104023-03-040

BSC 11.4.5

CMG DRAINAGE ENGINEERING, INC.

CLINTON M. GLASS, P.E., PRESIDENT

4574 N. FIRST AVENUE, SUITE 100 TUCSON, AZ 85718 PHONE (520) 882-4244 FAX (520) 882-3006 EMAIL cmgde@cmgdrainage.com

November 4, 2005

John Wood P.E.
Presidio Engineering, Inc.
4582 N 1st Ave #120
Tucson, Arizona 85718

Re: The Pines Phase I
Hydraulic Analysis for Storm Drain Design Revisions

Dear John,

The information attached with this letter is being provided to you in response to the storm drain design revisions after the 2nd submittal of the drainage report. The purpose of the attached Storm CAD model is to update the hydraulic analysis to reflect revisions to the storm drain profile and catch basin locations requested by your office. Based on the storm drain revisions that your firm sent to us, we conducted the hydraulic analyses for the revised storm drain systems and the results showed that all the onsite runoff will be safely conveyed to the pits along the west property boundary within the storm drain system during the 100-year event. The results of the hydraulic analyses are attached with this letter.

If you have any questions please call.

Yours truly,

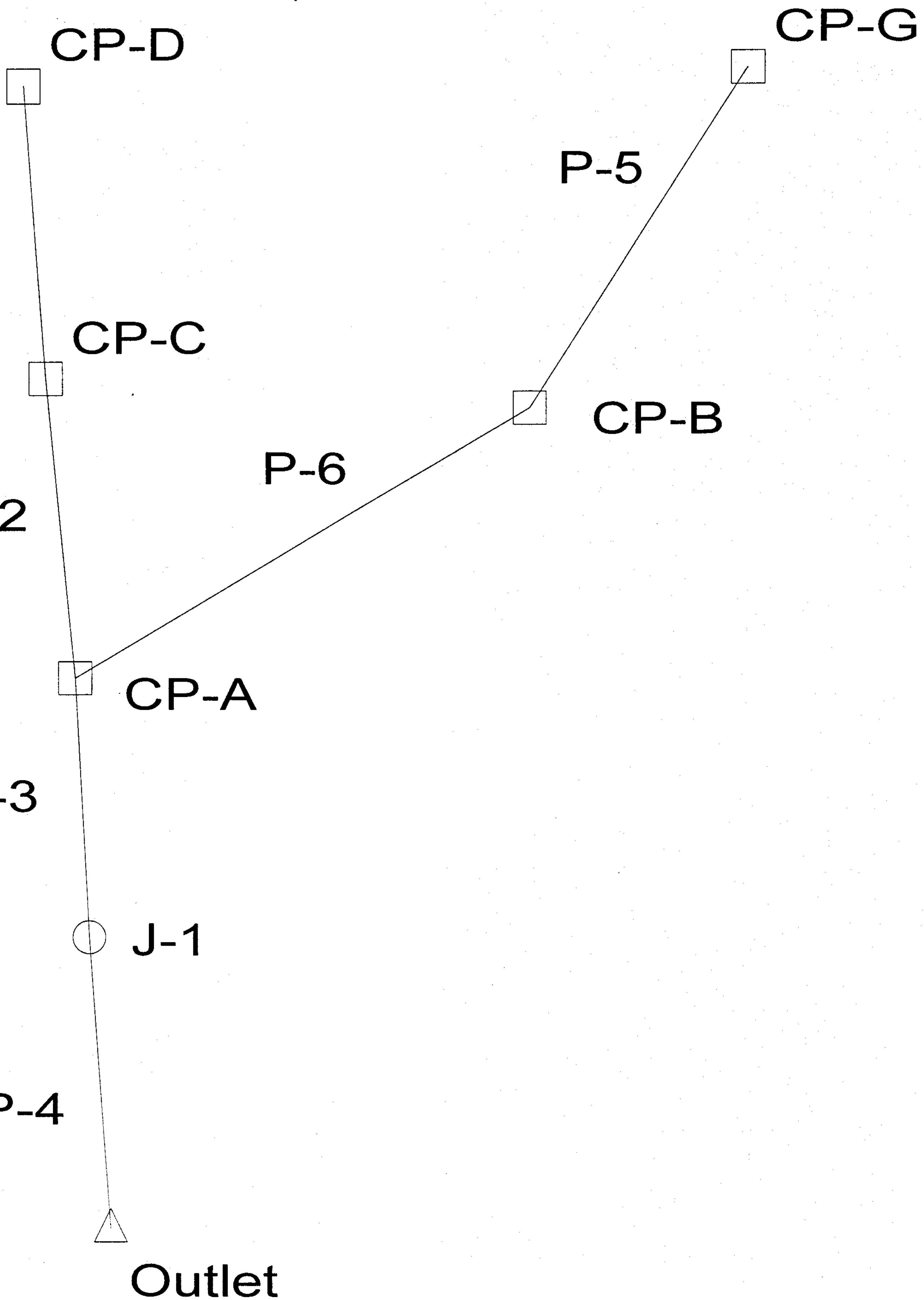
Clinton M. Glass P.E.

CERTIFICATE NO. 15275 CLINTON MURRAY GLASS ARIZONA, U.S.A.

SUBMITTAL NO. 1

ENG0511-015

Storm Drain System I



```
------------------- Beginning Calculation Cycle -------------------
Discharge: 16.90 cfs  at node CP-D
Discharge: 31.10 cfs  at node CP-C
Discharge: 28.50 cfs  at node CP-G
Discharge: 52.30 cfs  at node CP-B
Discharge: 105.90 cfs  at node CP-A
Discharge: 105.90 cfs  at node J-1
Discharge: 105.90 cfs  at node Outlet
Beginning iteration 1
Discharge: 16.90 cfs  at node CP-D
Discharge: 31.10 cfs  at node CP-C
Discharge: 28.50 cfs  at node CP-G
Discharge: 52.30 cfs  at node CP-B
Discharge: 105.90 cfs  at node CP-A
Discharge: 105.90 cfs  at node J-1
Discharge: 105.90 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
Warning: No Duration data exists in IDF Table
Information: P-2 Surcharged condition
Information: P-6 Surcharged condition
Information: P-1 Surcharged condition
Information: P-5 Surcharged condition
-------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3
```

---------------- Network Quick View -----------------------

Label	Length	Size	Discharge	Hydraulic Grade Upstream	Hydraulic Grade Downstream
P-1	291.00	36 inch	16.90	2,137.12	2,136.49
P-2	348.00	36 inch	31.10	2,136.10	2,133.52
P-3	114.70	48 inch	105.90	2,130.35	2,129.19
P-4	196.10	48 inch	105.90	2,126.81	2,116.06
P-5	400.30	42 inch	28.50	2,137.59	2,136.50
P-6	558.00	48 inch	52.30	2,136.04	2,133.52

