



**Inventory, Mapping, and Condition Class Assessment
of Visitor-Created Trails on the Beehive
Acadia National Park**



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EXECUTIVE SUMMARY

In July 2009, we inventoried visitor-created trails on the Beehive using Global Positioning Systems technology (GPS) and applied a Condition Class Assessment as we have for similar projects in the park. The study area ran from the top of the Beehive Trail rungs to the West Beehive (secondary summit) overlooking the Bowl.

We found three clusters of visitor-created trails in our Beehive study area, and to ease understanding will refer to them as the Beehive Summit, the Tableland, and the West Beehive.

The largest cluster was found on both sides of a ¼ mile segment of the maintained trail at the Beehive Summit and near the North View, a large sloping ledge popular as a stopping point.. Some of these trails extended far to the north and south of the Beehive Trail. The southernmost extension of trails appears to have been the result of hikers missing a switchback in the maintained trail, perhaps due to poor trail marking. Although hikers seem to make this turn now, the results are still a Condition Class (CC) 5 section of trail, heavily eroded. Many heavily impacted trail segments (CC 4 and 5) are on the north side of the Beehive Trail and associated with the North View and an “attraction” boulder that can be seen by hikers after they finish the iron rungs. The boulder draws them over, and from there, some move on to the North View.

The second cluster is on both sides of the maintained trail through the Tableland, an area found just before the Beehive Trail drops down to a saddle where a connector trail (to be closed per the Hiking Trails Plan, 2002) leads to the Bowl Trail and back to the road. The south side of the maintained trail here offers fine views, but the north side is forested. Both sides are full of CC 5 trails, eroded to bare soil.

The third cluster is located on the West Beehive. The Beehive Trail across the West Beehive offers some views to the east and north but it stays on the east side and below the summit. All the visitor-created trails are west of the maintained trail where there are more views in all directions, including over the Bowl. Many of these trails are in CC 4.

We used GIS to calculate the total length of visitor created trails and the length of trails in each condition class. The total length of visitor-created trails was 2,931.8 feet, or 0.56 miles. Slightly more than 50% of these were in the worst condition, Condition Class 5, and 70% were Condition Class 4 or 5.

Visitor-created trails on the Beehive can and should be managed to reduce the impacts to soils and vegetation and encourage natural recovery. Strategies will be similar to those used in other park areas, with an emphasis on site management (including area closures), and educational signs.

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INTRODUCTION

The Beehive is a 520-foot high mountain located just northwest of Sand Beach in Acadia National Park. A trailhead along the Park Loop Road provides hiker access. The views from the trail and adjacent ledges are outstanding and include Sand Beach and the Ocean Drive as well as Cadillac, Dorr, and Champlain Mountains. The Beehive is one of Acadia's ladder trails, enabling hikers to climb the steep cliff face using iron rungs, rails, and the occasional ladder. The summit is no more than half a mile from the road and there are two easy routes down, one short and one a little longer. The shorter loop is due to close soon, as recommended in the Acadia National Park Hiking Trails Plan (2002).

All of these features make the Beehive a very popular hike. Trailhead censuses conducted from 9:00 a.m. to 4:00 p.m. on one day during the first week of August over a five year period counted the following numbers of hikers: 1999 - 401; 2000 - 331, 2001 - 405; 2002 - 571; and 2003 - 256 (Jacobi 2003).

Like other popular locations around the park (Cadillac Mountain and along the Ocean Drive for example), wherever many visitors go, visitor-created trails are many too, as visitors seek a little privacy, a photograph, pick blueberries, or simply explore. Once these linear routes begin to look like a trail, more visitors are attracted into using them. Eventually the vegetation is trampled and lost, and bare soil is often exposed. These impacts usually remain on the landscape unless managers take action.

In 2009, we inventoried visitor-created trails on the Beehive using Global Positioning Systems technology (GPS) and applied a Condition Class Assessment as we have for similar projects on Little Moose Island (Jacobi 2004) and along Ocean Drive (Jacobi and Anderson 2005).

METHODS

Our study area on the Beehive began just above the last of the iron rungs near the top and extended to a secondary summit, the West Beehive, overlooking a mountain pond called the Bowl. We did not map the trail braids on the face of the Beehive itself (a few exist), although one of our mapped trails extended far down the south side of the mountain to reconnect with the maintained trail.

Recreation Technician Kevin Dougherty and Geographic Information Systems (GIS) Specialist Karen Anderson mapped visitor-created trails July 16, 17, and 20, 2009 using a Trimble ProXL and a Trimble GeoXT GPS unit. Both units were set to capture data at submeter accuracy. Critical GPS settings included a signal to noise ratio (SNR) threshold of 6, maximum positional dilution of precision (PDOP) value of 4 [range 1.2 to 3.9, no units], using a minimum of 4 satellites (a "3D position"). A minimum of 12 GPS fixes were collected for each point. All data were corrected differentially with Trimble Pathfinder Office ver4.1 using the Bar Harbor CORS base station. Horizontal precision, estimated by Pathfinder Office, ranged from 0.5 to 1.2 meters (95% confidence).

During differential correction, the software failed to correct 36 GPS fixes--33 of these were due to excessive multipath error and 3 were due to missing base data. It additionally excluded 3 positions due to high DOP values. All of these uncorrected positions were filtered out and they were not included in the average location calculation for the point. This resulted in two points having less than the recommended 12 GPS fixes to average (point FID = 120 and 122)

During our mapping effort on Ocean Drive (Jacobi 2005) we used the GPS to map the trails as lines while walking them. While this has been effective for larger scale mapping efforts, we found that for such a small-scale project, where the trail segments were many, usually short, and highly interconnected, the inherent variability in GPS position fixes scrambled the lines. Extensive editing was required and many additional site visits were necessary to ground-truth the edited data. We decided, for this mapping effort on the Beehive, to use a different technique that we referred to as a "GPS-informed sketch." This time we used the GPS to map points (which are more accurate because they consist of many GPS position fixes averaged together) and made a general field sketch, by hand, of the trail network. GPS points were mapped at trail beginning/end points, intersections, and major inflection points (as necessary to capture curves or changes of direction). We also mapped a few key natural features such as boulders, and re-mapped the maintained Beehive Trail to help orient our work.

