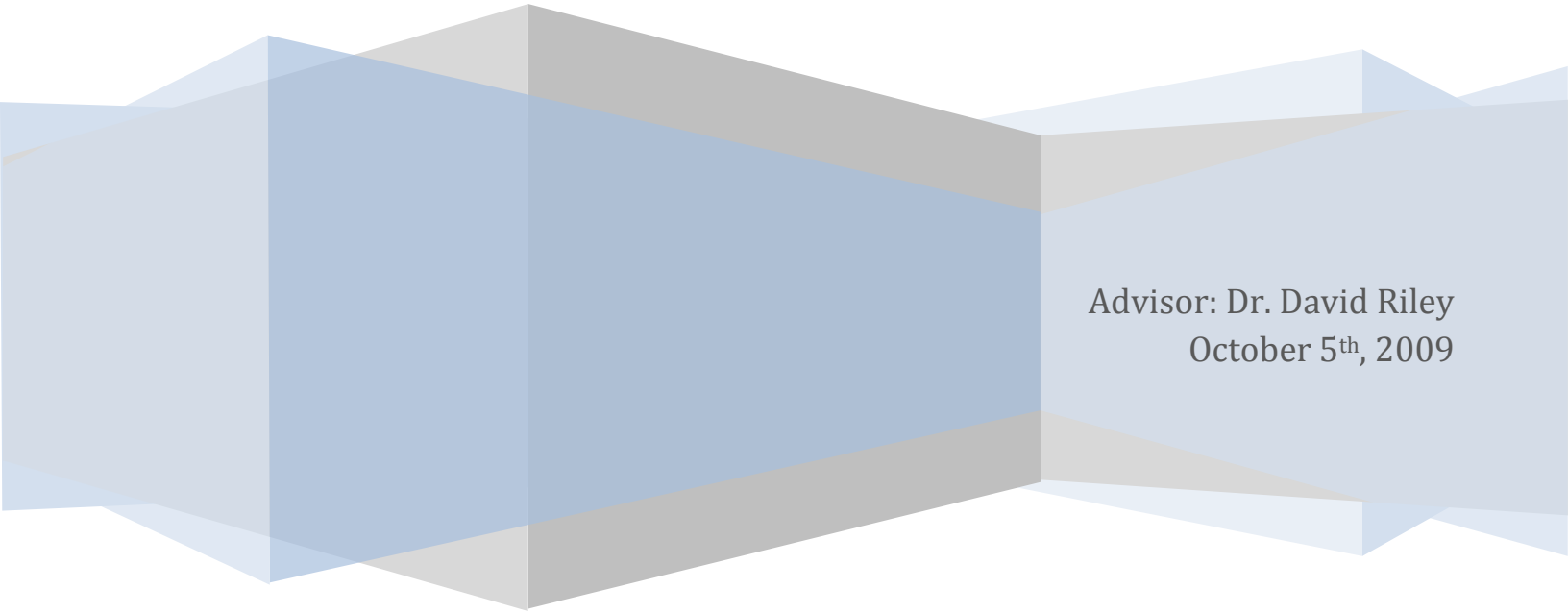
Westinghouse Electric Company
Nuclear Power Engineering Campus

Technical Assignment 1

Construction Project Management

Mark Speicher



Advisor: Dr. David Riley
October 5th, 2009

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EXECUTIVE SUMMARY

Technical assignment 1 looks at the existing conditions of the Westinghouse Electric Company's Nuclear Power Engineering Headquarters Campus site. Such aspects as the project's cost and schedule will be looked at, as well as the local conditions, client information, and project delivery system among others.

The building owner, Wells Reit II, a development company, is constructing the campus for Westinghouse Electric Company who will occupy the building on a 15 year lease. Westinghouse Electric Company was growing and unable to hold their employees in their current offices. They decided on locating a new office on an 83 acre site in Cranberry Township, PA. The campus will become the new office location for over 4,000 engineers.

The campus consists of 3 buildings. Building One will be the largest of the three at approximately 460,000 square feet. In addition to office space, Building One consists of a fitness center, data center, kitchen, and a cafeteria. Buildings Two and Three are smaller at approximately 230,000 square feet and primarily hold just office space. Detailed data was only available for Building One. Therefore, this technical assignment will focus more on this building. Some data including the cost will look at the campus as a whole. Others, such as the schedule, focus more on Building One. The building systems summary data was taken from information gathered from Building One, but is applicable to the other buildings.

Turner Construction was awarded the project and began work in February 2008. The project will be constructed in three phases; one phase for each of the three buildings. Building One was completed in May 2009 and is currently occupied while construction is continues on Buildings Two and Three. The campus should be completed in its entirety by May 2010.

PROJECT SCHEDULE SUMMARY

The design was completed when Turner Construction Company was awarded the project. Turner bid the project as separate Guaranteed Maximum Price contracts for each of the three buildings. Only the schedule for Building One was supplied by Turner. Therefore, the focus will be on Building One, the main building. Turner began construction on this building on February 11, 2008. At this time mobilization began on the caissons and the foundations as well as excavation for access roads and ramps.

The first four months was spent working on the substructure. During this time the caissons, foundation walls foundation waterproofing, underground utilities, and slab on grade were begun. Construction on the superstructure did not begin until June 4th with the start of structural steel, process which was not completed for five months on November 4th. Other tasks were also being performed during this time. The slab-on-deck, exterior framing, MEP rough-in, and the roof are all examples of activities which were being performed while the structural steel was not yet completed.

When Turner was awarded the project, they only provided a bid for the core and shell of the building. The interior work was to be designed as per the tenant's request, with the tenant being Westinghouse Electric Company. Work on the Tenant's Improvements began in October of 2008. Substantial completion of the core and shell occurred in March of 2009; however, the Tenant work was not completed until almost two months later on May 6, 2009. At this time, Building One was ready to be occupied.

A summary of the schedule can be found on the next page. A copy of the Microsoft Project file in which the summary was taken can be found in Appendix A.

No.	Activity	Duration	Start	Finish
1	Start Construction	0 days	2/11/2008	2/11/2008
2	Mobilization	0 days	2/11/2008	2/11/2008
3	Footer Excavation	30 days	2/18/2008	3/28/2008
4	Caissons	15 days	2/18/2008	3/7/2008
5	Foundation Walls	80 days	3/17/2008	7/4/2008
6	Underground Utilities	35 days	3/31/2008	5/16/2008
7	Slab on Grade	114 days	4/28/2008	10/2/2008
8	Foundation Waterproofing	114 days	5/8/2008	10/14/2008
9	Structural Steel Start	0 days	6/4/2008	6/4/2008
10	Slab on Deck	90 days	7/16/2008	11/18/2008
11	Exterior Framing	75 days	8/20/2008	12/2/2008
12	MEP Rough In	135 days	8/21/2008	2/25/2009
13	Start Roof	0 days	8/21/2008	8/21/2008
14	Metal Panels	75 days	9/17/2008	12/30/2008
15	Glass and Glazing	85 days	9/17/2008	1/13/2009
16	Start Tenant Improvement Work	0 days	10/1/2008	10/1/2008
17	Elevator Install	65 days	10/6/2008	1/2/2009
18	Structural Steel Erection Complete	0 days	11/4/2008	11/4/2008
19	MEP/FP Finishes	90 days	11/3/2008	3/6/2009
20	Roof Complete	0 days	12/2/2008	12/2/2008
21	Substantially Complete Core and Shell	0 days	3/20/2009	3/20/2009
22	Finish Tenant Improvement Work	0 days	5/6/2009	5/6/2009

Figure 1: A summary schedule for Building One. See Appendix A for MS Project file.