Label	Discharge	Elevations Ground	Elevations Upstream HGL	Elevations Downstream HGL
CP-D	16.90	2,137.29	2,137.12	2,137.12
CP-C	31.10	2,136.50	2,136.49	2,136.10
CP-A	105.90	2,136.18	2,133.52	2,130.35
J-1	105.90	2,136.80	2,129.19	2,126.81
Outlet	105.90	2,123.00	2,116.06	2,116.06
CP-G	28.50	2,137.77	2,137.59	2,137.59
CP-B	52.30	2,137.23	2,136.50	2,136.04

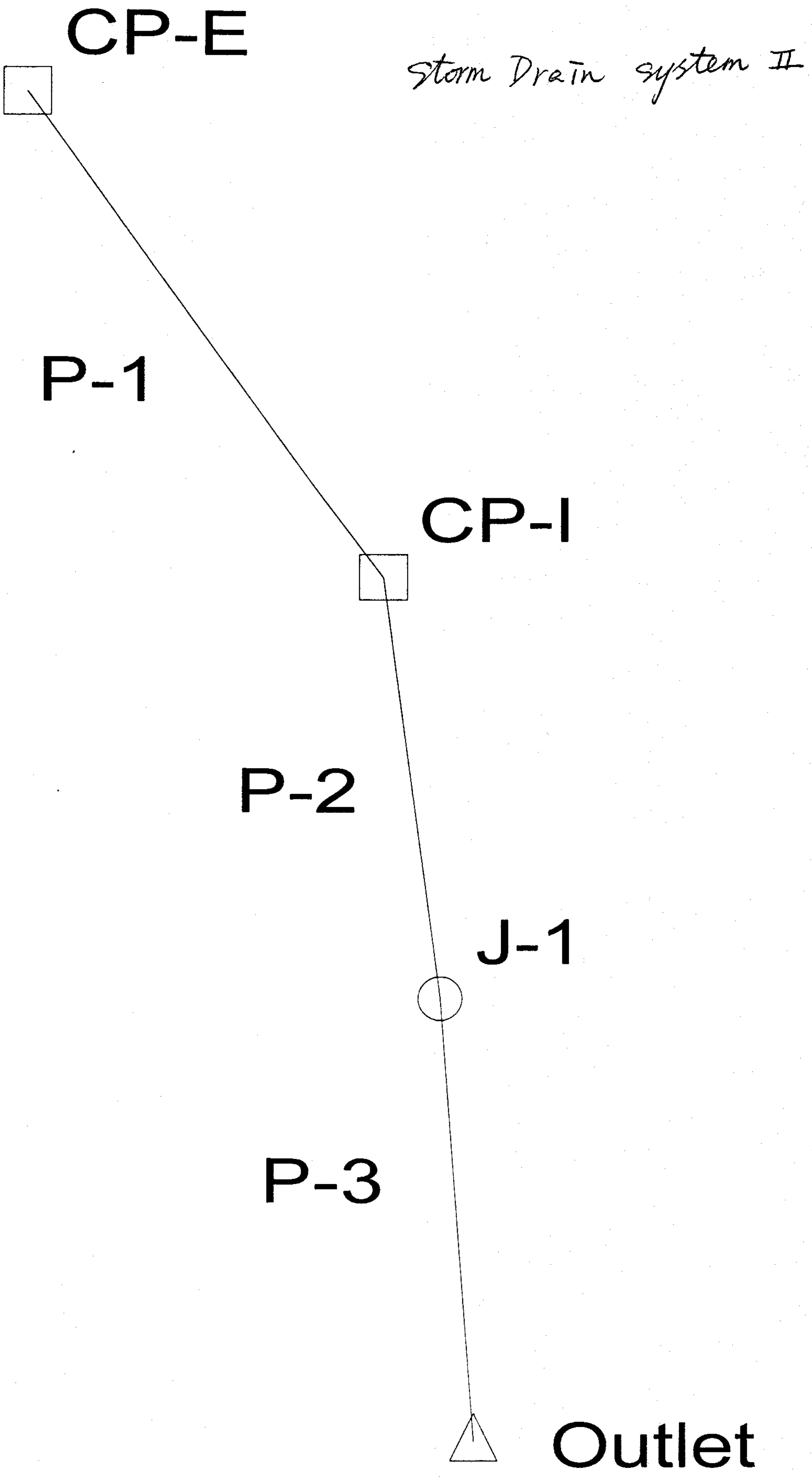
Elapsed: 0 minute(s) 0 second(s)

DOT Report

Pipe	-Node- Upstream Downstream	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Roughness
P-5	CP-G	2,137.77	2,137.59	0.002735	28.50	Circular	400.30	2.96	0.024
	CP-B	2,137.23	2,136.50	0.004996	38.52	42 inch			
P-6	CP-B	2,137.23	2,136.04	0.004519	52.30	Circular	558.00	4.16	0.024
	CP-A	2,136.18	2,133.52	0.005000	55.01	48 inch			
P-1	CP-D	2,137.29	2,137.12	0.002188	16.90	Circular	291.00	2.39	0.024
	CP-C	2,136.50	2,136.49	0.005017	25.59	36 inch			
P-2	CP-C	2,136.50	2,136.10	0.007411	31.10	Circular	348.00	4.40	0.024
	CP-A	2,136.18	2,133.52	0.005000	25.55	36 inch			
P-3	CP-A	2,136.18	2,130.35	0.014350	105.90	Circular	114.70	9.26	0.013
	J-1	2,136.80	2,129.19	0.029991	248.75	48 inch			
P-4	J-1	2,136.80	2,126.81	0.054819	105.90	Circular	196.10	10.09	0.024
	Outlet	2,123.00	2,116.06	0.054819	182.16	48 inch			

Combined Pipe/Node Report

Pipe	Upstream Node	Downstream Node	Length (ft)	Section Size	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Downstream Cover (ft)	Upstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Roughness
P-5	CP-G	CP-B	400.30	42 inch	2.96	2,132.53	2,130.53	0.004996	3.20	1.74	2,137.59	2,136.50	0.024
P-6	CP-B	CP-A	558.00	48 inch	4.16	2,130.03	2,127.24	0.005000	4.94	3.20	2,136.04	2,133.52	0.024
P-1	CP-D	CP-C	291.00	36 inch	2.39	2,131.54	2,130.08	0.005017	3.42	2.75	2,137.12	2,136.49	0.024
P-2	CP-C	CP-A	348.00	36 inch	4.40	2,129.98	2,128.24	0.005000	4.94	3.52	2,136.10	2,133.52	0.024
P-3	CP-A	J-1	114.70	48 inch	9.26	2,127.24	2,123.80	0.029991	9.00	4.94	2,130.35	2,129.19	0.013
P-4	J-1	Outlet	196.10	48 inch	10.09	2,123.70	2,112.95	0.054819	6.05	9.10	2,126.81	2,116.06	0.024
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A


