

## **Chaco Culture National Historical Park International Dark Sky Annual Report Submitted September 2017**

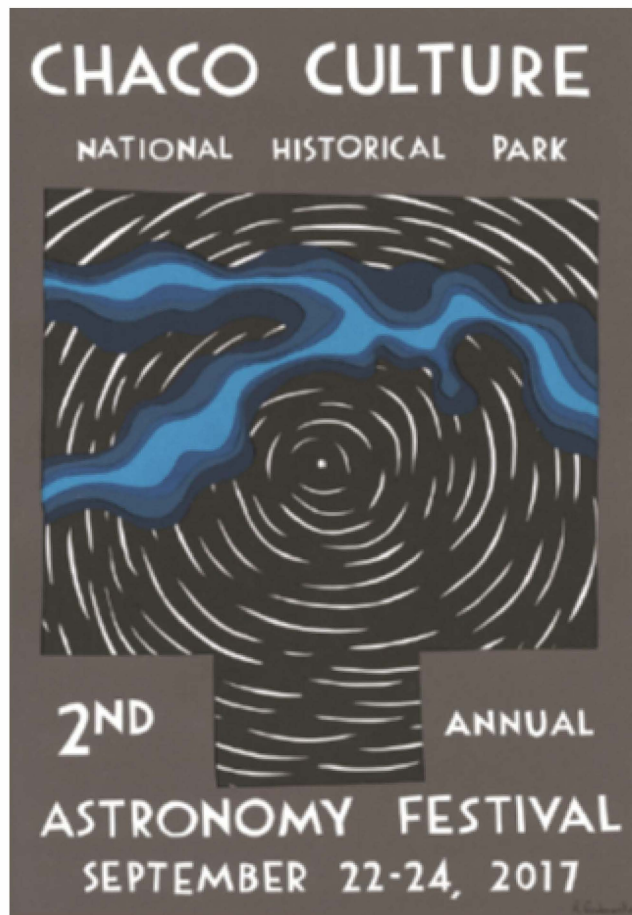
### **General Information and Outreach Statistics**

Chaco Culture National Historical Park has continued to maintain a successful night sky program with increased focus on stewardship of our dark night skies. In addition to regular scheduled public programs including regular night sky programs every Tuesday, Friday, and Saturday evening, monthly moon walks, and special guest lectures we have conducted outreach to local communities bringing night sky appreciation to local elementary schools. The park's Interpretive staff has made every effort to inspire and educate our visiting public about Chaco's dark night skies.

This year, the park successfully put on its Second Annual Astronomy Festival. The event occurred over three days and highlighted the negative effects of light pollution while also sharing the amazing dark skies found in Chaco Culture NHP. A total of 21 programs were provided each day with up an average of nearly 248 visitors a day attending. Guest speakers included award-winning photographer Stan Honda, who put on a night sky photography workshop the coordinator of the Colorado Plateau Dark Sky Cooperative, Bettymaya Foott, who spoke about light pollution Dr. Erica Ellingson of CU Boulder who presented a planetarium show about the history of astronomy in Chaco Canyon and author David Baron, who spoke about his recent book *American Eclipse*, which follows three scientists as they chase the 1878 total solar eclipse. In addition to our esteemed guest speakers, Chaco Culture National Historical Park was pleased to premier the short NPS film *Starry Nights Over Chaco Culture NHP*. This short film detailed the importance of our IDA Dark Sky Park designation. This collaborative effort was years in the making and the park was extremely pleased to be able to share. We hope this event will continue to grow so that we can share the dark skies of Chaco with vast audiences.

The Chaco Night Sky Program program has increased programs this year as we continue to see expanded interest in our dark sky programs. A total of 49 dark sky programs was provided to visitors this year. Chaco has maintained long standing partnerships with the Albuquerque Astronomical Society and the Friends of Chaco their support our dark sky programs is much appreciated.

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- \* No new developments.
- \*Park has maintained the lighting standards adopted to minimize light pollution.
- \*There is no non-compliant lighting in the park.
- \*No additional territory was added to the park.

\*No known changes.

\* Sky Quality data were collected. See table below.

