057	0 02223	2 8907	1 4969	0 0185	2 6594	0 0221	0 0221	0 0138	0 0138	993 1	11 63	632 60	1 12	0 0164	386 6	606 6	840				
119	850	0 0057	0 02223	2 9129	1 5154	0 0185	2 6816	0 0221	0 0221	0 0138	0 0138	1001 4	11 60	631 31	1 11	0 0163	396 3	605 1	850				
120	860	0 0057	0 02223	2 9351	1 5339	0 0185	2 7037	0 0221	0 0221	0 0138	0 0138	1009 7	11 57	630 10	1 10	0 0161	406 0	603 7	860				
121	870	0 0057	0 02223	2 9574	1 5525	0 0186	2 7258	0 0221	0 0221	0 0138	0 0138	1018 0	11 54	628 97	1 10	0 0160	415 6	602 5	870				
122	880	0 0057	0 02223	2 9796	1 5711	0 0186	2 7480	0 0221	0 0221	0 0138	0 0138	1026 3	11 52	627 91	1 09	0 0158	425 1	601 3	880				
123	890	0 005	0 0195	2 9991	1 5875	0 0164	2 7674	0 0194	0 0194	0 0121	0 0130	1034 1	11 50	626 92	1 08	0 0157	434 5	599 6	890				
124	900	0 005	0 0195	3 0186	1 6039	0 0164	2 7868	0 0194	0 0194	0 0121	0 0121	1041 4	11 47	625 57	1 07	0 0155	443 8	597 6	900				
125	910	0 005	0 0195	3 0381	1 6203	0 0164	2 8062	0 0194	0 0194	0 0121	0 0121	1048 7	11 43	623 88	1 06	0 0153	453 0	595 7	910				
126	920	0 005	0 0195	3 0576	1 6367	0 0164	2 8256	0 0194	0 0194	0 0121	0 0121	1056 0	11 39	622 29	1 05	0 0151	462 1	593 9	920				
127	930	0 005	0 0195	3 0771	1 6532	0 0165	2 8451	0 0194	0 0194	0 0121	0 0121	1063 3	11 36	620 80	1 04	0 0150	471 1	592 2	930				
128	940	0 005	0 0195	3 0966	1 6697	0 0165	2 8645	0 0194	0 0194	0 0121	0 0121	1070 5	11 33	619 39	1 03	0 0148	479 9	590 6	910				
129	950	0 005	0 0195	3 1161	1 6862	0 0165	2 8839	0 0194	0 0194	0 0121	0 0121	1077 8	11 30	618 07	1 02	0 0146	488 7	589 1	950				
130	960	0 005	0 0195	3 1356	1 7028	0 0166	2 9033	0 0194	0 0194	0 0121	0 0121	1085 1	11 27	616 83	1 02	0 0145	497 4	587 7	960				
131	970	0 005	0 0195	3 1551	1 7194	0 0166	2 9228	0 0194	0 0194	0 0121	0 0121	1092 4	11 24	615 66	1 01	0 0144	506 0	586 3	970				
132	980	0 005	0 0195	3 1746	1 7360	0 0166	2 9422	0 0194	0 0194	0 0121	0 0121	1099 7	11 22	614 55	1 00	0 0142	514 6	585 1	980				
133	990	0 005	0 0195	3 1941	1 7526	0 0166	2 9616	0 0194	0 0194	0 0121	0 0121	1107 0	11 19	613 51	0 99	0 0141	523 1	583 9	990				
134	1000	0 005	0 0195	3 2136	1 7692	0 0166	2 9810	0 0194	0 0194	0 0121	0 0121	1114 2	11 17	612 52	0 99	0 0140	531 5	582 8	1000				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
