

2015

Appendix B – Civil Design



**HEGEWISCH MARSH, COOK COUNTY, ILLINOIS
FEASIBILITY STUDY**

**APPENDIX B
CIVIL DESIGN**

January 2015

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I. INTRODUCTION

General

1. The purpose of this appendix is to present the engineering analysis for the formation of FEASIBILITY STUDY plans. This study is composed of six sections: a. water control structure; b. bank naturalization; c. vernal pool habitat creation; d. ridge and swale habitat creation; e. evapotranspiration reduction; and f. marsh, wet prairie and woodland community restoration.

2. Hegewisch Marsh currently consists of degraded marsh, wet prairie and woodland habitat. The study area includes approximately 131 acres and is located in on the southeast side of Chicago in Cook County, Illinois. The site is bounded to the north by 130th Street, to the east by Torrence Avenue, to the south by United States Corps of Engineers (USACE) Rock Island District property (Thomas J. O'Brien Lock and Dam), and to the west by the Calumet River (T37N, R14E, S36). USACE also owns 1.8 acres along the southern edge of the site, and has an access road leading to the Thomas J. O'Brien Lock and Dam.

Purpose and Scope

3. The purpose of this appendix is to: (a) describe design criteria, engineering methods and procedures that were used layout and perform preliminary design analysis of the alternatives; (b) present the methods used and calculations developed for earthwork quantities; (c) present the requirements for the real estate needed; (d) present criteria and requirements for utility interferences; and (e) discuss the engineering design analysis requirements for the next phase of the project.

Previous Investigations

4. Several studies, reports and nearby projects have been completed on Hegewisch Marsh. These are summarized in section 1.5 of the main report.

Topographic Survey, Survey Control and Soils

5. Topography was generated from the Illinois 2009 digital elevation model that was created from City of Chicago lidar data having one-foot contours. The horizontal coordinates are on the North American Datum of 1983 (NAD 83) grid, State Plane Illinois East Stateplane Coordinate System. The vertical datum is the North American Vertical Datum of 1988 (NAVD 88).

6. No soil boring data was obtained at this feasibility level, nor is it suggested prior to the next phase of design due to the site containing contaminated surface soils. On-site soil disturbance is to be limited.

Final Design Activities/Tasks

7. Verification of existing conditions is required by the USACE. Further survey data will need to be obtained, especially points along the river bank sections and inland wetland areas.
8. Planning constraints include: (a) avoiding adverse affects to existing migratory bird and butterfly habitats, (b) avoiding adverse impacts to the few functioning vernal pools, (c) avoiding adverse impacts to surrounding functional hydrogeomorphology, (d) avoiding adverse affects to animals by avoiding various contaminated patches, and (e) minimizing the removal of trees that are not considered to be highly invasive or having adverse affects on hydrology or native species.

Utilities

9. Existing utility data that serve the project areas were obtained at the concept level from aerial photographs and site observations. Overhead power lines were not observed within the projects limits. A request has been made to the City of Chicago Office of Underground Coordination at 1-312-744-4828 and affected utility companies to provide mapping of utilities within the project limits. A more thorough gathering of utility information will be completed during the design phase. Based on current information, there is no interference with utilities within the project area.

Staging Areas and Access Routes

10. Staging areas are required during construction for staging equipment and supplies and stockpile of debris (if any) to be transported off site. One location is identified for a staging area. The proposed staging area is the existing parking lot of Hegewisch Marsh accessible from Torrence Avenue. Its pavement consists of wood chips. The staging area will be enclosed with fencing.
11. Three access routes were identified. The primary access route is the main entrance to Hegewisch Marsh from Torrence Avenue. A second potential access route is the USCE, Rock Island District access road for the Thomas J. O'Brien Lock and Dam. A third potential access route is located parallel to the railroad along the north boundary of the project area. It belongs to the railroad. A right-of-entry would be required for to use the later two access routes.
12. The construction staging area and access routes are located to minimize environmental impacts. The areas are mostly flat undeveloped areas. No environmental impacts would occur from their use since they are not located in environmentally sensitive areas.