CP-E
Storm Drain system II
P-1
CP-I
P-2
J-1
P-3
Outlet

------------------ Beginning Calculation Cycle ------------------
Discharge: 15.90 cfs at node CP-E
Discharge: 29.20 cfs at node CP-I
Discharge: 29.20 cfs at node J-1
Discharge: 29.20 cfs at node Outlet
Beginning iteration 1
Discharge: 15.90 cfs at node CP-E
Discharge: 29.20 cfs at node CP-I
Discharge: 29.20 cfs at node J-1
Discharge: 29.20 cfs at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error: 0.0
Warning: No Duration data exists in IDF Table
Information: P-1 Surcharged condition
-------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method: Manning's Formula
HGL Convergence Test: 0.001000
Maximum Network Traversals: 5
Number of Pipe Profile Steps: 5
Discharge Convergence Test: 0.001000
Maximum Design Passes: 3

---------------- Network Quick View -----------------------

Label	Length	Size	Discharge	Hydraulic Grade Upstream	Hydraulic Grade Downstream
P-1	171.60	30 inch	15.90	2,130.30	2,129.42
P-2	114.30	30 inch	29.20	2,127.66	2,125.45
P-3	169.60	30 inch	29.20	2,124.13	2,102.05

Label	Discharge	Elevations Ground	Elevations Upstream HGL	Elevations Downstream HGL
CP-E	15.90	2,136.13	2,130.30	2,130.30
CP-I	29.20	2,135.30	2,129.42	2,127.66
J-1	29.20	2,135.30	2,125.45	2,124.13
Outlet	29.20	2,107.00	2,102.05	2,102.05

Elapsed: 0 minute(s) 1 second(s)

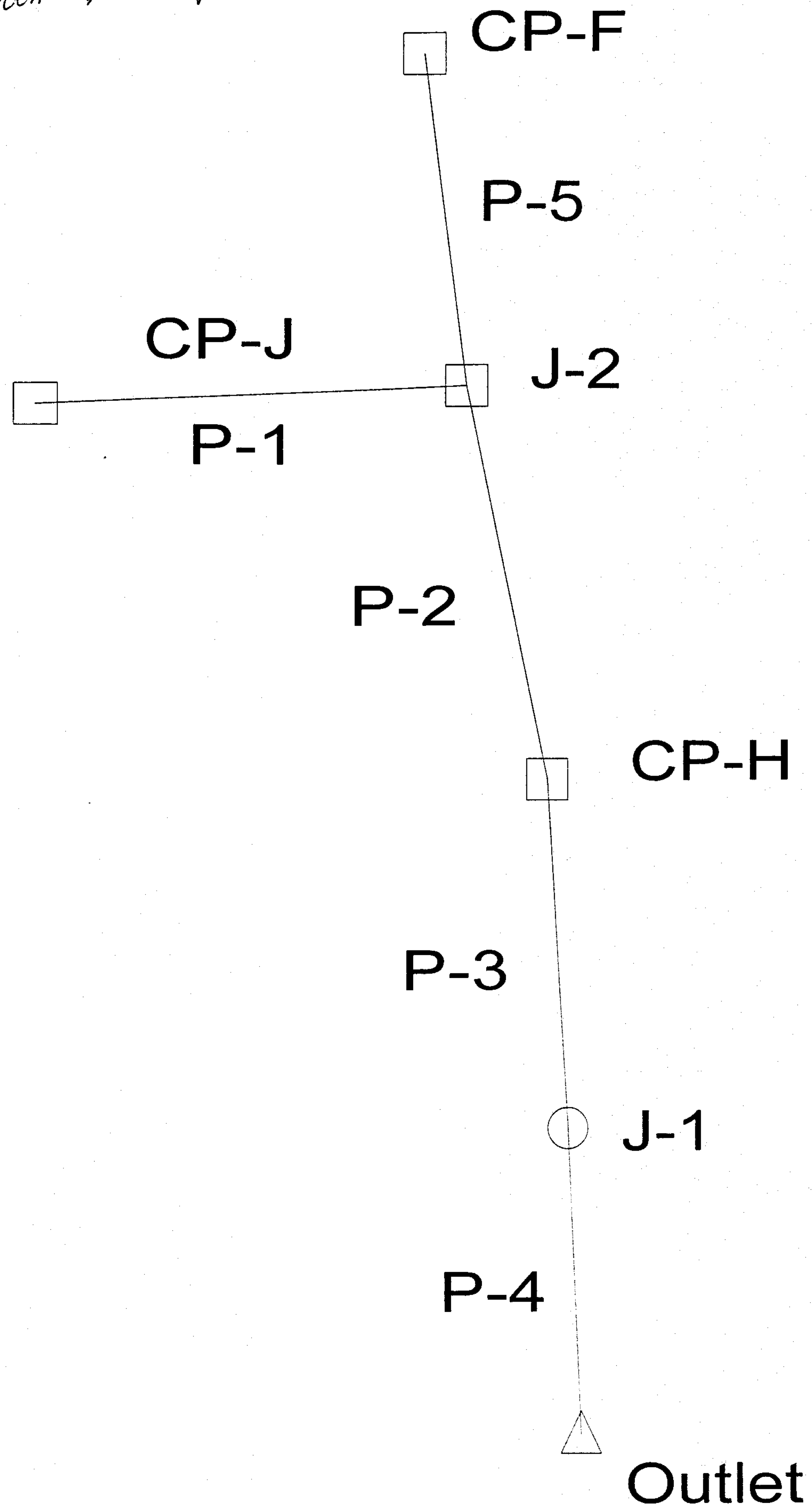
DOT Report

Pipe	-Node- Upstream Downstream	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Roughness
P-1	CP-E	2,136.13	2,130.30	0.005122	15.90	Circular	171.60	3.24	0.024
	CP-I	2,135.30	2,129.42	0.005012	15.73	30 inch			
P-2	CP-I	2,135.30	2,127.66	0.022219	29.20	Circular	114.30	6.74	0.024
	J-1	2,135.30	2,125.45	0.030009	38.49	30 inch			
P-3	J-1	2,135.30	2,124.13	0.115183	29.20	Circular	169.60	11.19	0.024
	Outlet	2,107.00	2,102.05	0.125531	78.71	30 inch			