BUILDING SYSTEMS SUMMARY

Yes	No	Work Scope
	X	Demolition Required
X		Structural Steel Frame
X		Cast in Place Concrete
	X	Precast Concrete
X		Mechanical System
X		Electrical System
X		Masonry
X		Curtain Wall
X		Support of Excavation

Table 1: Building systems summary checklist.

Structural Steel Frame:

The structural system of the buildings on the Westinghouse Campus is a primarily a steel framing system. The columns are typically spliced in two places with typical sizes of W14x211, W14x120, and W14x11 as you move from the basement to the roof. The steel girders are typically W24x55 with W18x55 beams creating a bay size of 8' x 24'. On top of the beams is a 2", 22 gauge composite deck .

Cast in Place Concrete:

- 5" slab on grade in basements
- 2 ½" lightweight concrete slabs on upper floors
- The entire building is supported by a caisson foundation system. The caissons were placed anywhere from 12 to 20 feet deep and vary in size from 36 to 84 inches.

Mechanical System:

The mechanical system of the building consists of four air handling units (AHUs) located in the mechanical penthouse and 3 air conditioning units (ACUs) located in the basement. Together these units deliver almost 300,000 CFM. The ACUs are used to cool the mechanical and electrical spaces in the basement, whereas the AHUs are used to cool the spaces on the occupied floors (1 through 5). The air is circulated through the space using fan powered boxes and distributed to variable air volume boxes. These boxes control the amount of air to actually enter the space depending on user controlled thermostats in each zone.

Electrical System:

- 480Y/277V, 3 phase, 4 wire main supply
- Main electrical room located in the basement
- Two 3,000 amp main distribution switchgears
- Two 1,500 kVA transformers

Masonry/Curtain Wall:

The exterior of the building is a combination of an aluminum curtain wall system, aluminum windows, and polished concrete block.

Support of Excavation:

Excavation was necessary with each building having a basement, however no information was provided on how the excavation was supported.

PROJECT COST EVALUATION

On February 25, 2009 the reported cost of the Westinghouse Headquarters Campus by Turner Construction Company was $134,000,000. The number has increased dramatically since that time. Currently, the reported cost of the campus is $240,000,000. With the increase, the **Total Project Cost/Square Foot = $284/sf.** The increase is mostly due to the Tenant Improvements which were not originally planned for. For example, Westinghouse called for twice the amount of restrooms as was required and planned for.

Building systems cost was not included in the information from the contractor. Values were obtained using information from R.S. Means and will be treated as actual costs until the information is received.

Building Systems Cost Calculations

		% of Subtotal	Cost
Structural			
Substructure		2.1%	$3,825,753
Superstructure		19.0%	$34,613,957
Exterior Enclosure		15.3%	$27,873,345
Roofing		0.5%	$910,894
	Total	36.9%	$67,223,949
Mechanical			
	Total	12.3%	$22,407,983
Electrical			
	Total	15.1%	$27,508,987

In order to evaluate this project cost a square foot estimate was developed using RS Means and D4 Cost software. These estimates are represented below.

D4 Cost Software:

D4 Cost software provides the user with an estimate based on previously built projects. Similarities are found between these projects and the user's project and a "smart averaging" tool is used. At the same time D4, adjusts for location and square footage to better represent the cost. Upon completion of the "smart averaging" tool, a report is produced which provides a CSI division breakdown of the cost, as well as a total building cost.

To estimate the cost of the Westinghouse project, three other projects which shared properties with the Westinghouse campus were averaged together. These projects included the Ha-Lo Headquarters, Infonet Corporate Headquarters, and the Rio San Diego Plaza.

Project	Use	Size	No. of Floors	Bldg. Cost
Ha-Lo Headquarters	Office	267,334 sq ft	7	$ 37,643,382
Infonet Corporate Hedquarters	Office	156,000 sq ft	3	$ 20,777,000
Rio San Diego Plaza	Office	198,000 sq ft	6	$ 11,209,795

Table 2: Properties of projects selected to complete D4 estimate.

These projects share other features besides their use as office buildings. The features include:

- New construction projects
- Curtain walls
- Concrete floors
- Membrane roofs
- Caisson foundations

As was previously stated, D4 adjusts for location and square footage. Pittsburgh was inputted as the project location and 844,595 square feet was inputted as the total square footage. The smart averaging tool was then used.

The D4 software calculated a Total Building Cost estimate of $179,552,529 or a $212/sf value. This is approximately 75% of the value reported by Turner. Reasons for this difference could be a result of the amenities added by Westinghouse. As was the case with the original estimate Turner provided, the additions were not accounted for within the software. A complete Statement of Probable Cost provided by D4 can be found in Appendix B of this report.

R.S. Means Square Foot estimate:

To obtain an estimate for the Westinghouse buildings, the project was likened to a 5-10 story office building from R.S. means. Complete data for this building type can be found in Appendix C. The calculation of the estimate is as follows.

Building Values	
Square Footage	844,595
Perimeter	3,062
Story Height	14
Basement Square Footage	189,409
No. of Elevators*	4

**Building One only*

Estimate Calculations					
Cost/Square Foot					
Base cost				=	$146
Perimeter Adjustment					
(3062/100)	*x*	$	1.90	=	$58
Story Height Adjustment					
2	*x*	$	1.05	=	$2
					$207
Cost					
844595	*x*		$207	=	$174,601,435
Basement Cost					
189409	*x*	$	36.40	=	$6,894,488
Common Additives (Elevators)					
4	*x*	$	170,700	=	$682,800
			Subtotal		$182,178,723
			Location Factor		0.96
			TOTAL		**$174,891,574**

Values used for the calculations and the tables they came from can be found in Appendix C.

Assumptions:

- Building type- M.470, Office, 5-10 story
- Exterior wall type- Face Brick with Concrete Block Back-up/Steel Frame
- Square Foot Cost, Perimeter Adjustment, and Story Height Adjustment values for 300,000 sq ft. building were used (no extrapolation).