29	Time	Rainfall	Incremental	Accum	Accum	Incremental	Accum	Incremental	Total	Instant	Design	Runoff	Head in	Infiltration	Infiltration	Infiltration	Infiltration	Storage	Time		Percolation Test Results October 2007		
30	Incre	Distnb	Rainfall	Rainfall	Runoff	Runoff	Runoff	Runoff	Runoff	Hydrograph	Hydrograph	Volume	Drywell	Area	Rate	Hydrograph	Volume	Volume	Incre		Esperanza NE NW and SW Drywell perc tests		
31	(dt)	% of Pt									increased by	into drywell	+ bottom			out of		in drywell	(dt)		by BCG Inc		
32											Design FOS					drywell							
33	Minutes		Inches	Inches	Inches	Inches	Inches	Inches	Inches	CFS	CFS	CF	FT	FT2	IN/HR	CFS	CF	CF	Minutes		H2O head (ft)	Meas Infil rate (in/hr)	
34																					1	0 1	
135	1010	0 004	0 0156	3 2292	1 7826	0 0133	2 9966	0 0155	0 0155	0 0097	0 0109	1120 8	11 15	611 60	0 98	0 0139	539 8	581 0	1010				
136	1020	0 004	0 0156	3 2448	1 7959	0 0134	3 0121	0 0155	0 0155	0 0097	0 0097	1126 6	11 12	610 12	0 97	0 0137	548 1	578 6	1020				
137	1030	0 004	0 0156	3 2604	1 8093	0 0134	3 0277	0 0155	0 0155	0 0097	0 0097	1132 5	11 07	608 11	0 96	0 0135	556 2	576 3	1030				
138	1040	0 004	0 0156	3 2760	1 8227	0 0134	3 0432	0 0155	0 0155	0 0097	0 0097	1138 3	11 03	606 22	0 95	0 0133	564 2	574 1	1040				
139	1050	0 004	0 0156	3 2916	1 8361	0 0134	3 0588	0 0155	0 0155	0 0097	0 0097	1144 1	10 99	604 42	0 94	0 0131	572 1	572 1	1050				
140	1060	0 004	0 0156	3 3072	1 8495	0 0134	3 0743	0 0155	0 0155	0 0097	0 0097	1149 9	10 95	602 72	0 93	0 0130	579 8	570 1	1060				
141	1070	0 004	0 0156	3 3228	1 8629	0 0134	3 0898	0 0155	0 0155	0 0097	0 0097	1155 8	10 91	601 11	0 92	0 0128	587 5	568 3	1070				
142	1080	0 004	0 0156	3 3384	1 8763	0 0134	3 1054	0 0155	0 0155	0 0097	0 0097	1161 6	10 88	599 58	0 91	0 0126	595 1	566 5	1080				
143	1090	0 004	0 0156	3 3540	1 8898	0 0135	3 1209	0 0155	0 0155	0 0097	0 0097	1167 4	10 84	598 13	0 90	0 0125	602 6	564 9	1090				
144	1100	0 004	0 0156	3 3696	1 9033	0 0135	3 1365	0 0155	0 0155	0 0097	0 0097	1173 3	10 81	596 75	0 89	0 0124	610 0	563 3	1100				
145	1110	0 004	0 0156	3 3852	1 9168	0 0135	3 1520	0 0155	0 0155	0 0097	0 0097	1179 1	10 78	595 44	0 89	0 0122	617 3	561 8	1110				