We then downloaded and differentially corrected the GPS data, and exported them to ESRI shapefile format for use in GIS. An empty line shapefile was created and the trail lines were hand-digitized to snap to the GPS points in accordance to the field sketch, displaying other GIS imagery and data layers for orientation. Resource Specialist Charlie Jacobi and Dougherty added a condition class rank to each trail segment (see below) based on field observations. We returned to the field 2-3 times with our maps of points and lines to verify that they were connected and ranked correctly; these visits were essential to correct errors. We deleted a few unknown points (not connected to any visitor-created trail), deleted or corrected a few lines (due to the confusion of the dense network), and even drew in a few new lines for trails that we had missed in the earlier site visits (these new lines are shown on our maps without corresponding GPS points).

The condition class ranking was adapted from a system suggested by Dr. Jeff Marion of Virginia Tech.

Condition classes were:

- 0) Trail barely distinguishable; no/minimal disturbance of vegetation and/or organic litter
- 1) Trail distinguishable; slight loss of vegetation and/or minimal disturbance of organic litter.
- 2) Trail obvious; vegetation cover lost or disturbed. Tread defined, but overgrown.
- 3) Vegetation cover and organic litter lost in nearly all places. Little or no erosion.
- 4) Soil erosion or compaction in tread is beginning in some places. Soil erosion is common but still modest in extent.

- 5) Tread is obviously below ground surface. Soil erosion is extensive and/or severe.
- 6) Ledge makes up most of the trail.

The following criteria were used for mapping:

- only segments longer than 10 ft. were mapped unless they were in severe condition (Condition Class ≥ 4);
- the Condition Class assigned was based on the worst case condition of the segment;
- long trail sections with different condition classes were mapped as separate segments;
- condition class 0 segments were mapped (these were not mapped in previous studies)

RESULTS

We found three clusters of visitor-created trails in our Beehive study area, and to ease understanding will refer to them as the Summit, the Tableland, and the West Beehive (Figure 1).

The largest cluster (Figure 2) was found on both sides of a $\frac{1}{4}$ mile segment of the maintained trail at the Beehive Summit and near the labeled feature called the North View.¹ Some of these trails extended far to the north and south of the Beehive Trail. The southernmost extension of trails appears to have been the result of hikers missing a switchback in the maintained trail, perhaps due to poor trail marking. Although hikers seem to make this turn now, the results are still a Condition Class (CC) 5 section of trail, heavily eroded. Many heavily impacted trail segments (CC 4 and 5, orange and red on the map) are on the north side of the Beehive Trail and associated with the North View and an “attraction” boulder that can be seen by hikers after they finish the iron rungs. The boulder draws them over to it, and from there, some move on to the North View.

The lead author notes that twenty-five years ago the existence of this North View ledge was probably not known to many hikers as the way to it from the Beehive Trail was obscured by some branches not obvious at all to hikers. It is obvious now, perhaps due to repeated use by those knowing of it, and many hikers find their way to the North View.

The northernmost extension of trails (north of the North View) do not show on the Summit map because of scale, but do show on the first map, an overall view of all three sites.

The second cluster (Figure 3) is on both sides of the maintained trail through the Tableland, and is found just before the Beehive Trail drops down to a saddle where a connector trail (to be closed per the Hiking Trails Plan, 2002) leads to the Bowl Trail and

¹ The actual summit of the Beehive is at the North View, is not marked in any way, and is not obvious. During some informal observations of visitor behavior, we found at least one party looking for the summit near the “attraction” boulder, and a number of trails are found around the boulder and what appears to be the summit near there.

back to the road. The south side of the maintained trail here offers fine views, but the north side is forested. Both sides are full of CC 5 trails, eroded to bare soil.

The third cluster (Figure 4) is located on the West Beehive. The Beehive Trail offers some views to the east and north here but it stays on the east side and below the summit of the West Beehive. All the visitor-created trails are west of the maintained trail where there are more views in all directions, including over the Bowl. Many of these trails are in CC 4.

We used GIS to calculate the total length of visitor created trails and the length of trails in each condition class. These are shown in Table 1. The total length of visitor-created trails was 2,931.8 feet, or 0.56 miles. Slightly more than 50% of these were in the worst condition, Condition Class 5, and 70% were Condition Class 4 or 5.

**TABLE 1: LENGTH OF VISITOR-CREATED TRAILS ON THE BEEHIVE
BY CONDITION CLASS, 2009**

Condition Class	Number of Segments	Length in Feet	Length in Meters	Percent of Total Length
0	2	31	9	1.06%
1	4	109	33	3.73%
2	14	307	94	10.47%
3	22	418	127	14.24%
4	27	552	168	18.84%
5	51	1514	462	51.66%
Totals	120	2932	894	100.00%
6 (Ledge)	13	232	71	

DISCUSSION AND RECOMMENDATIONS

The cumulative length of visitor-created trails and the percent of them in Condition Class 4 and 5 is a testament to the popularity of the Beehive Trail and the human urge to explore or to find a private spot away from other hikers. These impacts are the same as those we have found on Little Moose Island, along Ocean Drive, and on a smaller scale, at many other sites in the park.

These visitor-created trails on the Beehive can and should be managed crew to reduce the impacts to soils and vegetation and encourage natural recovery. Revegetation of some sites is also an option. Each of the three cluster areas of trails should be managed independently with site management and education strategies similar to those used in other locations throughout the park. Park et al (2009) demonstrated the efficacy of these strategies on Gorham Mountain in Acadia National Park.