Combined Pipe/Node Report

Pipe	Upstream Node	Downstream Node	Length (ft)	Section Size	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Downstream Cover (ft)	Upstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Roughness
P-1	CP-E	CP-I	171.60	30 inch	3.24	2,126.78	2,125.92	0.005012	6.88	6.85	2,130.30	2,129.42	0.024
P-2	CP-I	J-1	114.30	30 inch	6.74	2,125.82	2,122.39	0.030009	10.41	6.98	2,127.66	2,125.45	0.024
P-3	J-1	Outlet	169.60	30 inch	11.19	2,122.29	2,101.00	0.125531	3.50	10.51	2,124.13	2,102.05	0.024
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Storm Drain system III



```
------------------- Beginning Calculation Cycle -------------------
Discharge: 21.30 cfs  at node CP-J
Discharge: 40.00 cfs  at node CP-F
Discharge: 61.30 cfs  at node J-2
Discharge: 75.50 cfs  at node CP-H
Discharge: 75.50 cfs  at node J-1
Discharge: 75.50 cfs  at node Outlet
Beginning iteration 1
Discharge: 21.30 cfs  at node CP-J
Discharge: 40.00 cfs  at node CP-F
Discharge: 61.30 cfs  at node J-2
Discharge: 75.50 cfs  at node CP-H
Discharge: 75.50 cfs  at node J-1
Discharge: 75.50 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
Warning: No Duration data exists in IDF Table
Information: P-2 Surcharged condition
Information: P-1 Surcharged condition
Information: P-5 Surcharged condition
-------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3

---------------- Network Quick View  -----------------------
```

Label	Length	Size	Discharge	Hydraulic Grade Upstream	Hydraulic Grade Downstream
P-1	272.20	36 inch	21.30	2,133.79	2,132.85
P-2	257.30	42 inch	61.30	2,131.77	2,128.52
P-3	117.10	48 inch	75.50	2,126.21	2,124.33
P-4	196.60	48 inch	75.50	2,122.60	2,101.51
P-5	68.20	42 inch	40.00	2,133.21	2,132.85

Label	Discharge	Elevations Ground	Elevations Upstream HGL	Elevations Downstream HGL
CP-J	21.30	2,133.96	2,133.79	2,133.79
J-2	61.30	2,134.22	2,132.85	2,131.77
CP-H	75.50	2,134.26	2,128.52	2,126.21
J-1	75.50	2,134.26	2,124.33	2,122.60
Outlet	75.50	2,108.00	2,101.51	2,101.51
CP-F	40.00	2,134.22	2,133.21	2,133.21

Elapsed: 0 minute(s) 1 second(s)

Combined Pipe/Node Report

Pipe	Upstream Node	Downstream Node	Length (ft)	Section Size	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Downstream Cover (ft)	Upstream Cover (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Roughness
P-5	CP-F	J-2	68.20	42 inch	4.16	2,125.81	2,125.47	0.004985	5.25	4.91	2,133.21	2,132.85	0.024
P-1	CP-J	J-2	272.20	36 inch	3.01	2,126.93	2,125.57	0.004996	5.65	4.03	2,133.79	2,132.85	0.024
P-2	J-2	CP-H	257.30	42 inch	6.37	2,125.37	2,124.08	0.005014	6.68	5.35	2,131.77	2,128.52	0.024
P-3	CP-H	J-1	117.10	48 inch	7.31	2,123.58	2,120.07	0.029974	10.19	6.68	2,126.21	2,124.33	0.024
P-4	J-1	Outlet	196.60	48 inch	12.97	2,119.97	2,100.00	0.101577	4.00	10.29	2,122.60	2,101.51	0.024
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

DOT Report

Pipe	-Node- Upstream Downstream	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Roughness
P-5	CP-F	2,134.22	2,133.21	0.005388	40.00	Circular	68.20	4.16	0.024
	J-2	2,134.22	2,132.85	0.004985	38.48	42 inch			
P-1	CP-J	2,133.96	2,133.79	0.003476	21.30	Circular	272.20	3.01	0.024
	J-2	2,134.22	2,132.85	0.004996	25.54	36 inch			
P-2	J-2	2,134.22	2,131.77	0.012654	61.30	Circular	257.30	6.37	0.024
	CP-H	2,134.26	2,128.52	0.005014	38.59	42 inch			
P-3	CP-H	2,134.26	2,126.21	0.021111	75.50	Circular	117.10	7.31	0.024
	J-1	2,134.26	2,124.33	0.029974	134.70	48 inch			
P-4	J-1	2,134.26	2,122.60	0.089414	75.50	Circular	196.60	12.97	0.024
	Outlet	2,108.00	2,101.51	0.101577	247.97	48 inch			

JUN 02 2005

Terracon
Consulting Engineers & Scientists

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June 1, 2005

Presidio Engineering, Inc
4582 North 1st Avenue
Suite 120
Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: Geotechnical Engineering Report
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63055225, Addendum 1

Terracon has received your request for an additional site plan showing the boring locations with the lot layout. We have provided the overlay of the boring locations as attached in Figure 2. The original site plan, Figure 1, was originally provided in Terracon Report Number 63045225, dated December 8, 2004, which was prepared for Standard Pacific of Tucson.

Please let us know if you have any other questions concerning these additions.

Sincerely,

TERRACON

David C. Mwewa, E.I.T.
Project Engineer

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: (3) Addressee

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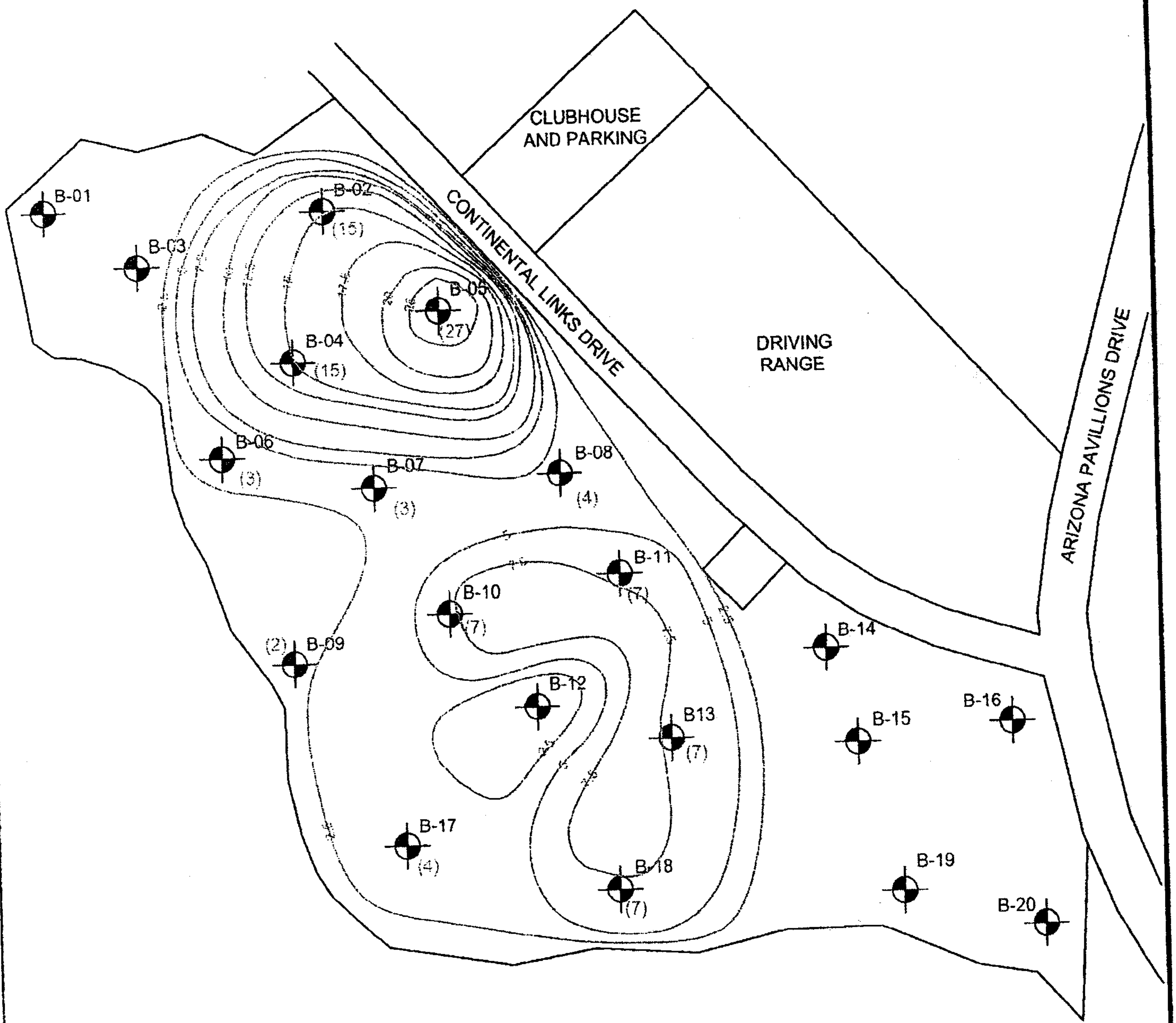