This estimate is close but less representative than the estimate created using the D4 Cost software. R.S. Means gives a cost/square foot value of $207/sf. There are several possible sources of deviation. First, the value obtained using R.S. Means does not include any contractor or architects fees. Therefore, this number represents just the construction costs rather than the total project cost. Also, R.S. Means did not have values associated with a curtain wall system which the Westinghouse buildings primarily are. As mentioned above in the D4 section, the Westinghouse tenant improvements also drove the costs past what would be the typical numbers produced in R.S. Means. This is the most likely source for a high percentage of the difference.

SITE PLAN OF EXISTING CONDITIONS

LEGEND

- New Construction
- Existing Buildings
- Ponds
- Dry Ponds
- Sanitary Lines
- Gas Lines
- Water Lines
- Fire Hydrants

1 Building One
434,803 sq ft
5 Stories

2 Building Two
204,896 sq ft
4 Stories

3 Building Three
204,896 sq ft
4 Stories

Westinghouse Electric Company
Nuclear Power Engineering
Campus

Site Plan of Existing Conditions

Mark Speicher | 10/5/2009

LOCAL CONDITIONS

The Westinghouse Headquarters Campus is located 20 miles north of Pittsburgh in Cranberry Township, PA. The campus is conveniently located off of both Interstate-79 and the Pennsylvania Turnpike (Interstate-76). The campus is now served by Cranberry Woods Drive which extends off of Route 228 (see Figure 1 below).

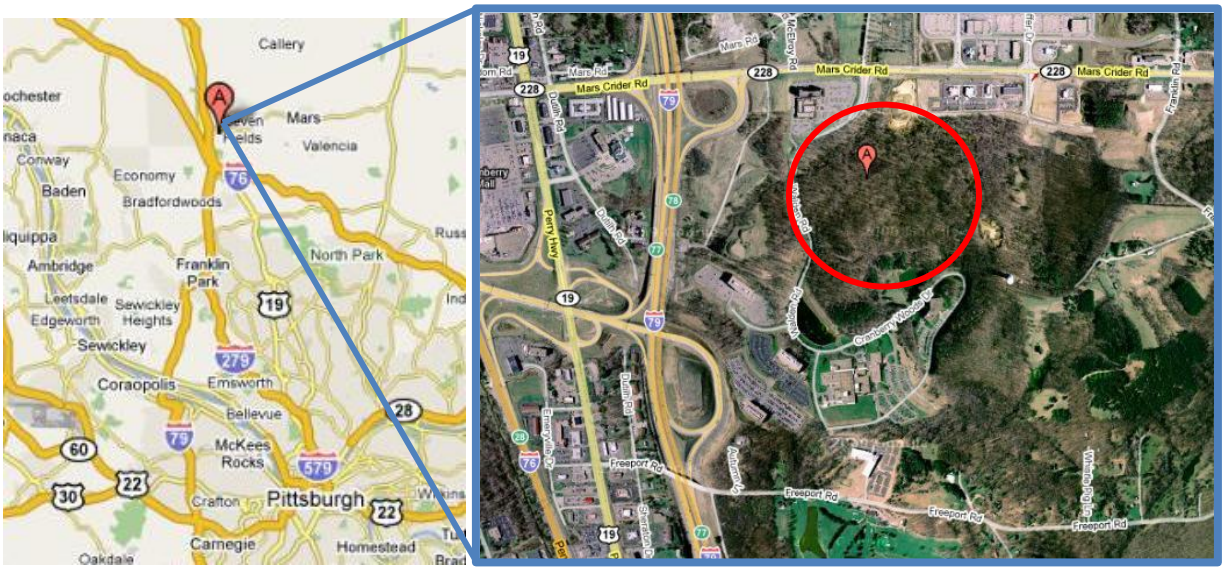


Figure 2: Map of site's location in western PA and an enlarged aerial view of the site prior to construction.

Historically the Pittsburgh area has been known for the production of steel. Although the amount of steel produced in the area has decreased steel is still the material of choice.

Due to the somewhat isolated site location logistics were not much of an issue. There was space available for not only Turner Construction to have on-site office trailers, but also for many of the subcontractors to as well. These trailers were located in the rear of the building. On-site parking for the workers was also provided in the rear of the building.

A soil survey report was created using the United States Department of Agriculture's (USDA) Web Soil Survey Tool. The majority of the site is covered with Brinkerton silt loam at a three to eight percent slope. A typical profile would be:

- Silt loam: 0 to 8 inches
- Silty clay loam: 8 to 21 inches
- Silt Loam: 21to 42 inches
- Channery silt loam: 42 to 65 inches

According to the soil report, there is no flooding or ponding in areas with Brinkerton silt loam. Other soil types found on the site include:

- Cavode silt loam

- Atkins silt loam
- Ernest silt loam
- Gilpin-Weikert silt loams
- Vandergrift-Cavode silt loams

For a complete list of soils, their properties, and the acres of each included on the site see the attached sheets of the soil report found in Appendix D.

CLIENT INFORMATION

"We pride ourselves on being the landlord of choice to some of the world's greatest companies."

--Wells REIT II

Although Westinghouse Electric Company is the occupant of the headquarters campus, they are not the owner. The 82 acre site was purchased by Wells REIT II. Wells REIT II is a real estate investment trust which specializes in office properties. They own over 61 buildings throughout the United Sates worth over $3 billion. Like the Cranberry Woods property, 98% of their properties are leased. Following the completion of the project, Westinghouse will occupy the property under a 15-year lease.

Because the property is a build-to-suit development, Wells REIT is not the only client to Turner Construction Company. The needs of Westinghouse must also be met. Westinghouse Electric Company is one of the world's top nuclear power companies. They supplied the world's first pressurized water reactor in 1957 in Shippingport, PA. It was very important to the state of Pennsylvania that Westinghouse stayed in the state. With the employment of over 4,000 of the world's top nuclear engineers, Westinghouse provides a major boost to the economy of the Pittsburgh region.

The decision Wells REIT II bought the property was due to the need of Westinghouse to grow. With little room to expand, the Cranberry area not only provided room in the present, but sufficient space for continual growth. Due to the reputation of both Wells REIT and Westinghouse, it is important the campus be constructed with the upmost quality. Also, it was designed to be LEED-certified, again to enhance the reputations of the associated companies.

The building was to be completed in two phases. With the hiring of many new engineers Building One and the need for a place to hold them, Building One was completed in May 2009. Buildings Two and Three are to be completed and ready for more engineers in May 2010.