Maintenance of Traffic

13. The construction will have a negligible impact on traffic and minimal risk for causing pavement damage. Regardless, maintenance of traffic during construction is required per the Illinois Department of Transportation (IDOT); and pavement for the road surfaces damaged during construction will be removed and replaced in accordance with IDOT specifications for pavement patching.

Real Estate Requirements

14. The Real Estate holdings listed in TABLE 2 is preliminary and it will be finalized at the 100 percent design phase. Permanent easement consists of property that is necessary for the project features and access for any performing maintenance and general inspections. The Real Estate is owned primarily by Chicago Park District (local sponsor) and secondarily by the Metropolitan Water Reclamation Department of Greater Chicago.

15. Temporary Easement. Temporary easements, which are also called work limits, consist of property that is needed during the construction phase. The Real Estate plans will be finalized during the design phase.

16. No Work Areas. Three areas are excluded from the project due to hazardous, toxic and radioactive waste (HTRW) concerns. There are denoted as No Work Areas on the Plan Sheets. Through coordination with the Great Lakes and Ohio River Division Environmental Engineering personnel, they are denoted as Remediation Areas A, B and C, (i.e., Zones A and B), Zone C, and the Truss Storage Area in Appendix E – HTRW of this report.

II. SECTION 1 – WATER CONTROL STRUCTURE

General

17. An existing and functional water control structure will be used. It is currently operated and maintained by the City of Chicago Department of Environment.

Final Design Activities/Tasks.

18. Beyond general identifying measures on the plans, no design activity is required for this measure since it is currently operational and does not need modification to support the proposed project habitat features.

III. SECTION 2 – BANK NATURALIZATION

General

19. The restoration goal of the Calumet River bank slopes and two marsh and wet prairie ecotone areas is to make them more uniform and less steep. One ecotone is located in the middle area and the other is located in the northeast corner of the project site. The bank slope naturalization will allow for native plant species to be established, allow turtles, frogs and snakes ease of passage between the river and marsh and vernal pool habitats, and provide Calumet River fishes with habitat along the toe of the bank. The river bank and two ecotone areas will be stripped of any unnatural and nonfunctional infrastructure (debris), if present, as well as invasive and non-native vegetation. Banks will be graded and native vegetation will be established. Existing concrete and rock rubble present along the Calumet River will be used to develop underwater habitat along the existing river bank. The location of these habitats will be finalized during the design phase.

20. The slope gradient along the Calumet River and two ecotone areas require negligible grading. This measure pertains to regrading the top one foot of material. In addition to reasons noted in paragraph 19, another purpose of the regrading is to make the slopes more uniform and to expose potential seed banks of indigenous plant species. To comply with higher headquarters project authorization restrictions and regulatory requirements, grading within the site cannot exceed an one foot depth. Bank naturalization quantity volumes were obtained by delineating the area to be graded (i.e., removal of top one-foot of material) as starting at respective water surfaces and proceeding up the sloped-surface of each bank until the existing topography becomes relatively level. Quantity takeoffs are provided in TABLE 3 and were computed by using Microstation Inroads software developed by Intergraph. Two methods were used to compute the volumes. They were the End Area Volume and Triangle methods. The more conservative estimate was used for Quantity takeoff volumes. Quantity takeoff volumes will be revised as the design progresses. The two ecotone areas are designated as the “Middle Area” and “Northeast Corner” on the plans.

Erosion and Sediment Controls

21. Soil erosion and sediment control measures will be designed in accordance with the Illinois Urban Manual. Minimum measures required at the project site may include: (a) hydroseeding, seeding, and mulching to stabilize disturbed areas; (b) installing silt fences in and around construction areas; (c) protecting water ways with floating turbidity barriers that retain debris and prevent sediments from traveling downstream; (d) stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site (e.g., gravel, tire washing); (e) installing erosion blanket and seeding along the re-graded stream banks; (f) requiring dust control practices; and/or (g) requiring Storm Water Pollution Prevention Plan.

