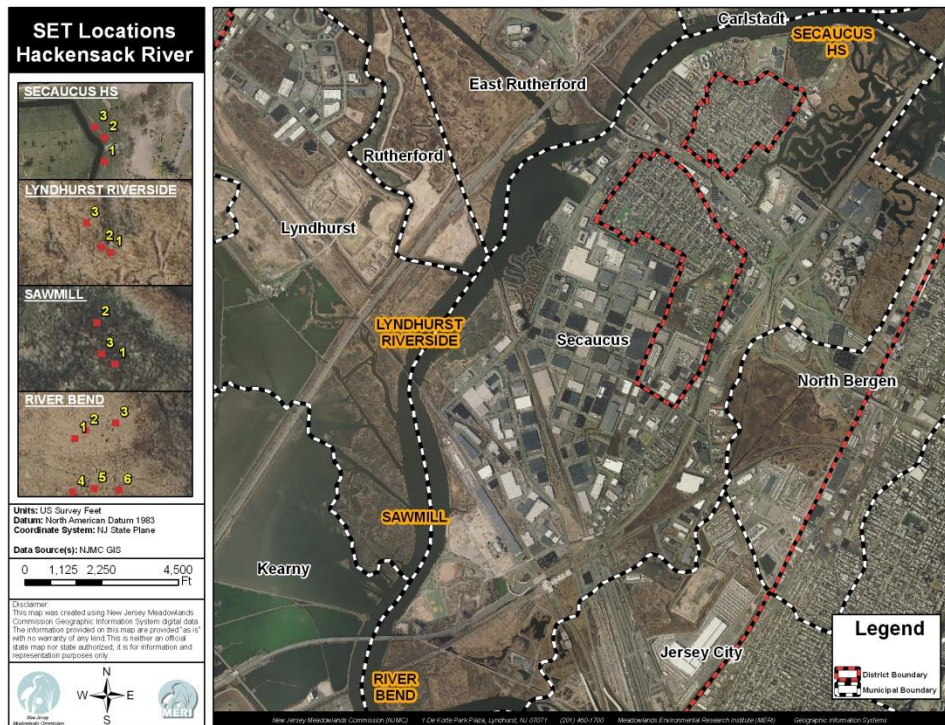


Measuring Elevation Change in Meadowlands Marshes Using Surface Elevation Tables (SETs) and Marker Horizons

Meadowlands Environmental Research Institute (December, 2012)

The surface elevation table (SET) provides a constant plane in space from which the distance to a marsh surface can be measured by means of pins lowered to the surface (USGS 2010). During August of 2008, at five locations in the lower Hackensack River Meadowlands, benchmark rods were established, marker horizons of feldspar were emplaced and baseline readings were taken. Periodic monitoring will determine rates of accretion in marsh areas, and track and compare both shallow and deep subsidence. Each site was revisited and readings taken annually except 2009. This report is a summary of those measurements taken up to the fall of 2012.

Figure 1: Study Area



Locations were chosen to span several miles of tidal wetlands and represent different vegetation and marsh regimes. The five sites selected include a restored *Spartina alterniflora* low marsh (Secaucus High School, SHS), a *Spartina alterniflora* low marsh (Saw Mill, SM), a *Spartina patens* dominated high marsh (Rivrebend-Patens, RBP), a mixed *Spartina patens* and *Phragmites australis* high marsh (Riverbend Mixed, RBM) and a *Phragmites australis* dominated high marsh (Lyndhurst Riverside, LR). At each site, three replicate plots were installed. At each plot, nine pins are lowered to the marsh surface. Readings are taken in each of four directions resulting in a total of 108 measurements for each of the 5 sites. At the time of each subsequent reading, results obtained from each pin are compared. The average of the resulting differences becomes one data point that represents the level of the marsh surface elevation.

