Glacier Bay National Park and Preserve Visibility Monitoring Program

2004 Integrated Report for Scene Monitoring

Prepared by

Air Resource Specialists, Inc.

Fort Collins, Colorado

GLACIER BAY NATIONAL PARK AND PRESERVE, ALASKA
VISIBILITY MONITORING PROGRAM

INTEGRATED REPORT FOR
SCENE MONITORING

MAY 6, 2004 through OCTOBER 6, 2004

Prepared for the

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1.0 INTRODUCTION

Glacier Bay National Park and Preserve (GLBA) comprises 3.3 million acres and encompasses 940 square miles of marine waters. It is home to a variety of marine flora and fauna and is a major destination where most visitors arrive via marine vessels.

Legislation that established the National Park Service (NPS) and Glacier Bay National Park and Preserve, as well as other laws, obliges the NPS to anticipate and mitigate the potential effects of marine vessels on park resources and values. Since 1985, a vessel permit system has regulated the number of vessels entering the bay. Regulations established in 1996 increased the vessel quotas above 1985 levels. In 2001, legislation was passed requiring preparation of an environmental impact statement (EIS) to identify and analyze possible effects of the 1996 vessel quota increases. As part of the EIS, the Park applied draft impairment guidance and determined that the impact from vessel operations is "moderate." This determination was based on NO_x emissions, observed impacts (vessel stack opacity measurements), plume blight, and observed haze during inversions.

In May 2004, the National Park Service initiated a visibility monitoring program to characterize vessel operations and observed impacts at Glacier Bay National Park and Preserve. A high-resolution digital camera system was installed on an unnamed island southeast of Blue Mouse Cove on May 6, 2004. The camera views vessel traffic and visibility conditions on the West Arm channel of Glacier Bay, approximately 5 miles to the northeast. Included in the vista are the Tidal Inlet and Glacier Bay Wilderness mountain ridge between Tidal Inlet and Tlingit Point. The West Arm channel is the primary channel for visitor vessel traffic.

Collected images provide a means to document the frequency and duration of vessel activity and qualitatively review subtle color variations, which are important for discerning ground-based and elevated hazes and plumes. Unless associated with concurrent human observation measurements and advanced analysis, digital images do not measure plume intensity or opacity.

This integrated report of scene monitoring data describes the monitoring configuration and presents the operational status and analytical results of all digital image data collected during the 2004 monitoring season. Qualitative analysis has been performed on the data to characterize the types and frequency of haze and vessel-related activity that influenced the region. A summary of the analysis concisely identifies the number and percent of days that vessel exhaust or haze was observed and the typical duration (15 minutes minimum) of exhaust and/or haze impacts.

Provided in this report are:

- Site Specifications
- Operational Timelines
- Example Visibility Condition Images
- Qualitative Image Analysis and Data Summaries
- CD Archives

2.0 VISIBILITY MONITORING PROCEDURES

2.1 Site Configuration

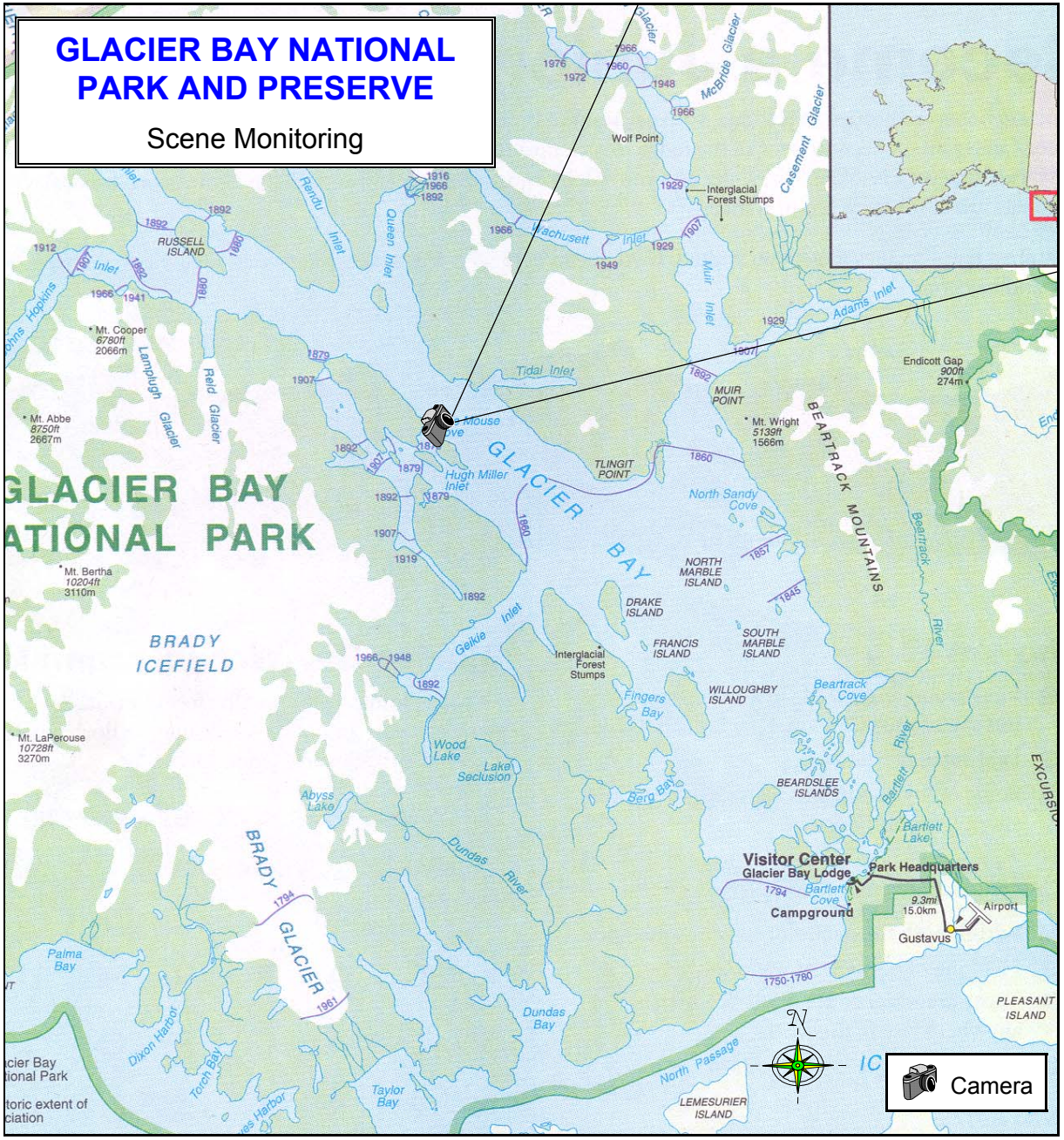
The NPS and Air Resource Specialists, Inc. (ARS) reviewed potential monitoring sites that provided a scenic view of Glacier Bay as well as a means to observe marine vessel traffic and vessel emission impacts. Final site selection was based on solar exposure, installation and servicing logistics, and an optimum vista for viewing vessel activity. Land use restrictions and difficult accessibility limited the number of possible sites. Potential locations were discussed with park staff prior to installation. Of the two possible sites (the visitor center and Blue Mouse), the Blue Mouse site was determined to have the more appropriate vista. The visitor center site did not have a view of the channel.