Final Design Activities/Tasks.

22. Prior to final design, a detailed survey along river bank and two ecotone areas will be performed. The survey data will be used to better calculate quantity takeoffs (i.e., the grading plan). Existing utility mapping within the project limits will be finalized and shown on drawings. Utility conflicts, if any, will be resolved. The final design drawings and specifications will require the Contractor to specify, for USACE approval, the locations and details of the soil erosion and sediment control measures to be used on site. Disturbed areas will be re-established with vegetation. If used, erosion control blankets should be biodegradable and will be left in place, and silt fencing and turbidity barriers shall be removed after construction is completed.

23. Grading activities are restricted to less than a one-foot depth to minimize potential disturbance of subsurface soils. Material excavated from the bank naturalization shall be placed inland of the regraded banks and smoothed to grade. There will be no off-site disposal of graded soil. Structural debris, if any, shall be disposed of off-site.

IV. SECTION 3 – VERNAL POOL HABITAT CREATION

General

24. Approximately 8.8 acres of Vernal Pool habitat will be created in existing low areas to take advantage of the perched water table and naturalize the geomorphology of various wet areas. Invasive species will be removed through use of broad scale herbicides, controlled burns, and tree removal. Perimeters of existing small wet surface water pockets will be smoothed out and their pool bottom moderately compacted through mechanical and/or manual means. Organic compost soil amendment will be incorporated into the top six-inches of the existing soil.

Erosion Control

25. The contractor will be required to minimize potential erosion during construction.

Final Design Activities/Tasks.

26. Disturbed areas will be re-established with vegetation. If used, erosion control blankets should be biodegradable and will be left in place. If used, silt fencing and turbidity barriers shall be removed after construction is completed. The final design drawings and specifications will require the Contractor to specify, for USACE approval, the locations and details of the soil erosion and sediment control measures to be used on site.

27. Grading activities are restricted to less than a one-foot depth to minimize potential disturbance of subsurface soils.

V. SECTION 4 – RIDGE AND SWALE HABITAT CREATION

General

28. This measure seeks to utilize the long parallel wetland depressions created by tire rutting to create Ridge and Swale geomorphic habitat. This measure would gently grade the existing depressions to smooth them out and add organic compost just the same as the Vernal Pool measure. The ridges would be created by bringing in clean sand via barge, and placing the sand between the swales to a height of two-feet at the crest. The ridges would be sloped down to the swale toe, just as a natural ridge sandy ridge would. The 4.1-acres of ridge would require about 6,600-cyd of clean sand. The ridges would also require organic leaf litter compost to be worked into the top six-inches of sand.

29. This project feature is not included in the National Ecosystem Restoration (NER) Plan. An alternative measure for the Ridge and Swale area will be to convert the area into an area with many Vernal Pools (i.e., the swale areas).

Erosion Control and Final Design Activities/Tasks

30. Not applicable since this project feature is not included in the NER Plan.

VI. SECTION 5 – EVAPOTRANSPIRATION REDUCTION

General

31. This measure seeks to reduce the rate of groundwater loss by removing non-native and weedy species and pertains all invasive species present in the entire project area. Trees and shrubs would be removed via cutting and leaving stumps and roots in place. Stumps and remaining stems would receive herbicide application. All herbaceous vegetation would be removed via large scale herbicide application, mowing, and/or controlled burning.

Final Design Activities/Tasks.

32. Provide plans and specifications direction pertaining to the removal of the non-native and weedy species during the final design phase. The work will include the use of broad scale herbicide, controlled burns, and tree removal. Locations and details of the use of the broad scale herbicide, controlled burns, and tree removal will be specified on the design drawings and in the specifications.

