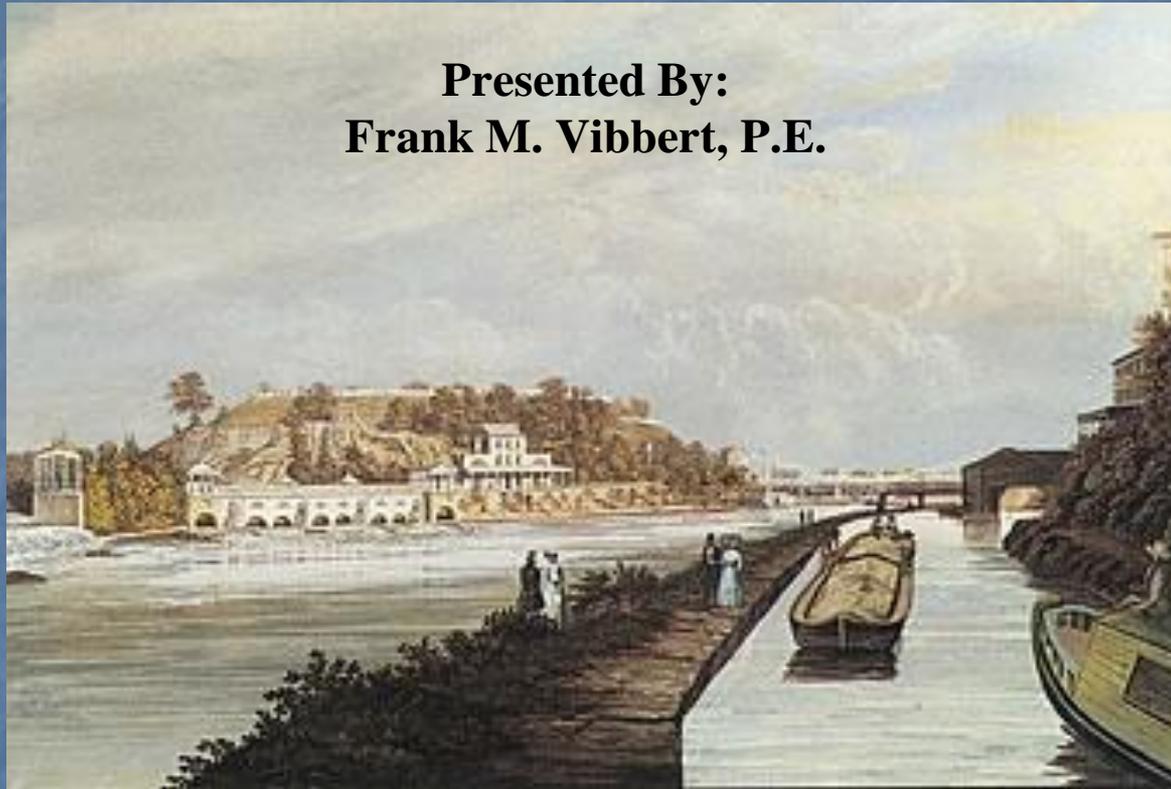


Philadelphia Museum of Art Garage and Sculpture Garden Earth Retention Walls

Presented By:
Frank M. Vibbert, P.E.



Watercolor by George Lehman, 1842

Project Information

Philadelphia Museum of Art

Landscaped Parking Facility and Sculpture Garden

Atkin Olshin Lawson-Bell Architects, Olin Partnership Landscape Architects, L.F. Driscoll Co. Construction Manager



A new sculpture garden is being constructed over a 440-car parking garage on this site. The facility will open in the spring of 2009. Additional information is available at the Philadelphia Museum of Art's website: www.philamuseum.org

Financial assistance from

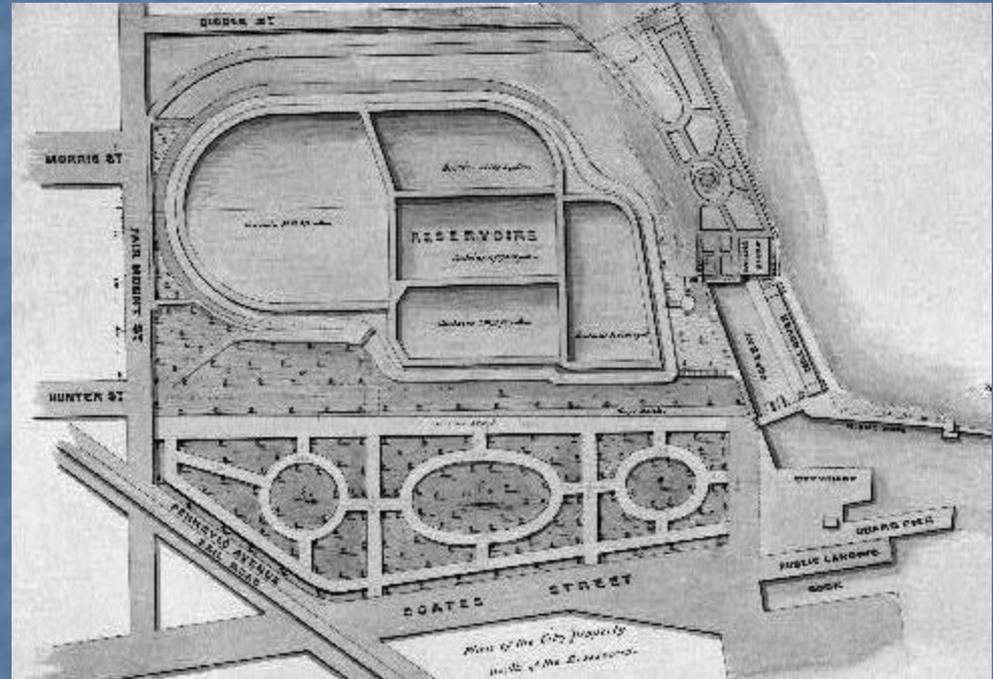
Commonwealth of Pennsylvania
Honorable Edward G. Rendell, Governor