A solar-powered High-Resolution Digital Camera System (HRDC-R) was first installed on May 6, 2004, on the southeastern side of an unnamed island, southeast of Blue Mouse Cove (Figure 2-1 and report cover). The camera viewed the West Arm channel of Glacier Bay with a 119mm (35mm equivalent) zoom from May 6, 2004, through June 17, 2004. The zoom setting was changed to 53mm by Park personnel on June 17 (11:45am) to improve the viewing angle of Tidal Inlet and observed marine vessel activity. *To optimize viewing angles for the observance of vessel activity and potential haze conditions, ARS recommends a zoom setting around 75mm to optimize vessel visibility and field of view.* Monitoring with the 53mm zoom continued daily through the high-use visitor season. On October 6, 2004, the system computer was removed and relocated to an NPS storage facility located at ARS. The remaining components (camera, solar system) are still on site or in storage in the park. A graphical summary of the 2004 site location, viewing angle, and monitoring specifications is provided as Figure 2-2.

The Glacier Bay system uses a unique power-saving "sleep mode" which configures the image capture computer to place itself in "standby" mode between image capture events.

Figure 2-1.

Glacier Bay HRDC-R
Solar Powered Camera System
Base Station



SITE SPECIFICATIONS

Instrument:	Digital HRDC-R camera system with 119/53 mm lens
Elevation:	sea level
Longitude:	136° 28' 47"
Latitude:	58° 47' 00"
Bearing:	~50°
Map Reference:	Glacier Bay National Park and Preserve Visitor Map, NPS
Target/Vista:	Tidal Inlet
Target Distance:	~5 miles
Monitoring Period:	05/06/04 - 10/06/04

119mm zoom lens: 5/6/04 - 6/17/04 (1130)

53mm zoom lens: 6/17/04 (1145) - 10/6/04

Figure 2-2. Graphical Summary of the 2004 Site Location, Viewing Angle, and Monitoring Specifications.

2.2 Data Acquisition

Images of the West Arm of Glacier Bay, including Tidal Inlet, were taken automatically every 15 minutes (top of hour; 15, 30, and 45 minutes after the hour), 24 hours a day. The site operator routinely copied collected images from the system hard drive to a transportable USB hard-drive. The USB hard-drive was shipped monthly to ARS where images were archived to CD for review and further distribution.

Summaries of the camera operations and data collection efficiencies for the 2004 monitoring season are presented as Table 2-1 and Table 2-2 respectively. Data recovery statistics are based on daylight images collected from 0300 through 2245 standard time (Daylight Images Possible). 12,140 daylight images were analyzed for the 2004 monitoring season. Images received that were too dark to make a valid observation are not included in the Daylight Images Valid statistics.

2.3 Data Reduction

A primary goal of visibility monitoring is to quantify how well image-forming information in a vista is transmitted through the atmosphere to an observer some distance away. In this monitoring program, the approach used to quantify visual air quality is the qualitative measurement of observed haze types and visibility conditions observed from high-resolution digital images. The NPS also wanted to quantify vessel activity; therefore, an additional scene condition code was established to classify marine vessel-related activity observed during the period. No opacity measurements can be derived from digital image media.

Each image was visually reviewed and assigned a three-digit scene condition code. These codes identify sky illumination conditions, weather conditions, observed hazes or plumes, marine vessel-related activity, and unusable (e.g., dark) or missing observations. The Three-Digit Scene Condition Code Key is presented in Figure 2-3. Experienced scene coding technicians performed all coding. Quality assurance checks of the codes were made prior to data analysis and reporting. All random and systematic coding variations were investigated.

The image file name, date, time, and assigned scene condition codes for every 15-minute observation was compiled in a Microsoft Access database for qualitative analysis. Tabular and graphical summaries are based on daylight images collected from 0300 through 2245 standard time. Due to the instantaneous nature of still-frame photography, the minimum duration of observed vessel activity, hazes, or vessel-related exhaust is 15 minutes. The nature of using digital image media also limits the analyst's ability to conclusively identify haze/exhaust attributable to vessel activity.

