Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 3, 2015

Project No. 603541-003

Sharp Healthcare
8695 Spectrum Center Boulevard
San Diego, California 92123

Attention: Mr. Matthew Teichner

Subject: Update Foundation Capacity Design Recommendations
Sharp Chula Vista Master Plan
Chula Vista, California

Leighton Consulting, Inc. (Leighton) is pleased to submit this update letter for the subject project. This letter provides additional foundation recommendations for the Sharp Chula Vista Master Plan, per your authorization of our supplemental scope on July 21, 2015 and is an addendum to the August 29, 2013 geotechnical investigation prepared by Leighton (Appendix A).

Introduction

Leighton previously prepared the geotechnical investigation for the proposed Master Plan improvements and has provided grading observation and soil testing services for the Phase I – Make Ready Phase improvements associated with the Master Plan (see References). The project area is located at 751 Medical Center Court and is currently occupied by the existing hospital, subsidiary structures, western parking deck structure, and other site improvements (Figure 1). This letter may be used for the proposed East Patient Care Building and other improvements included under the Sharp Chula Vista Medical Center Master Plan. Figure 2 depicts the general limits of the proposed buildings (per the Master Plan), as well as the locations of relevant geotechnical explorations in the vicinity.

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Site Conditions

Construction on the Phase I – Make Ready Phase of the Sharp Chula Vista Master Plan was nearly complete at the time of drafting this document. Construction for Phase I included the completion of site grading, a loop roadway and utility corridor, five segmental walls, surface parking lots, 6-story parking structure, and cooling tower. Specifically, in the area of the proposed East Patient Care Tower, construction of the loop roadway/utility corridor, and segmental Walls 4 and 5 resulted in the modification of original grades at the site (Figure 2). Construction of segmental Walls 4 and 5 included the localized removal of unsuitable soil materials during grading and placement of a new fill slope along the eastern portion of the site area. It should be noted that portions of the previously existing undocumented fill were left in-place during recent grading (Figure 2).

With regard to the Master Plan location of the proposed East Patient Care Tower, existing site topography ranges from approximate elevation 455 feet MSL at the north end of the proposed building footprint, to 435 feet MSL at the east end, adjacent to an existing retaining wall (Wall 4 on Figure 2). The site is bound by a descending cut slope to the north and fill slope to the east. Segmental Walls 4 and 5 are located along the top and bottom of the descending eastern fill slope, respectively. Variably thick fill soils ranging from approximately 3 to 25 feet underlie the site. Based upon our geotechnical explorations, the deepest fills are anticipated along the top of the existing fill slope on the northeast side of the proposed loop driveway, and adjacent to the eastern half of Wall 4 in the vicinity of Borings B-13, B-8, and B-6.

Shallow Foundations

We have provided shallow foundation capacity curves for foundations bearing on fill soils and undisturbed formation (Very Old Paralic Deposits and San Diego Formation). We recommend that foundations supporting buildings be founded in formation. Additionally, foundations supporting accessory structures may be supported in properly compacted fill or formation. Allowable bearing capacity curves are provided in Appendix B.

Bearing capacity of shallow foundations is controlled by footing shape and size, embedment, and tolerable settlement. We recommend that shallow foundations supporting buildings be embedded a minimum of 1.5 feet in undisturbed formation. Figures B-1 and B-2 provide allowable bearing capacity curves (F.S.$\geq$3) for 1-inch and 1/2-inch of tolerable foundation settlement for square and continuous footings

considering embedment depths of 1.5 feet and 3 feet in formation. Note that the allowable bearing capacity at relatively narrow footing widths is controlled by the shear strength of the soil, whereas at progressively larger footing widths, the bearing capacity is limited by the potential settlement of soils below the footing.

We anticipate that some accessory structures (retaining walls, seat walls, equipment pads, etc.) may be founded on properly compacted fill soils. Figure B-3 provides allowable bearing capacity for 1-inch of tolerable settlement on fill. Subgrade preparation (including recommendations for removal of compressible soils) for shallow foundations should be conducted in accordance with our 2013 geotechnical investigation. Soils within 5 feet of pad grade should have a very low to low expansion potential (EI <50).

Continuous footings should be designed in accordance with the structural engineer's requirements and have a minimum reinforcement of four No. 5 reinforcing bars (two top and two bottom). Reinforcement of individual column footings should be per the structural requirements.

Deep Foundations

Axial Capacity

If more heavily loaded elements are planned or deep foundations are desired to bypass existing fill materials, support of those elements on cast-in-drilled hole (CIDH) piles may be considered. Ultimate and allowable axial capacities for CIDH piles were developed using the Modified Beta Method considering the skin friction developed along the length of the CIDH pile. The analysis considers site conditions, with up to 25 feet of fill underlain by dense formational material. Appendix C presents the recommended design curves for 24, 30, and 36-inch diameter drilled shafts. Upward capacity equal to one-half the total allowable axial/compressive value is recommended to resist tensile loads. CIDH pile settlement is anticipated to be less than 1/4 inch under design loads and normal service conditions. The design graphs in Appendix C are based on a center to center pile spacing of at least 3 pile diameters. Where piles are spaced more closely, reduction in pile capacity is necessary.

Lateral Capacity

Lateral pile capacity was analyzed using LPile (Version 2015) produced by Ensoft. Maximum lateral pile capacity for 24, 30, and 36-inch piles based on ¼-inch and ½-inch deflection was calculated. Fixed and free head conditions for level and sloping ground were considered. A tabular summary of results is presented in Appendix D, along with moment and deflection profiles for each case. For the sloping ground condition, we considered piles located on a 2:1 (H:V) descending slope. We assumed the following pile properties for the CIDH piles:

Modulus of Elasticity	3,650,000 psi
Moment of Inertia, 24-Inch CIDH	16,286 in^4
Moment of Inertia, 30-Inch CIDH	39,761 in^4
Moment of Inertia, 36-Inch CIDH	82,448 in^4

Where piles are situated closer than 5 diameters (center to center) apart, reduction in lateral bearing is needed and should be reviewed by Leighton Consulting on a case-by-case basis.

All pile installation should be performed under the observation of Leighton Consulting and be consistent with standard practice. Drilling equipment should be powerful enough to drill into the dense to very dense/cemented formational material with cobbles to the design penetration depths. Once a pile excavation has been started, it should be completed within 8 hours, which includes inspection, placement of the reinforcement, and placement of the concrete.

Construction Observation

The recommendations provided in this letter are based on preliminary design information and subsurface conditions disclosed by widely spaced excavations. The interpolated subsurface conditions should be confirmed by Leighton Consulting in the field during construction. Construction observation of all onsite excavations and field density testing of all compacted fill should be performed by a representative of this office. We recommend that all excavations be mapped by a representative of this office during grading to determine if any potentially adverse geologic conditions exist at the site.

Plan Review

Final project grading and foundation plans should be reviewed by Leighton Consulting as part of the design development process to ensure that recommendations in this letter are incorporated in project plans as intended.

We appreciate the opportunity to work with you on this project. If you have any questions or if we can be of further service, please contact us at (*858) 242-8030*.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Robert C. Stroh, CEG 2099
Senior Project Geologist

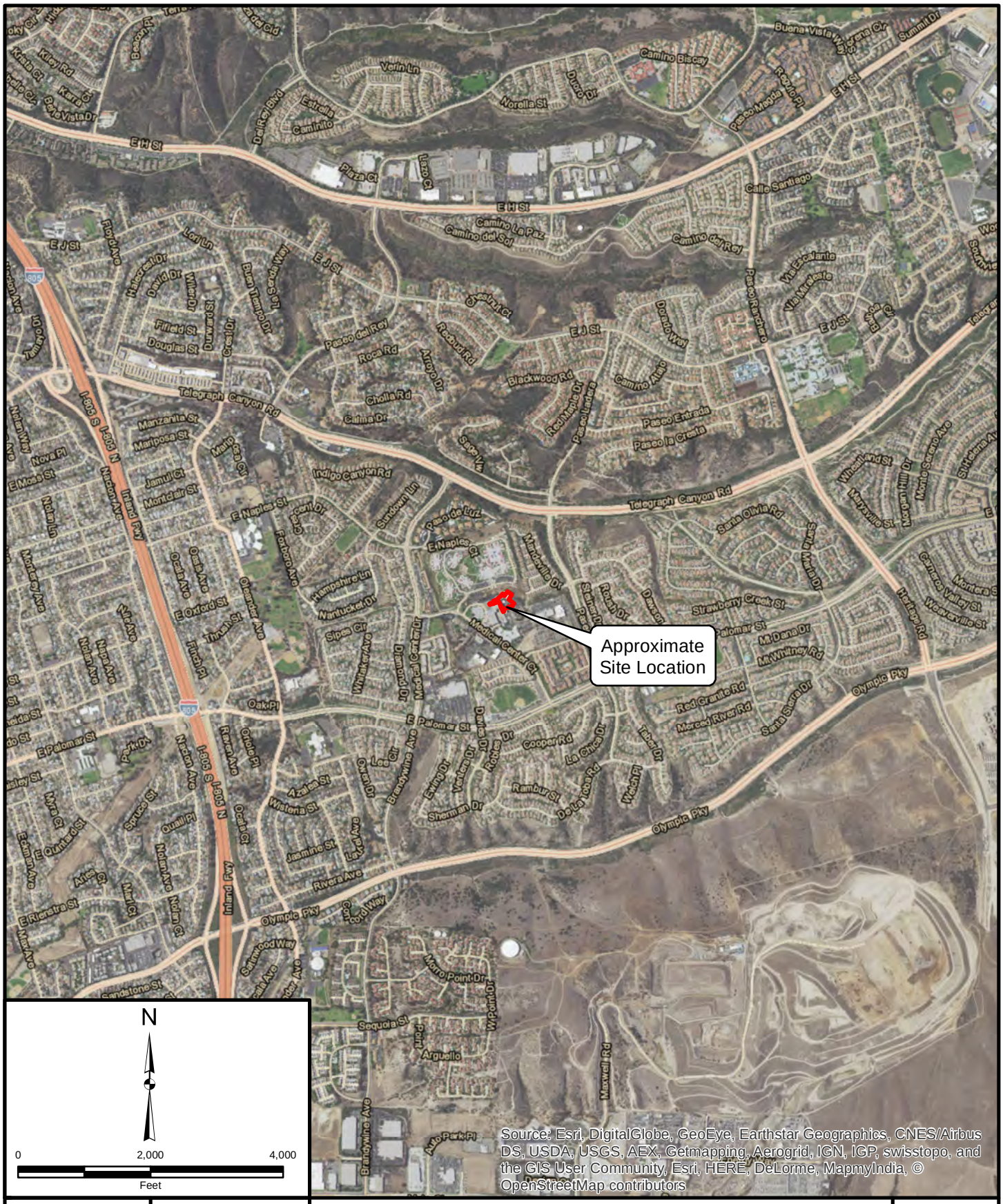
David B. Nevius, PE, GE 2789
Associate Engineer