Many Generous Donors



Site History

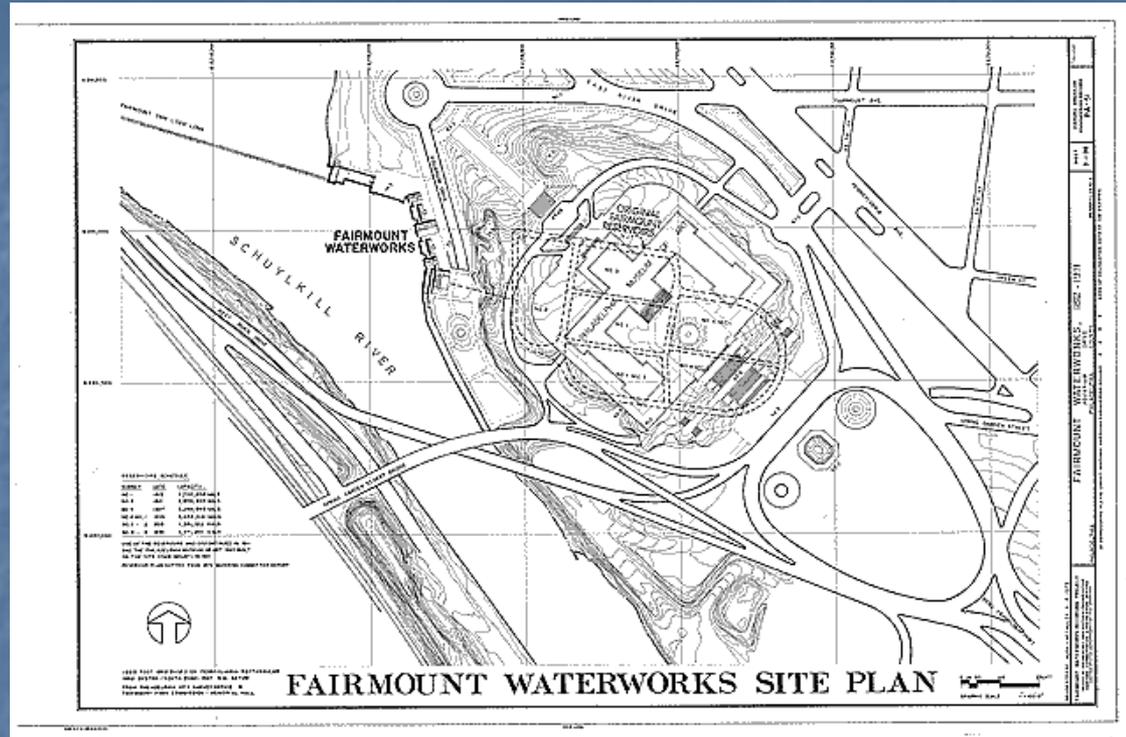
- 1789 - Ben Franklin said “In Philadelphia everyone has a cistern and a well, and the two are becoming indistinguishable.”
- 1790 - Ben Franklin willed the city 100,000 pounds to develop a water supply for the City of Philadelphia
- Engineer, Ben Latrobe recommended tapping the Schuylkill River for water.
- 1801 - Schuylkill River was supplying 63 homes and 4 breweries thru a network of wood pipes.
- 1805 - Frederick Graff set out to design Water Works at Faire Mount.



Reservoir Plan

Site History

- 1812 - Construction of Fairmount Water Works and the reservoir walls began.
- 1821 – Fairmount Dam is completed.
- 1909 - Water Works closes after operating for 94 years due to pollution in Schuylkill River.
- 1924 - Reservoir removed and Philadelphia Art Museum built.



1812 – 1911 Site Plan



2008

Existing Conditions



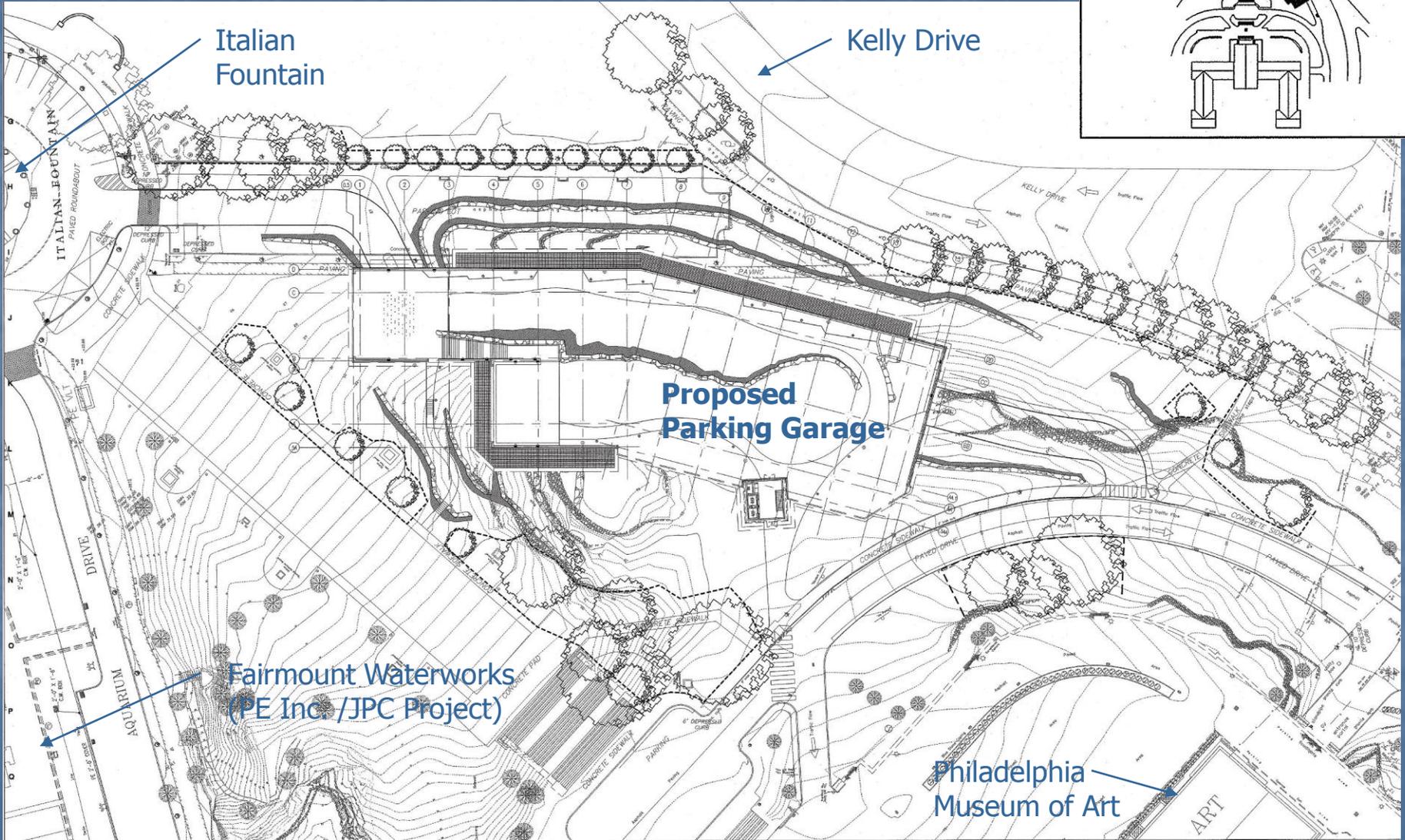
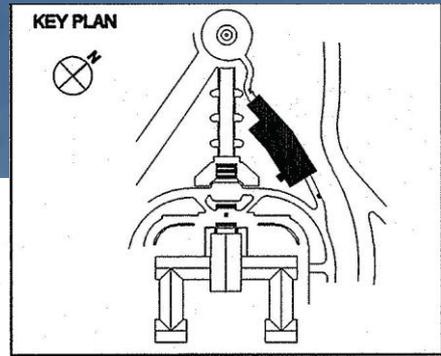
Philadelphia Museum of Art Master Plan

