Site Evaluation Report for the Proposed Astronomy Campsite near Alma, New Mexico

Abstract

On October 30, 2010, a group from the Silver City Astronomical Society, accompanied by Bill McCabe, traveled to the proposed U.S. Forest Service astronomy campsite for the purpose of a dark sky evaluation. The site was found to be of excellent quality for the proposed use.

The site is located at 108 55 20.1 west and 33 28 47.2 north and an elevation of 5318 feet above sea level (Fig 1). The site is flat and level with no high obstructions in any direction (Fig 2).

Figure 1 – The site is located a short distance east of U.S. Highway 180 in an area free of artificial lights and is surrounded by low hills that help to further block any distant lights.

Figure 2 – The area is easily accessed from highway #180 by a small dirt road and is covered by grass, bushes, and scattered small trees.

Many factors contribute to make this site excellent one for astronomy observation. These include a lack of artificial lighting, clarity of the air above the site, and cloudless skies. Several years ago a map of the "Sky at Night" was compiled from an Air Force DMSP satellite and shows the extent of light pollution from artificial light sources and regions of dark skies at that time (Fig 3). These maps show the brightest regions as white and the darkest sky regions as black.

The National Park Service measures the horizontal visibility in an on-going program to show the clarity of the air at national parks and from this data has assembled a map of the visibility range in the United States. This range is a true indicator of the atmosphere above a location. From the map (Fig 4) one can see that the proposed Forest Service site is located in one of the clearest regions in the country.

While no statistics exist on the amount of night-time cloud cover in the southwest U.S., daytime statistics for this region show it to be one of the most cloud-free areas in the United States.