Attachments: Figure 1 – Site Location Map
Figure 2 – Existing Site Conditions and Exploration Map

Appendix A – References
Appendix B – Shallow Foundation Capacity Curves
Appendix C – CIDH Capacity Curves
Appendix D – Lateral Capacity of Drilled Shafts

Distribution: (1) Addressee

Leighton



Project: 603541-003	Eng/Geol: DBN/RCS
Scale: 1 " = 2,000 '	Date: August 2015

Base Map: ESRI ArcGIS Online 2015
Thematic Information: Leighton
Author: (mmurphy)

SITE LOCATION MAP

Sharp Chula Vista Master Plan
Foundation Recommendations
Chula Vista, California

Figure 1

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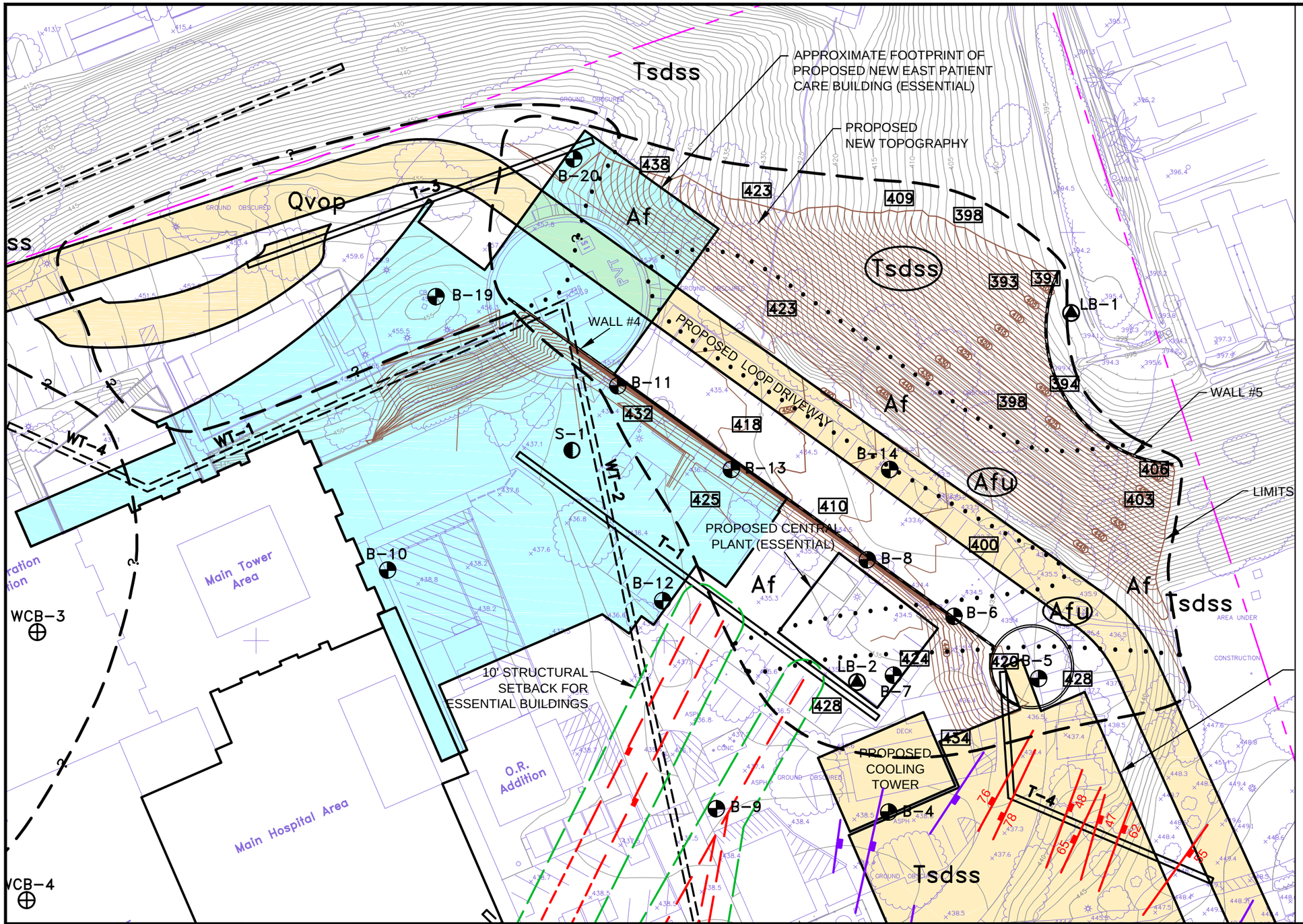
Map Saved as P:\Drafting\603541\003\Maps\603541-003_F01_SLM_2015-07-29.mxd on 7/29/2015 10:20:24 AM



LEGEND

428	ELEVATION FOR REMOVAL BOTTOM
S-1	APPROXIMATE LOCATION OF DOWNHOLE SEISMIC BORING
LB-2	APPROXIMATE LARGE DIAMETER BORING LOCATION (2014)
B-20	APPROXIMATE BORING LOCATION (2013)
WCB-10	APPROXIMATE BORING LOCATION (WOODWARD-CLYDE, 1989)
T-6	APPROXIMATE FAULT EXPLORATION TRENCH LOCATION
WT-5	APPROXIMATE FAULT EXPLORATION TRENCH LOCATION (WOODWARD-GIZIENSKI & ASSOCIATES, MARCH 15, 1973)
	APN 641-010-28
78	MINOR FAULT – POTENTIALLY ACTIVE (11k-1.6k YEARS bp), DASHED WHERE APPROXIMATE, BOX AND NUMBER INDICATE DIRECTION AND AMOUNT OF DIP, WHERE KNOWN
78	MINOR FAULT MAPPED DURING GRADING
?	APPROXIMATE GEOLOGIC CONTACT, QUERIED WHERE ASSUMED, DOTTED WHERE BURIED
	10' STRUCTURAL SETBACK FOR ESSENTIAL BUILDINGS
Afu	UNDOCUMENTED FILL (GREATER THAN 5' IN THICKNESS)
Qvop	UNDIFFERENTIATED LATE PLEISTOCENE-AGE VERY OLD PARALIC DEPOSITS
Tsdss	SAN DIEGO FORMATION – EARLY PLEISTOCENE AND LATE PLIOCENE, MARINE SANDSTONE (CIRCLED WHERE BURIED)

N

0 50 100
SCALE FEET

Project: 603541-003	Eng/Geol: DBN/RCS
Scale: 1"=50'	Date: August 2015
Reference:	
Author: MAM	

EXISTING SITE CONDITIONS AND EXPLORATION

Sharp Chula Vista Master Plan
Foundation Recommendations
Chula Vista, California

Figure 2

Leighton

P:\DRAFTING\603541\003\CAD\603541-003_F02_DTLM_2015-07-29.DWG (08-03-15 3:12:15PM) Plotted by: mmurphy

APPENDIX A

References

Leighton and Associates, 1996, Evaluation of Faulting and Seismicity, Proposed Veteran's Home, Chula Vista, California, dated July 2.

Leighton Consulting, 2008, Fault Hazard Study, Proposed Senior Care Campus at Vista Hill, 730 Medical Center Court, Chula Vista, California, dated June 23.

————, 2008, Geologic Reconnaissance and Feasibility Study, 730 Medical Center Court, Chula Vista, California, Project No. 602104-001, dated January 10.

————, 2013, Fault Hazard Study, Sharp Chula Vista Medical Center, Master Plan, Chula Vista, California, Project No. 603541-001, dated January 31.

————, 2013, Geotechnical Investigation, Sharp Chula Vista Medical Center Master Plan, California, Project No. 603541-002, dated July 18, 2013, Revised August 29, 2013.

————, 2014, Review of Civil and Segmental Wall Plans for the Make Ready Work of Parking Lots 1, 2, and 3, Sharp Chula Vista Medical Center Master Plan, Chula Vista, California, dated February 25, 2014.

————, 2014, Geotechnical Review of Revised Grading Plan, Sharp Chula Vista Medical Center Master Plan, Chula Vista, California, dated April 23, 2014.

————, 2014, Geotechnical Plan Review, Cooling Tower OSHPD Building Submittal Plans, Sharp Chula Vista Medical Center Master Plan, Chula Vista, California, OSHPD Project Number G131958-37, [plan] dated February 10, 2014, dated May 7, 2014.

————, 2014, As-Graded Fault Locations, Cooling Tower, Sharp Chula Vista Medical Center Master Plan, Chula Vista, California, OSHPD Project Number G131958-37, [plan] dated February 10, 2014, dated September 24, 2014.

————, 2015, As-Graded Report, Sharp Chula Vista Medical Center, Chula Vista, Cooling Tower, California, OSHPD Project Number, H140030-37-00, dated June 17, 2015.

URS, 2006, Updated Geotechnical Evaluation, Sharp Chula Vista Medical Center, Chula Vista, California, dated August 10, revised February 8, 2007.

APPENDIX A (Continued)

References

Woodward-Clyde, 1989, Geotechnical Investigation for the Proposed Additions to the Main Hospital and Overhead Parking Deck, Community Hospital of Chula Vista, Chula Vista, California, dated April 25.