LEGEND

APPROXIMATE BORING

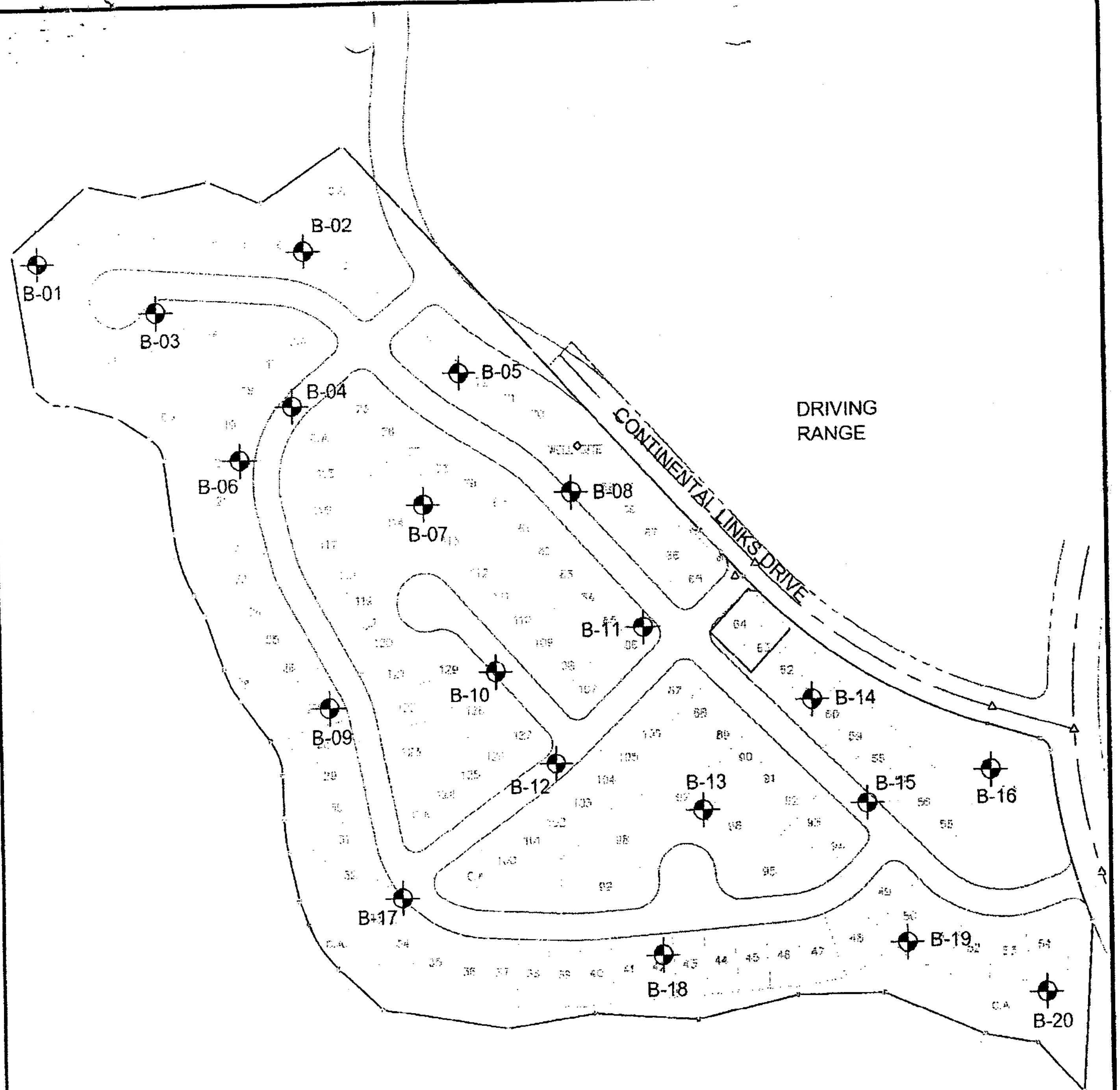
(5) APPROXIMATE DEPTH OF FILL

N

DIAGRAM IS FOR GENERAL LOCATION ONLY.
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

SITE PLAN AND BORING LOCATIONS
PROPOSED PHASE I RESIDENTIAL DEVELOPMENT AT THE PINES
NORTH OF CORTARO ROAD AND WEST OF INTERSTATE 10
MARANA, ARIZONA
STANDARD PACIFIC OF TUCSON

Project Mngr: OBL	Terracon	Project No.	63045225
Designed By:		Scale:	None
Checked By:	355 South Euclid, Suite 107 Tucson, Arizona 85719	Date:	11-23-04
Approved By: OBL		Drawn By:	BWR(63)
File Name: n:\public\04georept\63045225\6304225.dwg	L(Layout1)	Figure No.	1



LEGEND

APPROXIMATE BORING LOCATION

N

SITE PLAN AND BORING LOCATIONS
PROPOSED PHASE I RESIDENTIAL DEVELOPMENT AT THE PINES

NORTH OF CORTARO ROAD AND WEST OF INTERSTATE 10
MARANA, ARIZONA
STANDARD PACIFIC OF TUCSON

Project Mngr: OBL	Terracon	Project No.	63045225
Designed By:		Scale:	None
Checked By:	355 South Euclid, Suite 107	Date:	06-01-05
Approved By: OBL	Tucson, Arizona 85719	Drawn By:	DCM(63)
File Name: n:\public\04georept\63045225\6304225.dwg	L(Layout1)	Figure No.	2