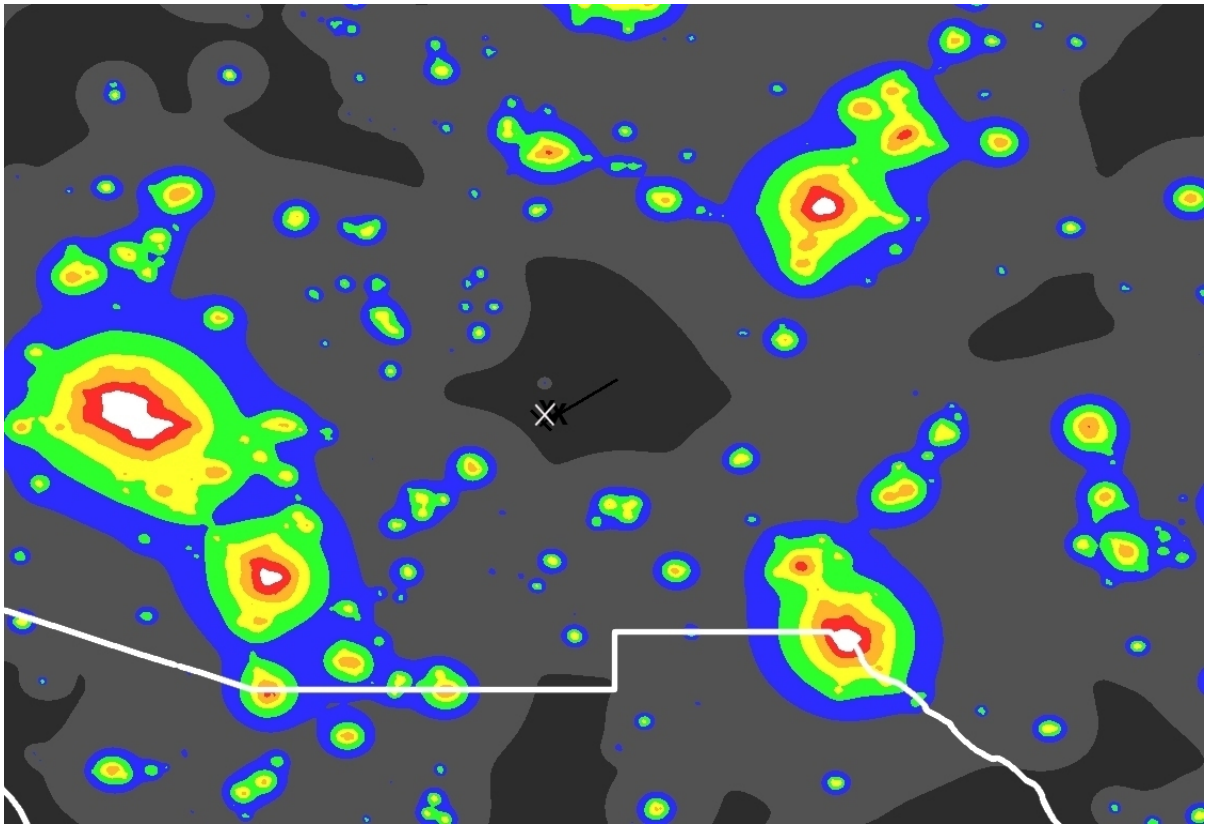

Figure 3 – A portion of "The Sky at Night" satellite image showing the southern portions of Arizona and New Mexico. The "X" marks the location of the proposed site. The large very bright area west of the site is Phoenix, Arizona at a distance of 180 miles. Note that the site is in a black region.

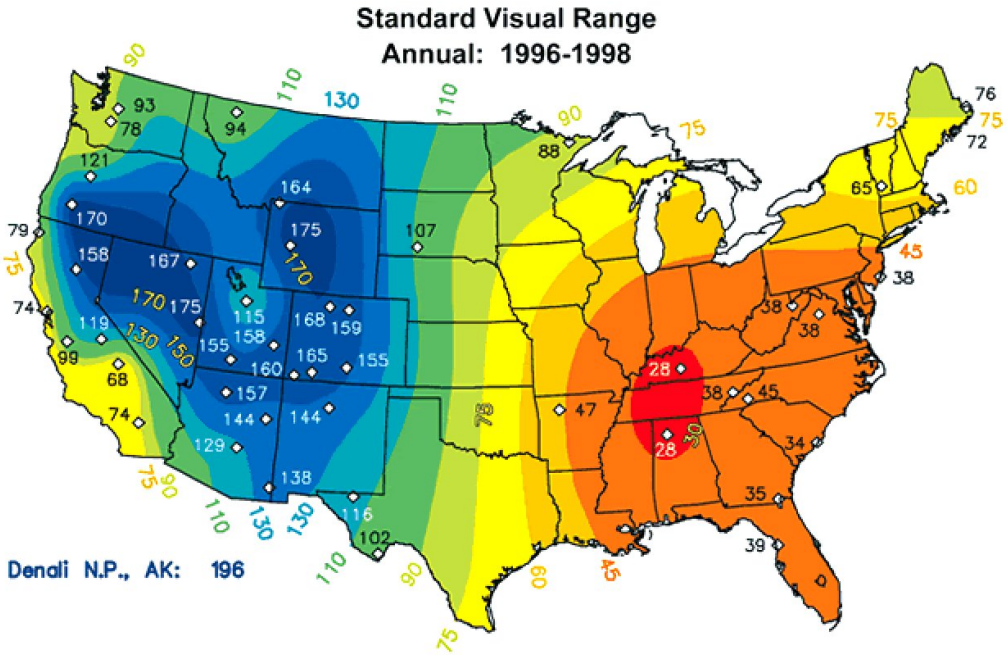

Figure 4 – The numbers on this National Park Service map are the distances in miles that one can expect to see on a clear day. This map indicates that the proposed astronomy camp site can expect a visibility of about 140 miles.

The instruments used for this evaluation were a Sky Quality Meter (SQM) model LE for continuously recording the zenith sky brightness in units of magnitudes per square arc second and a wide-angle cooled CCD camera with a field-of-view (FOV) of 31 X 21 degrees.

As shown by the SQM plot, twilight ended around 7:45 PM local time and the sky remained almost constant for the remainder of the evening (Fig 5).