PROJECT DELIVERY SYSTEM

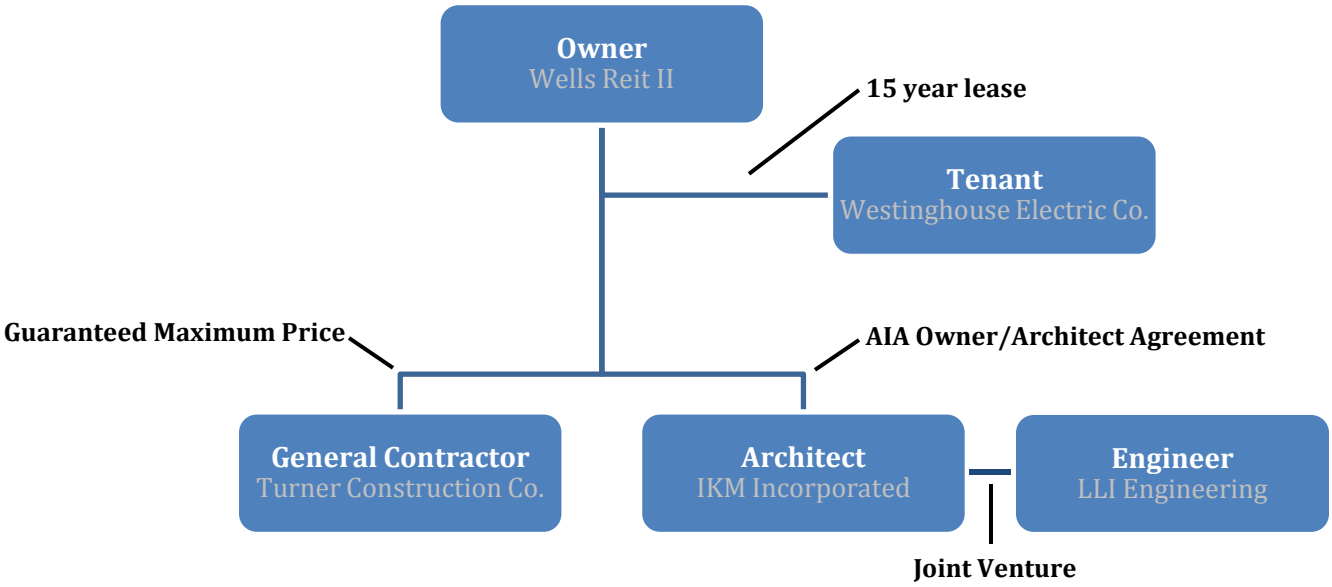


Figure 3: Organizational chart of the project delivery system

Above is an organization chart outlining the project delivery system for the Westinghouse campus which will be a design-bid-build project. Westinghouse Electric Company is holding a 15 year lease with Wells Reit II, the owner. It is Wells Reit II which holds contracts with both the general contractor (Turner Construction Company) and the architect (IKM Incorporated).

Wells Reit II holds an AIA Owner/Architect agreement with LLI/IKM. IKM Incorporated (an architect) and LLI Engineering (general engineering services including structural, mechanical, electrical, and fire protection systems) hold a joint venture contract for the design of the Westinghouse campus.

There are three contracts held between Wells Reit II and Turner Construction, all of which are guaranteed maximum price (GMP) contracts. Because the three buildings on the campus are to be constructed in three phases, it was decided to hold separate contracts for each. A GMP was chosen due to the incomplete design. The design which was bid on was merely the core and shell of the buildings. A complete design was to be coordinated with the needs of Westinghouse Electric Co. and performed later. A GMP contract type allows for the potential of change orders which would most likely occur due to the tenant's improvements.

STAFFING PLAN

A true staffing plan was not able to be obtained from Turner Construction Company. Below you will find a typical staffing plan which was developed through familiarity with the project and past Turner Construction projects. The team is primarily on-site with the exception of the project executive. On-site the project engineers and secretary are primarily in the office, while the field superintendant, safety manager, and field engineer are in the field. The project manager will usually split his time between the field and office.

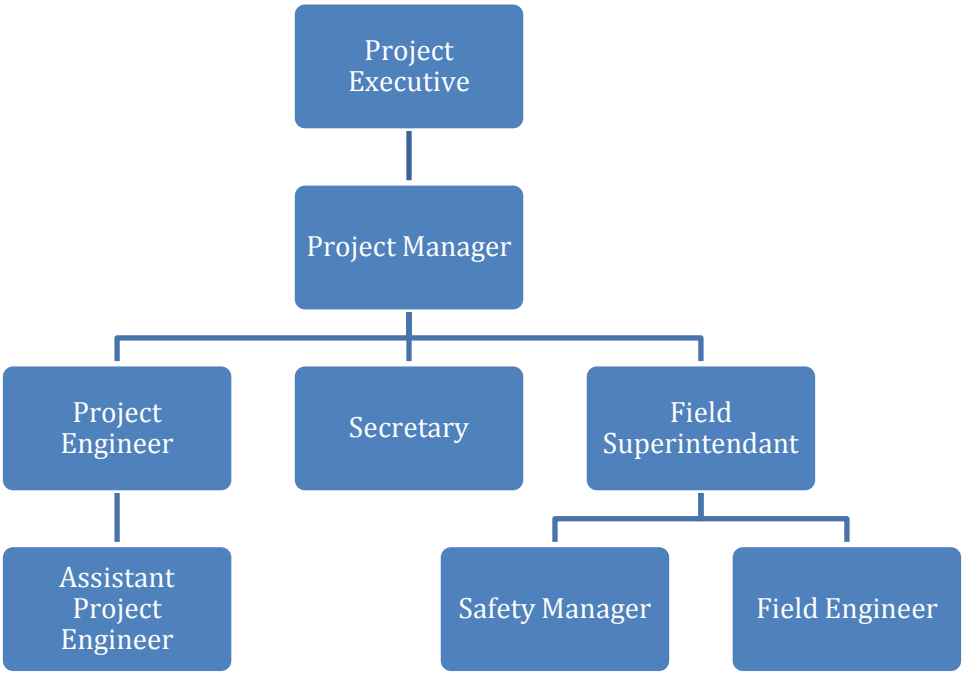
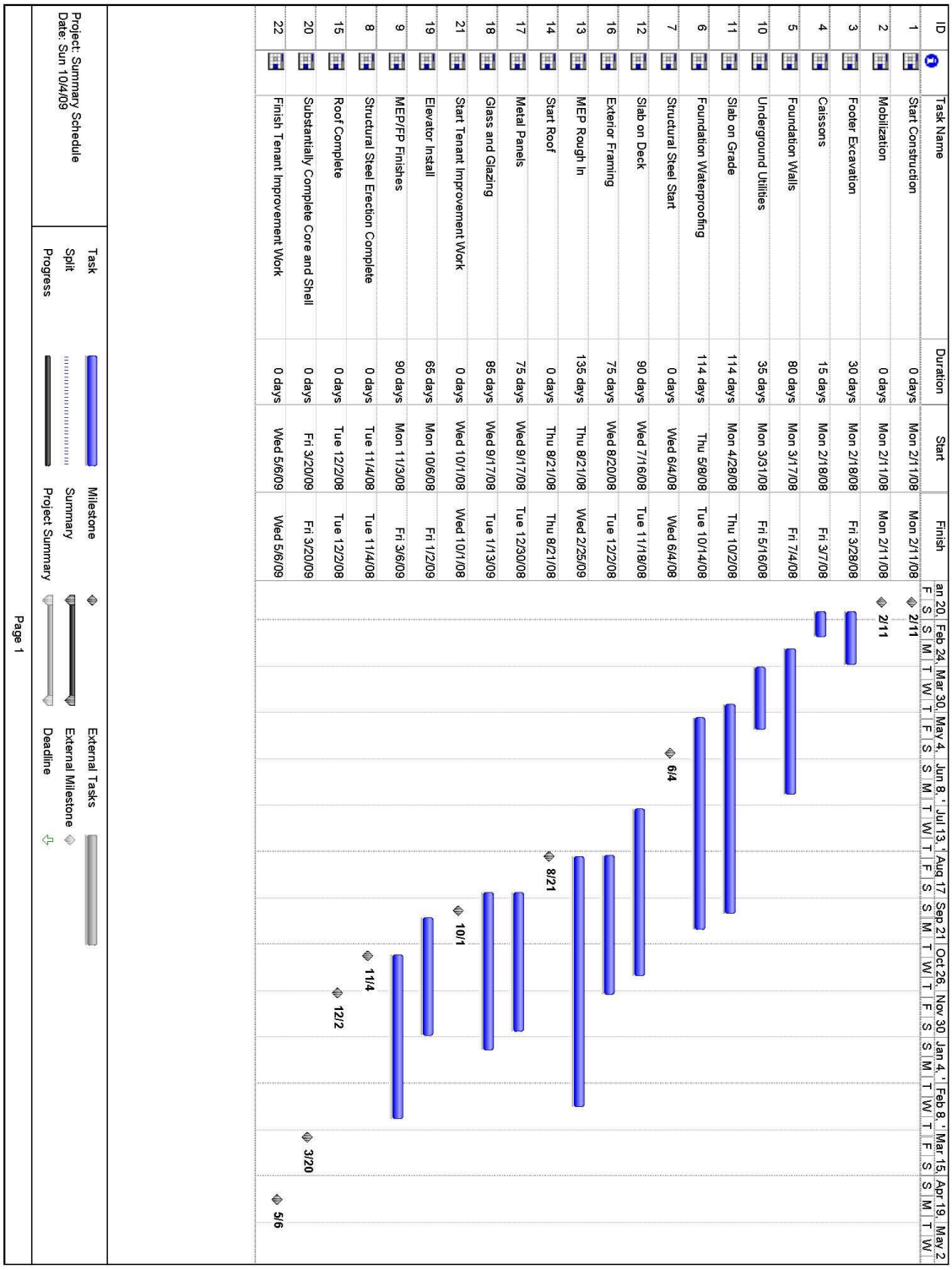


