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Cumberland Gap National Historical Park
Kentucky / Virginia / Tennessee

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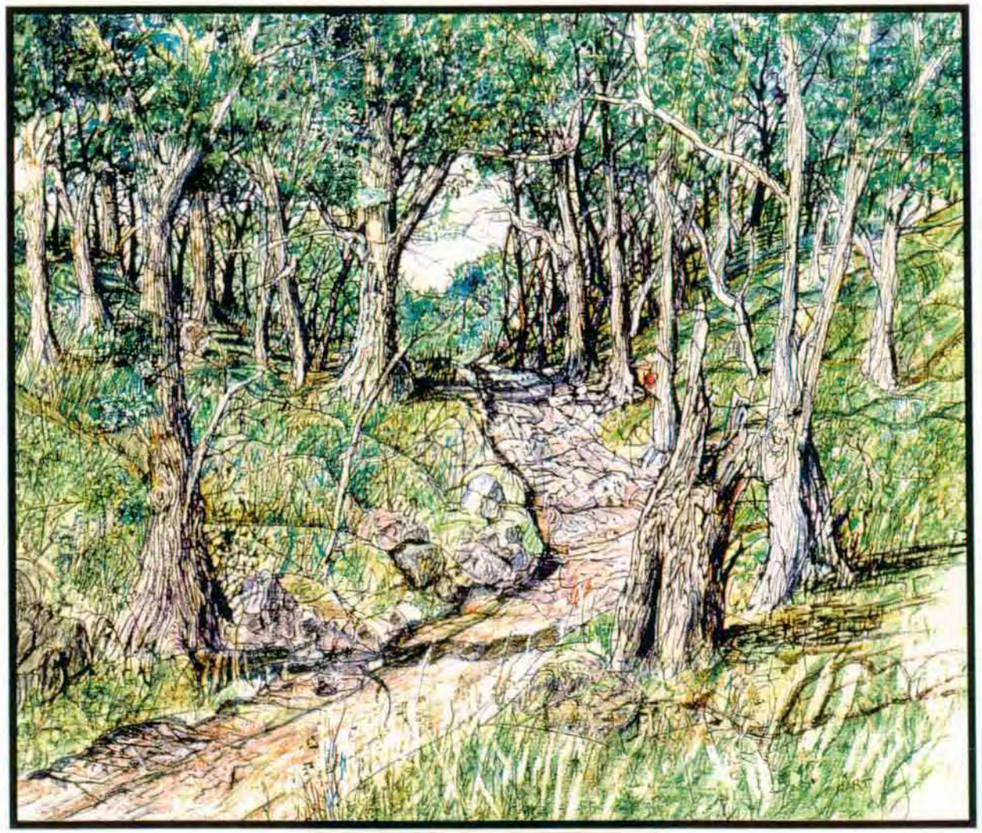
Restoration of Historic Features
Cumberland Gap National Historical Park



Wilderness Road
1780-1810

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Restoration of Historic Features
Cumberland Gap National Historical Park

Research methodology for the "Rediscovery" of historically significant resouces: Procedures developed to derermine ther original topography of the historic saddle of Cumberland Gap and identify the vertical and horizontal alignment of the historic road.

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Based on personal interviews with, and information provided by,
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Introduction

Cumberland Gap National Historical Park (CUGA) was established on June 11, 1940, to set apart as a public park for the benefit and inspiration of the public, certain lands, structures, and other property, including Cumberland Gap — a natural gap, or low point, on Cumberland Mountain — and a segment of the historic Wilderness Road which crosses Cumberland Mountain through the Gap. The Gap, along with the Wilderness Road that passes through it, is nationally significant, because it was the first feasible and sustained two-way passage through the Appalachian Mountain barrier used during the early years of American westward expansion. Today, CUGA comprises more than 20,000 acres of land in the states of Kentucky, Virginia, and Tennessee that are administered by the National Park Service (NPS).

Cumberland Gap National Historical Park was listed in the National Register of Historic Places on October 15, 1966. On May 28, 1980, the Cumberland Gap Historic District was listed in the National Register. In 1994, an amendment to the National Register nomination form for the historic district clarified the inclusion of the Wilderness Road as a contributing resource, and provided a more detailed description of road segments in the park that have a high degree of integrity. The amendment also designated the corridor of US 25E from its junction with Route 58 (in Virginia) to Indian Rock beyond the saddle of the Gap (in Kentucky) as a contributing resource, since it follows the general route of the historic road.

Historical documentation regarding the significance and location of the Gap and the Wilderness Road may be found in U.S. Department of the Interior, National Park Service, Location of the Wilderness Road at Cumberland Gap National Historical Park, by Jere L. Krakow, National Park Service, August 1987, and Robert L. Kincaid, The Wilderness Road (6th ed., Harrogate, Tennessee, Lincoln Memorial University, 1996).

Historic Context

The Wilderness Road served as the principal route from the eastern settlements on the Atlantic seaboard to the interior lands drained by the Ohio River beyond the Appalachian mountain barrier. Prior to heavy commercial and settler traffic on the road between 1780 and 1810, the route was primarily used by migrating herds of bison and by several tribes of American Indians traveling between their villages and hunting grounds. Commercial use, especially by livestock drovers, began around the turn of the 19th century.

The network of traces laid down by bison formed the basis of trails used by American Indians, and in time, frontiersmen and settlers. Foremost among Indian routes in the eastern United States was the "Warriors' Path," which looped southward through the Gap connecting the Ohio River Valley and that of the Shenandoah and Potomac. Branches of the road also continued southeast to the Cherokee and Creek settlements. The path laid down by animals and early peoples was eventually adapted by settlers, land speculators, and opportunists from the colonies on the eastern seaboard.

Early Anglo-American travelers through Cumberland Gap included Gabriel Arthur and Dr. Thomas Walker. The latter's 1750 written account provided the earliest recorded Anglo eyewitness description of the Gap. In 1763, a group of hunters led by Elisha Walden (Wallen) crossed intoKentucky through Cumberland Gap. Success of the hunt brought others to Kentucky, including DanielBoone, the individual most often identified with the Gap. Boone first traversed the Gap in 1769. Working for Judge Richard Henderson, Boone explored Kentucky for productive lands that promised to return profits to investors and marked the well-defined trail in 1775 with his band of ax-men.

Four years later, the first of a still-continuing series of road improvements began as Virginia passed a law authorizing construction of "a good waggon [sic] road through the great mountains." In 1780, the builders of the road requested payment for the road over Cumberland Gap in a petition that stated that wagons had passed over it to the emerging western settlements. Thereafter, Virginia, and then Kentucky, passed laws to improve the road over Cumberland Mountain. Commensurate with the road improvements was the expanding population of the settlements in Kentucky, which increased from 73,000 in 1790 to 220,000 in 1800. Thereafter, demand for road improvements became a constant in order to facilitate settlers and commercial traffic. The route became the most direct and most easily traveled from the lower Ohio Valley to Philadelphia until the opening of the Erie Canal in 1825 and roads across the mid-Atlantic states during that same decade.

After the heyday of settler usage (about 1810), east-west traffic over the Wilderness Road tended to be more commercial in orientation, involving primarily livestock droving from Kentucky into the southeastern states. During the Civil War, the Gap became a strategic location for both Union and Confederate troops, and numerous defensive positions and an attendant military road network modified the landscape.

During the 20th century, modern road building techniques left a substantial imprint on the theCumberland Gap area. A macadamized surface road, designated the Object Lesson Road, replaced the old road in 1908. Built by the Bureau of Public Roads, the 2-1/2 mile roadway demonstrated the efficacy of modern technology and all-weather surface for roads in the area. On the Kentucky side, the alignment replaced the route of the Wilderness Road (Kentucky State Road) when the county abandoned the old road.

The Object Lesson Road thus held its own place of importance in the historical development of the Gap area. What had begun as a bison trace and Indian trail in due course became a pathway for explorers and land speculators, then a major route for settlers, travelers, and drovers, and finally an instrument for learning how to construct modern roads. Subsequently, present US 25E used much of the same alignment of the Wilderness Road, as 20th-century boosters proclaimed it to be the Dixie Highway from Detroit, Michigan, to Miami, Florida.

Cumberland Mountain and the Gap through which the Wilderness Road passed retain many of the topographical features known to its earliest users. With some exceptions, the Gap and vegetative cover convey much of the historic scene for which the national historical park was set aside. Nearly all structures associated with 20th-century development have been removed in the course of developing the park, and the present-day landscape closely reflects that of the focal period 1780-1810. Of principal importance, sections of the historic road still exist in the area.

Heavy impacts to the topography of the Gap area have been identified — the alignment of US 25E, utility lines, a commercial store, a water reservoir, the modern community of Cumberland Gap, Tennessee, and the Seaboard System Railroad. Road construction, mainly during the 20th century, led to major modifications in the topography of the Gap, most noticeably in the saddle of the Gap where large amounts of quarrying and leveling occurred to make the grade of modern roadways less steep and to widen the traffic lanes for the convenience and safety of vehicular traffic. It is estimated that about 215,000 cubic yards of earth have been removed from the Gap as a result of various road construction projects. Elsewhere road cuts and fills (present and former), culverts, rock faces, and embankments have impacted the historic landscape.

Two management objectives for the national historical park are to restore and preserve as closely as possible the appearance of Cumberland Gap that existed at the turn of the 18th century, and to foster public understanding and appreciation of the park's historical and natural significance through various interpretive programs and facilities. The intent is to provide the opportunity for visitors to walk to the Gap along the Wilderness Road, to feel what it must have been like to cross the Gap during the pioneer days of 1780-1810; to see the landscape as it might have existed then; and to experience some of the thoughts and emotions of the pioneers crossing from Anglo settlements to unfamiliar lands that lay to the west.

Further information on the National Park Service's restoration/rehabilitation efforts at CUGA may be found in U.S. Department of the Interior, National Park Service, *Restoration of the Gap, Cumberland Gap National Historical Park, Preliminary Design, Preliminary Drawings and Design Analysis, Package* 139, Drawing Number 380/41,024, December 1997.

Purpose / Significance of the Study

This study documents the methodology employed by Michael F. Hart, former Visual Information Specialist (now retired), NPS, Denver Service Center (DSC), to rediscover the alignment of the original Wilderness Road as well as other early trails and Civil War-era roads and restore the approximate "historic period" contours of the topography of Cumberland Gap at the Kentucky-Tennessee-Virginia state line intersection. The detailed methodology was a meticulous, step-by-step "continual refinement" of procedures to prove the historical accuracy of his conclusions as expressed by graphic representations for the rehabilitation of the Gap and the Wilderness Road. All actions and methods detailed below refer to Mr. Hart, unless otherwise noted.

During the mid-1990s, artistic talents were employed in graphics-related activities at CUGA. During the course of this work, a familiarity with the physical setting and the complicated issue of rehabilitation of the Gap and the Wilderness Road to the 1780-1810 period was acquired. An in-depth study allowed identification of subtle landforms and topographic features integral to the location of the road, as well as partial rehabilitation of the surrounding cultural landscape.

This project began with graphic representations prepared as part of the relocation of US 25E and the Cumberland Gap tunnel project. Using photographic skills, structural designs for those projects were superimposed over landscape photographs of the project area, resulting in an acute understanding of the landforms and topographical features of that locale.

As construction of the tunnel moved toward completion (1996), the development concept plan for the partial rehabilitation of the Gap and Wilderness Road corridor became a major goal of Cumberland Gap National Historical Park. The partially rehabilitated Gap and Wilderness Road would become the centerpiece for public use and enjoyment. To accomplish the design work, knowledge of the routes and remnants of the roads in the CUGA area needed identification above and beyond the findings of the history study prepared by Krakow in 1987.

The use of artistic skills, combined with knowledge of photography, surveying, and map reading/interpretation, the NPS was provided with an innovative approach to recreation of the historic landscape at the Gap, and partial rehabilitation of the adjacent corridor. Considerable ingenuity in identifying topographic features was required. The application of diverse skill led to the discovery of the configuration of the historic road corridor. Recreating historic photographs by locating the original camera positions, combined with surveying from existing known points, generated much baseline data for guiding the design effort. Extensive field study, foot by foot on the mountainsides, along with detailed study of historic photographs, maps, and remnant pieces of topography, added to the knowledge of road alignment locations. Verification and cross checking with surveying equipment and computer-generated data have confirmed the fieldwork findings and validated the methodology. The work of NPS historians has been supplemented and enhanced, revising the previously identified Wilderness Road location through careful and thoughtful study of historic documents as well as present-day topography.

The methodology employed was unorthodox in approach, but was critical to the NPS understanding of the physical setting of the Gap and the Wilderness Road in CUGA. This unique approach is considered by some knowledgeable researchers to be a creative piece of work that has resulted in the accurate visual re-creation of the historic (cultural) landscape configuration of the Gap, the Wilderness Road, and their associated cultural landscapes. Further, the results of this work will enable NPS administrators to formulate appropriate management policies to preserve, protect, and interpret those resources.

The results of the work have made a significant contribution to the historical resource database of CUGA. Compilation of information developed through new techniques and from numerous disciplines and sources has resulted in refinement of road locations and revision of previous road study results.

The Wilderness Road alignment was rediscovered, from just below the O'Dell House in Virginia, to the Little Yellow Creek ford, in Middlesboro, Kentucky, and includes the upper and lower roads. The end product of the saddle research provided an accurate historical vertical and horizontal regrading plan for the rehabilitation of that part of Cumberland Gap.

A portion of the Warriors' Path was also rediscovered. For the most part that alignment is the same as the Lower Virginia Road (the portion on Cumberland Mountain).

The research also verified the original and unknown rock shape and configuration of the front entrance to Gap Cave. This is the former entrance to the cave but the end (or exit) of the cave system today. Research showed how the cave entrance looked in 1775 and earlier, before road construction removed it.

Another end product was the missing portion of Wilderness Road, known as the land bridge, now a collapsed feature. The collapse of such a feature is now understood to be a normal geological occurrence caused by ground erosion and the ongoing karst process.

Other rediscovered items and refinement understandings include three existing trees from the Civil War era (two were validated; one was not); one lost state monument; Harlan Road, a famous Civil War supply route; a real understanding of many existing road remnants that survive with improvements or destroyed because of modern construction or agriculture; the configuration of the original Iron Furnace; and finally, enough information to rebuild most Civil War gun emplacements on their original locations.

William L. Witmer

The Cumberland Gap
Coming Full Circle

The thundering herds of migrating buffalo which once traversed a low point in the Appalachian barrier along what is today the intersecting state lines of Kentucky, Tennessee and Virginia, disappeared centuries ago. Tractor-trailer trucks following the same general route ceased to do so on October 18, 1996. On that date, the opening of a dual-bore tunnel began yet another chapter in the eons of animal/human traffic flow through the imposing Cumberland Gap.

This long-awaited tunnel between Middlesboro, Kentucky, and Cumberland Gap, Tennessee, was an event that allowed the closure of the two-mile-long intervening section of U.S. Route 25E. The surrounding Cumberland Gap National Historical Park was established on June 11, 1940, to promote public understanding and appreciation of the Gap's role during the early years of American westward expansion. Public Law 93-87 (August 13, 1973) authorized the relocation of 25E to permit restoration of the Gap while improving traffic safety via a tunnel. A multi-decade interagency planning, design, and construction effort involving the National Park Service (NPS), the Federal Highway Administration (FHWA), and the Natural Resources Conservation Service (NRCS), is now moving into the final mitigation phases as required by the 1979 Final Environmental Impact Statement.

View from the main park viewpoint (The Pinnacle) to the Gap. Kentucky is on the right; Tennessee and Virginia are on the left. Photo by the author.

The immediate mitigation goals include the deconstruction and removal of the old road surface and base from Route 25E, re-opening the fresh water drainage issuing from Cudjo Cave (which flows under the old roadbed), regrading of the Gap to historic contours of the 1780-1810 initial Kentucky settlement era, and construction of a pedestrian trail which will follow, as much as practical, the Wilderness Road cut by Daniel Boone and his 30 axmen in March 1775.

Historic Topography of the Gap

One NPS staffer undertook the extremely complicated task of arriving at an accurate regrading plan at the Gap proper, from the critical historical timeframe. This effort was successful, such that information has now been incorporated into FHWA contract bid documents.

The short version of the rediscovery process began with gathering of available data, including an 1833 survey, 1862 Civil War photographs, 1903 and 1921 Association Lands maps, 1938 FHWA aerial photographs, plus current mapping from FHWA tunnel-related contracts. In the studio, this assemblage was used to locate and validate the original ridge lines and drainage features, using a combination of survey, mathematical, and graphic art skills. When the studio work had progressed to a certain point, several field trips were made for onsite discovery and verification. Work at the park involved extensive investigation on foot, bushwhacking up and down the mountainsides, additional photography from specific vantage points—including from a helicopter—to emulate the historical photos for comparative purposes. Supplementary-survey work came from an interested Middlesboro engineering firm.

Specific coordinate points (northings/eastings and elevations) were determined for old road traces, Indian Rock, and the Daughters of the American Revolution monument on the Kentucky side of the Gap, plus Cudjo Cave, Gap Creek, and the Iron Furnace on the Virginia/Tennessee side. This was instrumental in bringing the various older overlapping surveys into the same scale, and locking them into the correct alignment with present day mapping. Thousands of feet of colored flagging were placed to outline shapes and breaks in ground lines before being photographed. At each stage of refinement, the vertical, horizontal, and birds-eye perspective information, coupled with painstaking scaled graphic delineation of puzzle-piece remnants of undisturbed topography, were needed to pin down the cross-referenced data. Missing pieces of topography were mechanically reconstructed on paper. The historic mapping, photography, and delineations eventually were merged with present-day mapping. The composite survey data was entered into a computer using AutoCad, Release 14 and Softdesk, Release 8 programs. What resulted were three-dimensional wireframe views of what the entire Gap area topography looked like in 1790. By comparison to today's landforms, the resultant grading plan provided by NPS to FHWA has allowed engineers to calculate the amount of fill needed to be hauled into the Gap from nearby tunnel construction stockpiles. In all, the Saddle is 32 feet lower today than 200 years ago, thanks to the continuum of road improvements. About 215,000 cubic yards (an estimated 165,000 cubic meters) of fill will be provided to return the Gap to historic grades when Daniel Boone and his fellow trailblazers first crossed over into "Kaintucky."

Finding the Wilderness Road

As work on the topography progressed, a tandem effort was pursued to locate the original alignment of the Wilderness Road. On the Virginia/Tennessee side, the 1833 survey map was compared with known locations of Cudjo Cave and the Gap. Again delineating topographic remnants, an alignment of the 1790 track emerged and was plotted on paper. At the park, the centerline was cut by hand, surveyed, and staked. During fieldwork, several remnants of the Wilderness Road were found to be intact. Other portions were no longer visible due to roadbuilding and 200 years of erosion. One thing became obvious—although the Wilderness Road crossed Route 25E several times, the historic line did not lie under the present roadbed. As in the 1833 map, the true line was somewhat downhill from today's pavement. Portions of the original alignment are being incorporated into the pedestrian trail.

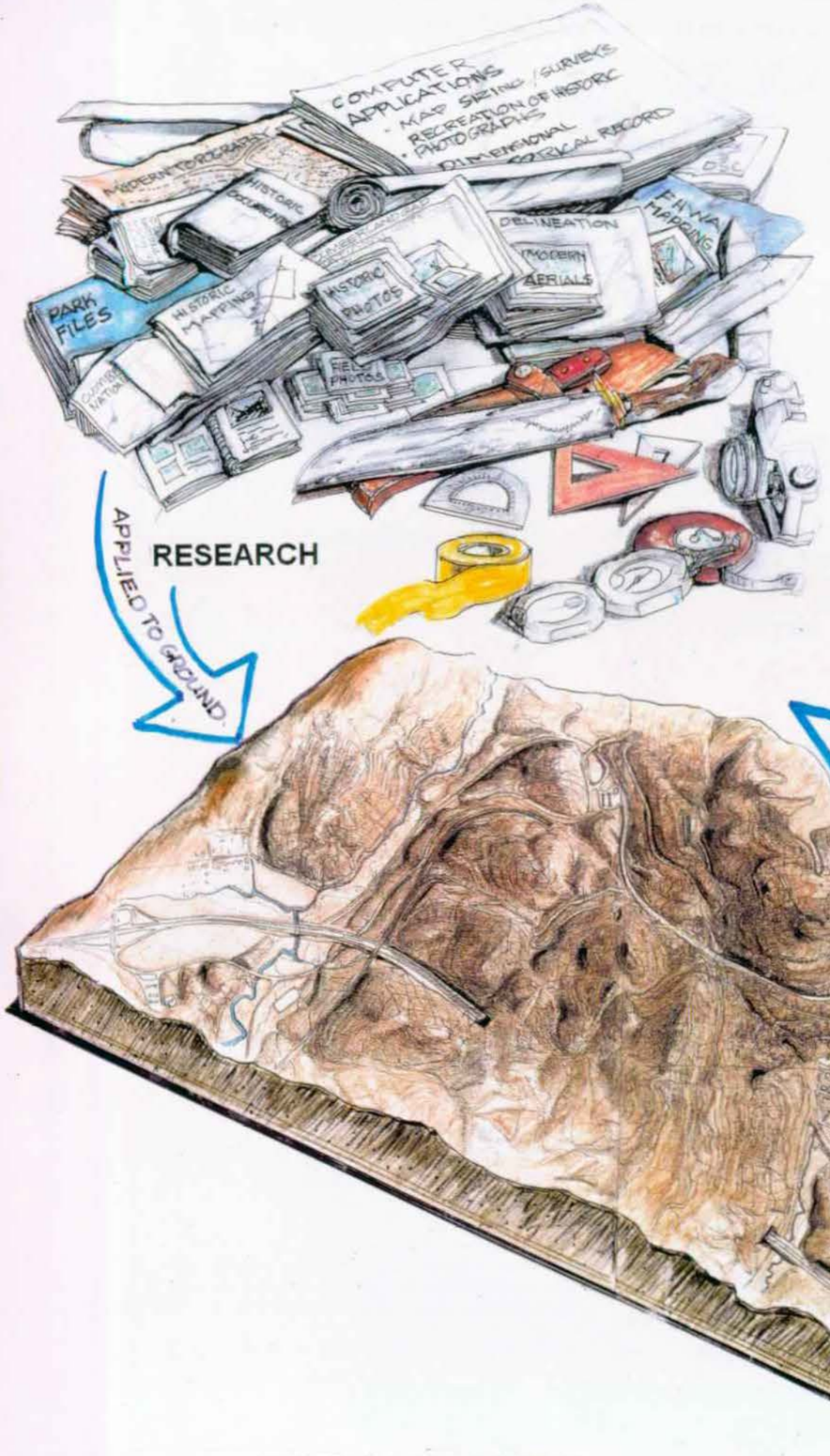
Next Steps

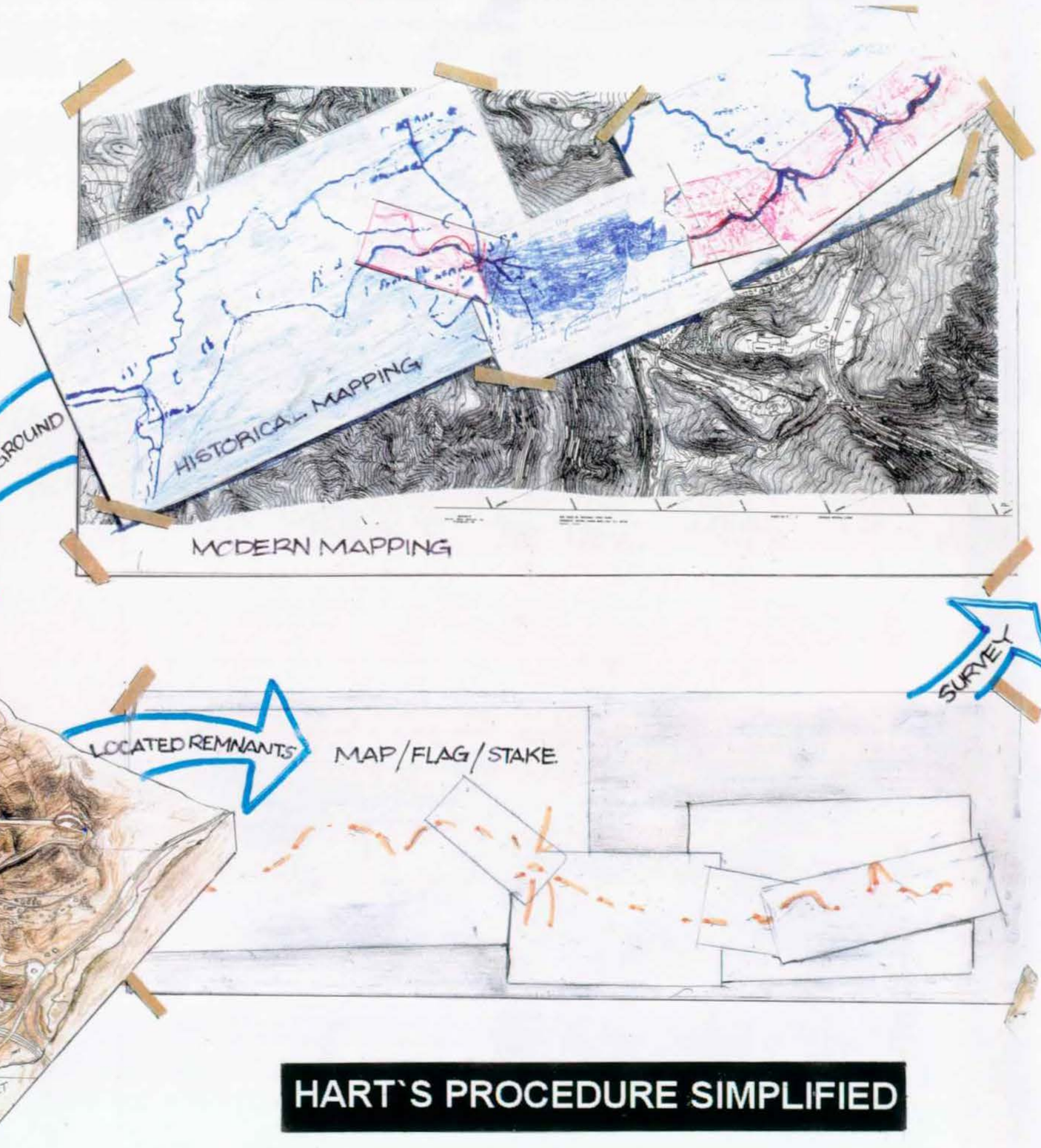
FHWA will contract with a construction firm in 2001 to remove the Route 25E pavement, re-establish the historic grades, and construct a trail from the Wilderness Road Parking Area in Virginia, through the Gap, to the Thomas Walker Parking Area in Kentucky. Several spur trails will be connected where appropriate, including one to Cudjo Cave to facilitate pre-arranged underground tours. NPS will have an archeologist present during the demolition/removal phase, looking for additional evidence of original topographic features and artifacts related not only to the Boone era, but also to subsequent events such as the Civil War and the 1908 construction of Object Lesson Road, an early experiment in the use of asphalt. NPS will also provide a landscape architect to give technical guidance to FHWA during the regrading operation. NRCS continues to grow native plant materials for what will be a substantial revegetation effort. This will put things back to Boone's era as closely as we could hope to achieve. The final phase of mitigation, scheduled for 2003, includes a modest exhibit pavilion, ranger station, and restrooms in Virginia, numerous interpretive devices along the trails, plus new museum exhibits and a movie for the visitor center in Middlesboro, Kentucky, just downhill from the north portal of the Cumberland Gap Tunnel.