Table 1: Time Elapsed Between Readings

Location	Initial Date	Most Recent Date	Days	Years
RBP and RBM	8/26/2008	11/28/2012	1555	4.26
SM	8/28/2008	12/11/2012	1566	4.29
LR	8/29/2008	12/3/2012	1557	4.27
SHS	8/28/2008	11/29/2012	1554	4.26

Table 1 provides the dates for each reading and the time elapsed in days and years

Table 2: Average Elevation Change (mm) – Fall 2012 Sampling

Riverbend Patens		Riverbend Mixed		Sawmill	
All Platforms	25.21	All Platforms	29.76	All Platforms	34.07
Std Error	2.09	Std Error	4.01	Std Error	3.77
RB-1	29.22	RB-4	23.97	SM-1	40.08
Std Error	5.57	Std Error	8.20	Std Error	9.14
RB-2	22.17	RB-5	37.47	SM-2	35.00
Std Error	0.89	Std Error	10.72	Std Error	5.77
RB-3	24.25	RB-6	27.83	SM-3	27.14
Std Error	4.09	Std Error	5.60	Std Error	8.01
RB-1 pos 1	30.00	RB-4 pos 1	36.33	SM-1 pos 2	14.78
RB-1 pos 3	32.22	RB-4 pos 3	10.22	SM-1 pos 4	50.78
RB-1 pos 5	40.67	RB-4 pos 5	39.89	SM-1 pos 6	39.00
RB-1 pos 7	14.00	RB-4 pos 7	9.44	SM-1 pos 8	55.78
RB-2 pos 1	21.56	RB-5 pos 2	24.89	SM-2 pos 1	39.89
RB-2 pos 3	20.22	RB-5 pos 4	42.22	SM-2 pos 3	48.00
RB-2 pos 5	22.44	RB-5 pos 6	17.22	SM-2 pos 5	30.89
RB-2 pos 7	24.44	RB-5 pos 8	65.56	SM-2 pos 7	21.22
RB-3 pos 1	34.56	RB-6 pos 2	19.11	SM-3 pos 1	45.67
RB-3 pos 3	14.89	RB-6 pos 4	21.11	SM-3 pos 3	19.00
RB-3 pos 5	25.56	RB-6 pos 6	43.78	SM-3 pos 5	9.56
RB-3 pos 7	22.00	RB-6 pos 8	27.33	SM-3 pos 7	34.33

Lyndhurst Riverside	
All Platforms	32.13
Std Error	9.81
LR-1	20.33
Std Error	12.15
LR-2	24.44
Std Error	5.11
LR-3	51.61
Std Error	14.27
LR-1 pos 1	3.44
LR-1 pos 3	13.89
LR-1 pos 5	56.22
LR-1 pos 7	7.78
LR-2 pos 1	33.56
LR-2 pos 3	10.00
LR-2 pos 5	25.11
LR-2 pos 7	29.11
LR-3 pos 1	19.00
LR-3 pos 3	64.22
LR-3 pos 5	84.22
LR-3 pos 7	39.00

Secaucus HS	
All Platforms	27.72
Std Error	12.37
SHS-1	32.8
Std Error	13.10
SHS-2	4.22
Std Error	6.56
SHS-3	46.2
Std Error	9.4
SHS-1 pos 2	69.2
SHS-1 pos 4	33.1
SHS-1 pos 6	19.3
SHS-1 pos 8	9.33
SHS-2 pos 1	23.67
SHS-2 pos 3	-3.4
SHS-2 pos 5	-3.89
SHS-2 pos 7	0.56
SHS-3 pos 2	39.8
SHS-3 pos 4	38.9
SHS-3 pos 6	73.9
SHS-3 pos 8	32.22

Table 2a: SETs Locations and Measurements – Fall 2012 sampling

Location		Marsh Type	Dominant Vegetation	Rate of Elevation Change from 2008 to 2012(mm/yr.)
RBP	Riverbend Patens	High Marsh	<i>Spartina patens</i>	5.92
RBM	Riverbend Mixed	High Marsh	<i>Phragmites australis</i> / <i>Spartina patens</i>	6.99
SM	Sawmill	High Marsh	<i>Spartina alterniflora</i>	7.94
LR	Lyndhurst Riverside	High Marsh	<i>Phragmites australis</i>	7.53
SHS	Secaucus HS	Low Marsh	<i>Spartina alterniflora</i>	6.51

The above two tables, Tables 2 and 2A, are summaries of the changes in elevation measured at each location.