- New underground parking facility with a rooftop sculpture garden
- Located between Azalea Garden and the West Entrance
- 400-440 parking spaces
- Primarily intended for Museum visitor, but others welcome too
- Rejuvenate the declining landscape with new trees, shrubs, and perennial plants
- Transform an underutilized space into a unique destination

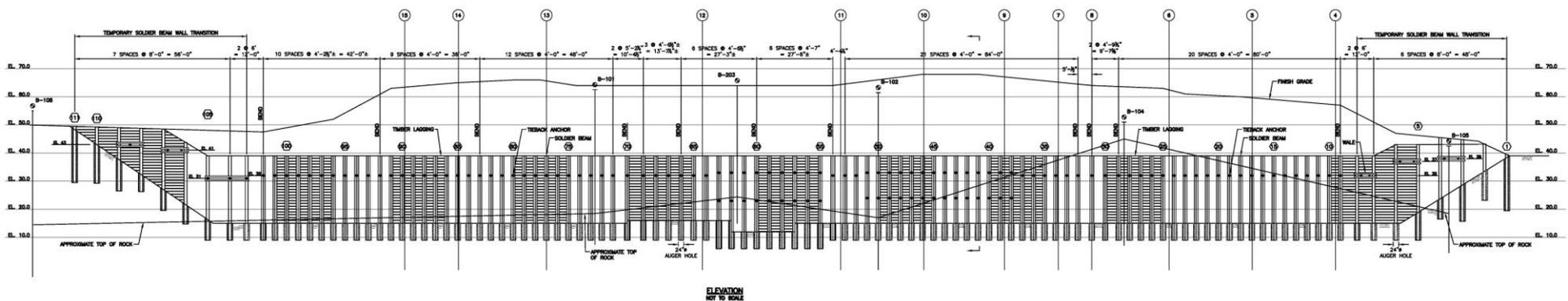
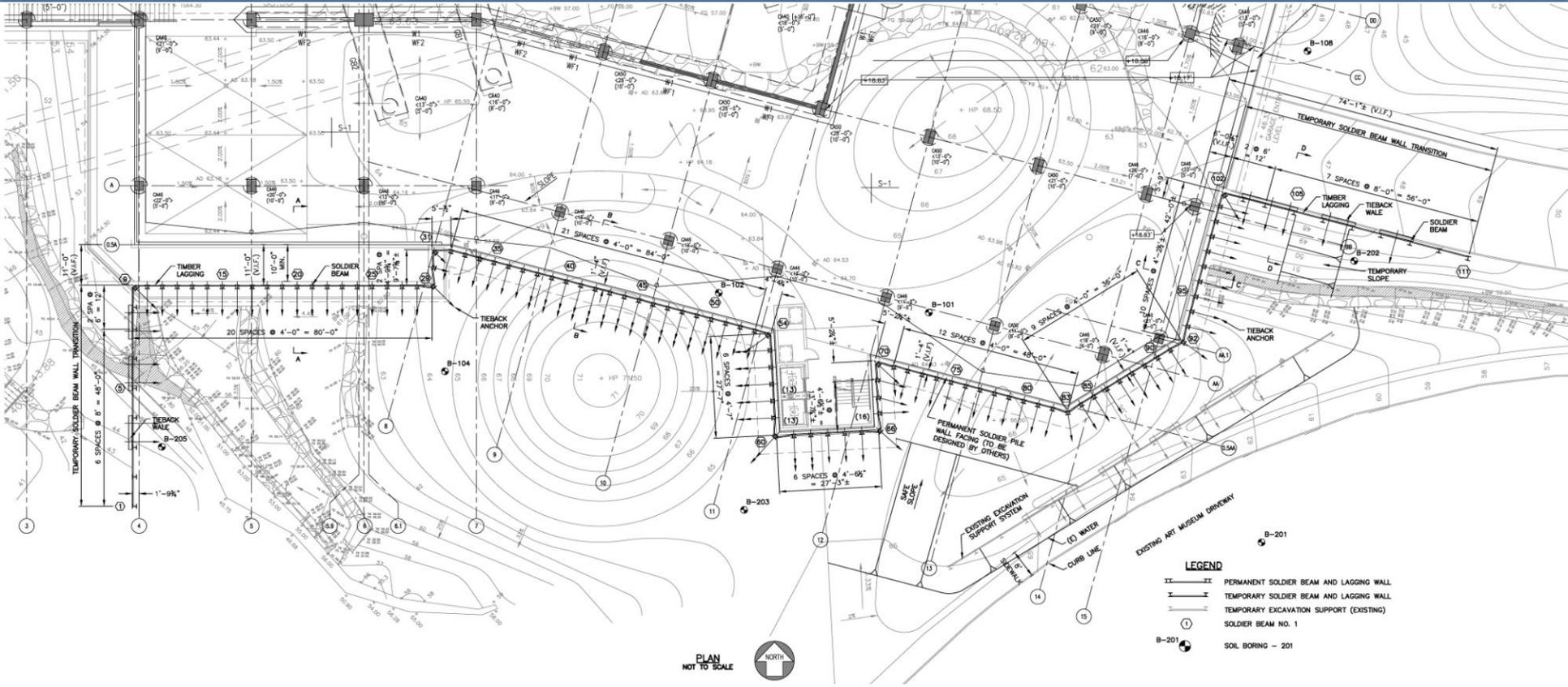