Conclusion

Coordinated federal interagency efforts like this come along once in a career. Many meetings, telephone calls, and emails have occurred to ensure that everyone involved has the same understanding of the goals, and the prerequisites to achieve them. Moreover, FHWA has added many more "special" requirements to the contract specifications to guide the contractor. An interesting twist is that gasoline tax funds from the Federal Lands Highway Program, normally used to build roads and bridges, will be used to remove a road and rehabilitate a site in this one instance. The beneficiaries of this effort, the visiting public, will hopefully experience some of the excitement felt by the early settlers, as they moved their families, belongings, and livestock beyond the last wall of eastern mountains to begin a new life in Kentucky.

William L. Witmer is project manager/landscape architect at the NPS Denver Service Center in Colorado, working primarily with FHWA on road and bridge projects in the Southeast.





HART`S PROCEDURE SIMPLIFIED

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SEE BLOW-UP OF
SADDLE MAP PAGE

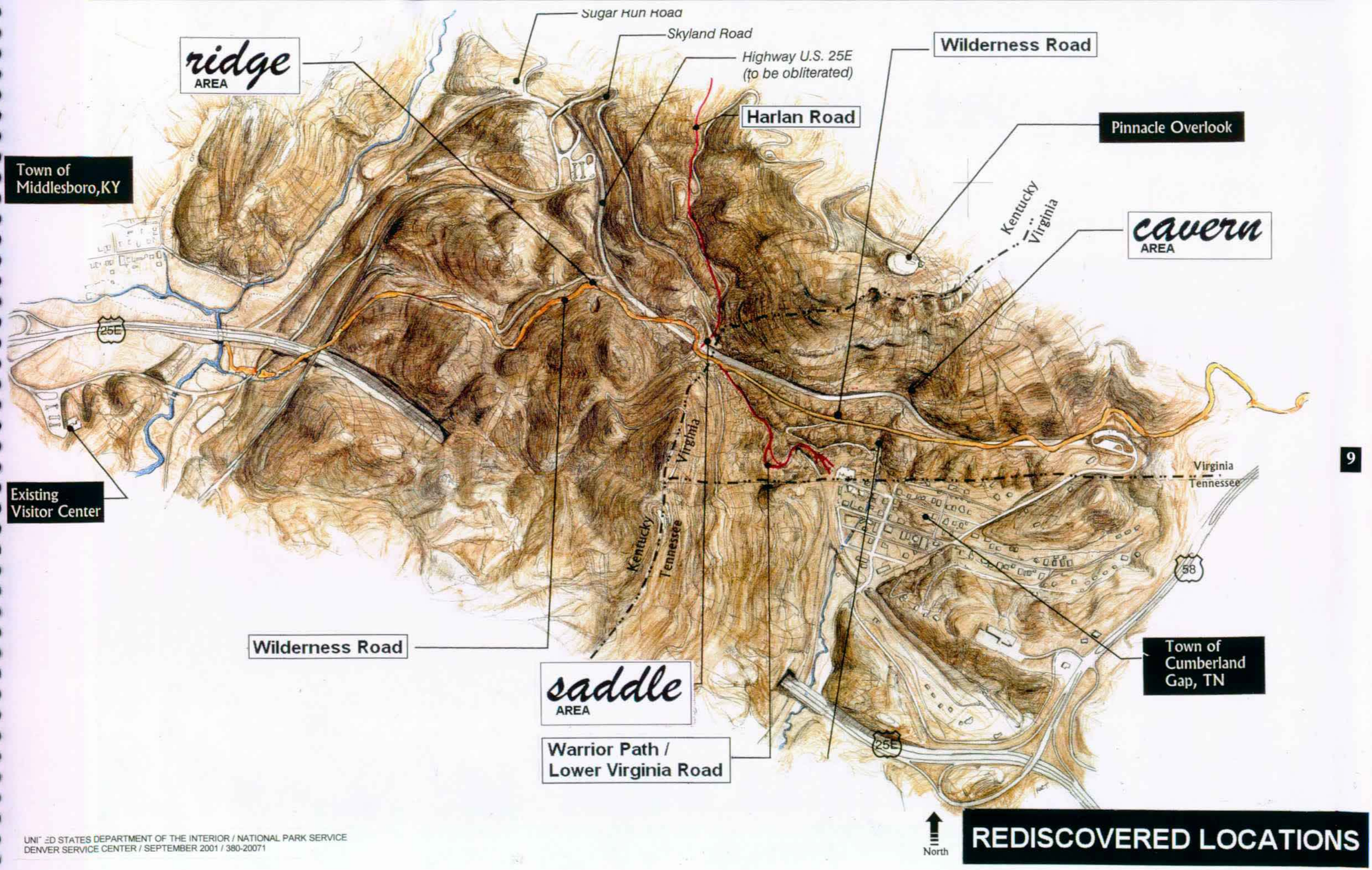
Descent Survey
Validation Point # 30

RECOVERED REMNANTS ARE THEN RECORDED BY
MODERN SURVEY AND COMPUTER

WILDERNESS ROAD

APPLIED TO
HISTORICAL MAPPING

HISTORICAL MAPPING



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VALIDATION POINT DESCRIPTION
(WITH LOCATION METHODS)

#1 Wilderness Road Remnant Because of its distinctive shape and its relationship to modern and historic topographical mapping, this remnant was established as a benchmark for the beginning of the section of this Wilderness Road, and the starting point of this project. A1 : A3 : A4 : A5 : B1 : C

#2 Wilderness Road Remnant Because of its distinct shape and continuous alignment on the ground, this remnant contains the original and second interchange with the historic Lower Virginia Road. A1 : A3 : A4 : A5 : B1 : C

#3 Wilderness Road Remnant This remnant shows slight road alignment improvements that match historic survey mapping.
A1 : A3 : A4 : A5 : B1 : B2 : C : F

#4 Wilderness Road Remnant This remnant is a major landmark because of its distinct shape and curve in the alignment. It also provides validity that the geometry of this alignment is correct.
A1 : A3 : A4 : A5 : B1 : C : F

#5 Partial Wilderness Road Remnant Remaining bank stabilization materials on inside road edge. Also location of a small road improvement (a slight curve alignment was taken out) made some time after the Civil War. A1 : A3 : A4 : A5 : B1 : B2 : C : F

#6 Wilderness Road Remnant A small, straight, section of the road.
A1 : A3 : A4 : A5 : B1 : B2 : C : F

#7 Rock Outcrop This large existing outcrop formation is a major landmark because its distinct shape is a precise match to historic photos and surveys. A1 : A2 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

#8 Location of Original Cave Opening (circa 1700-1880) This cave opening is one of the first of three initial landmarks used to establish the correct positioning and validity of the 1833 Survey and the historical horizontal alignment of the Wilderness Road.
A1 : A2 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

#9 Wilderness Road Remnant A full width road remnant tapering on and off from the downhill edge of the collapsed feature (missing land bridge) to the existing Iron Furnace Trail.
A1 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

#10 Existing Drainage and Topographical Formation These features match those identified in historical documents.
A1 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

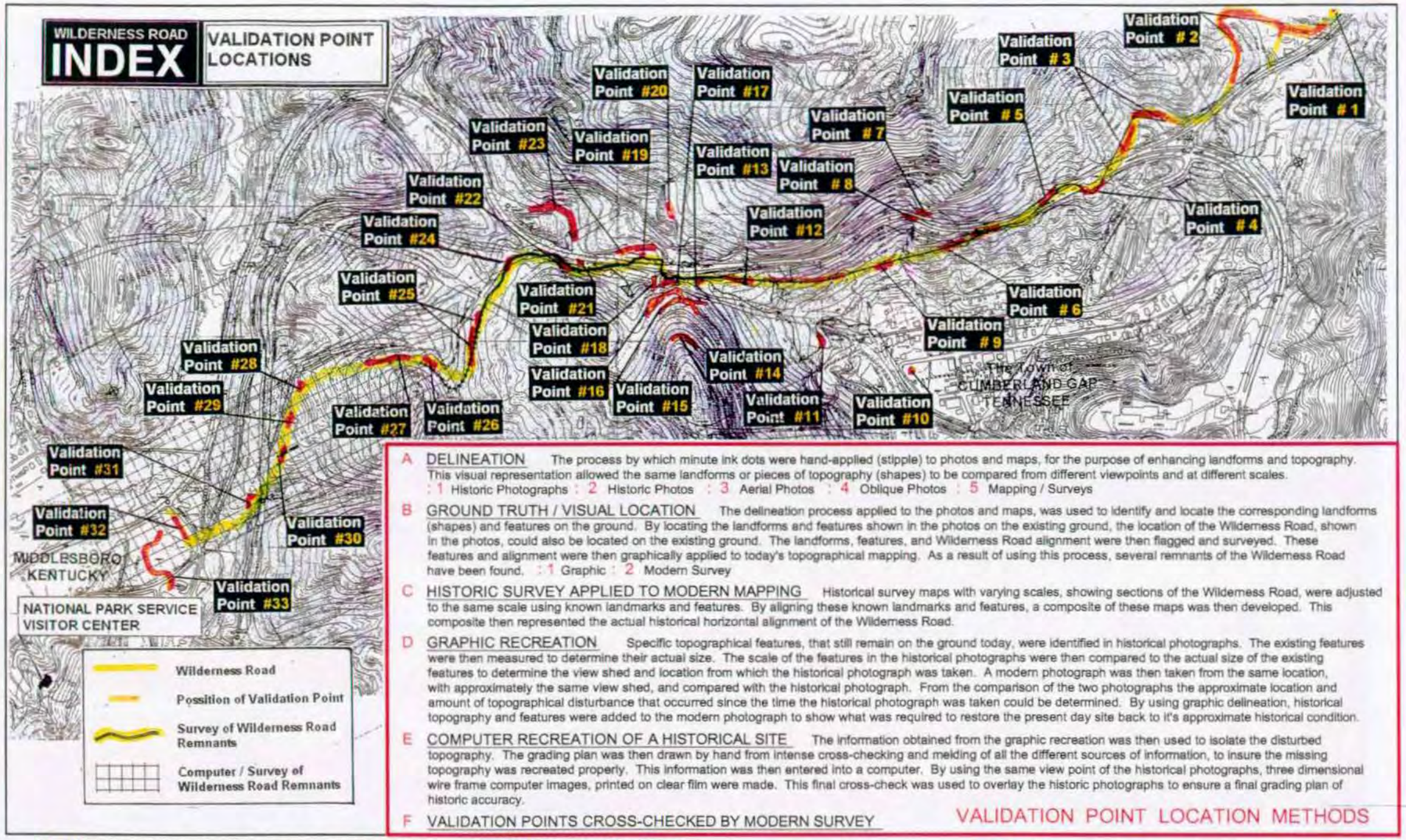
#11 Existing Red Oak Tree (approx. 12.5 ft. circumference) This tree is evident in an old Civil War photograph and still exists today. It is a major landmark used in the rediscovery of the Warrior Path relocation of the Wilderness Road, and in the recreation of the Gap Saddle Grading Plan. A1 : A2 : A3 : A4 : A5 : B1 : B2 : C : F

#12 Civil War Road Remnant A very distinctive shaped road remnant that is a Wilderness Road improvement made during the Civil War. This small remnant proved extremely useful, not only in the verification of the Wilderness Road location, but also in providing correct historical information that helped develop a relatively precise grading plan for the reconstruction of the original Gap formation.
A1 : A2 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

#13 Distinct Topographical Shape This distinct topographical shape appears in many of the historic photographs and exists on the ground today. A1 : A2 : A3 : A4 : A5

#14 Civil War Road Remnant This remnant was used to cross-check the Wilderness Road alignment because it appears in many different historical references.
B1 : B2 : C : D : E : F

#15 Civil War Road Remnant This remnant was a major validation point. It is shown or referenced throughout almost all of the rediscovery process. B1 : B2 : C : D : E : F



A DELINEATION The process by which minute ink dots were hand-applied (stipple) to photos and maps, for the purpose of enhancing landforms and topography. This visual representation allowed the same landforms or pieces of topography (shapes) to be compared from different viewpoints and at different scales.
: 1 Historic Photographs : 2 Historic Photos : 3 Aerial Photos : 4 Oblique Photos : 5 Mapping / Surveys

B GROUND TRUTH / VISUAL LOCATION The delineation process applied to the photos and maps, was used to identify and locate the corresponding landforms (shapes) and features on the ground. By locating the landforms and features shown in the photos on the existing ground, the location of the Wilderness Road, shown in the photos, could also be located on the existing ground. The landforms, features, and Wilderness Road alignment were then flagged and surveyed. These features and alignment were then graphically applied to today's topographical mapping. As a result of using this process, several remnants of the Wilderness Road have been found. : 1 Graphic : 2 Modern Survey

C HISTORIC SURVEY APPLIED TO MODERN MAPPING Historical survey maps with varying scales, showing sections of the Wilderness Road, were adjusted to the same scale using known landmarks and features. By aligning these known landmarks and features, a composite of these maps was then developed. This composite then represented the actual historical horizontal alignment of the Wilderness Road.

D GRAPHIC RECREATION Specific topographical features, that still remain on the ground today, were identified in historical photographs. The existing features were then measured to determine their actual size. The scale of the features in the historical photographs were then compared to the actual size of the existing features to determine the view shed and location from which the historical photograph was taken. A modern photograph was then taken from the same location, with approximately the same view shed, and compared with the historical photograph. From the comparison of the two photographs the approximate location and amount of topographical disturbance that occurred since the time the historical photograph was taken could be determined. By using graphic delineation, historical topography and features were added to the modern photograph to show what was required to restore the present day site back to it's approximate historical condition.

E COMPUTER RECREATION OF A HISTORICAL SITE The information obtained from the graphic recreation was then used to isolate the disturbed topography. The grading plan was then drawn by hand from intense cross-checking and melding of all the different sources of information, to insure the missing topography was recreated properly. This information was then entered into a computer. By using the same view point of the historical photographs, three dimensional wire frame computer images, printed on clear film were made. This final cross-check was used to overlay the historic photographs to ensure a final grading plan of historic accuracy.

F VALIDATION POINTS CROSS-CHECKED BY MODERN SURVEY

VALIDATION POINT LOCATION METHODS

#16 Civil War Road Remnant This remnant was a major validation point. It is shown or referenced throughout almost all of the rediscovery process. B1 : B2 : C : D : E : F

#17 Daniel Boone Monument This monument is an existing landmark, but not in its original location. B1 : B2 : C : D : E : F

#18 Civil War Road Remnant This remnant was a major validation point. It is shown or referenced throughout almost all of the rediscovery process. B1 : B2 : C : D : E : F

#19 Existing Topographic Feature This small distinct earth formation appears in the historic photographs and exists on the ground today. B1 : B2 : C : D : E : F

#20 Harlan Road Remnant This remnant is a major landmark used for locating the Wilderness Road, developing the grading plan for the reconstruction of the original Gap formation, and for the rediscovery of the Harlan Road itself. B1 : B2 : C : D : E : F

#21 Indian Rock This large existing rock is the second of three initial landmarks used to establish the correct positioning and validity of the 1833 Survey and the historical horizontal alignment of the Wilderness Road. B1 : B2 : C : D : E : F

#22 Wilderness Road Remnant
B1 : B2 : C : D : E : F

#23 Object Lesson Road Remnant
A1 : A3 : A4 : B1

#24 Wilderness Road Remnant and Topographic Feature
A1 : A2 : A3 : A4 : A5 : B1 : B2 : C : D : E : F

#25 Wilderness Road This remnant consists of approximately 200 feet of the outside, original, road edge. This remnant is a major landmark validating the alignment and geometric relationship of historic survey mapping to the ground. The existing road, located just above, is a later road improvement cut into the mountain.
A1 : A3 : A4 : A5 : B1 : B2 : C : F

#26 Wilderness Road Remnant This is a small, vague, remnant.
A1 : A2 : A3 : A4 : A5 : B1 : C

#27 Wilderness Road Remnant This remnant is a very well defined, improved trace, on line with the original road. Because of the types of disturbance on both ends of this segment, survey should be used to verify the location of the road through these disturbed areas.
A1 : A3 : A4 : A5 : B1 : C

#28 Wilderness Road Remnant This is a vague, tapering, remnant that has been, at one time, disturbed by farming, and is now grown over with forest. A1 : A3 : A4 : A5 : B1 : C

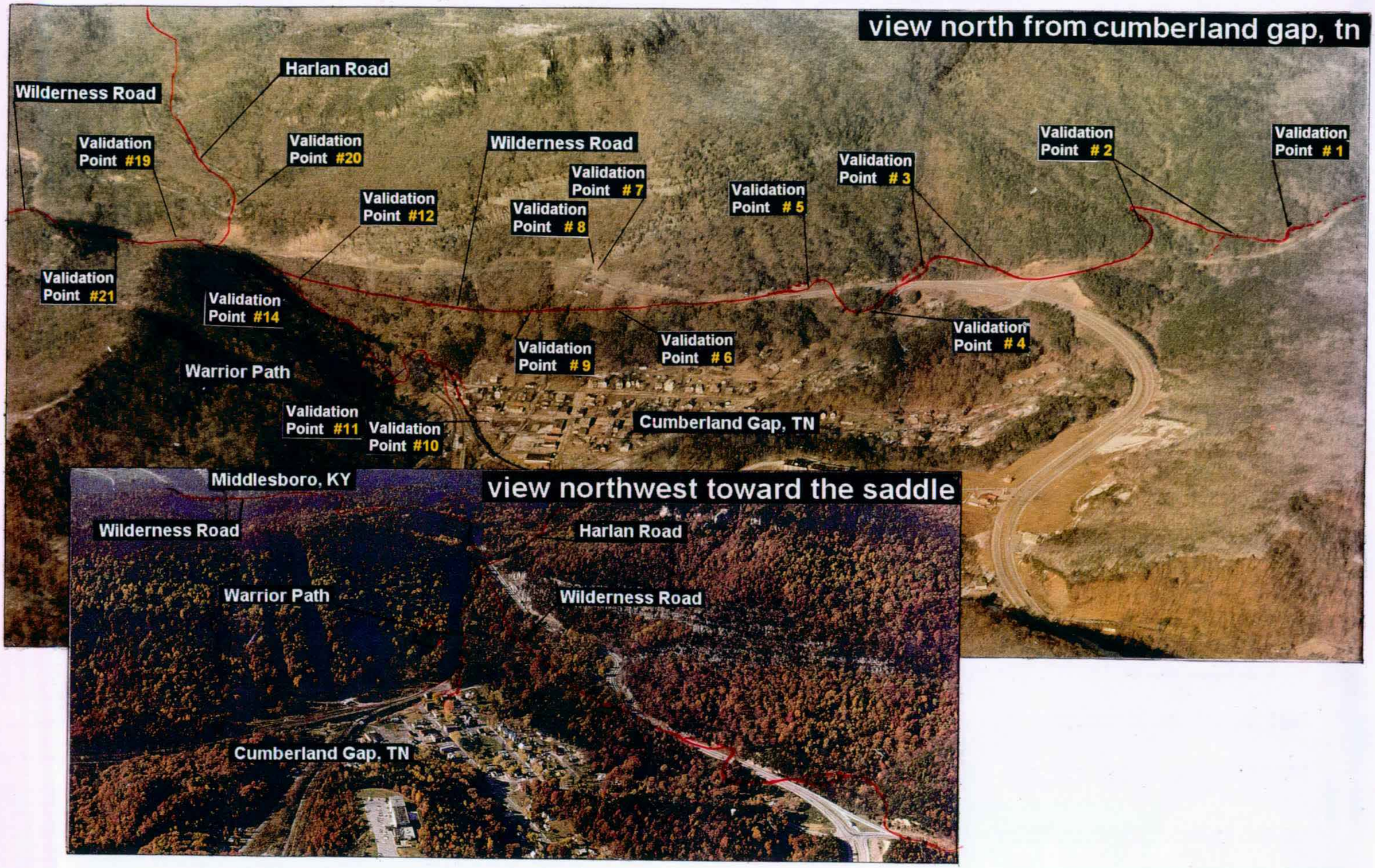
#29 Wilderness Road Remnant This is a vague, tapering, remnant that has been, at one time, disturbed by farming, and is now grown over with forest. A1 : A3 : A4 : A5 : B1 : C

#30 Wilderness Road Remnant This is a vague, tapering, remnant that has been, at one time, disturbed by farming, and is now grown over with forest. This portion of the Wilderness Road has not yet been surveyed, however, because of the importance of this particular remnant, it was surveyed to verify its position. This remnant is a major landmark validating the alignment and geometric relationship of historic survey mapping to the ground. A1 : A3 : A4 : A5 : B1 : C : F