Figure 4: Typical Turner Construction staffing plan

APPENDIX A: MICROSOFT PROJECT SUMMARY SCHEDULE



ID	Task Name	Duration	Start	Finish
1	Start Construction	0 days	Mon 2/11/08	Mon 2/11/08
2	Mobilization	0 days	Mon 2/11/08	Mon 2/11/08
3	Footer Excavation	30 days	Mon 2/18/08	Fri 3/28/08
4	Caissons	15 days	Mon 2/18/08	Fri 3/7/08
5	Foundation Walls	80 days	Mon 3/17/08	Fri 7/4/08
10	Underground Utilities	35 days	Mon 3/31/08	Fri 5/16/08
11	Slab on Grade	114 days	Mon 4/28/08	Thu 10/2/08
6	Foundation Waterproofing	114 days	Thu 5/8/08	Tue 10/14/08
7	Structural Steel Start	0 days	Wed 6/4/08	Wed 6/4/08
12	Slab on Deck	90 days	Wed 7/16/08	Tue 11/18/08
16	Exterior Framing	75 days	Wed 8/20/08	Tue 12/2/08
13	MEP Rough In	135 days	Thu 8/21/08	Wed 2/25/09
14	Start Roof	0 days	Thu 8/21/08	Thu 8/21/08
17	Metal Panels	75 days	Wed 9/17/08	Tue 12/30/08
18	Glass and Glazing	85 days	Wed 9/17/08	Tue 1/13/09
21	Start Tenant Improvement Work	0 days	Wed 10/1/08	Wed 10/1/08
19	Elevator Install	65 days	Mon 10/6/08	Fri 1/2/09
9	MEP/FP Finishes	90 days	Mon 11/3/08	Fri 3/6/09
8	Structural Steel Erection Complete	0 days	Tue 11/4/08	Tue 11/4/08
15	Roof Complete	0 days	Tue 12/2/08	Tue 12/2/08
20	Substantially Complete Core and Shell	0 days	Fri 3/20/09	Fri 3/20/09
22	Finish Tenant Improvement Work	0 days	Wed 5/6/09	Wed 5/6/09

Project: Summary Schedule
Date: Sun 10/4/09

Task · Split · Progress · Milestone · Summary · Project Summary · External Tasks · External Milestone · Deadline

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APPENDIX B: D4STATEMENT OF PROBABLE COST

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Statement of Probable Cost

Westinghouse Nuclear Campus - May 2010 - PA - Pittsburgh

Prepared By:		Prepared For:	
	Fax:		Fax:
Building Sq. Size:	844595	Site Sq. Size:	166928
Bid Date:		Building use:	Office
No. of floors:	6	Foundation:	
No. of buildings:	3	Exterior Walls:	CUR
Project Height:		Interior Walls:	
1st Floor Height:		Roof Type:	MEM
1st Floor Size:		Floor Type:	CON
		Project Type:	NEW

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**3.16**	**6.73**	**5,681,465**
	Bidding Requirements	3.16	6.73	5,681,465
01	**General Requirements**	**10.97**	**23.32**	**19,696,028**
	General Requirements	10.97	23.32	19,696,028
02	**Site Work**	**7.24**	**15.40**	**13,007,204**
	Site Work	7.24	15.40	13,007,204
03	**Concrete**	**12.30**	**26.14**	**22,077,028**
	Concrete	12.30	26.14	22,077,028
04	**Masonry**	**1.79**	**3.80**	**3,210,372**
	Masonry	1.79	3.80	3,210,372
05	**Metals**	**10.40**	**22.12**	**18,679,397**
	Metals	10.40	22.12	18,679,397
06	**Wood & Plastics**	**0.61**	**1.31**	**1,102,567**
	Wood & Plastics	0.61	1.31	1,102,567
07	**Thermal & Moisture Protection**	**1.86**	**3.96**	**3,344,220**
	Thermal & Moisture Protection	1.86	3.96	3,344,220
08	**Doors & Windows**	**15.35**	**32.63**	**27,561,227**
	Doors & Windows	15.35	32.63	27,561,227
09	**Finishes**	**5.51**	**11.70**	**9,884,916**
	Finishes	5.51	11.70	9,884,916
10	**Specialties**	**3.53**	**7.51**	**6,341,416**
	Specialties	3.53	7.51	6,341,416
11	**Equipment**	**0.15**	**0.33**	**277,067**
	Equipment	0.15	0.33	277,067
12	**Furnishings**	**1.47**	**3.13**	**2,640,042**
	Furnishings	1.47	3.13	2,640,042
14	**Conveying Systems**	**3.14**	**6.68**	**5,643,136**
	Conveying Systems	3.14	6.68	5,643,136
15	**Mechanical**	**13.73**	**29.19**	**24,655,676**
	Mechanical	13.73	29.19	24,655,676
16	**Electrical**	**8.77**	**18.65**	**15,750,767**
	Electrical	8.77	18.65	15,750,767
Total Building Costs		**100.00**	**212.59**	**179,552,529**
Total Non-Building Costs		**100.00**	**0.00**	**0**