146	1120	0 004	0 0156	3 4008	1 9302	0 0135	3 1676	0 0155	0 0155	0 0097	0 0097	1184 9	10 75	594 19	0 88	0 0121	624 6	560 3	1120				
147	1130	0 004	0 0156	3 4164	1 9438	0 0135	3 1831	0 0155	0 0155	0 0097	0 0097	1190 8	10 73	593 01	0 87	0 0120	631 8	559 0	1130				
148	1140	0 004	0 0156	3 4320	1 9573	0 0135	3 1987	0 0155	0 0155	0 0097	0 0097	1196 6	10 70	591 88	0 87	0 0119	638 9	557 7	1140				
149	1150	0 004	0 0156	3 4476	1 9708	0 0135	3 2142	0 0155	0 0155	0 0097	0 0097	1202 4	10 68	590 80	0 86	0 0118	646 0	556 4	1150				
150	1160	0 004	0 0156	3 4632	1 9844	0 0135	3 2298	0 0156	0 0156	0 0097	0 0097	1208 3	10 65	589 78	0 86	0 0117	653 0	555 3	1160				
151	1170	0 004	0 0156	3 4788	1 9979	0 0136	3 2453	0 0156	0 0156	0 0097	0 0097	1214 1	10 63	588 80	0 85	0 0116	660 0	554 1	1170				
152	1180	0 004	0 0156	3 4944	2 0115	0 0136	3 2609	0 0156	0 0156	0 0097	0 0097	1219 9	10 61	587 87	0 85	0 0115	666 9	553 1	1180				
153	1190	0 004	0 0156	3 5100	2 0251	0 0136	3 2764	0 0156	0 0156	0 0097	0 0097	1225 7	10 59	586 98	0 84	0 0114	673 7	552 0	1190				
154	1200	0 004	0 0156	3 5256	2 0387	0 0136	3 2920	0 0156	0 0156	0 0097	0 0097	1231 6	10 57	586 13	0 84	0 0113	680 5	551 1	1200				
155	1210	0 004	0 0156	3 5412	2 0523	0 0136	3 3075	0 0156	0 0156	0 0097	0 0097	1237 4	10 55	585 32	0 83	0 0113	687 3	550 1	1210				
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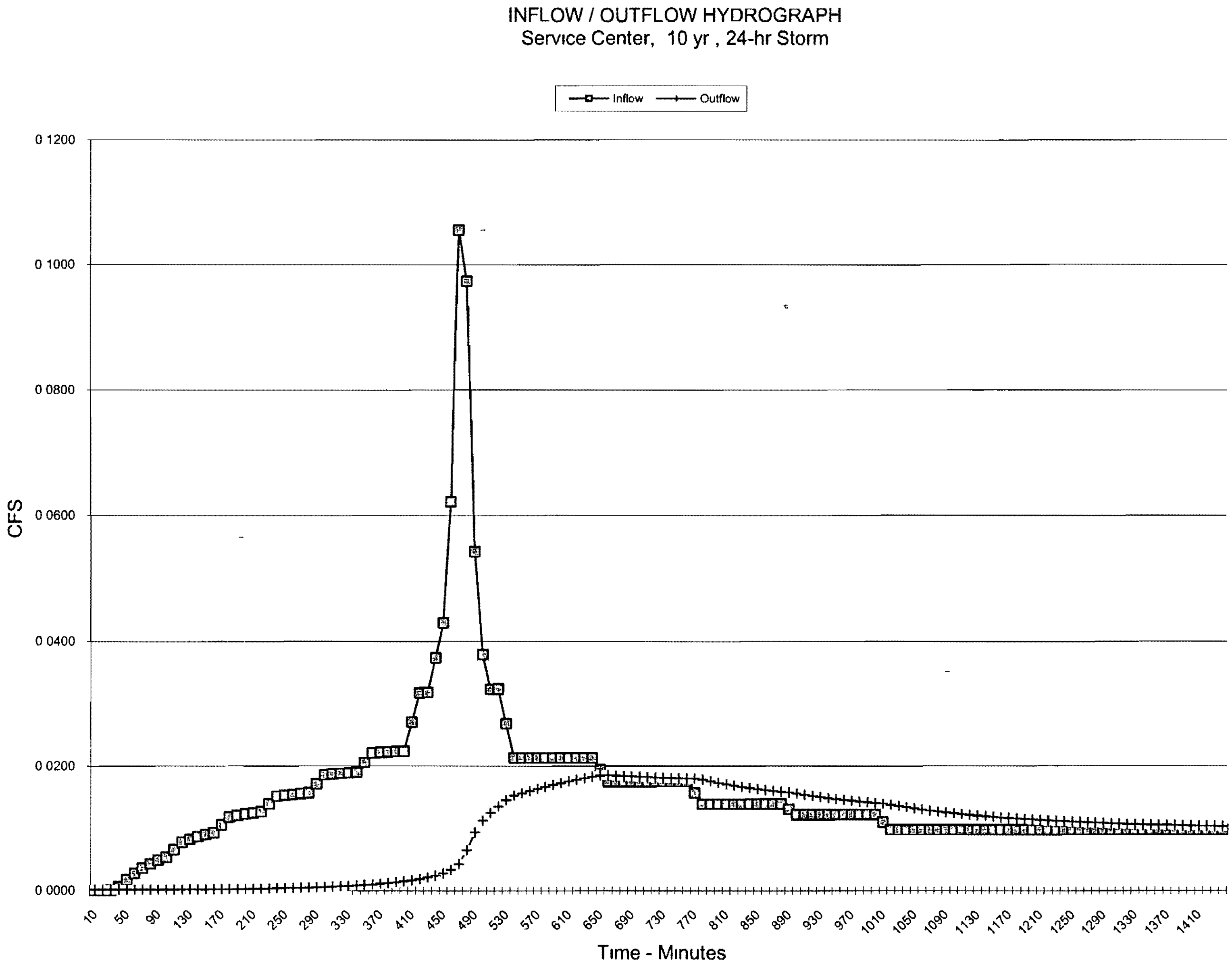
157	1230	0 004	0 0156	3 5724	2 0796	0 0136	3 3387	0 0156	0 0156	0 0097	0 0097	1249 1	10 52	583 81	0 82	0 0111	700 7	548 4	1230				
158	1240	0 004	0 0156	3 5880	2 0932	0 0137	3 3542	0 0156	0 0156	0 0097	0 0097	1254 9	10 50	583 11	0 82	0 0111	707 3	547 6	1240				
159	1250	0 004	0 0156	3 6036	2 1069	0 0137	3 3698	0 0156	0 0156	0 0097	0 0097	1260 7	10 49	582 44	0 82	0 0110	713 9	546 8	1250				
160	1260	0 004	0 0156	3 6192	2 1206	0 0137	3 3853	0 0156	0 0156	0 0097	0 0097	1266 6	10 47	581 79	0 81	0 0110	720 5	546 1	1260				
161	1270	0 004	0 0156	3 6348	2 1342	0 0137	3 4009	0 0156	0 0156	0 0097	0 0097	1272 4	10 46	581 18	0 81	0 0109	727 1	545 3	1270				