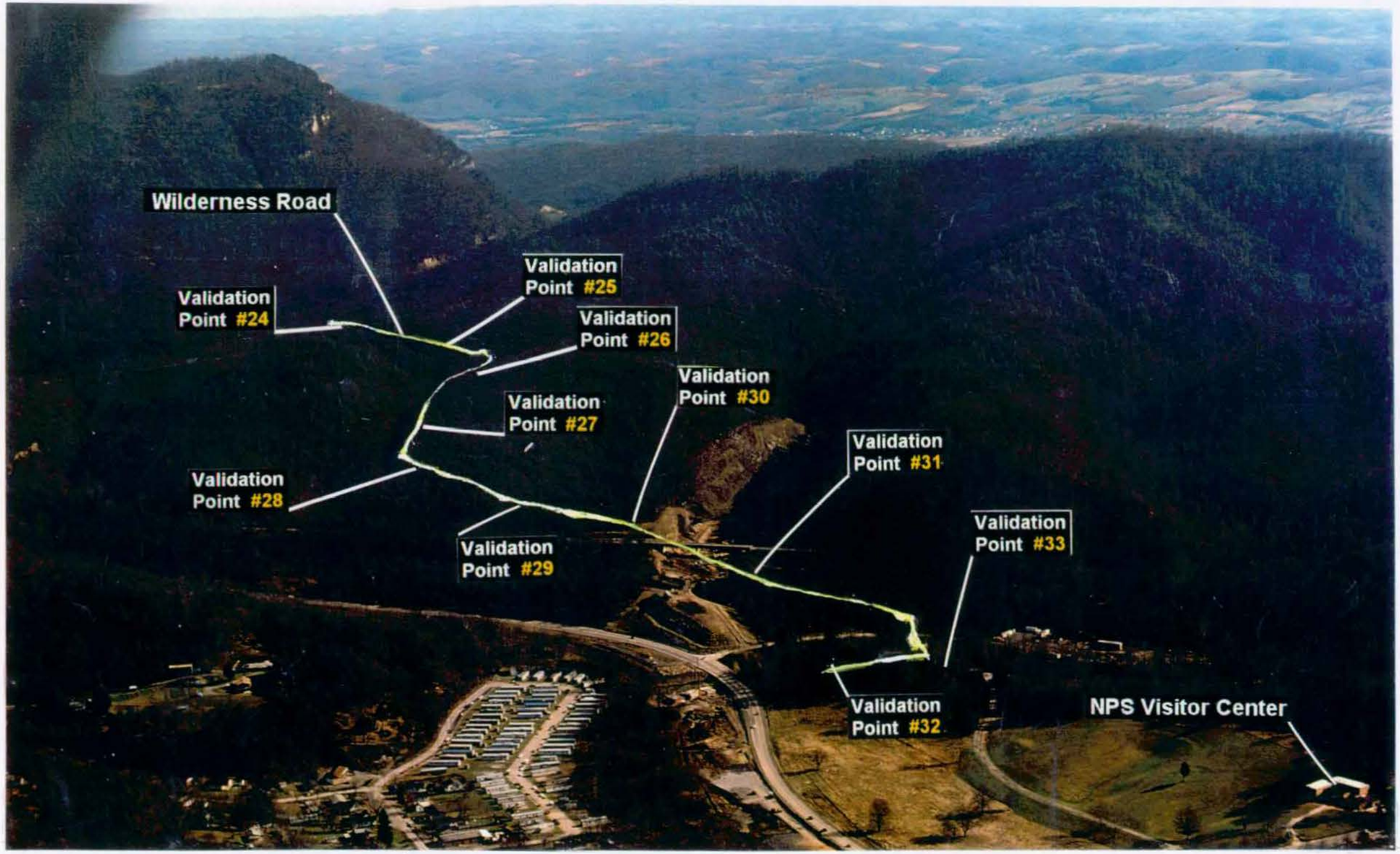
#31 Wilderness Road Remnant This is a short, but distinct remnant.
A1 : A3 : A4 : A5 : B1 : C : F

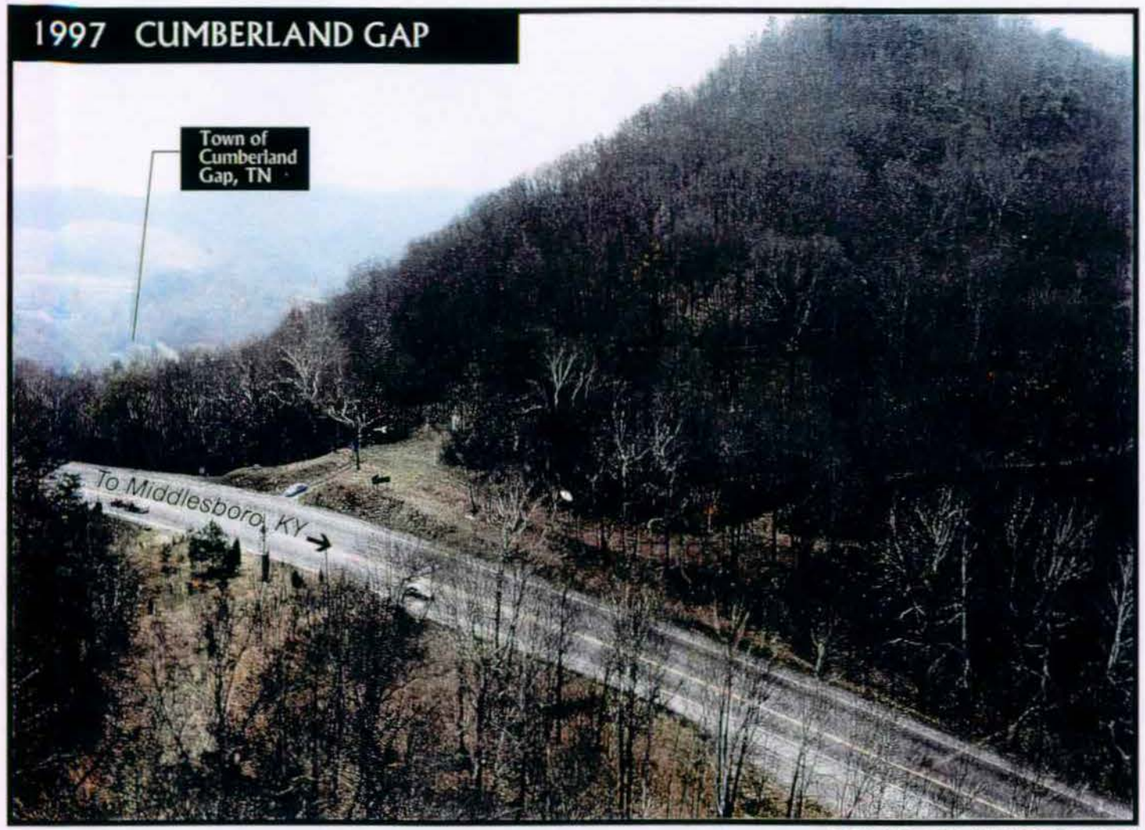
#32 Wilderness Road Remnant This is a vague and worn remnant.
A1 : A3 : A4 : A5 : B1 : C

#33 Old River Channel Remnant This is a large, very distinct section of old river channel that matches the historic survey mapping. This channel remnant is the third of three initial landmarks used to establish the correct positioning and validity of the 1862 Civil War Map and the historical horizontal alignment of the Wilderness Road. This remnant was established as a benchmark for the end of this section of the Wilderness Road, and the end point of this project. A1 : A3 : A4 : A5 : B1 : C

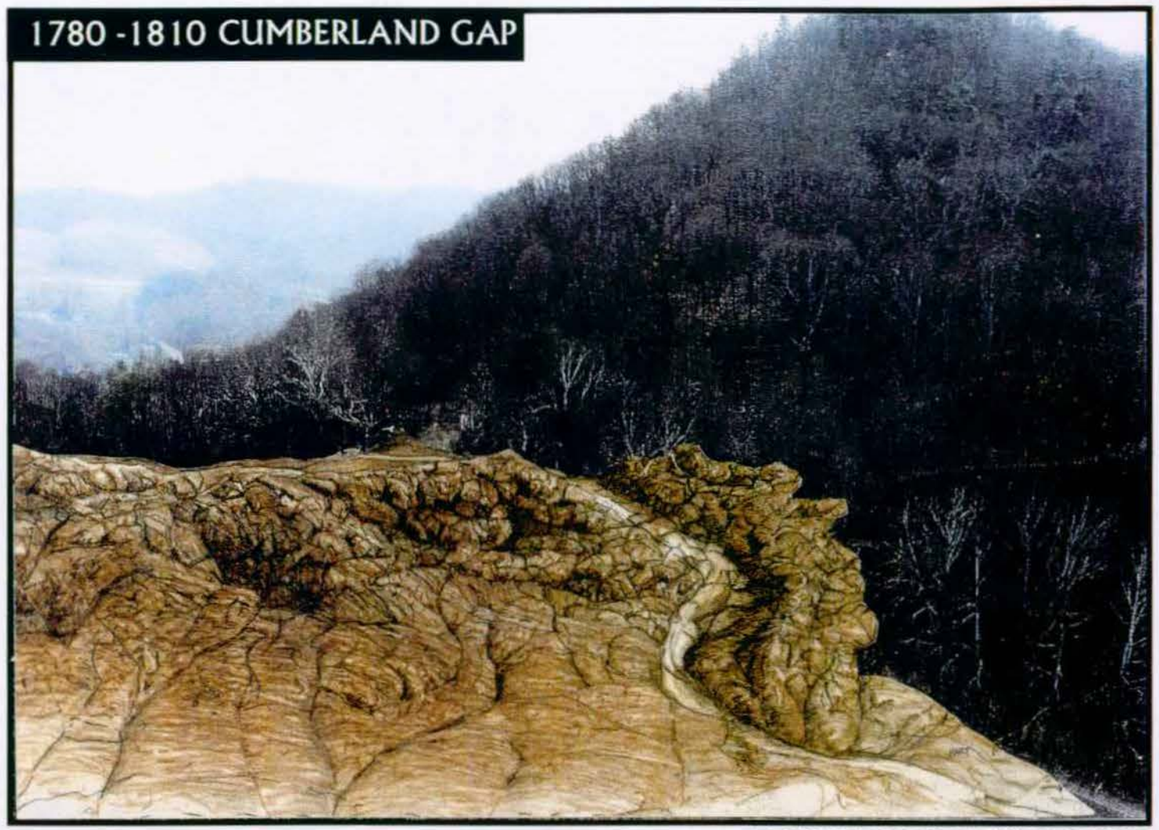

view north from cumberland gap, tn
Wilderness Road
Harlan Road
Validation Point #19
Validation Point #20
Validation Point #12
Wilderness Road
Validation Point # 7
Validation Point # 8
Validation Point # 5
Validation Point # 3
Validation Point # 2
Validation Point # 1
Validation Point #21
Validation Point #14
Validation Point # 9
Validation Point # 6
Validation Point # 4
Warrior Path
Validation Point #11
Validation Point #10
Cumberland Gap, TN
Middlesboro, KY
view northwest toward the saddle
Wilderness Road
Harlan Road
Warrior Path
Wilderness Road
Cumberland Gap, TN

view southeast from middlesboro, ky

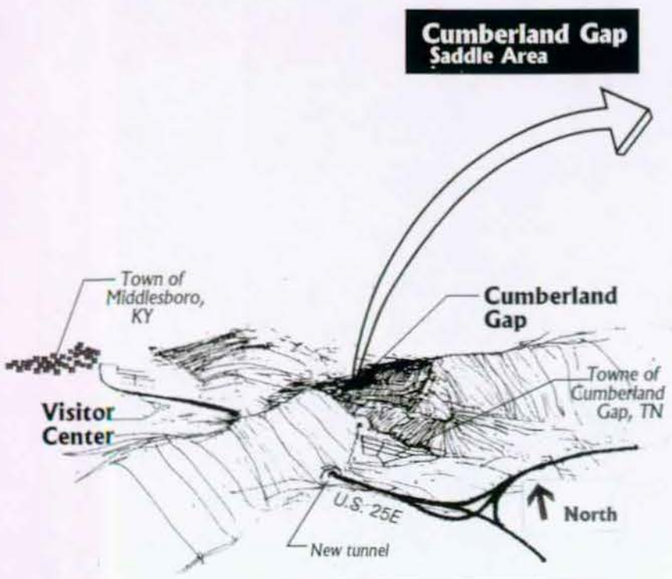


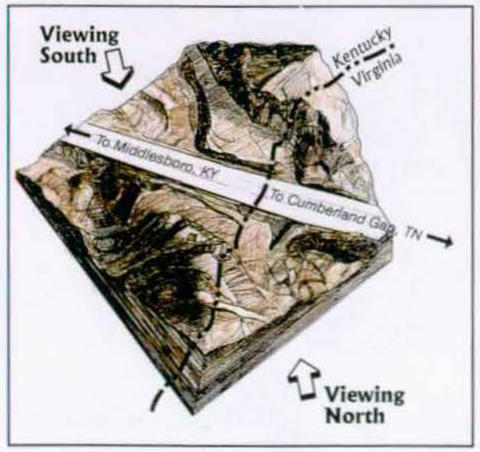


OLD US 25E (NOW CLOSED)



REHABILITATION (VIEWING SOUTH)





FINISH GRADE AFTER REHABILITATION

SADDLE REHABILITATION

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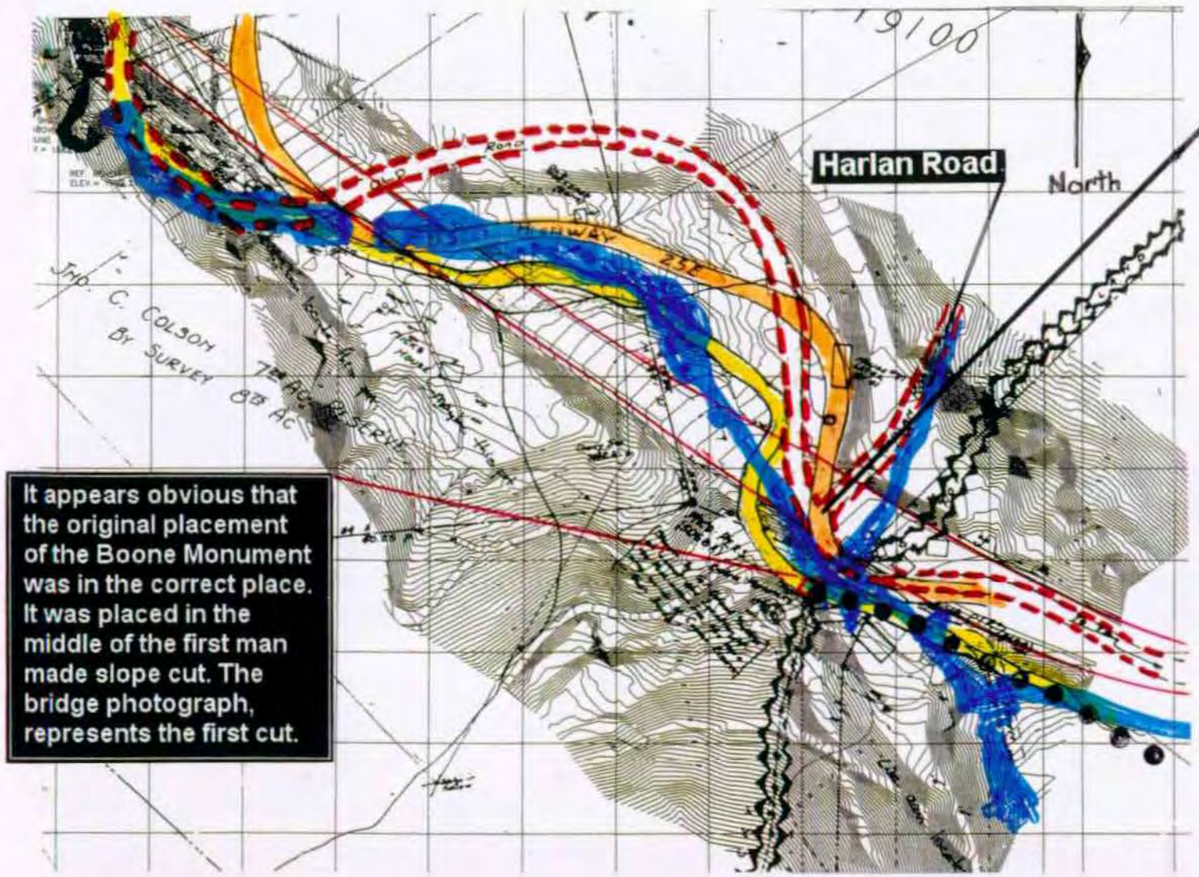

Harlan Road alignment does not match because this interchange was formed after the second slope cut.

It appears obvious that the original placement of the Boone Monument was in the correct place. It was placed in the middle of the first man made slope cut. The bridge photograph, represents the first cut.

CHRONOLOGICAL ORDER OF WILDERNESS ROAD ALIGNMENTS

- 1833 Survey
- 1862 Civil War Map
- Unknown years of use. This alignment was chosen for rehabilitation because it was best suited for pedestrain, wagon, and livestock passage.
- Unknown years of use, but was constructed during the second time the grade was lowered.
- The Object Lesson was constructed in 1906 and also called US 25 E
- Todays alignment is basically as it was first constucted in the 1930`s

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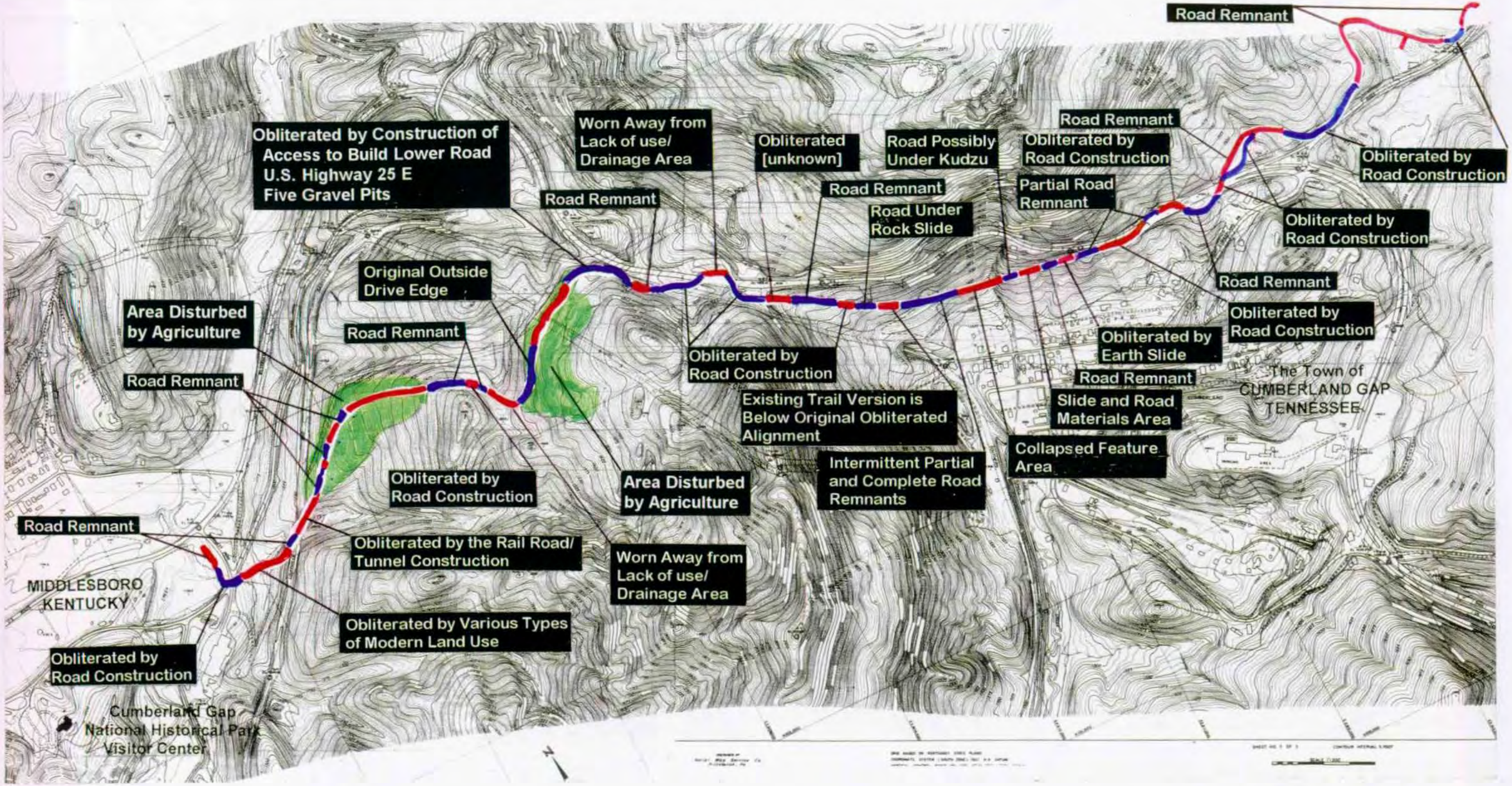
WILDERNESS ROAD ALIGNMENTS THROUGH THE SADDLE OF THE GAP



WILDERNESS ROAD EXISTING CONDITIONS

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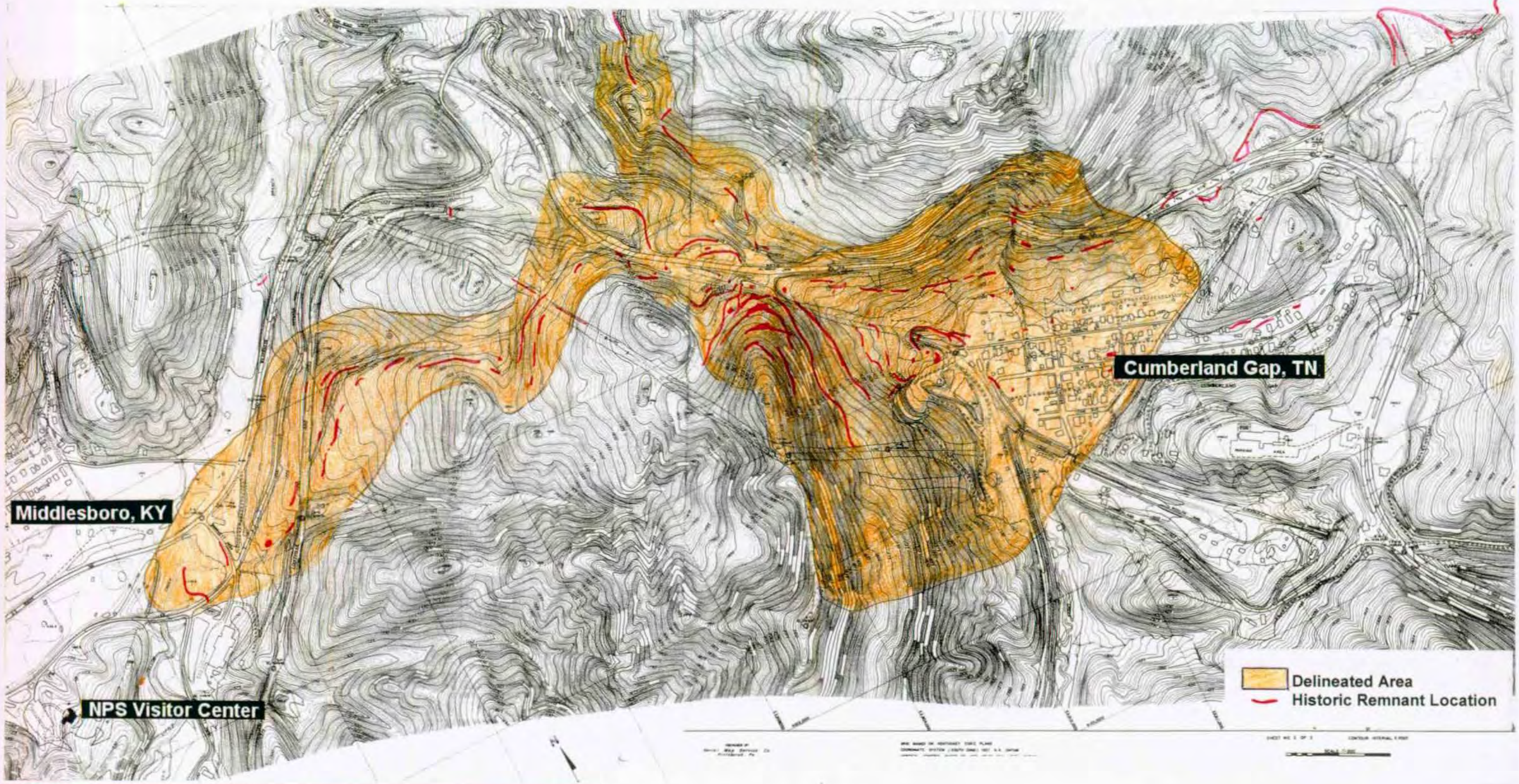

This sheet shows the total area hand-delineated, plus the physical locations of historic road remnants still on the ground today. These remnants were used to find and crosscheck the Wilderness Road location, and were instrumental in the rehabilitation of the topography at the Gap. Using the remnants facilitated the determination as to whether or not topography and the Wilderness Road had been disturbed from their original configurations.