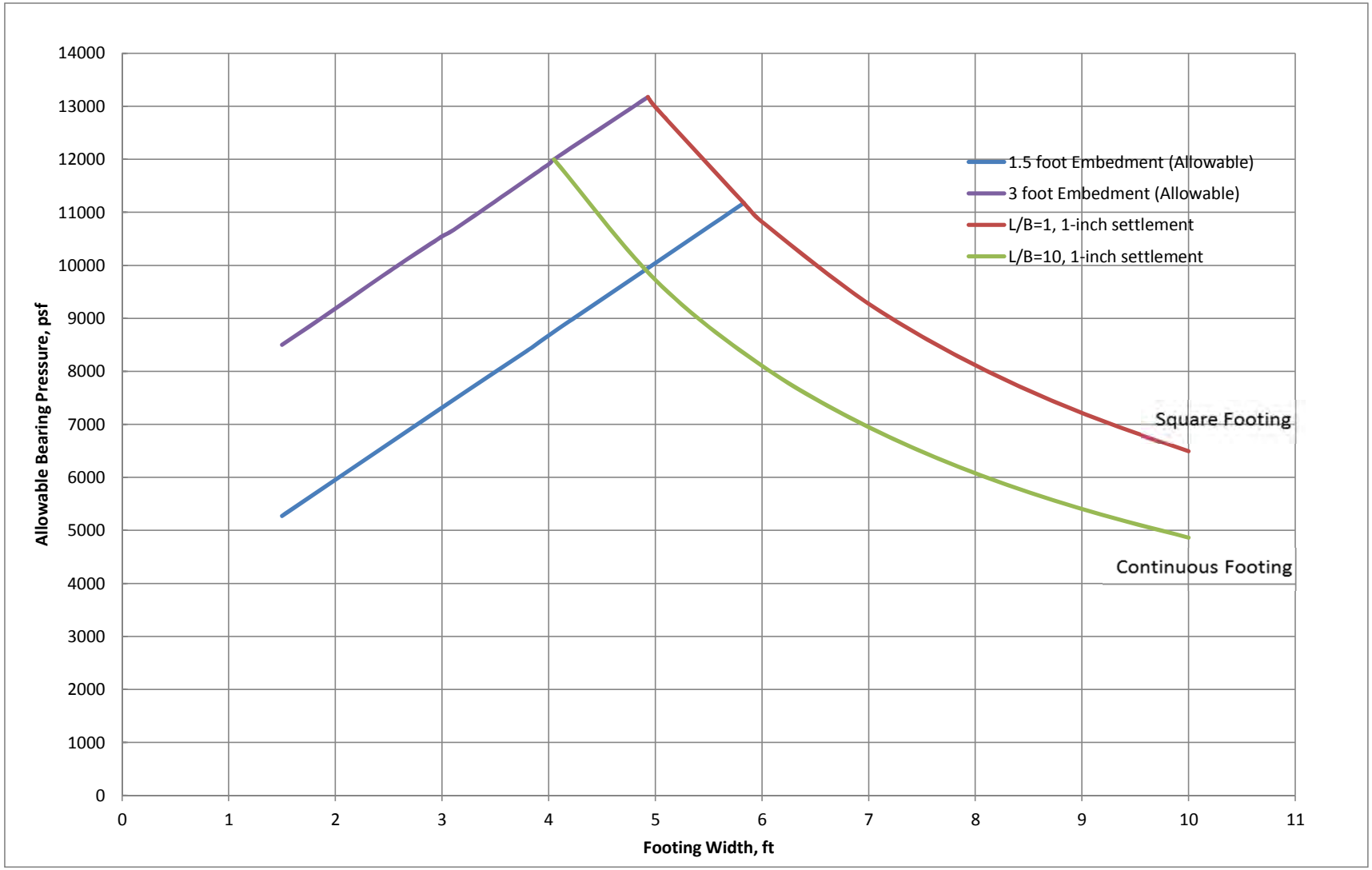
Woodward-Clyde Consultants, 1986, Fault and Geologic Hazards Investigation, Proposed Vista Hill Hospital Expansion, San Diego County, California, dated September 2.

Woodward-Clyde, 1984, Geotechnical Investigation for the Proposed South Bay Community Convalescent Hospital of Chula Vista, California, dated April 20.

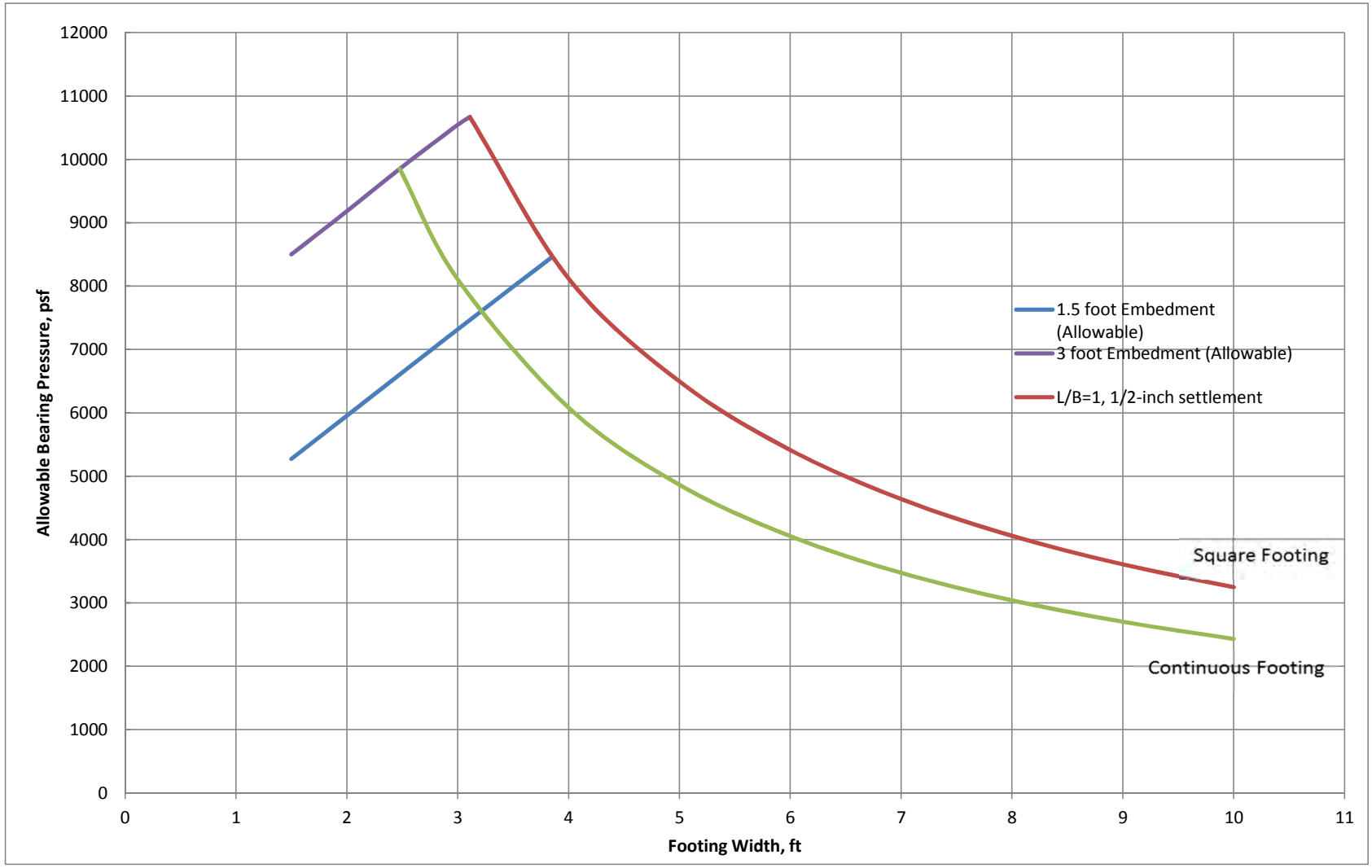
Woodward-Gizenski & Associates, 1973, Additional Engineering and Geological Study, General Hospital Facility, Community Hospital of Chula Vista, California, dated March 15.