Table 2 contains the averages of elevation changes obtained at each of the three plots as well as at each of the 4 orientation positions. The averages of measurements from all 108 platforms at each site are also included in Table 2. The average of all platforms is then divided by the time elapsed since the initial date (Table 1) to derive the rate of elevation change in mm/yr (Table 2a). The complete data set for elevation can be found in appendices at the end of the report. As shown in table 2a, values ranged from a subsidence rate of 5.92 mm/yr. at Riverbend Patens site to a maximum rise in elevation of 7.94 mm/yr. at the Sawmill site. All of the sites have exhibited similar increases in elevation.

Table 3: Average Accretion (mm) – Fall 2012 sampling

Riverbend Patens	
All Platforms	2.72
Std Error	0.09
RB-1	2.63
Std Error	0.05
RB-2	2.63
Std Error	0.09
RB-3	2.90
Std Error	0.20
RB-1	
A	2.6
B	2.7
C	2.6
RB-2	
A	2.6
B	2.5
C	2.8
RB-3	
A	3.2
B	2.8
C	2.7

Riverbend Mixed	
All Platforms	2.69
Std Error	0.08
RB-4	2.83
Std Error	0.15
RB-5	2.67
Std Error	0.33
RB-6	2.57
Std Error	0.15
RB-4	
A	3.2
B	2.5
C	2.8
RB-5	
A	3.3
B	2.5
C	2.2
RB-6	
A	2.5
B	2.2
C	3.0

Sawmill	
All Platforms	4.76
Std Error	0.52
SM-1	5.50
Std Error	0.50
SM-2	5.00
Std Error	0.29
SM-3	3.77
Std Error	1.89
SM-1	
A	6.0
B	4.5
C	6.0
SM-2	
A	5.5
B	5.0
C	4.5
SM-3	
A	6.0
B	0.0
C	5.3

Lyndhurst Riverside	
All Platforms	1.81
Std Error	0.17
LR-1	2.13
Std Error	0.20
LR-2	1.57
Std Error	0.07
LR-3	1.73
Std Error	0.40
LR-1	
A	2.0
B	2.0
C	2.4
LR-2	
A	1.5
B	1.5
C	1.7
LR-3	
A	2.3
B	1.5
C	1.4

Secaucus HS	
All Platforms	2.84
Std Error	0.08
SHS-1	2.77
Std Error	0.15
SHS-2	3.00
Std Error	1.55
SHS-3	2.75
Std Error	0.25
SHS-1	
A	0.0
B	4.3
C	4.0
SHS-2	
A	5.2
B	0.0
C	3.8
SHS-3	
A	2.5
B	3.0
C	5.7

Table 3a: Feldspar Horizon Measurements 2008/2012

Site	Positive Accretion (Percent)	Accretion Rate (mm/yr.)
Riverbend Patens	100	6.39
Riverbend Mixed	100	6.31
Sawmill	89	11.10
Lyndhurst Riverside	100	4.20
Secaucus HS	67	6.70

Tables 3 and 3a are summaries of the accretion measured by use of feldspar horizons emplaced at each benchmark location

Feldspar horizons were emplaced inside three corners of each benchmark plot. The sediment between the white feldspar marker and the horizon is measured. One reading is taken at each of the three corners resulting in a total of nine values associated with each marsh; the average of all readings produces a summary value (Table 3a). Not all horizons produced recognizable accretion; it is possible that the feldspar cannot be found and will need to be replaced and a new data set generated. Where negligible material accumulated above the horizon, “0.0 accretion” is designated. All recoverable values are included in the calculation for accretion rate.

To obtain a yearly rate, this value is divided by the number of days that have elapsed between establishment of the benchmark and the subsequent reading. Approximately four and a quarter years elapsed between the readings summarized in this report. Table 1 provides the dates for each reading and the time elapsed in days and years.