HISTORIC REMNANT LOCATIONS

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Methodology

Goal of Methodology

The rediscovery and partial rehibilitation of the saddle of the Gap, Wilderness Road, Warriors' Path, Harland Road, and verification of segments of other historic roads/trails in Cumberland Gap National Historical Park.

Starting Point of Methodology

The principal starting-point inspiration for this work was a late 1800s-era photograph (photographer unknown) of Cumberland Gap (from Inman Photographers, Middlesboro, Kentucky, courtesy of Cumberland Gap National Historical Park photo collection) showing a bridge across the saddle of the Gap.[1] [Hereinafter, this photograph will be referred to as the historic bridge photograph.]

Other research documentation used included historic maps (18th-20th century) and photographs (19th-20th century), Federal Highway Administration (FHWA) topographic contour maps and 1938 aerials, NPS files, including park files, DSC roads and trails files, DSC Technical Information Center files, and the previously mentioned Krakow study and its supporting historical documentation.

(Documentation and research materials used for the preparation of this study will be deposited in the files of Cumberland Gap National Historical Park when the project is completed.)

[1] Apparently, the first earth was removed from the saddle of the Gap (i.e., first road improvements) to lower the steepness of the grade and thus enable wagons to get through without high centering. Hence the bridge was likely constructed to provide crossover access, because the earth removal left only limited access across the saddle.

Cumberland Gap

Initial Steps Undertaken

1. Establish the view shed of the historic bridge photograph, as the handwritten documentation on the photograph did not explain the orientation in a definitive manner.

2. Refine the features in the historic bridge photograph to enable a determination of its direction/orientation.

3. Determine the time of day and approximate season that the historic bridge photograph was taken.

4. Use FHWA topographic contour maps (1980s-era) prepared for the Obliteration Plan of US 25E as the first basis to study the orientation of the historic bridge photograph.

5. Use a solar book showing ranges for time of day, time of year, shadows, etc., to develop all possible scenarios and locate their positions on the ground in relation to the saddle. This was critical because there would be only one position that the building and its shadow would have in relationship to the sun as shown in the photograph.

6. Build a small model on the topographic map with a north orientation to see how the sun would strike buildings visible in the historic photograph. Physically apply annual solar chart information to the model. This procedure, in turn, reduced the scenarios from 4 to 2. Shine a portable light on the scale dimensional buildings on top of the map, thus recreating actual shadows. By reading the actual topographic map in relation to the photograph and comparing the shadow model to the photograph, the spot where the photograph had been taken from was concluded to be on the Kentucky side of the saddle, from north to south toward Virginia-Tennessee.

Information Obtained from the Steps

The initial steps:

1. **Established the viewing area (from and to) of the historic bridge photograph in relation to the Gap during the late 1800s.**

2. **Established the study area of the historic view shed and its topographical relationship with respect to present-day FHWA topographic mapping.**

3. **Established approximate position of the photographer on the ground when the photograph was taken.**

Next Problem to be Resolved

1. Identify the historic view shed by establishing a plan view to fit to present-day topography by researching maps, photographs, and aerials to determine what this view would look like.

2. This research led to the conclusion that it was not possible to validate a three-dimensional view shed from a one-dimensional plan view. Thus, the goal of the methodology was to recreate the historic view shed on the present day site, by locating the position of the photographer taking the historic photograph. The next step was to identify the correct historical viewpoint on the ground.

Next Problem to be Resolved

Because the historic view shed could not be proven from the plan view, research was required to prove the actual 1860s-era topographic features against present-day topography. That would determine which pieces of topography have been removed and which remain today.

Steps Undertaken to Resolve Problem

1. Conduct research of available materials on the saddle (photographs, maps, 1938 FHWA aerial photographs, NPS files, photo enlargements, etc.)

2. Study the site in relation to the available research materials.

3. During the research, a survey map was found, which showed the Polly Boyd Tract No. 74 prepared by the Engineer's Office of American Association Incorporated, a firm located in Middlesboro, Kentucky. This map was based on surveys conducted in 1903 and 1921. The map (hereinafter referred to as the Association Lands Map) showed information that related to 19th-century developments in the Gap area. The survey measurements on this map were noted in poles (one pole equals 16-1/2 feet in linear measure).

4. After converting poles to feet, the information was graphically overlaid on the Association Lands Map, then compared to present-day FHWA aerial photographs and topographic maps.

5. The Association Lands Map provided two points, Indian Rock and Boone Monument (placed by the Daughters of the American Revolution) easily identified on the ground today. These points provided not only graphic proof (scaled distances of features) but also validated the Association Lands Map. This, in turn, provided the area's original ridge lines and drainage features. This map also showed new road alignments that would be helpful later in understanding the evolution of the road network in the Gap area, and provided an explanation as to why pieces of the mountain continued to be removed to lessen the steep grade and provide for road widening through the area.

6. Further study of the historic bridge photograph compared to modern aerial photographs concluded that two road benches were possibly existing on the ground.

7. To verify that the road remnants existed, a site visit was made to check and compare the basic historic topographical features against present-day topography. To do this, the photograph's horizons, major geological features and mountain formations in the background had to be determined which, although disturbed, remained. These, in turn, would provide the basis for the next stage of verifying historic topographic features. Confident that the scenario was in the correct view shed, the first application of delineation[2] of the area's topography was developed before the site trip.

8. While at the site, the following steps were designed to develop and refine an accurate procedure leading toward re-creation/mock-up of the historic bridge photograph:

   a. Stakes were driven at the point where the photographer most likely had taken the photograph, in order to help verify the "expected view" from the photograph.

   b. The point was then plotted on the topographic map from where the photographer had most likely taken the photograph.

   c. After walking to the plotted point, a problem was encountered — the site was covered with trees which were not present at the time of the late 1800s-era photograph. Although the horizons, viewpoint, and stake position were believed to be accurate, the "expected view" was not visible because of the trees. Thus, the initial conclusion could not be proven. Although the camera viewpoint was found on the ground, there was no immediate way to relate this evidence to others, because of the heavy vegetation.

   d. Hart's background and training enabled him to visualize in "three-dimension." He mentally placed himself in the photograph, moved closer to the historic view shed portrayed in the photograph, then "backed out" of the perspective of the photograph and up the hill to the rear, in an attempt to reach the point from where the photograph had been taken. In backing out of the photograph, the viewpoints were cross-checked, verifying horizon points and more topographic points not seen earlier because of the trees.

   e. At this juncture, the correctness of the view shed was convincing, since in the intersecting cross-checks the same mountain configuration was visible in the background intersecting with the foreground. This was deemed correct, since entire mountain ranges do not move.

   f. Believing the research to be correct and hampered by the heavily-forested slopes, a method was then developed to verify the topography by moving closer to the view shed, thus refining the view of the historic bridge photograph.

   g. Permission was received from CUGA management to cut a line (minimal clearing of vegetation). Then, physically backing out of the perspective view of the photograph while on the actual site should logically intersect with the photographer's original position. This ended up very close to the pre-plotted position point of the photographer, cross-checking and verifying horizon tangent points.

   h. The view shed plotted on the modern topographic map was accurate.

   i. The area was then canvassed, seeking topographic points that were in the view shed of the historic bridge photograph but were currently hidden from view by existing ground cover.

   j. Several bench remnants of historic roadbeds were located, thus allowing verification of what was in the photograph. The remnant road benches needed to be tied to those visible in the photograph.

   k. To locate the remnants, the historic bridge photograph was recreated by "mocking up" the topographical features at their actual size on the ground, using some 4,000 feet of fluorescent flagging ribbon.

   l. The flagging ribbon was strung to distinguish the topographic "breaks"[3] that are visible on the ground, and hopefully prove the road benches seen in the historic bridge photograph.

   m. Flagging ribbon was used to delineate the road benches, recreating the historic bridge photograph as "tight" or close as possible on the ground, given the limitations of the heavily forested slopes.

   n. The next challenge was to recreate the historic bridge photograph by developing a technical perspective drawing. This was started by placing gauges (PVC pipe) on the ground, which consisted of 2-inch-diameter, 10-foot lengths of PVC pipe, painted in alternating segments — one foot of red, one foot of white.

   By backing out of the photograph, the pipe targets were continually realigned to refine the view shed for accurate recreation of the historic bridge photograph.

[2] Definition of delineation — Hart hand-applied with a 4.00 technical pen (a device that produces an ultra-fine inkline or dot) a fine-line inkline in three different styles to different kinds of images to enhance the topographic features so they could be specifically applied to many problems.

[3] Definition of "break"- A "break is any change or deviation in the elevation or lay of the land either attrubutable to natural causes or man-made activities

o. As before, trees posed a problem, necessitating a closer perspective within the view shed from the original photographer's vantage point.

p. Concluding the closer viewpoint was accurate enough, the photograph was again "backed out" of.

q. Concerns about elevation changes, the distance from the original photographer's viewpoint, and the heavily-forested slopes, any of which might distort the mockup evidence, led to other ways to refine the position of the photograph for the mockup, with corrected elevation and distance.

r. When use of a truck from the Middlesboro Fire Department (MFD) could not be placed in the correct location, MFD recommended contact with Jeff Campbell of Campbell Electric Company in Middlesboro. Campbell's truck allowed sufficient elevation to recreate the vantage point of the historic bridge photograph. Their assistance was greatly appreciated.

s. When the findings, such as locating the photographer's viewpoint and road remnants were presented to NPS management and staff, a determination was made to proceed with the fieldwork. The project then became a design problem, leading toward restoration of the original topography of the Gap.

t. Because of the time of year (spring foliage was appearing), and the impact of the project on the National Park Service design activities, a determination was made that the best method to further verify the conclusions and recreate the perspective of the historic photograph was to use a Department of the Interior-certified helicopter to conduct aerial and perspective photography in lieu of professional flight mapping.

u. Before employing the helicopter, a rudimentary survey was conducted[4], staking and mapping a combination of points visible in the historic bridge photograph and marked on the Association Lands Map at locations where those points were believed to be located.

v. Needing to establish gauges quickly to take aerial and perspective photographs, required the assistance of Frank Lyons (DSC), who placed 2-foot by 3-foot ceiling tiles next to the PVC pipes to accentuate these perspective targets. He also parked an NPS vehicle in the view shed. Al Hollister (DSC) painted 100-foot marks along the centerline of the existing (old) US 25E highway through the Cumberland Gap. Significant points from the historic bridge photograph mockup were also marked on the ground.

w. The helicopter was positioned above the point that research indicated was the location from which the historic bridge photograph had been taken. Maneuvering was done so that the horizon tangent points visible in the historic photograph were located. In order to obtain flat aerials, the helicopter was then maneuvered on its side, circling in a 360-degree pattern, enabling photography of the ground targets for future aerial mapping use. Confident that these re-creation shots were good, the adjoining study area was then photographed. These photographs proved to be of future value. The products of the fieldwork and helicopter photography were taken back to the office where a method was developed to apply this information to the historic bridge photograph.

x. A technical perspective drawing technique was applied to a selected 8-x 10-inch color print of one helicopter oblique shot, thought to be very close to the historic bridge photograph view. Clear film overlays were applied directly over the photograph. Using technical drawing techniques to construct a two-point perspective, and employing the on-the-ground PVC pipe targets, vertical alignment, vanishing points, and horizons were established. Then, using a 4.00 pen on the film overlay, the flagging ribbon that represented the historic road bench was traced. The helicopter photographs and overlays were converted to the same scale as the historic bridge photograph. By measuring the known common points in both photographs, the percentage of reduction difference (approximately 50 percent) was calculated and then printed out on color xerox paper. Everything was then converted to the same scale. In a composite view, everything fit - the graphic re-creation proved to be a match. This provided conclusive evidence that visual re-creation graphically applied to the historic bridge photograph did result in the production of an accurate re-creation of the Kentucky side of the saddle looking toward Virginia/Tennessee.

Next problem to be resolved

1. Having established the location from which the historic bridge photograph was taken and seeing what the Gap looked like from the Kentucky side, it was then necessary to look at the Gap from the Virginia/Tennessee side to verify that side of the saddle.

2. To define the appropriate study area, research was conducted using available historical and present-day resource materials, attempting to relate any additional information to the Virginia/Tennessee side of the saddle. A study area having a radius of four to six miles centered on the saddle and focused on the road corridor through Cumberland Gap was established.

3. The research/verification activities were based on a historic ca. 1862 photograph (courtesy of the Kentucky Historical Society) of Cumberland Gap looking toward Kentucky. This photograph shows the Gap area as seen from the Virginia/Tennessee side of the Gap. [Hereinafter, this photograph will be referred to as the "1862 photograph".] The next challenge was to verify this second photograph in relation to the historic bridge photograph, using the

[4]Definition of a rudimentary survey — Hart visually staked evidence to the ground without instruments (other than a hand-held compass and a 100-foot tape) and then marked the position of the hand-plotted stakes on present-day mapping.

same technical perspective approach to compare the topographic features in relation to those shown in the first photograph? To do so would require verifiable points on the Virginia/Tennessee side of the saddle looking toward Kentucky, like were found on the other side. A determination was needed of what topographic remnants on the Kentucky side of the saddle exist today, and points had to be found on that side and tied to points on the Virginia side to prove that they were the same.

This task was likened to one of constructing a huge mechanical drawing from specifications, without any specifications being available. There was a need to create a set of "specifications" by visually proving, on the ground, specific topographic remnants found in the 1862 photograph. The systematic comparison of these topographic remnants on both sides of the saddle, moved toward refinement of this reconstruction. The solution to this problem consisted of delineation and ground truthing to develop the "specifications".

4. A handwritten notation on the 1862 photograph indicated that another photograph existed. A second photograph presumably would provide an image that would give intersecting points that one could locate on the ground today. In pursuit of the matter, however, it was found that the "second" photograph was instead a side-by-side addition to the first photograph, which did demonstrate a relationship between the two sides of the saddle.

5. The historic Morrison House in present-day Cumberland Gap, Tennessee, no longer standing, was visible in the 1862 photograph. Knowing the approximate location of this structure provided the first point for verification purposes.

6. Realizing that the photograph must have been taken by a large format camera because of the year of its origination, the quality of an enlargement would be very good. The 1862 photograph showed that the mountain had been clear-cut for defensive purposes during the Civil War. Clear resolution of an enlarged photograph would permit better isolation of the visible topographic features. Van Brower, an offset photographer in the Denver Service Center graphics department, enlarged the photograph to various sizes and exposures, coming up with the best sizes for detail.

7. Taking this photograph, the only other evidence relating to the Kentucky side of the saddle were old 5-and 10-foot contour FHWA maps. Again using a mechanical drawing approach, points needed to be found that would to tie to the photograph taken from the Kentucky side of the Gap. The basic delineation system (see Footnote No. 2), was applied to the photograph. At this stage, the delineation system consisted of using a 4.00 pen on a clear film overlay on the enlarged photograph. Intricate hand lining enabled a better view of the breaks in the topography.

   With sufficient information on both sides of the Gap, it became evident that the reconstruction of the saddle could now be accomplished in a historically accurate manner whereas before this would have been based purely on conjecture.

   The Spring "leaf-out" was severely hampering the transfer of information from the delineated photograph to the ground. Study of the photograph continued, in order to find at least three points. Studying the photograph and its delineation in comparison to modern-day aerials, provided confidence that the historic road benches in the photograph could be found on site. Applying this evidence in the field with extensive ground-truthing, resulted in evidence of numerous road alignments.

   About 5,000 feet of scattered road alignment segments were flagged, while canvassing both sides of the mountain. Some locations were revisited four or five times to understand their relationship to the photograph. Confident that enough historic points for further refinement of the technical perspective drawing were available, the fieldwork data was applied to 50-scale present-day mapping.

8. With a heavily forested area and limited mapping, the view shed was re-created and the field results applied to the FHWA mapping. Tying a now-suspected road alignment to the ground and to the other side of the saddle, required re-creating the photograph by pinning weather balloons to road remnants. The balloons had to be sufficiently high so they were visible above the trees (at 4-6 points), thus creating the positions of historic points in the historic ca. 1862 photograph to present-day topography. This allowed a basic re-creation of the historic view shed in the 1862 photograph. The Bureau of Standards in Boulder, Colorado, loaned a helium regulator and donated weather balloons for the project.

9. At this point in time, NPS design activities became directly involved in the Gap restoration process and the designers determined that they needed a two-foot contour topographic map of the saddle of the Gap. This design requirement caused a major change in Hart's procedures.

Significant Shift in Procedural Direction

1. The two-foot contour topographic surveys developed for the saddle of the Cumberland Gap area, and the FHWA two-foot contour aerial topographic maps of the Virginia-Tennessee side of the Gap that were made available provided better tools for verification and refinement than the 50-scale FHWA maps. These present day surveys led to the idea that both view sheds of the study area could be technically applied to the ground, thus proving the historic position of topographic features to present-day mapping. These surveys changed the procedural direction.

   Use of these surveys pointed to the possibility that the historic view sheds of both historic photographs could be re-created via computer. This led to a reexamination of known fieldwork and historic research materials, resulting in extremely tight delineation of both view sheds in both historic photos. By using a technical perspective approach, the newly-acquired data would enable the development of an entirely new level of technical accuracy. The field was revisited with this new site-specific information. This was an application of the specific topographical formations found within the view shed of both photographs, including various roads and road segments. Hundreds of feet of lines were flagged and cut to prepare for surveyors who would survey coordinate positions and traverse lines. While the teams conducted two-foot contour surveys, they were directed to also survey the newly developed information, representing the historic photograph and its features. The road benches and site specific points were scattered over a broad area involving a 700-foot elevation change, covering the town of Cumberland Gap, both sides of the saddle, and both sides of the mountain to a point below Cudjo Cavern (Gap Cave).

2. A very complex exercise was undertaken with DSC staff and Survey Chief Ted West, Eastern Federal Lands Highway Division, FHWA, Sterling, Virginia, to merge four kinds of digital survey data into one composite survey database.

3. West was asked to produce a computerized wire frame model of the same view shed as in the photo to enable a determination of where the photographer was standing when he took the 1862 photograph. To aid West's work, the view shed of the historic photo was "cropped" on present-day topographic mapping and points marked that were visible in the photograph and had been located on the ground during the fieldwork.

4. A survey triangulation system was devised, tying into the historic points that had been found previously on the ground. This triangulation system covered both oblique and flat mapping perspectives. Triangulation of the points was applied to flat topographic mapping with the view shed of the historic photograph marked on the map.

5. DSC personnel submitted the coordinates of the historic points to West, who provided a wire frame overlay that matched the view shed in the Civil War-era historic photograph. This visual verification was another stage of refinement on the Virginia/Tennessee side of the saddle, proving this was close to the view shed of the 1862 photograph. By overlaying the historic photo delineation on a computerized image, the corresponding features matched with very little adjustment.

   The procedural accuracy was verified by the example of the Red Maple tree. Coordinate points were provided from the saddle survey, which included tree sizes. Study of these points showed the location of a 16-1/2-foot (circumference) tree. One of the surveyors, Billy Parker, had measured a tree within the saddle area. The measured tree appeared to be in the same location as a tree visible in the historic photograph. Because of the size of the tree, a decision was made to use it as a point in the triangulation system to pinpoint the location from which the photograph had been taken.

6. The next step was to determine the point from which the historic ca. 1862 photograph had been taken. The photograph had been taken so far from the saddle that there was a need to "get closer" to the view shed of the saddle to refine site specific information.

7. Again relying on the capability of the large format camera that had undoubtedly been used to take the photograph, it was decided to focus on the saddle area to see if it would hold up under even more enlargement. The image held up well. This was an actual photograph of what the saddle topography looked like before being disturbed.

8. Several graphic steps of dot (stippling) delineation followed. Pieces of topography in the enlargement were enhanced and matched with similar line-type delineation on the FHWA two-foot contour aerial survey, enabling the isolation of historic remnants on present-day terrain. This, in turn, proved which remnants could still be located on the ground and isolated remnants that have disappeared.

9. With these findings, DSC personnel assisted in an attempt to recreate the view shed of the historic photograph on a computer, using on-the-ground surveys, coordinate positions, and historic points on the photograph. Color-coded computerized vertical lines in one-foot-gauge increments were used — a refinement of the same methodology of applying technical perspective drawing methods to a computerized three dimensional model. Available information was combined to move the photo viewpoint closer to the saddle. This allowed the re-creation of a closer view of the saddle area, which led to the conclusion that the Red Maple in the photograph was the same tree that exists on the ground today. Although the reconstructed view was slightly off, the accuracy was judged to be sufficiently high.

10. Summarization — At this point, recreating the view shed in the historic photograph was very close, but it was not cost-effective to continue this endeavor until delineation of the Virginia-Tennessee side of the saddle was completed. Therefore, the next task was to determine how to reconstruct the missing historic topographic pieces by further tying both sides of the saddle together.

Next Stage of Refinement

After the two-foot contour topographic surveys of the saddle had been completed, the points from the historic bridge photograph had been translated into coordinate positions, and most of the coordinate points for the remnants and the traverse lines of the old road benches had been determined, it was necessary to apply this information to the view from the Kentucky side of the saddle looking toward Virginia/Tennessee. This refinement would provide further opportunity for cross-checking.

1. This refinement involved the technical application of modern-day surveys to the graphic recreation of the historic photographs. DSC staff entered the historic viewpoints of the re-creation into a computer wire frame. If the conclusions were correct, all the re-created historic viewpoints on the wire frame would match, when overlayed, with the graphic re-creation of the historic photographs.

2. Confidence was high that the computerized reconstruction would be a close match to the recreation of the historic photograph. The map coordinates of the "viewing from" and "viewing to" vantagepoints in the historic photographs were determined. The coordinates, as well as a graphic image of what the wire frame was expected to look like, were sent to West at FHWA.

3. West provided a three-dimensional contour wire frame, demonstrating that the computerized reconstruction was very accurate when compared with the historic photograph.

4. West also provided merged computer files, including the two-foot contour ground survey, FHWA aerial survey developed from the two-foot surveys, and other surveys subcontracted to Vaughan & Melton, Middlesboro, Kentucky.

5. Complications relating to transfer of computer data, and the incompatibility of the NPS and FHWA computer systems, resulted in the transfer of the computer database to the FHWA office in Denver, Colorado. When the gigantic size of the database proved too cumbersome, it was cut to eliminate all data not pertinent to the historic image.

6. Using the same technical perspective drawing approach applied to the computer, significant points and topographical features were triangulated to recreate a wire frame that would hopefully fit the historic view shed. The exact coordinates from flat mapping were determined. Use of triangulations, photographic view re-creations, fieldwork and survey points allowed the determination of the coordinates of "viewing from" and "viewing to" vantage points relative to the historic photographs and the wire frame.

7. Several adjustments further refined the application of the wire frame model of the existing topographic survey overlaying the ca. 1862 historic bridge photograph. Using a technical perspective drawing approach, vertical targets were drawn on known ground features visible in the historic photographs. Adjusting the same system to survey the same features in the computer image brought assurance that they were triangulating the correct view shed as closely as possible. Fine adjustments continued until the triangulations matched, proving the topographic features in the photograph corresponded with the computer model, with cross-checked coordinate positions "hitting" the same topographical features. This provided further proof of the view shed and gave the current coordinates at the camera position that would be required later to complete the final grading plan.

8. Refinements going far beyond what was originally expected led to the conclusion that it might be possible to prepare construction drawings for the physical restoration of the Gap topography to the 1780-1810 era. This required the formulation of a way to isolate the remaining original topographic remnants and recreate the topographic features that had been removed. In theory, the re-creation and proof of a view in perspective, and subsequent application to a plan view, should result in a grading plan. The difference between the re-created wire frame and the historic bridge photograph would lead to the amount of material needed to be imported to the site to reestablish the original features and contours as envisioned in NPS planning documents.

Next Stage of Refinement

1. Since computer program capabilities did not allow one to assign elevation to a perspective view, the large amount of missing topographical pieces would have to be identified and assigned "intelligence" for the computer to recognize it.

2. The combined re-creation methods proved the historic topography to be the same as shown in the historic bridge photograph. In order to re-create the historic view, it was necessary to isolate individual topographic pieces that were missing, then compare them to specific topographic pieces presently on the ground.

3. Examination of the different sizes and exposures of the historic bridge photograph, showed that the quality was good enough to apply a more refined (upgraded) delineation process. Dots applied with a 4.00 pen embellished the topographic points in the historic bridge photograph, resulting in high detail delineation.

4. If delineation could be applied to the modern-day drawing, it might be a way to prepare an accurate historic topographic model.

5. Research was conducted to locate available historical documentation relative to the Kentucky side of the saddle looking toward Tennessee.

6. With a focus on the Kentucky side of the Gap, work progressed toward the re-creation of the Kentucky side of the Gap in a plan view, a step that would lead toward preparation of a grading plan.

