APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES
Remediation Area A Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines							
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %
OL-STA-40001-SS	OL-0100-21	1125717	915316	0.0	0.5	0.3	122												Non-Plastic			
OL-STA-40002-VC	OL-0118-27	1125857	916064	0.0	3.3	1.7	75	0	0	0	38.8	0	3.8	35.0	61.2	47.4	13.8		Non-Plastic		2.75	4.1
OL-STA-40002-VC	OL-0118-28	1125857	916064	3.3	6.6	5.0	71	0	0	0	38.5	0	4.5	34.0	61.5	48.3	13.2		Non-Plastic		2.74	3.0
OL-STA-40003-SB	OL-0004-05	1126212	916643	2.0	4.0	3.0	64	0	0	0	47.8	0	4.8	43.0	52.2	42.1	10.2		Non-Plastic		2.65	2.9
OL-SB-40006-SS	OL-0100-18	1126049	915034	0.0	0.5	0.3	112												Non-Plastic			
OL-SB-40008-SS	OL-0100-20	1126054	915565	0.0	0.5	0.3	87												Non-Plastic			
OL-VC-40033	OL-0293-14	1126583	914155	0.0	3.3	1.7	71.6															
OL-VC-40033	OL-0287-17	1126583	914155	3.3	6.6	5.0	76	1.6	0	1.6	17.8	2.0	3.0	12.8	80.6	67.6	13.0					
OL-VC-40034	OL-0293-18	1126272	914342	0.0	3.3	1.7	77.9															
OL-VC-40034	OL-0287-08	1126272	914342	3.3	6.6	5.0	72.1	5.0	0	5.0	22.1	5.0	4.0	13.1	72.9	57.9	15.0	45	32	13		
OL-VC-40035	OL-0280-11	1125978	914699	0.0	3.3	1.7	86.6															
OL-VC-40035	OL-0280-12	1125978	914699	3.3	6.6	5.0	89.9															
OL-VC-40036	OL-0280-03	1126013	914972	0.0	3.3	1.7	78.7															
OL-VC-40036	OL-0286-19	1126013	914972	3.3	6.6	5.0	36	0	0	0	27.8	1.8	11.0	15.0	72.2	55.2	17.0	40	30	10		
OL-VC-40037	OL-0286-07	1126276	915058	0.0	3.3	1.7	56.1	0	0	0	5.1	0	1.1	4.0	94.9	78.9	16.0	42	33	9		
OL-VC-40037	OL-0279-03	1126276	915058	3.3	6.6	5.0	85.5															
OL-VC-40038	OL-0286-10	1125836	915146	0.0	3.3	1.7	90.5	2.3	0	2.3	22.6	1.6	3.0	18.0	75.1	69.1	6.0	51	40	11		
OL-VC-40038	OL-0280-16	1125836	915146	3.3	6.6	5.0	73.8															
OL-VC-40039	OL-0279-08	1126344	915409	0.0	3.3	1.7	56.3															
OL-VC-40039	OL-0288-01	1126344	915409	3.3	6.6	5.0	80.9	0	0	0	16.2	1.2	1.0	14.0	83.8	54.8	29.0	47	34	13		
OL-VC-40040	OL-0292-12	1125964	915414	0.0	3.3	1.7	100.2															
OL-VC-40040	OL-0292-13	1125964	915414	3.3	6.6	5.0	109.3															
OL-VC-40041	OL-0286-13	1125806	915734	0.0	3.3	1.7	81.7											53	35	18		
OL-VC-40041	OL-0278-17	1125806	915734	3.3	6.6	5.0	68.2															
S304	SF0052	1126196	915421	0.0	0.5	0.2		0	0	0	27	NA[1]	NA[1]	NA[1]	73	63	10					
S304	SF0053	1126196	915421	0.5	1.0	0.7		0	0	0	62	NA[1]	NA[1]	NA[1]	38	30	8					
S304	VC0025	1126196	915421	1.0	3.3	2.1		0	0	0	3	NA[1]	NA[1]	NA[1]	97	87	10					
S304	VC0026	1126196	915421	3.3	6.6	4.9		0	0	0	8	NA[1]	NA[1]	NA[1]	92	81	11					
S358	SF0006	1126256	914360	0.0	0.5	0.2		0	0	0	58	NA[1]	NA[1]	NA[1]	42	27	15					
S358	SF0007	1126256	914360	0.5	1.0	0.7		0	0	0	37	NA[1]	NA[1]	NA[1]	63	42	21					
S360	SF0010	1125666	915766	0.0	0.1	0.0		0	0	0	42	NA[1]	NA[1]	NA[1]	58	49	9					
S360	SF0066	1125666	915766	0.0	0.1	0.0		0	0	0	40	NA[1]	NA[1]	NA[1]	60	53	7					
S360	SF0011	1125666	915766	0.1	0.5	0.3		0	0	0	22	NA[1]	NA[1]	NA[1]	78	73	5					
S360	SF0164	1125666	915766	0.1	0.5	0.3		0	0	0	34	NA[1]	NA[1]	NA[1]	66	62	4					
S360	SF0012	1125666	915766	0.5	1.0	0.7		0	0	0	55	NA[1]	NA[1]	NA[1]	45	39	6					
S360	SF0169	1125666	915766	0.5	1.0	0.7		0	0	0	51	NA[1]	NA[1]	NA[1]	49	43	6					
S81	S00520	1126367	915210	0.0	0.1	0.0	50.3	51.6	NA[1]	NA[1]	28.6	NA[1]	NA[1]	NA[1]	19.8	18.0	1.8					
Average[2]							78.9	2.8	0	0.4	32.0	1.3	4.0	21.0	65.2	54.0	11.2	46	34	12	2.71	3.3
Maximum[2]							122.0	51.6	0	5.0	62.0	5.0	11.0	43.0	97.0	87.0	29.0	53	40	18	2.75	4.1
Minimum[2]							36.0	0	0	0	3.0	0	1.0	4.0	19.8	18.0	1.8		Non-Plastic		2.65	2.9
Standard Deviation[2] (s)							19.4	11.0	0	1.2	16.8	1.6	2.9	13.0	19.4	17.9	6.2	5.0	3.4	3.2	0.06	0.7
Number of Samples							25	22	21	21	22	9	9	9	22	22	22	6	6	6	3	3
Average+1.96s							116.9	24.3	0	2.8	64.9	4.5	9.8	46.6	103.3	89.0	23.4	56	41	19	2.82	4.6
Average-1.96s							40.9	-18.8	0	-2	-0.9	-1.9	-1.7	-4.6	27.2	19.0	-0.9	36	27	6	2.61	2.0

Notes:

1. NA indicates that the full grain-size distribution curve is not available; therefore, the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum, and Standard Deviation are calculated based on the Number of Samples available for each category.

APPENDIX A
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Remediation Area B Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines							
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %
OL-STA-30012-VC	OL-0011-01	1123593	919125	0	3.3	1.65	82	0	0	0	41.8	0	11.8	30.0	58.2	40.7	17.5	63	40	23	2.55	2.4
OL-STA-30012-VC	OL-0011-02	1123593	919125	3.3	6.6	4.95	65	0	0	0	44.0	4.0	16.0	24.0	56.0	34.7	21.3	Non-Plastic			2.49	3.7

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES
Remediation Area C Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines						
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity
OL-VC-20068	OL-0290-05	1119832	921526	0	3.3	1.65	104.5														
OL-VC-20068	OL-0289-12	1119832	921526	3.3	6.6	4.95	86.9	0	0	0	26.9	0.9	7.0	19.0	73.1	49.0	24.1				
OL-VC-20069	OL-0290-07	1119612	921377	0	3.3	1.65	79.4														
OL-VC-20069	OL-0289-13	1119612	921377	3.3	6.6	4.95	68.7	3.3	0	3.3	17.3	1.7	2.6	13.0	79.4	54.7	24.7				
OL-VC-20070	OL-0289-15	1119473	921496	0	3.3	1.65	63.9	16.3	0	16.3	30.0	5.0	8.0	17.0	53.7	30.6	23.1				2.76
OL-VC-20071	OL-0289-18	1119429	921704	0	3.3	1.65	65.2	24.3	0	14.3	37.5	10.5	8.0	19.0	38.2	19.8	18.4	39	31	8	2.72
OL-VC-20072	OL-0232-09	1118947	922399	0	3.3	1.65	98.4	0.0	0	0	33.8	0	1.8	32.0	66.2	44.4	21.8				2.7
OL-VC-20072	OL-0231-02	1118947	922399	3.3	6.6	4.95	94.7														
OL-VC-20080	OL-0289-20	1119415	921607	0	3.3	1.65	67.8	28.9	0	28.9	27.1	8.0	5.0	14.1	44.0	28.6	15.4				
OL-VC-20081	OL-0290-02	1119359	921665	3.3	6.6	4.95	73.6	4.7	0	4.7	28.7	4.3	7.0	17.4	66.6	53.8	12.8	44	30	14	
OL-VC-20082	OL-0290-16	1119387	921635	0	3.3	1.65	73.7														
Average[1]							79.7	11.1	0	9.6	28.8	4.3	5.6	18.8	60.2	40.1	20.1	42	31	11	2.73
Maximum[1]							104.5	28.9	0	28.9	37.5	10.5	8.0	32.0	79.4	54.7	24.7	44	31	14	2.76
Minimum[1]							63.9	0	0	0	17.3	0	1.8	13.0	38.2	19.8	12.8	39	30	8	2.70
Standard Deviation[1] (s)							14.3	12.0	0	10.7	6.3	3.9	2.6	6.3	15.3	13.7	4.6	3.5	0.7	4.2	0.03
Number of Samples							11	7	7	7	7	7	7	7	7	7	7	2	2	2	3
Average+1.96s							107.7	34.6	0	30.6	41.2	11.9	10.6	31.1	90.1	67.1	29.1	48	32	19	2.79
Average-1.96s							51.7	-12.5	0	-11.3	16.3	-3.2	0.6	6.5	30.2	13.2	11.1	35	29	3	2.67

Note:

1. The Average, Minimum, Maximum, and Standard Deviation are calculated based on the Number of Samples available for each category.

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area D Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-STA-10001-VC	OL-0118-14	1118518	923452	0.0	3.3	1.7	160	0.1	0	0.1	1.4	0	0.4	1.0	98.5	84.9	13.6	102	32	70	2.37	7.0	
OL-STA-10002-VC	OL-0118-09	1118312	924292	3.3	6.6	5.0	203	0	0	0	3.1	0	0	3.1	96.9	58.1	38.8	90	41	49	2.50	8.7	52
OL-STA-10003-VC	OL-0118-16	1118154	924908	0.0	3.3	1.7	137	0	0	0	1.6	0	0	1.6	98.4	73.3	25.1	76	35	41	2.75	3.2	61
OL-STA-10004-VC	OL-0118-18	1118356	924951	3.3	6.6	5.0	233	0.1	0	0.1	2.3	0	0	2.3	97.6	86.0	11.6	94	41	53	2.53	4.5	70
OL-STA-10005-VC	OL-0118-20	1117898	925576	0.0	3.3	1.7	178	0	0	0	2.4	0	0	2.4	97.6	80.5	17.1	114	53	61	2.38	2.9	52
OL-STA-10007-VC	OL-0118-07	1117647	926138	3.3	6.6	5.0	141	0	0	0	2.6	0	0	2.6	97.4	84.9	12.5	75	43	32	2.62	5.8	70
OL-STA-10010-VC	OL-0118-12	1117686	924774	3.3	6.6	5.0	89	0.2	0	0.2	33.9	0.9	12.0	21.0	65.9	49.5	16.4	58	42	16	2.41	6.9	61
OL-STA-10012-VC	OL-0118-05	1116801	925924	3.3	6.6	5.0	123	0	0	0	9.3	0	2.0	7.3	90.7	77.4	13.3	68	40	28	2.43	4.6	52
OL-STA-10014-SB	OL-0111-09	1118399	924596	0.0	2.0	1.0	87.0																
OL-STA-10016-SB	OL-0111-20	1117874	925906	0.0	2.0	1.0	124.0	0	0	0	1.0	0	0	1.0	99.0	72.0	27.0	60	38	22	2.34		
OL-STA-10016-SB	OL-0111-21	1117874	925906	5.0	7.0	6.0	61.0																
OL-STA-10016-VC	OL-0119-02	1117872	925899	0.0	3.3	1.7	108.3	0	0	0	1.5	0	0.5	1.0	98.5	66.8	31.7	45	31	23			
OL-STA-10017-VC	OL-0119-06	1118246	926104	0.0	3.3	1.7	152																
OL-STA-10018-SB	OL-0111-35	1117844	923784	0.0	2.0	1.0	121.0																
OL-STA-10019-SB	OL-0111-45	1118112	923848	0.0	2.0	1.0	71.0																
OL-STA-10019-SB	OL-0111-46	1118112	923848	5.0	7.0	6.0	151.0																
OL-STA-10020-SB	OL-0111-57	1117703	924383	0.0	2.0	1.0	19.0																
OL-STA-10021-SB	OL-0111-70	1117948	924470	0.0	2.0	1.0	133.0																
OL-STA-10022-SB	OL-0111-84	1118139	924560	0.0	2.0	1.0	151.0																
OL-STA-10023-SB	OL-0071-54	1117457	925020	0.0	2.0	1.0	173.0	0	0	0	35.4	12.1	7.1	16.2	64.6	47.4	17.2	Non-Plastic			2.61	8.3	70.0
OL-STA-10024-SB	OL-0071-66	1117849	925237	0.0	2.0	1.0	100.0																
OL-STA-10024-SB	OL-0071-67	1117849	925237	5.0	7.0	6.0	67.0																
OL-STA-10025-SB	OL-0071-31	1117211	925485	0.0	2.0	1.0	157.0	0	0	0	2.6	0	0.6	2.0	97.4	75.9	21.5	Non-Plastic			2.39	5.0	83.0
OL-STA-10026-VC	OL-0119-03	1117572	925702	3.3	6.6	5.0	54.7	0	0	0	55.3	12.0	17.0	26.3	44.7	26.7	18.0	69	45	24			
OL-VC-10034	OL-0236-08	1118060	923086	0.0	3.3	1.7	180.6																
OL-VC-10034	OL-0236-07	1118060	923086	3.3	6.6	5.0	213.1																
OL-VC-10037	OL-0236-13	1118399	923321	0.0	3.3	1.7	112.3																
OL-VC-10037	OL-0256-01	1118399	923321	3.3	6.6	5.0	161.4	0	0	0	1.6	0	0	1.6	98.4	54.4	44.0	78	59	19	2.45		
OL-VC-10038	OL-0250-19	1117948	923415	0.0	3.3	1.7	161.3	3.0	0	3.0	35.6	5.6	11.0	19.0	61.4	27.4	34.0	127	80	47			
OL-VC-10038	OL-0236-17	1117948	923415	3.3	6.6	5.0	215.2																
OL-VC-10040	OL-0237-01	1118352	923587	0.0	3.3	1.7	88.9																
OL-VC-10040	OL-0237-02	1118352	923587	3.3	6.6	5.0	114.3																
OL-VC-10046	OL-0237-03	1118047	924009	0.0	3.3	1.7	173.4																
OL-VC-10046	OL-0250-15	1118047	924009	3.3	6.6	5.0	153.6	0	0	0	4.2	0	1.0	3.2	95.8	66.8	29.0	108	70	38	2.67		
OL-VC-10047	OL-0237-07	1118465	924146	0.0	3.3	1.7	144.9																
OL-VC-10047	OL-0250-13	1118465	924146	3.3	6.6	5.0	151.3	0	0	0	4.0	0	1.0	3.0	96.0	64.0	32.0	91	56	35	2.63		
OL-VC-10054	OL-0237-15	1117824	924273	0.0	3.3	1.7	134.3																
OL-VC-10057	OL-0237-11	1118236	924432	0.0	3.3	1.7	143.7																
OL-VC-10057	OL-0250-09	1118236	924432	3.3	6.6	5.0	197.1	0	0	0	27.6	0.6	5.0	22.0	72.4	45.4	27.0	130	88	42			
OL-VC-10062	OL-0237-19	1117994	924727	0.0	3.3	1.7	177.8																
OL-VC-10062	OL-0250-07	1117994	924727	3.3	6.6	5.0	127.3	0	0	0	7.6	0	1.6	6.0	92.4	59.4	33.0	103	63	40			
OL-VC-10063	OL-0250-05	1118435	924795	0.0	3.3	1.7	221.6	0	0	0	1.2	0	0	1.2	98.8	68.8	30.0	88	60	28			
OL-VC-10063	OL-0238A-03	1118435	924795	3.3	6.6	5.0	209.4																
OL-VC-10066	OL-0238A-07	1117659	924773	0.0	3.3	1.7	131.7																
OL-VC-10066	OL-0249-12	1117659	924773	3.3	6.6	5.0	112.4	0	0	0	30.3	6.0	9.0	15.3	69.7	52.7	17.0	60	50	10			
OL-VC-10071	OL-0249-14	1118399	925184	0.0	3.3	1.7	169.7	0	0	0	1.1	0	0	1.1	98.9	56.9	42.0	86	47	39			
OL-VC-10071	OL-0238A-11	1118399	925184	3.3	6.6	5.0	186																
OL-VC-10073	OL-0245-01	1118025	925124	0.0	3.3	1.7	196.6																
OL-VC-10073	OL-0245-02	1118025	925124	3.3	6.6	5.0	147.7																
OL-VC-10076	OL-0245-06	1117526	925240	0.0	3.3	1.7	151.4																
OL-VC-10076	OL-0245-07	1117526	925240	3.3	6.6	5.0	154.2																
OL-VC-10077	OL-0249-18	1118080	925346	0.0	3.3	1.7	150.4	0	0	0	0.4	0	0	0.4	99.6	68.6	31.0	61	44	17			
OL-VC-10077	OL-0245-10	1118080	925346	3.3	6.6	5.0	187.5																
OL-VC-10078	OL-0248-05	1117846	925416	0.0	3.3	1.7	48.1																
OL-VC-10078	OL-0248-06	1117846	925416	3.3	6.6	5.0	108.5																