Table 4: Elevation Rate and Accretion Rate values – Fall 2008 to Fall 2012

Riverbend Patens						
Days	0	632	819	980	1165	1555
Sample Date	8/26/2008	5/20/2010	11/23/2010	5/3/2011	11/4/2011	11/28/2012
Elevation Rate mm/yr	0.00	2.48	6.13	6.02	6.92	5.92
Accretion Rate mm/yr	0.00	0.00	5.35	5.69	7.24	6.39

Riverbend Mixed						
Days	0	632	819	980	1165	1555
Sample Date	8/26/2008	5/20/2010	11/23/2010	5/3/2011	11/4/2011	11/28/2012
Elevation Rate mm/yr	0.00	5.96	7.25	7.58	8.34	6.99
Accretion Rate mm/yr	0.00	0.00	5.45	7.80	7.31	6.31

Sawmill						
Days	0	631	813	980	1181	1566
Sample Date	8/28/2008	5/21/2010	11/19/2010	5/5/2011	11/22/2011	12/11/2012
Elevation Rate mm/yr	0.00	-4.66	6.60	5.51	6.28	7.94
Accretion Rate mm/yr	0.00	0.00	7.70	13.80	12.00	11.10

Lyndhurst Riverside						
Days	0	630	811	979	1179	1557
Sample Date	8/29/2008	5/21/2010	11/18/2010	5/5/2011	11/21/2011	12/3/2012
Elevation Rate mm/yr	0	8.79	9.63	6.38	6.25	7.53
Accretion Rate mm/yr	0	2.74	4.63	3.94	4.70	4.20

Secaucus HS						
Days	0	609	810	984	1166	1553
Sample Date	8/28/2008	4/29/2010	11/16/2010	5/9/2011	11/7/2011	11/28/2012
Elevation Rate mm/yr	0.00	13.28	6.71	5.00	6.83	6.52
Accretion Rate mm/yr	0.00	2.74	5.26	5.05	8.20	6.70

Table 4 shows the yearly elevation and accretion rate for every sampling event.

Table 5: Marsh Processes (USGS 2010)

2010)SURFACE PROCESSES:
1) Sediment deposition
2) Sediment erosion
SUBSURFACE PROCESSES:
3) Root Growth
4) Decomposition
5) Pore water Flux
6) Compaction

Table 5 explains both surface and subsurface interactions (USGS, 2010).

Discussion

Elevation change measured by the SET is influenced by both surface and subsurface processes occurring within the soil profile (USGS 2010). The marker horizons reveal surface processes only. One can surmise the relative contribution of these processes by looking at the difference between the rates obtained by each.

The fall 2012 sampling took place 1 month after the super storm Sandy, but there were no significant changes observed for all the sampling sites.

While it is tempting to try to draw conclusions from this data set, one must acknowledge that marsh sediment processes take place slowly over long periods of time. To quote Jim Lynch, USGS SETs methodology expert, "...It will take a long time to get enough data to see what's going on."(2010, personal communication).

Conclusions

The installation of the surface elevation tables and feldspar horizons provides an accurate method for determining changes in the marshes of the Hackensack River estuary. The data derived during the period covered in this report suggest surface and subsurface processes are at work; and the two methods indicate the relative contribution of each. The data shows that all the sites are beginning to show relatively similar elevation rates as well as the accretion rates except at Sawmill. This may be due to the location of the Sawmill site, which has the greatest tidal influence of all the sites.

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Appendix 1: Riverbend Patens Surface Elevation Table Readings (mm)