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

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JUN 0 8 2005

Terracon
Consulting Engineers & Scientists

355 South Euclid, Suite 107
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June 6, 2005

Presidio Engineering, Inc
4582 North 1st Avenue
Suite 120
Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: Geotechnical Engineering Report
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63055225, Addendum 2

Terracon has received your request for additional recommendations concerning the pavement design for Continental Links Drive. Based on anticipated traffic volumes for Continental Links Drive, the road would be classified as a collector street. The Pima County Subdivision Street Standards recommend using a minimum design structural number of 1.75 for collector streets. A minimum pavement section consisting of 3 inches of asphalt (PAG Mix No. 2) over 4 inches of aggregate base course has a structural number of 1.76 and is recommended for design. Alternatively, a pavement section of 2.5 inches of asphalt over 6 inches of aggregate base course has a structural number of 1.76 and may also be used.

Please let us know if you have any other questions concerning these additions.

Sincerely,

TERRACON

Bryan W. Reed, E.I.T.
Project Engineer

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

6/6/05

Copies: (3) Addressee

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July 21, 2005

Terracon
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4582 North 1st Avenue
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Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: **Geotechnical Engineering Report**
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63045225, Addendum 3

Terracon has received your request for additional recommendations concerning the deep fills present on the site. Fills as deep as 27 feet were encountered, as reported in Terracon Report Number 63045225, Dated December 8, 2004. We have been requested to provide alternative solutions, other than removing and replacing all of the fill, for building support in the areas were existing fill depths are potentially greater than 7 feet deep, see Site Plan Figure 1 and 2 in Terracon Report 63045225, Dated June 1, 2005. These options include: alternative foundations systems tolerant of potential settlement, placing geogrid reinforcement in engineered fill under building pad areas, or adding a surcharge to the fill area and allowing between 6 to 12 months for consolidation of the fill prior to home construction.

Alternative Foundation Systems

Reinforced Mat (Raft) Foundations: As an alternative, reinforced mat foundations could be used for foundation support of the structures. The following criteria is based on the reinforced slab bearing directly on a minimum of 4 feet of engineered fill. A modulus of subgrade reaction, k, of 200 pci could be used for design and evaluation of soil-structure interaction of a reinforced mat foundation bearing fill soils. It is common to reduce the k-value to account for dimensional effects of large loaded areas. A commonly used correction is:

$$k_c=k((b+1)/2b)^2$$

Where k_c is the corrected or design modulus value and b is the mat width or tributary loaded area. However, in no case should the contact pressure of the mat exceed 750 psf. Perimeters of the mats should bear a minimum of 8 inches below adjacent grades. The raft foundation should be designed to withstand up to 3-inches of differential settlement.

Post-Tensioned Slab Foundation Systems (Compressible Soil Case): Post-tensioned slab construction can be considered as an alternate foundation system for the project. The following criteria is for the area where the depth of loose existing fill varies between 7 and 27 feet and is based on the post-tensioned slab bearing directly on a minimum of 4 feet of new engineered fill. The total settlement of the engineered fill may be much larger than maximum estimated differential settlements. Post-tensioned slabs should be designed using criteria outlined by the Post-Tensioning Institute[1] for the compressible soil case based on the following:

- Maximum Allowable Bearing Pressure....................................750 psf
- Soil Modulus of Elasticity, Es ....2000 psi
- Edge Moisture Variation Distance, e_m
  - Center Lift Condition .... 5 feet
- Differential Soil Movement, y_m
  - Center Lift Condition .... 3 inches
- Total Soil Movement, δ .... 3 inches*
- Slab-Subgrade friction coefficient, μ
  - on polyethylene sheeting.. 0.75
  - on cohesionless soils 1.00
  - on cohesive soils.. 2.00

*Estimated settlement based upon total structure load expressed as a uniform 750 psf pressure acting over the entire slab area.

[1] PTI Slab-on-Ground Committee, (1996), ***Design and Construction of Post-Tensioned Slabs-on-Ground***, Post-Tensioning Institute, Second Edition.

Post-tensioned slabs, thickened or turn-down edges and/or interior beams should be designed and constructed in accordance with the requirements of the Post-Tensioning Institute and the American Concrete Institute. Perimeters of the post-tensioned slabs should bear a minimum of 12 inches below adjacent grades. Subgrades supporting a post-tensioned slab should be prepared as recommended in this report.

Anticipated differential settlement of structures founded on either raft or post-tension systems in the deep existing fill areas could be as much as 3 inches.

Underground piping within or near the proposed structures should be designed with flexible couplings, so deviations in alignment do not result in breakage or distress. Utility knockouts in foundation walls should be oversized to accommodate differential movements.

Geogrid Support

To further limit potential differential settlements, layers of geogrid may be incorporated into the engineered fill below the mat or post-tension foundations. The geogrid will add shear strength to the engineered fill and allow it to better bridge potential subsurface loose areas and voids. If this alternative is chosen, we recommend sheets of Tensar BX1200 geogrid (or equivalent) be placed within every foot lift of compacted engineered fill. This would be a total of four layers of geogrid. The geogrid should extend at least five feet beyond the perimeters of the foundations. We expect the geogrid support to limit differential settlements to 1-inch or less, however total settlement may be higher.

Underground utilities located below the foundations will need to penetrate through the layers of geogrid. This will create difficult excavation conditions for utility contractors.

Pre-Loading or Surcharge

As a third alternative the fill at the site could be pre-consolidated before construction begins by pre-loading the area with a surcharge of soil. It is our understanding that a minimum of 2 feet of fill is required on site to raise site grades. We understand approximately 70,000 cubic yards of material will be needed to raise grades. A portion of this material could be stockpiled in the deep fill area, while other areas of the site are being developed. A ten foot high surcharge pile would sufficiently stress the area to something equivalent to the anticipated loads created by the proposed structures. We are assuming the surcharge soils will have a density of at least 100 pcf, this density should be achieved by the movement of equipment creating the pile.

Once the final height of the surcharge has been reached, settlement monuments should be placed on the surface of the of surcharge pile. Settlement monuments should be embedded at least 2 to 3 feet in the surface of the surcharge soil and set in concrete. We recommend at least 15 monuments be set across the site, preferably in a regular grid pattern.

The settlement monuments should be surveyed every 2 weeks and measured to the nearest 0.001 of a foot. The benchmark should be located well away from the fill and the impact of any potential settlement. Terracon should be given the survey data to evaluate when construction should begin. We would expect between 4 to 7 inches of settlement of the fill material to occur over a period of 6 to 12 months. However if the earthwork is performed relatively slowly, much of the settlement could occur during fill placement. Determination of when construction should begin should be based on settlement monitoring data.