7. This required developing a system of delineation which applied to the grading plan topography and its relationship to present-day mapping. This involved a meticulous "step-by-step" methodology:

   a. This delineation enabled Hart to apply the actual configuration of the historic topography into a plan view on present-day mapping.

   b. The delineation of historic topography remnants compared to present-day mapping was difficult, with reference material in different scales, views, and perspectives. The end product was to provide a detailed plan view, with an understanding of how the land had been altered.

   c. This process had to isolate refined pieces of topography to determine whether the same topographic shapes were intact or had been changed.

   d. Use of the line-type delineation system to accentuate topographic features and thus "read" them better, led to merging previously delineated modern and historic topographic features and applying them accurately to present-day mapping.

   e. Having all reference materials at the same level of delineation enabled the isolation and location of the same topographic features on the Vaughn & Melton two-foot contour map. This led to discoveries of large pieces of topography, which were then located on present-day two-foot topographic map. This procedure produced a puzzle-like outline of land features on topographic map.

   f. Matching the puzzle pieces between present-day and historic topographic shapes proved the position of historic topographic pieces on present-day topographic maps. If a piece in the puzzle was missing, it would be obvious, because there would be no match.

   g. Larger pieces of the puzzle were refined further in the same manner. The end product was expected to be a grading plan having a degree of accuracy of approximately 1 to 2-foot contours. There was still no way of obtaining accurate elevations on the plan view. A method to figure elevation would have to be developed later.

   h. Summarization — Hart determined that he had all necessary information, but not the process, for preparation of final construction drawings for the Kentucky side of the saddle.

Wilderness Road - Virginia / Tennessee Side

After establishing the historic topography for the Kentucky side of the Gap, attention turned to the Virginia/ Tennessee side of the Gap. The goal was to prove the topography on that side of the Gap to the ground, and bring that work to the same level of refinement as that of the Kentucky side.

Restudying the reference materials brought several matters to mind, including (1) the configuration of road alignments (i.e., switchbacks), as shown in the obscura print and the 1833 Survey Map; and (2) that something was incorrect with the road alignments.

Points from all available sources were delineated in an effort to try and find consistency in the topography in the early road alignments (including the FHWA wire frame). The list of sources from which points were delineated included:

1. **Obscura print**
2. **Civil War-era photographs**
3. **Two 1800s-era photographs**
4. **1833 Survey Map**
5. **FHWA 2-foot topographical maps**

Pieces of topography (approximately 300-600 square feet in size) were delineated from these sources, each of which were of a different scale and taken from different angles. The same topographical piece was taken from each source, isolated by way of delineation so the form could be observed. Then each piece was applied to modern mapping with its own delineation. This process allowed for checking/cross-checking to ensure that the pieces delineated were the same topographical piece.

While delineating the topographical features from the various resource materials, the 1833 Survey Map resurfaced. Up to this time, it had been dismissed as an illustration, not as a technically drawn map. Now, when delineated and compared with other sources, smaller pieces of topography (approximately 100 square feet or smaller) began to match, thus providing a more detailed refinement matching previous topographical shapes. The 1833 Survey Map was found to be very accurate; it appeared to be based on the use of a 100-foot chain, providing regular topographic breaks. This led to a focused effort to prove the accuracy of the map.

Starting with two known points — Cudjo Cavern and the saddle —13 pieces of delineated topography on the 1833 Survey Map were isolated. They matched 13 pieces of delineation on a present-day map when overlaid, leading to the conclusion that the 1833 Survey Map was accurate.

The 1833 Survey Map showed an upper road that was not U.S. 25E. The map indicated this was the "Virginia Road," another name for the "Wilderness Road." Thus, it was concluded that present-day U.S. 25E did not follow the historic Wilderness Road alignment, or vice-versa. NPS management was informed that this discovery posed potentially serious design concerns, because the agency was planning to restore the Wilderness Road, believing it to be on the same alignment as U.S. 25E.

Needing to prove the board work out on the site, the delineations were taken to the park. First, the entire site was reviewed. One of the first applications focused on three topographical points — a rectangular-shaped water system structure, the saddle, and a section in between the two. Evidence was sought by chaining, staking, and cutting a line, following the alignment on the 1833 Survey Map as applied to present-day mapping. Topographical remnants matching previously delineated topographical pieces were located in the field. Hart was able to identify the same shapes on the ground that were previously delineated by hand. The results of this work led to a conclusion that this was the correct alignment of the historic Wilderness Road.

Next, this alignment was to be staked and surveyed. However, when a steep embankment was encountered on the forested slopes at Gap Creek that blocked the historic alignment of the Wilderness Road, the information sources were again rechecked for accuracy.

By delineating specific features from an historic photograph that showed the Wilderness Road crossing Gap Creek, a missing landform identified[5]. Convinced the fieldwork and research provided an answer to questions surrounding the missing landform, the staking of the downhill portion of the Wilderness Road to the O'Dell House was completed.

Approaching U.S. 25E, delineation showed a landslide near the spot where the 1833 alignment swung back to the present U.S. 25E. An "X" was therefore painted on the pavement to see how close chaining and staking would coincide with the historic alignment of the Wilderness Road.

With confidence that this was the right alignment on the ground, a way was designed to prove the conclusions by overlaying the 1833 mapping on present-day mapping, figuring the coordinates and then independently entering the coordinates into surveying equipment. The coordinates would have to coincide with this alignment to prove it was accurate. Two weeks later, NPS received the survey results, consisting of a map showing where coordinates hit the ground. That map was applied to the FHWA two-foot topographical map with the 1833 Survey Map independently overlaying both. All of the coordinates hit the historic alignment the entire distance up the mountain with one minor exception, which was later corrected on the ground. Furthermore, when the Association Lands Map was overlaid on these surveys, it also matched. The survey work was accurate.

[5] Later in March 1998, Hart provided graphics representations of the "missing land bridge" at an open house in Cumberland Gap National Historical Park. This material was presented to explain the "land bridge" issue to lay persons and to address questions relating to its "mystery." To prepare the graphics, Hart took the following steps: (1) He took an 1880s-era photograph and enlarged that specific area of the photo that showed the road bench continuing across the creek along the approximate alignment shown in the 1833 survey; (2) To confirm the 1833 survey alignment, he employed his previously-used delineation system in very high meticulous detail to enhance the topography of the "missing land bridge" in the photograph, and taking the 2-foot on-the-ground FHWA survey and previously-used delineation system, he used a fine line pen to delineate the breaks; (3) As a result, he was able to compare the missing pieces of topography in the photograph as they relate to the present-day topographical pieces; and (4) Hart relayed the information to Ronal Kerbo, National Cave Management Coordinator of the National Park Service. Mr. Kerbo relayed that on-going karst processes, cave stream resurgence, and surface erosion caused the feature known as the "land bridge", to collapse. Hart took an early 1800s-era obscura print that showed the missing "land bridge" from another angle, and, using minimal delineation, verified the same topographical piece, leading him to believe that his evidence was conclusive.

Warrior's Path / Lower Virginia Road

1. As a result of the research and fieldwork, Hart had become very familiar with the topography of the Virginia-Tennessee side of the Wilderness Road alignment, concluding that the switchbacks shown on Civil War-era photographs and maps did not appear to coincide with the road configuration in the early 1800's-era obscura print.

2. Little credence had been given to the obscura print, as it appeared to be hand-painted, and of questionable use as a technical reference document.

3. A xerox copy of the obscura print was stipple delineated in the field, showing that a number of features matched with other research materials. The delineation exposed a high degree of accuracy/credibility. The obscura print merited further study as a source document, so the earliest generation, highest quality image was obtained, and enlarged to a 30" x 40" print.

4. Using a large number of dots on the image and an overlay, the trail from the Gap's saddle down to the present-day town of Cumberland Gap was delineated. This resulted in an almost exact match, proving the obscura print was accurate and could be used as a technical reference.

5. A continued embellishment of the obscura print's delineation brought out topographical forms that were visible in the 1860s-era photograph.

6. Similar topographic remnants were isolated and applied to the present-day FHWA 2-foot topographical maps.

7. This led to a new discovery of possible significance. NPS Historian Jere Krakow, who worked on research at CUGA earlier, was consulted when the Warriors' Path appeared during delineation. This path was discussed and described in Dr. Walker's mid-18th century description of the area.

8. The obscura print shows switchbacks on the northeast facing slope (instead of the southwest) of the mountain looking toward Kentucky.

9. The accuracy and credibility of the obscura print led to a new historical finding. Researchers heretofore had assumed the switchbacks in the 1860s-era photograph were on the southwest facing slope of the mountain looking toward Kentucky. This new find represented the earliest known Indian path through the Gap, determined because the early writings of Dr. Walker and early trail maps showing a route up Cumberland Mountain from what is now the town of Cumberland Gap, Tennessee. The obscura print showing the use of wagons matching the recovered remnants, led to the conclusion that the Lower Virginia Road was also for the most part the Warriors' Path. What is not known at this time is if this is also the first road built by Congressional order, as the first two-way wagon road on the Virginia/Tennessee side of the mountain in 1775.

10. Convinced this find was significant, NPS directed Hart to finish applying the procedures to the ground to ensure accuracy.

11. With photographs and the obscura print, topographic remnants were identified, isolated, delineated, and compared to remnants in the 1860s-era photograph and obscura print, and applied to present-day FHWA 2-foot topographical mapping.

12. As a result of matching remnants, the entire Warriors' Path alignment (approximately 3,000 feet from the NPS exit road at the Iron Furnace to the top of the mountain at the saddle of the Gap) was identified and applied to FHWA 2-foot topographical maps.

13. By applying these findings to the ground, the hope was that Warriors' Path remnants could be found on site. Coordinates were calculated as to where the path should be located on today's mapping. In heavily wooded terrain, a line was cut to clear the way, and the path's alignment was flagged up the side of the mountain.

14. The surprise was finding clearly visible remnants of historic topography, as well as path remnants, on the ground that were so precise they could be located nowhere else. These findings helped to confirm an understanding of the Warriors' Path's alignment as progress was made up the mountain.

15. The first major switchback on the alignment (the earliest one and shown in the obscura print) of the Warriors' Path posed a dilemma. Confident the line cut and flagged was the correct alignment of the Warriors' Path, Vaughan & Melton was hired to survey the line. Positive that the delineated puzzle system as applied to present-day mapping was accurate, the surveyors were directed to plug in the coordinates to see if they "hit" as Hart guided them up the mountain.

16. During the trek up the mountain, everything matched up to the second switchback, the survey began to diverge, indicating a possible error. Reevaluating the flagging and mapping, the second switchback was re-flagged at a lower elevation believed to be a more correct alignment. With this adjustment, the coordinates came back on line, and the procedure corrected itself.

17. Topographical features and the path's alignment cross-checked all the way up the mountain except for the last 150 feet — a location not shown in the photograph or the obscura print. There was only one way to the Gap, through the area where the present-day concrete steps are located at the end of the existing Iron Furnace Trail to the saddle.

18. There is still the unanswered question as to which of the road traces were made "wagonable", to include the Upper and Lower Virginia Roads. Since the object of this study was intensely focused on the Gap rehabilitation/grading and locating the Wilderness Road alignment, time and funding for such ancillary research was not possible. We may never be positive which track was the one constructed for the United States Congress. Hart feels that Boone's original Wilderness Road trace was abandoned, because it was too narrow, with side slopes too steep to permit safe two-way wagon passage. Hart believes that the Warrior's Path was then improved to become the main and first wagon passage from the Virginia/Tennessee side. That track went directly through downtown Cumberland Gap, Tennessee.

Cudjo Cavern

1. While the early 1800s-era obscura print had proven to be accurate, it was generally known that the historical front of Cudjo Cavern had been removed, presumably during some phase of the construction evolution of US 25E.

2. Hart noticed that the original cavern front was in the obscura print. The cavern image was delineated in precise, enlarged detail.

3. Familiar with the existing cavern entrance, there was also a portion of the existing vent hole that appeared in the obscura print.

4. NPS determined this find was sufficiently significant to take the historical front of the cavern to a stage of "re-creation" that would provide a view of what topographical features were still intact in relation to the image in the obscura print.

5. When the same general method used with the helicopter at the saddle of the Gap to determine historical topographical features was not allowed, another new procedure to obtain the necessary information had to be developed.

6. To recreate the point of view from which the obscura print was taken, the alignment of today's mapping in relationship to the cavern was determined. After establishing the angle of the obscura print, Hart moved in as close as possible with a modern-day camera to re-create the obscura print's view. Using the vent hole as a focal point, along with applied flagging and placement of several 8-foot pickets to serve as markers or measuring gauges, an angle and size relationship to recreate the perspective in the obscura print was refined.

7. Then, a highly detailed delineation of both the obscura print and the modern photograph was done, using clear film and overlays for each.

8. Later, the scales of the obscura print and the modern photograph were adjusted so that they were the same.

9. Overlaying the delineation of the modern-day photograph on that of the obscura print allowed a determination of which topographic remnants from the obscura print were still extant and which had been removed. The delineations were very close. Discolored areas on the photograph show the topographical shapes that have broken away.

10. Although this provided sufficient evidence to take the cavern front further as a re-creation, the work stopped here since NPS determined not to reconstruct the cavern front.

Wilderness Road - Kentucky Side

1. Hart was asked to look at how the Wilderness Road segment inside the park boundary in Kentucky tied into the saddle of the Gap and Indian Rock (one of the principal benchmarks for this study), as well as the continuation of the road northward into Kentucky outside of the park.

2. At the time he had not seen any part of the Wilderness Road alignment on the ground on the Kentucky side of the Gap, and had limited mapping (1862 and 1927) of that section.

3. Acquiring a working knowledge and preliminary overview of that section of the road, required walking the entire Kentucky alignment within the park boundary. This produced evidence the Wilderness Road alignment passed along the south side of Indian Rock.

4. The alignment was walked and the area examined in relation to available mapping. The main problem relating to the alignment was at the top of the ridge above Indian Rock where the road curved to the left. It was impossible for the Wilderness Road alignment, as previously mapped at that curve, to fit the 1862 mapped configuration.

5. This area was changed — approximately one-half of the ridge above Indian Rock and about 600 feet of road alignment in the curve's vicinity had been disturbed by four gravel pits. Evidence of the road at the curve was missing/destroyed.

6. Krakow was consulted to obtain historical background information about the Kentucky side. There were two parallel road alignments on the Kentucky side — the upper alignment had been designated the Wilderness Road by Krakow. The lower alignment (which generally parallels the upper alignment some 80-200 feet in distance and 50-125 feet vertically) was also a well-defined road. The missing road segment at the curve led to confusion as to the direction of the road and which alignment was correct. There was no detailed present-day map of the project area, only the 1927 map with 200-scale, five-foot contours. Lack of precision in relation to the 1862 map meant that more "on-the-ground" evidence was required.

7. A comprehensive "ground-truthing" exercise of the approximate 6,000-foot alignment on the Kentucky side of the saddle resulted in finding several intersecting and crossover road remnants connecting the two parallel road alignments.

8. Several days were spent cutting lines and flagging all remnants that connected with the two parallel road alignments.

9. Working with several different scales, the 1862 map was graphically applied to the 1927 map. This application of mapping to the ground-truthing and flagging led to developing several scenarios that might explain the findings.

10. Certain that the previously presumed alignment in the disturbed curve area was not the historic Wilderness Road, there was confidence that the answers were in the disturbed area. There was no current survey to determine precisely the ground relationship to the 1927 map.

11. "Eyeballing" the disturbed curve area led to an educated guess as to where the correct Wilderness Road alignment would probably have been located. Since topography had been removed by subsequent road building, points in midair were assigned which designated where the most logical alignment of the road would have been located in the disturbed area.

12. Since there were surveys for the upper road alignment, a survey was undertaken to tie the lower road alignment to the available historic mapping. The belief was that this endeavor would enable a determination of which road alignment best fit the 1862 map. Application of this lower road survey to the 1927 map should answer this question.

13. A graphics transfer application was used relative to the 1862 and 1927 maps to figure the coordinates. The coordinates kept hitting approximately 50-80 feet above, but parallel to, the lower road alignment. The finished survey tied in road remnants and crossover pieces and other on-the-ground evidence. Several road alignment cross sections were also prepared.

14. As a result of the graphic application of all of the material obtained from the studies and surveys, one scenario kept hitting higher up on the mountain slope on the descending portion of the Wilderness Road on the Kentucky side of the Gap.

15. More evidence was needed to verify this scenario. Just above the railroad crossing of US 25E, three roadbed benches about 80-100 feet apart were found. All three alignments disappeared into the cut of the US 25E tunnel.

16. The FHWA office at CUGA provided survey maps of the tunnel approach that predated construction of the railroad bridge and tunnel. The scenario was restudied with the newly obtained mapping, and the findings applied to the 1927 map.

17. Hart cut the first 100-200 feet of the alignment for all three road benches, then walked each alignment. Knowing that the area had been cultivated or used as pasture during the 1930s, each line was walked to see where it would come out in relationship to the upper and lower road alignments.

18. Using the FHWA maps, the 1862 map was graphically applied to the scenario, attempting to determine which of the three road benches best fit. The existing power line served as a guide to relate to the 1862 map.

19. Finding that not only had the ground around the tunnel and bridge been disturbed as a result of their construction, there was also disturbance by the installation of a power line (shown on the new map). The mapping application was thrown off course by the fact that the power line had subsequently been moved. This was resolved by studying the relationship of the original railroad bridge to the disturbed ground, clarified by a rough survey. Of the old power line alignment only the poles remained. To determined where the power line had been moved and which pole was still relevant to the ground and the FHWA survey, Hart tied his position to the 1927 map and tied angles to the existing railroad bridge. This determined the middle bench of the three best fit the 1862 map.

20. With visible evidence of a remnant of the middle alignment, there was confidence that the determination was correct. To more fully answer the road alignment question, other remnant evidence was ground-truthed outside the immediate study area. Among things checked were 20-25 other topographical remnants that hit the 1862 map on today's mapping as far as five miles away. These findings further verified the accuracy of the 1862 map.

21. At this point, all the necessary evidence was in hand. Understanding the accumulated information and the ramifications of the findings posed concerns of how to explain this in a way others would understand.

22. The next task was to combine all pieces of evidence — historic/present-day surveys, maps, photographs, etc., relate the pieces to each other and to the ground, then tie them to present-day mapping. The graphic application of this evidence resulted in production of a composite overlay that presented proof of the entire Wilderness Road alignment. The composite overlay was significant because it visually showed where the Wilderness Road alignment was in relationship to the existing ground. The composite possessed a high degree of technical accuracy, thus enabling the alignment to be staked on the ground and tied all extant road remnants together.

The following information was applied to the composite:

a. 1862 map of Wilderness Road graphically applied to 1927 five-foot contour mapping.

b. Composite of five on-the-ground surveys conducted by Vaughan & Melton for this project on the Kentucky side.

c. DSC staff applied 100-foot grid system to the composite.

d. After DSC staff made a composite of all modern-day surveys, two scales were printed out — one to be applied to the graphics representations and one of larger scale to be used for field checking.

23. The principal question now was whether the upper or the lower road alignment was the correct one after passing through the disturbed gravel pit area - did it come out on the upper or the lower road alignment?

24. Hart graphically applied the modern-day composite in a clear film form to one base using the 1927 five-foot topographical map as the overall base.

25. The correct positioning of the 1862 map was initially derived by application of a rudimentary survey of features to the overall composite, involving verification of how accurately the 1862 map fit to the ground and to the 1927 map.

26. Next came a graphic application to the composite of about 20 on-the-ground road remnants that had been examined and coincided with historic mapping.

27. The middle road bench alignment required verification by present-day surveying. Vaughan & Melton added one point to the recent survey. Once this point in the road remnant was located, it pinned down the Wilderness Road alignment on the Kentucky side, locking the 1862 alignment into the correct position.

28. Graphic application of the rough survey that had now been verified by present-day surveying methods established that the upper road alignment was the correct one. After passing through the disturbed gravel pit area, the Wilderness Road alignment came back on the upper line. This graphically applied evidence was conclusive, since so many on-the-ground remnants matched the remnants on the composite graphic.

29. Corroboration of the conclusions involved showing the graphics to David Atwell, a certified engineer at Vaughan & Melton Company. Atwell concluded that the field findings and graphics were true, and that the coincidence of so many remnants was proof of accuracy. Atwell observed that "geometry does not lie," and that the identified Wilderness Road alignment was, in his opinion, correct.

30. There is further evidence relating to the questions of why and/or why not there are visual remnants on the ground today. This evidence, which provides further evidence of the accuracy of Hart's work, is shown in two photographs taken during the 1920s and in 1938. The photos show that two areas where the road remnants end were used as agricultural fields at the time they were taken. It was obvious that the fields obliterated the road alignment.

31. Oblique and aerial photographs and a rendered topographical map, demonstrated from three different viewpoints that the lower alignment did not exist until after 1927. Further study of the 1927 topography as it relates to modern-day elevations proved that an area (approximately 500 feet west of the gravel pits off US 25E) on the Kentucky side was disturbed after 1927. This disturbance was shown on the 1938 photograph. Hand drawn cross sections showed that the amount of earth removed from the disturbed area was approximately 11 feet deep at the center of the lower road access cut, and obvious that the disturbance was man-made. Hart also concluded that the disturbed area was the main passage to the lower road alignment, convinced that the combined evidence of the historic photographs and mapping indicated that the lower road alignment did not exist until after 1927. Therefore, it could not have been the Wilderness Road.

32. At the other end of the lower road alignment, there was no "natural" way for a roadway to climb out of the hollow bordered by a steep ridge. A man-made road alignment had been constructed to get the alignment out of the hollow. Prepared cross sections showing the parallel road alignments as well as the steep ridge concluded that a man-made road to compensate for the ridge would not have been constructed during the 18th century. The upper road alignment, on the other hand, was located on ground that was sufficiently flat for both an 18th century road and a later agricultural field.

33. Observing that this combined evidence shows that the Wilderness Road alignment passed from the saddle of the Gap toward Kentucky, behind Indian Rock, and then to the ridge top where it hits

another disturbed area just before the gravel pits, Hart noted:

a. The 1920s photograph of Indian Rock (with the Harley sign visible) shows the road rising dramatically west of the rock.

b. The 1862 mapping and modern-day surveys of extant road remnants coincide, which proves that the upper road alignment is the correct one.

c. The 1920s-era oblique photograph shows the road above Indian Rock.

d. The historic Association Map tied to the original work on the saddle also ties to the upper road alignment behind Indian Rock.

34. Ground-truthing the disturbed area (described above) made it difficult to understand where the Wilderness Road alignment ran after leaving the ridge top. Revisiting the 1920s-era oblique photograph led to re-cropping that specific area of the photo and then applying delineation. This provided a graphic showing what the area looked like before it was disturbed. The photograph showed the road bench disappearing into the gravel pit. Reviewing the totality of the evidence, resulted in a likely scenario to explain what might have happened. The more natural lay of the land of the upper road alignment that extended into the hollow was cut off by construction of the railroad in 1890. The railroad cut off use of the hollow for travelers who wished to ascend. Thus, it forced other paralleling man-made alternatives because the historic Wilderness Road alignment was cut off from further use.

35. Preparation of field maps from what appeared to be overwhelming evidence still needed to be applied to the ground. Three-foot-long oak stakes, painted florescent orange, were used for staking the findings to the ground. Old mapping was not sufficiently precise. By combining all evidence in graphic and technical form, Hart was able to determine very precisely where he was on the road alignment.

36. Because of the need for a set of field maps, DSC staff applied a ten-foot grid onto the 100-foot grid so that location in the heavily forested terrain was more accurate.

37. A Polaroid camera was used to take a photograph of the view shown in the historic 1920s-era photo with the Harley sign, thus re-creating this view shed. Further study showed a large rock in the historic photo that matches a rock still on the ground today. By comparing the historic 1920's-era photograph with the Polaroid photograph, it was revealed that certain topography was missing along the road bench behind Indian Rock. Visible road remnants were staked to the area disturbed by a gravel pit. Rocks in that location were ground-truthed using visual evidence compiled from historic photographs.

38. The combined mapping effort then started. From a known measuring point where the overhead power line and the haul road intersected, the haul road was measured from the gravel pit to a known remnant of the Wilderness Road, to check how it related to the 1862 mapping and the grid on the present-day mapping. The area from the power line/haul road intersection back to the disturbed area had been used as an agricultural field during the 1930s. By using the haul road and power line as reference points, about 300 feet of Wilderness Road alignment was staked across the field.