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area D Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-VC-10080	OL-0245-14	1116981	925396	0.0	3.3	1.7	135.2																
OL-VC-10080	OL-0250-01	1116981	925396	3.3	6.6	5.0	94.6	0	0	0	9.2	1.0	3.0	5.2	90.8	64.8	26.0	56	40	16			
OL-VC-10081A	OL-0248-01	1117444	925497	0.0	3.3	1.7	132.6																
OL-VC-10081A	OL-0250-03	1117444	925497	3.3	6.6	5.0	172.1	0	0	0	3.0	0	1.0	2.0	97.0	59.0	38.0	122	67	55	2.69		
OL-VC-10089	OL-0248-10	1117288	925743	0.0	3.3	1.7	91.7																
OL-VC-10089	OL-0248-11	1117288	925743	3.3	6.6	5.0	135.7																
OL-VC-10090	OL-0248-15	1118132	925905	0.0	3.3	1.7	179.1																
OL-VC-10090	OL-0256-09	1118132	925905	3.3	6.6	5.0	104.3	0	0	0	1.7	0.7	0	1.0	98.3	78.3	20.0	52	35	17			
OL-VC-10094	OL-0248-20	1116632	925868	0.0	3.3	1.7	126.7																
OL-VC-10094	OL-0249-11	1116632	925868	3.3	6.6	5.0	86.3	0	0	0	11	0	2.0	9.0	89.0	73.0	16.0	46	31	15	2.58		
OL-VC-10095A	OL-0256-05	1118336	925975	0.0	3.3	1.7	193	0	0	0	2.7	0.7	1.0	1.0	97.3	73.3	24.0	109	38	71			
OL-VC-10095A	OL-0256-06	1118336	925975	3.3	6.6	5.0	140.2	0	0	0	1.9	0	0.9	1.0	98.1	79.1	19.0	101	41	60			
OL-VC-10096	OL-0256-03	1117842	925985	0.0	3.3	1.7	101.7	0	0	0	3.2	1.0	1.0	1.2	96.8	73.8	23.0	56	36	20			
OL-VC-10096	OL-0244A-08	1117842	925985	3.3	6.6	5.0	94.5																
OL-VC-10102	OL-0244A-12	1117485	926068	3.3	6.6	5.0	101.4																
OL-VC-10103	OL-0244A-16	1117084	926132	0.0	3.3	1.7	161.5																
OL-VC-10103	OL-0244A-17	1117084	926132	3.3	6.6	5.0	178.0																
OL-VC-10105	OL-0296-06	1116859	926187	0.0	3.3	1.7	215.3	0	0	0	11.7	1.7	4.0	6.0	88.3	53.8	34.5	89	55	34	2.60		
OL-VC-10105	OL-0244A-01	1116859	926187	0.0	3.3	1.7	210.9																
OL-VC-10105	OL-0256-12	1116859	926187	3.3	6.6	5.0	162.6	0	0	0	27.0	2.0	8.0	17.0	73.0	47.0	26.0	84	59	25			
OL-STA-20002-VC	OL-0071-03	1118665	922578	3.3	6.6	5.0	89	0	0	0	12.8	0	0.8	12.0	87.2	77.3	9.9	65	41	24	2.36	4.4	
OL-STA-20004-VC	OL-0118-25	1118299	922721	0.0	3.3	1.7															2.69		
OL-STA-20004-VC	OL-0071-08	1118299	922721	0.0	3.3	1.7	136	0	0	0	27.0	0	4.0	23.0	73.0	51.4	21.6	85	44	41		13.9	
OL-STA-20007-VC	OL-0071-17	1118055	922922	3.3	6.6	5.0	113	0	0	0	7.5	0.5	2.0	5.0	92.5	79.3	13.2	110	39	71		15.7	
OL-STA-20012-VC	OL-0071-25	1118395	922766	3.3	6.6	5.0	128	0	0	0	10.9	0	1.9	9.0	89.1	82.0	7.2	109	46	63		13.4	
OL-STA-20014-VC	OL-0071-28	1118322	922919	0.0	3.3	1.7	132	0	0	0	1.6	0	0	1.6	98.4	83.4	15.0	71	46	25		7.0	
OL-STA-20015-VC	OL-0071-30	1118145	922986	3.3	6.6	5.0	178	0	0	0	0.5	0	0	0.5	99.5	60.0	39.5	127	63	64		6.5	
OL-VC-20075	OL-0231-04	1118764	922723	0.0	3.3	1.7	242.2																
OL-VC-20075	OL-0232-17	1118764	922723	3.3	6.6	5.0	178.3	0	0	0	5.2	3.2	1.0	1.0	94.8	51.8	43.0	74	50	24			
OL-VC-20078	OL-0233-04	1118584	923176	0.0	3.3	1.7	219.1	0	0	0	1.6	0	0	1.6	98.4	87.4	11.0	122	66	56			
OL-VC-20078	OL-0231-15	1118584	923176	3.3	6.6	5.0	137.4																
OL-VC-20079	OL-0231-18	1118450	923077	0.0	3.3	1.7	140.9																
OL-VC-20079	OL-0297-02	1118450	923077	0.0	3.3	1.7	123.3	0	0	0	0.7	0	0	0.7	99.3	88.7	10.6	55	36	19	2.58		
OL-VC-20079	OL-0231-19	1118450	923077	3.3	6.6	5.0	153.6																
OL-VC-70017	OL-0233-12	1117926	926251	0.0	3.3	1.7	226.7																
OL-VC-70017	OL-0235-14	1117926	926251	3.3	6.6	5.0	207.0	0.3	0	0.3	1.4	0	0.7	0.7	98.3	63.3	35.0	109	60	49	2.59		
OL-VC-70021	OL-0234-09	1117331	926382	0.0	3.3	1.7	130.7																
OL-VC-70021	OL-0234-10	1117331	926382	3.3	6.6	5.0	103.0																
OL-VC-70023	OL-0234-18	1116854	926349	0.0	3.3	1.7	109.1																
OL-VC-70023	OL-0234-19	1116854	926349	3.3	6.6	5.0	69.7																
OL-VC-80029	OL-0281-08	1118587	924084	3.3	6.6	5.0	123.3	0	0	0	6.0	1.0	2.0	3.0	94.0	67.0	27.0	79	55	24	2.57		
OL-VC-80030	OL-0281-17	1118545	924726	3.3	6.6	5.0	232.0	0	0	0	1.5	0	0	1.5	98.5	69.5	29.0	99	61	38			
OL-VC-80031	OL-0272-07	1118458	925320	0.0	0.5	0.3	161.3																
OL-VC-80031	OL-0272-08	1118458	925320	0.5	3.3	1.9	238.1																
OL-VC-80031	OL-0272-09	1118458	925320	3.3	6.6	5.0	185.6																
OL-VC-80031	OL-0303-05	1118458	925320	3.3	6.6	5.0	179.4	0.4	0	0.4	1.3	0	0.5	0.8	98.3	64.4	33.9	80	45	35	2.55		
OL-VC-80033	OL-0281-09	1118853	923783	0.0	0.5	0.3	211.2	0	0	0	0.8	0	0	0.8	99.2	66.2	33.0	115	47	68	2.62		
OL-VC-80033	OL-0271-01	1118853	923783	3.3	6.6	5.0	147.9																
OL-VC-80034	OL-0281-10	1118809	924391	0.0	0.5	0.3	215.6	0	0	0	0.7	0	0	0.7	99.3	74.3	25.0	113	49	64			
OL-VC-80034	OL-0304-08	1118809	924391	0.5	3.3	1.9	232.5	0	0	0	1.4	0	0.7	0.7				161	49	112			
OL-VC-80034	OL-0271-06	1118809	924391	3.3	6.6	5.0	181.4																
OL-VC-80035	OL-0281-18	1118788	925064	0.0	0.5	0.3	219.2	0	0	0	2.1	1.0	0	1.1	97.9	72.9	25.0	103	48	55	2.73		
OL-VC-80035	OL-0273-11	1118788	925064	3.3	6.6	5.0	186.6																
S309	SF0062	1118178	923491	0.0	0.5	0.2		0.1	0	0.1	27.4	0.2	3.9	23.3	72.5	47.9	24.6	34.9	30.2	4.7	2.45		59.2
S309	SF0063	1118178	923491	0.5	1.0	0.7		0	0	0	7.0	0	1.0	6.0	93.0	75.7	17.3	35.3	32.3	3.0	2.48		57.8

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S309	VC0087	1118178	923491	1.0	2.4	1.7		0	0	0	10	NA[1]	NA[1]	NA[1]	90.0	82.0	8.0						59.2
S309	VC0065	1118178	923491	2.4	5.7	4.1		0	0	0	7.1	0	2.5	4.6	92.9	67.9	25.0	36.3	33.7	2.6	2.54		59.4
S310	SF0064	1118393	924481	0.0	0.5	0.2		0	0	0	9.3	0	0.3	9.0	90.7	58.9	31.8	35.3	31.8	3.5	2.53		62.1
S310	SF0065	1118393	924481	0.5	1.0	0.7		0	0	0	5.1	0	0.4	4.7	94.9	71.0	23.9	34.7	32.8	1.9	2.57		61.5
S310	VC0073	1118393	924481	1.0	3.3	2.1		0	0	0	2.8	0	1.1	1.7	97.2	69.3	27.9	36.7	24.6	12.1	2.52		59.0
S310	VC0074	1118393	924481	3.3	6.6	4.9		0	0	0	1.2	0	0.4	0.8	98.8	72.2	26.6	37.7	32.8	4.9	2.58		58.7
S311	VC0207	1117120	925290	0.0	0.5	0.2		0	0	0	26	NA[1]	NA[1]	NA[1]	74.0	66.0	8.0						59.2
S311	VC0208	1117120	925290	0.5	1.0	0.7		0	0	0	10	NA[1]	NA[1]	NA[1]	90.0	84.0	6.0						58.8
S311	VC0081	1117120	925290	1.0	3.3	2.1		0	0	0	5.2	0	1.0	4.2	94.8	69.8	25.0	39.5	36.1	3.4	2.58		60.4
S311	VC0082	1117120	925290	3.3	6.6	4.9		0	0	0	7.1	0	0.7	6.4	92.9	68.0	24.9	44.5	40.8	3.7	2.62		61.9
S311	CT0003	1117120	925290	5.6	5.6	5.6	139.8	0	0	0	1.8	0.1	0.3	1.4	99.7	98.2	1.5				2.56		34.0
S312	SF0068	1117276	926023	0.0	0.5	0.2		0	0	0	4.9	0	1.1	3.8	95.1	83.9	11.2	31.2	29.3	1.9	2.57		56.9
S312	SF0069	1117276	926023	0.5	1.0	0.7		0	0	0	1.7	0	0.1	1.6	98.3	86.2	12.1	30.4	28.4	2	2.54		56.5
S312	VC0089	1117276	926023	1.0	3.3	2.1		0	0	0	5.5	0	1.2	4.3	94.5	62.8	31.7	39.3	35.8	3.5	2.58		59.5
S312	VC0090	1117276	926023	3.3	6.6	4.9		0	0	0	4.9	0	0.4	4.5	95.1	69.6	25.5	34.1	29.9	4.2	2.56		61.0
S312	CT0004	1117276	926023	4.5	4.5	4.5	158.8	0	0	0	0.3	0	0.1	0.2	99.7	NA[1]	NA[1]				2.02		32.0
S339	SF0124	1118149	922819	0.0	0.5	0.2		0	0	0	21.9	0	7.9	14.0	78.1	71.0	7.1	34	30.9	3.1	2.55		64.3
S339	SF0125	1118149	922819	0.5	1.0	0.7		0	0	0	15.0	0	4.7	10.3	85.0	74.9	10.1	37.4	32.5	4.9	2.53		63.0
S339	SB0031	1118149	922819	1.0	3.3	2.1		0	0	0	6.7	0	0.8	5.9	93.3	74.9	18.4	36.9	29.3	7.6	2.47		59.6
S339	CT0005a	1118149	922819	1.2	1.2	1.2	135.2	0	0	0	3.9	0.1	0.5	3.3	96.1	91.1	5.0				2.54		32.0
S339	SB0032	1118149	922819	3.3	5.5	4.4		0	0	0	2.6	0	0.3	2.3	97.4	70.8	26.6	35	30.3	4.7	2.53		60.3
S339	SF0123_E	1118149	922819	5.5	6.6	6.0		0	0	0	5.3	0.2	0.7	4.4	94.7	67.4	27.3	37.5	31	6.5	2.56		63.0
S339	CT0005b	1118149	922819	6.3	6.3	6.3	242.2	0	0	0	1.1	0.1	0.3	0.7	98.9	NA[1]	NA[1]				2.50		30.0
S340	SF0123	1117863	923498	0.0	0.1	0.0		36.0	35.1	0.9	1.6	0.8	0.1	0.7	62.4	54.7	7.7	36.4	34	2.4	2.61		57.6
S340	SF0123_R	1117863	923498	0.0	0.1	0.0		20.7	11.0	9.7	22.3	2.7	7.2	12.4	57.0	46.2	10.8	32.2	28.6	3.6	2.62		59.8
S340	SF0126	1117863	923498	0.0	0.5	0.2		0	0	0	35.7	0	11.5	24.2	64.3	43.4	20.9	35.1	32.6	2.5	2.55		58.2
S340	SF0127	1117863	923498	0.5	1.0	0.7		0	0	0	12.6	0	3.7	8.9	87.4	61.4	26.0	37.5	34.1	3.4	2.58		59.8
S340	SB0033	1117863	923498	1.0	3.3	2.1		0	0	0	33.6	0	12.6	21.0	66.4	37.8	28.6	36.9	35.5	1.4	2.54		64.8
S340	SB0034	1117863	923498	3.3	6.6	4.9		0	0	0	18.7	0	3.1	15.6	81.3	68.0	13.3	40.3	36.3	4	2.52		64.9
S341	SF0128	1117794	923911	0.0	0.5	0.2		3.6	0	3.6	44.2	6.9	14.2	23.1	52.2	42.2	10.0	29.5	27.4	2.1	2.58		66.2
S341	SF0129	1117794	923911	0.5	1.0	0.7		1.5	0	1.5	44.6	13.4	13.1	18.1	53.9	43.8	10.1	47.2	44.3	2.9	2.71		71.9
S341	SB0063	1117794	923911	1.0	2.8	1.9		0	0	0	11.4	1.0	4.5	5.9	88.6	71.5	17.1	34.4	32.8	1.6	2.57		60.3
S341	SB0064	1117794	923911	2.8	5.2	4.0		0.3	0	0.3	4.5	0.5	0.7	3.3	95.2	69.6	25.6	33.6	31	2.6	2.53		57.6
S341	SF0119	1117794	923911	5.2	6.6	5.9		0	0	0	3.3	0.3	0.5	2.5	96.7	63.4	33.3	38.6	35.7	2.9	2.53		57.2
S341	CT0006	1117794	923911	5.5	5.5	5.5	118.2	0.3	0	0.3	4.7	0.5	1.2	3.0	95.0	95.0	1.5				2.52		35.0
S342	BC0011	1118375	923951	0.0	0.1	0.0		0	0	0	38	NA[1]	NA[1]	NA[1]	62.0	55.0	7.0						
S342	SF0130_T	1118375	923951	0.0	0.5	0.2		3.1	0.1	3.0	15.2	0.2	6.1	8.9	81.7	77.3	4.4	42.2	36.9	5.3	2.53		58.9
S342	BC0012	1118375	923951	0.1	0.3	0.2		0	0	0	66	NA[1]	NA[1]	NA[1]	34.0	29.0	5.0						
S342	SF0131	1118375	923951	0.5	1.0	0.7		0	0	0	7.9	0	1.2	6.7	92.1	64.7	27.4	39.8	34.4	5.4	2.59		49.3
S342	SB0037	1118375	923951	1.0	3.3	2.1		0	0	0	4.3	0	0.9	3.4	95.7	68.5	27.2	34.9	33	1.9	2.50		55.9
S342	SB0038	1118375	923951	3.3	6.6	4.9		0	0	0	2.2	0	0.5	1.7	97.8	64.8	33.0	38.7	33.3	5.4	2.56		52.8
S343	SF0132	1117698	924527	0.0	0.5	0.2		0.3	0	0.3	26.7	2.9	6.8	17.0	73.0	56.2	16.8	28.5	25.5	3	2.53		58.4
S343	SF0133	1117698	924527	0.5	1.0	0.7		0.2	0	0.2	16.0	0.4	2.8	12.8	83.8	63.9	19.9	31.9	27.5	4.4	2.57		60.5
S343	SF0167	1117698	924527	1.0	3.3	2.1		0	0	0	45.8	0.4	12.3	33.1	54.2	43.8	10.4	42.9	40.7	2.2	2.55		66.8
S343	SB0039	1117698	924527	1.0	3.3	2.1		2.1	0	2.1	48.1	6.6	11.0	30.5	49.8	39.2	10.6	48.6	45	3.6	2.54		66.6
S343	SB0040	1117698	924527	3.3	6.6	4.9		5.0	0	5.0	47.9	3.5	15.5	28.9	47.1	33.8	13.3	46.5	41	5.5	2.54		68.3
S344	BC0007	1118147	925066	0.0	0.1	0.0		0	0	0	78	NA[1]	NA[1]	NA[1]	22.0	17.0	5.0						
S344	SF0111_T	1118147	925066	0.0	0.5	0.2		0	0	0	15	NA[1]	NA[1]	NA[1]	85.0	78.0	7.0						
S344	BC0008	1118147	925066	0.1	0.5	0.3		0	0	0	17	NA[1]	NA[1]	NA[1]	83.0	78.0	5.0						
S344	SF0112	1118147	925066	0.5	1.0	0.7		0	0	0	0.6	0	0.2	0.4	99.4	73.5	25.9	33.4	29.1	4.3	2.56		56.3
S344	SB0019	1118147	925066	1.0	3.3	2.1		0	0	0	6.8	0	1.1	5.7	93.2	67.8	25.4	36.1	33	3.1	2.59		56.8
S344	SB0070	1118147	925066	1.0	3.3	2.1		0	0	0	5.5	0	0.7	4.8	94.5	69.8	24.7	37.6	32.6	5	2.59		58.9
S344	CT0009	1118147	925066	2.1	2.1	2.1	90.6	0.1	0	0.1	3.4	0.3	1.1	2.0	96.5	92.5	4.0				2.32		33.0