162	1280	0 004	0 0156	3 6504	2 1479	0 0137	3 4164	0 0156	0 0156	0 0097	0 0097	1278 2	10 45	580 59	0 81	0 0109	733 6	544 7	1280				
163	1290	0 004	0 0156	3 6660	2 1617	0 0137	3 4320	0 0156	0 0156	0 0097	0 0097	1284 1	10 43	580 03	0 80	0 0108	740 1	544 0	1290				
164	1300	0 004	0 0156	3 6816	2 1754	0 0137	3 4475	0 0156	0 0156	0 0097	0 0097	1289 9	10 42	579 49	0 80	0 0108	746 5	543 4	1300				
165	1310	0 004	0 0156	3 6972	2 1891	0 0137	3 4631	0 0156	0 0156	0 0097	0 0097	1295 7	10 41	578 98	0 80	0 0107	752 9	542 8	1310				
166	1320	0 004	0 0156	3 7128	2 2029	0 0137	3 4786	0 0156	0 0156	0 0097	0 0097	1301 6	10 40	578 48	0 80	0 0107	759 3	542 2	1320				
167	1330	0 004	0 0156	3 7284	2 2166	0 0138	3 4942	0 0156	0 0156	0 0097	0 0097	1307 4	10 39	578 01	0 79	0 0106	765 7	541 7	1330				
168	1340	0 004	0 0156	3 7440	2 2304	0 0138	3 5098	0 0156	0 0156	0 0097	0 0097	1313 2	10 38	577 56	0 79	0 0106	772 1	541 2	1340				
169	1350	0 004	0 0156	3 7596	2 2442	0 0138	3 5253	0 0156	0 0156	0 0097	0 0097	1319 1	10 37	577 13	0 79	0 0106	778 4	540 7	1350				
170	1360	0 004	0 0156	3 7752	2 2579	0 0138	3 5409	0 0156	0 0156	0 0097	0 0097	1324 9	10 36	576 72	0 79	0 0105	784 7	540 2	1360				
171	1370	0 004	0 0156	3 7908	2 2717	0 0138	3 5564	0 0156	0 0156	0 0097	0 0097	1330 7	10 35	576 32	0 79	0 0105	791 0	539 7	1370				
172	1380	0 004	0 0156	3 8064	2 2856	0 0138	3 5720	0 0156	0 0156	0 0097	0 0097	1336 6	10 34	575 94	0 78	0 0105	797 3	539 3	1380				
173	1390	0 004	0 0156	3 8220	2 2994	0 0138	3 5876	0 0156	0 0156	0 0097	0 0097	1342 4	10 33	575 58	0 78	0 0104	803 5	538 9	1390				
174	1400	0 004	0 0156	3 8376	2 3132	0 0138	3 6031	0 0156	0 0156	0 0097	0 0097	1348 2	10 32	575 23	0 78	0 0104	809 8	538 5	1400				
175	1410	0 004	0 0156	3 8532	2 3270	0 0138	3 6187	0 0156	0 0156	0 0097	0 0097	1354 1	10 32	574 90	0 78	0 0104	816 0	538 1	1410				
176	1420	0 004	0 0156	3 8688	2 3409	0 0139	3 6342	0 0156	0 0156	0 0097	0 0097	1359 9	10 31	574 58	0 78	0 0103	822 2	537 7	1420				
177	1430	0 004	0 0156	3 8844	2 3548	0 0139	3 6498	0 0156	0 0156	0 0097	0 0097	1365 8	10 30	574 27	0 78	0 0103	828 4	537 4	1430				
178	1440	0 004	0 0156	3 9000	2 3686	0 0139	3 6654	0 0156	0 0156	0 0097	0 0097	1371 6	10 29	573 98	0 77	0 0103	834 6	537 0	1440				