ID	Observation Date	Local Observation Time	Location Name	Latitude/Longitude	
Comments on Location	Sky Conditions	Cloud Cover	Zenith 45°	Horizon	Average
Direction	Other Direction	Internal Temperature (°C)	Ambient Temperature (°C)	Relative	
Humidity (%)	Notes	Observers	Names		
1	10/25/2016	21:15	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"	Pueblo Alto
wayside sign.	Milky Way visible, no Moon.	1/4	21.53 21.36 21.01 21.30	North	
Phil Varela, Leah White, Brandon Velivis					
2	10/25/2016	21:30	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"	Pueblo Alto
wayside sign.	Milky Way visible, no Moon.	1/4	21.47 21.35 21.64 21.49	South	
Phil Varela, Leah White, Brandon Velivis					
3	10/25/2016	21:40	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"	Pueblo Alto
wayside sign.	Milky Way visible, no Moon.	1/4	21.50 21.15 21.31 21.32	West	
Phil Varela, Leah White, Brandon Velivis					
4	10/25/2016	21:44	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"	Pueblo Alto
wayside sign.	Milky Way visible, no Moon.	1/4	21.44 21.35 21.52 21.44	East	
Phil Varela, Leah White, Brandon Velivis					
5	10/25/2016	22:40	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top
of crack	Milky Way visible, no Moon, few clouds SSE.	1/4	21.43 21.10 21.07 21.20		
West					
Phil Varela, Leah White, Brandon Velivis					
6	10/25/2016	22:44	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top
of crack	Milky Way visible, no Moon, few clouds SSE.	1/4	21.38 21.26 21.38 21.34		
South					
Phil Varela, Leah White, Brandon Velivis					
7	10/25/2016	22:49	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top
of crack	Milky Way visible, no Moon, few clouds SSE.	1/4	21.36 21.20 21.05 21.20		
Phil Varela, Leah White, Brandon Velivis					
8	10/25/2016	22:56	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top
of crack	Milky Way visible, no Moon, few clouds SSE.	1/4	21.43 21.21 21.42 21.35		
North					
Phil Varela, Leah White, Brandon Velivis					
9	10/25/2016	23:48	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank
Milky Way visible, no moon, few clouds on horizon	1/4	21.36 21.25 21.21 21.27	South		
Phil Varela, Leah White, Brandon Velivis					

10	10/25/2016	23:52	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"					South of water tank	
Milky Way visible, no moon, few clouds on horizon 1/4 21.38 21.18 20.92 21.16 East										
Phil Varela, Leah White, Brandon Velivis Grabowska										
11	10/25/2016	23:55	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"					South of water tank	
Milky Way visible, no moon, few clouds on horizon 1/4 21.39 21.23 21.55 21.39 North										
Phil Varela, Leah White, Brandon Velivis										
12	10/25/2016	23:59	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"					South of water tank	
Milky Way visible, no moon, few clouds on horizon 1/4 21.40 21.17 21.14 21.24 West										
Phil Varela, Leah White, Brandon Velivis										
13	1/25/2017	19:41	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"					Pueblo Alto	
wayside sign Milky Way visible, no moon, clouds low around horizon. 1/4 21.68 21.89 21.47										
21.68	North	-1	-5.6	65.1	Phil Varela, Leah White, Laura Johnston, Hilary					
14	1/25/2017	19:58	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"					Pueblo Alto	
wayside sign No moon, clouds moved in, covering more of sky 1/2 21.69 21.74 21.94 21.79										
West	-2	-6.9	75.8	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska						
15	1/25/2017	20:02	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"					Pueblo Alto	
wayside sign No moon, clouds moved in, covering more of sky 1/2 21.70 21.78 21.63 21.70										
South	-2	-6.9	75.0	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska						
16	1/25/2017	20:06	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"" W"					Pueblo Alto	
wayside sign No moon, clouds moved in, covering more of sky 1/2 21.74 21.66 21.99 21.80 East										
-3	-7	75.5	Pueblo blocking horizon	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska						
17	1/25/2017	20:43	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"					Top	
of crack No moon. Clouds mostly around horizon 1/2 21.68 21.81 22.18 21.89 North										
-1	-6.5	75.3	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska							
18	1/25/2017	20:48	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"					Top	
of crack No moon. Clouds mostly around horizon 1/2 21.65 21.66 21.58 21.63 West										
-2	-6.5	75.3	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska							
19	1/25/2017	20:53	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"					Top	
of crack No moon. Clouds mostly around horizon 1/2 21.64 21.76 22.08 21.83 South										
-2	-6.5	75.3	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska							
20	1/25/2017	20:57	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"					Top	
of crack No moon. Clouds mostly around horizon 1/2 21.66 21.65 22.05 21.79 East										
-3	-6.5	75.3	Phil Varela, Leah White, Laura Johnston, Hilary Grabowska							
21	1/25/2017	21:47	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"					South of water tank	No
moon. Clouds covering >75% of sky. 3/4 22.12 22.11 22.15 22.13 North -1 -6.5 75.3										
Phil Varela, Leah White										