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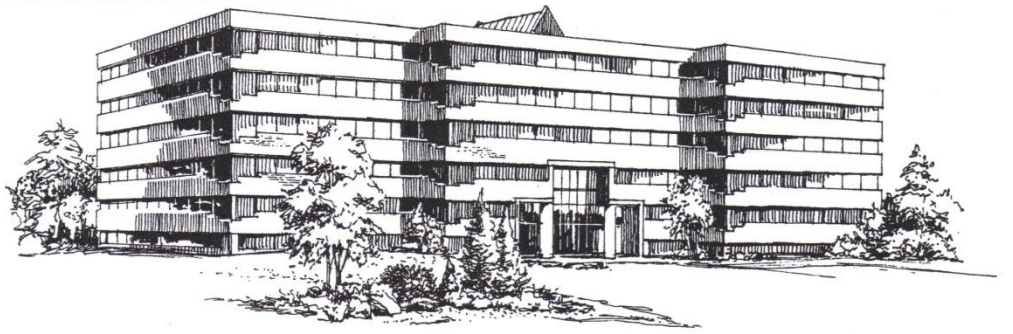
Total Project Costs	--	--	**179,552,529**

APPENDIX C: R.S. MEANS

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL | **M.470** | **Office, 5-10 Story**



Costs per square foot of floor area

Exterior Wall	S.F. Area	20000	40000	60000	80000	100000	150000	200000	250000	300000
	L.F. Perimeter	260	360	400	420	460	520	600	640	700
Precast Concrete Panel	Steel Frame	219.75	191.10	176.00	167.10	162.85	155.70	152.70	150.00	148.55
	R/Conc. Frame	215.70	186.70	171.55	162.60	158.30	151.10	148.10	145.40	143.95
Face Brick with Concrete Block Back-up	Steel Frame	212.30	185.15	171.35	163.35	159.45	152.90	150.15	147.80	146.45
	R/Conc. Frame	205.90	179.90	166.50	158.65	154.85	148.55	145.85	143.50	142.20
Limestone Panel Concrete Block Back-up	Steel Frame	256.90	216.70	194.95	182.05	175.95	165.60	161.20	157.30	155.20
	R/Conc. Frame	252.25	212.05	190.25	177.40	171.25	160.90	156.55	152.65	150.55
Perimeter Adj., Add or Deduct	Per 100 L.F.	27.40	13.65	9.10	6.80	5.50	3.65	2.75	2.25	1.90
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	5.70	3.90	2.90	2.30	2.05	1.50	1.35	1.15	1.05

For Basement, add $36.40 per square foot of basement area

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $74.60 to $219.35 per S.F.

Common additives

Description	Unit	$ Cost
Clock System		
20 room	Each	16,000
50 room	Each	39,100
Closed Circuit Surveillance, One station		
Camera and monitor	Each	1850
For additional camera stations, add	Each	1000
Directory Boards, Plastic, glass covered		
30" x 20"	Each	595
36" x 48"	Each	1450
Aluminum, 24" x 18"	Each	600
36" x 24"	Each	675
48" x 32"	Each	980
48" x 60"	Each	2025
Elevators, Electric passenger, 5 stops		
2000# capacity	Each	158,700
3500# capacity	Each	167,200
5000# capacity	Each	170,700
Additional stop, add	Each	13,000
Emergency Lighting, 25 watt, battery operated		
Lead battery	Each	282
Nickel cadmium	Each	805

Description	Unit	$ Cost
Intercom System, 25 station capacity		
Master station	Each	2650
Intercom outlets	Each	169
Handset	Each	470
Smoke Detectors		
Ceiling type	Each	187
Duct type	Each	480
Sound System		
Amplifier, 250 watts	Each	2350
Speaker, ceiling or wall	Each	191
Trumpet	Each	365
TV Antenna, Master system, 12 oulet	Outlet	315
30 outlet	Outlet	203
100 outlet	Outlet	194

178 **Important: See the Reference Section for Location Factor**

Model costs calculated for a 8 story building with 12′ story height and 80,000 square feet of floor area