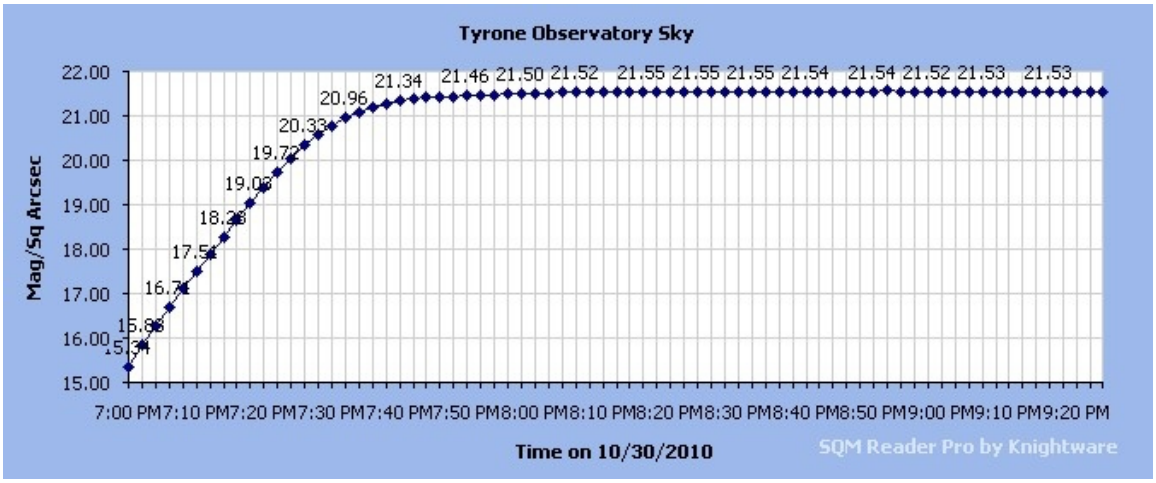

Figure 5 – The SQM trace shows that the zenith sky was a little darker than 21.5 mag/arc-sec^2 and was steady, indicating a lack of any clouds. The higher numbers represent a darker sky.

While the sky brightness of 21.5 is not indicative of a good "true, natural dark sky," it was the result of an overall haze that covered southwest New Mexico for about three days during our survey. Shortly after ending the observations at the Forest Service site, two other sites were measured and found to be about .2 magnitude brighter than clear nights in this region. If we add this .2 magnitude to the readings at the Forest Service site, we get a sky reading of about 21.74 magnitude/arc-sec^2. Over the period of the past several years and hundreds of measurements in the darkest locations in Colorado, Utah, Nevada, Arizona and New Mexico, we have found that good nights in these locations have a "true, natural dark sky" value of around 21.72 magnitude. So we can say with some confidence that this proposed astronomy site has a true natural dark sky. Further measurements will certainly confirm this.

Two sources of artificial light can be seen along the horizon and these were imaged with the low-light level camera. The first and brightest source has been identified as the glow from the city of Phoenix, Arizona. The Phoenix glow can be seen from a large area covering parts of Arizona, New Mexico, and Utah. This glow (Figs 6 & 7) is limited to below 10 degrees elevation due west of the site and in no way affects the quality of the sky overhead.

Figure 6 – The sky looking west from the Forest Service site showing the glow from Phoenix 180 miles to the west. The height of this image is 21 degrees. The diagonal lines in the image are not clouds but airglow bands and are the result of solar activity and may have contributed to the brighter than normal zenith sky brightness.