22	1/25/2017	21:52	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank	No
moon. Clouds covering >75% of sky. 3/4			22.00 22.09 22.32 22.14	West	-1 -6.5	-75.3
Phil Varela, Leah White						
23	1/25/2017	21:55	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank	No
moon. Clouds covering >75% of sky. 3/4			21.91 21.93 22.43 22.09	South	-2 -6.5	-75.3
Phil Varela, Leah White						
24	1/25/2017	21:59	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank	No
moon. Clouds covering >75% of sky. 3/4			21.99 22.05 22.37 22.14	East	-2 -6.5	-75.3
Phil Varela, Leah White						
25	4/17/2017	21:08	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"	Pueblo Alto wayside sign	
30% Cloud cover, thick haze, bright stars visible.			1/4 21.58 21.56 21.65	21.60	East	
Leah White, Kelly Richards						
26	4/17/2017	21:13	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"	Pueblo Alto wayside sign	
Same as E- haze slightly clearing, some dimmer stars coming into view			1/4 21.64 21.52 21.30			
21.49	South			Leah White, Kelly Richards		
27	4/17/2017	21:17	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"	Pueblo Alto wayside sign	
Same as south, clearing			1/4 21.6 21.31 21.45 21.46	West		
Leah White, Kelly Richards						
28	4/17/2017	21:20	Pueblo Alto Ruins	"36° 04' 12"" N 107° 57' 29"	Pueblo Alto wayside sign	
Hazy 1/4 21.65 21.56 20.60 21.27			North			
Richards Leah White, Kelly						
29	4/17/2017	22:00	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top	
of crack Clouds only on horizon, haze is clearing, milky way and zodiacal light barely visible						
Clear	21.70 21.58 21.43 21.57	South				Leah White, Kelly Richards
30	4/17/2017	22:02	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top	
of crack Same as south Clear			21.66 21.30 21.24 21.40	West		
Leah White, Kelly Richards						
31	4/17/2017	22:05	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top	
of crack haze lessening Clear			21.66 21.49 21.58 21.57	North		
pointed at rock Leah White, Kelly Richards						
32	4/17/2017	22:10	Pueblo Alto Trail, Top of Crack	"36° 03' 55"" N 107° 58' 09"" W"	Top	
of crack			21.67 21.56 21.59 21.67	East		
White, Kelly Richards Leah						
33	4/17/2017	23:10	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank	
Clear Clear			21.72 21.65 21.48 21.62	North		
Richards Leah White, Kelly						

34	4/17/2017	23:14	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank
Clear	21.80	21.60	21.14	21.51	West Leah White, Kelly Richards
35	4/17/2017	21:17	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank
Clear	21.82	21.70	21.43	21.65	South Leah White, Kelly Richards
36	4/17/2017	23:20	Water Tank	"36° 01' 53"" N 107° 54' 30"" W"	South of water tank
Clear	21.81	21.73	21.42	21.65	East Leah White, Kelly Richards

- \*Sky brightness appeared to minimally increase. The trend may only be transitional through development.
- \* Park is looking into options for permanent sky quality monitors.

#### **Conservation/Research:**

There is no research being conducted that directly relates to night skies.

#### **Funding:**

- \* Park has recently hired a seasonal position to administer the night skies program.
- \* Friends of Chaco purchased a telescope mount for the park and funded commemorative pins.
- \*There are no grants currently to administer dark skies programming.
- \* Park will explore additional fund sources.



View of the Milky Way from Pueblo Bonito