Appendix B

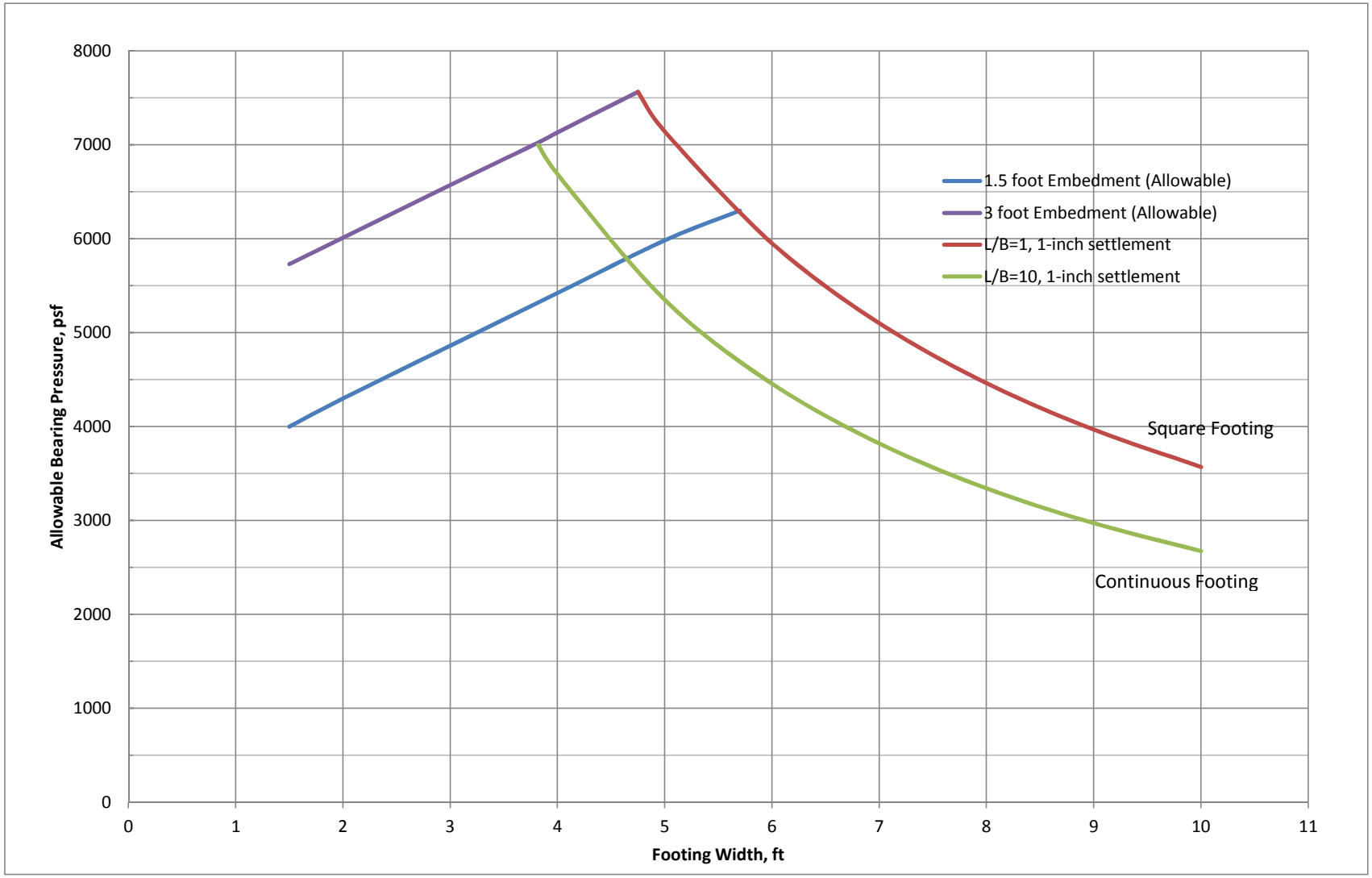
Shallow Foundation Capacity Curves



BUILDING FOUNDATIONS **ALLOWABLE BEARING CAPACITY (FORMATION)** **1-inch Tolerable Settlement** **SHARP CHULA VISTA MEDICAL CENTER**		**Exhibit: B1**	Leighton
		Date: August 2015	Project No.: 603541-003



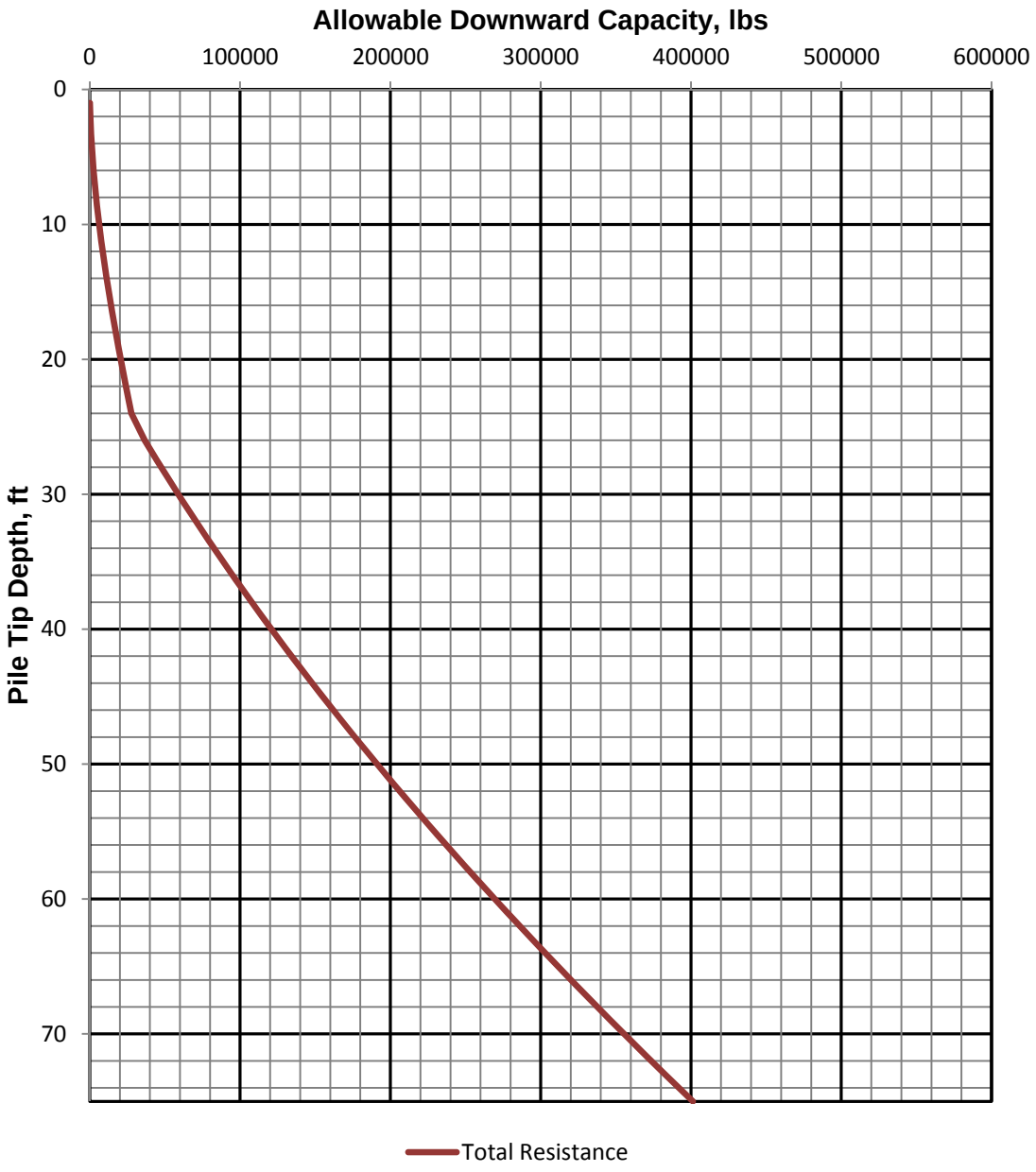
BUILDING FOUNDATIONS **ALLOWABLE BEARING CAPACITY (FORMATION)** **1/2-inch Tolerable Settlement** **SHARP CHULA VISTA MEDICAL CENTER**		**Exhibit: B2**	Leighton
		Date: August 2015	Project No.: 603541-003



ACCESSORY STRUCTURE FOUNDATIONS **ALLOWABLE BEARING CAPACITY (FILL)** **1-inch Tolerable Settlement** **SHARP CHULA VISTA MEDICAL CENTER**		**Exhibit: B3**	Leighton
		Date: August 2015	Project No.: 603541-003

Appendix C

CIDH Capacity Curves



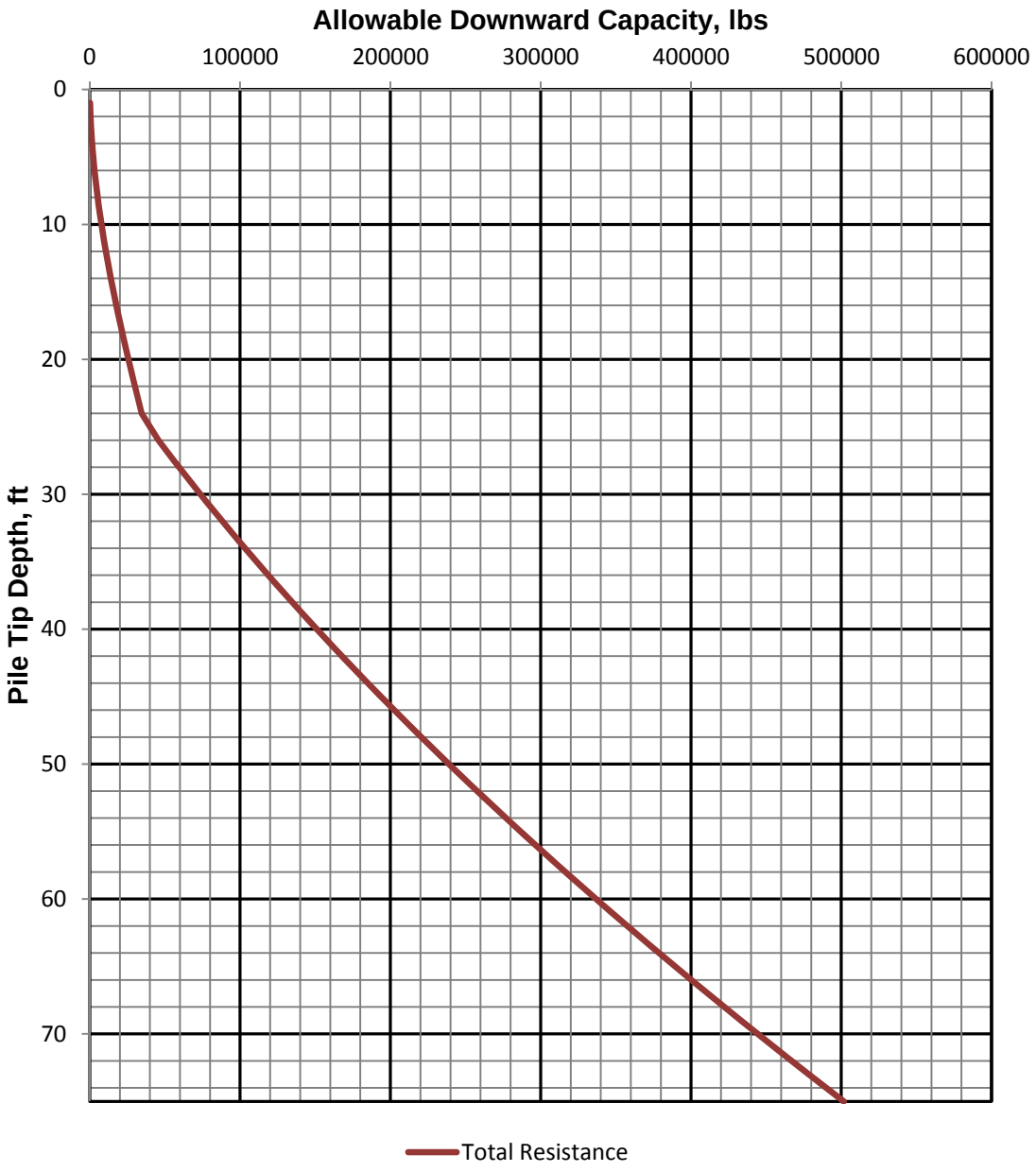
24 INCH DIAMETER CIDH
ALLOWABLE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C1