VII. SECTION 6 – MARSH, WET PRAIRIE AND WOODLAND COMMUNITY RESTORATION

General

33. Restoration of native plant communities throughout the site, excluding 11.2 acres of restricted parcels. Approximately 118.9 acres of the project area will be eradicated of invasive and non-native vegetation via herbicide application and hand removal. Woody species will also be thinned in areas having dense canopy to allow sunlight to infiltrate the understory, hence allowing the growth of a rich herbaceous layer. In total, 34.1 acres of marsh, 21.5 acres of wet prairie, and 63.3 acres of woodland habitat will be restored with native vegetation indicative of each plant community.

34. Each plant community will receive the following: (a) selective seeding of areas to establish native base vegetation matrix; (b) plant plugs of native marsh, wet prairie or woodland species to provide habitat structure and diversity; (c) install predatory control features (e.g., chicken wire, strings, snow fencing); (d) spot herbicide invasive species for length of contract; and (e) perform prescribed burns (as needed) over a five year period. These measures also include establishment activities such as watering and soil amendments.

35. Marsh – This measure seeks to restore approximately 34.1 acres of hemi-marsh and side-stream marsh habitat to establish aquatic emergent and submergent macrophytes.

36. Wet Prairie – This measure seeks to restore approximately 21.5 acres of wet prairie habitat to establish hydrophytic and transitional wetland species. This measure would be inclusive of planting Vernal Pools and Ridge and Swale areas that overlap this habitat type.

37. Woodland – This measure seeks to restore approximately 63.3 acres of woodland habitat to establish wet and mesic shade tolerant species. This measure would be inclusive of planting Vernal Pools that overlap this habitat type should those measures be selected.

Erosion Control

38. Similar minimum measures required for bank naturalization apply to the plant community restoration work. The erosion and sediment control measures will be finalized during the design phase. The final design drawings and specifications will require the Contractor to specify, for USACE approval, the locations and details of the soil erosion and sediment control measures to be used on site.

Final Design Activities/Tasks.

39. Provide plans and specifications direction pertaining to the removal of the non-native and weedy species and reestablishment of marsh, wet prairie and woodland habitat. Disturbed areas will be re-established with respective habitat vegetation. If used, erosion control blankets shall be biodegradable and left in place after construction is completed. If used, silt fence and turbidity barriers will be removed after construction is completed. The final design drawings and specifications will require the Contractor to specify, for USACE approval, the locations and details of the soil erosion and sediment control measures to be used on site.

**HEGEWISCH MARSH, COOK COUNTY, ILLINOIS
FEASIBILITY STUDY**

TABLE 1 – BID SCHEDULE

ITEM	DESCRIPTION	Quantity	U/M	Unit Price	Amount
<u>BASE BID ITEMS</u>					
00 01	MOBILIZATION	1	JOB		\$0.00
00 02	DEMOBILIZATION	1	JOB		\$0.00
00 03	BANK NATURALIZATION	6,686.8	CY		\$0.00
00 04	VERNAL POOL CREATION				
00 04A A	GRADING	1	JOB		\$0.00
00 04A B	SOIL AMMENDMENT	8.8	AC		\$0.00
00 05	INVASIVE SPECIES REMOVAL (EVAPOTRANSPIRATION REDUCTION)				
00 05A A	BROADSCALE HERBICIDE	118.9	AC		\$0.00
00 05A B	CONTROLLED BURN	118.9	AC		\$0.00
00 05A C	TREE REMOVAL	1,189	EA		\$0.00
00 06	WET PRAIRIE				
00 06A A	PLUGS	172,000	EA		\$0.00
00 06A B	SEED	53.75	LB		\$0.00
00 07	WOODLAND				
00 07A A	PLUGS	126,600	EA		\$0.00
00 07A B	SEED	237	LB		\$0.00
00 08	MARSH				
00 09A A	PLUGS	341,000	EA		\$0.00
00 10	PLANT ESTABLISHMENT ACTIVITIES	1	JOB		\$0.00
00 11	PERFORMANCE AND PAYMENT BOND FOR BID ITEMS 0001 TO 0010	1	LOT		\$0.00

GRAND TOTAL: Bid Items 0001 through 0011

\$0.00

**HEGEWISCH MARSH, COOK COUNTY, ILLINOIS
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TABLE 2 – REAL ESTATE SUMMARY