Table 2-1
Operation Summary for 2004 Operating Season
Glacier Bay National Park and Preserve, Alaska
Visibility Monitoring Program
May 6, 2004 through October 6, 2004

Date	Problem[1] Description Comments/Resolution
05/09 – 05/26	Camera out of alignment – Site operator corrected it on 5/26/04 at 1045.
05/26	Missing images from 1100-2245 – reason unknown.
06/17	Zoom changed from 119mm to 53mm at 1145.
07/27	Missing images from 1100-2245 – reason unknown.
08/10 – 08/17	Power failure – camera batteries failed- Site operator changed batteries on 8/17/04 at 1800.

[1] Note: Only instrument problems or issues affecting data collection are documented.

Table 2-2
Data Recovery Statistics for 2004 Operating Season
Glacier Bay National Park and Preserve, Alaska
Visibility Monitoring Program
May 6, 2004 through October 6, 2004

CD Number	Start Date	End Date	Daylight[2] Images Possible	Daylight Images Received	Daylight Images Valid	Comments
1	05/06	05/14	720	663	233	All collected images invalid 5/9 @1945 through 5/26 @1030. Camera was out of alignment.
2	05/15	05/23	720	720	0	All collected images invalid 5/9 @1945 through 5/26 @1030. Camera was out of alignment.
3	05/24	05/26	192	192	1	Data missing 5/26 @1100-2245. Reason unknown.
4	05/27	05/31	400	400	398	
5	06/01	06/06	480	480	478	
6	06/07	06/13	560	560	559	
7	06/14	06/19	480	480	469	
8	06/20	06/25	480	480	463	
9	06/26	06/30	400	400	398	
10	07/01	07/07	560	560	559	
11	07/08	07/14	560	560	552	
12	07/15	07/20	480	480	465	
13	07/21	07/27	514	514	480	
14	07/28	08/03	560	560	520	
15	08/04	08/09	480	480	436	
16	08/10	08/17	640	640	4	Data missing 8/10 @0500 through 8/18 @0515. Battery failure.
17	08/18	08/25	640	640	536	
18	08/26	09/02	640	640	499	
19	09/03	09/10	640	640	465	
20	09/11	09/17	560	560	383	
21	09/18	09/24	560	560	364	
22	09/25	09/30	480	480	297	Many images not usable due to window condensation.
23	10/01	10/06	480	451	268	
Data Collection Efficiency	5/6	10/6	12,320	12,140	8,827	99% Data Capture 72% Data Valid

[2] Images collected at 15 minute intervals between 0300 and 2245 standard time (80 images/day)

SCENE CONDITION CODE KEY		
SKY CONDITIONS		SKY CONDITIONS VIEWED AS CHARACTERISTIC OF THE PERIOD
0	No clouds	No clouds visible anywhere in the sky.
1	Scattered clouds < half of sky	Less than one-half of the sky has clouds present.
2	Overcast > half of sky	More than one-half of the sky has clouds present.
3	Haze concealing scene	Atmospheric haze is such that determination of the sky value is impossible.
5	Concealed by weather	Clouds or precipitation are such that determination of the sky value is impossible.
8	Inconsistent exposure	Exposure inconsistencies, improper metering, lens flare, lens (or window) condensation, or view obstructed by a foreign object.
9	No observation	Observation missing from chronological sequence.
LAYERED HAZE TYPE		FORM OF HAZE OR EXHAUST OBSERVED DURING THE PERIOD
0	No layer	No layered boundary (intensity of coloration edge) is perceptible, i.e. uniform.
1	Ground-based layer only	Only a single-layered boundary is perceptible with the layer extending to the surface.
2	Elevated layer only	An elevated layer with two boundaries is perceptible.
3	Multiple layers	More than a single ground-based or elevated layer is perceptible. This can be multiple ground-based layers or a combination of both.
5	Concealed by weather	Clouds or precipitation are such that determination of the presence of coloration layers is impossible.
9	No observation or cannot be determined	Used with a sky condition of 9 or if a haze condition value cannot be determined due to reasons other than weather.
ACTIVITY TYPE		FORM OF MARINE VESSEL-RELATED ACTIVITY OBSERVED IN VIEW DURING THE PERIOD
0	No activity	No vessel-related activity is perceptible in view.
1	Marine vessel(s) present	One or more marine vessels are perceptible in the view; however no plume or exhaust is associated with the vessel(s).
2	Marine vessel exhaust evident	One or more marine vessels are perceptible, and one or more vessel-related plumes are also evident in the view.
5	Concealed by weather	Clouds or precipitation are such that determination of the level of vessel-related activity is impossible.
9	No observation or cannot be determined	Used with a sky condition of 9 or the form of vessel-related activity cannot be determined due to reasons other than weather.

Figure 2-3. Three-Digit Scene Condition Code Key.

2.4 Data Analysis

Data listings containing associated dates and times of the reviewed daylight images and resulting qualitative scene condition codes were compiled for each of the 23 image CD archives created during the 2004 monitoring season. A CD archive of these Microsoft Excel file(s) is included in Appendix A.

A Microsoft Access database was used to compile activity type and haze condition statistical summaries by combined hour for the entire 2004 monitoring period (May 6, 2004 through October 6, 2004). Hourly data are represented by qualitative readings from the "top-of-the-hour," 15, 30, and 45 minutes past the hour.

- The presence and form of marine vessel-related activity observed in the view was categorized as Activity Type. Activity was classified as none; marine vessel perceptible in view, no plume or exhaust associated; or marine vessel perceptible in view, with exhaust or vessel-related plumes evident. All cases where no vessel-related activity was observed were classified as No Activity. Cases where the vista was not visible due to weather were also noted.

- The presence and form of uniform and/or layered haze observed in the view was categorized as Haze Condition. When distinct haze layers are visible, they are categorized as ground-based, elevated, or simultaneous ground-based and elevated hazes (multiple). Most observed vessel exhaust (plumes) took the form of elevated haze. All cases where the horizon was visible and no distinct haze layer occurred were classified as uniform hazes. Cases where the vista was not visible due to weather were also noted.