Leighton

Date: August 2015

Project No.: 603541-003



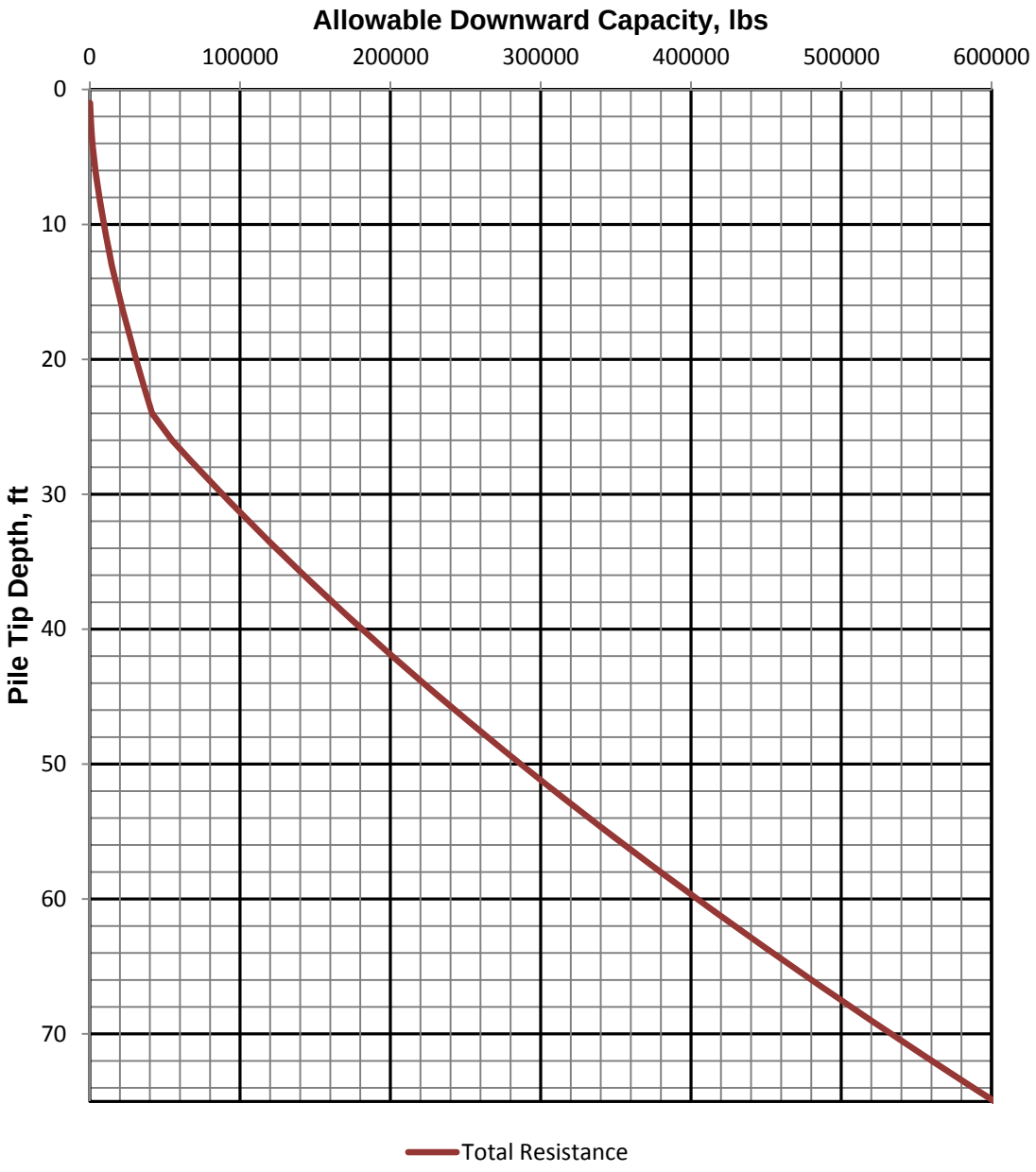
30 INCH DIAMETER CIDH
ALLOWABLE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C2

Leighton

Date: August 2015

Project No.: 603541-003



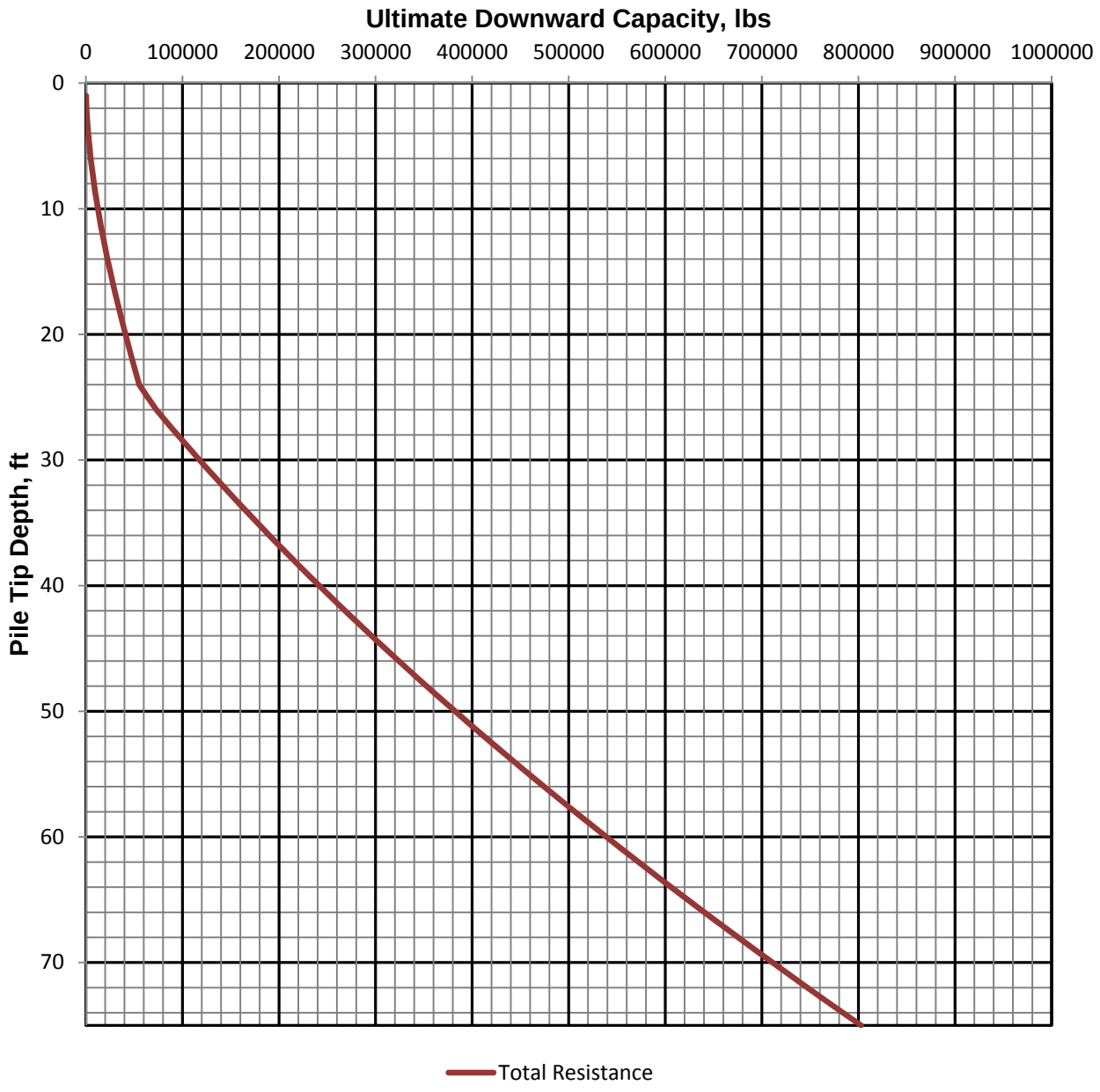
36 INCH DIAMETER CIDH
ALLOWABLE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C3

Leighton

Date: August 2015

Project No.: 603541-003



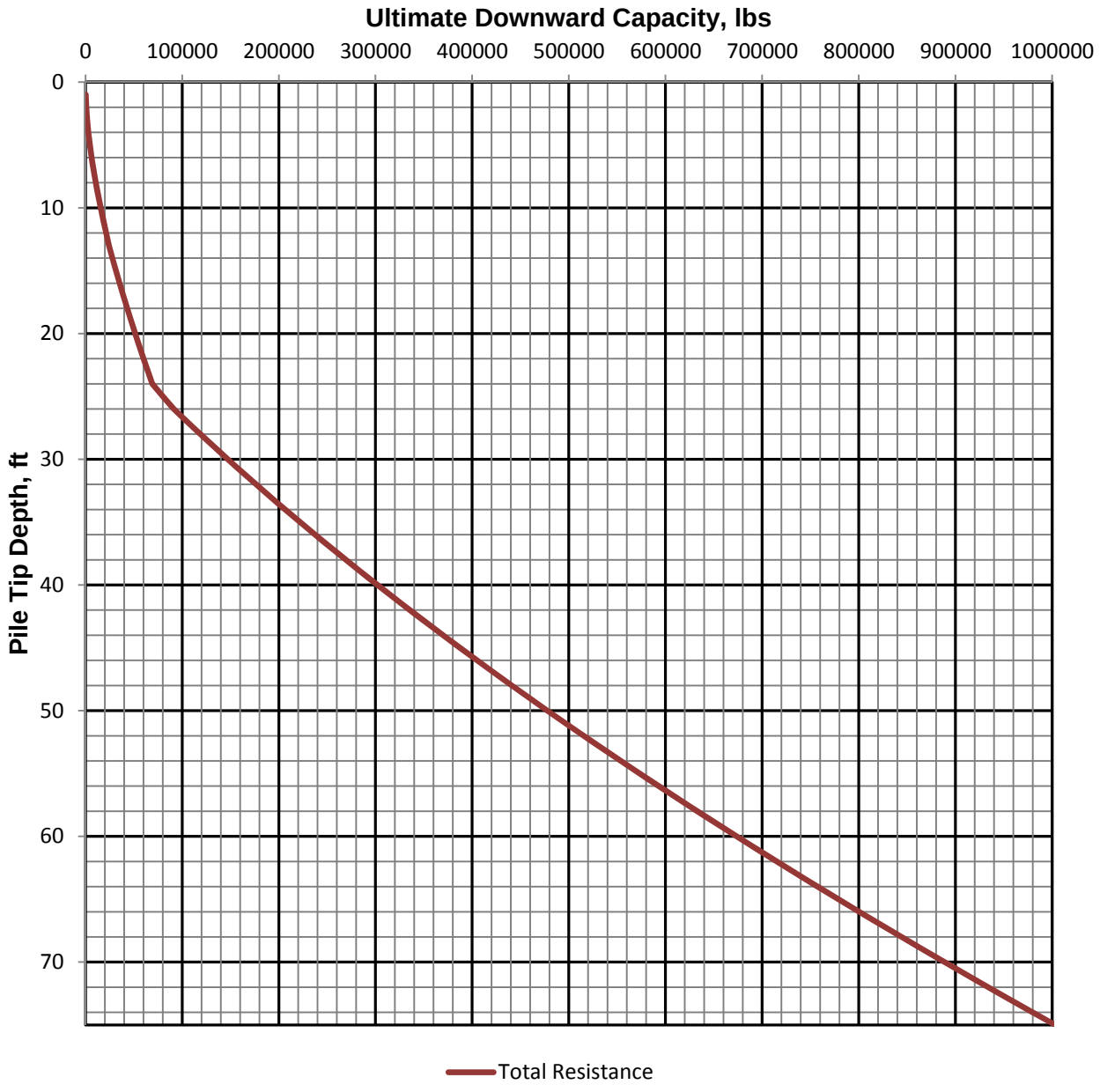
24 INCH DIAMETER CIDH
ULTIMATE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C4