RB-1					RB-2					RB-3				
Position	Pin	8/26/2008	11/28/2012	Difference	Position	Pin	8/26/2008	11/28/2012	Difference	Position	Pin	8/26/2008	11/28/2012	Difference
1	1	197	231	34	1	1	145	167	22	1	1	192	224	32
	2	227	252	25		2	150	169	19		2	179	217	38
	3	213	254	41		3	157	172	15		3	180	209	29
	4	230	259	29		4	159	170	11		4	188	204	16
	5	228	252	24		5	160	188	28		5	174	209	35
	6	222	256	34		6	160	180	20		6	177	215	38
	7	208	244	36		7	163	182	19		7	164	195	31
	8	226	255	29		8	161	185	24		8	158	199	41
	9	232	250	18		9	150	186	36		9	161	212	51
3	1	201	240	39	3	1	158	177	19	3	1	167	203	36
	2	203	257	54		2	155	184	29		2	196	185	-11
	3	211	244	33		3	157	167	10		3	175	202	27
	4	218	255	37		4	143	182	39		4	182	205	23
	5	202	241	39		5	160	182	22		5	180	189	9
	6	220	236	16		6	162	182	20		6	192	211	19
	7	221	245	24		7	160	174	14		7	173	183	10
	8	223	241	18		8	165	180	15		8	191	209	18
	9	214	244	30		9	166	180	14		9	191	194	3
5	1	215	250	35	5	1	162	180	18	5	1	187	214	27
	2	208	266	58		2	165	184	19		2	195	209	14
	3	214	249	35		3	157	182	25		3	195	196	1
	4	208	256	48		4	158	181	23		4	204	227	23
	5	216	252	36		5	155	180	25		5	193	210	17
	6	221	247	26		6	161	176	15		6	199	211	12
	7	219	264	45		7	143	180	37		7	200	224	24
	8	216	262	46		8	161	184	23		8	185	225	40
	9	227	264	37		9	165	182	17		9	152	224	72
7	1	216	233	17	7	1	160	179	19	7	1	130	172	42
	2	213	240	27		2	154	185	31		2	178	181	3
	3	215	230	15		3	156	183	27		3	179	183	4
	4	216	231	15		4	155	187	32		4	195	213	18
	5	221	229	8		5	156	171	15		5	176	220	44
	6	216	236	20		6	155	177	22		6	193	214	21
	7	212	208	-4		7	154	177	23		7	195	212	17
	8	217	223	6		8	153	174	21		8	192	220	28
	9	212	234	22		9	151	181	30		9	191	212	21

Appendix 2: Riverbend Mixed Surface Elevation Table Readings (mm)

RB-4					RB-5					RB-6				
Position	Pin	8/26/2008	11/28/2012	Difference	Position	Pin	8/26/2008	11/28/2012	Difference	Position	Pin	8/26/2008	11/28/2012	Difference
1	1	196	216	20	2	1	148	174	26	1	1	180	206	26
	2	196	209	13		2	136	168	32		2	189	190	1
	3	100	227	127		3	146	157	11		3	186	190	4
	4	196	222	26		4	164	175	11		4	177	215	38
	5	186	215	29		5	161	172	11		5	185	220	35
	6	206	235	29		6	106	165	59		6	181	217	36
	7	212	227	15		7	136	154	18		7	189	205	16
	8	190	235	45		8	155	181	26		8	178	174	-4
	9	180	203	23		9	149	179	30		9	149	169	20
3	1	190	222	32	4	1	153	174	21	3	1	173	195	22
	2	192	214	22		2	137	184	47		2	182	215	33
	3	196	199	3		3	134	175	41		3	168	207	39
	4	194	190	-4		4	140	210	70		4	177	196	19
	5	183	196	13		5	141	194	53		5	176	209	33
	6	193	174	-19		6	160	189	29		6	185	203	18
	7	198	210	12		7	159	184	25		7	181	198	17
	8	190	208	18		8	144	191	47		8	192	195	3
	9	190	205	15		9	149	196	47		9	187	193	6
5	1	198	241	43	6	1	141	175	34	5	1	178	212	34
	2	172	215	43		2	164	159	-5		2	176	223	47
	3	195	219	24		3	149	170	21		3	149	200	51
	4	189	235	46		4	163	190	27		4	154	200	46
	5	198	235	37		5	162	190	28		5	151	222	71
	6	204	236	32		6	160	187	27		6	161	204	43
	7	209	240	31		7	162	180	18		7	168	204	36
	8	208	250	42		8	176	179	3		8	178	208	30
	9	177	238	61		9	170	172	2		9	148	184	36
7	1	193	205	12	8	1	138	190	52	7	1	134	195	61
	2	203	220	17		2	142	199	57		2	161	209	48
	3	201	205	4		3	145	189	44		3	163	200	37
	4	197	215	18		4	68	180	112		4	178	206	28
	5	201	199	-2		5	126	207	81		5	175	209	34
	6	202	199	-3		6	141	181	40		6	191	209	18
	7	199	213	14		7	139	184	45		7	192	195	3
	8	190	215	25		8	120	199	79		8	193	195	2
	9	203	203	0		9	124	204	80		9	188	203	15