The results of each type of qualitative image analysis conducted are presented in Section 3.0. Images depicting various scene conditions observed (e.g., pristine, elevated haze, marine vessel perceptible in view, etc.) are presented in Figure 2-4.

The measurement of the horizontal physical extent of observed plumes and hazes was limited by the field of view of the images. Therefore, the horizontal extent of the observed plumes and hazes was not analyzed.

Pristine
6/18/04 (1530)

Scenic
Date/Time Unavailable

Figure 2-4. Example Visibility Condition Images.

Marine Vessel(s) Present
7/19/04 (1230)

Marine Vessel(s) Present – Exhaust Evident
7/15/04 (1245)

Marine Vessel(s) Present – Exhaust Evident
Elevated Layer Present
No Vessel(s) Present
6/23/04 (0900)

Ground-based Layered Haze
7/9/04 (0500)

Unique Vessel Present – Exhaust Evident
7/31/04 (1500)

Layered Haze Type
Concealed by Weather
7/23/04 (1600)

Figure 2-4 (continued). Example Visibility Condition Images.

3.0 2004 VISIBILITY MONITORING DATA SUMMARY

Tables 3-1 and 3-2 and Figure 3-1 (located at the end of Section 3.0) summarize, by hour of the day, the frequency of vessels present with exhaust and vessels present without exhaust. Often, vessel observations could not be made due to concealment of the view by weather or extreme underexposure (dark conditions). 12,140 daylight images were analyzed for 2004.

- Vessel activity without exhaust present was primarily observed between the hours of 0900 and 1600, with the highest percentage of hourly vessel observations without exhaust present between 1000 and 1100 (45 observations, 7.4%).

- Vessel activity with exhaust present was primarily observed between the hours of 0800 and 1800, with the highest number of hourly vessel-with-exhaust observations between the hours of 1400 and 1500 (7 observations, 1.2%).

- Ground-based and elevated layer hazes were primarily observed between the hours of 0500 and 1700, with the highest percentage between 0800 and 0900 (2.1% ground-based, and 4.4% elevated).

Figure 3-2 and Tables 3-3 and 3-4 (also provided at the end of Section 3.0) summarize the frequency of vessel activity observed by day of the year (May 6, 2004 – October 6, 2004). A maximum of 80 observations is possible for one day (eg., 0300-2245 at 15-minute intervals). Often vessel observations could not be made due to concealment of the view by weather or extreme underexposure (dark conditions). 12,140 daylight observations were analyzed for 2004.

- The maximum number (13) of vessel observations (exhaust or no exhaust) in any one day was documented on June 21, 2004. Note: No vessels with exhaust evident were observed on June 21.

- The maximum number of vessel observations with exhaust evident in any one day was 2 (15-minute) observations on August 4, August 21, and September 15.
  Note: Never were these observations consecutive to denote a duration of exhaust observed for 30 minutes or more.

Vessels were observed in the view on 97 of the 154 days during the monitoring season (63% of days). Of the 154 days, 14% (or 21 days) included one or more observations of vessels with exhaust.

Figure 3-3 and Table 3-5 summarize by day of the year the frequency of vessel activity and correlating frequency and duration of layered hazes observed.

The maximum number of layered haze observances on any one day was 27, on July 11, 2004. Note: Twenty (20) of these observances were consecutive (2:30pm - 7:30pm). Although vessel activity was observed on July 11, no vessel activity with exhaust present was observed for the entire day.

Table 3-1

Qualitative Digital Image Analysis
Glacier Bay National Park and Preserve
Combined Hourly Activity Condition Summaries
by Number and Percent (%) of Total Daylight Observations Collected
May 6, 2004 through October 6, 2004

	0		1		2		5		9		
Hour (Local Standard Time)	No Activity		Marine vessel(s) present. No vessel exhaust evident		Marine vessel(s) present. Vessel exhaust evident		Concealed by Weather		Cannot be Determined		Total Daylight* Observations Collected
	No.	%	No.	%	No.	%	No.	%	No.	%	No.
3:00	216	35.3%	1	0.2%	0	0.0%	0	0.0%	395	64.5%	612
4:00	312	51.0%	6	1.0%	0	0.0%	4	0.7%	290	47.4%	612
5:00	340	55.6%	1	0.2%	0	0.0%	0	0.0%	271	44.3%	612
6:00	414	67.6%	1	0.2%	0	0.0%	9	1.5%	188	30.7%	612
7:00	491	80.2%	5	0.8%	0	0.0%	10	1.6%	106	17.3%	612
8:00	485	79.2%	18	2.9%	4	0.7%	5	0.8%	100	16.3%	612
9:00	481	78.6%	23	3.8%	1	0.2%	7	1.1%	100	16.3%	612
10:00	455	74.3%	45	7.4%	0	0.0%	11	1.8%	101	16.5%	612
11:00	467	77.1%	29	4.8%	2	0.3%	8	1.3%	100	16.5%	606
12:00	472	78.1%	29	4.8%	3	0.5%	4	0.7%	96	15.9%	604
13:00	470	77.8%	32	5.3%	3	0.5%	3	0.5%	96	15.9%	604
14:00	459	76.0%	35	5.8%	7	1.2%	6	1.0%	97	16.1%	604
15:00	470	77.9%	27	4.5%	0	0.0%	5	0.8%	101	16.7%	603
16:00	478	79.7%	22	3.7%	2	0.3%	0	0.0%	98	16.3%	600
17:00	479	79.4%	24	4.0%	2	0.3%	0	0.0%	98	16.3%	603
18:00	487	80.6%	21	3.5%	0	0.0%	0	0.0%	96	15.9%	604
19:00	448	74.2%	6	1.0%	0	0.0%	1	0.2%	149	24.7%	604
20:00	387	64.1%	5	0.8%	0	0.0%	0	0.0%	212	35.1%	604
21:00	325	53.8%	0	0.0%	0	0.0%	1	0.2%	278	46.0%	604
22:00	260	43.0%	2	0.3%	0	0.0%	1	0.2%	341	56.5%	604
Grand Total	**8,396**	**69.2%**	**332**	**2.7%**	**24**	**0.2%**	**75**	**0.6%**	**3,313**	**27.3%**	**12,140**