PARCEL NUMBER	OWNER	ACERAGE (Excludes No Work Areas)
25365010010000	Railroad	Not Measured
25365000030000	Railroad	Not Measured
25361000130000	Chicago Department of Planning	88.70
25361000090000	Metropolitan Water Reclamation District of Greater Chicago	14.56
25361000060000	U.S. Army Corps of Engineers	0.57
25361000190000	City of Chicago Park District	10.56
25365000020000	Railroad	Not Measured
TOTAL FEE SIMPLE AREA:		114.39

**HEGEWISCH MARSH, COOK COUNTY, ILLINOIS
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TABLE 3 – QUANTITY CALCULATIONS

PROJECT MEASURE	DESCRIPTION OF FEATURE (Grading of existing banks by removal of top one foot of material)	VOLUME (CUBIC YARDS)	
		TRIANGLE	END AREA VOLUME
Bank Naturalization	River Bank	2971.5	3187.7
	Middle Transitional Area	2323.7	2827.8
	Upper Transitional Area	588.9	671.3
	TOTAL VOLUME	5884.1	6686.8

**HEGEWISCH MARSH, COOK COUNTY, ILLINOIS
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SOFTWARE CALCULATIONS

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ACERAGE:

Acreage was determined through use of Environmental Systems Research Institute (ESRI) ArcGIS program using polyline geometry displaying one-foot contours for Cook County, Illinois. The one-foot contours were interpolated from a Digital Terrain Model (DTM) that was created during 2009 for the Cook County Board of Commissioners by the engineering firm Merrick and Company (Merrick). Vernal Pool areas and the marsh, woodland and areas were delineated and their acreage computed.

EARTHWORK QUANTITIES:

Two Microstation INROADs software methods were used to compute bank naturalization quantities. They are the “End Area Volume” and “Triangle” methods.

Primary Method: The “End Area Volume” command performs a traditional end-area volume calculation to compute cut, fill, and net volumes using a series of cross sections extracted along a previously defined alignment. A complete report listing all computed quantities on a station-by-station basis can be generated with this command.

Typically, this command can be used to calculate excavation and analyze a design after the Roadway Designer command has been run. The Roadway Designer command creates new design surfaces that can represent different types of surfaces. Once the surface is created, cross sections can be extracted along the alignment, displaying these surfaces in each cross section. A surface displayed in a cross section is called a cross-section surface.

Note: All entities for display under End Area Volumes Annotation are annotated except Cut Volume, Fill Volume, Mass Ordinate and Tabulated Volume when a skewed section is encountered. Everything else on the End Area Volume command is ignored.

Because this command calculates volumes between any combination of surfaces, it can be used to compute the materials required in a roadway. The processing of end area volumes uses the computational output from the command and Create or Append to a Quantity Manager (MDB) file. The software uses the output values and Pay Items defined in the dialog(s) and puts them in the proper database fields for reporting and additional editing within the Quantity Manager program.

Note: A Pay Item Database is required and should be loaded to define pay items in all volumes commands. The computational values from each command are directly populated into the database. No computational formulas from the Pay Item Database are used.

Each run of a command creates a new entry into the Quantity Manager database. No attempt to purge entries is performed. Removing duplicate entries is the responsibility of the user

Secondary Method: The “Triangle” method was used to determine cut and fill quantities. A vertical to 10 horizontal (1V:10H) slope was superimposed upon cross-sections generated at 100-foot intervals with the one-foot contour data.

The “Triangle” command is the most accurate of the three tools available within this product to compute cut and fill volumes. Cut and fill volumes obtained with this command are calculated between two surfaces, or Digital Terrain Models (DTMs), by projecting the triangles from the Original Surface onto the Design Surface and then computing the volume of each of the resultant prisms. Volumes where the Design Surface is below the Original Surface are cut volumes. Fill volumes exist where the Design Surface is above the Original Surface. The volume calculated using the Triangle command is the exact mathematical volume between the two selected surfaces. The accuracy of the results of the Triangle command is limited only by the accuracy of the DTMs you are using. In other words, surface models (DTMs) are less accurate than the method for computing volumes between them.