INFLOW / OUTFLOW HYDROGRAPH
Service Center, 10 yr , 24-hr Storm
Inflow
Outflow
CFS
0 1200
0 1000
0 0800
0 0600
0 0400
0 0200
0 0000
10
50
90
130
170
210
250
290
330
370
410
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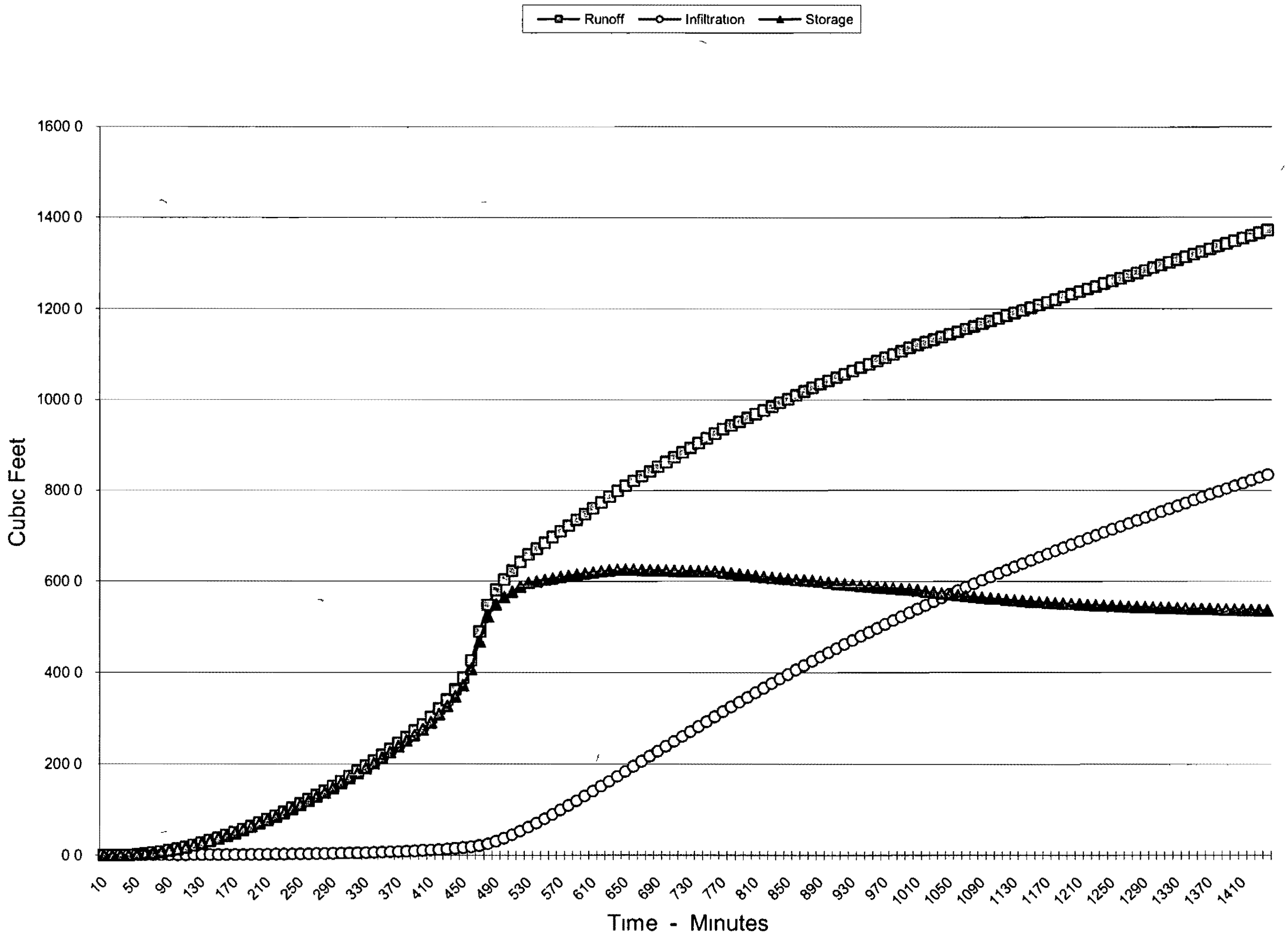
490
530
570
610
650
690
730
770
810
850
890
930
970
1010
1050
1090
1130
1170
1210
1250
1290
1330
1370
1410
Time - Minutes