Philadelphia
Museum of Art
West Entrance

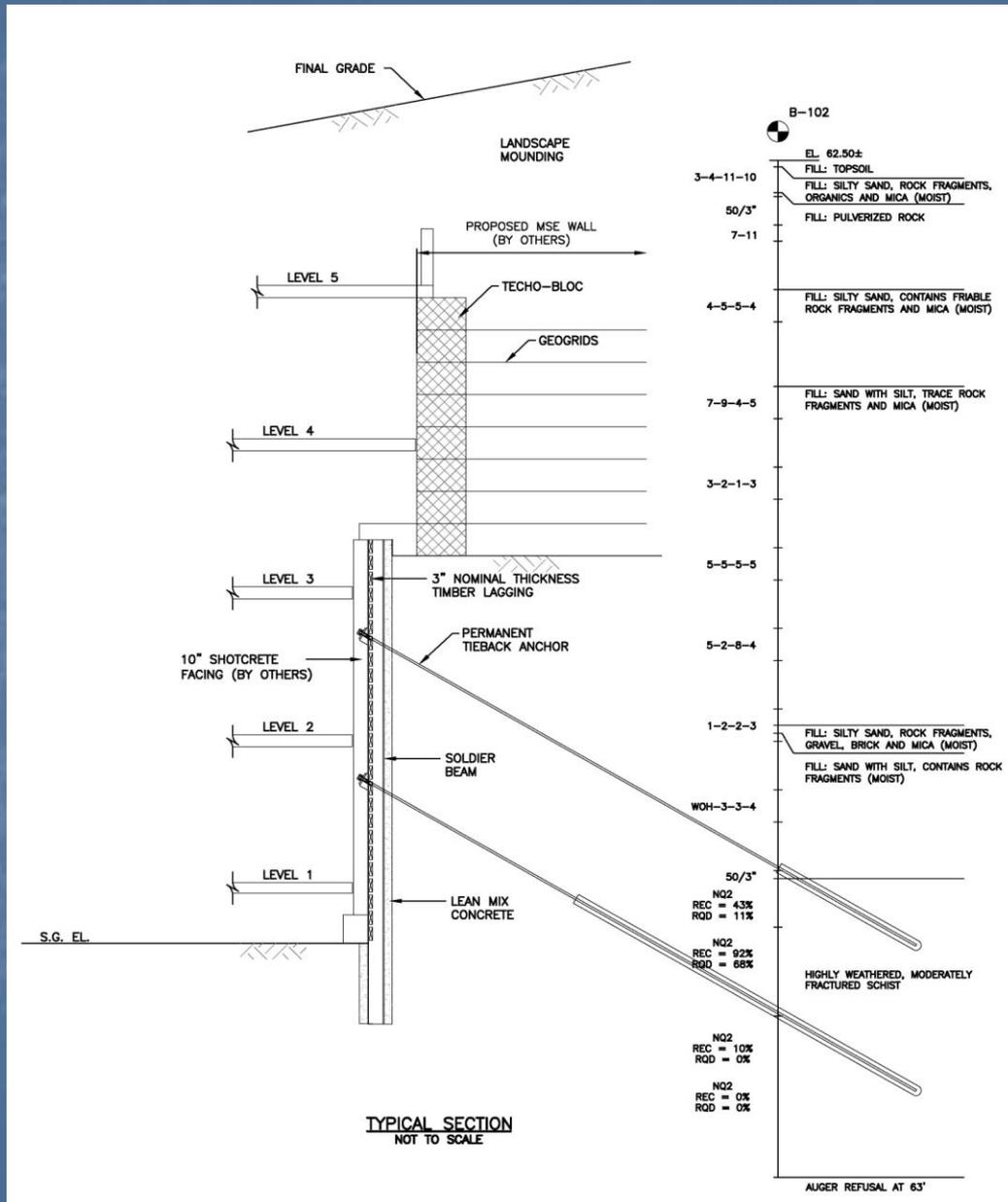
Proposed Site Plan



Proposed Anchored Soldier Beam Retaining Wall Plan

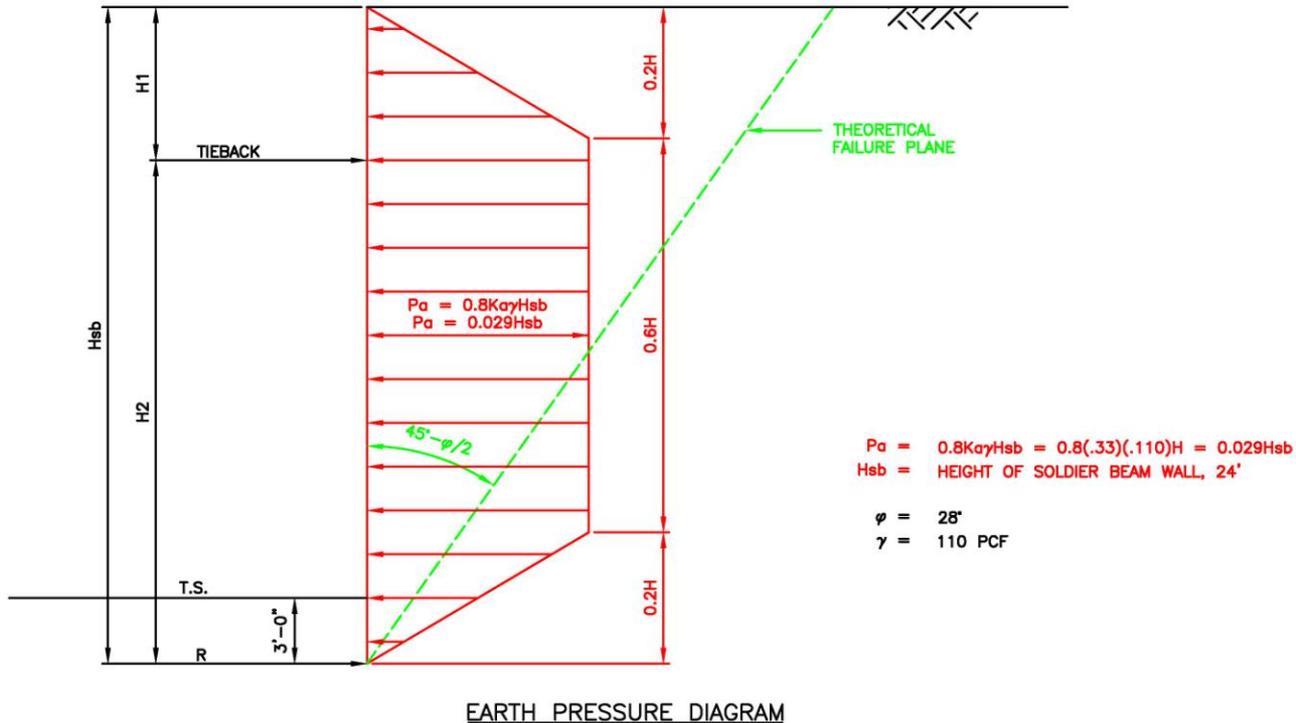