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Remediation Area D Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
S344	SB0020	1118147	925066	3.3	6.6	4.9		0	0	0	2.2	0	0.4	1.8	97.8	70.7	27.1	39.4	35.9	3.5	2.61		54
S346	SF0138	1117238	924923	0.0	0.5	0.2		10.3	6.8	3.5	23.2	8.4	8.6	6.2	66.5	52.1	14.4	26.1	24.7	1.4	2.63		61.8
S346	SF0139	1117238	924923	0.5	1.0	0.7		0.4	0	0.4	14.6	2.7	3.2	8.7	85.0	67.3	17.7	30.4	30.1	0.3	2.60		58.7
S346	SB0045	1117238	924923	1.0	5.2	3.1		0.1	0	0.1	12.4	0.4	1.6	10.4	87.5	65.0	22.5	36.5	35.3	1.2	2.56		60.6
S346	SB0046	1117238	924923	5.2	6.6	5.9		0.8	0	0.8	34.9	3.5	5.8	25.6	64.3	47.0	17.3	Non-Plastic			2.34		56.8
S347	SF0140	1117468	925224	0.0	0.5	0.2		2.2	0	2.2	53.9	6.1	21.6	26.2	43.9	30.2	13.7	Non-Plastic			2.45		63.4
S347	SF0141	1117468	925224	0.5	1.0	0.7		5.4	0	5.4	56.0	9.9	18.9	27.2	38.6	29.3	9.3	Non-Plastic			2.40		66.4
S347	SB0047	1117468	925224	1.0	3.3	2.1		9.2	0	9.2	24.8	5.7	6.4	12.7	66.0	49.3	16.7	Non-Plastic			2.45		62.8
S347	SB0048	1117468	925224	3.3	6.6	4.9		0.3	0	0.3	22.1	1.1	5.9	15.1	77.6	57.9	19.7	44.5	41.4	3.1	2.57		61.3
S348	SF0142	1116868	925641	0.0	0.5	0.2		0	0	0	7.4	0	2.0	5.4	92.6	62.5	30.1	40.3	35.2	5.1	2.55		60.2
S348	SF0143	1116868	925641	0.5	1.0	0.7		0	0	0	3.7	0	0.4	3.3	96.3	71.0	25.3	36.6	33.6	3	2.58		59.1
S348	SB0049	1116868	925641	1.0	3.6	2.3		0	0	0	19.9	0	6.2	13.7	80.1	59.8	20.3	46.3	36	10.3	2.57		62.3
S348	SB0050	1116868	925641	3.6	6.6	5.1		0	0	0	2.7	0	1.4	1.3	97.3	66.6	30.7	33.8	30.6	3.2	2.59		59.4
S350	SF0146	1116488	926012	0.0	0.5	0.2		0.5	0	0.5	9.6	0	2.8	6.8	89.9	57.8	32.1	38.2	33.5	4.7	2.68		60.1
S350	SF0147	1116488	926012	0.5	1.0	0.7		0	0	0	6.7	0	1.1	5.6	93.3	70.0	23.3	33.6	31.2	2.4	2.61		59.5
S350	SB0053	1116488	926012	1.0	3.0	2.0		0	0	0	5.3	0	1.0	4.3	94.7	72.9	21.8	40.6	32.8	7.8	2.63		61.4
S350	SB0054	1116488	926012	3.0	6.6	4.8		0	0	0	12.0	0.3	1.2	10.5	88.0	77.7	10.3	32.2	28.3	3.9	2.56		64.4
S350	SB0067	1116488	926012	3.0	6.6	4.8		0	0	0	11.5	0	1.0	10.5	88.5	70.0	18.5	34.1	30.2	3.9	2.55		65.0
S351	SF0173	1116245	926468	0.0	0.1	0.0		0	0	0	12.4	1.7	0.5	10.2	87.6	65.0	22.6	38	35	3	2.49		61.8
S351	SF0149	1116245	926468	0.0	0.5	0.2		21.7	0	21.7	34.6	6.0	11.6	17.0	43.7	33.0	10.7	Non-Plastic			2.45		64.0
S351	SF0150	1116245	926468	0.5	1.0	0.7		32.6	NA[1]	NA[1]	50.2	NA[1]	NA[1]	NA[1]	17.2	12.6	4.6	Non-Plastic			2.52		68.2
S351	SB0055	1116245	926468	1.0	3.3	2.1		13.6	0	13.6	22.4	14.1	1.1	7.2	64.0	57.0	7.0	26.5	26.4	0.1	2.54		64.6
S351	SB0056	1116245	926468	3.3	6.6	4.9		0	0	0.0	28.6	0	17.9	10.7	71.4	60.2	11.2	34.4	31.1	3.3	2.50		63.1
S351	CT0010	1116245	926468	5.9	5.9	5.9	76.3	0.2	0	0.2	49.5	0.4	8.5	40.6	50.3	48.3	2.0				2.46		23.0
Average[2]							149.1	1.3	0.4	0.6	13.7	1.2	3.2	7.8	84.9	64.2	20.5	61	40	20	2.54	7.4	58.8
Maximum[2]							242.2	36.0	35.1	21.7	78.0	13.4	21.6	33.1	99.7	98.2	44.0	161	88	112	2.75	15.7	83.0
Minimum[2]							19.0	0	0	0	0.3	0	0	0.2	17.2	12.6	1.5	Non-Plastic			2.02	2.9	30.0
Standard Deviation[2] (s)							47.2	5.2	3.3	2.4	16.1	2.7	4.6	8.1	18.1	16.3	10.0	31.5	12.1	22.9	0.10	3.9	9.0
Number of Samples							113	125	124	124	125	116	116	116	124	122	122	103	103	103	93	16	80
Average+1.96s							241.7	11.5	7.0	5.3	45.3	6.4	12.1	23.7	120.3	96.1	40.0	122.4	64.0	65.3	2.74	14.9	76.4
Average-1.96s							56.6	-8.9	-6.1	-4.1	-17.9	-4.1	-5.8	-8.2	49.5	32.2	1.0	-1.2	16.7	-24.6	2.34	-0.2	41.2

Notes:

1. NA indicates that the full grain-size distribution curve is not available; therefore, the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum, and Standard Deviation are calculated based on the Number of Samples available for each category.

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area E Index Test Results Summary (Top 2m within Dredging Zone, Non-ILWD)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel %	Percent Fine Gravel %	Percent Sand %	Percent Coarse Sand %	Percent Medium Sand %	Percent Fine Sand (0.075mm- %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-SB-60001-VC	OL-0026-01	1121361	928470	0.0	3.3	1.7	87.0	22.0	0	22.0	42.8	11.8	11.0	20.0	35.2	22.4	12.8		Non-Plastic		2.59	2.4	
OL-SB-60001-VC	OL-0026-02	1121361	928470	3.3	6.6	5.0	75.0	0.6	0	0.6	22.6	0	6.0	16.6	76.8	57.7	19.1		Non-Plastic		2.61	4.2	
OL-SB-60007-VC	OL-0023-01	1119195	928698	0.0	3.3	1.7	32.0	0.2	0	0.2	65.5	2.0	8.0	55.5	34.3	29.0	5.3		Non-Plastic		2.67	0.7	
OL-SB-60007-VC	OL-0023-02	1119195	928698	3.3	6.6	5.0	41.0	0.2	0	0.2	53.9	0.9	3.0	50.0	45.9	34.7	11.2		Non-Plastic		2.63	1.5	
OL-SB-60013-VC	OL-0020-01	1117305	928031	0.0	3.3	1.7	47.0	0.4	0	0.4	49.7	0	1.7	48.0	49.9	42.7	7.2		Non-Plastic		2.63	1.2	
OL-SB-60013-VC	OL-0020-02	1117305	928031	3.3	6.6	5.0	66.0	0.1	0	0.1	44.2	0	1.2	43.0	55.7	41.2	14.5		Non-Plastic		2.63	1.8	
OL-STA-60016-SB	OL-0071-44	1120195	928826	2.0	4.0	3.0	75.0																
OL-STA-60017-SB	OL-0009-05	1120228	928663	2.0	4.0	3.0	85.0	0	0	0	43.0	0	4.0	39.0	57.0	42.5	14.5		Non-Plastic		2.60	2.4	
OL-STA-60017-SB	OL-0071-47	1120228	928663	4.0	6.0	5.0	82.0																
OL-STA-60018-SB	OL-0071-51	1118122	928427	4.0	6.0	5.0	251.0																
OL-STA-60019-SB	OL-0009-09	1118229	928296	2.0	4.0	3.0	55.0	0.6	0	0.6	93.8	0	7.0	86.8	5.6	NA[1]	NA[1]						
OL-VC-60066	OL-0276-05	1121150	928367	3.3	6.6	5.0	74.8																
OL-VC-60066	OL-0283-07	1121150	928367	0.0	3.3	1.7	81.6	20.3	0	20.3	47.5	20.0	12.0	15.5	32.2	21.2	11.0	38	32	6			
OL-VC-60067	OL-0274-03	1120674	928359	0.0	3.3	1.7	91.6																
OL-VC-60067	OL-0283-15	1120674	928359	3.3	6.6	5.0	98.0	0	0	0	32.4	1.0	4.0	27.4	67.6	51.6	16.0	50	38	12			
OL-VC-60068	OL-0275-17	1119471	928330	3.3	6.6	5.0	53.6																
OL-VC-60068	OL-0283-09	1119471	928330	0.0	3.3	1.7	50.4	0.5	0	0.5	71.7	3.7	15.0	53.0	27.8	18.8	9.0	36	27	9			
OL-VC-60069	OL-0275-14	1118853	928238	3.3	6.6	5.0	52.6																
OL-VC-60069	OL-0283-12	1118853	928238	0.0	3.3	1.7	39.8	0	0	0	87.1	0	4.0	83.1	12.9	7.9	5.0						
OL-VC-60070	OL-0276-09	1117648	927621	3.3	6.6	5.0	74.5																
OL-VC-60070	OL-0282-13	1117648	927621	0.0	3.3	1.7	80.4	0.1	0	0.1	58.2	1.2	6.0	51.0	41.7	33.7	8.0						
OL-STA-60098	OL-0338-01	1117362	927889	0.0	3.2	1.6	52.3	3.0	0	3.0	70.5	6.0	25.0	39.5	26.5	14.1	12.4		Non-Plastic		2.61	2.8	
OL-STA-60100	OL-0338-02	1119575	928597	0.0	3.3	1.7	66.6	0	0	0	41.2	1.0	2.0	38.2	58.8	47.5	11.3	53	34	19	2.60	2.7	
OL-SB-70002-VC	OL-0032-01	1116473	927021	0.0	3.3	1.7	77.0	0.1	0	0.1	62.4	0	15.0	47.4	37.5	30	7.3		Non-Plastic		2.67	2.4	
OL-SB-70002-VC	OL-0032-02	1116473	927021	3.3	6.6	5.0	58.0	0.1	0	0.1	48.9	0	8.9	40.0	51.0	44.6	6.4		Non-Plastic		2.64	2.2	
OL-SB-70003-VC	OL-0026-05	1116492	927305	0.0	3.3	1.7	63.0	0	0	0	35.6	0	1.6	34.0	64.4	49.9	14.5		Non-Plastic		2.70	1.3	
OL-SB-70003-VC	OL-0026-06	1116492	927305	3.3	6.6	5.0	62.0	0.2	0	0.2	39.6	0	3.6	36.0	60.2	45.8	14.4		Non-Plastic		2.59	1.4	
OL-STA-70005-SB	OL-0028-01	1116458	926838	0.0	2.0	1.0	67.0	0	0	0	20.4	1.4	3.0	16.0	79.6	60.25	19.35	54	36	18	2.50	12.2	
OL-SB-70009-SS	OL-0100-30	1117550	926511	0.0	0.5	0.3												138	39	99			
OL-SB-70012-SS	OL-0100-31	1116663	926520	0.0	0.5	0.3	94.0												Non-Plastic				
OL-SB-70013-SS	OL-0100-32	1116727	926908	0.0	0.5	0.3	123.0											59	34	25			
OL-STA-70015-SS	OL-0100-35	1116570	926452	0.0	0.5	0.3	146.0											69	43	26			
OL-VC-70023	OL-0234-18	1116854	926349	0.0	3.3	1.7	109.1																
OL-VC-70023	OL-0234-19	1116854	926349	3.3	6.6	5.0	69.7																
OL-VC-70024	OL-0235-02	1116858	926641	0.0	3.3	1.7	133.9																
OL-VC-70024	OL-0235-03	1116858	926641	3.3	6.6	5.0	114.7																
OL-VC-70025	OL-0290-19	1116331	926720	0.0	3.3	1.7	81.8																
OL-VC-70025	OL-0288-19	1116331	926720	3.3	6.6	5.0	67.9	0	0	0	62.1	0	5.0	57.1	37.9	31.9	6.0						
OL-VC-70026	OL-0291-01	1116387	926928	0.0	3.3	1.7	64.2																
OL-VC-70026	OL-0288-10	1116387	926928	3.3	6.6	5.0	92.9	0	0	0	38.7	0	4.7	34.0	61.3	41.3	20.0						
OL-VC-70027	OL-0291-04	1116246	926946	0.0	3.3	1.7	61.7																
OL-VC-70027	OL-0288-13	1116246	926946	3.3	6.6	5.0	83.6	0	0	0	42.7	0.7	5.0	37.0	57.3	48.3	9.0						
OL-VC-70028	OL-0289-03	1116368	927229	0.0	3.3	1.7	50.8	0	0	0	65.8	1.8	10.0	54.0	34.2	26.2	8.0						
OL-VC-70028	OL-0291-06	1116368	927229	3.3	6.6	5.0	77.7																
OL-VC-70029	OL-0291-09	1116560	927423	0.0	3.3	1.7	66.0																
OL-VC-70029	OL-0289-06	1116560	927423	3.3	6.6	5.0	54.5	0	0	0	33.1	0	5.1	28.0	66.9	58.9	8.0				2.59		
OL-VC-70030	OL-0288-16	1116809	927658	0.0	3.3	1.7	84.8	1.2	0	1	37.3	2.3	10.0	25.0	61.5	40.5	21.0	50	36	14			
OL-VC-70030	OL-0291-12	1116809	927658	3.3	6.6	5.0	76.9																
OL-S1	S00556	1116419	926536	0.0	0.1	0.0	37.4	38.5	NA[1]	NA[1]	52.1	NA[1]	NA[1]	NA[1]	9.4	8.7	0.7						
OL-S1	S00557	1116419	926536	0.0	0.1	0.0	39.7	39.5	NA[1]	NA[1]	49.3	NA[1]	NA[1]	NA[1]	11.2	10.2	1.0						
OL-S1	S00558	1116419	926536	0.0	0.1	0.0	46.2	46.2	NA[1]	NA[1]	40.9	NA[1]	NA[1]	NA[1]	12.9	11.8	1.1						
OL-S2	S00546	1116760	926601	0.0	0.1	0.0	52.5	52.7	NA[1]	NA[1]	30	NA[1]	NA[1]	NA[1]	17.3	14.9	2.4						

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area E Index Test Results Summary (Top 2m within Dredging Zone, Non-ILWD)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel %	Percent Fine Gravel %	Percent Sand %	Percent Coarse Sand %	Percent Medium Sand %	Percent Fine Sand (0.075mm- %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-S3	S00613	1116801	926609	0.0	0.1	0.0	53.0	53.2	NA[1]	NA[1]	28.8	NA[1]	NA[1]	NA[1]	18.0	15.0	3.0						
OL-S5	S00547	1116893	927107	0.0	0.1	0.0	53.9	54.7	NA[1]	NA[1]	22.2	NA[1]	NA[1]	NA[1]	23.1	19.3	3.8						
OL-S6	S00582	1117218	927545	0.0	0.1	0.0	28.9	28.3	NA[1]	NA[1]	70.8	NA[1]	NA[1]	NA[1]	0.9	0.3	0.6						
OL-S7	S00555	1117251	927378	0.0	0.1	0.0	31.4	31.0	NA[1]	NA[1]	66.1	NA[1]	NA[1]	NA[1]	2.9	1.9	1.0						
P1	S00014	1116419	926536	0.0	1.0	0.5	45.4	43.6	NA[1]	NA[1]	35.3	NA[1]	NA[1]	NA[1]	21.1	19.3	1.8						
P1	S00015	1116419	926536	1.0	2.0	1.5	50.7	51.4	NA[1]	NA[1]	3.0	NA[1]	NA[1]	NA[1]	45.6	42.6	3.0						
P1	S00016	1116419	926536	2.0	3.0	2.5	47.5	48.3	NA[1]	NA[1]	4.2	NA[1]	NA[1]	NA[1]	47.5	43.0	4.5						
P3	S00340	1116857	926636	0.0	1.0	0.5	55.4	54.8	NA[1]	NA[1]	20.3	NA[1]	NA[1]	NA[1]	24.9	22.7	2.2						
P3	S00341	1116857	926636	1.0	2.0	1.5	51.5	53.3	NA[1]	NA[1]	17.9	NA[1]	NA[1]	NA[1]	28.8	26.5	2.3						
P3	S00342	1116857	926636	2.0	3.0	2.5	51.5	54.0	NA[1]	NA[1]	4.7	NA[1]	NA[1]	NA[1]	41.3	36.9	4.4						
P3	S00343	1116857	926636	3.0	3.9	3.4	48.9	50.8	NA[1]	NA[1]	3.1	NA[1]	NA[1]	NA[1]	46.1	42.2	3.9						
P3	S00344	1116857	926636	3.9	4.9	4.4	46.4	47.4	NA[1]	NA[1]	3.6	NA[1]	NA[1]	NA[1]	49.0	46.0	3.0						
P4	S00335	1117325	926380	0.0	1.0	0.5	52.0	53.9	NA[1]	NA[1]	18.2	NA[1]	NA[1]	NA[1]	27.9	26.2	1.7						
P4	S00336	1117325	926380	1.0	2.0	1.5	48.1	50.9	NA[1]	NA[1]	14.2	NA[1]	NA[1]	NA[1]	34.9	32.8	2.1						
P4	S00337	1117325	926380	2.0	3.0	2.5	48.6	50.6	NA[1]	NA[1]	12.5	NA[1]	NA[1]	NA[1]	36.9	34.5	2.4						
P4	S00338	1117325	926380	3.0	3.9	3.4	48.2	49.8	NA[1]	NA[1]	5.7	NA[1]	NA[1]	NA[1]	44.5	41.4	3.1						
P4	S00339	1117325	926380	3.9	4.9	4.4	47.8	48.7	NA[1]	NA[1]	3.3	NA[1]	NA[1]	NA[1]	48.0	45.4	2.6						
P11	S00162	1118691	927781	0.0	1.0	0.5	60.1	59.8	NA[1]	NA[1]	11.8	NA[1]	NA[1]	NA[1]	28.4	25.6	2.8						
P11	S00163	1118691	927781	1.0	2.0	1.5	54.2	59.3	NA[1]	NA[1]	4.1	NA[1]	NA[1]	NA[1]	36.6	30.7	5.9						
P11	S00164	1118691	927781	2.0	3.0	2.5	53.4	55.9	NA[1]	NA[1]	5.6	NA[1]	NA[1]	NA[1]	38.5	31.1	7.4						
P16	S00062	1120323	928588	0.0	1.0	0.5	54.2	54.0	NA[1]	NA[1]	17.8	NA[1]	NA[1]	NA[1]	28.2	23.0	5.2						
P16	S00065	1120323	928588	0.0	1.0	0.5	52.1	47.8	NA[1]	NA[1]	22.8	NA[1]	NA[1]	NA[1]	29.4	23.6	5.8						
P16	S00066	1120323	928588	0.0	1.0	0.5	48.7	41.5	NA[1]	NA[1]	29.4	NA[1]	NA[1]	NA[1]	29.1	23.6	5.5						
P16	S00063	1120323	928588	1.0	2.0	1.5	49.5	62.0	NA[1]	NA[1]	6.8	NA[1]	NA[1]	NA[1]	31.2	22	9.2						
P16	S00064	1120323	928588	2.0	3.0	2.5	49.4	50.8	NA[1]	NA[1]	10.7	NA[1]	NA[1]	NA[1]	38.5	33.8	4.7						
S10	S00572	1118187	928281	0.0	0.1	0.0	39.8	39.3	NA[1]	NA[1]	52.2	NA[1]	NA[1]	NA[1]	8.5	7.1	1.4						
S11	S00567	1117954	927958	0.0	0.1	0.0	31.2	29.5	NA[1]	NA[1]	67.7	NA[1]	NA[1]	NA[1]	2.8	2.0	0.8						
S13	S00565	1119850	928512	0.0	0.1	0.0	50.4	51.8	NA[1]	NA[1]	17.5	NA[1]	NA[1]	NA[1]	30.7	24.1	6.6						
S16	S00566	1120567	928839	0.0	0.1	0.0	40.3	39.8	NA[1]	NA[1]	56.0	NA[1]	NA[1]	NA[1]	4.2	3.5	0.7						
S17	S00562	1120786	928512	0.0	0.1	0.0	52.0	52.6	NA[1]	NA[1]	40.5	NA[1]	NA[1]	NA[1]	6.9	5.4	1.5						
S17	S00563	1120786	928512	0.0	0.1	0.0	52.1	51.9	NA[1]	NA[1]	42.6	NA[1]	NA[1]	NA[1]	5.5	3.9	1.6						
S22	S00559	1117524	926324	0.0	0.1	0.0	69.3	70.5	NA[1]	NA[1]	1.9	NA[1]	NA[1]	NA[1]	27.6	25.0	2.6						
S313	VC0187	1116312	926501	0.0	0.5	0.2		0	0	0	50.0	NA[1]	NA[1]	NA[1]	50.0	41.0	9.0						
S313	VC0188	1116312	926501	0.5	1.0	0.7		0	0	0	71.0	NA[1]	NA[1]	NA[1]	29.0	22.0	7.0						
S313	VC0194	1116312	926501	1.0	3.3	2.1		0	0	0	2.0	NA[1]	NA[1]	NA[1]	98.0	91.0	7.0						
S313	VC0098	1116312	926501	3.3	6.6	4.9		0	0	0	7.0	NA[1]	NA[1]	NA[1]	93.0	83.0	10.0						
S314	SF0072	1116583	926449	0.0	0.5	0.2		0.2	0.1	0.1	20.1	0.5	2.1	17.5	79.7	58.4	21.3	Non-Plastic			2.35		56.5
S314	SF0073	1116583	926449	0.5	1.0	0.7		0	0	0	4.5	0	0.2	4.3	95.5	64.8	30.7	33.8	31.6	2.2	2.42		56.5
S314	VC0105	1116583	926449	1.0	3.3	2.1		0	0	0	3.0	0	0.4	2.6	97.0	65.3	31.7	37.2	30	7.2	2.50		56.7
S314	VC0200	1116583	926449	1.0	3.3	2.1		0	0	0	1.4	0	0.5	0.9	98.6	48.9	49.7	38.5	29.8	8.7	2.61		56.2
S314	VC0106	1116583	926449	3.3	6.6	4.9		0	0	0	2.0	0	0.1	1.9	98.0	71.1	26.9	34.9	29.6	5.3	2.58		57
S316	SF0076	1117543	927405	0.0	0.5	0.2		0	0	0	91.0	NA[1]	NA[1]	NA[1]	9	5	4						
S316	SF0077	1117543	927405	0.5	1.0	0.7		0	0	0	93.0	NA[1]	NA[1]	NA[1]	7	5	2						
S316	VC0121	1117543	927405	1.0	3.3	2.2		0	0	0	87.0	NA[1]	NA[1]	NA[1]	13	10	3						