Leighton

Date: August 2015

Project No.: 603541-003



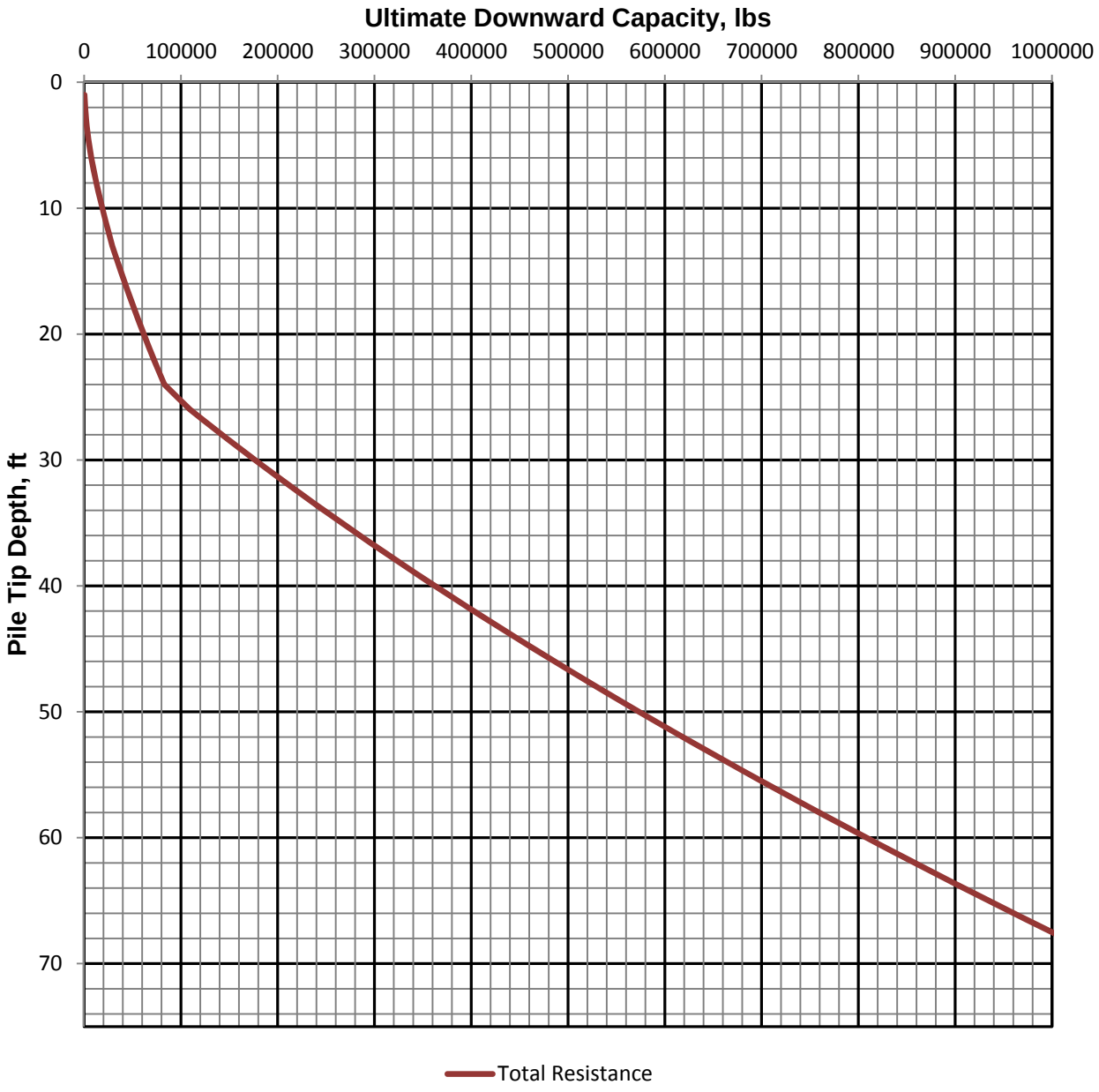
30 INCH DIAMETER CIDH
ULTIMATE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C5