Typical Wall Cross Section

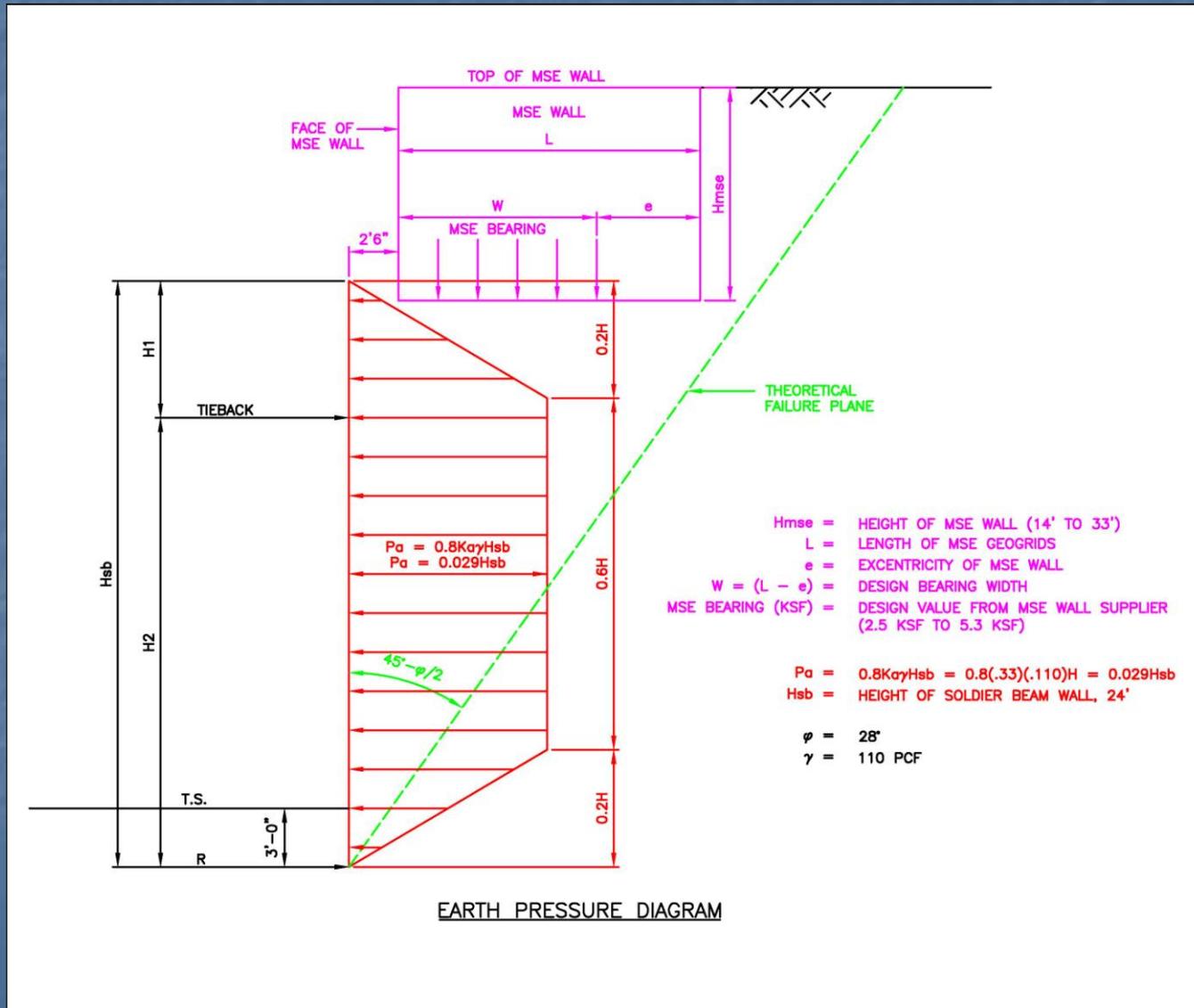


Wall Loading Diagram

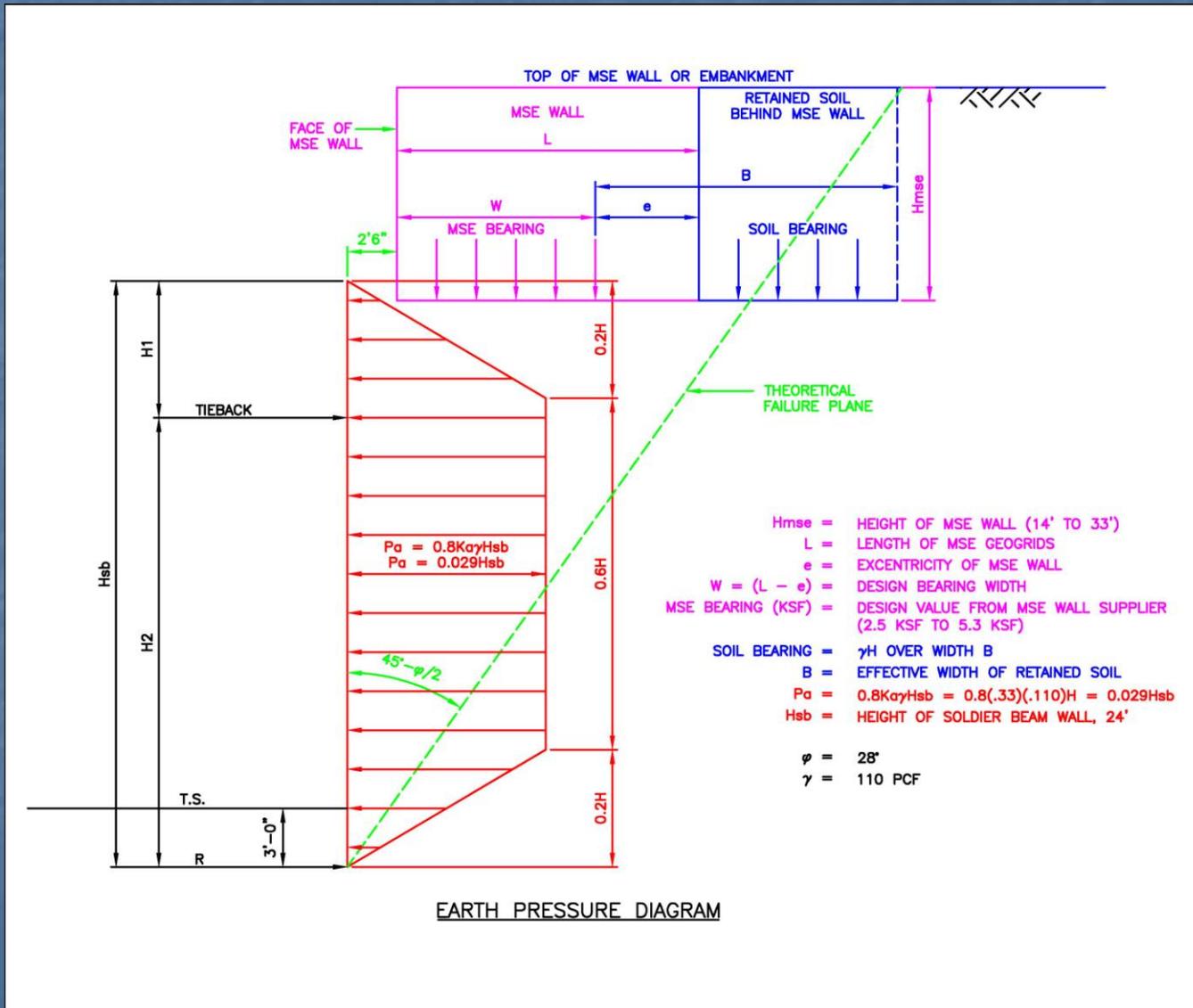
LATERAL EARTH PRESSURES					
DESCRIPTION	Φ	γ (PCF)	$P_a = 0.8K_a\gamma H$	TIEBACK DESIGN LOAD (KIPS) FOR H = 24'	Δ
PMA JOB SPECS.	28°	110	29H	88	+17%
SCHNABEL FND. CO.	-	-	25H	75	-
PADOT (RANKINE)	30°	125	33H	99	+32%
COMMON (COULOMB)	34°	120	24.5H	74	-1%