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area E Index Test Results Summary (Top 2m within Dredging Zone, Non-ILWD)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel %	Percent Fine Gravel %	Percent Sand %	Percent Coarse Sand %	Percent Medium Sand %	Percent Fine Sand (0.075mm- %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Specific Gravity	Organic Content %	Carbonate Alkalinity %
S316	VC0122	1117543	927405	3.3	6.6	5.0		0	0	0	40.0	NA[1]	NA[1]	NA[1]	60	52	8						
S318	VC0189	1118023	928074	0.0	0.5	0.2		0	0	0	91.0	NA[1]	NA[1]	NA[1]	9	8	1						
S318	VC0190	1118023	928074	0.5	1.0	0.7		0	0	0	92.0	NA[1]	NA[1]	NA[1]	8	6	2						
S318	VC0137	1118023	928074	1.0	3.3	2.1		0	0	0	91.0	NA[1]	NA[1]	NA[1]	9	6	3						
S318	VC0138	1118023	928074	3.3	6.6	4.9		0	0	0	34.0	NA[1]	NA[1]	NA[1]	66	59	7						
S321	SF0086	1118749	928457	0.0	0.5	0.2		0	0	0	93.0	NA[1]	NA[1]	NA[1]	7	3	4						
S321	SF0087	1118749	928457	0.5	1.0	0.7		0	0	0	92.0	NA[1]	NA[1]	NA[1]	8	5	3						
S321	VC0161	1118749	928457	1.0	3.3	2.1		0	0	0	83.0	NA[1]	NA[1]	NA[1]	17	15	2						
S321	VC0162	1118749	928457	3.3	6.6	4.9		0	0	0	66.0	NA[1]	NA[1]	NA[1]	34	29	5						
S322	SF0088	1120176	928436	0.0	0.5	0.2		0	0	0	19.0	NA[1]	NA[1]	NA[1]	81	81	0						
S322	SF0089	1120176	928436	0.5	1.0	0.7		0	0	0	8.0	NA[1]	NA[1]	NA[1]	92	69	23						
S322	VC0169	1120176	928436	1.0	3.3	2.1		0	0	0	30.0	NA[1]	NA[1]	NA[1]	70	52	18						
S322	VC0170	1120176	928436	3.3	6.6	4.9		0	0	0	44.0	NA[1]	NA[1]	NA[1]	56	44	12						
S352	SF0151	1116216	926825	0.0	0.5	0.2		1.1	0	1.1	39.0	2.4	9.3	27.3	59.9	44.1	15.8	Non-Plastic			2.50		67.9
S352	SF0152	1116216	926825	0.5	1.0	0.7		0	0	0	2.2	0.2	0.4	1.6	97.8	71.4	26.4	29.7	27.7	2	2.57		63.2
S352	SB0057	1116216	926825	1.0	3.3	2.1		0	0	0	26.5	0	1.1	25.4	73.5	66.2	7.3	26.1	24.1	2	2.59		67.9
S352	SB0058	1116216	926825	3.3	6.6	4.9		0	0	0	52.2	0	2.1	50.1	47.8	33.0	14.8	Non-Plastic			2.67		61.2
S353	SF0113	1116583	927268	0.0	0.5	0.2		0	0	0	92.0	NA[1]	NA[1]	NA[1]	8.0	5.0	3.0						
S353	SF0114	1116583	927268	0.5	1.0	0.7		0	0	0	90.0	NA[1]	NA[1]	NA[1]	10.0	7.0	3.0						
S353	SB0021	1116583	927268	1.0	3.3	2.1		0	0	0	72.0	NA[1]	NA[1]	NA[1]	28.0	22.0	6.0						
S353	SB0022	1116583	927268	3.3	6.6	4.9		0	0	0	53.0	NA[1]	NA[1]	NA[1]	47.0	38.0	9.0						
Average[2]							65.5	19.1	0	0.9	40.5	1.6	5.7	34.5	40.4	32.4	8.3	49.8	32.8	17.0	2.59	2.8	60.3
Maximum[2]							251.0	70.5	0.1	22.0	93.8	20.0	25.0	86.8	98.6	91.0	49.7	138.0	43.0	99.0	2.70	12.2	67.9
Minimum[2]							28.9	0	0	0	1.4	0	0.1	0.9	0.9	0.3	0	Non-Plastic			2.35	0.7	56.2
Standard Deviation[2] (s)							30.6	24.3	0.0	3.9	28.7	3.9	5.3	21.1	26.9	21.1	8.3	27.2	5.1	24.0	0.08	2.8	4.9
Number of Samples							83	95	59	59	95	35	35	35	95	94	94	15	15	15	24	14	9
Average+1.96s							125.4	66.8	0	8.4	96.7	9.3	16.1	75.8	93.1	73.9	24.6	103.0	42.7	64.1	2.74	8.4	70.0
Average-1.96s							5.6	-28.5	0	-6.7	-15.8	-6.1	-4.8	-6.8	-12.3	-9.0	-8.0	-3.4	22.9	-30.0	2.43	-2.8	50.7

Notes:

1. NA indicates that the full grain-size distribution curve is not available; therefore, the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum, and Standard Deviation are calculated based on the Number of Samples available for each category.

APPENDIX B

SITE-SPECIFIC METEOROLOGICAL DATA

TABLE B.1
ONONDAGA LAKE - SYRACUSE, NY
DREDGING, SCA, & WATER TREATMENT OPERATIONS IDS
ANNUAL METEOROLOGICAL SUMMARY - WILLIS AVENUE SITE TOWER
JANUARY - DECEMBER 2007

	SCALAR SPEED			SCALAR DIRECTION			TEMPERATURE			DEW POINT TEMP.			RELATIVE HUMIDITY			SOLAR RADIATION			BAROMETRIC PRESSURE		
MONTH	MAX. (mph)	MIN. (mph)	MEAN (mph)	MAX. (deg.)	MIN. (deg.)	MEAN (deg.)	MAX. (deg. F)	MIN. (deg. F)	MEAN (deg. F)	MAX. (deg. F)	MIN. (deg. F)	MEAN (deg. F)	MAX. (%)	MIN. (%)	MEAN (%)	MAX. (W/m^2)	MIN. (W/m^2)	MEAN DLY TOT. (W/m^2)	MAX. (in Hg)	MIN. (in Hg)	MEAN (in Hg)
JANUARY	21.2	0.9	8.0	360	1	214	61.6	-1.9	29.2	56.8	-4.4	22.5	100	35.2	77.8	572	0	1473	30.44	29.15	29.72
FEBRUARY	23.2	1.2	9.7	359	1	230	45.4	-2.0	20.0	34.7	-11.7	12.4	98	32.2	73.5	731	0	2731	30.25	29.19	29.65
MARCH	22.3	0.8	7.7	358	1	210	64.3	-1.2	32.4	53.4	-10.3	22.8	100	18.8	69.9	944	0	3756	30.47	29.01	29.84
APRIL	17.7	1.0	7.8	359	2	222	84.9	22.7	44.5	59.5	12.7	32.6	100	14.9	69.2	1020	0	4189	29.93	28.79	29.59
MAY	19.2	0.9	5.5	360	1	215	89.5	35.1	57.7	61.5	16.9	39.8	99	14.4	56.2	1074	0	7130	30.23	29.30	29.84
JUNE	19.2	0.9	5.8	360	1	222	93.3	42.7	69.1	71.6	30.8	53.8	98	28.5	63.0	1099	0	7398	29.94	29.08	29.67
JULY	13.7	1.0	5.2	360	1	219	91.4	51.1	69.8	70.8	39.6	58.4	98	25.9	70.2	1100	0	6141	29.99	29.34	29.67
AUGUST	13.5	1.1	5.5	359	1	197	93.8	49.6	71.5	74.6	37.6	59.4	98	24.7	68.3	1020	0	5686	29.94	29.35	29.70
SEPTEMBER	17.0	1.2	5.6	359	1	205	94.5	41.9	65.8	70.8	37.1	54.8	98	24.9	70.8	937	0	4816	30.21	29.25	29.82
OCTOBER	17.0	0.9	5.8	360	1	196	83.9	31.2	58.7	71.2	29.5	49.8	99	23.9	74.9	751	0	2902	30.22	29.14	29.75
NOVEMBER	24.3	1.1	7.2	357	1	206	61.2	19.0	39.0	52.5	15.6	31.3	99	29.3	75.9	638	0	1776	30.21	29.26	29.75
DECEMBER	21.1	1.3	8.0	360	3	196	51.9	9.8	29.8	48.9	2.1	24.3	99	47.4	80.4	524	0	931	30.37	28.82	29.80

TABLE B.2
ONONDAGA LAKE - SYRACUSE, NY
DREDGING, SCA, & WATER TREATMENT OPERATIONS IDS
ANNUAL METEOROLOGICAL SUMMARY - WILLIS AVENUE SITE TOWER
JANUARY - DECEMBER 2008

	SCALAR SPEED			SCALAR DIRECTION			TEMPERATURE			DEW POINT TEMP.			RELATIVE HUMIDITY			SOLAR RADIATION			BAROMETRIC PRESSURE		
MONTH	MAX. (mph)	MIN. (mph)	MEAN (mph)	MAX. (deg.)	MIN. (deg.)	MEAN (deg.)	MAX. (deg. F)	MIN. (deg. F)	MEAN (deg. F)	MAX. (deg. F)	MIN. (deg. F)	MEAN (deg. F)	MAX. (%)	MIN. (%)	MEAN (%)	MAX. (W/m^2)	MIN. (W/m^2)	MEAN DLY TOT. (W/m^2)	MAX. (in Hg)	MIN. (in Hg)	MEAN (in Hg)
JANUARY	25.9	0.9	8.5	359	1	202	68.0	-0.4	30.9	52.4	-6.6	22.6	99	31.7	72.5	683	0	1627	30.44	28.83	29.78
FEBRUARY	24.3	0.9	7.7	358	1	212	55.1	2.0	27.0	48.1	-7.6	20.9	100	36.6	78.8	758	0	1855	30.21	29.04	29.69
MARCH	21.9	0.7	7.3	360	1	220	59.7	14.0	32.9	49.2	0.7	23.7	100	23.4	71.4	974	0	3614	30.44	28.84	29.76
APRIL	25.4	0.9	7.1	359	2	188	87.9	23.6	52.8	65.6	6.0	36.0	99	14.0	57.8	1038	0	5725	30.22	29.11	29.77
MAY	14.7	1.0	6.4	360	1	214	82.6	31.2	55.6	63.2	19.9	41.7	98	17.6	63.8	1101	0	5827	30.05	29.01	29.56
JUNE	14.6	1.1	5.9	360	1	214	95.3	54.3	70.5	74.0	43.5	59.2	96	29.3	69.7	1068	0	6082	30.04	29.36	29.61
JULY	13.8	0.9	5.5	360	1	210	90.1	53.7	72.5	72.8	47.2	61.7	98	31.6	71.0	1062	0	5961	29.87	29.32	29.64
AUGUST	13.5	1.1	5.2	360	1	247	87.2	48.4	67.6	68.9	39.5	58.0	99	31.9	73.8	988	0	5821	30.04	29.39	29.67
SEPTEMBER	28.6	1.0	5.1	360	1	233	91.7	40.4	63.6	71.5	38.7	54.9	98.2	23.3	76.0	919	0	4213	30.26	29.01	29.83
OCTOBER	17.7	0.7	6.2	360	2	255	77.8	28.4	51.5	63.7	24.0	41.9	99.2	29.3	74.2	763	0	3215	30.42	29.26	29.84
NOVEMBER	19.4	1.1	6.6	357	2	224	71.9	17.5	36.8	56.6	14.6	30.6	98.6	35.4	78.2	634	0	1485	30.28	28.98	29.71
DECEMBER	22.6	1.4	9.3	355	4	224	61.0	6.1	31.1	49.8	3.3	23.8	98.0	40.0	74.9	489	0	1062	30.31	28.95	29.76

TABLE B.3
ONONDAGA LAKE - SYRACUSE, NY
DREDGING, SCA, & WATER TREATMENT OPERATIONS IDS
ANNUAL METEOROLOGICAL SUMMARY - SETTLING BASIN 13 SITE TOWER
JANUARY - DECEMBER 2006

	SCALAR SPEED			*SCALAR DIRECTION*			*TEMPERATURE*			*DEW POINT TEMP.*			*RELATIVE HUMIDITY*			*SOLAR RADIATION*			*BAROMETRIC PRESSURE*			*RAIN*		
MONTH	MAX. *(mph)*	MIN. *(mph)*	MEAN *(mph)*	MAX. *(deg.)*	MIN. *(deg.)*	MEAN *(deg.)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. (%)	MIN. (%)	MEAN (%)	MAX. (W/m^2)	MIN. (W/m^2)	MEAN DLY TOT. (W/m^2)	MAX. (in Hg)	MIN. (in Hg)	MEAN (in Hg)	MAX. (in)	MIN. (in)	TOTAL (in)
JANUARY	28.8	1.0	7.7	355	1	194	56.0	13.6	35.6	45.2	11.6	29.9	100	32.5	81.5	252	-81	-59	30.28	28.89	29.56	0.13	0.00	2.42
FEBRUARY	35.3	1.0	9.5	358	2	217	58.7	-3.1	27.3	45.6	-5.0	20.3	100	36.0	76.8	269	-157	96	29.92	28.87	29.52	0.20	0.00	1.06
MARCH	29.7	1.1	8.7	358	1	243	78.1	10.4	34.0	58.6	-0.4	25.2	100	23.1	72.8	497	-91	656	29.94	28.94	29.60	0.27	0.00	1.28
APRIL	23.0	1.0	7.9	360	2	225	74.7	24.8	47.3	54.8	15.2	34.9	100	15.5	67.5	574	-120	1906	30.12	29.04	29.56	0.23	0.00	2.95
MAY	19.0	0.9	6.1	360	1	200	90.6	34.1	57.9	69.8	19.5	46.8	100	12.7	70.7	624	-144	2298	30.02	28.96	29.47	0.35	0.00	2.96
JUNE	14.9	0.7	5.3	360	1	229	89.6	46.9	65.8	71.5	41.1	57.2	100	29.0	76.8	648	-69	2536	29.81	29.29	29.56	0.30	0.00	3.77
JULY	16.9	0.8	5.6	359	3	238	91.1	54.0	73.3	76.7	50.6	64.4	100	40.5	76.2	631	-90	3121	29.90	29.36	29.57	1.17	0.00	7.48
AUGUST	14.4	0.8	5.2	360	2	226	93.6	44.1	68.2	79.7	42.4	60.2	100	33.2	78.4	603	-67	2624	29.91	29.30	29.61	0.48	0.00	3.52
SEPTEMBER	16.7	0.9	5.5	359	1	208	81.3	39.1	60.0	65.9	37.0	53.9	100	41.6	82.4	527	-79	1313	30.01	29.12	29.59	0.60	0.00	4.63
OCTOBER	26.8	0.7	7.5	359	3	213	74.6	27.3	48.6	63.2	19.6	41.2	100	27.7	78.4	466	-86	573	30.10	28.67	29.53	0.45	0.00	5.45
NOVEMBER	16.5	0.7	5.9	358	1	212	68.2	21.7	44.4	61.5	17.6	37.5	100	29.5	79.2	322	-92	110	30.15	28.96	29.69	0.32	0.00	2.60
DECEMBER	23.4	0.4	8.5	358	3	219	60.8	11.4	37.6	58.0	8.9	29.9	100	36.0	75.7	193	-81	-161	30.29	28.83	29.70	0.46	0.00	3.46