Office, 5-10 Story

				Unit	Unit Cost	Cost Per S.F.	% Of Sub-Total
A. SUBSTRUCTURE							
1010	Standard Foundations	Poured concrete; strip and spread footings		S.F. Ground	12.08	1.51	
1020	Special Foundations	N/A		–	–	–	
1030	Slab on Grade	4" reinforced concrete with vapor barrier and granular base		S.F. Slab	4.74	.59	2.1%
2010	Basement Excavation	Site preparation for slab and trench for foundation wall and footing		S.F. Ground	.26	.03	
2020	Basement Walls	4′ foundation wall		L.F. Wall	78	.53	
B. SHELL							
	B10 Superstructure						
1010	Floor Construction	Concrete slab with metal deck and beams		S.F. Floor	26.25	22.97	19.0%
1020	Roof Construction	Metal deck, open web steel joists, interior columns		S.F. Roof	8.08	1.01	
	B20 Exterior Enclosure						
2010	Exterior Walls	Precast concrete panels	*80% of wall*	S.F. Wall	38.24	15.42	
2020	Exterior Windows	Vertical pivoted steel	*20% of wall*	Each	552	3.71	15.3%
2030	Exterior Doors	Double aluminum and glass doors and entrance with transoms		Each	3542	.22	
	B30 Roofing						
3010	Roof Coverings	Built-up tar and gravel with flashing; perlite/EPS composite insulation		S.F. Roof	5.52	.69	0.5%
3020	Roof Openings	N/A		–	–	–	
C. INTERIORS							
1010	Partitions	Gypsum board on metal studs	*30 S.F. Floor/L.F. Partition*	S.F. Partition	9.09	3.03	
1020	Interior Doors	Single leaf hollow metal	*400 S.F. Floor/Door*	Each	875	2.19	
1030	Fittings	Toilet Partitions		S.F. Floor	.73	.73	
2010	Stair Construction	Concrete filled metal pan		Flight	15,800	3.36	19.2%
3010	Wall Finishes	60% vinyl wall covering, 40% paint		S.F. Surface	1.35	.90	
3020	Floor Finishes	60% carpet, 30% vinyl composition tile, 10% ceramic tile		S.F. Floor	7.62	7.62	
3030	Ceiling Finishes	Mineral fiber tile on concealed zee bars		S.F. Ceiling	6.38	6.38	
D. SERVICES							
	D10 Conveying						
1010	Elevators & Lifts	Four geared passenger elevators		Each	292,600	14.63	11.6%
1020	Escalators & Moving Walks	N/A		–	–	–	
	D20 Plumbing						
2010	Plumbing Fixtures	Toilet and service fixtures, supply and drainage	*1 Fixture/1370 S.F. Floor*	Each	2781	2.03	
2020	Domestic Water Distribution	Gas fired water heater		S.F. Floor	.42	.42	2.1%
2040	Rain Water Drainage	Roof drains		S.F. Roof	1.84	.23	
	D30 HVAC						
3010	Energy Supply	N/A		–	–	–	
3020	Heat Generating Systems	Included in D3050		–	–	–	
3030	Cooling Generating Systems	N/A		–	–	–	12.3 %
3050	Terminal & Package Units	Multizone unit gas heating, electric cooling		S.F. Floor	15.50	15.50	
3090	Other HVAC Sys. & Equipment	N/A		–	–	–	
	D40 Fire Protection						
4010	Sprinklers	Wet pipe sprinkler system		S.F. Floor	2.33	2.33	2.7 %
4020	Standpipes	Standpipes and hose systems		S.F. Floor	1.07	1.07	
	D50 Electrical						
5010	Electrical Service/Distribution	1600 ampere service, panel board and feeders		S.F. Floor	1.86	1.86	
5020	Lighting & Branch Wiring	High efficiency fluorescent fixtures, receptacles, switches, A.C. and misc. power		S.F. Floor	11.11	11.11	15.1%
5030	Communications & Security	Addressable alarm systems, internet and phone wiring, emergency lighting		S.F. Floor	5.05	5.05	
5090	Other Electrical Systems	Emergency generator, 100 kW, uninterruptible power supply		S.F. Floor	1.02	1.02	
E. EQUIPMENT & FURNISHINGS							
1010	Commercial Equipment	N/A		–	–	–	
1020	Institutional Equipment	N/A		–	–	–	0.0 %
1030	Vehicular Equipment	N/A		–	–	–	
1090	Other Equipment	N/A		–	–	–	
F. SPECIAL CONSTRUCTION							
1020	Integrated Construction	N/A		–	–	–	0.0 %
1040	Special Facilities	N/A		–	–	–	
G. BUILDING SITEWORK		**N/A**					
					Sub-Total	126.14	100%
	CONTRACTOR FEES (General Requirements: 10%, Overhead: 5%, Profit: 10%)				25%	31.50	
	ARCHITECT FEES				6%	9.46	
					Total Building Cost	**167.10**	

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Location Factors

STATE/ZIP	CITY	Residential	Commercial
NORTH DAKOTA (CONT'D)			
586	Dickinson	.76	.84
587	Minot	.81	.87
588	Williston	.76	.83
OHIO			
430-432	Columbus	.93	.93
433	Marion	.89	.89
434-436	Toledo	1.00	.98
437-438	Zanesville	.88	.89
439	Steubenville	.93	.93
440	Lorain	.98	.96
441	Cleveland	1.01	1.00
442-443	Akron	.98	.96
444-445	Youngstown	.95	.94
446-447	Canton	.93	.92
448-449	Mansfield	.93	.92
450	Hamilton	.92	.91
451-452	Cincinnati	.92	.92
453-454	Dayton	.91	.91
455	Springfield	.92	.91
456	Chillicothe	.94	.93
457	Athens	.87	.88
458	Lima	.90	.92
OKLAHOMA			
730-731	Oklahoma City	.79	.83
734	Ardmore	.78	.81
735	Lawton	.80	.83
736	Clinton	.76	.81
737	Enid	.76	.82
738	Woodward	.76	.80
739	Guymon	.67	.69
740-741	Tulsa	.77	.80
743	Miami	.81	.82
744	Muskogee	.71	.74
745	Mcalester	.73	.77
746	Ponca City	.77	.80
747	Durant	.77	.80
748	Shawnee	.75	.80
749	Poteau	.77	.81
OREGON			
970-972	Portland	1.00	1.01
973	Salem	.98	1.00
974	Eugene	.99	1.00
975	Medford	.98	1.00
976	Klamath Falls	.98	1.00
977	Bend	1.00	1.00
978	Pendleton	.98	.97
979	Vale	.97	.92
PENNSYLVANIA			
150-152	Pittsburgh	.96	.98
153	Washington	.93	.96
154	Uniontown	.90	.95
155	Bedford	.87	.93
156	Greensburg	.93	.96
157	Indiana	.90	.95
158	Dubois	.89	.95
159	Johnstown	.89	.94
160	Butler	.91	.94
161	New Castle	.91	.93
162	Kittanning	.93	.95
163	Oil City	.89	.92
164-165	Erie	.93	.93
166	Altoona	.87	.92
167	Bradford	.89	.93
168	State College	.90	.93
169	Wellsboro	.90	.94
170-171	Harrisburg	.94	.96
172	Chambersburg	.89	.93
173-174	York	.91	.95
175-176	Lancaster	.91	.92
177	Williamsport	.85	.88
178	Sunbury	.91	.94
179	Pottsville	.91	.93
180	Lehigh Valley	1.01	1.02
181	Allentown	1.03	1.01
182	Hazleton	.90	.94
183	Stroudsburg	.91	.97
184-185	Scranton	.95	.97
186-187	Wilkes-Barre	.92	.94
188	Montrose	.90	.94
189	Doylestown	1.05	1.05