39. Returning to the first staked Wilderness Road remnant, the next 600 feet of centerline was staked into the hollow. During staking, although historic Wilderness Road remnants were visibly intertwined with the more modern roadway, the 1862 alignment was still apparent.

40. After passing through the hollow, the Wilderness Road came back into line on a historic road trace. It continued about another 800 feet before passing through a 1930's-era agricultural field, where the trace had been obliterated. As the alignment approached the disturbance of the new 25E highway cut, stakes were placed on three different visible historic road remnants.

41. Ground-truthing followed the staking to see if the alignment would come out of the woods on the middle of the three stakes. If it did, this would confirm that this was the correct alignment. The alignment was cut through the thick woods. This alignment emerged right on the middle stake, in the area that had been disturbed by the construction of the US 25E tunnel and the railroad bridge.

42. Heavily wooded terrain posed problems in finding the way and staying on line. Using a protractor and compass to turn angles off the 10-foot and 100-foot grids, the angles were applied to modern-day mapping. Following a procedure of cutting and flagging the line 50 to 100 feet at a time, then rechecking bearings, about 800 feet of the alignment was staked. This effort utilized a combination of applying historic mapping to remnants of the road trace on the ground and analyzing how they matched modern-day mapping and related to the power line. They related closely throughout the entire distance, from the saddle of the Gap to the Little Yellow Creek ford near the Kentucky Visitor Center.

43. Hart then presented his findings to the CUGA superintendent and staff.

44. Effort was then spent at the ridge on the Kentucky side of old US 25E (approximately 350 feet west of Indian Rock). This disturbed area constituted a major turn in direction (to the southwest) of the Wilderness Road's alignment on the Kentucky side, and was a complicated piece of topography to study, because of several different road alignments and development of a gravel pit.

45. This ridge area was studied in more detail because it was located in the old 25E corridor, and in the natural view shed of the saddle looking into Kentucky. All available resources were reviewed to determine what the ridge looked like and where the missing portion of the ridge coincided with historic mapping in relation to on-the-ground features.

46. A 1930s-era oblique photograph of the area was enlarged and delineated. Then a 1900s-era photograph of the same area was enlarged and delineat-

ed. These two photographs were taken from different vantage points, but provided images of the same general view shed. By delineating the same pieces of topography in the two photographs and comparing them precisely, they were found to contain corresponding pieces of topography that matched.

47. To provide FHWA with a grading plan, the investigation was taken a step further to understand how the information from the photographs and delineations of the disturbed area at the Kentucky ridge corresponded with present-day mapping. To understand how to properly reconstruct the Wilderness Road alignment, there was a need to understand how it had been disturbed.

48. One photograph with a buggy in it provided an image of the disturbed Kentucky ridge area before development of the gravel pit. Examination of the image led to a need to understand the relationship of the Wilderness Road alignment to 19th century mapping as well as the relationship of the cut to the power lines in the background of the photograph. It was extremely difficult to relate these features to the present contours of the ridge area. The most controversial topographic remnants required the highest degree of delineation.

49. A 1930's-era aerial photograph was composited with present-day FHWA highway mapping and Vaughn & Melton's survey of the area. An independent delineation of the topographic mapping, aerials, and surveys was done, to form a composite.

50. The two delineated products of the same area, one an oblique view and the other a plan view, provided an index, because the various topographic pieces matched like a puzzle. Using the applied combined information, Hart provided FHWA with a two-foot interval grading plan. As a cross-check, the grading plan was hand drawn and digitized in a CADD program that approximated one of the aerial views that ensure that it related properly with the historic maps, photographs, and surveys.

51. Because of the refined delineation of the 1930's-era oblique photograph, more refined evidence was provided which corroborated the data for the Kentucky side. This refinement found nine more pieces of topography that corresponded and matched earlier work on the Kentucky side.

52. Throughout this effort, there were suspicions that the irregular topographic shapes in the 1862 mapping were in fact surveyed images of the Wilderness Road. The oblique photographs that related to reconstruction of the Kentucky ridge area were examined. With no present-day mapping with which to tie this work, four of the nine topographic remnants were isolated. These isolated pieces corroborated all previous evidence gathered during the study. All evidence cross-checked and proved that some of the topographic shapes are still visible on the ground today.

53. This portion of the Wilderness Road was staked on the ground, with certainty that two of the topographic shapes in the 1862 map were tied to the 1920s-era map. NPS decided not to restore this Wilderness Road portion as part of the interpretive site because of disturbance by modern-day transportation arterial development, and by 1920's/1930's agricultural operations. This also reaffirmed the descent of the Wilderness Road into the valley near the present-day CUGA visitor center, showing where the original road crossed the modern-day transportation corridor disturbed in the late 1800's by the railroad and more recently by the U.S. 25E tunnel approach.

Cumberland Gap

1. Having determined the Wilderness Road alignment on the Virginia/Tennessee side of the Gap and the Kentucky side of the Gap, Hart returned to finish work on the saddle of the Gap. All of the previously collected information was graphically close, but did not provide for a grading plan. Saddle topography could not be reconstructed from just the graphic evidence - a grading plan was required.

2. This last stage of refinement for the saddle would be the combined transfer of all graphic evidence into a grading plan for FHWA contracting purposes.

3. The saddle area was revisited. All previously collected information was reviewed, which included the Association Lands Map, the 1833 survey, the 1862 survey, and Vaughn & Melton's 1990s two-foot saddle topographic survey (constituting an existing conditions survey). Information from the maps, surveys, and photographs was delineated and studied intensively in terms of the relationship of the topographic shapes to one another and to the ground. The level of accuracy was found to be very high. Topographic shapes in these items all cross-checked as applied to the ground today. The graphic recreations fit the historic photographs almost exactly.

4. The question of how to convert this information into a grading plan for FHWA bidding purposes created a need to give the graphics dimension in technically accurate construction drawings. How did one give vertical intelligence to the graphics? FHWA needed a vertical and horizontal grading plan tied to present-day mapping.

5. The resolution was to develop a procedure to scale all of the missing topography, creating criteria to assign vertical intelligence to the information.

6. All delineated materials were cross-checked to isolate and compare the existing topography to the missing historic topography.

7. The Association Map provided the accurate position of missing historic topography, providing base information to relate the vertical scale to the overall missing coordinate positions.

8. A mechanical drawing type approach was used and the Association Map ridge lines were the basis to construct and triangulate missing topography.

9. This methodology was applied to the entire plan view of the saddle area (present-day surveys).

10. The grading plan needed the application of computer intelligence to create the plan view.

11. When the computer re-created the grading plan, it would have to match the historic photographic view to be correct. The two photographic views in Photographs No. 1 and 1A needed to match.

12. Using the list of resources (See No. 3 above), historic and existing points were developed and positioned on the plan.

13. A target system was then developed to apply to these points. When the historic view was re-created, a vertical pole was placed at each point. Each pole had five-foot vertical increments marked on them. This system enabled the gauging of five-foot increments wherever they appeared in perspective so that later the entire study area surface in the vicinity of the Saddle could be triangulated.

14. Using the Association Map first, the missing ridge lines were reconstructed.

15. A preliminary ten-foot contour grading plan was prepared (with assigned intelligence), that re-created the original historic view looking into Kentucky.

16. The preliminary grading plan proved to be close enough so a triangulation system would be workable.

17. The preliminary grading plan was refined to ensure that the ridge lines at this point were exactly correct. Both sides of the mountain and both views (from the Kentucky side and from the Virginia/Tennessee side) tied to the ridge lines had to match for correctness.

18. Using all available evidence, the data was painstakingly applied to a one-foot contour grading plan of the entire saddle area using the triangulation system.

19. Then the time had come for the big test. Would the new technical application, when replotted, match the historic graphic view?

20. The two were found to be amazingly close, needing only minor elevation adjustments to refine both views. Hart had produced the final grading plan!

21. As of late 2001/early 2002, the Federal Highway Administration had removed the old US 25E pavement, hauled material back into the saddle of the Gap, and was regrading the area with Hart's plan to guide the work.

Source Materials

- Two Civil War photographs (both photos, which overlap, were taken from one tripod location)
- Late 1800s bridge photograph.
- Two oblique aerial photographs from Kentucky looking toward Tennessee.
- Two aerial photographs (helicopter shots) - 1933 and 1969.
- Numerous oblique and aerial photographs of area taken by Hart during the 1990s, the most significant being a recreation of historic bridge photograph.
- FHWA aerial photographs - 1980s.
- Buggy photograph - 1920s.
- Buckboard photograph.
- Two wagon photographs.
- Indian Rock Harley-Davidson photograph.
- Obscura print.
- Monument/Wilderness Road photograph looking from Virginia toward Kentucky.
- Gap cut close-up photograph looking from Virginia toward Kentucky.
- 20 photographs taken from a helicopter.
- Historical maps.
- Surveys.

Vaughn & Melton
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March 14, 2001

RECEIVED
MAR 19 2001
DSC-PM

Bill Witmer
NPS-DSC-PM
12795 West Alameda Parkway
P.O. Box 25287
Denver, Colorado 80225-0287

Re: Cumberland Gap / Wilderness Road

Dear Mr. Witmer:

I have gone through the material that Mike Hart sent me several times. It isn't a process that is easily grasped in a one-time reading. I have heard the procedure described as unorthodox and I agree with that assessment. Even so, there is a basis in long recognized and used procedures. It could be said that it touches on normality. It is infrequent that photographs are enlarged or shrunk to a particular scale such as Mike has done to match scale of the mapping, but it is done. The verification of the scale is usually done very similarly to the method he used, that is to measure between points that can be seen in the photograph and scale the photograph until the resulting enlargement will scale the same distance. In the engineering and mapping community, the procedure is usually used on an unusual project and the approach is described as unorthodox. I hear some of those terms being applied to the procedures developed by Mike Hart and used on the Wilderness Road project. Whenever we have scaled photographs up or down, we usually find that the resulting accuracy is within about two feet or less. His delineation process is truly new to me. He may have developed a new method this time.

The match of the topographic features with the historic photographs is truly amazing and worthy of comment. Mike has described to me the procedure he used to fit and check information to the maps from historical documents and photographs. Even after hearing the method described, few of us, and perhaps none of us, will ever be able to replicate the method Mike has developed but it is obvious that it works. His unique combination of training and experience has combined to provide him the ability to develop and use his own method of researching, matching, fitting, and adjusting evidence of the old to the existing features. While providing surveys for Mike to use in his field work and data gathering and seeing the result, I came to expect the precision of the fit and agreement of features that remain today with the locations shown in the photographs and early surveys. By the time I was reviewing the graphics which Mike furnished to me, I expected that the historical features that had been found would fit the modern day mapping. Perhaps I should have been skeptical but by then I had seen enough of his procedure and results that I expected the terrain to fit his projections. His past performance had caused me to expect success. Many of the surveys from the 1800's were done carefully and were amazingly accurate. We recognize that some were not. In this situation we are indeed fortunate that the 1833 survey upon which Mike had to rely was one of the good ones. In our practice of surveying in this region, we frequently use or retrace surveys from that period and have found many of them to fit terrain features very well.

I was impressed that in one or two instances Mike was able to recognize that existing features did not fit his forecast location and search for the source of error. Even though none of us likes to make an error, the recognition of it lends credence to the method. His willingness to search for the error and correct it brings credence to him. We were very pleased to be involved in the surveys which he used to tie old and new elements together, and to be a part of the Cumberland Gap Project. I was at first skeptical and then later surprised at the precision of the geometry Mike projected when we laid out the lines on the ground. We surveyed through disturbed areas and began once more to find evidence of the Wilderness Road beyond the disturbed area and at the location he predicted. Most of the features were found to be within a few feet of the predicted location. We owe a debt to the Surveyor who did the original work. Geometry has served us well once more. I once commented to Mike that the proof is in the geometry applied to the ground. Geometry never lies and it never fails. Fortunately it is a tool we can use and depend upon.

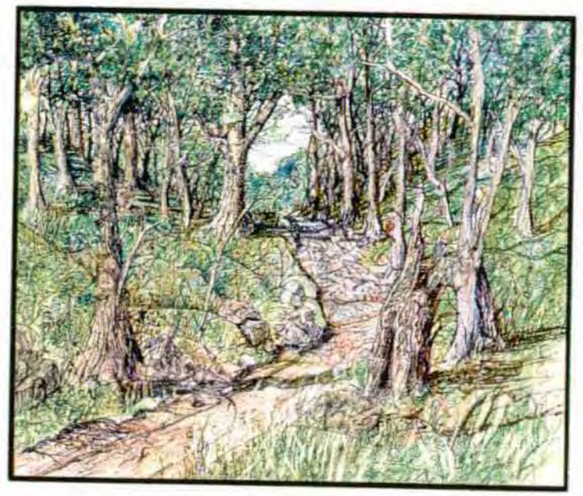
I complement Mike upon the development of this unique procedure and the dedication he have shown to the project. I look forward to seeing what will become of the historic Cumberland Gap in the future.

Very truly yours,

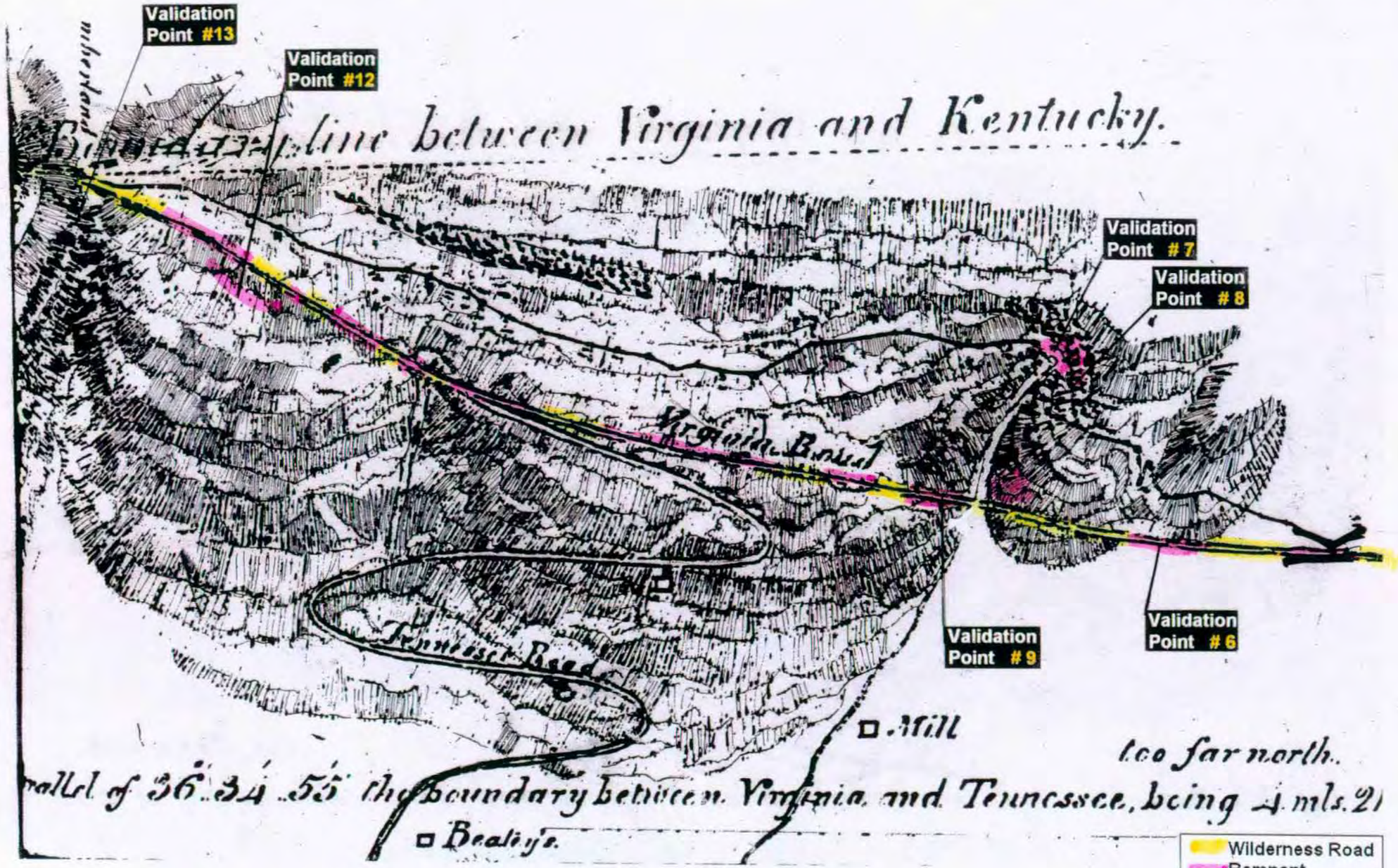
VAUGHN AND MELTON CONSULTING ENGINEERS (KENTUCKY), INC.

David A. Atwell

David A. Atwell, PLS, PE



primary
HISTORIC REFERENCES


Validation Point #13
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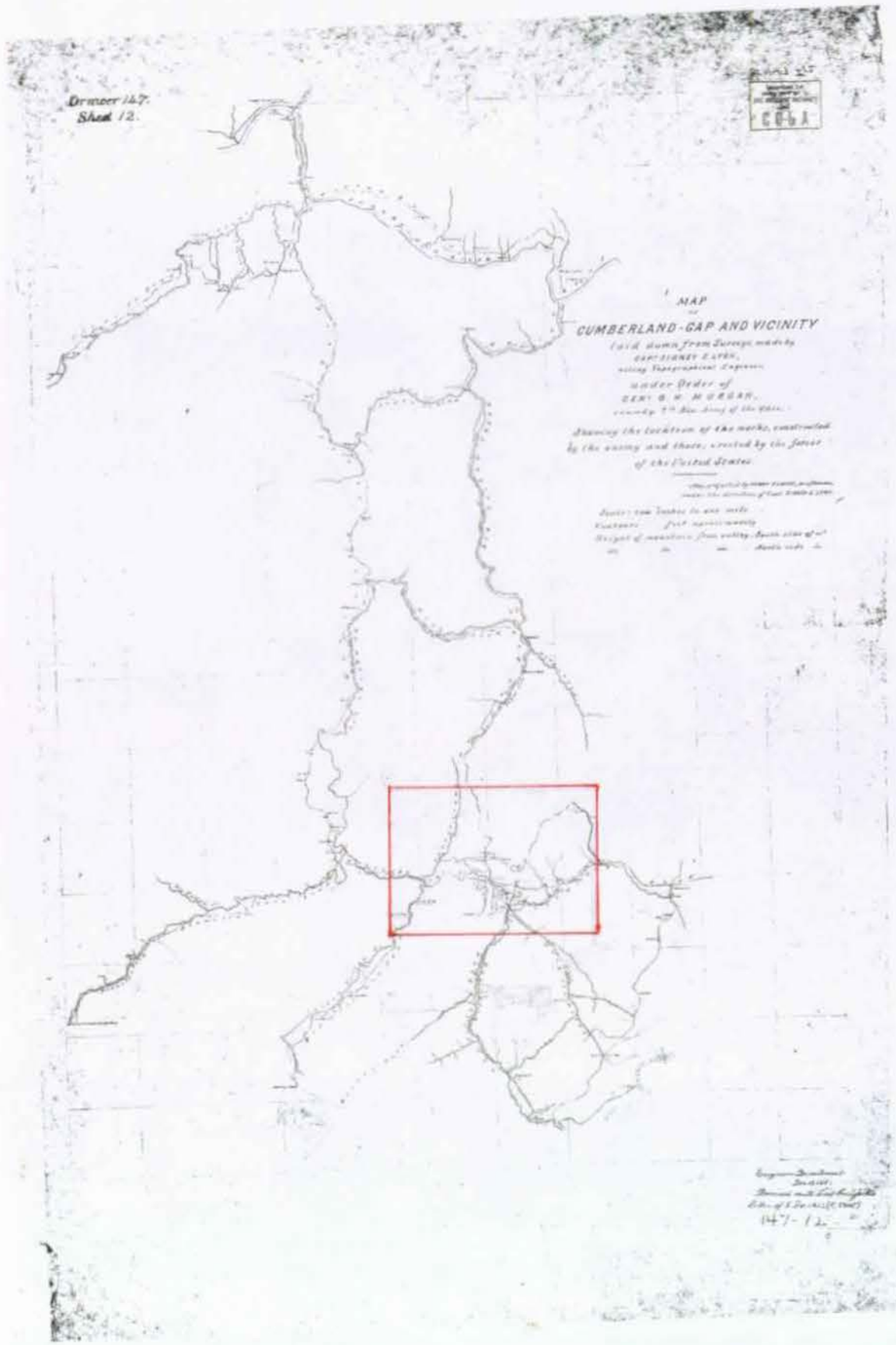
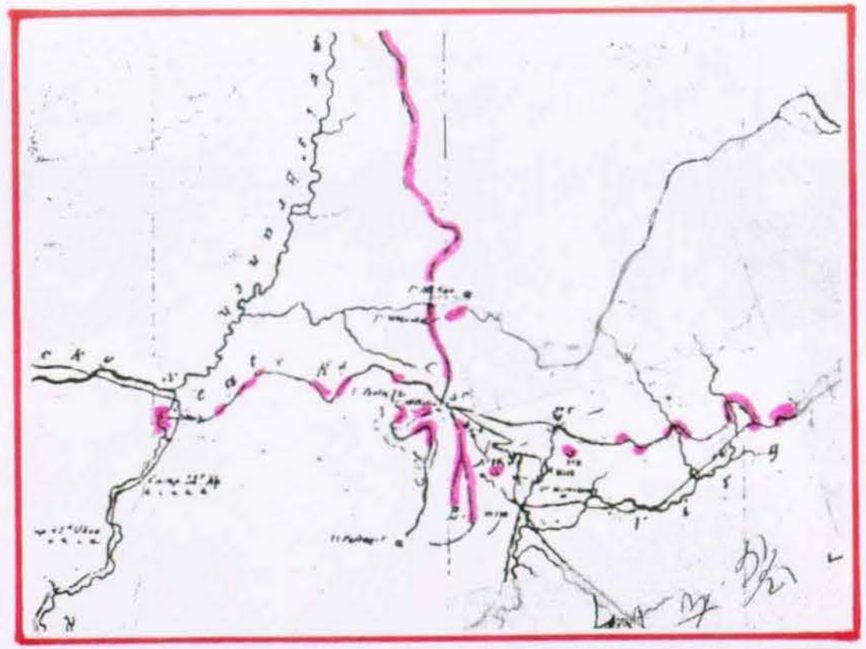
line between Virginia and Kentucky.
Wilderness Road
Mill
too far north.
Beatty's
Wilderness Road
Remnant



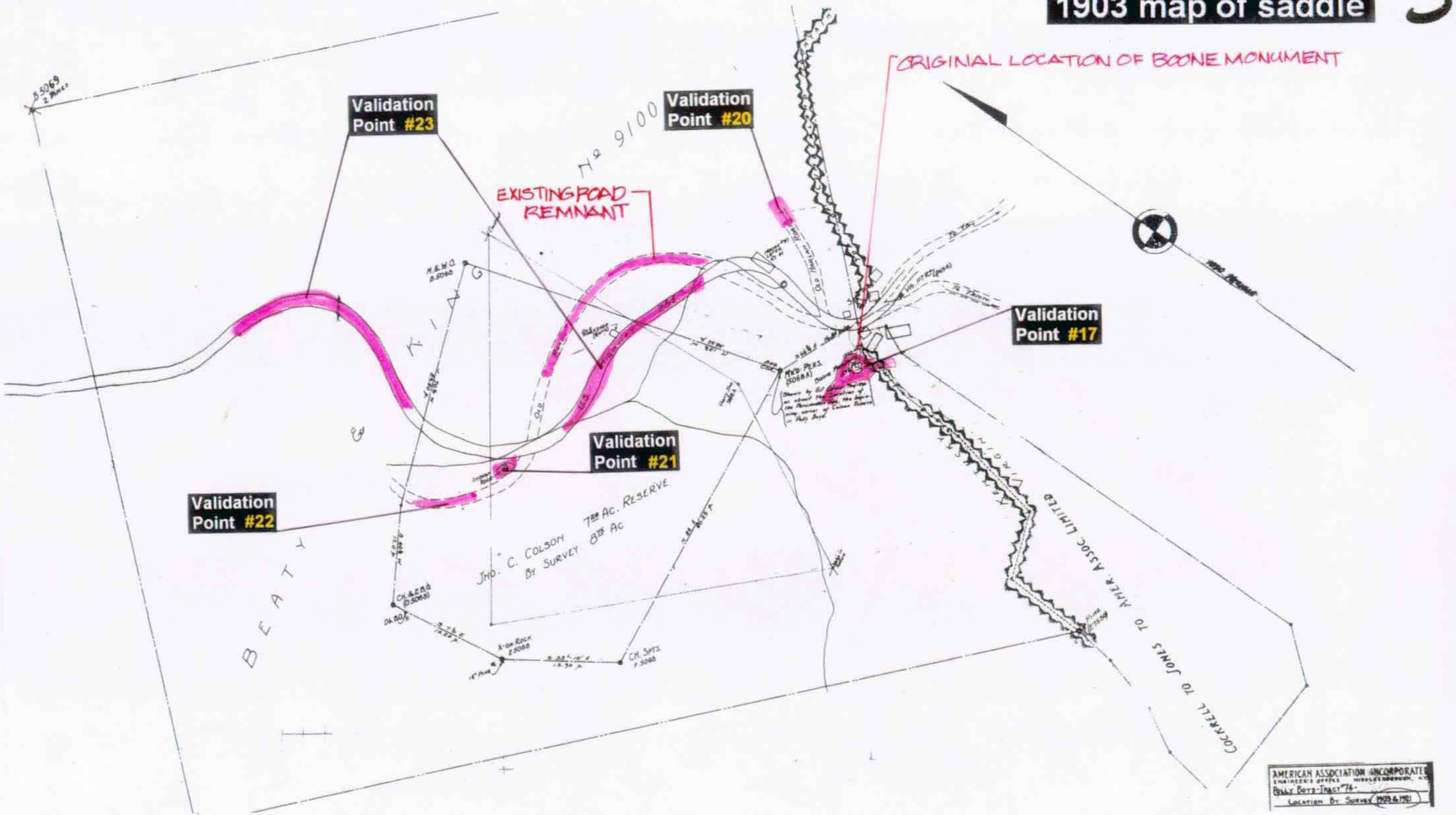
1862 map of area 2



Existing road remnants shown above in red were physically located in the field, and incorporated into the Wilderness Road discovery procedure.