RUNOFF / INFILTRATION / STORAGE VOLS
Service Center, 10 yr , 24-hr Storm



Alder Geotechnical Services

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September 8, 2008
Project No 568-2

Ms Susan Lind,
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

INFILTRATION RATE FOR PERVIOUS PAVEMENT
CLARK FAMILY CENTER BUILDING
2740 SE POWELL BOULEVARD,
PORTLAND, OREGON

Dear Ms Lind

I understand that pervious pavers will be used for the entrance to the parking level of the Clark family center In my opinion, the soils on this portion of the site are suitable for infiltrating stormwater from pervious pavement

In November 2005, we drilled at 11½-foot deep boring in the entrance area The near surface soils encountered in our boring consisted of brown silts with some to much fine sand The NRCS Multnomah County soil survey identifies these soils as "Urban Land 51B" and places them in Hydrologic Group B, with an infiltration rate up to 2 inches per hour

In our opinion, an infiltration rate of 2 inches per hour may be used when designing a pervious pavement for this site This recommendation assumes that only native soils are present beneath the pervious pavement section Any fill soils encountered during site grading will need to be over-excavated and replaced with drain rock

I recommend that the pervious pavers be supported on at least 1½ inches of No 4-minus coarse sand that is underlain by at least 12 inches of AASHTO No 57 aggregated (1½"- No 8 gradation)

I hope this information meets your needs at this time Please contact me if you have further questions

Sincerely,

ALDER GEOTECHNICAL SERVICES, LLC

REGISTERED PROFESSIONAL
ENGINEER
13507
John N Cunningham
OREGON
March 19, 1987
JOHN N CUNNINGHAM

EXP 12-31-09

John Cunningham, P E , G E
Oregon Registered Geotechnical Engineer No 13,507

(1) Addressee
(1) Scott Rimmer, Lundin Cole Architects
(1) Cole Presthus, WDY Civil-Structural Engineers

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September 8, 2008
Project No 568-2

Ms Susan Lind,
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

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CLARK FAMILY CENTER BUILDING
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PORTLAND, OREGON

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Sincerely,

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EXP. 12-31-09

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January 31, 2009
Project No 568-2

Ms Terri Silvis
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

**ADDENDUM NO. 1 TO JULY 24, 2008
GEOTECHNICAL INVESTIGATION REPORT FOR
PROPOSED CATHOLIC CHARITIES CLARK FAMILY CENTER BUILDING
2740 SE POWELL BOULEVARD, PORTLAND, OREGON**

Dear Ms Silvis

This letter provides specific foundation design recommendations for a large mat foundation supporting shear walls for the building I understand the mat foundation is about 36 feet wide, 68 feet long and 4 feet thick It supports interior shear wall associated with elevator and stairwell shafts My July 24, 2008 geotechnical report for the project provided foundation design recommendations only for exterior wall footings up to about 6 feet wide and interior column footings up to about 12 feet square

MAT FOUNDATION DESIGN

The maximum allowable average contact pressure of the mat should be limited to about 1,700 psf when supporting normal dead and long-term live loads This average contact pressure is estimated to limit long term static settlement of the mat to about 1 inch