*Daylight Hours Defined 03:00-22:45

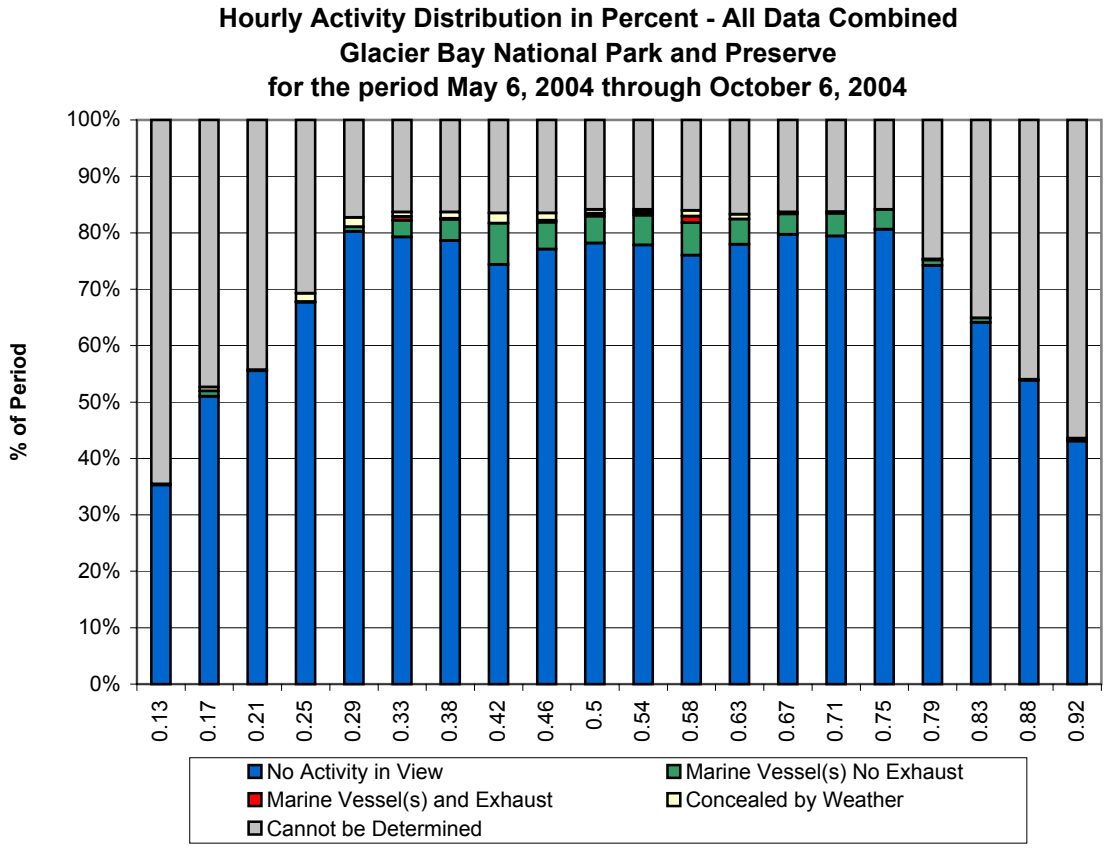
Table 3-2

Qualitative Digital Image Analysis
Glacier Bay National Park and Preserve
Combined Hourly Haze Condition Summaries
by Number and Percent (%) of Total Daylight Observations Collected
May 6, 2004 through October 6, 2004

	0		1		2		3		5		9		
Hour (Local Standard Time)	No Layer		Ground-Based Layer		Elevated Layer		Multiple Layers		Concealed by Weather		Cannot be Determined		Total Daylight* Observations Collected
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
3:00	206	33.7%	0	0.0%	0	0.0%	0	0.0%	11	1.8%	395	64.5%	612
4:00	290	47.4%	0	0.0%	0	0.0%	0	0.0%	32	5.2%	290	47.4%	612
5:00	289	47.2%	6	1.0%	1	0.2%	0	0.0%	45	7.4%	271	44.3%	612
6:00	353	57.7%	8	1.3%	3	0.5%	0	0.0%	60	9.8%	188	30.7%	612
7:00	402	65.7%	9	1.5%	9	1.5%	0	0.0%	86	14.1%	106	17.3%	612
8:00	386	63.1%	13	2.1%	27	4.4%	2	0.3%	84	13.7%	100	16.3%	612
9:00	405	66.2%	6	1.0%	24	3.9%	1	0.2%	76	12.4%	100	16.3%	612
10:00	425	69.4%	4	0.7%	6	1.0%	0	0.0%	76	12.4%	101	16.5%	612
11:00	441	72.8%	2	0.3%	2	0.3%	0	0.0%	61	10.1%	100	16.5%	606
12:00	436	72.2%	5	0.8%	10	1.7%	1	0.2%	56	9.3%	96	15.9%	604
13:00	432	71.5%	6	1.0%	20	3.3%	0	0.0%	50	8.3%	96	15.9%	604
14:00	444	73.5%	6	1.0%	18	3.0%	0	0.0%	39	6.5%	97	16.1%	604
15:00	442	73.3%	2	0.3%	13	2.2%	0	0.0%	45	7.5%	101	16.7%	603
16:00	449	74.8%	6	1.0%	4	0.7%	0	0.0%	43	7.2%	98	16.3%	600
17:00	450	74.6%	0	0.0%	7	1.2%	0	0.0%	48	8.0%	98	16.3%	603
18:00	457	75.7%	0	0.0%	4	0.7%	0	0.0%	47	7.8%	96	15.9%	604
19:00	427	70.7%	1	0.2%	2	0.3%	0	0.0%	25	4.1%	149	24.7%	604
20:00	370	61.3%	0	0.0%	0	0.0%	0	0.0%	22	3.6%	212	35.1%	604
21:00	305	50.5%	0	0.0%	0	0.0%	0	0.0%	21	3.5%	278	46.0%	604
22:00	243	40.2%	0	0.0%	0	0.0%	0	0.0%	20	3.3%	341	56.5%	604
Grand Total	**7,652**	**63.0%**	**74**	**0.6%**	**150**	**1.2%**	**4**	**0.0%**	**947**	**7.8%**	**3,313**	**27.3%**	**12,140**