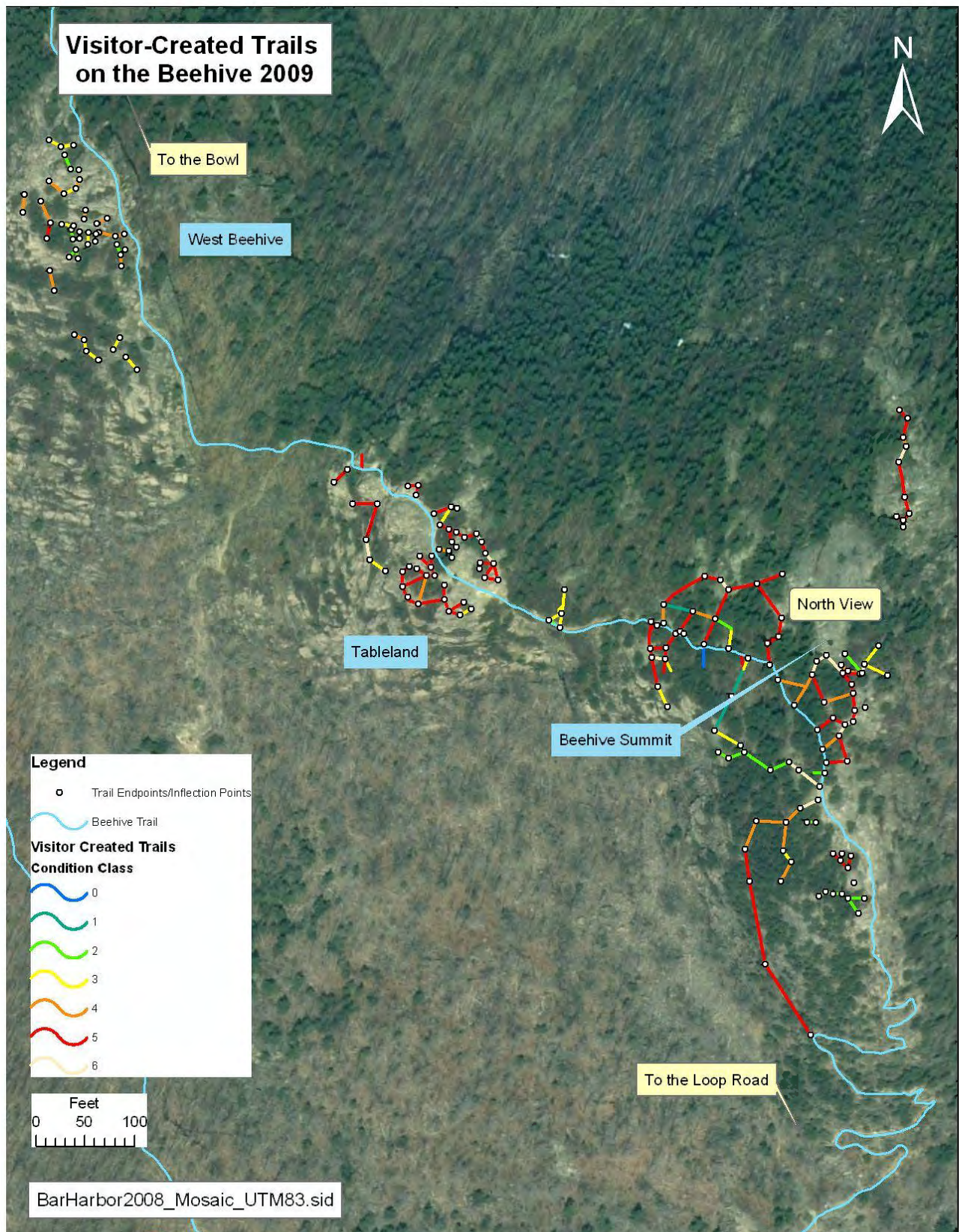


FIGURE 1: VISITOR-CREATED TRAILS ON THE BEEHIVE: 2009.