Leighton

Date: August 2015

Project No.: 603541-003



36 INCH DIAMETER CIDH
ULTIMATE DOWNWARD AXIAL CAPACITY
SHARP CHULA VISTA MEDICAL CENTER

Exhibit: C6

Leighton

Date: August 2015

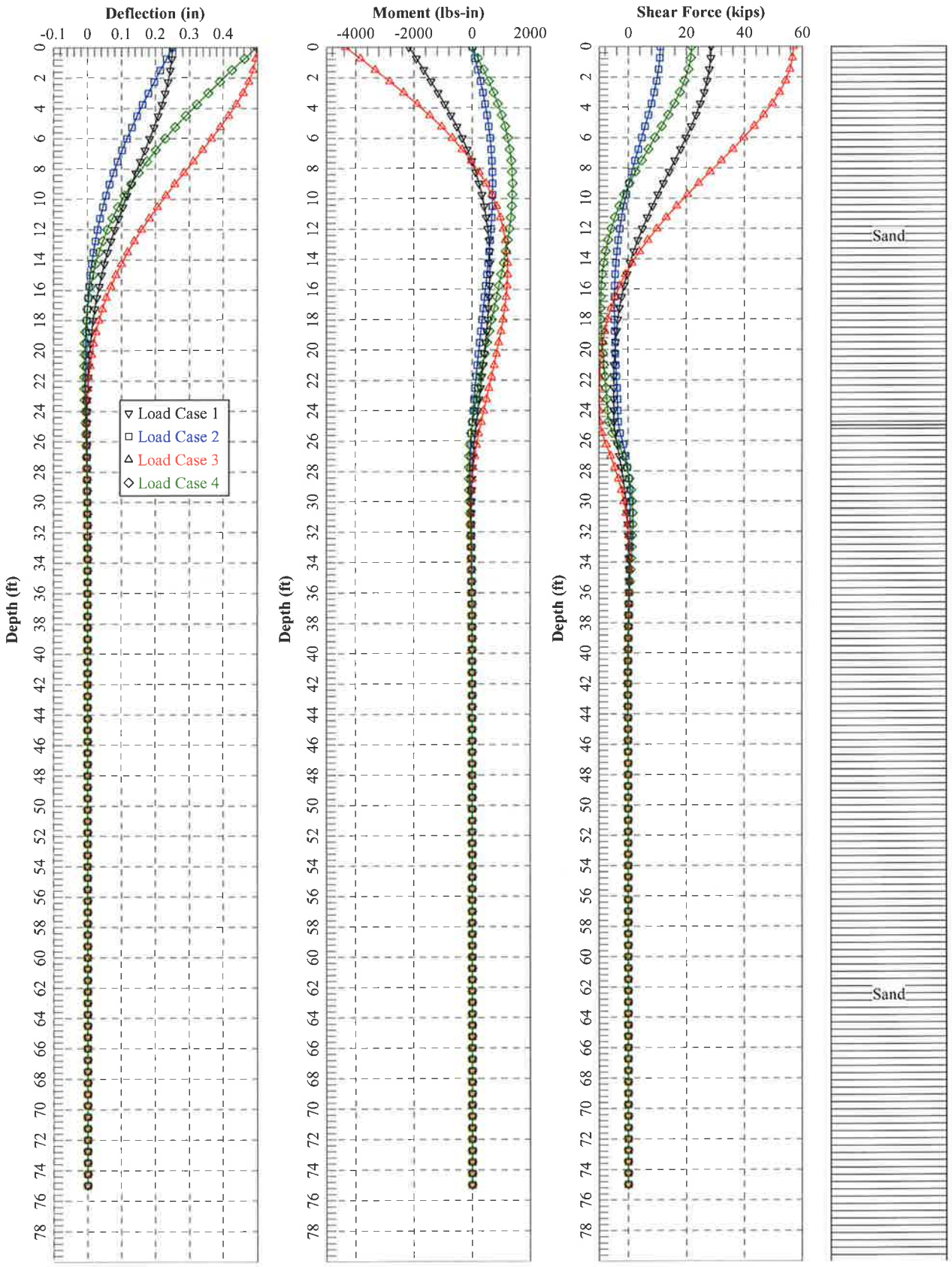
Project No.: 603541-003

Appendix D

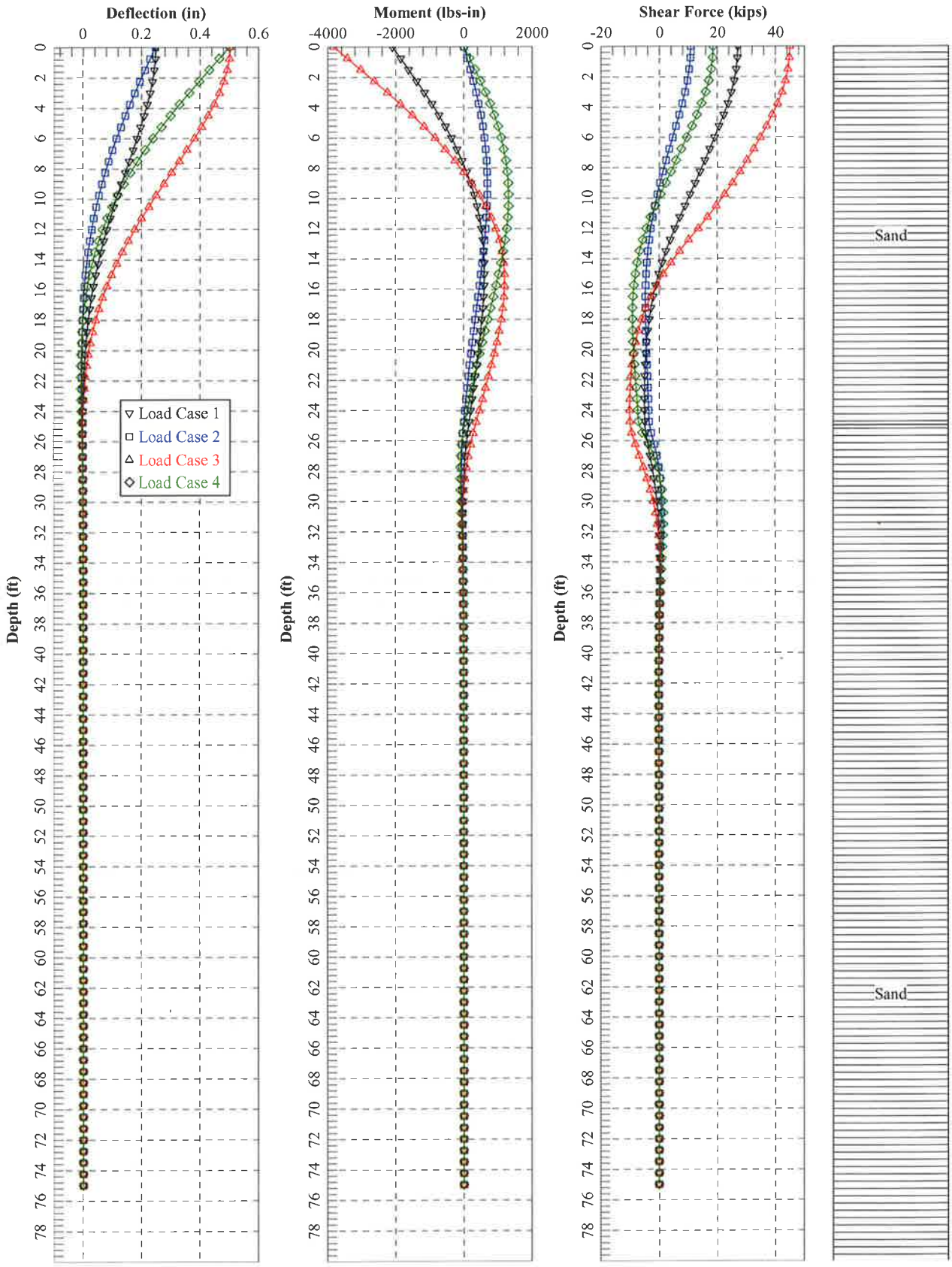
Lateral Capacity of Drilled Shafts

Sharp Chula Vista LPile Summary						
Pile Diameter	Loading Condition	Ground Surface	1/4-inch deflection		1/2-inch deflection	
			Max Load	Max Moment	Max Load	Max Moment
inches			*kips*	*k-ft*	*kips*	*in-lbs*
24	Fixed Head	Level	28.5	181.2	57.0	362.4
24	Free Head	Level	11.0	58.8	21.8	116.6
24	Fixed Head	Sloping	27.0	175.3	45.0	319.5
24	Free Head	Sloping	10.8	58.0	18.5	110.3
30	Fixed Head	Level	41.0	311.8	81.0	615.9
30	Free Head	Level	15.8	101.0	31.5	201.4
30	Fixed Head	Sloping	41.0	311.8	68.0	56.1
30	Free Head	Sloping	15.8	101.0	28.7	19.6
36	Fixed Head	Level	55.0	487.0	110.0	975.0
36	Free Head	Level	21.0	155.3	42.0	310.7
36	Fixed Head	Sloping	55.0	487.0	110.0	975.0
36	Free Head	Sloping	21.0	155.3	42.0	310.7