1903 map of saddle

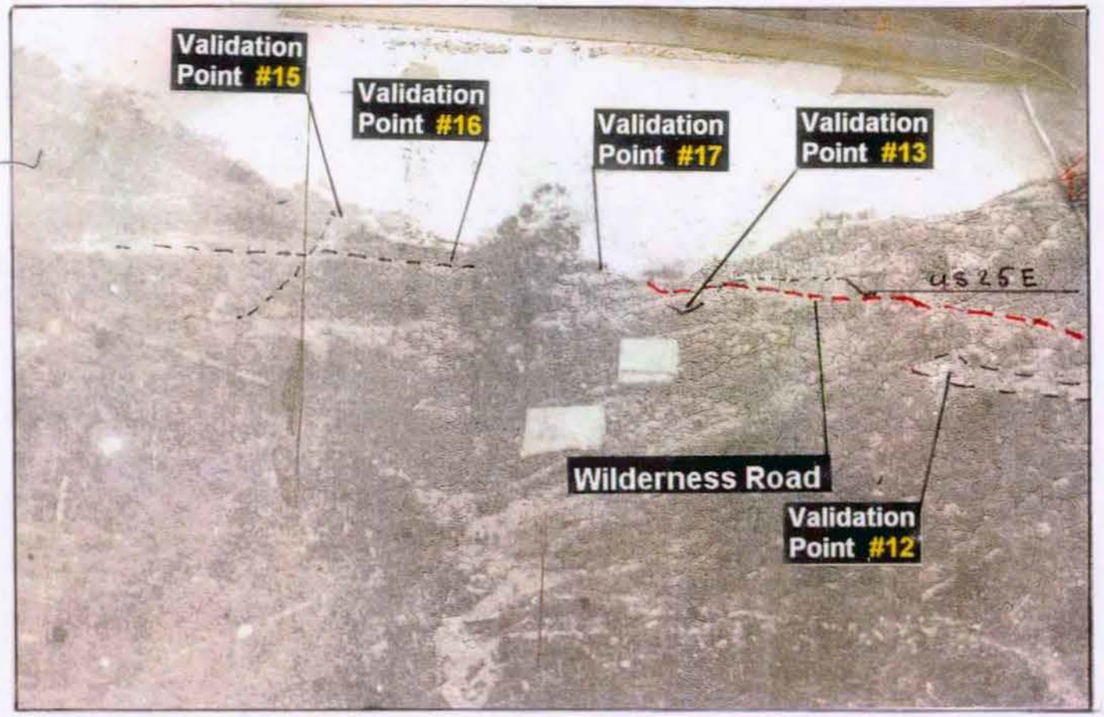
3

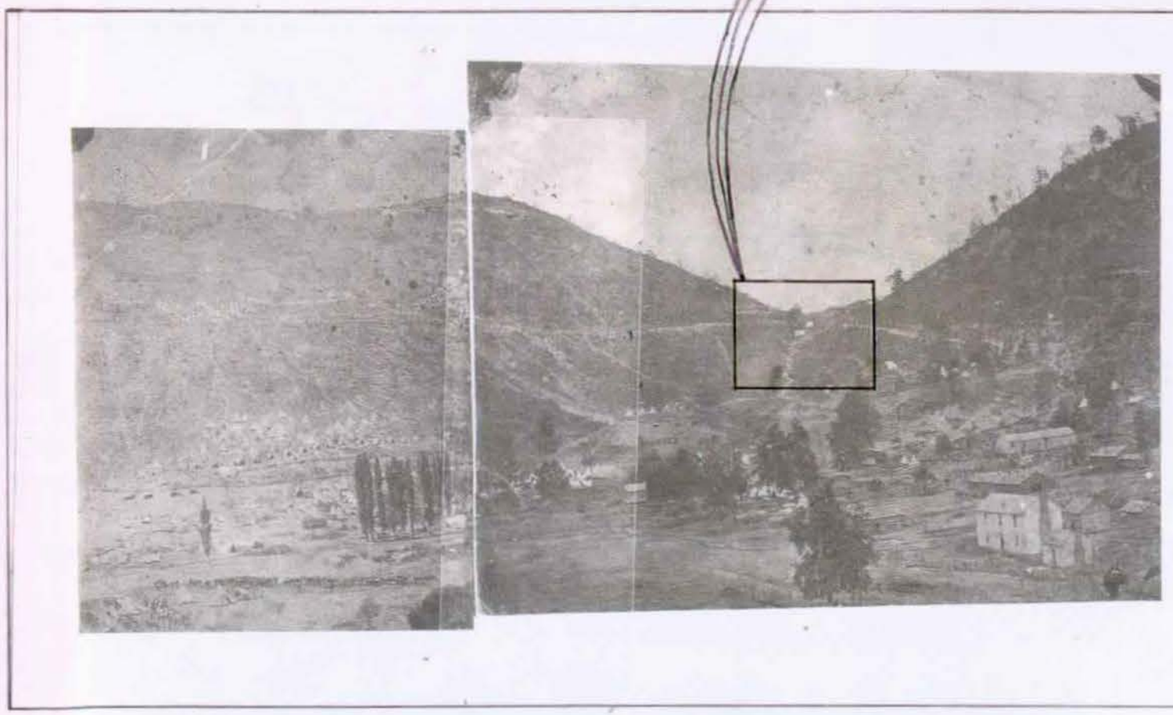


kentucky utilities corp.
Power Poles/Object Lesson Road /
Old US Highway 25 E (1936)

4

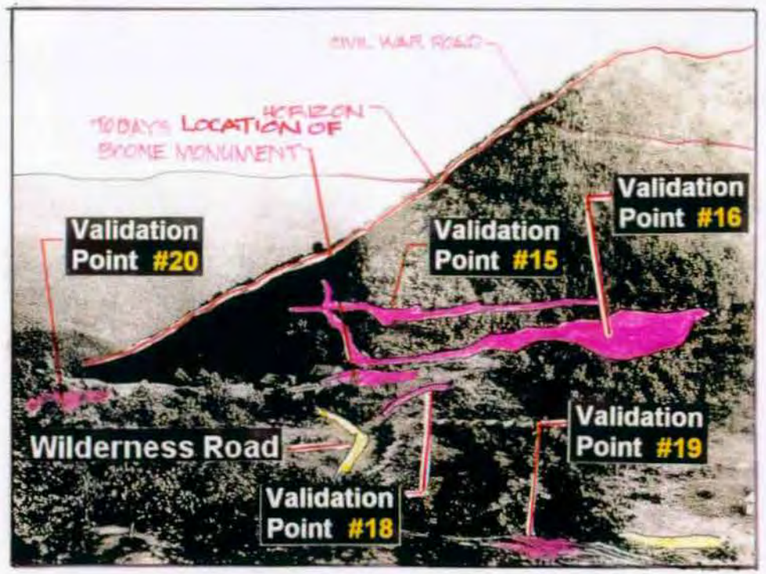
view northwest toward the saddle 5

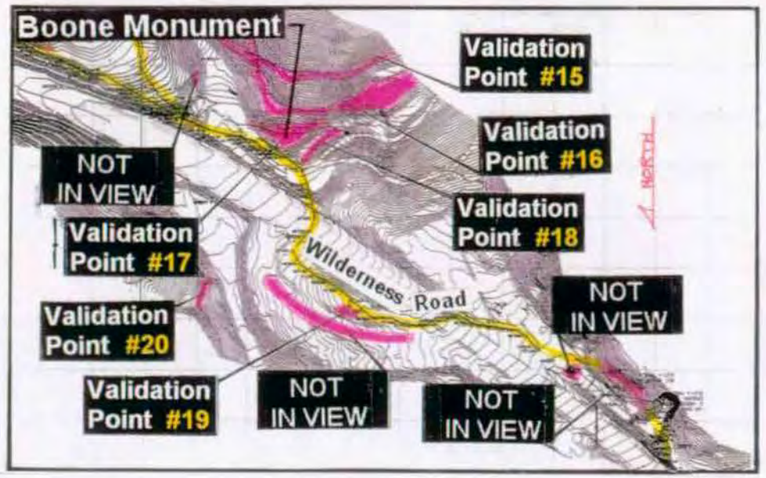




This photograph was taken during the Civil War about 1862. The view is looking Northwest, from what is now the town of Cumberland Gap, Tennessee.

This photograph was taken by Inman Photographers, of Middlesboro, Kentucky. Courtesy of Cumberland Gap National Historical Park.



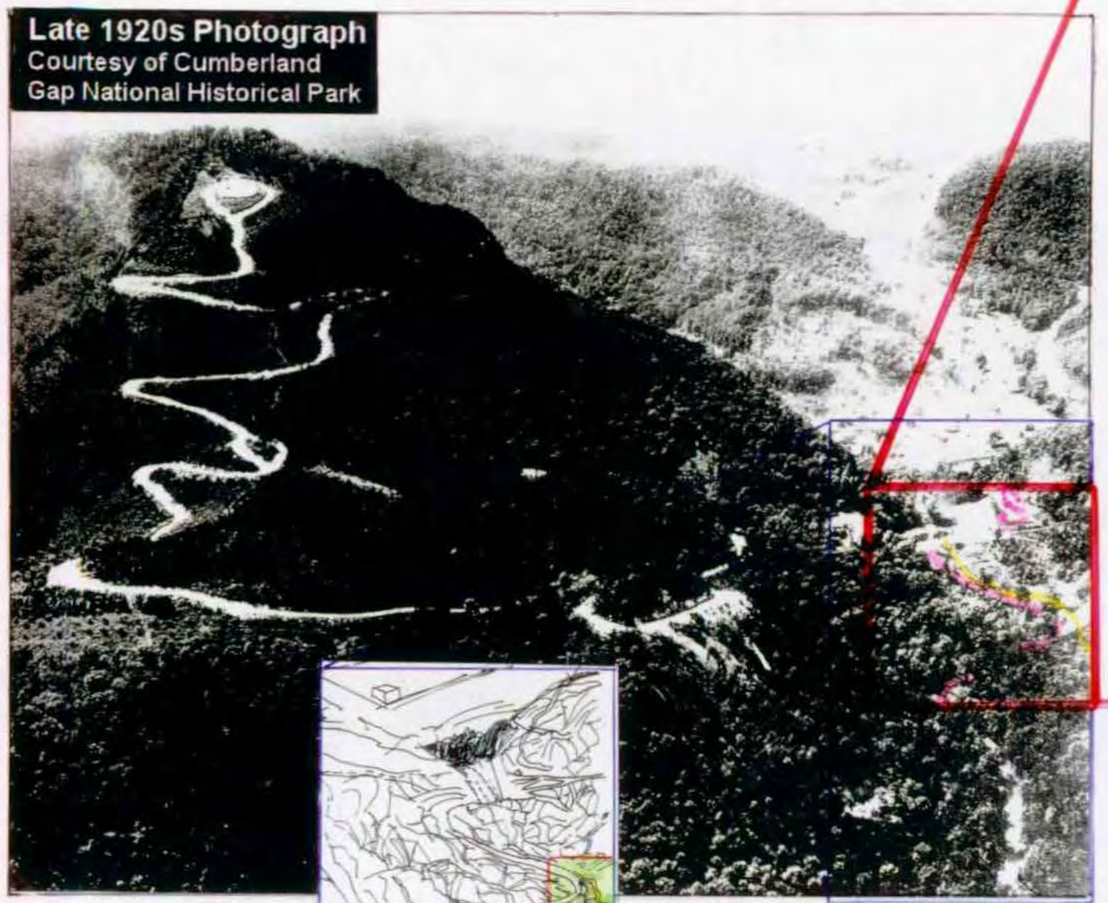


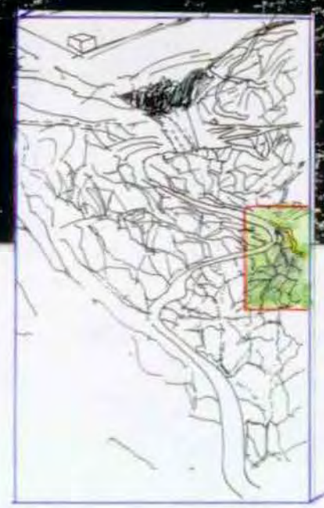
view northwest toward the saddle

7

This photograph is believed to be taken from an obscura print. (estimated to be from 1775 to 1860) Courtesy Of Cumberland Gap National Historical Park.

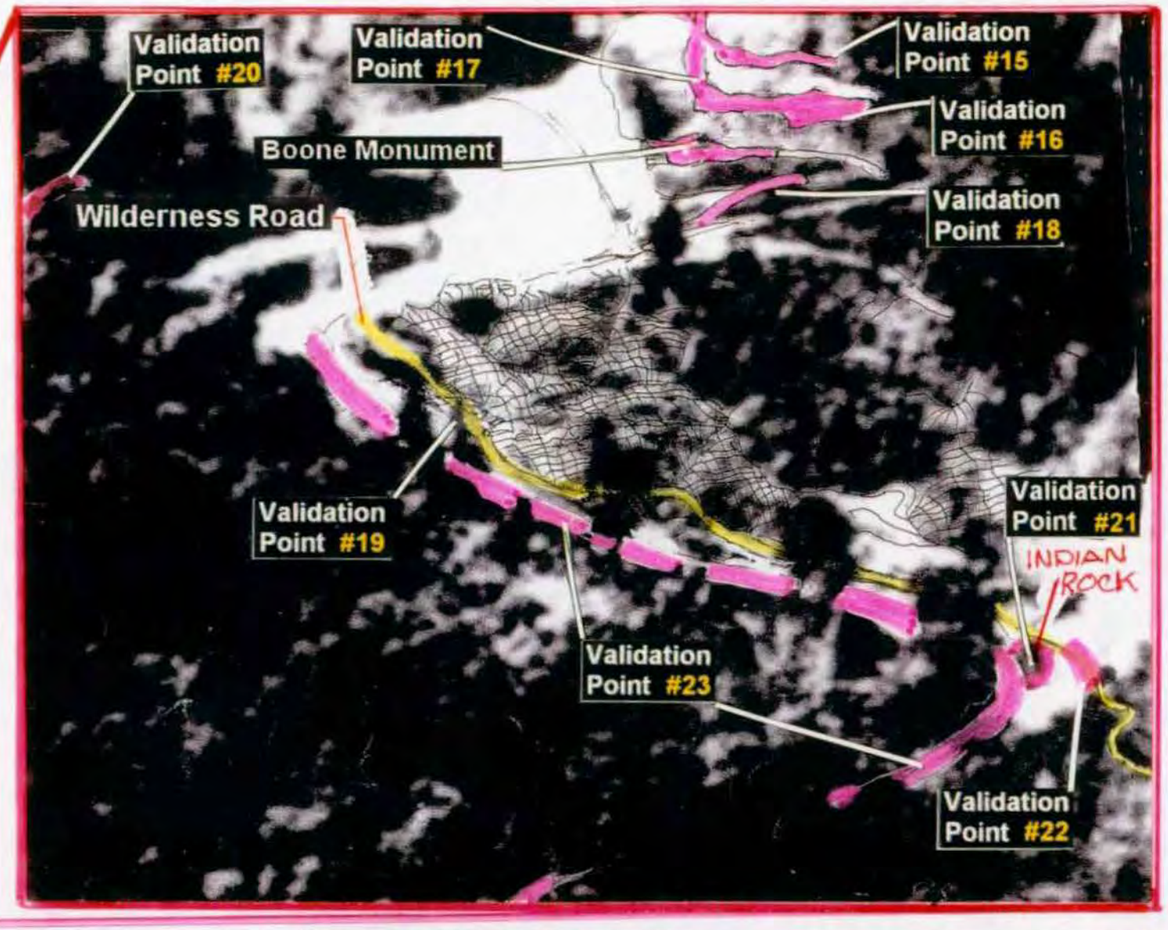
Late 1920s Photograph
Courtesy of Cumberland Gap National Historical Park

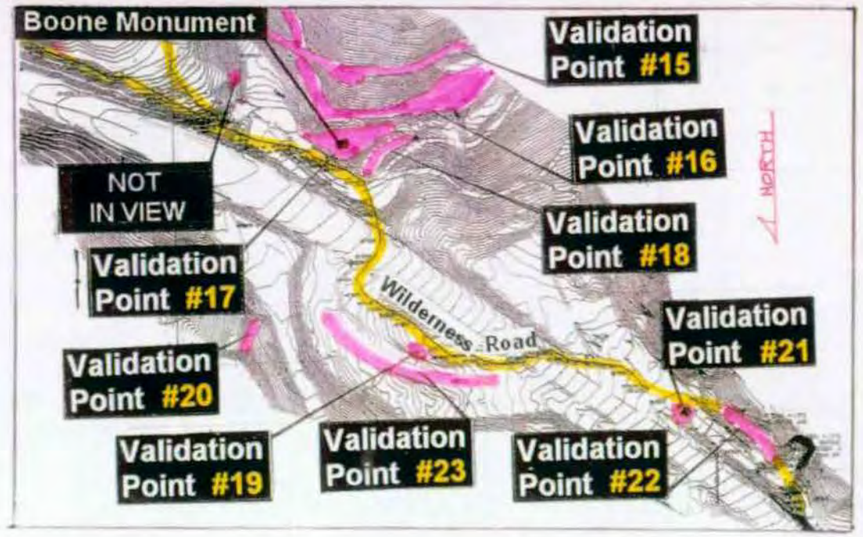


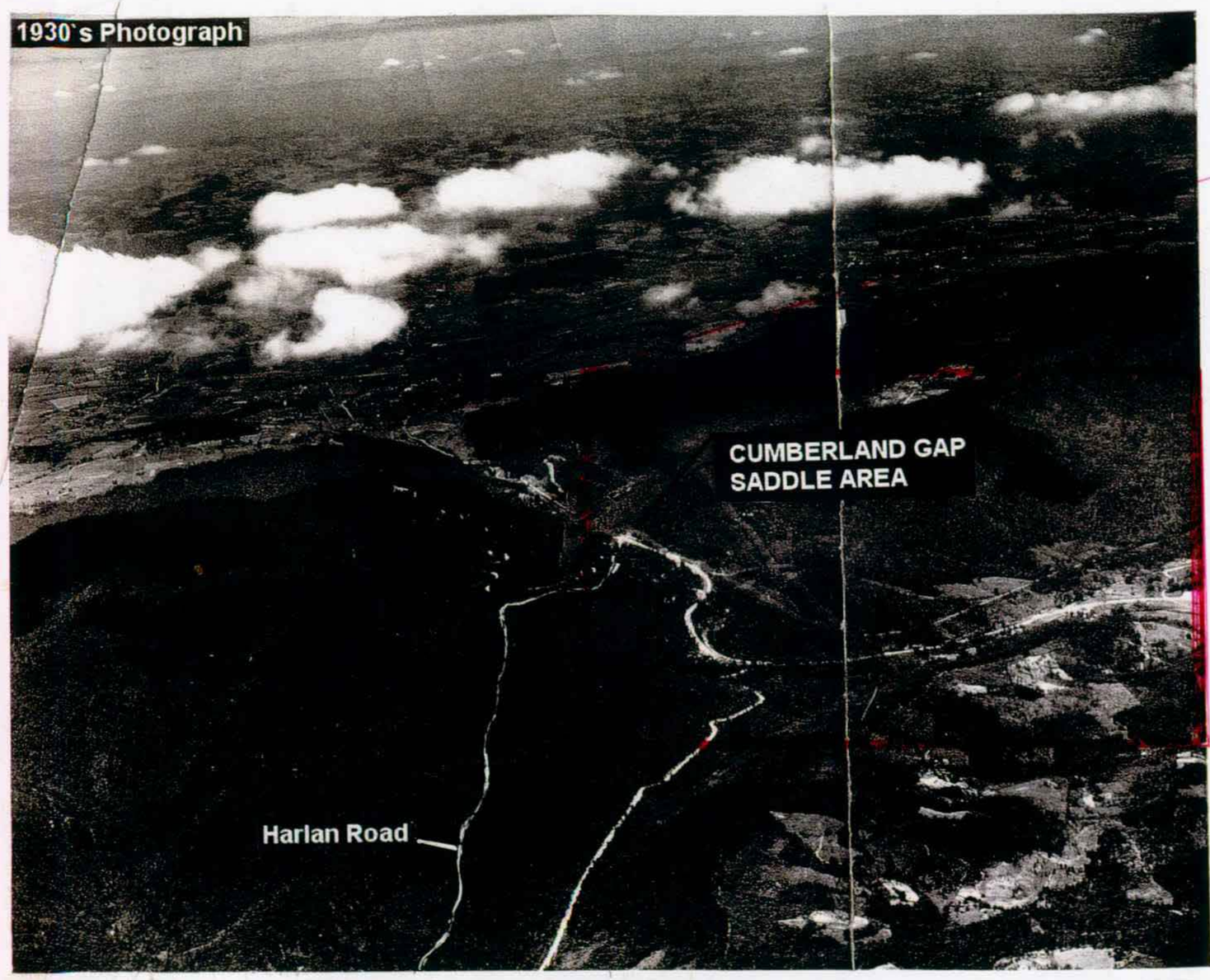


RIDGE AREA

saddle area viewing south



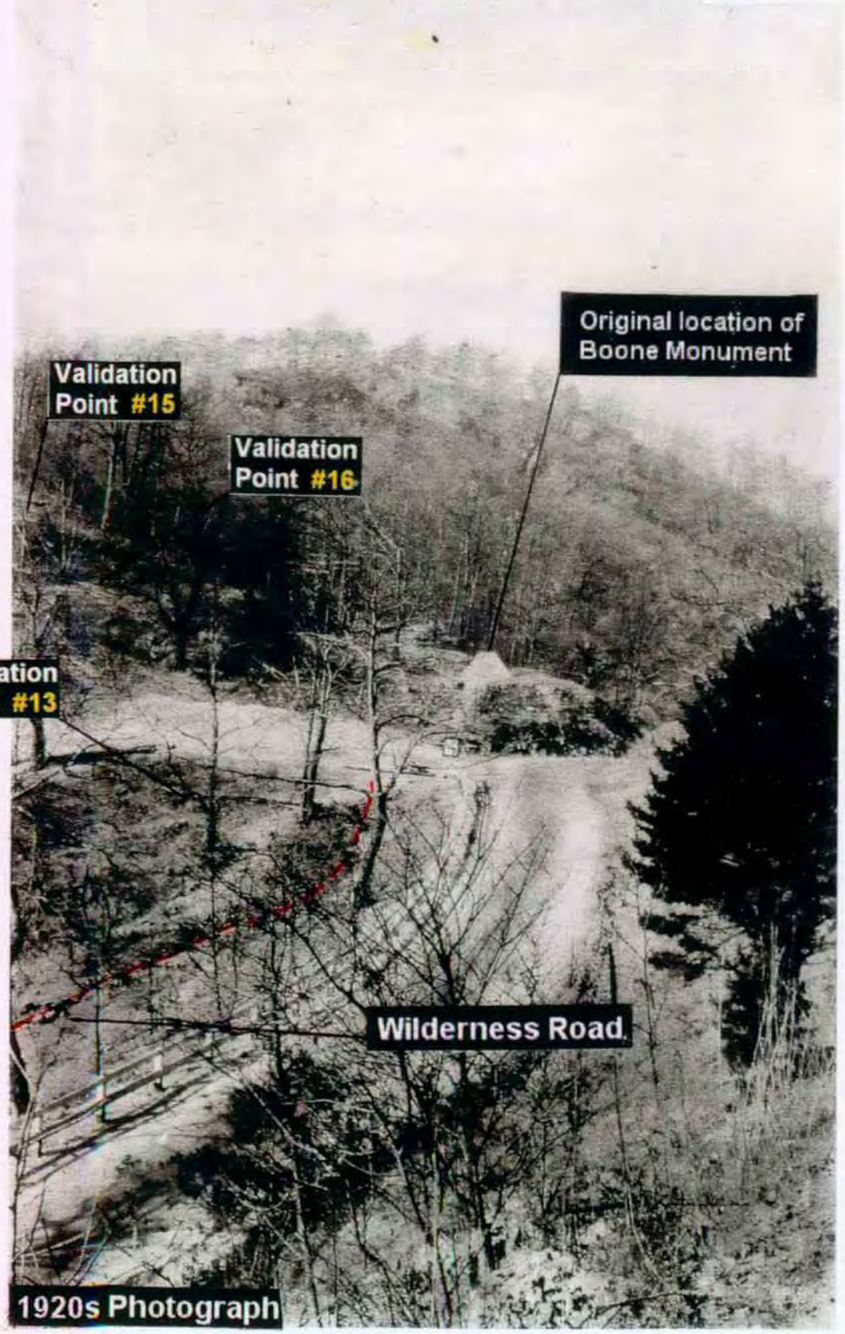




Aerial photograph of Cumberland Mountain and surrounding area.
Courtesy of Cumberland Gap National Historical Park.