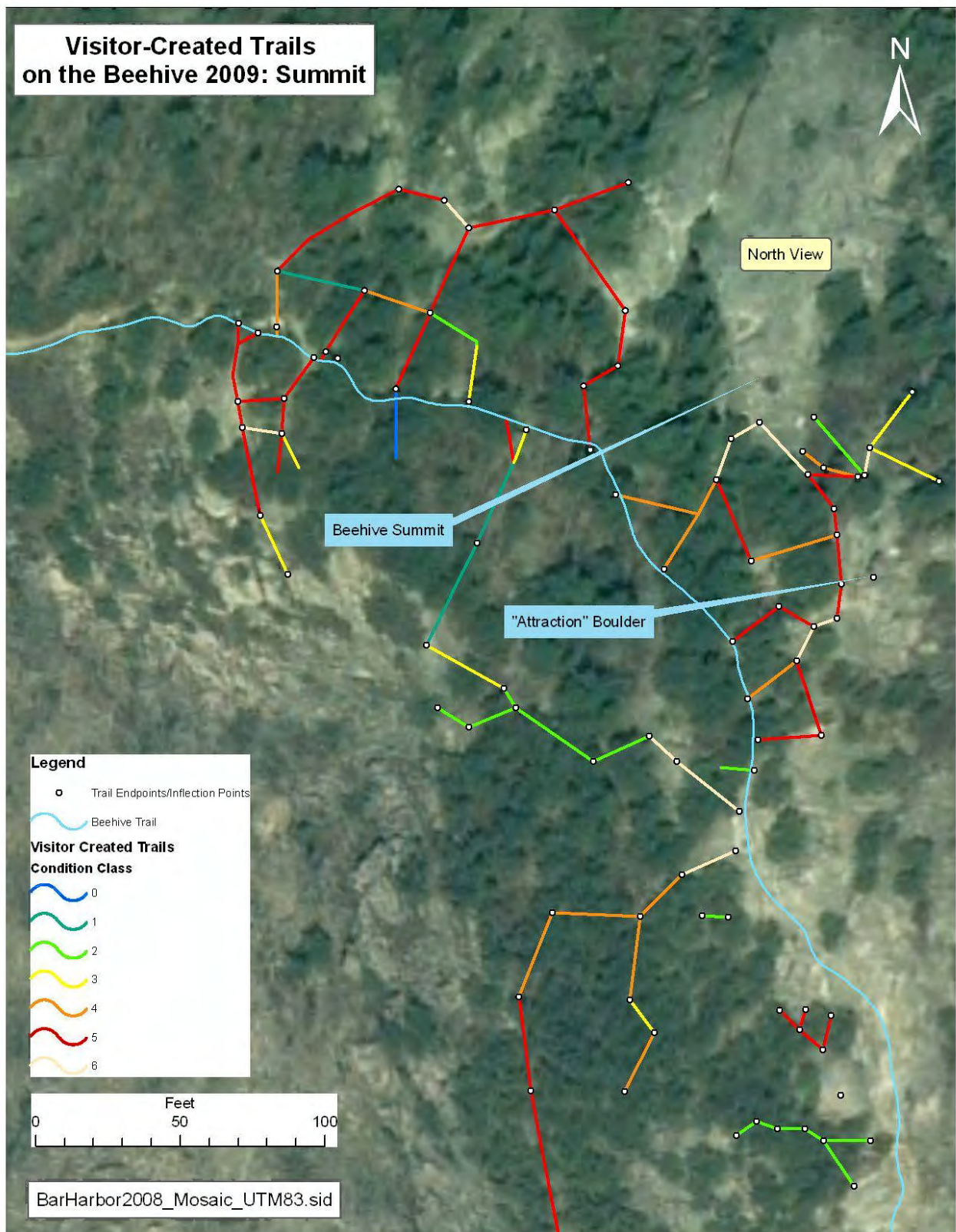


FIGURE 2: VISITOR-CREATED TRAILS ON THE BEEHIVE 2009: SUMMIT

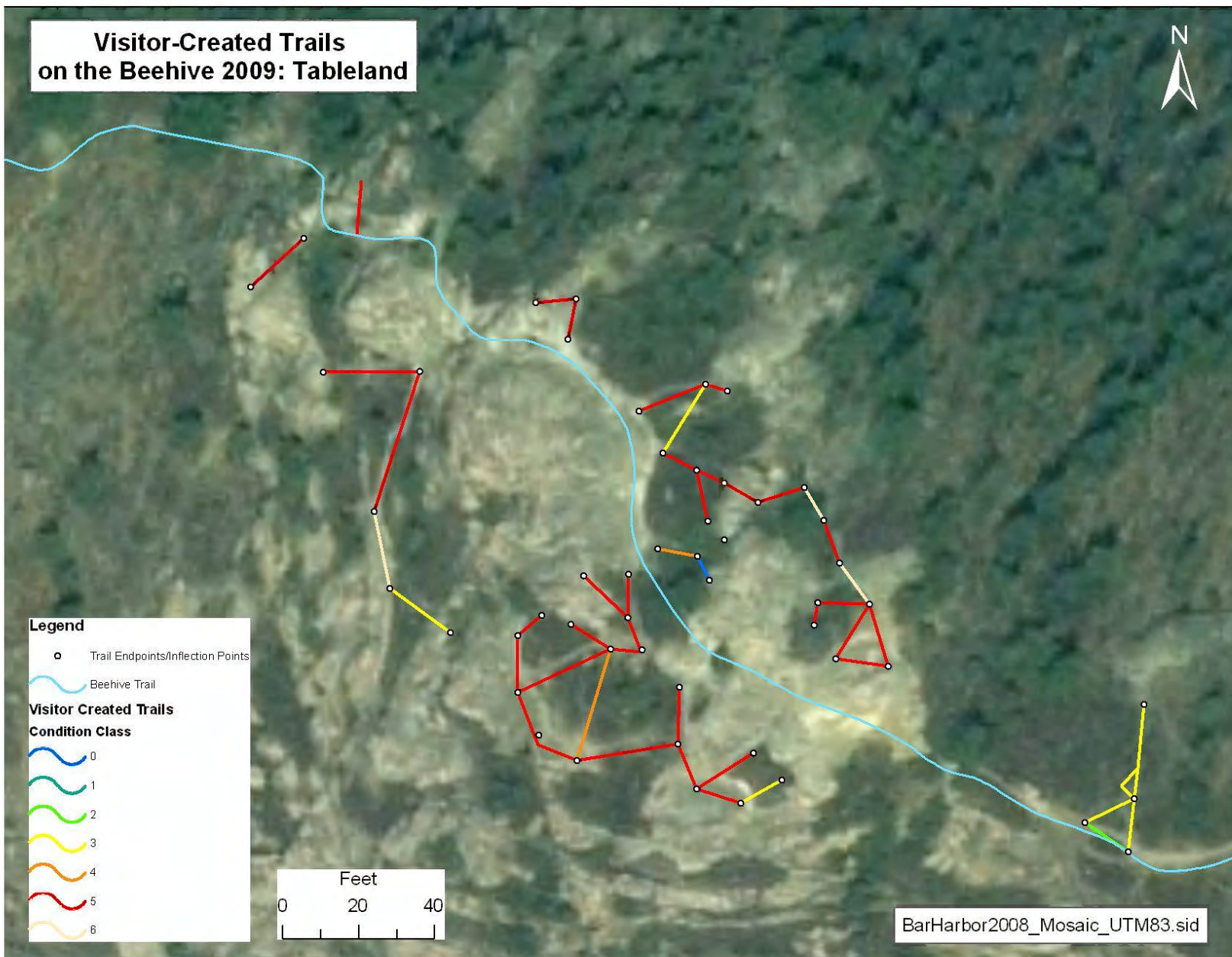


FIGURE 3: VISITOR-CREATED TRAILS ON THE BEEHIVE 2009: TABLELAND

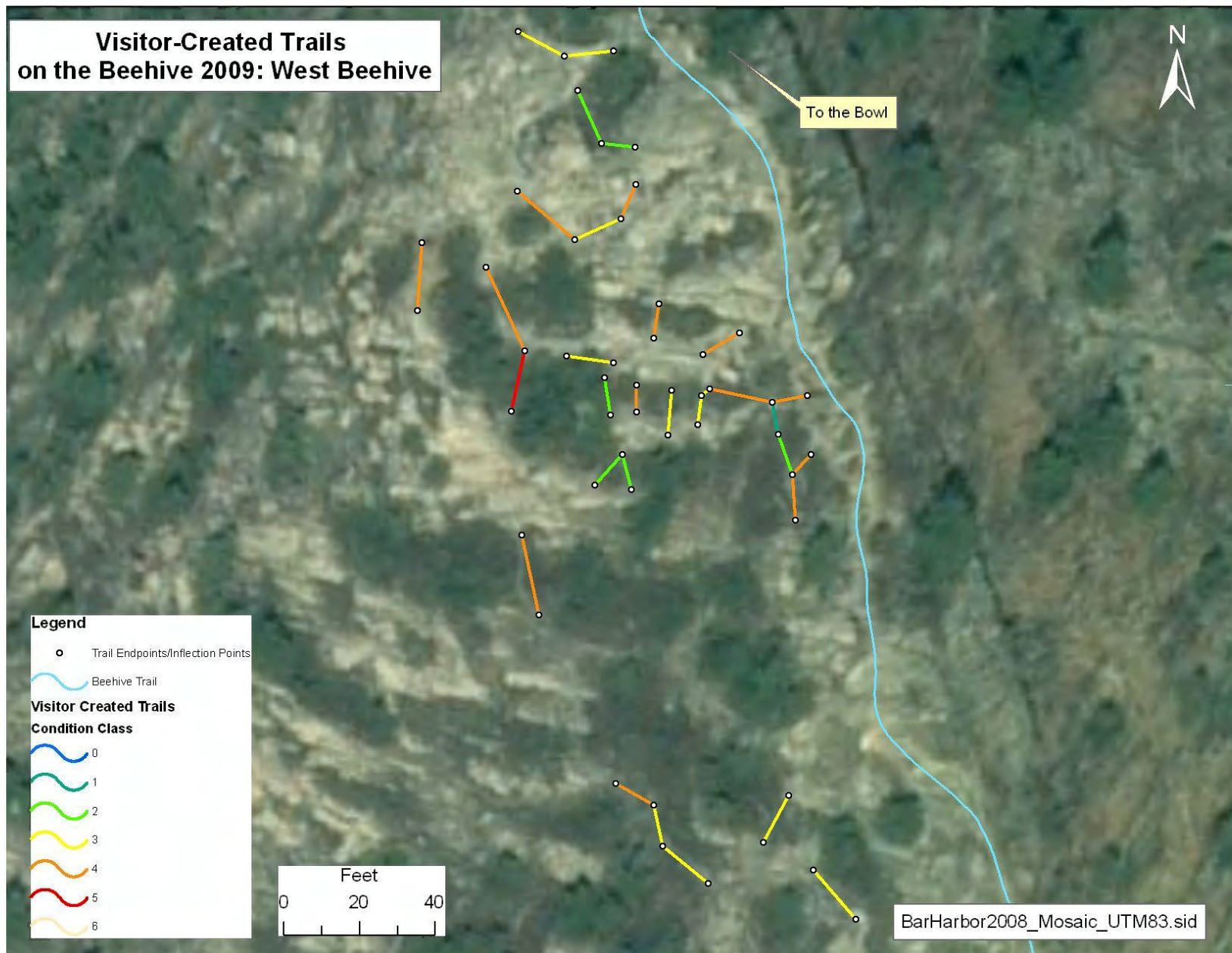


FIGURE 4: VISITOR-CREATED TRAILS ON THE BEEHIVE 2009: WEST BEEHIVE

1. Site management. Using stakes, ropes (or possibly cedar fencing), and brush, certain areas and/or visitor-created trails should be closed to visitor traffic. Visitors should be directed to the most popular sites with the best views unless there are compelling reasons for closure. Designated, maintained spur trails to and from the Beehive Trail to viewpoints are one option. Complete re-routes of the Beehive Trail to take hikers where they want to go is another. These reroutes would be relatively minor, sustainable, and localized. Often, a well-established and beaten path already exists.
2. Education. The Ocean Path model for signs should be followed for consistency of messages in closed areas throughout the park. Several “entry” type signs would explain the requested behavior. The following entry sign text was reviewed by the park Sign Committee and was used along Ocean Drive: *Leave No Trace. Your footsteps damage fragile plants and soil. Please stay on established trails or step on bedrock.* It could be used here. These would be supplemented by signs in the closed areas reading *Restoration Area* and using the standard footprint with a red slash symbol. Signs can be supplemented with occasional in-person Leave No Trace education by ridgerunners, other staff, and volunteers.

Resource management and trail crew staff should prepare a brief plan (similar to the one for the Monument Cove area adjacent to the Ocean Path) outlining action recommendations that can be reviewed by the park’s management team.

Methods. Although we did not do this in our study, the newer GPS unit (GeoXT) now allows you to map lines, in the field, as a series of averaged points (“vertex averaging”). This makes the line vertices more accurate (which was the aim of this mapping effort on the Beehive) and reduces the inherent GPS “jiggle” that was such a problem in the Ocean Drive mapping effort (Jacobi and Anderson 2005). Also, because you are mapping lines, you can take advantage of the GPS’s data dictionary feature and enter your condition class rankings at the same time as you map the trail; this should reduce field time. We strongly recommend this practice and will use it in future mapping efforts.

LITERATURE CITED

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2009 Integrated research in the sociology and ecology of outdoor recreation. PhD Dissertation. Department of Forest Resources and Environmental Conservation, College of Natural Resources. Virginia Tech, Blacksburg, VA.