*Daylight Hours Defined 03:00-22:45

Figure 3-1


Hourly Activity Distribution in Percent - All Data Combined
Glacier Bay National Park and Preserve
for the period May 6, 2004 through October 6, 2004
% of Period
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.13
0.17
0.21
0.25
0.29
0.33
0.38
0.42
0.46
0.5
0.54
0.58
0.63
0.67
0.71
0.75
0.79
0.83
0.88
0.92
No Activity in View
Marine Vessel(s) No Exhaust
Marine Vessel(s) and Exhaust
Concealed by Weather
Cannot be Determined

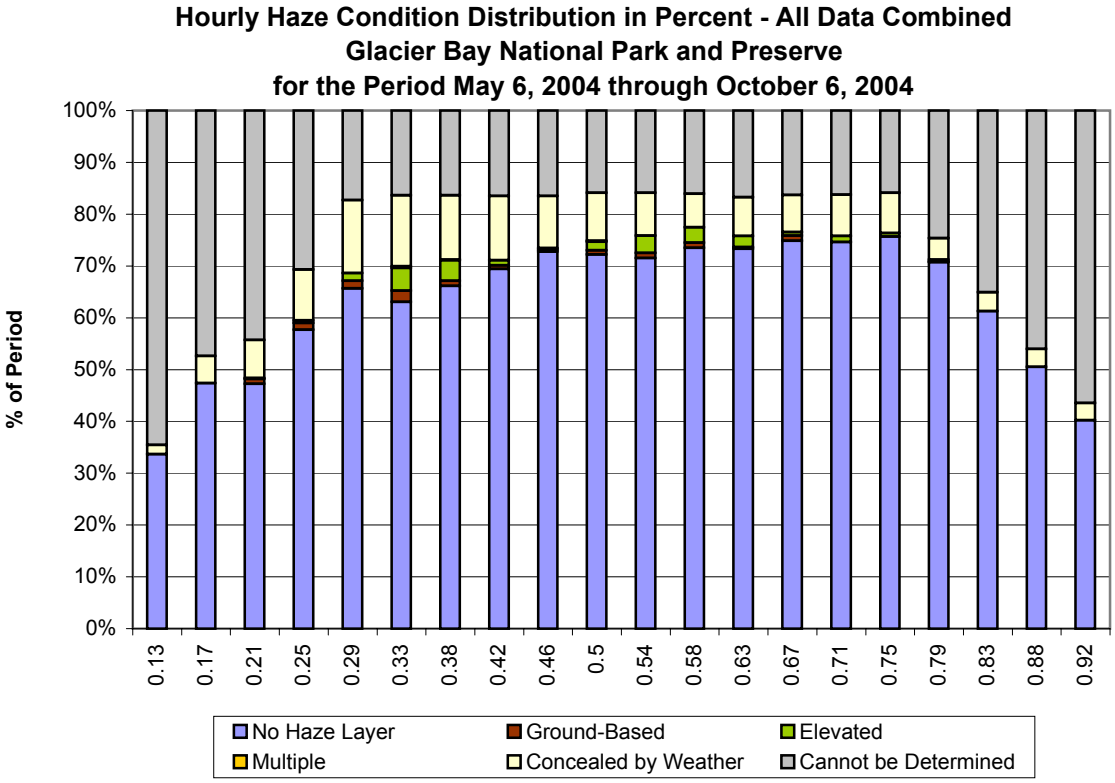

Hourly Haze Condition Distribution in Percent - All Data Combined
Glacier Bay National Park and Preserve
for the Period May 6, 2004 through October 6, 2004
% of Period
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.13
0.17
0.21
0.25
0.29
0.33
0.38
0.42
0.46
0.5
0.54
0.58
0.63
0.67
0.71
0.75
0.79
0.83
0.88
0.92
No Haze Layer
Ground-Based
Elevated
Multiple
Concealed by Weather
Cannot be Determined

Figure 3-2

Daily Counts when Marine Vessel Activity Observed in View
Glacier Bay National Park and Preserve - 2004