All recommendations given in our previous report are still valid. If you have any questions regarding this report, please contact us.

Sincerely,

TERRACON

Bryan W. Reed, E.I.T.
Project Manager

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: (3) Addressee

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AUG 01 2005

Terracon
Consulting Engineers & Scientists

Terracon Consultants, Inc.
355 South Euclid, Suite 107
Tucson, Arizona 85719
Phone 520.770.1789
Fax 520.792.2539
www.terracon.com

July 27, 2005

Presidio Engineering, Inc
4582 North 1st Avenue
Suite 120
Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: **Geotechnical Engineering Report**
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63045225, Addendum 4

Terracon has received your request for clarification of the lots and areas affected by the deep fills at the site. It appears based on our exploration that the area with fill deeper than 7 feet will affect the following lots:

Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	
Lot [redacted]		Lot [redacted]		Lot [redacted]	

All recommendations given in our previous report are still valid. If you have any questions regarding this report, please contact us.

Sincerely,

TERRACON

07-26-05

Bryan W. Reed, E.I.T.
Project Manager

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: (3) Addressee

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October 19, 2005

Terracon
Consulting Engineers & Scientists

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4582 North 1st Avenue
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Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: Geotechnical Engineering Report
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63045225, Addendum 5

Terracon has received your request for post-tensioned foundation design criteria for areas of the site outside of the areas with the deepest existing fills.

In Addendum No. 4 to the geotechnical report, dated July 27, 2005, we identified the lots we expect to be affected by deep uncontrolled existing fills. We stated the following lots would be affected:

Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]
Lot [redacted]	Lot [redacted]	Lot [redacted]

The recommendations in Addendum No. 3, dated July 21, 2005, provided alternatives to removing all the existing fill and replacing it with engineered fill. We understand that Standard Pacific Homes is considering the alternative of placing four feet of engineered fill in this area and designing post-tensioned slabs with the criteria provide in Addendum 3.

For the areas outside the above-referenced lots (outside the deep fills, where the post-tensioned foundations will bear on a minimum of 2 feet of engineered fill) we are providing the following design criteria:

Post-Tensioned Slab Foundation Systems (Compressible Soil Case): Post-tensioned slabs should be designed using criteria outlined by the Post-Tensioning Institute[1] for the compressible soil case based on the following:

- Maximum Allowable Bearing Pressure.................................1000 psf
- Soil Modulus of Elasticity, Es ....2000 psi
- Edge Moisture Variation Distance, e_m
  - Center Lift Condition .... 5 feet
- Differential Soil Movement, y_m
  - Center Lift Condition .... 3/4 inches
- Total Soil Movement, δ .... 3/4 inches*
- Slab-Subgrade friction coefficient, μ
  - on polyethylene sheeting... 0.75
  - on cohesionless soils 1.00
  - on cohesive soils.. 2.00

*Estimated settlement based upon total structure load expressed as a uniform 750 psf pressure acting over the entire slab area.

[1]PTI Slab-on-Ground Committee, (2003), ***Design and Construction of Post-Tensioned Slabs-on-Ground***, Post-Tensioning Institute, Second Edition.

Post-tensioned slabs, thickened or turn-down edges and/or interior beams should be designed and constructed in accordance with the requirements of the Post-Tensioning Institute and the American Concrete Institute. Perimeters of the post-tensioned slabs should bear a minimum of 12 inches below adjacent grades. Subgrades supporting a post-tensioned slab should be prepared as recommended in this report.

All recommendations given in our previous report are still valid. If you have any questions regarding this report, please contact us.

Sincerely,

TERRACON

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: (1) Addressee
(1) Standard Pacific Homes, Attn: Jeff Curtin
(1) Borm Engineers, Attn: Bobbie Brown

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Terracon
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June 1, 2005

Presidio Engineering, Inc
4582 North 1st Avenue
Suite 120
Tucson, Arizona 85718

Attn: Erin Donovan, P.E.

RE: Geotechnical Engineering Report
Phase I Residential Development at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63055225, Addendum 1

Terracon has received your request for an additional site plan showing the boring locations with the lot layout. We have provided the overlay of the boring locations as attached in Figure 2. The original site plan, Figure 1, was originally provided in Terracon Report Number 63045225, dated December 8, 2004, which was prepared for Standard Pacific of Tucson.

Please let us know if you have any other questions concerning these additions.

Sincerely,

TERRACON

David C. Mwewa, E.I.T.
Project Engineer

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: (3) Addressee

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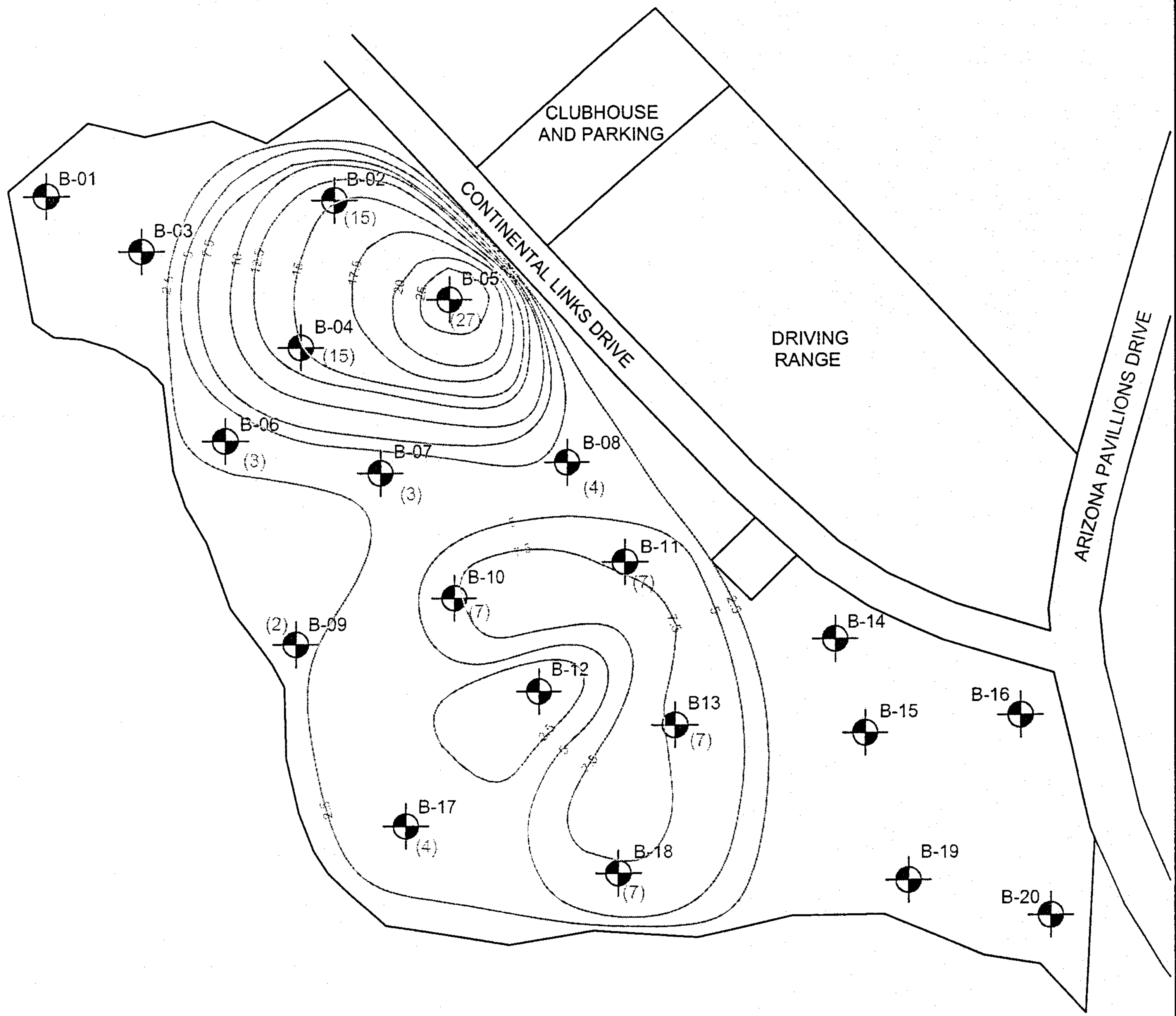
SUBMITTAL NO. 1