APPENDIX 1: GIS/GPS DATA

FID#	GPS_Date	Max_PDOP	Filt_Pos	Horz_Prec	Std_Dev	Northing	Easting
0	7/20/2009	2.2	12	0.5	0.088338	4909350.380	564517.391
1	7/20/2009	2.2	12	0.5	0.140464	4909354.301	564513.950
2	7/20/2009	2.2	12	0.5	0.066580	4909360.320	564511.934
3	7/20/2009	2.2	12	0.5	0.088610	4909356.525	564509.893
4	7/20/2009	2.2	12	0.5	0.154813	4909353.216	564505.428
5	7/20/2009	2.2	12	0.5	0.047385	4909356.221	564501.761
6	7/20/2009	2.4	12	0.5	0.108806	4909359.588	564501.034
7	7/20/2009	2.4	12	0.6	0.082388	4909361.292	564497.990
8	7/20/2009	2.4	12	0.6	0.061662	4909374.875	564491.775
9	7/20/2009	2.4	12	0.6	0.078008	4909381.343	564490.433
10	7/20/2009	1.3	12	0.5	0.077984	4909385.364	564496.328
11	7/20/2009	1.3	12	0.5	0.061788	4909387.852	564498.545
12	7/20/2009	1.3	12	0.5	0.110555	4909385.015	564499.241
13	7/20/2009	1.3	12	0.5	0.127069	4909392.606	564513.433
14	7/20/2009	1.3	12	0.5	0.257454	4909392.050	564510.600
15	7/20/2009	1.3	12	0.5	0.132419	4909393.133	564505.552
16	7/20/2009	1.3	12	0.5	0.092449	4909393.026	564502.479
17	7/20/2009	1.3	12	0.5	0.055332	4909389.397	564502.210
18	7/20/2009	1.3	12	0.5	0.156309	4909390.214	564504.635
19	7/20/2009	1.3	12	0.5	0.183877	4909392.608	564504.895
20	7/20/2009	1.3	12	0.5	0.078069	4909391.262	564499.662
21	7/20/2009	1.3	12	0.5	0.084331	4909393.443	564499.652
22	7/20/2009	1.3	12	0.5	0.068975	4909394.027	564497.098
23	7/20/2009	1.3	12	0.5	0.082066	4909391.046	564497.563
24	7/20/2009	1.3	12	0.5	0.033286	4909395.252	564497.808
25	7/20/2009	1.3	12	0.5	0.096286	4909395.771	564493.992
26	7/20/2009	1.3	12	0.5	0.141255	4909397.196	564501.086
27	7/20/2009	1.6	12	0.5	0.196105	4909400.009	564501.463
28	7/20/2009	2.0	12	0.5	0.298465	4909397.640	564508.000
29	7/20/2009	2.0	12	0.5	0.117379	4909395.925	564505.019
30	7/20/2009	2.0	12	0.5	0.077194	4909389.435	564511.088
31	7/20/2009	2.0	12	0.5	0.059705	4909382.522	564512.469
32	7/20/2009	2.0	12	0.5	0.072487	4909387.854	564513.737
33	7/20/2009	2.0	12	0.5	0.087888	4909386.233	564512.247
34	7/20/2009	2.0	12	0.5	0.121022	4909391.328	564489.566
35	7/20/2009	2.0	12	0.5	0.239986	4909396.192	564490.662
36	7/20/2009	2.0	12	0.5	0.125668	4909402.917	564487.519
37	7/20/2009	2.0	12	0.5	0.126708	4909404.932	564482.362
38	7/20/2009	2.0	12	0.5	0.159348	4909399.437	564482.007
39	7/20/2009	2.0	12	0.5	0.099965	4909409.079	564490.060

APPENDIX 1: GIS/GPS DATA

FID#	GPS_Date	Max_PDOP	Filt_Pos	Horz_Prec	Std_Dev	Northing	Easting
40	7/20/2009	2.0	12	0.5	0.153875	4909405.181	564494.692
41	7/20/2009	2.0	12	0.5	0.119370	4909421.937	564490.102
42	7/20/2009	2.0	12	0.5	0.147904	4909419.970	564493.837
43	7/20/2009	2.0	12	0.5	0.109453	4909420.371	564497.825
44	7/20/2009	2.0	12	0.5	0.056761	4909417.204	564494.936
45	7/20/2009	2.0	12	0.5	0.129760	4909412.916	564496.863
46	7/20/2009	2.0	12	0.5	0.063305	4909412.601	564499.526
47	7/20/2009	2.0	12	0.5	0.057106	4909409.622	564499.604
48	7/20/2009	2.0	12	0.5	0.030926	4909406.822	564498.436
49	7/16/2009	1.9	39	0.7	0.144878	4909220.123	564730.092
50	7/16/2009	2.5	30	1.0	0.257932	4909227.698	564732.076
51	7/16/2009	3.3	30	1.2	0.165574	4909238.016	564729.357
52	7/16/2009	3.1	39	1.2	0.326794	4909245.688	564722.143
53	7/16/2009	3.3	38	1.0	0.118751	4909253.499	564717.065
54	7/16/2009	3.0	59	1.0	0.201409	4909260.355	564707.643
55	7/16/2009	3.9	60	0.9	0.158002	4909264.697	564693.857
56	7/16/2009	2.3	51	0.7	0.138543	4909267.988	564685.210
57	7/16/2009	2.3	58	0.7	0.143270	4909270.553	564679.343
58	7/16/2009	2.3	54	0.7	0.096222	4909285.751	564694.193
59	7/16/2009	2.3	23	0.7	0.089879	4909284.568	564698.967
60	7/16/2009	2.3	39	0.7	0.060354	4909286.452	564718.362
61	7/16/2009	2.3	52	0.7	0.055189	4909337.707	564755.000
62	7/16/2009	2.5	59	0.7	0.196160	4909335.068	564757.430
63	7/16/2009	2.5	56	0.7	0.089692	4909329.081	564756.046
64	7/16/2009	2.5	38	0.7	0.107275	4909326.280	564757.007
65	7/16/2009	2.5	61	0.7	0.119852	4909321.490	564754.695
66	7/16/2009	2.5	68	0.7	0.113730	4909261.137	564732.187
67	7/16/2009	2.5	55	0.9	0.164530	4909259.433	564729.201
68	7/16/2009	2.0	50	0.8	0.134797	4909258.093	564736.763
69	7/16/2009	2.0	24	1.1	0.187479	4909256.353	564738.976
70	7/16/2009	2.0	50	1.0	0.038003	4909255.431	564742.545
71	7/16/2009	2.0	45	0.9	0.212808	4909264.320	564748.309
72	7/16/2009	2.0	50	0.8	0.106552	4909258.430	564743.875
73	7/16/2009	2.2	47	1.0	0.132052	4909254.882	564751.114
74	7/16/2009	1.9	50	0.8	0.070368	4909255.575	564743.286
75	7/16/2009	1.9	50	0.9	0.255561	4909261.682	564737.908
76	7/16/2009	2.6	77	1.0	0.170233	4909235.997	564736.125
77	7/16/2009	2.2	55	0.8	0.092748	4909228.159	564738.736
78	7/20/2009	1.9	12	0.5	0.061794	4909284.798	564630.081
79	7/20/2009	1.9	12	0.5	0.104647	4909289.761	564628.535
80	7/20/2009	1.9	12	0.5	0.139015	4909289.925	564624.407