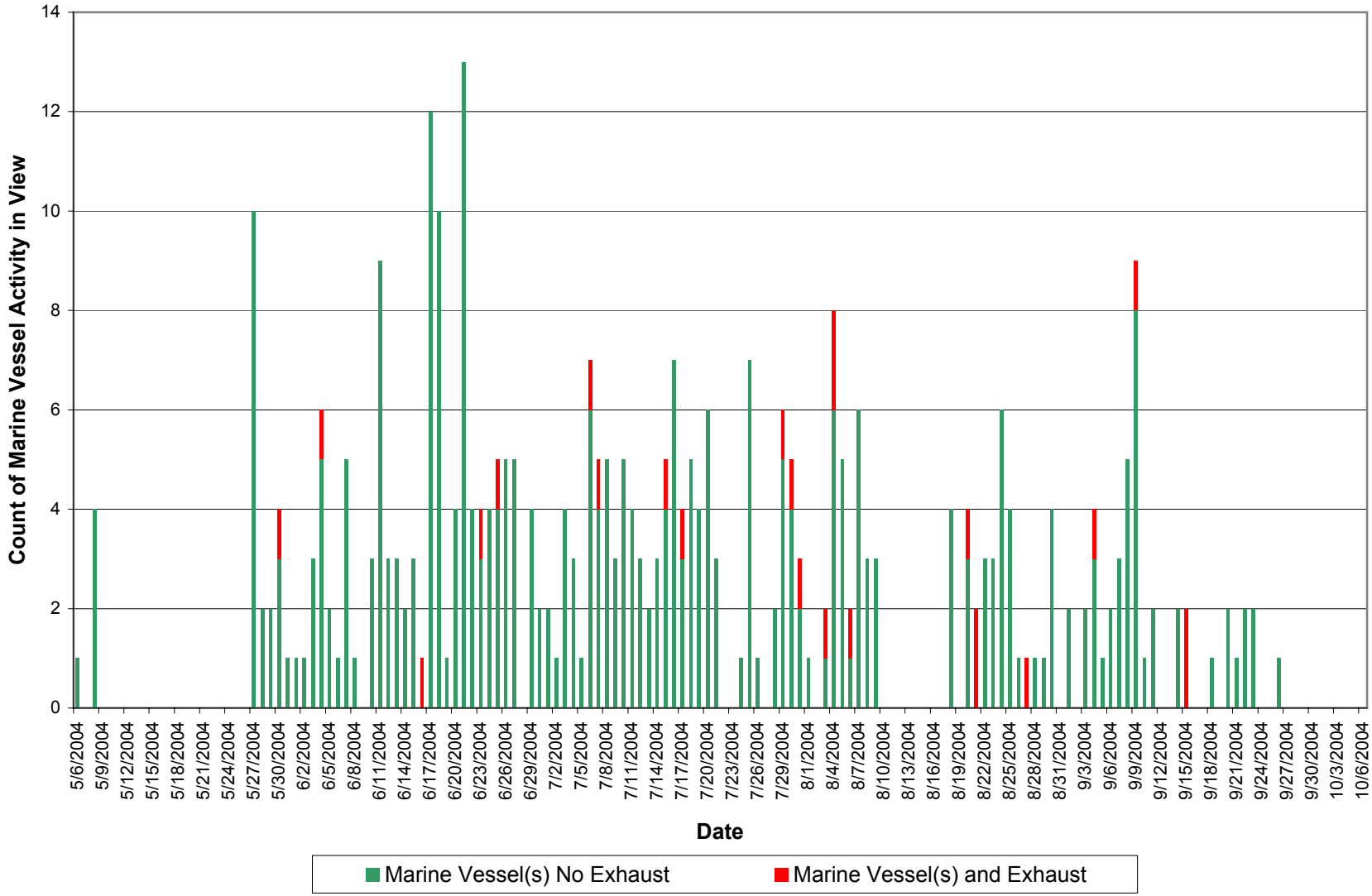


Table 3-3

Ten Highest Daily Vessel Activity Observation Counts
Glacier Bay National Park and Preserve
May 6, 2004 through October 6, 2004

Value	Date	Vessel Activity No Exhaust	Vessel Activity Exhaust Evident	Total Vessel Observations
1	6/21/2004	13		13
2	6/17/2004	12		12
3	5/27/2004	10		10
4	6/18/2004	10		10
5	6/11/2004	9		9
6	9/9/2004	8	1	9
7	8/4/2004	6	2	8
8	7/16/2004	7		7
9	7/25/2004	7		7
10	7/6/2004	6	1	7

Table 3-4

All Days Observed with Vessel Activity and Exhaust Evident
Glacier Bay National Park and Preserve
May 6, 2004 through October 6, 2004

Date	Vessel Activity Counts Exhaust Evident
8/4/2004	2
8/21/2004	2
9/15/2004	2
5/30/2004	1
6/4/2004	1
6/16/2004	1
6/23/2004	1
6/25/2004	1
7/6/2004	1
7/7/2004	1
7/15/2004	1
7/17/2004	1
7/29/2004	1
7/30/2004	1
7/31/2004	1
8/3/2004	1
8/6/2004	1
8/20/2004	1
8/27/2004	1
9/4/2004	1
9/9/2004	1

The following figure graphically depicts all daily vessel activity observation counts recorded. Vessels were observed in the view on 97 of the 154 days during the period, or 63% of the days. Of the 154 days, 14% (or 21 days) included one or more observations of vessels with exhaust.

Figure 3-3

Daily Counts when Marine Vessel Activity and Layered Haze were Observed in View
Glacier Bay National Park and Preserve - 2004