Appendix 3: Sawmill Surface Elevation Table Readings (mm)

SM-1					SM-2					SM-3				
Position	Pin	8/28/2008	12/11/2012	Difference	Position	Pin	8/28/2008	12/11/2012	Difference	Position	Pin	8/28/2008	12/11/2012	Difference
2	1	171	191	20	1	1	119	193	74	1	1	205	235	30
	2	178	210	32		2	114	203	89		2	176	250	74
	3	170	205	35		3	145	180	35		3	196	229	33
	4	172	200	28		4	162	175	13		4	175	219	44
	5	144	189	45		5	152	172	20		5	206	280	74
	6	234	169	-65		6	152	162	10		6	219	260	41
	7	169	166	-3		7	117	175	58		7	205	247	42
	8	182	199	17		8	144	195	51		8	207	260	53
	9	202	226	24		9	135	144	9		9	238	258	20
4	1	70	190	120	3	1	149	170	21	3	1	218	233	15
	2	127	175	48		2	135	192	57		2	203	225	22
	3	127	169	42		3	85	142	57		3	200	232	32
	4	155	162	7		4	111	160	49		4	213	196	-17
	5	160	180	20		5	91	186	95		5	240	250	10
	6	156	210	54		6	140	174	34		6	226	210	-16
	7	161	215	54		7	150	195	45		7	203	234	31
	8	166	229	63		8	153	185	32		8	222	257	35
	9	167	216	49		9	140	182	42		9	203	262	59
6	1	164	194	30	5	1	156	184	28	5	1	230	195	-35
	2	35	192	157		2	150	192	42		2	215	205	-10
	3	149	174	25		3	145	196	51		3	215	190	-25
	4	146	149	3		4	156	170	14		4	218	236	18
	5	109	140	31		5	143	181	38		5	225	237	12
	6	134	140	6		6	157	180	23		6	225	268	43
	7	151	131	-20		7	175	196	21		7	215	235	20
	8	121	168	47		8	176	206	30		8	216	241	25
	9	130	202	72		9	160	191	31		9	228	266	38
8	1	155	233	78	7	1	115	190	75	7	1	232	248	16
	2	172	235	63		2	92	169	77		2	226	239	13
	3	153	207	54		3	100	110	10		3	205	196	-9
	4	122	184	62		4	132	90	-42		4	167	192	25
	5	57	144	87		5	107	96	-11		5	210	248	38
	6	129	150	21		6	116	104	-12		6	185	256	71
	7	50	131	81		7	164	197	33		7	200	230	30
	8	146	200	54		8	144	180	36		8	206	242	36
	9	187	189	2		9	155	180	25		9	147	236	89