End Area Volume Report

Report Created: 12/11/2014
Time: 11:15am

Cross Section Set Name: Bank Naturalization Gradinh

Alignment Name: Bank Naturalization Gradinh

Input Grid Factor: 1.000000 **Note:** All units in this report are in feet, square feet and cubic yards unless specified otherwise.

----- Station Quantities -----										----- Added Quantities -----						
Baseline	----- Cut -----				----- Fill -----				----- Cut -----				----- Fill -----		Mass	
Station	Factor	Area	Volume	Adjusted	Factor	Area	Volume	Adjusted	Factor	Volume	Adjusted	Factor	Volume	Adjusted	Ordnate	
0+00.00	1.00	16.6	0.0	0.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	0.0	
1+00.00	1.00	16.6	61.4	61.4	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	61.4	
2+00.00	1.00	21.5	70.5	70.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	132.0	
3+00.00	1.00	15.1	67.8	67.8	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	199.8	
4+00.00	1.00	36.6	95.6	95.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	295.4	
5+00.00	1.00	33.0	128.9	128.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	424.3	
6+00.00	1.00	27.3	111.7	111.7	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	536.0	
7+00.00	1.00	30.5	107.1	107.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	643.0	
8+00.00	1.00	25.8	104.3	104.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	747.4	
9+00.00	1.00	35.7	114.0	114.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	861.3	
10+00.00	1.00	53.3	164.9	164.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1026.2	
11+00.00	1.00	72.5	233.1	233.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1259.2	
12+00.00	1.00	44.0	215.9	215.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1475.1	
13+00.00	1.00	37.7	151.4	151.4	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1626.5	
14+00.00	1.00	34.9	134.5	134.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1761.0	
15+00.00	1.00	37.1	133.3	133.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1894.3	
16+00.00	1.00	43.2	148.7	148.7	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2043.0	
17+00.00	1.00	45.7	164.6	164.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2207.6	
18+00.00	1.00	41.8	161.9	161.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2369.5	
19+00.00	1.00	39.0	149.6	149.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2519.1	
20+00.00	1.00	30.2	128.3	128.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2647.4	
21+00.00	1.00	40.8	131.5	131.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2778.9	
22+00.00	1.00	33.7	137.9	137.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2916.8	
23+00.00	1.00	31.1	120.0	120.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	3036.8	
24+00.00	1.00	25.2	104.3	104.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	3141.1	
24+99.84	1.00	0.0	46.6	46.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	3187.7	
Grand Total:			3187.7	3187.7			0.0	0.0			0.0	0.0		0.0		

End Area Volume Report

Report Created: 12/11/2014
Time: 11:47am

Cross Section Set Name: Middle Grading_New_1

Alignment Name: Middle Grading_New

Input Grid Factor: 1.000000 **Note:** All units in this report are in feet, square feet and cubic yards unless specified otherwise.

Baseline Station	----- Station Quantities -----								----- Added Quantities -----								Mass Ordinate	
	Factor	Cut		Fill		Factor	Cut		Fill		Factor	Cut		Fill				
		Area	Volume	Adjusted	Factor	Area	Volume	Adjusted	Factor	Volume	Adjusted	Factor	Volume	Adjusted	Factor	Volume	Adjusted	
0+00.00	1.00	123.7	0.0	0.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	0.0
1+00.00	1.00	75.5	368.8	368.8	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	368.8
2+00.00	1.00	25.3	186.6	186.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	555.4
3+00.00	1.00	33.3	108.6	108.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	663.9
4+00.00	1.00	31.8	120.6	120.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	784.6
5+00.00	1.00	25.6	106.2	106.2	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	890.8
6+00.00	1.00	54.9	148.9	148.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1039.7
7+00.00	1.00	45.1	185.1	185.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1224.8
8+00.00	1.00	45.4	167.5	167.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1392.3
9+00.00	1.00	52.4	181.1	181.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1573.4
10+00.00	1.00	38.6	168.6	168.6	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1742.0
11+00.00	1.00	47.1	158.7	158.7	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1900.7
12+00.00	1.00	43.4	167.7	167.7	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2068.5
13+00.00	1.00	50.6	174.1	174.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2242.6
14+00.00	1.00	56.5	198.3	198.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2440.9
15+00.00	1.00	41.5	181.5	181.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2622.3
16+00.00	1.00	48.6	166.9	166.9	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2789.2
16+21.31	1.00	49.1	38.5	38.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	2827.8
Grand Total:			2827.8	2827.8			0.0	0.0			0.0	0.0		0.0			0.0	