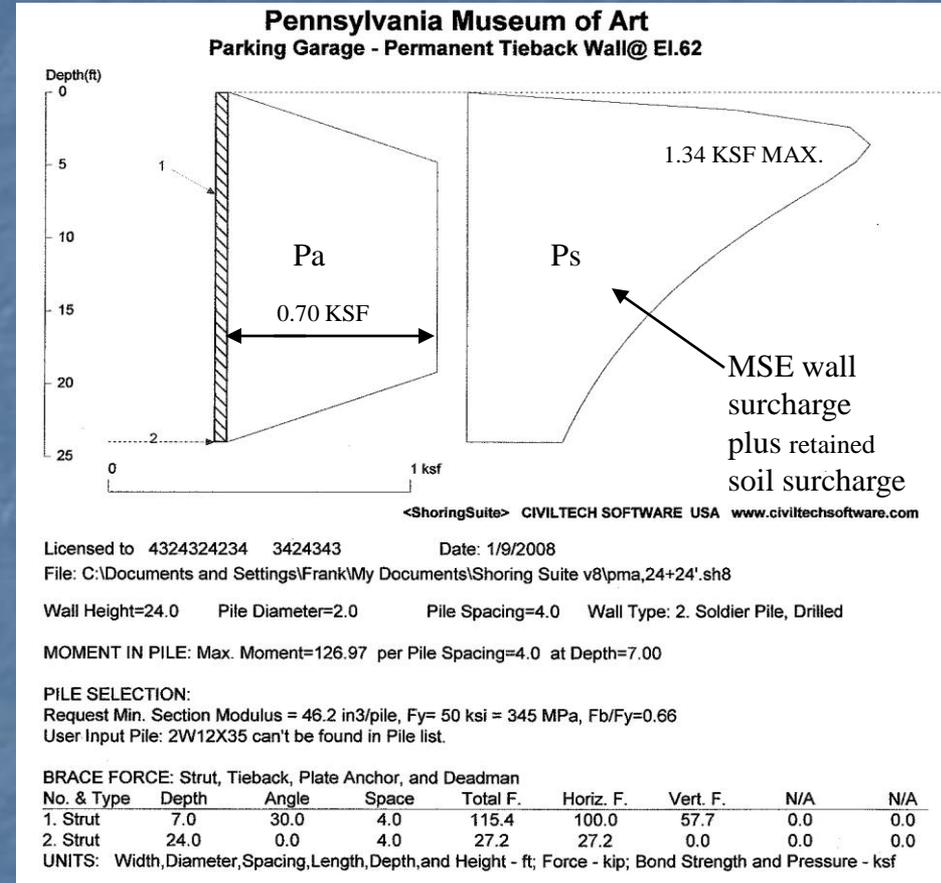
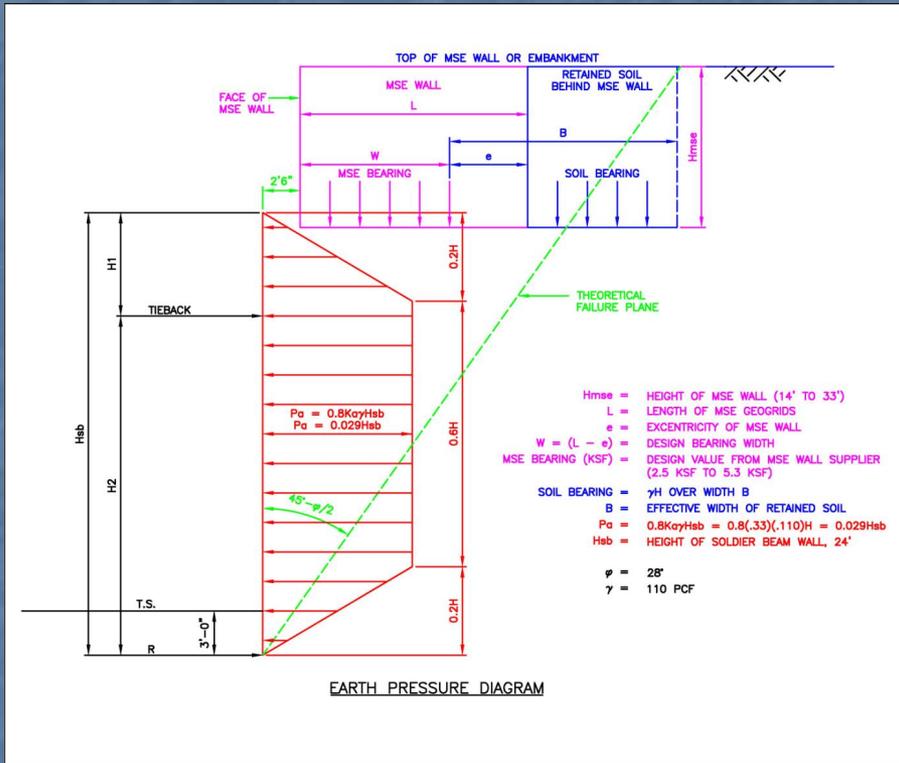
Wall Loading Diagram



Wall Loading Diagram



Wall Loading Diagram



Shoring Suite, V8 by Civil Tech

Drilling Begins

- Drilling begins on July 5, 2007 for temporary excavation support along the museum driveway.



Temporary Excavation Support

- Temporary excavation support required along Kelly Drive and the Art Museum Driveway in advance of the permanent anchored wall.
- 14 each soldier beams along Kelly Drive.
- 16 each soldier beams along the Museum Driveway
- Tiebacks are installed on temporary excavation support walls.



Drilling Conditions



Soldier Beam Installation



Anchored Soldier Beam Wall Layout

- Soldier beams installed at 4' O.C.
- 94 each permanent soldier beams
- 17 each temporary soldier beams



Soldier Beam Installation

- Double W12x35 soldier beams, $F_y = 50$ KSI
- 24" diameter drill holes
- Lean mix concrete or flowable fill, $F'_c = 100$ PSI minimum



Timber Lagging Installation

- 3” nominal thickness timber lagging, untreated, mixed hardwoods
- Tucked behind front flanges
- Louvers



Timber Lagging Installation



Tieback Installation

- 12 each Temporary Tieback Anchors
- 117 each Permanent Encapsulated Tieback Anchors
- Design Loads
 - Upper Tier 69 - 140 Kips
 - Lower Tier 53 - 69 Kips
- 0.6" diameter, 270 KSI, polystrand tendons, ASTM A416
- Double channel wales, A572



Tieback Installation



Tieback Installation



Casing Pipe



Drill Bits

Tieback Installation – Drill Hole Size



Retracted Drill Bit

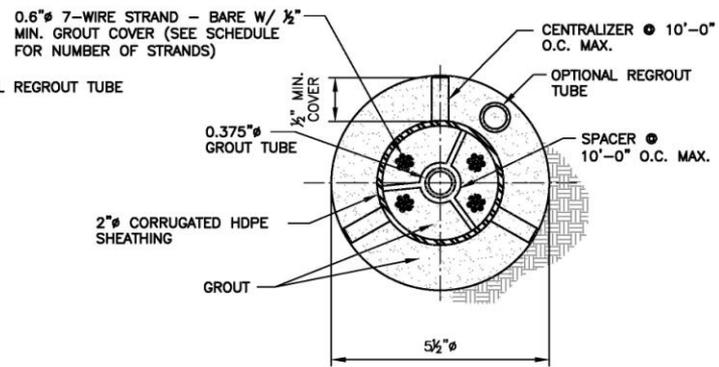
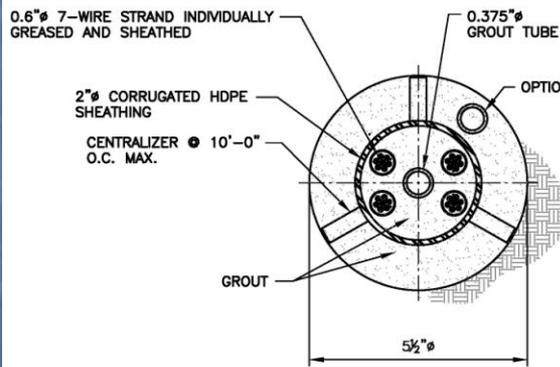