TABLE B.4
ONONDAGA LAKE - SYRACUSE, NY
DREDGING, SCA, & WATER TREATMENT OPERATIONS IDS
ANNUAL METEOROLOGICAL SUMMARY - SETTLING BASIN 13 SITE TOWER
JANUARY - DECEMBER 2007

	SCALAR SPEED			*SCALAR DIRECTION*			*TEMPERATURE*			*DEW POINT TEMP.*			*RELATIVE HUMIDITY*			*SOLAR RADIATION*			*BAROMETRIC PRESSURE*			*RAIN*		
MONTH	MAX. *(mph)*	MIN. *(mph)*	MEAN *(mph)*	MAX. *(deg.)*	MIN. *(deg.)*	MEAN *(deg.)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. (%)	MIN. (%)	MEAN (%)	MAX. (W/m^2)	MIN. (W/m^2)	MEAN DLY TOT. (W/m^2)	MAX. (in Hg)	MIN. (in Hg)	MEAN (in Hg)	MAX. (in)	MIN. (in)	TOTAL (in)
JANUARY	24.5	1.1	8.1	356	2	222	61.7	-7.5	28.5	57.0	-10.2	22.5	100	37.4	79.8	240	-96	-211	30.30	29.05	29.59	0.26	0.00	2.32
FEBRUARY	24.6	0.3	10.6	359	6	232	44.4	-4.4	19.4	34.9	-13.1	12.1	100	29.8	74.7	89	-116	-243	30.11	29.08	29.52	0.11	0.00	0.80
MARCH	26.1	0.8	8.3	360	1	216	62.6	-4.9	32.3	52.8	-7.9	22.9	100	15.2	72.1	490	-160	593	30.32	28.90	29.72	0.44	0.00	2.47
APRIL	21.2	1.2	8.7	360	4	231	83.3	19.9	43.5	58.9	11.8	33.1	100	14.9	71.2	569	-130	1462	29.83	28.68	29.48	0.37	0.00	3.47
MAY	16.3	0.9	5.6	360	1	241	87.7	33.0	58.3	64.6	15.0	41.5	100	15.9	59.4	614	-132	3013	30.12	29.20	29.73	0.11	0.00	0.53
JUNE	19.3	0.9	5.7	360	1	235	89.9	46.4	67.8	72.5	32.1	54.8	100	30.1	67.6	641	-97	3432	29.84	28.98	29.57	0.87	0.00	3.24
JULY	14.5	0.9	5.2	360	1	232	91.6	46.4	68.4	71.6	40.1	58.8	100	26.0	74.9	654	-77	2887	29.89	29.24	29.57	0.41	0.00	3.55
AUGUST	15.5	0.6	5.2	360	2	211	93.7	46.4	70.0	74.2	37.8	59.5	100	23.6	73.0	617	-82	2621	29.83	29.26	29.60	0.25	0.00	1.26
SEPTEMBER	17.0	0.9	5.4	360	3	221	94.6	36.4	64.1	70.6	36.4	54.7	100	25.4	75.6	562	-110	1963	30.10	29.15	29.71	0.24	0.00	2.92
OCTOBER	19.3	0.8	5.8	360	8	208	84.3	29.2	57.4	70.6	29.1	49.7	100	24.7	78.6	429	-121	831	30.10	29.04	29.65	0.21	0.00	4.28
NOVEMBER	25.6	1.3	7.2	355	1	207	60.8	16.9	38.2	53.0	15.3	31.5	100	26.2	79.3	296	-111	78	30.08	29.15	29.63	0.25	0.00	4.31
DECEMBER	25.3	1.1	8.0	359	2	199	51.4	5.4	29.1	48.8	0.7	24.3	100	48.5	83.1	105	-89	-165	30.23	28.70	29.67	0.51	0.00	3.86

TABLE B.5
ONONDAGA LAKE - SYRACUSE, NY
DREDGING, SCA, & WATER TREATMENT OPERATIONS IDS
ANNUAL METEOROLOGICAL SUMMARY - SETTLING BASIN 13 SITE TOWER
JANUARY - DECEMBER 2008

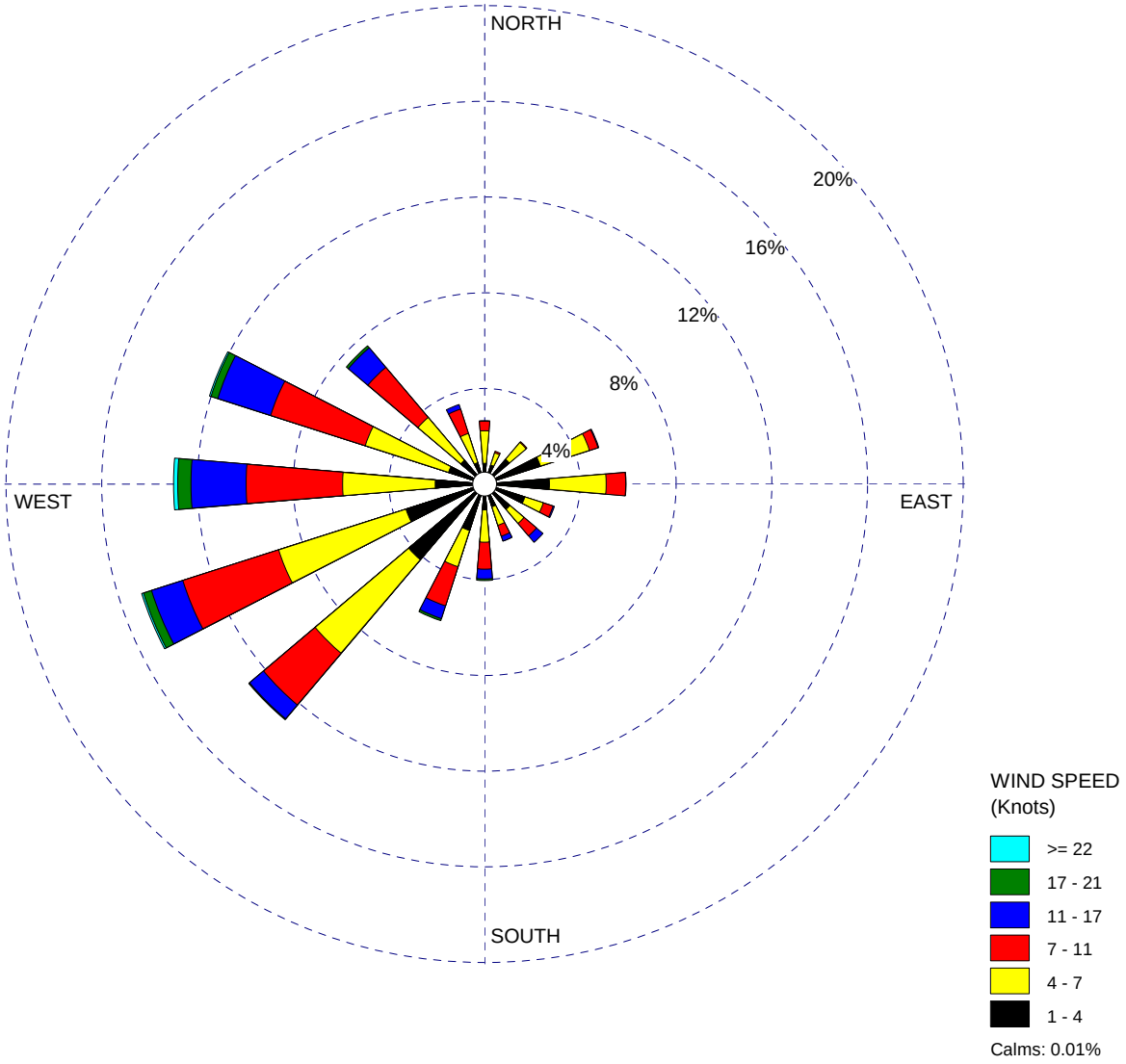
	SCALAR SPEED			*SCALAR DIRECTION*			*TEMPERATURE*			*DEW POINT TEMP.*			*RELATIVE HUMIDITY*			*SOLAR RADIATION*			*BAROMETRIC PRESSURE*			*RAIN*		
MONTH	MAX. *(mph)*	MIN. *(mph)*	MEAN *(mph)*	MAX. *(deg.)*	MIN. *(deg.)*	MEAN *(deg.)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. *(deg. F)*	MIN. *(deg. F)*	MEAN *(deg. F)*	MAX. (%)	MIN. (%)	MEAN (%)	MAX. (W/m^2)	MIN. (W/m^2)	MEAN DLY TOT. (W/m^2)	MAX. (in Hg)	MIN. (in Hg)	MEAN (in Hg)	MAX. (in)	MIN. (in)	TOTAL (in)
JANUARY	30.1	0.9	8.7	357	5	208	68.1	-4.8	30.2	52.8	-7.0	22.7	100	35.5	75.1	298	-105	-175	30.31	28.72	29.65	0.16	0.00	1.24
FEBRUARY	27.8	0.8	8.3	357	1	209	54.1	0.8	26.5	48.4	-8.1	21.1	100	40.5	81.3	258	-244	-92	30.07	28.93	29.56	0.25	0.00	2.74
MARCH	26.4	0.9	7.7	360	1	221	60.0	12.2	32.0	49.4	1.3	23.8	100	23.7	74.6	429	-120	606	30.31	28.73	29.64	0.25	0.00	3.43
APRIL	25.6	0.9	7.5	357	2	204	87.8	23.5	51.9	61.7	6.9	35.7	100	13.8	59.9	534	-74	2088	30.08	29.01	29.66	0.64	0.00	2.90
MAY	15.6	0.8	6.6	359	2	225	82.2	28.6	54.3	62.6	20.0	41.8	100	19.6	67.5	607	-149	2322	29.94	28.91	29.45	0.14	0.00	1.62
JUNE	13.5	1.0	5.6	360	3	225	94.8	50.6	69.1	73.3	43.8	59.2	99	29.2	73.5	649	-106	2863	29.94	29.27	29.51	0.31	0.00	2.38
JULY	13.1	0.8	4.9	360	1	223	90.1	50.7	71.1	71.3	48.0	62.0	100	33.5	75.9	677	-102	2743	29.77	29.21	29.54	0.71	0.00	4.83
AUGUST	11.5	0.9	5.0	359	3	226	85.8	47.8	66.6	69.8	38.7	58.8	100	31.4	78.7	590	-61	2576	29.94	29.29	29.57	0.40	0.00	4.19
SEPTEMBER	29.2	0.8	4.8	360	3	247	90.3	37.6	62.6	71.4	37.6	55.9	100	25.5	81.6	564	-66	1622	30.15	28.91	29.72	0.25	0.00	2.30
OCTOBER	21.2	0.8	6.3	360	1	256	78.2	24.5	47.9	64.0	22.8	40.2	100	28.0	78.1	406	-71	857	30.29	29.14	29.73	0.32	0.00	5.16
NOVEMBER	20.3	0.6	6.3	359	2	227	70.3	14.7	38.5	59.0	13.7	33.2	99.5	32.9	82.6	299	-88	38	30.16	28.87	29.59	0.20	0.00	2.43
DECEMBER	25.2	1.5	9.8	359	1	227	60.0	0.2	29.5	51.0	-1.7	23.2	99.1	41.4	78.4	208	-99	-78	30.18	28.83	29.63	0.17	0.00	2.26

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Wastebed 13 Monitoring Site - 10-meter Tower - 2006

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:		COMPANY NAME: PARSONS	
		MODELER:	
	CALM WINDS: **0.01%**	TOTAL COUNT: **8621 hrs.**	
	AVG. WIND SPEED: **6.02 Knots**	DATE: **8/20/2007**	PROJECT NO.: **443584-04252**

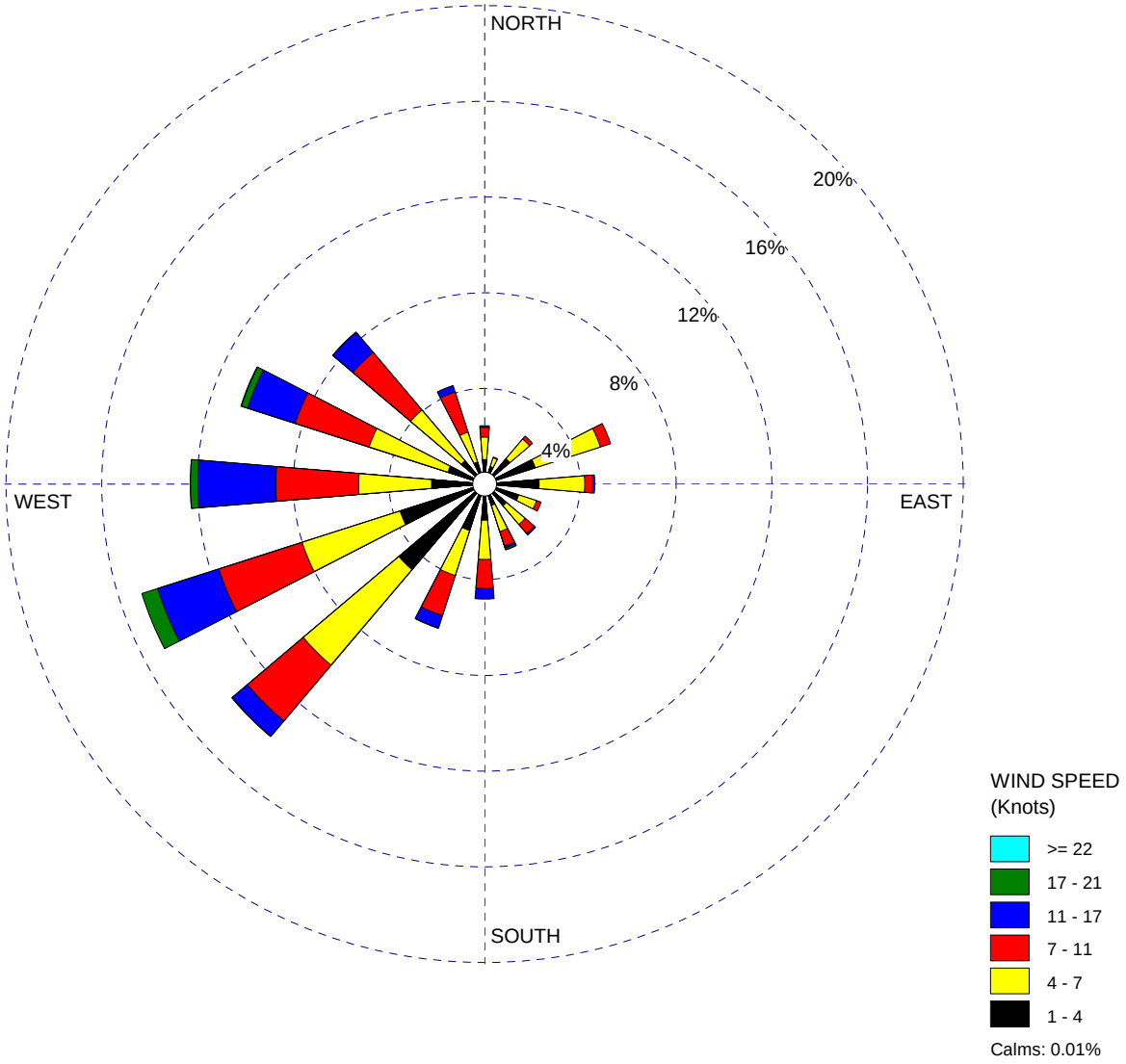
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Wastebed 13 Monitoring Site - 10-meter Tower - January-December 2007

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2007 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **0.01%**	TOTAL COUNT: **8623 hrs.**	
	AVG. WIND SPEED: **6.05 Knots**	DATE: **2/1/2008**	PROJECT NO.: **443665-02300**