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FID#	GPS_Date	Max_PDOP	Filt_Pos	Horz_Prec	Std_Dev	Northing	Easting
81	7/20/2009	1.9	12	0.5	0.059323	4909285.380	564625.846
82	7/20/2009	1.9	12	0.5	0.034547	4909288.118	564624.080
83	7/20/2009	1.9	12	0.5	0.080211	4909293.110	564626.125
84	7/20/2009	1.9	12	0.5	0.109308	4909296.555	564624.883
85	7/20/2009	1.9	12	0.5	0.109368	4909299.172	564623.283
86	7/20/2009	1.9	12	0.5	0.081121	4909297.958	564619.587
87	7/20/2009	2.5	12	0.5	0.051114	4909294.980	564616.856
88	7/20/2009	2.5	12	0.6	0.075103	4909293.647	564614.719
89	7/20/2009	2.5	12	0.6	0.104146	4909291.735	564615.665
90	7/20/2009	2.5	12	0.6	0.045878	4909294.226	564611.542
91	7/20/2009	2.5	13	0.6	0.071566	4909301.942	564611.939
92	7/20/2009	2.5	12	0.5	0.070890	4909300.555	564614.646
93	7/20/2009	2.5	12	0.5	0.184234	4909299.510	564616.897
94	7/20/2009	2.5	12	0.5	0.130355	4909296.476	564615.525
95	7/20/2009	2.5	12	0.5	0.094441	4909306.929	564617.138
96	7/20/2009	2.5	12	0.5	0.107765	4909307.489	564615.363
97	7/20/2009	2.5	12	0.5	0.064077	4909305.298	564609.991
98	7/20/2009	2.5	12	0.5	0.110907	4909314.263	564604.974
99	7/20/2009	2.5	12	0.5	0.053229	4909311.091	564604.307
100	7/20/2009	2.5	12	0.5	0.079163	4909314.005	564601.735
101	7/16/2009	2.5	12	0.5	0.086939	4909190.234	564740.791
102	7/16/2009	2.5	12	0.5	0.053916	4909185.433	564743.908
103	7/16/2009	2.5	12	0.5	0.082742	4909180.609	564742.226
104	7/16/2009	2.6	12	0.5	0.187545	4909185.433	564738.964
105	7/16/2009	3.4	12	0.7	0.166477	4909186.674	564737.014
106	7/16/2009	2.6	12	0.5	0.189427	4909186.662	564734.112
107	7/16/2009	3.5	12	0.7	0.218926	4909187.477	564731.880
108	7/16/2009	3.9	12	0.8	0.264027	4909185.985	564729.791
109	7/16/2009	2.6	12	0.5	0.089083	4909199.179	564734.296
110	7/16/2009	2.6	12	0.5	0.067053	4909197.088	564736.481
111	7/16/2009	2.6	12	0.5	0.172384	4909194.964	564738.913
112	7/16/2009	2.6	12	0.5	0.130368	4909198.579	564739.775
113	7/16/2009	2.6	12	0.5	0.077393	4909199.259	564737.065
114	7/16/2009	1.2	12	0.5	0.048990	4909208.951	564728.879
115	7/16/2009	1.2	12	0.5	0.083482	4909209.167	564726.148
116	7/16/2009	2.5	12	0.5	0.175485	4909213.418	564724.065
117	7/16/2009	3.2	12	0.7	0.278664	4909209.036	564719.640
118	7/16/2009	3.7	12	0.8	0.206587	4909200.235	564718.538
119	7/16/2009	3.7	12	0.8	1.128644	4909196.798	564721.144
120	7/16/2009	2.6	2	0.6	0.081705	4909190.597	564717.960
121	7/16/2009	3.7	12	1.0	0.334320	4909209.438	564710.358