The average soil contact pressure under the mat is calculated by dividing the total dead and live loads by the surface area of the footing Local contact pressures may exceed this recommended maximum average pressure value if an average soil subgrade modulus value of 12 pci (20 kcf) is used to evaluate bending moments in the mat

The design maximum seismic bearing pressure of 5,000 psf may be used The recommended maximum seismic allowable bearing pressure is about three times larger than the static allowable average bearing pressure This large increase is based on a review of (1) the theoretical ultimate bearing pressure (no factor of safety applied) q_u compared to the settlement-limited static allowable bearing pressure (with a factor of safety) $q_{a\,static}$, and (2) the ratio between the mat area (A) and the minimum area required to support the vertical loads (A_c) Recent research by Kutter et al (2006)[1] indicates that seismic settlements of shear wall footings will be less than a few inches if the real loads transmitted to the foundation during earthquake loading do not exceed ultimate soil capacities Gajan and Kutter (2008)[2] conclude that a large footing with A/A_c ratio of 10 or greater possesses a moment capacity that is insensitive to soil properties, does not suffer large permanent settlements, has a self-centering characteristic associated with uplift and gap closure, and dissipates seismic energy that corresponds to about 20% damping ratio The subject mat has a calculated A/A_c of 13

Permanent settlement of the mat foundations under seismic loading conditions is estimated to be about 1inch based on the method of Richards and others (1993)[3] and the research of Gajan and Kutter (2008)

CLOSURE

This letter is addendum No 1 to my July 24, 2008 geotechnical investigation report entitled "Catholic Charities Services Center, 2740 SE Powell Boulevard, Portland, Oregon" and is made part of that report by this reference

I hope this information meets your needs at this time Please contact me if you have questions

Sincerely,

ALDER GEOTECHNICAL SERVICES, LLC

EXP. 12-31-09

John Cunningham, P E , G E

Oregon Registered Geotechnical Engineer No 13,507

John Cunningham, PE GE
My digital signature approved for this document
2009 01 31 15 06 40 -08'00

(1) Addressee
(1) WDY Engineers, Inc
(1) Lundin Cole Architects

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[1] Kutter, B L et al 2006 "Workshop on Modeling of Nonlinear Cyclic Load-Deformation Behavior of Shallow Foundations " *Pacific Earthquake Engineering Research Center Report No 2005/14*, pp 4 and 10

[2] Gajan, S and Kutter, B (2008) "Capacity, Settlement, and Energy Dissipation of Shallow Footings Subjected to Rocking " *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, Vol 134, No 8, pp 1129-1141

[3] Richards, R , Elms, D G , and Budhu (1993) "Seismic Bearing Capacity and Settlements of Foundations " *Journal of Geotechnical Engineering*, ASCE, Vol 119, No 4, pp 662-674

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March 31, 2009
Project No 568-2

Ms Terri Silvis, Ph D
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

REVIEW OF CONSTRUCTION SHORING PLAN
CLARK FAMILY CENTER
2740 SE POWELL BOULEVARD
PORTLAND, OREGON

Dear Ms Silvis

Yesterday I reviewed the proposed shoring plans for the Clark Family Center The purpose of the review was to determine whether the plans were prepared in substantial conformance with my July 24, 2008 geotechnical report for the project As discussed below, it is my opinion that the shoring plan has been properly prepared and meets the project requirements

I was provided with the following documents to review

- Clark Family Center Shoring, plans prepared by Kramer Gehlen Consulting Engineers, Sheets S1-S4, dated March 17, 2009
- Clark Family Center Shoring, calculations prepared by Kramer Gehlen Consulting Engineers, dated March 27, 2009
- Wall Bracing, plans prepared by Kramer Gehlen Consulting Engineers, 2 sheets, dated March 25, 2009
- Clark Family Center Wall Bracing, calculations prepared by Kramer Gehlen Consulting Engineers, dated March 27, 2009

My geotechnical report included recommendations for at-rest, active and passive earth pressures of 52, 32 and 500 pcf These earth pressures were used by Kramer Gehlen in their analyses

I used the soil-structure interaction program *PYWall V3 0* by Ensoft, Inc (2007) to independently check the limit equilibrium approach used by Kramer Gehlen to select soldier pile embedment depths and sizes *PYWall* uses nonlinear soil-resistance-displacement relationships, pile spacing, penetration depths and structural properties to analyze the behavior of flexible retaining walls