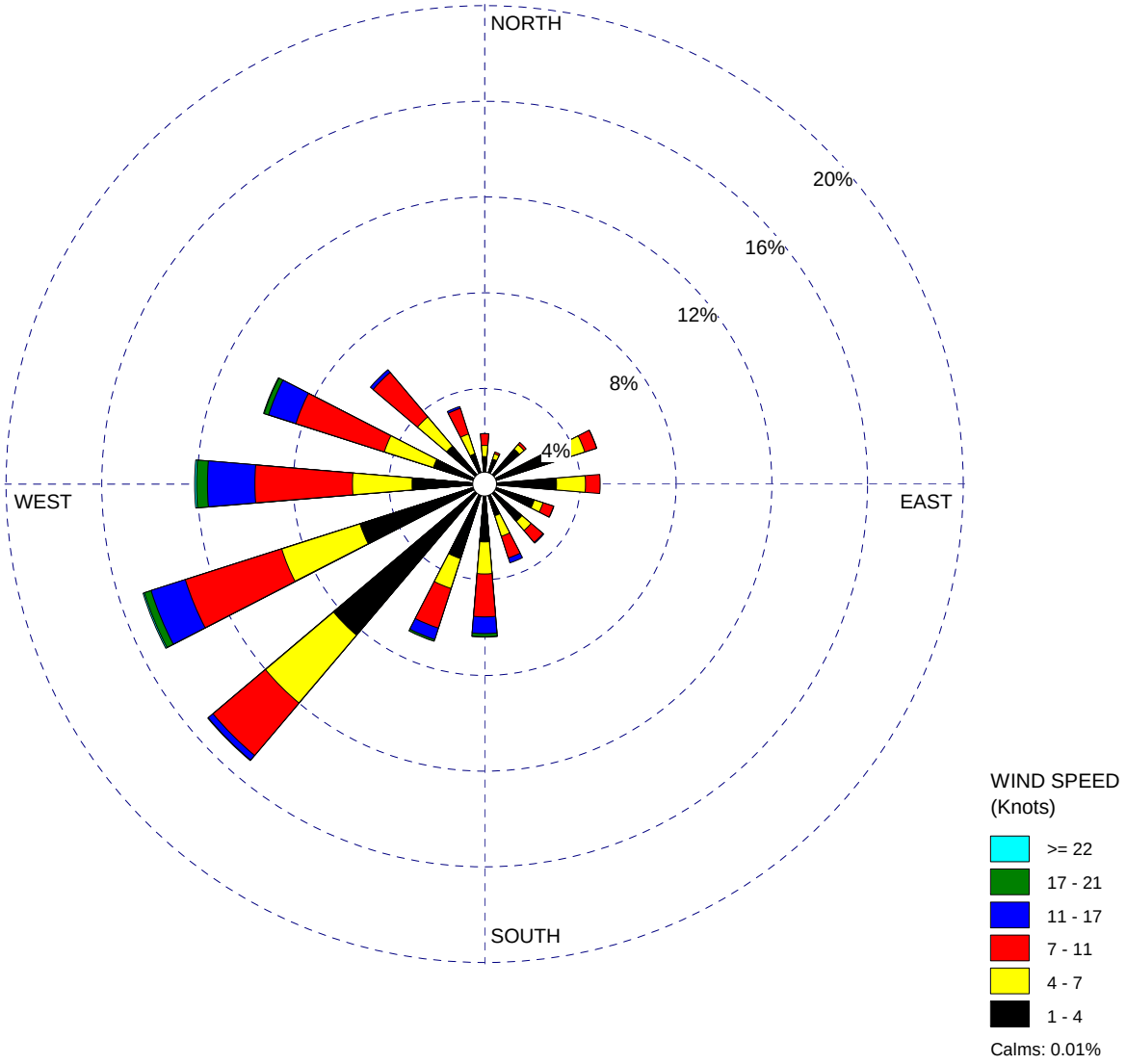
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Wastebed 13 Monitoring Site - 10-meter Tower - January-December 2008

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2008 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **0.01%**	TOTAL COUNT: **8533 hrs.**	
	AVG. WIND SPEED: **5.85 Knots**	DATE: **1/27/2009**	PROJECT NO.: **444540-02300**

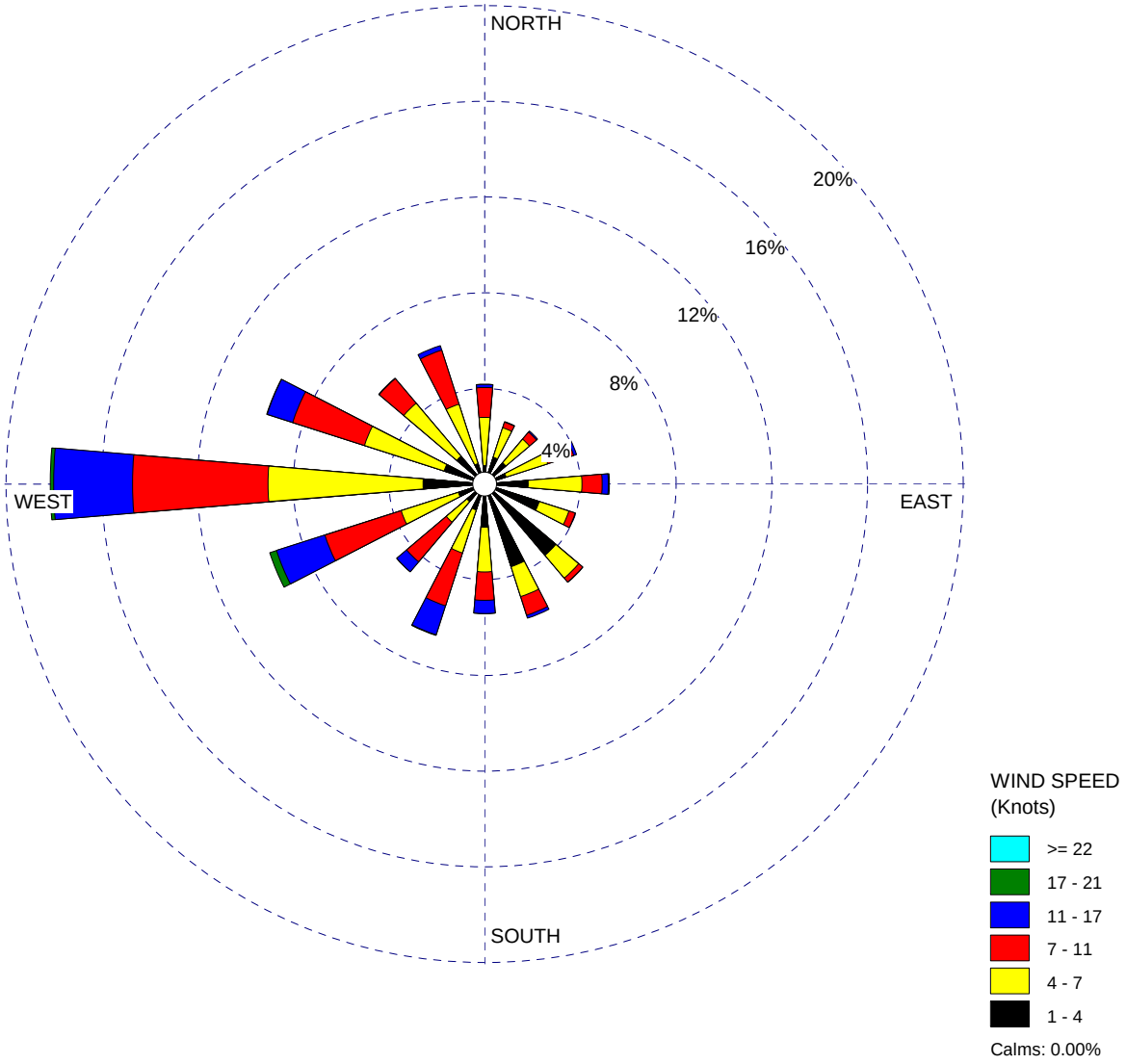
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Lakeshore/Willis Ave Monitoring Site - 10-meter Tower - January-December 2007

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2007 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **8594 hrs.**	
	AVG. WIND SPEED: **5.89 Knots**	DATE: **2/1/2008**	PROJECT NO.: **443665-02300**

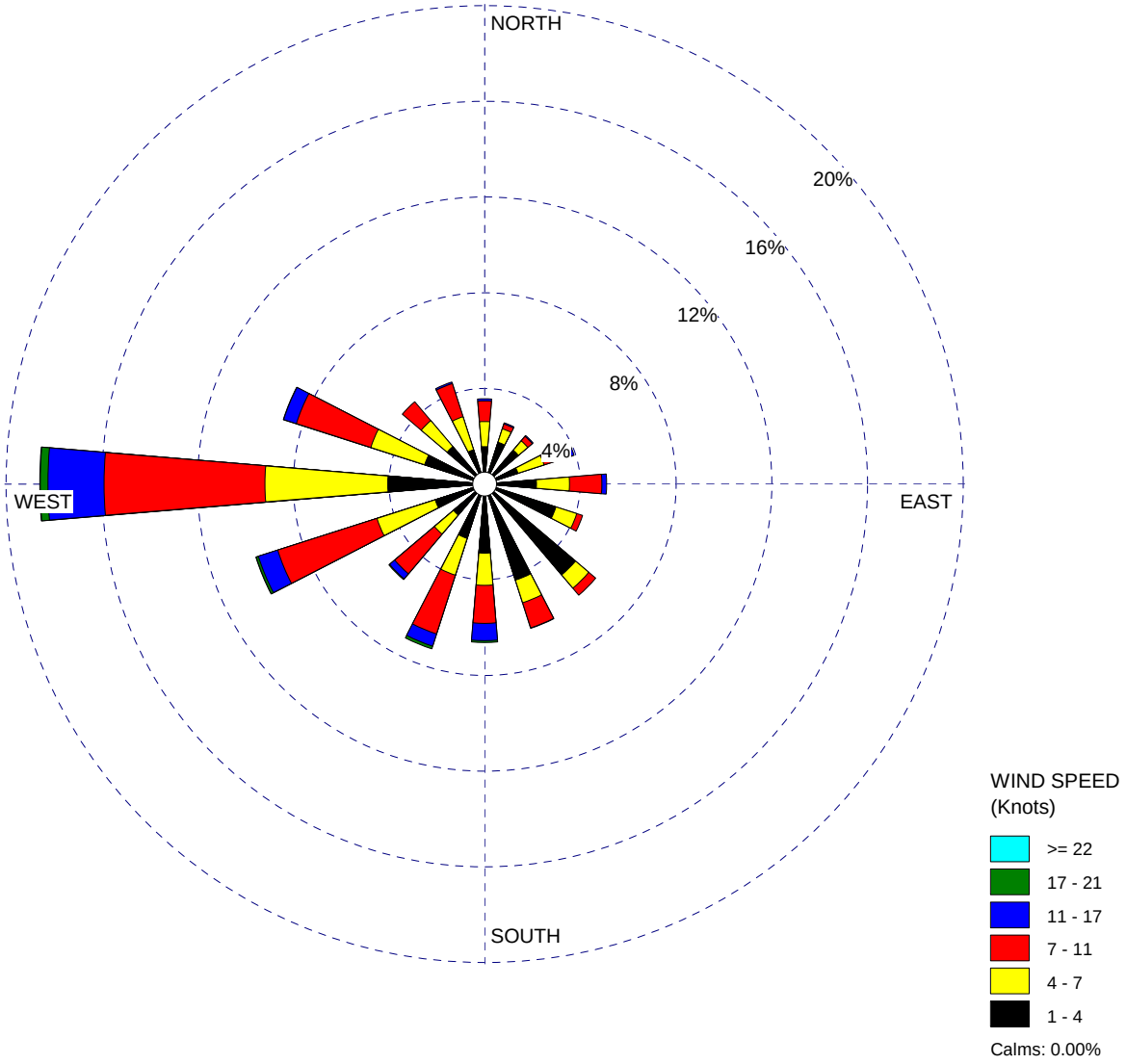
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Lakeshore/Willis Ave Monitoring Site - 10-meter Tower - January-December 2008

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2008 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **8590 hrs.**	
	AVG. WIND SPEED: **5.82 Knots**	DATE: **1/27/2009**	PROJECT NO.: **444540-02300**

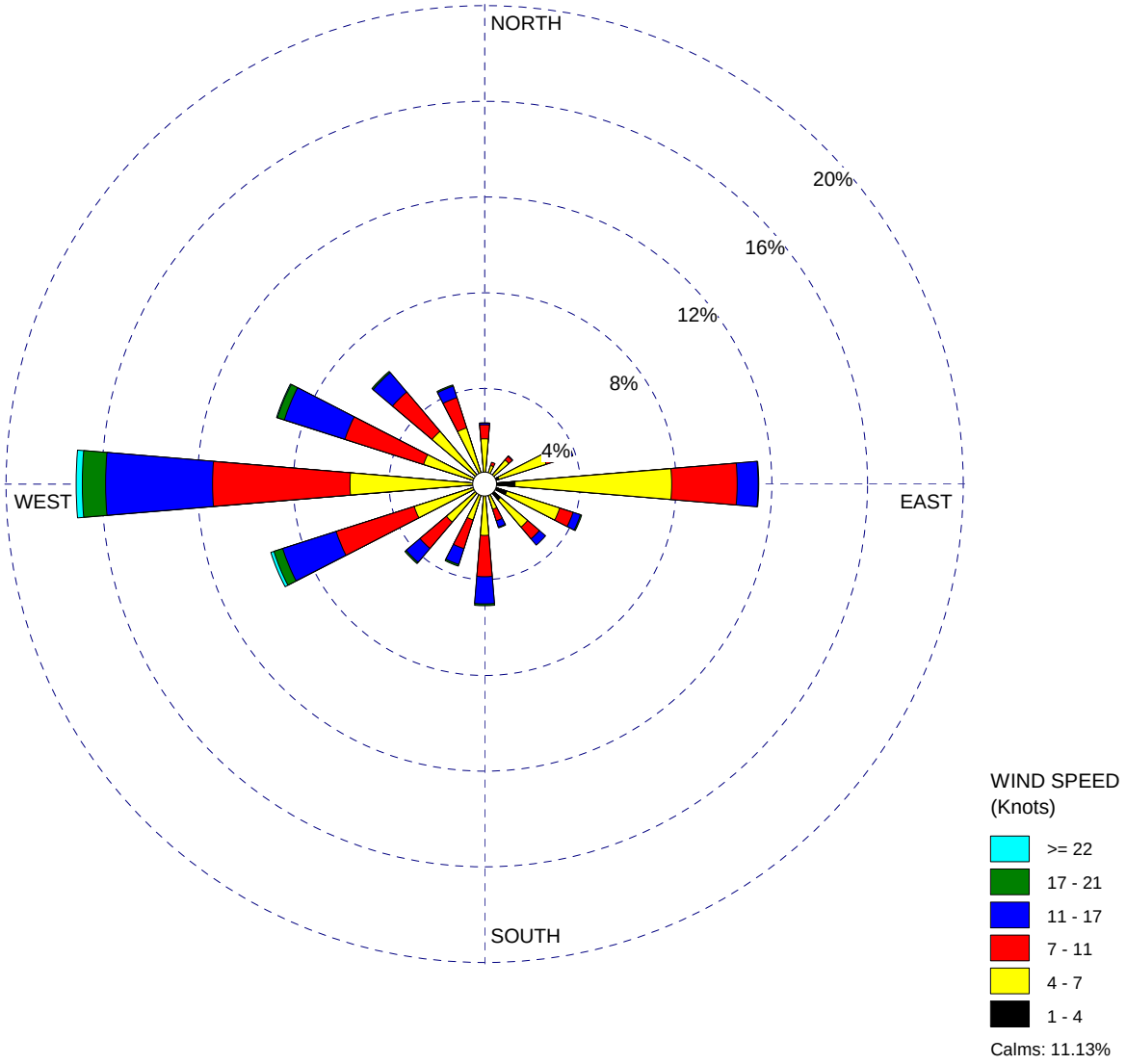
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Syracuse Hancock Int'l Airport - 2006

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:		COMPANY NAME:	
		PARSONS	
		MODELER:	
	CALM WINDS: **11.13%**	TOTAL COUNT: **8569 hrs.**	
	AVG. WIND SPEED: **6.52 Knots**	DATE: **8/20/2007**	PROJECT NO.: **443584-04252**

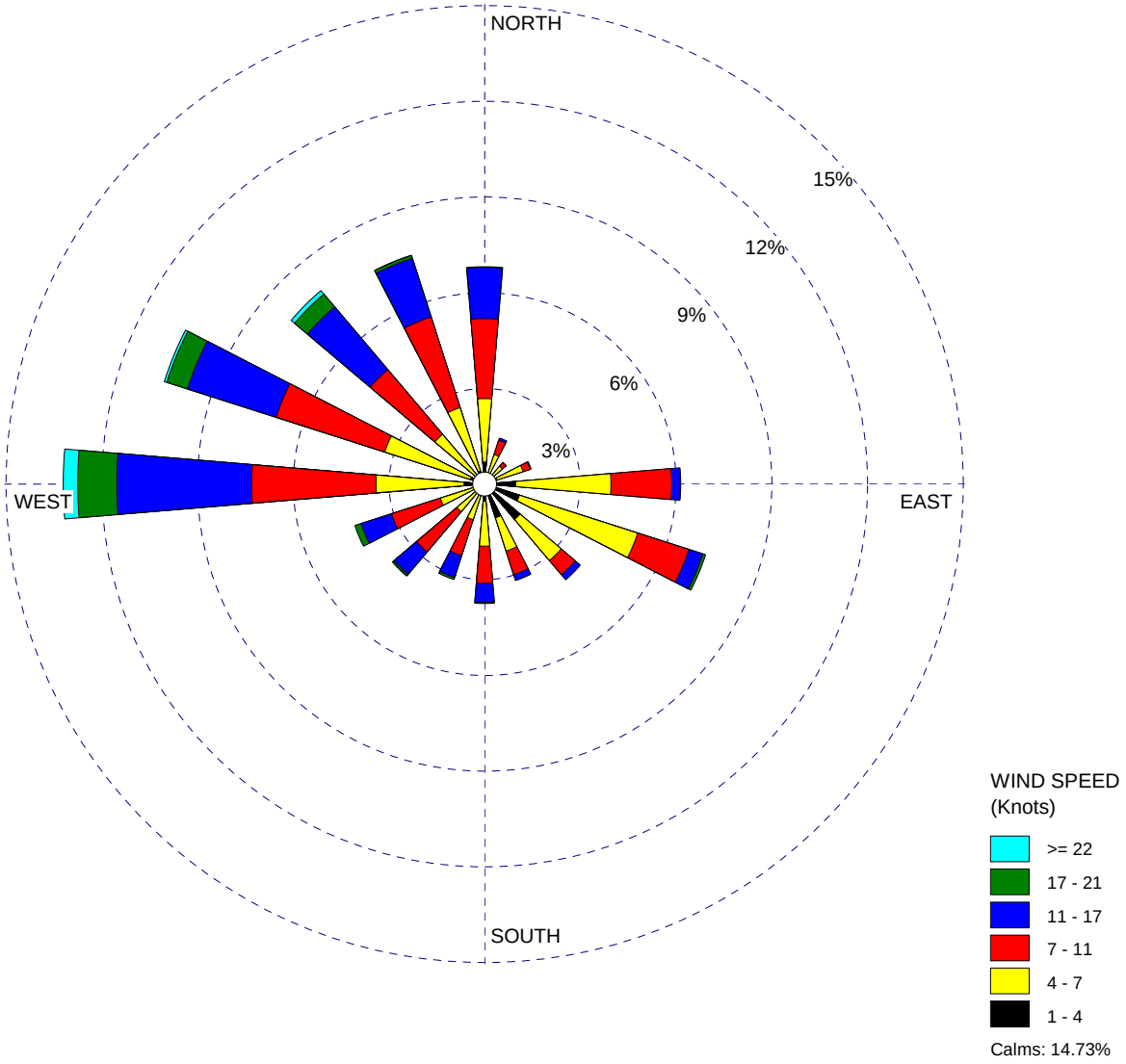
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Syracuse Hancock Int'l Airport
Annual Wind Rose - 2007