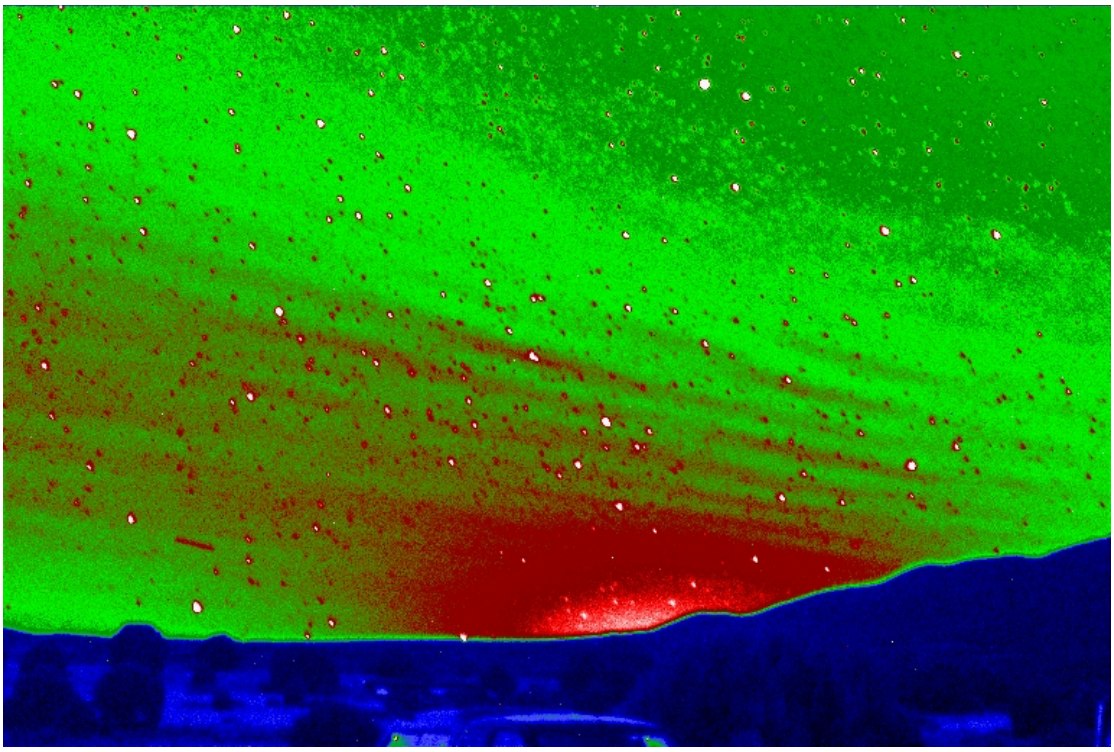

Figure 7 - False color isophot contour map of figure 4 shows that the glow from Phoenix extends less than 5 degrees above the horizon.

The other source of artificial light is from the Silver City area and includes the very bright lights of the Tyrone Mine located southwest of Silver City. This glow was not detected with the naked eye but with the CCD camera and again has no detrimental effect to the night sky above an elevation of 10 degrees above
the horizon (Figs 8 & 9).

Figure 8 - The faint glow just above the southeast horizon can just be detected with the CCD camera.

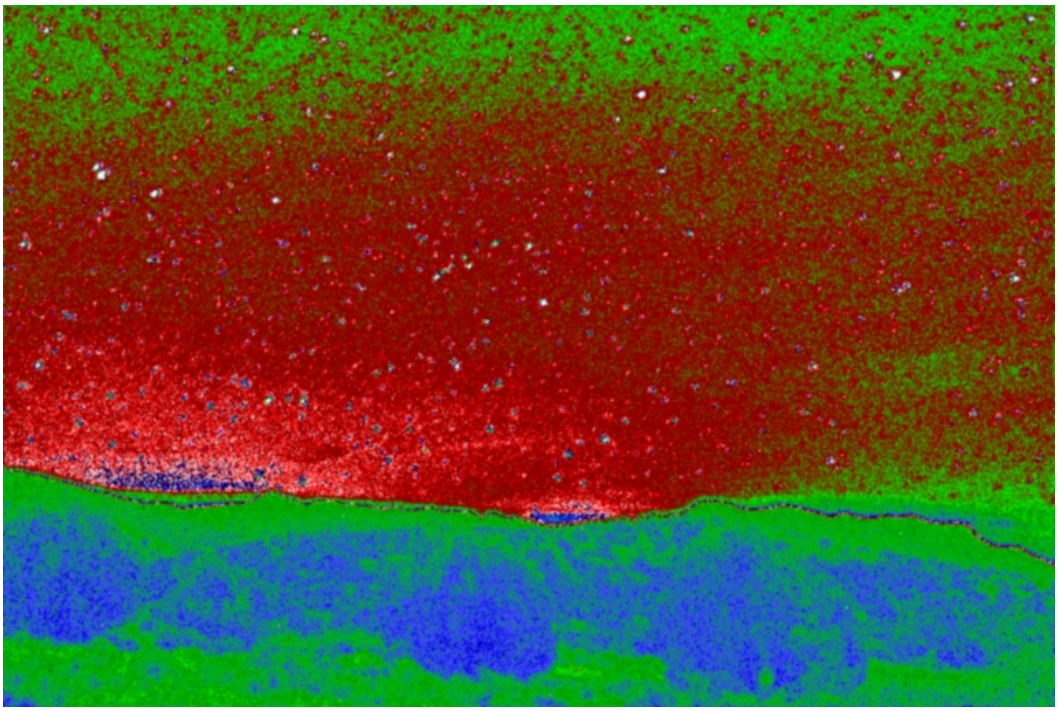

Figure 9 - The glow to the southeast is very faint and does not extend more than 5 degrees above the horizon.

In conclusion, we believe this site to be of excellent quality--exceptionally dark and free from artificial light. The site's location in the southwestern U.S. provides many nights of clear dark skies. We will continue making measurements from this location to further increase our knowledge of this proposed campground.

During his forty year career in Astronomy and Space Science, team leader Gary Emerson spent several years doing site surveys and site evaluations for proposed professional nighttime and solar observatories.

Gary Emerson – President, Silver City Astronomical Society
P.O. Box 1845
Silver City, NM