STATE/ZIP	CITY	Residential	Commercial
PENNSYLVANIA (CONT'D)			
190-191	Philadelphia	1.16	1.13
193	Westchester	1.10	1.07
194	Norristown	1.09	1.09
195-196	Reading	.97	.98
PUERTO RICO			
009	San Juan	.75	.80
RHODE ISLAND			
028	Newport	1.06	1.03
029	Providence	1.06	1.03
SOUTH CAROLINA			
290-292	Columbia	.84	.80
293	Spartanburg	.84	.78
294	Charleston	.87	.83
295	Florence	.80	.78
296	Greenville	.83	.78
297	Rock Hill	.82	.77
298	Aiken	.97	.86
299	Beaufort	.82	.76
SOUTH DAKOTA			
570-571	Sioux Falls	.79	.83
572	Watertown	.75	.80
573	Mitchell	.77	.80
574	Aberdeen	.77	.82
575	Pierre	.77	.81
576	Mobridge	.75	.80
577	Rapid City	.78	.82
TENNESSEE			
370-372	Nashville	.84	.88
373-374	Chattanooga	.75	.81
375,380-381	Memphis	.81	.86
376	Johnson City	.70	.80
377-379	Knoxville	.72	.79
382	McKenzie	.72	.80
383	Jackson	.70	.78
384	Columbia	.71	.79
385	Cookeville	.71	.81
TEXAS			
750	McKinney	.73	.79
751	Waxahackie	.74	.80
752-753	Dallas	.83	.85
754	Greenville	.68	.73
755	Texarkana	.72	.78
756	Longview	.67	.74
757	Tyler	.73	.80
758	Palestine	.66	.72
759	Lufkin	.70	.74
760-761	Fort Worth	.81	.82
762	Denton	.75	.77
763	Wichita Falls	.78	.80
764	Eastland	.71	.73
765	Temple	.74	.76
766-767	Waco	.76	.81
768	Brownwood	.68	.73
769	San Angelo	.71	.76
770-772	Houston	.85	.88
773	Huntsville	.68	.73
774	Wharton	.69	.76
775	Galveston	.83	.86
776-777	Beaumont	.80	.82
778	Bryan	.73	.82
779	Victoria	.73	.77
780	Laredo	.72	.77
781-782	San Antonio	.80	.83
783-784	Corpus Christi	.77	.78
785	McAllen	.75	.76
786-787	Austin	.79	.81
788	Del Rio	.66	.70
789	Giddings	.69	.72
790-791	Amarillo	.76	.81
792	Childress	.74	.77
793-794	Lubbock	.74	.80
795-796	Abilene	.74	.78
797	Midland	.75	.78
798-799,885	El Paso	.73	.78
UTAH			
840-841	Salt Lake City	.81	.88
842,844	Ogden	.78	.85
843	Logan	.79	.86

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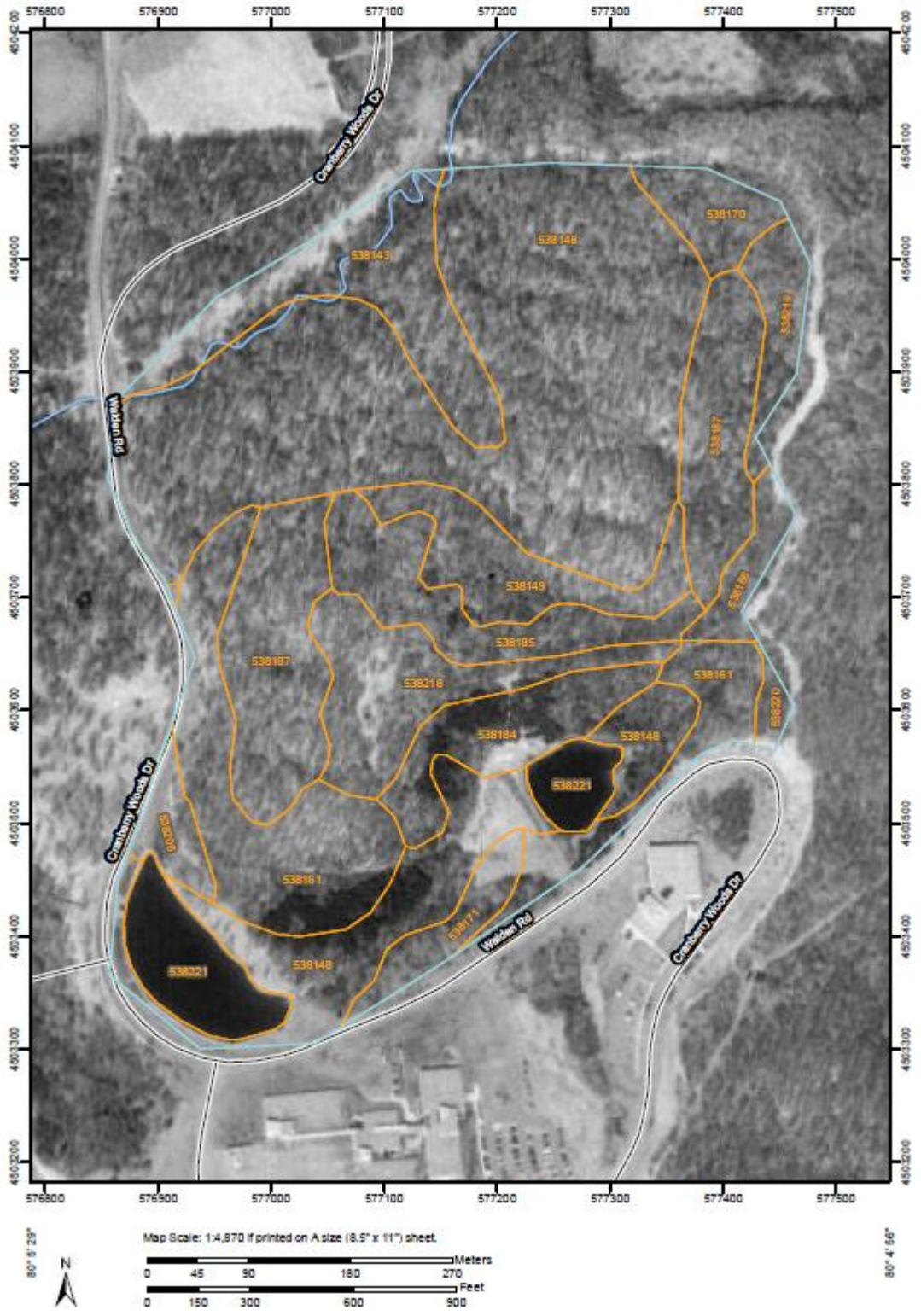
APPENDIX D: USDA SOIL REPORT DATA



Map Unit Legend

Butler County, Pennsylvania			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
538143	Atkins silt loam	5.9	6.7%
538148	Brinkerton silt loam, 3 to 8 percent slopes	35.2	39.6%
538149	Brinkerton silt loam, 8 to 15 percent slopes	3.8	4.2%
538161	Cavode silt loam, 8 to 15 percent slopes	9.9	11.1%
538170	Ernest silt loam, 3 to 8 percent slopes	1.8	2.0%
538171	Ernest silt loam, 8 to 15 percent slopes	1.6	1.8%
538184	Gilpin-Weikert channery silt loams, 15 to 25 percent slopes	3.6	4.0%
538185	Gilpin-Weikert channery silt loams, 25 to 70 percent slopes	4.2	4.7%
538186	Gilpin-Wharton silt loams, 8 to 15 percent slopes	1.3	1.5%
538187	Gilpin-Wharton complex, 15 to 25 percent slopes	9.3	10.5%
538206	Tilsit silt loam, 3 to 8 percent slopes	1.3	1.5%
538218	Vandergrift-Cavode silt loams, 3 to 8 percent slopes	4.7	5.3%
538219	Vandergrift-Cavode silt loams, 8 to 15 percent slopes	1.8	2.0%
538220	Vandergrift-Cavode silt loams, 15 to 25 percent slopes	0.4	0.5%
538221	Water	4.1	4.6%
Totals for Area of Interest		**88.9**	**100.0%**