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2007 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **14.73%**	TOTAL COUNT: **8531 hrs.**	
	AVG. WIND SPEED: **6.96 Knots**	DATE: **3/20/2008**	PROJECT NO.: **443665-02300**

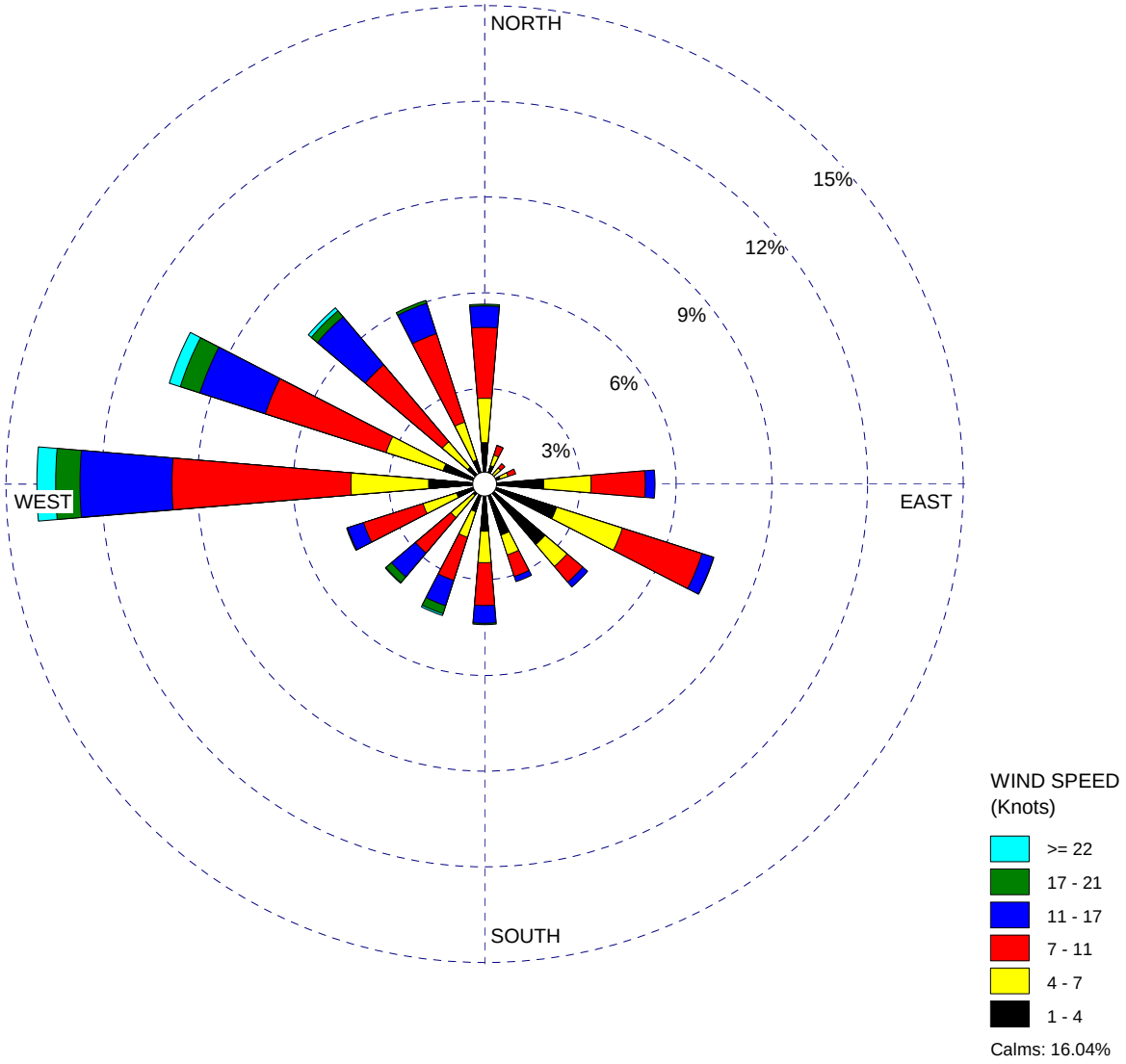
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Honeywell - Onondaga Lake - Meteorological Monitoring Program
Syracuse Hancock Int'l Airport - January-December 2008

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2008 **Jan 1 - Dec 31** **00:00 - 23:00**	**PARSONS**	
		MODELER:	
	CALM WINDS: **16.04%**	TOTAL COUNT: **8658 hrs.**	
	AVG. WIND SPEED: **6.82 Knots**	DATE: **1/29/2009**	PROJECT NO.: **444540-02300**

WRPLOT View - Lakes Environmental Software

APPENDIX C

DREDGE VOLUME ASSUMPTION BASIS

APPENDIX C

DREDGE VOLUME ASSUMPTION BASIS

C.1 SEDIMENT DREDGE VOLUME

Preliminary sediment cap areas and dredge areas and volumes were developed as part of the FS and ROD to achieve the project remedial objectives based on data collected as part of the RI. While the RI data set provided sufficient data to characterize the site and develop the recommended remedy, sampling density gaps required several conservative assumptions to be made pertaining to the extent of contaminant concentrations exceeding cleanup objectives. Subsequent to the FS, Honeywell has completed several design-related investigations, as detailed in Section 3, which served to fill data gaps from the RI data set. Results from these investigations have indicated that, in some locations, the extent of contaminated material was less than was previously assumed. As a result, the required dredge volume necessary to satisfy the Remedial Action Objectives described in Section 1 may be less than the maximum volume of 2,650,000 CY assumed in the ROD.

Data generated from these investigations is being used to develop preliminary capping and dredging designs for inclusion in the Sediment Capping and Dredge Area & Depth IDS. Identification of dredging areas and volumes is being addressed in the Sediment Capping and Dredge Area & Depth IDS because a significant portion of the dredging depends on evaluations related to cap design. Subsequent design submittals are expected to contain dredge plans.

Although the cap and dredge and volume designs are ongoing, some estimate of these parameters is necessary for advancement of this IDS Report. The estimated SMU-specific dredge volumes listed in the ROD and revised dredge volumes assumed for the purposes of this IDS Report are listed and discussed below. Actual volume of sediment dredging needed to accomplish the remedial goals may range from an estimated 1,600,000 CY to the maximum 2,653,000 CY estimated in the ROD. Based on a preliminary analysis of these investigation results, a dredge volume of 1,900,000 CY has been assumed for the purposes of this IDS Report. Further details pertaining to the assumptions associated with this volume are specified below. As stated above, this total volume will be revised as the design advances, and subsequent operations design-related submittals will reflect updated dredge volume estimates.

The volume estimates used to establish the 2,653,000 CY removal specified in the ROD included 12-inches of overdredge over all areas to be dredged. This overdredge assumption will be reevaluated as part of the development of dredge prism to be included in the Sediment Capping and Dredge Area & Depth IDS.

SMU	Volume Estimated in ROD (CY)	Volume Assumed in IDS (CY)
1	1,566,000	1,305,000
2	403,000	50,000
3	75,000	75,000
4	135,000	135,000
5	140,000	minimal
6	245,000	245,000
7	89,000	89,000
Total	Up to an estimated 2,653,000	1,900,000

As shown above, dredge volumes associated with SMUs 3, 4, 6, and 7 are assumed to be consistent with those estimated in the ROD. These removal volumes may vary as the design advances. However, for the purposes of this IDS Report, these volumes have remained the same.

The ROD estimates a removal in SMU 1 of between 2 and 3 meters on average, and lists a removal volume of 1,566,000 CY assuming the maximum removal of 3 meters on average. The final removal depth will depend on the amount of hot spot dredging required, which is yet to be determined. Therefore, the midpoint of the removal depth range, i.e., removal of an average of 2.5 meters, is assumed herein. This results in an assumed SMU 1 removal volume of 1,305,000 CY.

The ROD estimates a removal in SMU 2 of 403,000 CY based on removal of deep NAPL along the shoreline. However, as discussed in Section 1.3, the NYSDEC and USEPA issued an ESD which modifies the selected remedy in SMU 2. Therefore, in lieu of dredging, the alignment of the Willis-Semet IRM Barrier Wall (Willis portion) was moved offshore immediately beyond the farthest extent of pooled NAPLs beneath the lake. A reduced volume of dredging will likely be required for purposes such as habitat and ILWD removal, assumed herein to be approximately 50,000 CY.

The ROD estimated a removal volume of 140,000 CY in SMU 5, which was based on 4 data points in all of SMU 5 that exceeded cleanup criteria. Subsequent design-related investigations indicate minimal remedial action will be required in SMU 5. Therefore, it is assumed that minimal, if any, removal will be required in SMU 5.

Summary

A summary of the dredge volumes assumed for each remediation area, consistent with the assumed dredge volume developed on a SMU-by-SMU basis above, is presented below.

Remediation Area	Assumed Volume (CY)
A	135,000
B	75,000
C	50,000
D	1,305,000
E	334,000
F	Minimal
Total	**1,900,000**

APPENDIX D

PRODUCTION RATE AND FLOW CHARACTERISTIC CALCULATIONS

CALCULATION COVER SHEET

PROJECT: Onondaga Lake Dredging, Sediment Management & Water Treatment Initial Design Submittal	**CALC NO. 1**	**SHEET** 1 of 4
SUBJECT: Appendix D – Production Rate Calculation		

Objective: To evaluate the potential range of hydraulic dredging production rates for Onondaga Lake sediments using an average solids concentration by weight of 10%.

References:

Das, B.M. 1990. *Principles of Geotechnical Engineering*. Second Edition. PWS-KENT. Boston.

Herbich, J.B. 2000. *Handbook of Dredging Engineering*. Second Edition. McGraw-Hill. New York.

Evaluation of Dredging Production Rates. The following presents a detailed summary and calculation for hydraulic dredging production rates for the sediments in Onondaga Lake. The sediments and ILWD hydraulically dredged from the Remediation Areas in Onondaga Lake will be pumped as a slurry through a pipeline to the SCA. Production rate is defined as the volume of dredged material removed as a function of time (cubic yards per hour [cy/hr]). The steps in involved in the computation of the dredging production rate included:

1. Computing the dry mass of *in situ* sediment to be dredged in each remediation area
2. Estimate the concentration by weight in the slurry achievable by a hydraulic dredge
3. Computing the required velocity and flow rate in slurry pipeline
4. Computing the resulting production rate

To compute the dry mass of *in situ* sediment to be dredged in each remediation area, the *in situ* dredge volume, the specific gravity of the solid particles, and the water content is required. Based on the available geotechnical information, for Remediation Area D, these values are:

- *In situ* Dredge Volume = 1,305,000 cy
- Average particle Specific Gravity (SG_s) = 2.54
- Average water content (w) = 148.5%

It should be noted that average *in situ* SG_s and w values are being used in this calculation. It should be noted that these average statistics are not area- or volume-weighted. The average specific gravity and water content used to calculate the production rate is the arithmetic mean developed from the number of samples collected in each of the remediation areas. A volume- and area-weighted average for each of the remediation areas will be evaluated in the next design phase to present a better representation of geotechnical characteristics within the dredge prism for each of the remediation areas.

Compute the void ratio (e) assuming 100% saturation (S=1) using Equation 2.17 from Das (1990):

$$e = \frac{wSG_s}{S} = \frac{(1.485)(2.54)}{1} = 3.77$$

Compute the *in situ* dry density (γ_d) in pounds per cubic foot (lbs/ft^3) using Equation 2.16 from Das (1990) using the unit weight of water (γ_w) = 62.4 lbs/ft^3:

$$\gamma_d = \frac{SG_S \gamma_w}{1+e} = \frac{(2.54)(62.4)}{1+3.77} = 33.2$$

The total dry solids in Remediation Area D is computed to be:

$$\text{total dry solids} = \left(33.2\frac{lbs}{ft^3}\right)\left(\frac{27\,ft^3}{cy}\right)(1{,}305{,}000cy)\left(\frac{tons}{2000lbs}\right) = 585{,}000 \text{ tons}$$

Production rates were estimated for an average solids concentration in the slurry by weight (C_w) of 10%. The specific gravity of the slurry mixture (SG_m) and the concentration by volume (C_V) for particles with a SG_s = 2.54 is determined from Equations 7.76 and 7.77 from Herbich (2000):

$$C_w = \frac{SG_S(SG_m - SG_f)}{SG_m(SG_s - SG_f)}$$

$$C_V = \frac{SG_m}{SG_s}(C_w)$$

where

C_V = concentration of solids in the slurry by volume
C_w = concentration of solids in the slurry by weight
SG_s = specific gravity of solid particles
SG_f = specific gravity of fluid (water)
SG_m = specific gravity of mixture (slurry)

Solve for SG_m iteratively assuming SG_w = 1:

$$0.1 = \frac{2.54(SG_m - 1)}{SG_m(2.54-1)}$$

$$SG_m = 1.06$$

$$C_V = \frac{1.06}{2.65}(0.1) = 0.04$$

Compute the amount of solids dredged on an hourly basis at C_w = 10% and a flow rate of 4,736 gallons per minute (gpm) and SG_m =1.06. The slurry velocity calculation describes basis for the flow rate in the slurry pipeline.

$$\text{solids per hour} = 1.06\left(4736\frac{gal}{\min}\right)\left(\frac{60\min}{hr}\right)\left(\frac{8.34\text{ lbs of water}}{gal}\right)(0.1) = 251{,}000 \text{ lbs of solids per hour}$$

Compute the *in situ* volume for 251,000 lbs of solids using a γ_d = 33.2 lbs/ft³:

$$\text{in situ volume per hour} = \frac{251{,}000 lbs}{33.2 \frac{lbs}{ft^3}} \left(\frac{cy}{27\, ft^3} \right) = 280 \text{ cy per hour}$$

The production rate for Remediation Area D is 280 cy/hr when the hydraulic dredge is pumping 10% solids by weight.

Evaluation of Required Dredging Days. The production rate calculation was used to estimate the total number of days required to dredge Remediation Area D. This calculation assumes dredging operations for 24 hours a day with a 70% dredging efficiency (pumping 17 hours of the day).

$$\text{total number of days} = \frac{1{,}305{,}000 cy}{280 \frac{cy}{hr}} \left(\frac{day}{24 hours x 0.7} \right) = 275 \text{ days}$$

The total number of required to hydraulically dredge Remediation Area D is 275 days when pumping at an average of 10% solids by weight.

Table 1 summarizes the estimated production rates for Onondaga Lake following the methods described above.

Table 1
Summary of Estimated Production Rates for Onondaga Lake

Area	Volume (CY)	Average SG_S	Average *w* (%)	γ_d (lbs/ft3)	Total Dry Solids (lbs)	SG_m	Solids Per Hour (lbs/hr)	Production Rate (cy/hr)	Dredging Days Required
A	135,000	2.71	78.9	53.9	98,207	1.07	252,969	174	46
B	75,000	2.73	79.7	53.6	54,311	1.07	253,042	175	26
C	50,000	2.73	79.7	53.6	36,207	1.07	253,042	175	17
D	1,305,000	2.54	148.5	33.2	585,155	1.06	252,304	281	276
E	335,000	2.59	64.2	60.7	274,491	1.07	252,508	154	129

Notes:
1. Assumes a slurry solids concentration by weight of 10%
2. The geotechnical properties for Remediation Area C were used in the calculation of production rates for Remediation Area B
3. The values in the table are slightly different than the example calculation shown above as the values in the table were not rounded.

The sediments to be dredged in Onondaga Lake are comprised primarily of particle sizes in the fine sand to silt and clay range with low *in situ* solid contents. Therefore, an average solids concentration by weight of 10% was used to evaluate production estimates.

Based on these sediments characteristics, it is anticipated that the solids concentration by weight could be as low as 5% and as high as 15%. Table 2 presents the range of production estimates for a solids concentration by weight of 5% and for 15%.

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PROJECT:	Dredging, Sediment Management & Water Treatment IDS		CHECKED BY: JRV/RKM	CHECKED DATE:	
SUBJECT:	Appendix D – Production Rate Calculation				

Table 2
Summary of Estimated Range of Production Rates for Onondaga Lake

Area	Production Rate at 5% (cy/hr)	Production Rate at 10% (cy/hr)	Production Rate at 15% (cy/hr)
A	84	174	270
B	85	175	271
C	85	175	271
D	136	281	436
E	75	154	239

RECORD OF REVISIONS

NO.	REASON FOR REVISION	BY	CHECKED	APPROVED/ ACCEPTED	DATE

CALCULATION COVER SHEET

PROJECT: Onondaga Lake Dredging, Sediment Management & Water Treatment Initial Design Submittal	**CALC NO. 1**	**SHEET** 1 of 6
SUBJECT: Appendix D – Slurry Velocity Calculation		

Objective: To evaluate the required slurry velocity to convey dredged material (sediments and ILWD) from the lake to the SCA in the slurry pipeline from Onondaga Lake to the SCA.

References:

Durand, R. and E. Condolios. 1952. "Experimental Transportation of the Transportation of Solids in Pipes." Le Journals d'Hydraulique. Societe Hydrotechnique de France. Grenoble. June.

GIW Industries, Inc. 2001. *Slurry Pipeline Design Manual*. June

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Performance Pipe. 2007. *Field Handbook*. Chevron Phillips Chemical Company LP.

Turner, T.M. 2006. *Fundamentals of Hydraulic Dredging*. Second Edition. American Society of Civil Engineers. Reston.

Weir Slurry Division. 2002. *Slurry Pumping Manual*. First Edition. Warner International Ltd.

Wilson, K.C., G.R. Addie, A. Sellgren, and R.Clift. 1997. *Slurry Transport Using Centrifugal Pumps*. Blackie Academic & Professional. New York.

Evaluation of Slurry Velocity. The following presents a detailed summary and calculation for the Onondaga Lake slurry transport system. The sediments hydraulically dredged from the Remediation Areas in Onondaga Lake will be pumped as a slurry through a pipeline to the SCA. Due to the long distance and elevation difference between Onondaga Lake and the SCA, a single dredge pump will not be able to efficiently produce a hydraulic grade line to the SCA. Therefore, several booster pumps will be required to pump the slurry to the SCA. Booster pumps are supplements to the dredge pump and increases the distance the slurry can be pumped.

Based on the size of the material being conveyed in the slurry, there is a minimum velocity required to keep the slurry in suspension and prevent deposition and subsequent clogging of the slurry pipeline. Two methods were used to evaluate this critical velocity V_C:

- Durand and Condolios (1952) method (based on Equation 7.79 from Herbich 2000)
- Wilson et al. (1997) method (based on Figure 7.28 from Herbich 2000)

Compute V_C using the Durand and Condolios (1952) method:

$$V_C = F_L \left[2gD\left(\frac{SG_S - SG_W}{SG_W} \right) \right]^{1/2}$$

where

V_C = critical velocity in feet per second (fps)

g = gravitational acceleration = 32.2 feet per second squared (ft/s^2)

D = inside pipeline diameter in ft
SG_S = specific gravity of solid particles
SG_W = specific gravity of water
F_L = coefficient that is a function of slurry concentration by volume (see Figure 1).