My analyses indicates that the selected pile sizes, spacing and embedment depths meet static equilibrium requirements at acceptable bending stress levels Pile head deflections are estimated to be less than about 1 inch for all piles except Piles 12 through 17 and 22 through 25 These taller piles along the east and west shoring walls could deflect greater than 1 inch if more than about 2/3rd of the design active earth pressure mobilizes and pushes against the back of the lagging and piles

In my opinion, the anticipated pile deflections do not adversely affect the stability of the shoring However, pile movements may cause ground surface settlement that may affect underground utilities and surface structures located within 5 to 10 feet behind the subject soldier piles Kramer Gehlen and the shoring contractor should review their shoring plan and determine whether the anticipated soldier pile movements are within tolerable limits for the existing conditions behind the shoring

I hope this information meets your needs at this time Please contact me if you have questions

Sincerely,

ALDER GEOTECHNICAL SERVICES, LLC

REGISTERED PROFESSIONAL ENGINEER 13507 OREGON March 19, 1987 JOHN N CUNNINGHAM

EXP 12-31-09

John Cunningham, P E , G E
Oregon Registered Geotechnical Engineer No 13,507

REGISTERED PROFESSIONAL ENGINEER 13507 OREGON March 19, 1987 JOHN N CUNNINGHAM RENEWS 12-31-09

John Cunningham, PE, GE
My digital signature appro
for this document
2009 03 31 13 43 51 -07'00'

(1) Addressee via pdf
(1) Lundin Cole Architects via pdf
(1) Kramer Gehlen Consulting Engineers via pdf
(1) R&H Construction via pdf

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April 9, 2009
Project No 568-2

Ms Terri Silvis, Ph D
Project Manager
Catholic Charities of Oregon
231 SE 12th Avenue
Portland, Oregon 97214

RESPONSE TO SITE DEVELOPMENT CHECKSHEET ITEM 4
CLARK FAMILY CENTER
2740 SE POWELL BOULEVARD
PORTLAND, OREGON

Dear Ms Silvis

I am responding to Item No 4 in the March 23, 2009 Site Development Checksheet from the City of Portland Bureau of Development Services

Item 4—Permeable pavement (pavers) is shown to be located immediately adjacent to the building Stormwater will likely infiltrate into soil within the influence zone of the footing loads, potentially resulting in a saturated subgrade condition

Please submit a memorandum prepared by the geotechnical engineer that verifies that the bearing capacity and settlement estimates are valid for the portions of the foundation adjacent to the permeable pavement during the wet season

The presence of pervious pavers on the south side of the building does not change the recommended bearing pressure or estimated foundation settlements presented in our July 24, 2008 geotechnical investigation report or our Addendum No 1 dated January 31, 2009

The pervious pavers along the south side of the building are designed to infiltrate only the precipitation that falls on them Stormwater from nearby non-pervious areas will not be collected and discharged into the pervious paver area As such, the pervious pavers will infiltrate water the same as bare ground or landscaped areas Water will soak into the ground and slowly migrate down to the ground water table

Shallow, perched groundwater was not encountered in our borings drilled in October 2005 In addition, mottled soils, indicating seasonal saturated soil conditions, were not observed in the borings Groundwater was first encountered about 24 feet below the ground surface and at about elevation 72 feet The proposed new footings will be located between elevations 92½ and 95½ feet

Our opinion that additional infiltration of water will not affect the design of the south wall footings of the building is based on new foundation settlement calculations we performed These settlement calculations indicate that raising the groundwater table from 23 feet below the bottom of the footings to immediately below the bottom of the footings increases predicted foundation settlements under the full design dead and live loads by about 0 2 inch Along the south wall of the building, our settlement estimate for 3-foot wide wall footings increases from 0 6 inch to 0 8 inch Our settlement estimate for 6-foot wide wall footings increases from 0 9 inch to 1 1 inch

The foundation design recommendations presented in our July 24, 2008 geotechnical report are based on limiting foundation movement under the design loads to about 1 inch total settlement and about ½ inch differential settlement In our opinion, the current foundation design meets these criteria whether saturated soil conditions are present at the bottom of the footings or are present 23 feet below the bottom of footings

I hope this information meets your needs at this time Please contact me if you have questions

Sincerely,

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