Expanded Drill Bit

Tieback Installation



Trumpet

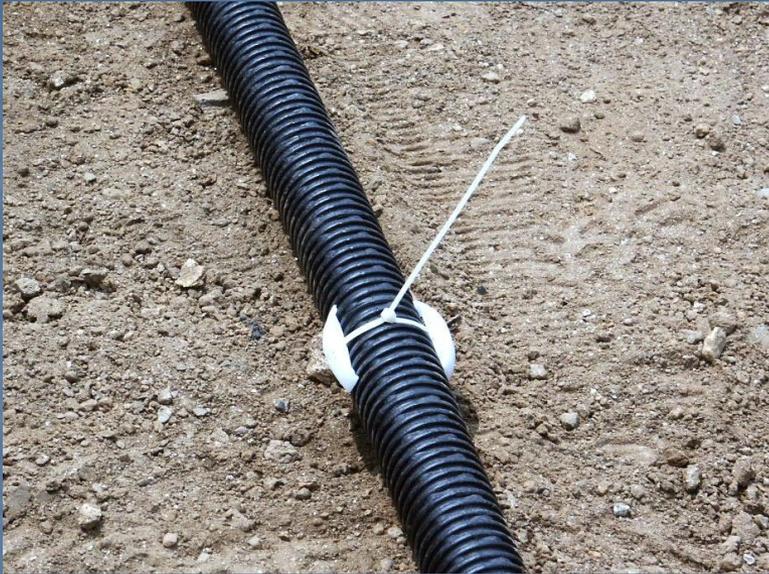


NOTE:
 USE 4 STRAND TENDONS FOR UPPER OR SINGLE ROW TIEBACK ANCHORS
 USE 3 STRAND TENDONS FOR LOWER OR 2ND ROW OF TIEBACK ANCHORS

UNBONDED LENGTH SECTION
 NOT TO SCALE

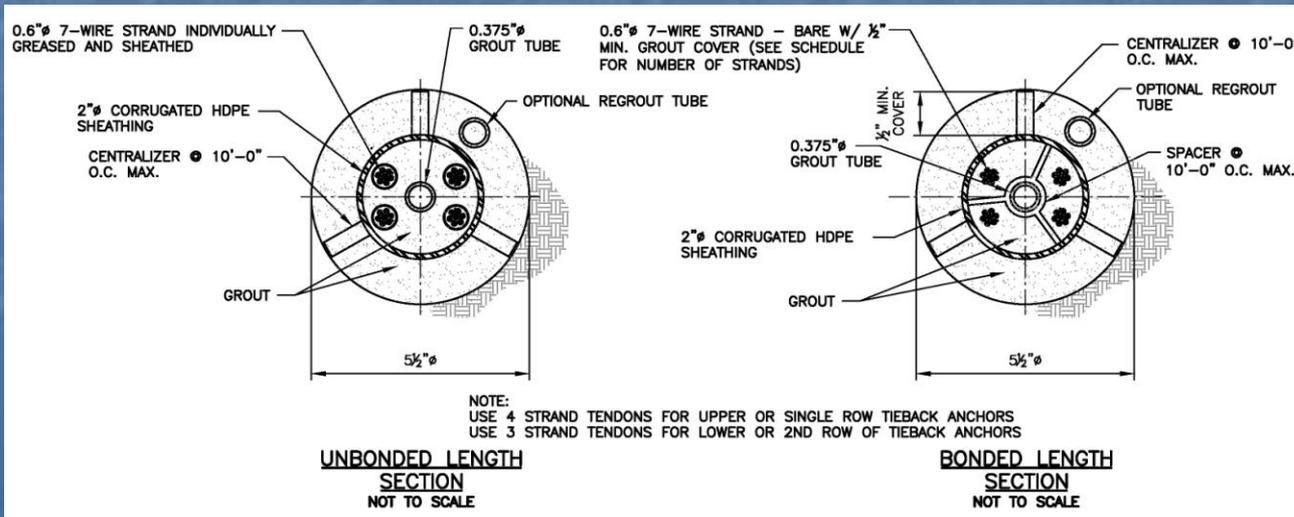
BONDED LENGTH SECTION
 NOT TO SCALE

Tieback Installation



Centralizer

Regrout tube



Tieback Testing



- Performance test
- Proof test
- Jack capacity
- Independent reference point

Locked-off Tieback

- Design Load = DL Kips
- Maximum Test Load,
 $TL = 133\% \times DL$
- Lock off Load, $90\% \times DL$
or $50\% \times GUTS$
- Testing each tieback
anchor tests the entire
system.



Constructability



Drill Rig Access

A tight fit at the elevator area!

Constructability



Coordination



Elevation



Elevation



Elevation



Wall Drainage



Wall Facing Reinforcement



Shotcrete Wall Facing



Shotcrete Wall Facing



October 5, 2007

Shotcrete Wall Facing



October 9, 2007

Completed Wall Facing



November 14, 2007

Completed Wall Facing



December 4, 2007

MSE Wall



MSE wall construction begins along Kelly Drive

Techo-Bloc Monumental Blok



Front Elevation



Side Elevation

MSE Wall Installation



Architect's Model



**Anticipated Completion
Winter 2009**

Any Questions?



Any More Questions?



**Thank you.
See you next month!**