The concentration by volume (C_V) for different solid particle specific gravities (SG_s) and concentrations by weight (C_W) is determined from Equations 7.76 and 7.77 from Herbich (2000):

$$C_w = \frac{SG_S\left(SG_m - SG_f\right)}{SG_m\left(SG_s - SG_f\right)}$$

$$C_V = \frac{SG_m}{SG_s}\left(C_w\right)$$

where

C_V = concentration of solids in the slurry by volume
C_w = concentration of solids in the slurry by weight
SG_S = specific gravity of solid particles
SG_f = specific gravity of fluid (water)
SG_m = specific gravity of mixture (slurry)

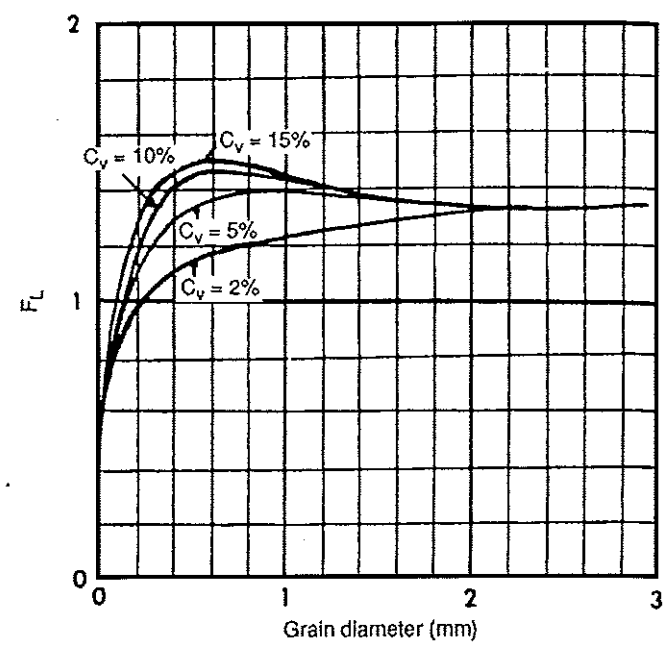

Figure 1. Variation of F_L with Grain Diameter (from Figure 7.27 of Herbich 2000)

For example, for a particle size of 0.2 millimeters (mm) with a SG = 2.65 being pumped through a High Density Polyethylene (HDPE) pipe with an inside diameter of 12.2-inches (in) as a slurry with a slurry concentration by weight (C_w) of 10%:

Solve for SG_m iteratively assuming $SG_w = 1$:

$$0.1 = \frac{2.65(SG_m - 1)}{SG_m(2.65 - 1)}$$

$$SG_m = 1.07$$

$$C_V = \frac{1.07}{2.65}(0.1) = 0.04$$

The slurry concentration by volume is 4%. Using Figure B-1, F_L is approximately 1.06.

Using $F_L = 1.06$, solve for V_C

$$V_C = 1.06\left[2(32.2)\left(\frac{12.2}{12}\right)\left(\frac{2.65-1}{1}\right)\right]^{1/2} = 11.0$$

<u>The critical velocity is 11.0 fps.</u>

The critical velocity was also computed using Wilson et al. (1997) method (Figure 2). This nomograph estimates the V_C as a function of pipe diameter, particle size, and solids density (Weir Slurry Division 2002). For example, for the same conditions described above, <u>the critical velocity is approximately 9 fps</u>.

The inclination of the pipeline can influence the velocity required for the slurry. The critical velocity increases as the angle between the pipe and horizontal increases up to an angle of approximately 35 degrees. The proposed slurry pipeline route may be inclined on slopes of up to 15% (8.5 degrees). Equation 7.81 from Herbich (2000) was used to estimate the effect of the pipe inclination on V_C:

$$V_{C(inclined)} = V_{C(horizontal)} + \Delta_D\left(\sqrt{2g(SG_s - 1)D}\right)$$

where
Δ_D is from Figure 3

Using the above example:

$$V_{C(inclined)} = 11.0 + 0.1\left(\sqrt{2(32.2)(2.65-1)\left(\frac{12.2}{12}\right)}\right) = 12.0$$

<u>The critical velocity for an inclined pipeline at 8.5 degrees is 12.0 fps.</u>

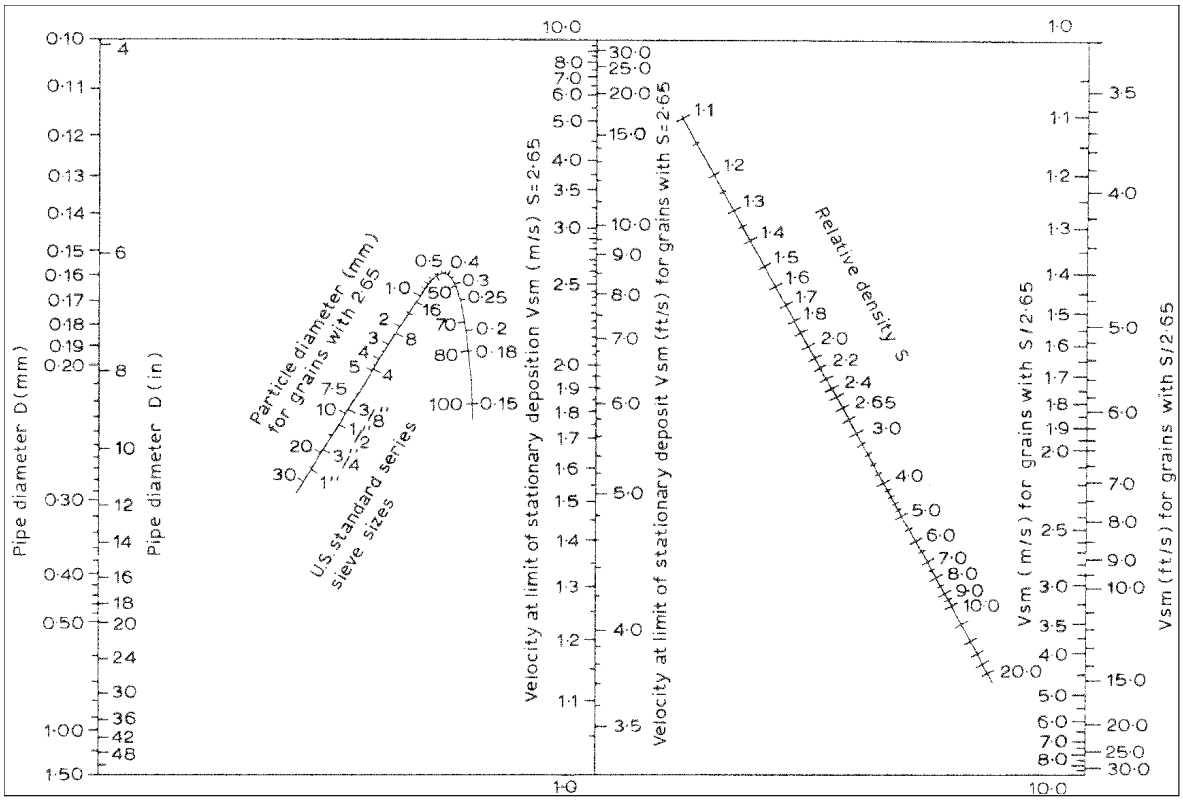

Figure 2. Wilson et al (1997) Nomograph of Critical Velocity (from Figure 7.27 of Herbich 2000)

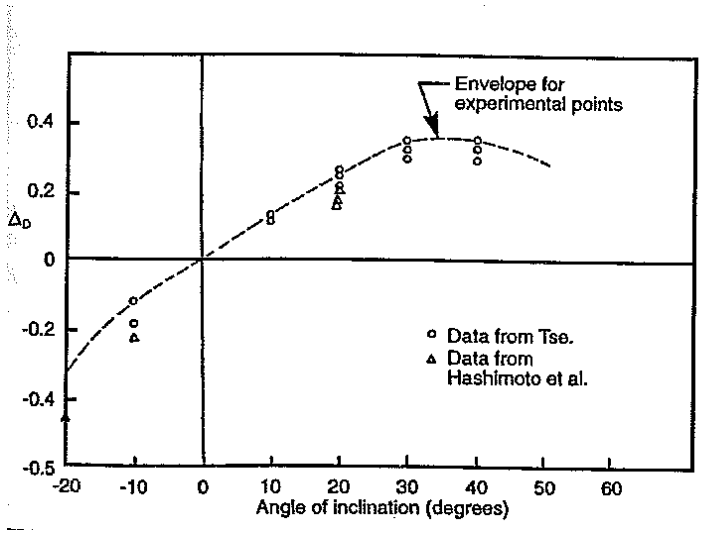

Figure 3. Effect of Angle of Inclination (from Figure 7.29 of Herbich 2000)

Compute the flow regime (heterogeneous versus homogeneous) for a particle size using Equation 7.82 by computing the transition velocity (V_{th}) between homogenous and heterogeneous flows regimes:

$$V_{th} = (1800 g D V_t)^{1/3}$$

where
V_{th} = transition velocity in fps
g = gravitational acceleration = 32.2 feet per second squared (ft/s^2)
d = Pipe Diameter in ft
v_t = terminal velocity in fps

For the above example, using a terminal velocity of 24 mm/s (0.078 fps) for a fine sand-sized particle with a diameter of 0.2 mm and a pipe with a 12.2-in inside diameter:

$$V_{th} = \left(1800(32.2)\left(\frac{12.2}{12}\right)(0.078)\right)^{1/3} = 16.6$$

The transition between heterogeneous and homogeneous occurs at a velocity of 16.6 fps. The critical velocity is the velocity at which the solids in the slurry will begin depositing in the pipe and eventually lead to plugging the pipeline. Therefore, it is desirable to operate above the critical velocity (Herbich 2000). For heterogeneous slurries (i.e. a portion of the solid particles are carried as suspended load and the remainder is moved as bed load along the bottom of the pipe) with centrifugal pumps as the prime movers, the slurry velocity is normally well above the critical velocity to maintain operating stability (GIW Industries 2001).

For the purposes of this calculation, it is assumed that the dredging contractor would pump the slurry at a velocity 20% above the critical velocity. In the example above for the two methods, the required operating velocity in the horizontal sections of the pipeline would be:

- Wilson et al (1997): 9 fps x 1.2 = 10.8 fps = 3,935 gpm in a 12.2-in inside diameter pipeline
- Durand and Condolios (1952): 11.0 x 1.2 = 13.2 fps = 4,817 gpm in a 12.2-in inside diameter pipeline

It should be noted that Herbich (2000) suggests operating at a velocity 30% above the critical velocity. Operating at velocity of 20% above the critical velocity was considered appropriately conservative for this analysis. The velocity of 13.2 fps is above the critical velocity for the inclined section of the pipe and below the threshold velocity between heterogeneous and homogeneous flow.

As an example, Table 1 presents the critical velocities for a range of particle sizes (sand, fine sand, and gravel), particle specific gravities, and slurry concentrations by weight that may be encountered during dredging of the Onondaga Lake sediments and ILWD. <u>This list is not all inclusive but provides an indication of the critical velocities for various materials based on the approach described above.</u> The *italicized* section is the example discussed above.

Table 1
Summary of Critical Velocities for a Range of Potentially Dredged Materials

Particle Size Description	d (mm)	SG_s	Cw (%)	SG_m	Cv (%)	Vc (Durand) (fps)	Vc (Wilson) (fps)	Vc (inclined) (fps)	Potential Operating Velocity (fps)	Q (gpm)
Fine Sand	0.1	2.65	5	1.03	2	7.3	6.4	8.3	8.7	3,181
Fine Sand	0.1	2.65	10	1.07	4	7.3	6.4	8.3	8.7	3,181
Fine Sand	0.1	2.65	15	1.10	6	7.3	6.4	8.3	8.7	3,181
Fine Sand	0.2	2.65	5	1.03	2	9.4	9.0	10.4	11.2	4,090
Fine Sand	*0.2*	*2.65*	*10*	*1.07*	*4*	*11.0*	*9.0*	*12.0*	*13.2*	*4,817*
Fine Sand	0.2	2.65	15	1.10	6	11.2	9.0	12.3	13.5	4,908
Medium Sand	0.5	2.50	5	1.03	2	11.4	13.0	14.0	15.6	5,684
Medium Sand	0.5	2.50	10	1.06	4	12.9	13.0	14.0	15.6	5,684
Medium Sand	0.5	2.50	15	1.10	7	13.9	13.0	14.9	16.6	6,066
Medium Sand	0.5	2.65	5	1.03	2	12.0	13.0	14.0	15.6	5,684
Medium Sand	0.5	2.65	10	1.07	4	13.5	13.0	14.6	16.2	5,908
Medium Sand	0.5	2.65	15	1.10	6	14.6	13.0	15.6	17.5	6,362
Medium Sand	0.5	2.70	5	1.03	2	12.1	14.0	15.1	16.8	6,121
Medium Sand	0.5	2.70	10	1.07	4	13.7	14.0	15.1	16.8	6,121
Medium Sand	0.5	2.70	15	1.10	6	14.8	14.0	15.8	17.7	6,458
Fine Gravel	5	2.65	5	1.03	2	13.5	9.0	14.6	16.2	5,908
Fine Gravel	5	2.65	10	1.07	4	13.5	9.0	14.6	16.2	5,908
Fine Gravel	5	2.65	15	1.10	6	13.5	9.0	14.6	16.2	5,908

Notes:
1. Pipeline inside diameter = 12.2 inches
2. Potential operating velocity is 20% higher than the maximum critical velocity between the Durand and Wilson methods in a horizontal pipe.
3. Q = volumetric flow rate in gallons per minute (gpm). Flow rate based on the potential operating velocity and an inside pipe diameter of 12.2-inches.

In summary, to pump a slurry consisting of particles with a particle size of 0.2 mm, a velocity of 13 fps could be used in a 12.2-in inside diameter pipeline. This equates to a volumetric flow rate of 4,736 gpm. This velocity is higher than the critical velocity for the inclined sections of the pipe. The flow in the pipeline would be heterogeneous. As can be seen from the table, if the slurry consisted primarily of larger particle sizes (in the medium sand to fine gravel particle size range), higher velocities would be required.

RECORD OF REVISIONS

NO.	REASON FOR REVISION	BY	CHECKED	APPROVED/ ACCEPTED	DATE

CALCULATION COVER SHEET

PROJECT: Onondaga Lake Dredging, Sediment Management & Water Treatment Initial Design Submittal	**CALC NO. 1**	**SHEET** 1 of 2
SUBJECT: Appendix D – Slurry Pipeline Friction Loss and Pressure Calculation		

Objective: To evaluate the amount of frictional loss in the slurry pipeline and to compute the operating pressure in the pipeline.

References:

Herbich, J.B. 2000. *Handbook of Dredging Engineering*. Second Edition. McGraw-Hill. New York.

Turner, T.M. 2006. *Fundamentals of Hydraulic Dredging*. Second Edition. American Society of Civil Engineers. Reston.

Evaluation of Frictional Loss in the Slurry Pipeline. When pumping the dredged material over long distances, the dredge pump may not have enough "head" (pressure) to reach the disposal area. The horizontal and vertical distance that the dredged material can be transported is, therefore, a function of the pump head. The friction effects on the slurry in the pipeline are quantified as frictional head losses (pressure drop). Head losses in the line were evaluated to estimate the potential number of booster pumps.

For the purposes of the conceptual design and the development of the baseline operational scenario, the Hazen-Williams Equation was used to evaluate the amount of frictional head loss in the slurry pipeline (Herbich 2000):

$$H = 0.2083\left(\frac{100}{C}\right)^{1.85}\left(\frac{Q^{1.85}}{D^{4.8655}}\right)$$

Where:
H= slurry friction loss per 100 ft of pipe (expressed as feet of water)
D = inside diameter of pipe in inches
Q= flow in gallons per minute
C = Hazen-Williams friction factor taken from Figure 10-2 in Turner (1996)

Turner (1996) estimated a Hazen-Williams friction factor (C) based on particle-size and slurry specific gravity for dredged material pipeline transport. From Figure 10-2 in Turner (1996) suggests that C = 129 for fine sands. Using the equation above for the conceptual design, the friction loss for a slurry consisting of finer materials (in the fine sand and silt and clay sizes particle range) and a specific gravity of 1.1 traveling at 13 fps in a 12.2-inch ID pipe:

$$H = 0.2083\left(\frac{100}{129}\right)^{1.85}\left(\frac{4{,}736^{1.85}}{12.2^{4.8655}}\right) = 4.2 \text{ ft per } 100 \text{ ft}$$

The friction losses are approximately 4 ft per 100 ft of pipeline.

As the solids concentration by weight (C_W) of the slurry increases, the specific gravity of the slurry increases. Table 10-2 from Turner (1996) presents the Hazen-Williams friction factors for slurries with specific gravities ranging from 1.0 to 1.5. The specific gravity of the slurry can range from 1.03 for a C_W = 5% to 1.10 for C_W = 15%. From Figure 10-2 in Turner (1996), for fine sands, C = 137 for a slurry specific gravity of 1.03 to C = 129 for a slurry specific gravity of 1.10. For comparison, using C=137, the friction loss is computed to be 3.8 ft per 100 ft.

In addition, Turner (1996) notes that the presence of finer materials such as silts and clays in the slurry can "lubricate" the slurry and reduce friction loss in the pipeline. For the purposes of this IDS, a friction loss of 4 ft per 100 ft of

pipeline was used. The friction loss will continue to be evaluated as the design progresses.

Evaluation of Frictional Loss in the Slurry Pipeline. The pressure in pounds per square inch (psi) in a pipeline is:

Pressure (psi) = 0.434 psi/ft (head in ft)(specific gravity)

A booster pump that generates 240 feet of head adds approximately 115 psi to the pipeline:

Pressure (psi) = 0.434 psi/ft (240 ft)(1.1) = 114.6 psi

The pressure in the slurry pipeline varies based on proximity to the booster pumps. For example, for the locations of the booster pumps shown in Figure 4.6, the maximum pressure at the outlet of each booster pump can range from approximately 115 psi (after the first booster pump) to 150 psi (after the third booster pump). The pressure in the pipeline decreases away from each booster pump due to friction losses. The pressure drop due to friction is 1.9 psi per 100 feet of pipeline.

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