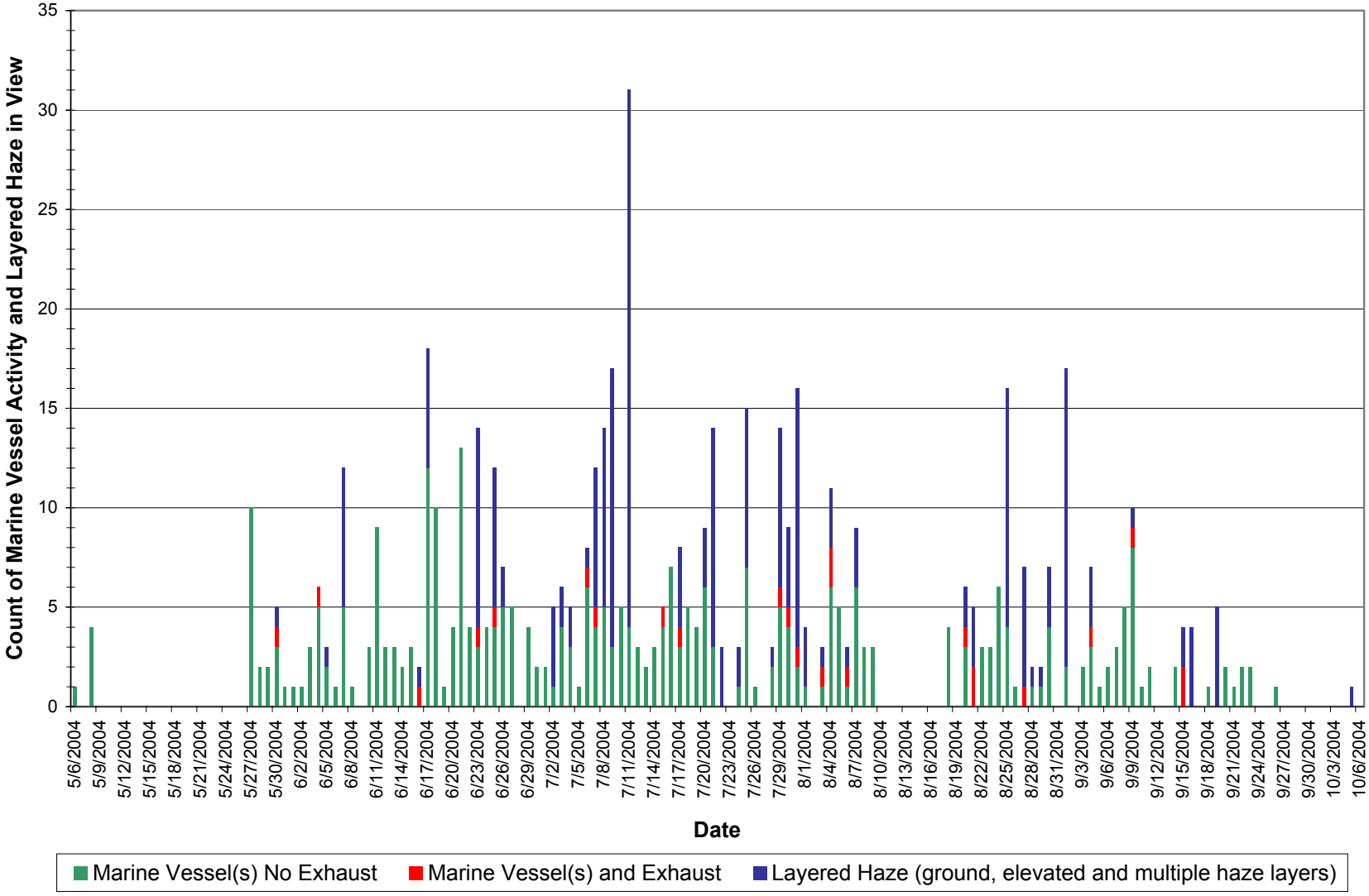


Table 3-5

All Days with Consecutive Layered Haze Observations
Glacier Bay National Park and Preserve
May 6, 2004 through October 6, 2004

Date	Number of Consecutive LH Observations	Duration
7/11/2004	20	2:30 – 7:30 p.m.
7/31/2004	10	1:30 – 3:45 p.m.
7/8/2004	8	7:45 – 9:30 a.m.
7/9/2004	8	5:00 – 6:45 a.m.
7/25/2004	8	12:00 – 1:45 p.m.
8/25/2004	8	8:45 – 10:30 a.m.
9/1/2004	8	3:00 – 4:45 p.m.
6/7/2004	7	6:45 – 8:15 a.m.
6/23/2004	7	6:30 – 8:00 a.m.
6/17/2004	6	8:00 – 9:30 a.m.
6/25/2004	6	7:00 – 8:15 a.m.
7/21/2004	6	9:15 – 10:30 a.m.
8/27/2004	6	2:15 – 4:00 p.m.
7/9/2004	5	12:00 – 1:00 p.m.
7/11/2004	5	8:30 – 9:45 a.m.
7/21/2004	5	1:15 – 2:30 p.m.
9/19/2004	5	9:00 – 10:00 a.m.
7/2/2004	4	8:00 – 8:45 a.m.
7/7/2004	4	5:45 – 6:30 a.m.
8/25/2004	4	1:30 – 2:15 p.m.
9/1/2004	4	8:15 – 9:00 a.m.
9/16/2004	4	8:00 – 8:45 a.m.
7/7/2004	3	5:45 – 6:30 a.m.
7/17/2004	3	8:30 – 9:00 a.m.
7/20/2004	3	12:30 – 1:15 p.m.
7/29/2004	3	10:30 – 11:00 a.m.
7/29/2004	3	1:00 – 1:30 p.m.
7/30/2004	3	2:00 – 2:30 p.m.
7/31/2004	3	8:15 – 9:00 a.m.
8/1/2004	3	9:15 – 9:45 a.m.
8/30/2004	3	7:00 – 7:30 a.m.
9/1/2004	3	12:15 – 12:45 p.m.
6/23/2004	2	9:00 – 9:15 a.m.
6/26/2004	2	5:30 – 5:45 a.m.
7/11/2004	2	11:45 a.m. – 12:00 p.m.
7/22/2004	2	1:00 – 1:15 p.m.
7/24/2004	2	1:00 – 1:15 p.m.
7/29/2004	2	1:15 – 1:30 p.m.
8/7/2004	2	1:00 – 1:15 p.m.
8/20/2004	2	2:15 – 2:30 p.m.
8/21/2004	2	8:00 – 8:15 a.m.
9/4/2004	2	8:45 – 9:00 a.m.

APPENDIX A CD ARCHIVE