Appendix 4: Lyndhurst Riverside Surface Elevation Table Readings

LR-1					LR-2					LR-3				
Position	Pin	8/29/2008	12/3/2012	Difference	Position	Pin	8/29/2008	12/3/2012	Difference	Position	Pin	8/29/2008	12/3/2012	Difference
1	1	218	239	21	1	1	116	137	21	1	1	226	227	1
	2	241	234	-7		2	90	140	50		2	219	240	21
	3	244	240	-4		3	55	151	96		3	219	240	21
	4	248	232	-16		4	64	143	79		4	215	231	16
	5	231	238	7		5	103	129	26		5	183	240	57
	6	223	241	18		6	114	141	27		6	234	235	1
	7	239	240	1		7	113	150	37		7	208	235	27
	8	228	229	1		8	188	153	-35		8	225	232	7
	9	217	227	10		9	168	169	1		9	215	235	20
3	1	234	247	13	3	1	175	160	-15	3	1	162	222	60
	2	210	257	47		2	179	162	-17		2	193	232	39
	3	237	250	13		3	102	153	51		3	184	224	40
	4	233	245	12		4	137	150	13		4	118	207	89
	5	242	249	7		5	150	151	1		5	153	209	56
	6	236	246	10		6	82	146	64		6	137	210	73
	7	258	255	-3		7	125	150	25		7	138	199	61
	8	230	240	10		8	185	173	-12		8	145	209	64
	9	225	241	16		9	207	187	-20		9	95	191	96
5	1	122	230	108	5	1	190	179	-11	5	1	195	216	21
	2	182	256	74		2	150	174	24		2	174	211	37
	3	210	239	29		3	166	176	10		3	134	219	85
	4	151	243	92		4	135	168	33		4	145	209	64
	5	210	251	41		5	137	162	25		5	72	195	123
	6	224	251	27		6	148	170	22		6	120	213	93
	7	208	254	46		7	145	174	29		7	97	229	132
	8	206	246	40		8	122	172	50		8	131	220	89
	9	197	246	49		9	130	174	44		9	114	228	114
7	1	212	215	3	7	1	135	158	23	7	1	165	235	70
	2	219	222	3		2	123	145	22		2	175	240	65
	3	213	221	8		3	135	153	18		3	222	226	4
	4	211	235	24		4	116	143	27		4	216	235	19
	5	200	211	11		5	100	134	34		5	205	232	27
	6	205	215	10		6	98	140	42		6	220	232	12
	7	207	210	3		7	110	146	36		7	169	241	72
	8	227	211	-16		8	115	145	30		8	199	235	36
	9	190	214	24		9	115	145	30		9	196	242	46

Appendix 5: Secaucus HS Surface Elevation Table Readings (mm)

Position	SHS-1				Position	SHS-2				Position	SHS-3			
	Pin	8/28/2008	11/28/2012	Difference		Pin	8/28/2008	11/28/2012	Difference		Pin	8/21/2008	11/28/2012	Difference
2	1	154	221	67	1	1	122	139	17	2	1	177	190	13
	2	158	234	76		2	90	142	52		2	165	215	50
	3	172	241	69		3	174	152	-22		3	160	199	39
	4	160	230	70		4	164	160	-4		4	168	211	43
	5	183	246	63		5	127	150	23		5	160	213	53
	6	172	246	74		6	155	156	1		6	170	198	28
	7	178	237	59		7	147	167	20		7	165	215	50
	8	170	236	66		8	90	174	84		8	170	198	28
	9	150	229	79		9	136	178	42		9	130	184	54
4	1	142	161	19	3	1	141	145	4	4	1	182	213	31
	2	127	150	23		2	144	144	0		2	175	209	34
	3	134	165	31		3	156	135	-21		3	174	215	41
	4	165	171	6		4	132	139	7		4	165	234	69
	5	176	195	19		5	130	128	-2		5	175	206	31
	6	156	212	56		6	135	163	28		6	174	217	43
	7	148	215	67		7	116	100	-16		7	175	202	27
	8	167	205	38		8	118	95	-23		8	177	212	35
	9	163	202	39		9	120	112	-8		9	175	214	39
6	1	170	177	7	5	1	146	146	0	6	1	180	230	50
	2	173	162	-11		2	145	158	13		2	149	235	86
	3	171	219	48		3	152	149	-3		3	155	224	69
	4	178	166	-12		4	150	150	0		4	174	231	57
	5	181	170	-11		5	156	153	-3		5	160	230	70
	6	165	186	21		6	155	135	-20		6	135	226	91
	7	182	220	38		7	140	122	-18		7	135	225	90
	8	185	229	44		8	120	120	0		8	148	250	102
	9	180	230	50		9	114	110	-4		9	170	220	50
8	1	187	175	-12	7	1	129	170	41	8	1	191	180	-11
	2	183	178	-5		2	187	179	-8		2	175	210	35
	3	184	246	62		3	232	179	-53		3	175	219	44
	4	178	165	-13		4	180	185	5		4	188	216	28
	5	185	195	10		5	174	171	-3		5	183	233	50
	6	199	176	-23		6	158	180	22		6	190	236	46
	7	182	195	13		7	190	185	-5		7	185	224	39
	8	186	215	29		8	186	187	1		8	200	214	14
	9	197	220	23		9	175	180	5		9	175	220	45