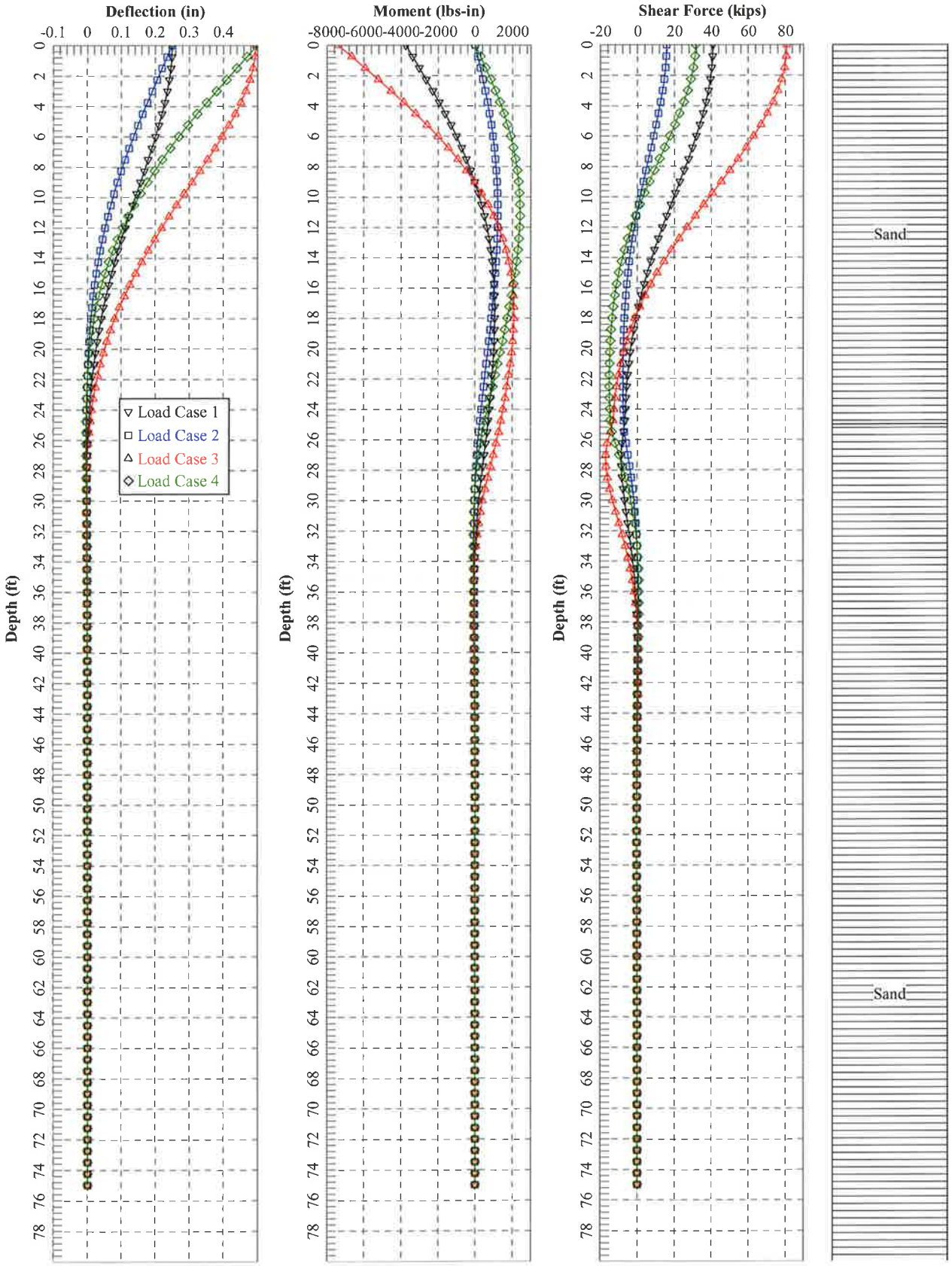
24-inch Shaft, Level Ground



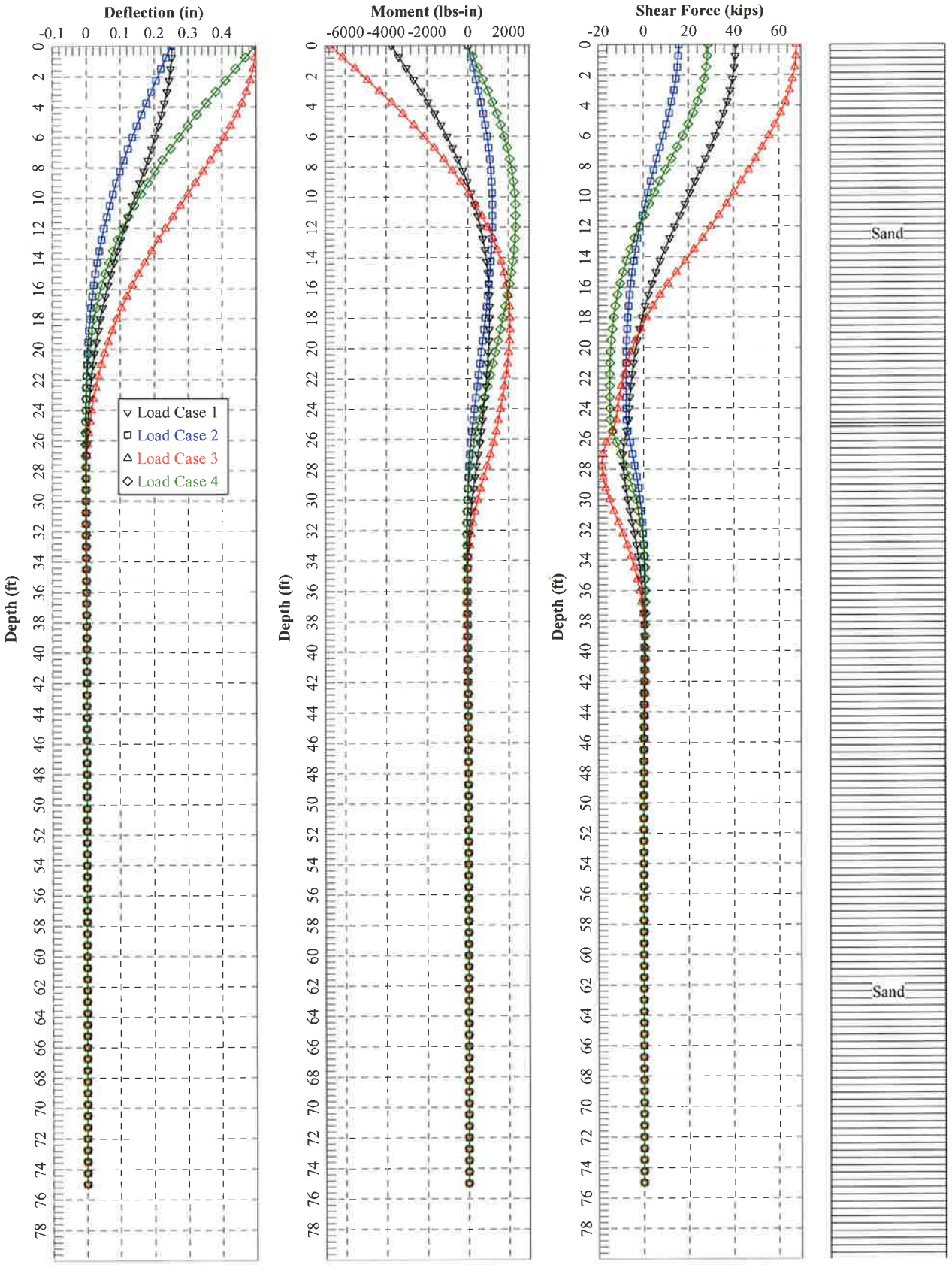
24-inch Shaft, Sloping Ground



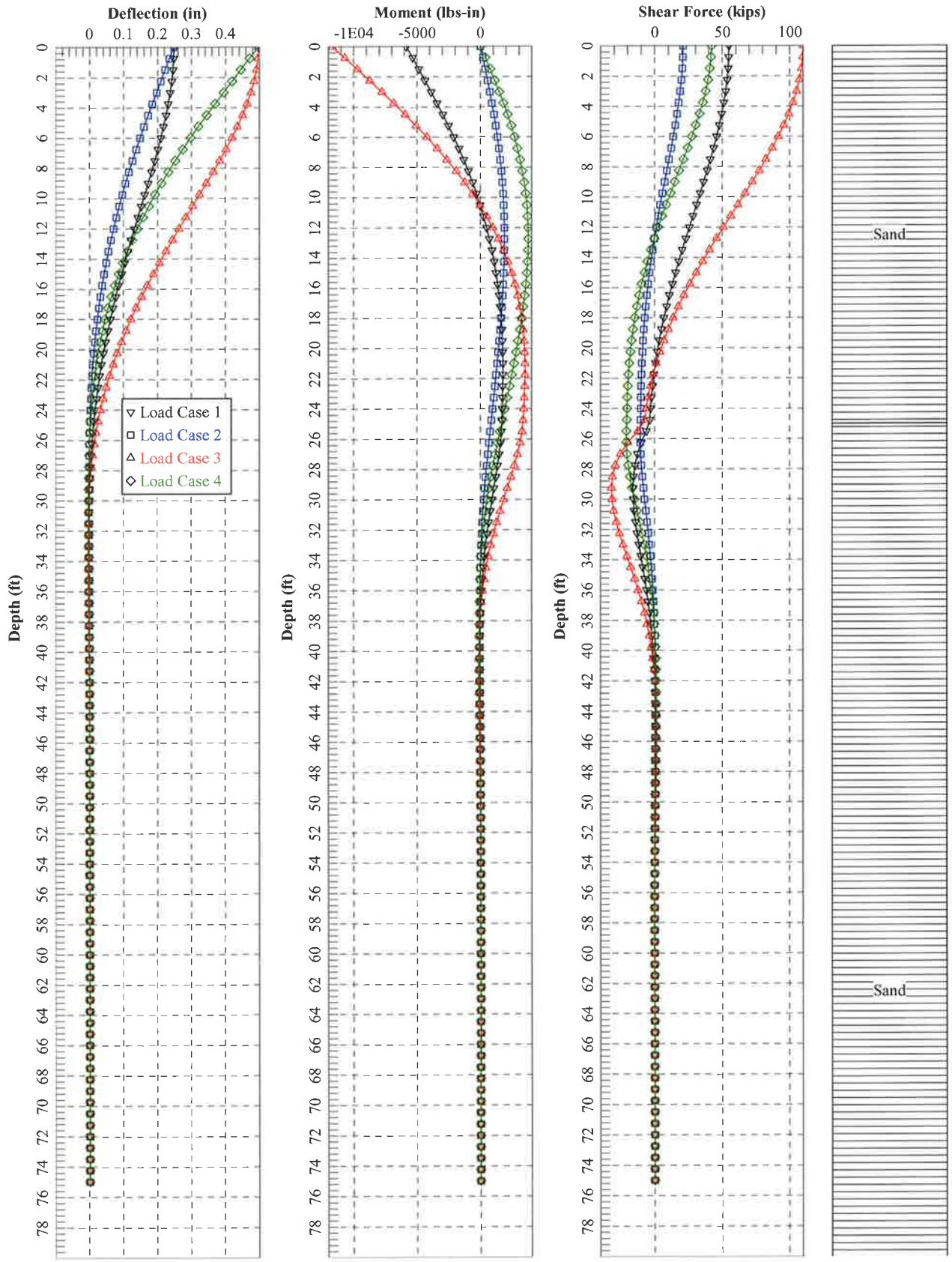
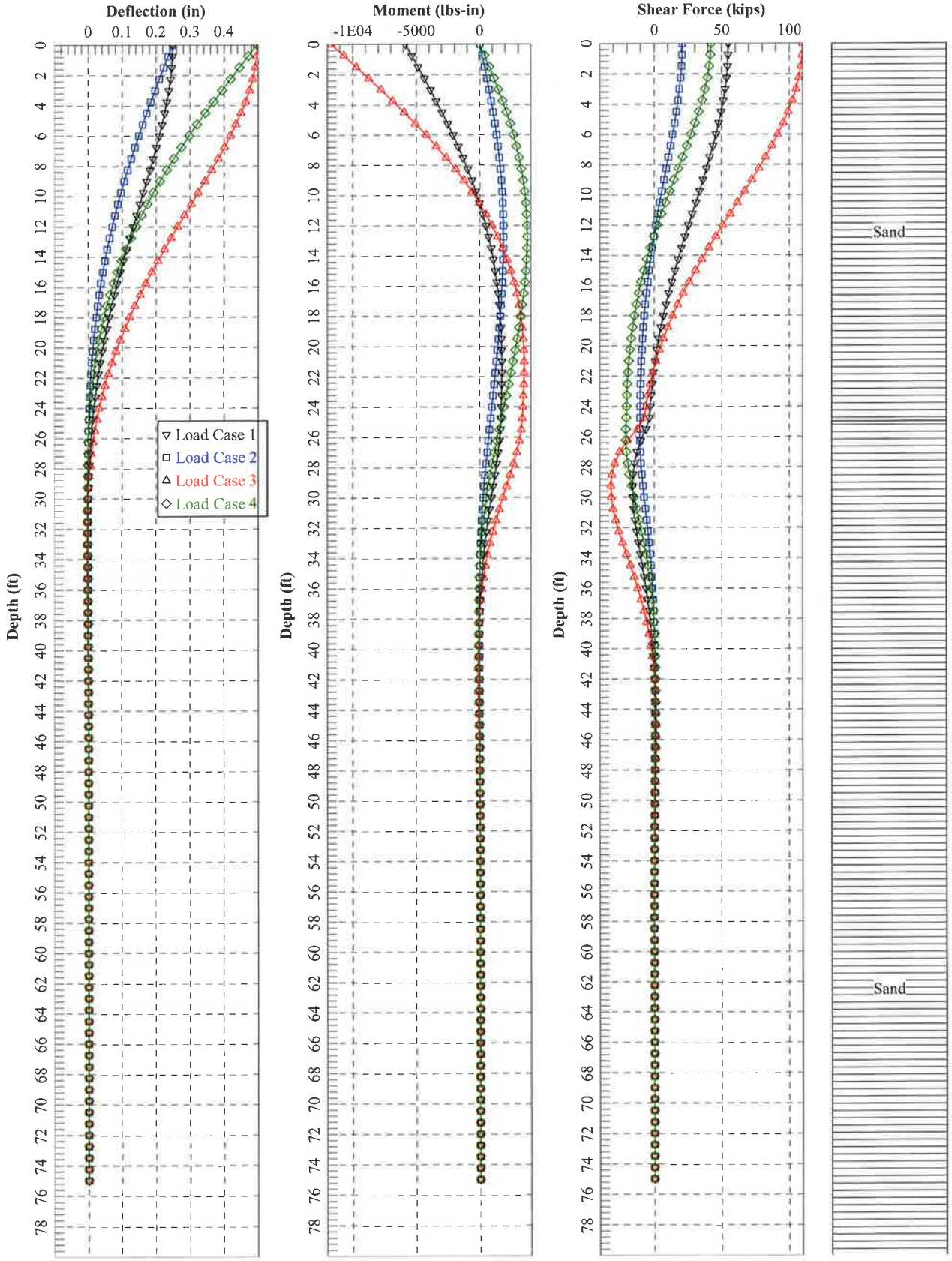
30-inch Shaft, Level Ground



30-inch Shaft, Sloping Ground



36-inch Shaft, Level Ground



36-inch Shaft, Sloping Ground (2:1)