APPENDIX 1: GIS/GPS DATA

FID#	GPS_Date	Max_PDOP	Filt_Pos	Horz_Prec	Std_Dev	Northing	Easting
122	7/16/2009	1.7	1	0.8	0.000000	4909200.590	564706.846
123	7/17/2009	3.7	12	1.0	0.240979	4909142.702	564727.122
124	7/17/2009	3.7	12	0.8	0.255326	4909164.787	564713.158
125	7/17/2009	3.6	12	0.8	0.245872	4909190.691	564708.138
126	7/17/2009	1.5	12	0.6	0.124134	4909225.365	564723.514
127	7/17/2009	3.5	12	0.7	0.198710	4909228.026	564720.572
128	7/17/2009	3.5	12	0.8	0.395347	4909225.413	564714.731
129	7/17/2009	3.5	12	0.6	0.431907	4909231.038	564706.537
130	7/17/2009	3.4	12	0.8	0.148304	4909229.036	564701.546
131	7/17/2009	3.4	12	0.8	0.100059	4909231.046	564698.317
132	7/17/2009	3.4	12	0.8	0.141668	4909233.123	564705.307
133	7/17/2009	3.4	12	0.8	0.253328	4909237.670	564697.113
134	7/17/2009	3.4	12	0.7	0.420812	4909248.374	564702.475
135	7/17/2009	3.3	12	0.8	0.153770	4909245.083	564682.513
136	7/17/2009	3.3	12	0.8	0.106961	4909251.318	564679.593
137	7/17/2009	3.3	12	0.7	0.295585	4909260.573	564677.697
138	7/17/2009	2.0	12	0.6	0.124741	4909263.354	564677.195
139	7/17/2009	3.1	12	0.7	0.139669	4909263.609	564682.099
140	7/17/2009	2.7	12	0.7	0.130181	4909259.985	564681.889
141	7/17/2009	3.0	12	0.7	0.142311	4909268.580	564686.484
142	7/17/2009	3.6	12	0.8	0.324104	4909275.016	564690.569
143	7/17/2009	2.6	12	0.7	0.111180	4909272.694	564697.520
144	7/17/2009	2.6	12	0.7	0.091326	4909269.887	564649.379
145	7/17/2009	2.6	12	0.7	0.144199	4909272.232	564645.893
146	7/17/2009	2.6	12	0.7	0.089488	4909274.144	564649.872
147	7/17/2009	2.6	12	0.7	0.110238	4909281.709	564650.651
148	7/17/2009	2.6	12	0.7	0.162108	4909275.629	564621.492
149	7/17/2009	2.6	12	0.6	0.131586	4909273.760	564618.176
150	7/17/2009	2.6	12	0.6	0.137768	4909277.805	564619.221
151	7/17/2009	2.6	12	0.6	0.099045	4909274.920	564614.644
152	7/17/2009	2.7	12	0.7	0.275400	4909283.126	564613.246
153	7/17/2009	2.7	12	0.7	0.167309	4909278.517	564613.168
154	7/17/2009	2.7	12	0.7	0.153114	4909277.194	564605.052
155	7/17/2009	2.7	12	0.7	0.153508	4909279.231	564601.929
156	7/17/2009	2.7	12	0.7	0.245747	4909282.672	564600.241
157	7/17/2009	2.7	12	0.7	0.072570	4909286.150	564607.755
158	7/17/2009	2.7	12	0.7	0.147176	4909288.135	564604.531
159	7/17/2009	2.7	12	0.7	0.151956	4909286.116	564610.255
160	7/17/2009	1.5	12	0.6	0.061294	4909288.714	564609.092
161	7/17/2009	1.5	12	0.6	0.153650	4909292.090	564605.577
162	7/17/2009	1.5	12	0.6	0.059000	4909292.166	564609.179

APPENDIX 1: GIS/GPS DATA

FID#	GPS_Date	Max_PDOP	Filt_Pos	Horz_Prec	Std_Dev	Northing	Easting
163	7/17/2009	1.5	12	0.6	0.106139	4909287.248	564600.244
164	7/17/2009	1.5	12	0.6	0.117198	4909288.860	564602.209
165	7/17/2009	1.5	12	0.6	0.055716	4909287.508	564594.850
166	7/17/2009	1.5	12	0.6	0.129894	4909291.045	564589.989
167	7/17/2009	1.5	12	0.6	0.167778	4909297.224	564588.736
168	7/17/2009	1.5	12	0.6	0.079396	4909308.483	564592.385
169	7/17/2009	1.5	12	0.6	0.120248	4909308.420	564584.601
170	7/17/2009	1.5	12	0.6	0.096523	4909315.233	564578.818
171	7/17/2009	3.2	12	0.7	0.187795	4909319.179	564583.056
172	7/16/2009	1.9	27	0.5	1.371079	4909215.959	564729.670
173	7/16/2009	3.0	12	0.5	0.378397	4909224.428	564731.668
174	7/16/2009	3.8	12	0.9	0.659576	4909231.976	564730.984
175	7/16/2009	3.1	12	0.6	0.283200	4909258.217	564714.368
176	7/16/2009	3.3	12	0.8	0.098547	4909263.365	564701.613
177	7/16/2009	3.0	12	0.6	0.081900	4909267.891	564687.722
178	7/16/2009	2.3	12	0.5	0.053999	4909271.158	564681.323
179	7/16/2009	2.9	12	0.6	0.102504	4909271.611	564677.337
180	7/16/2009	2.2	12	0.5	0.089977	4909277.091	564681.406
181	7/16/2009	2.2	12	0.5	0.176737	4909281.663	564701.618
182	7/16/2009	2.7	12	0.6	0.262472	4909283.478	564710.593
183	7/16/2009	2.7	12	0.6	0.050596	4909272.898	564718.106
184	7/16/2009	3.3	12	0.7	0.476432	4909267.092	564717.280
185	7/16/2009	2.6	12	0.6	0.236699	4909264.974	564713.672
186	7/16/2009	2.1	12	0.5	0.101838	4909305.489	564757.876
187	7/16/2009	2.5	12	0.6	0.096881	4909301.133	564756.095
188	7/16/2009	2.5	12	0.6	0.143808	4909303.390	564756.027
189	7/16/2009	2.5	12	0.6	0.050640	4909304.530	564754.021
190	7/16/2009	2.5	12	0.6	0.134047	4909310.535	564756.597
191	7/16/2009	2.5	12	0.6	0.213478	4909255.600	564737.281
192	7/16/2009	2.5	12	0.6	0.178612	4909252.004	564740.053
193	7/16/2009	2.5	12	0.6	0.144792	4909249.288	564740.421
194	7/16/2009	2.3	12	0.5	0.140672	4909246.480	564731.317
195	7/16/2009	2.3	12	0.5	0.262884	4909255.057	564727.623
196	7/16/2009	1.9	12	0.5	0.063397	4909244.794	564744.249
197	7/16/2009	2.2	12	0.6	0.037952	4909244.051	564740.851
198	7/16/2009	2.2	12	0.6	0.183821	4909240.507	564740.397
199	7/16/2009	2.2	12	0.6	0.183919	4909239.613	564737.921
200	7/16/2009	3.4	12	0.7	0.174008	4909241.707	564734.249