End Area Volume Report

Report Created: 12/11/2014
Time: 12:02pm

Cross Section Set Name: NorthEast_Grading

Alignment Name: NorthEast_Grading

Input Grid Factor: 1.000000 **Note:** All units in this report are in feet, square feet and cubic yards unless specified otherwise.

----- Station Quantities -----										----- Added Quantities -----						
Baseline	----- Cut -----				----- Fill -----				----- Cut -----				----- Fill -----		Mass	
Station	Factor	Area	Volume	Adjusted	Factor	Area	Volume	Adjusted	Factor	Volume	Adjusted	Factor	Volume	Adjusted	Ordinate	
0+00.00	1.00	16.3	0.0	0.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	0.0	
1+00.00	1.00	18.4	64.3	64.3	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	64.3	
2+00.00	1.00	21.3	73.7	73.7	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	138.0	
3+00.00	1.00	25.9	87.5	87.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	225.5	
4+00.00	1.00	40.0	122.0	122.0	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	347.5	
5+00.00	1.00	30.3	130.2	130.2	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	477.7	
6+00.00	1.00	24.3	101.1	101.1	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	578.8	
6+81.49	1.00	37.0	92.5	92.5	1.00	0.0	0.0	0.0	1.00	0.0	0.0	1.00	0.0	0.0	671.3	
Grand Total:			671.3	671.3			0.0	0.0			0.0	0.0		0.0		

Triangle Volume Report

Report Created: 12/15/2014
Time: 9:50am

Mode: Entire Surface

Input Grid Factor: 1.000000

Original Surface: Hegewisch_1ft_Existing

Description:

Preference: Default

Type: Existing

Design Surface: Bank 1' Stripping

Description:

Preference: Default

Type: Design

Cut Factor: 1.00

Fill Factor: 1.00

Cut: 80231.9 cu ft

Fill: 0.3 cu ft

Net: 80231.6 cu ft

Cut: 2971.6 cu yd

Fill: 0.0 cu yd

Net: 2971.5 cu yd

Triangle Volume Report

Report Created: 12/15/2014
Time: 12:39pm

Mode: Entire Surface

Input Grid Factor: 1.000000

Original Surface: Hegewisch_1ft_Existing

Description:

Preference: Default

Type: Existing

Design Surface: Middle 1' Stripping

Description:

Preference: Default

Type: Design

Cut Factor: 1.00

Fill Factor: 1.00

Cut: 62740.3 cu ft

Fill: 0.1 cu ft

Net: 62740.2 cu ft

Cut: 2323.7 cu yd

Fill: 0.0 cu yd

Net: 2323.7 cu yd

Triangle Volume Report

Report Created: 12/15/2014
Time: 12:50pm

Mode: Entire Surface

Input Grid Factor: 1.000000

Original Surface: Hegewisch_1ft_Existing

Description:

Preference: Default

Type: Existing

Design Surface: Northeast 1ft Stripping

Description:

Preference: Default

Type: Design

Cut Factor: 1.00

Fill Factor: 1.00

Cut: 15899.1 cu ft

Fill: 0.0 cu ft

Net: 15899.1 cu ft

Cut: 588.9 cu yd

Fill: 0.0 cu yd

Net: 588.9 cu yd