PRV-050606



LEGEND

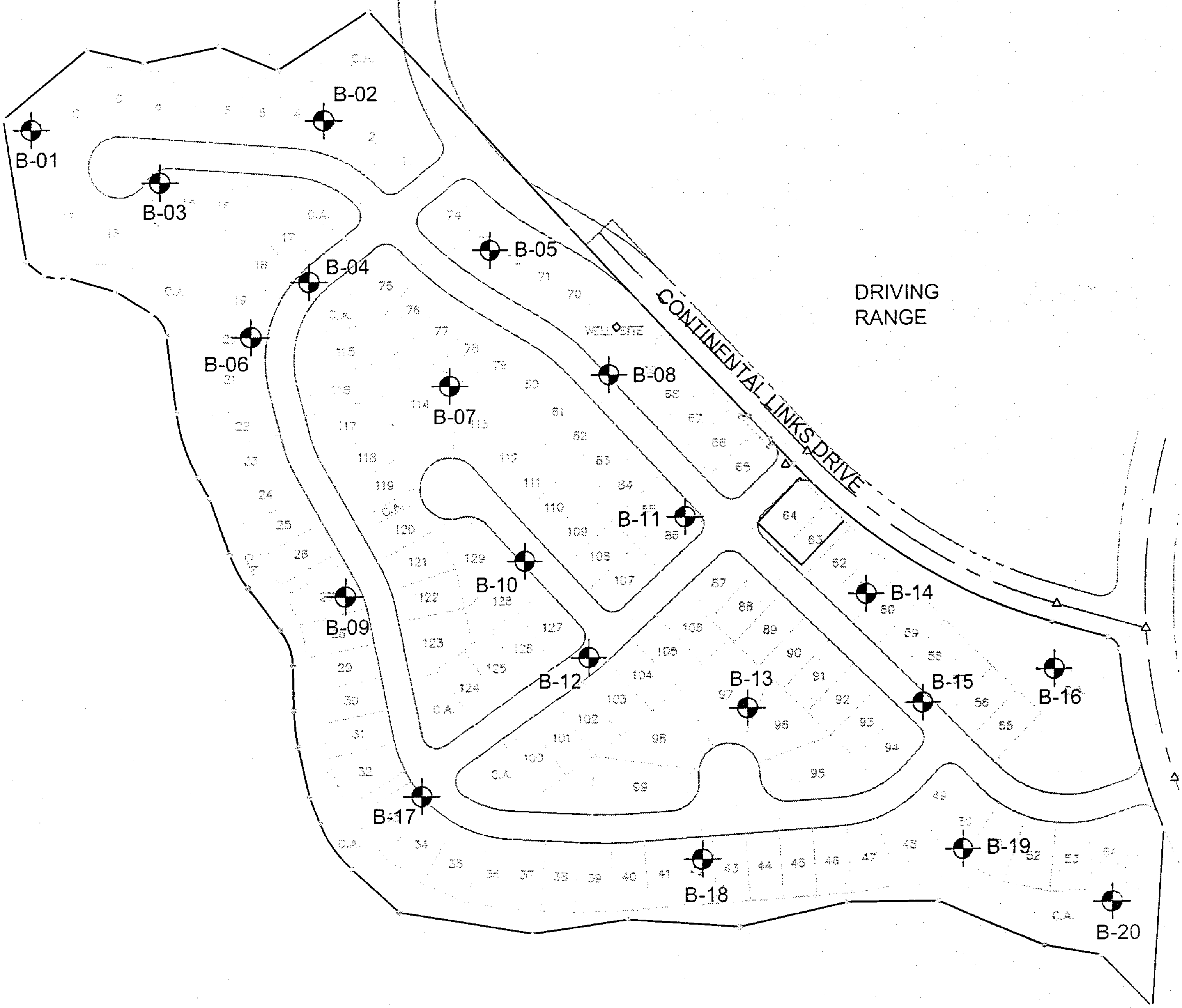
APPROXIMATE BORING

(5) APPROXIMATE DEPTH OF FILL

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

SITE PLAN AND BORING LOCATIONS
PROPOSED PHASE I RESIDENTIAL DEVELOPMENT AT THE PINES
NORTH OF CORTARO ROAD AND WEST OF INTERSTATE 10
MARANA, ARIZONA
STANDARD PACIFIC OF TUCSON

Project Mngr: OBL	Terracon	Project No. 63045225	
Designed By:		Scale: None	
Checked By:	355 South Euclid, Suite 107	Date: 11-23-04	
Approved By: OBL	Tucson, Arizona 85719	Drawn By: BWR(63)	
File Name: n:\public\04georept\63045225\6304225.dwg	L(Layout1)	Figure No. 1	



LEGEND

APPROXIMATE BORING LOCATION

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DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

SITE PLAN AND BORING LOCATIONS
PROPOSED PHASE I RESIDENTIAL DEVELOPMENT AT THE PINES
NORTH OF CORTARO ROAD AND WEST OF INTERSTATE 10
MARANA, ARIZONA
STANDARD PACIFIC OF TUCSON

Project Mngr:	OBL	Terracon	Project No. 63045225
Designed By:			Scale: None
Checked By:		355 South Euclid, Suite 107	Date: 06-01-05
Approved By:	OBL	Tucson, Arizona 85719	Drawn By: DCM(63)
File Name: n:\public\04georept\63045225\6304225.dwg		L(Layout1)	Figure No. 2