view south to the saddle 9

saddle area viewing west 10



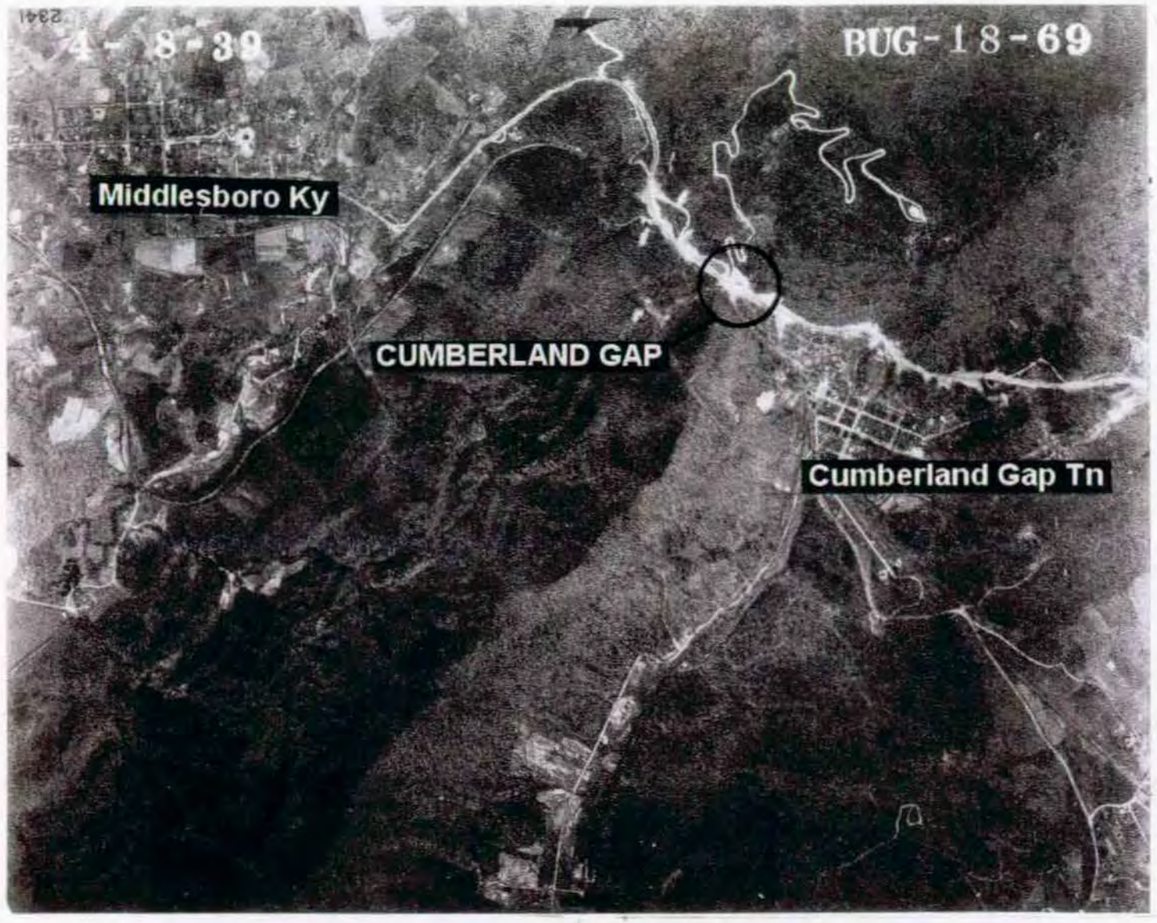
In todays photograph the Wilderness Road is also behind Indian Rock and to the left. Notice how the approach to this curve in the Wilderness Road has been removed. This portion of earth was removed in the early 1900`s to allow access for a gravel pit. The arrows show the very same rock in the same possition in both photographs.

indian rock viewing west 11

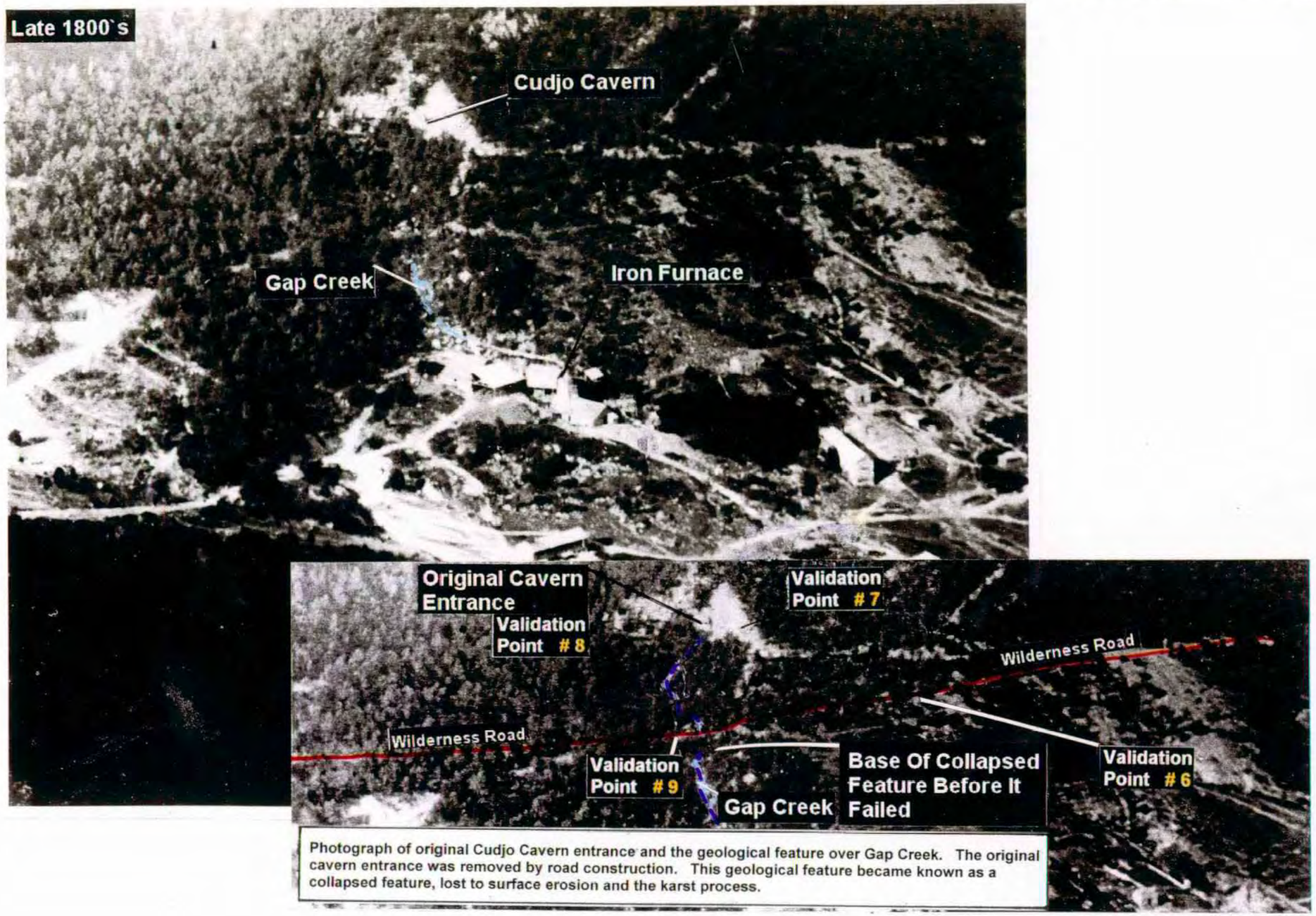
Validation Point #21

This historic photograph shows the Wilderness Road behind Indian Rock and to the left.

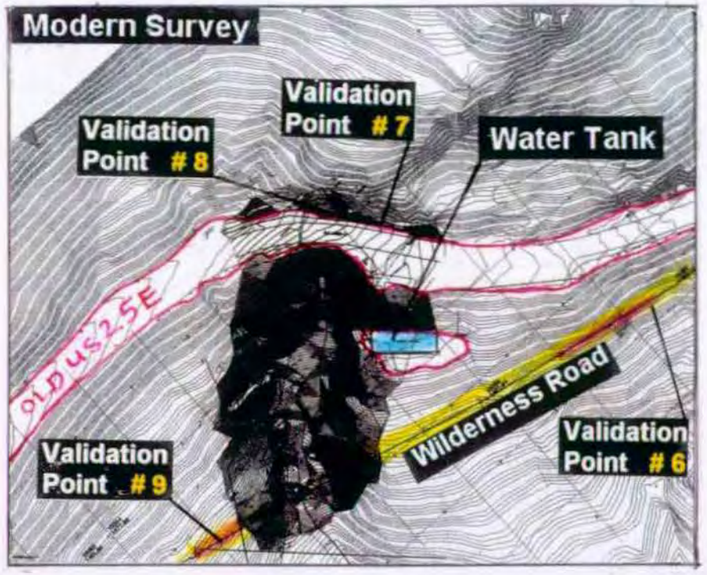
1939 aerial photograph of the area 12

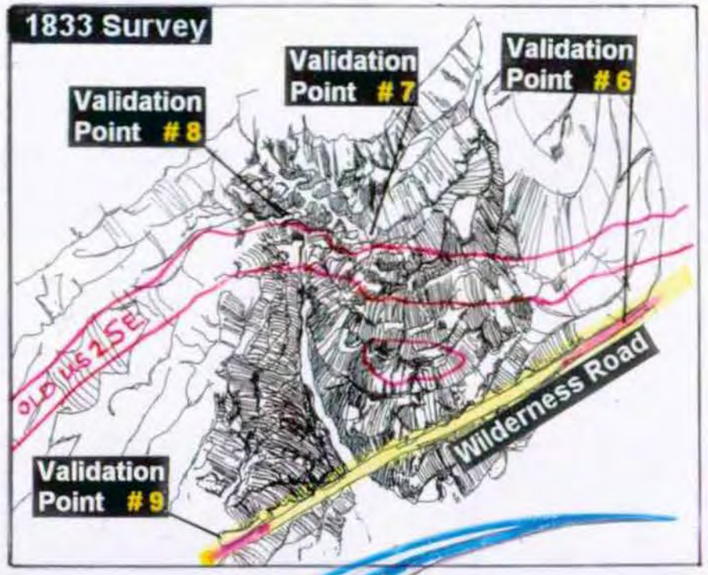


Photograph taken for the USDA Agriculture Stabilization and Conservation Service, April 8, 1939. Courtesy of the National Archives .

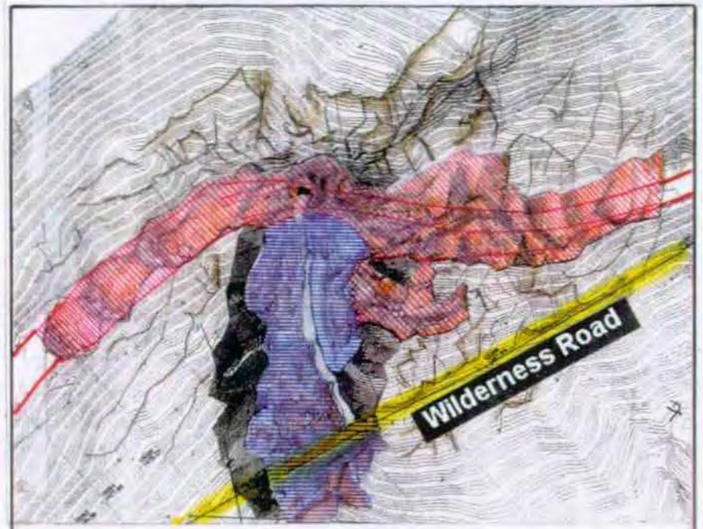


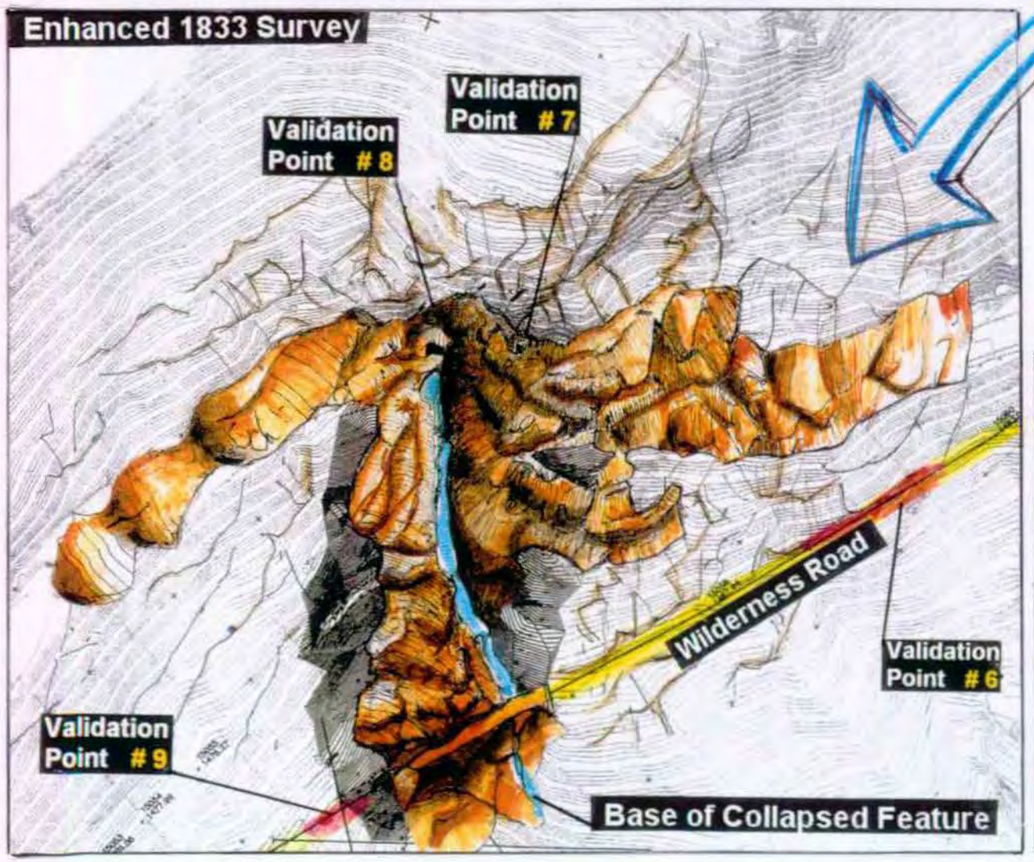
Photograph of original Cudjo Cavern entrance and the geological feature over Gap Creek. The original cavern entrance was removed by road construction. This geological feature became known as a collapsed feature, lost to surface erosion and the karst process.





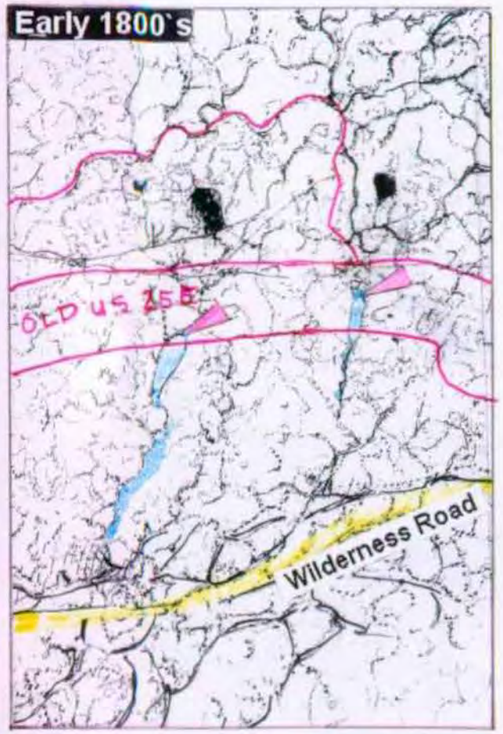
cavern area / geologic feature over gap creek

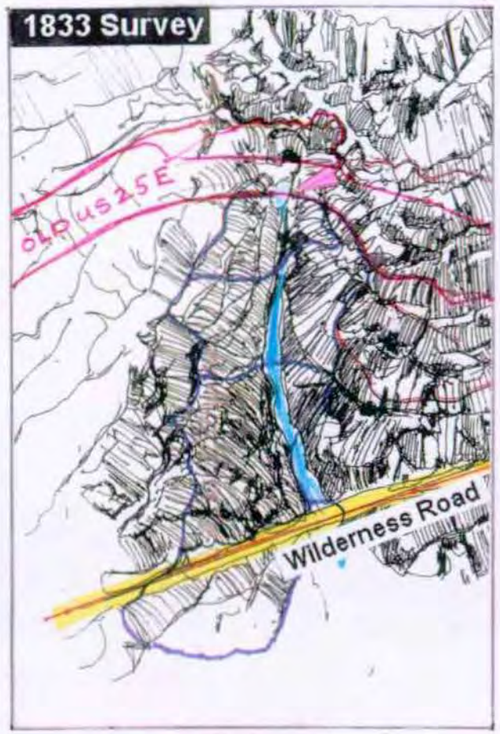


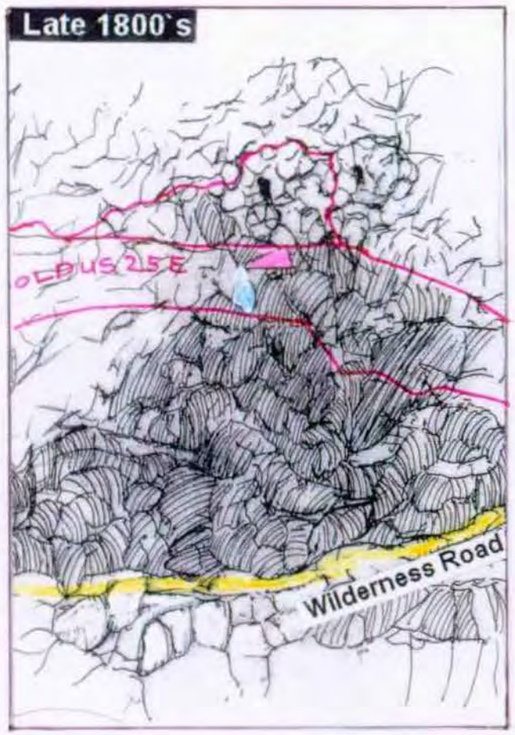


Enhanced 1833 Survey – This sheet shows a hand-enhanced version of the 1833 survey, overlaid on modern topography. The shape and position of the original cavern entrance, and the geological feature over Gap Creek, meshes perfectly with modern survey work.

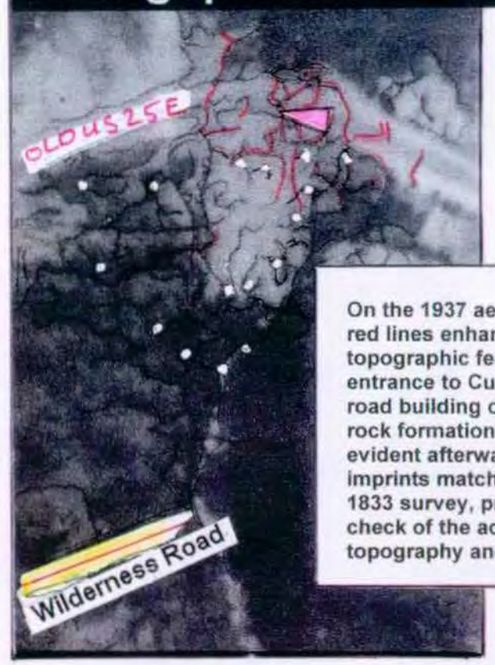
The 1833 survey is believed to be the base map used for the later construction of the initial alignment of U.S. Route 25E. The first road on the higher alignment was built sometime after 1833, but before 1862. The original cave entrance was not removed by road building until the late 1800's, the same approximate time frame as when the geological feature over Gap Creek failed.







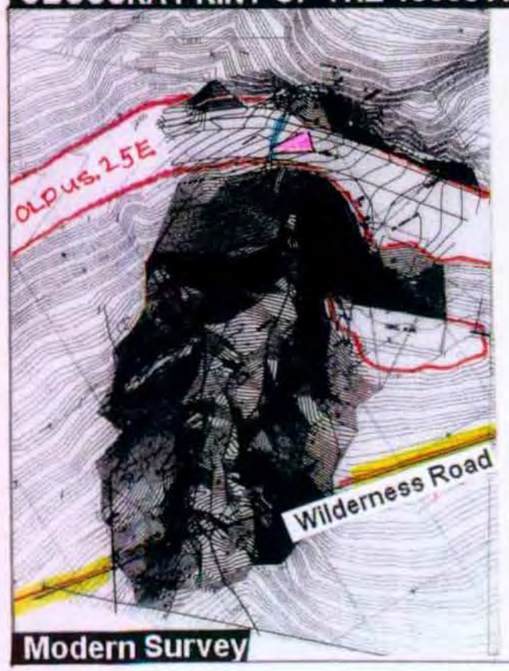
cavern area / geologic feature over gap creek

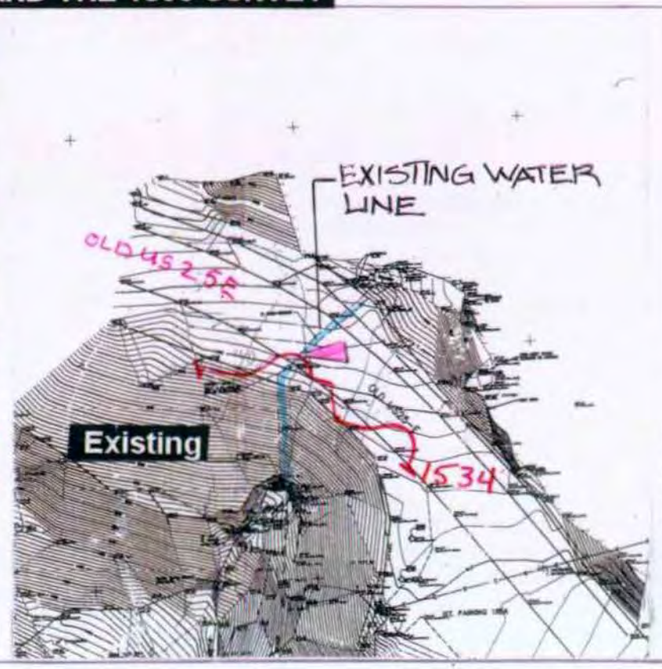


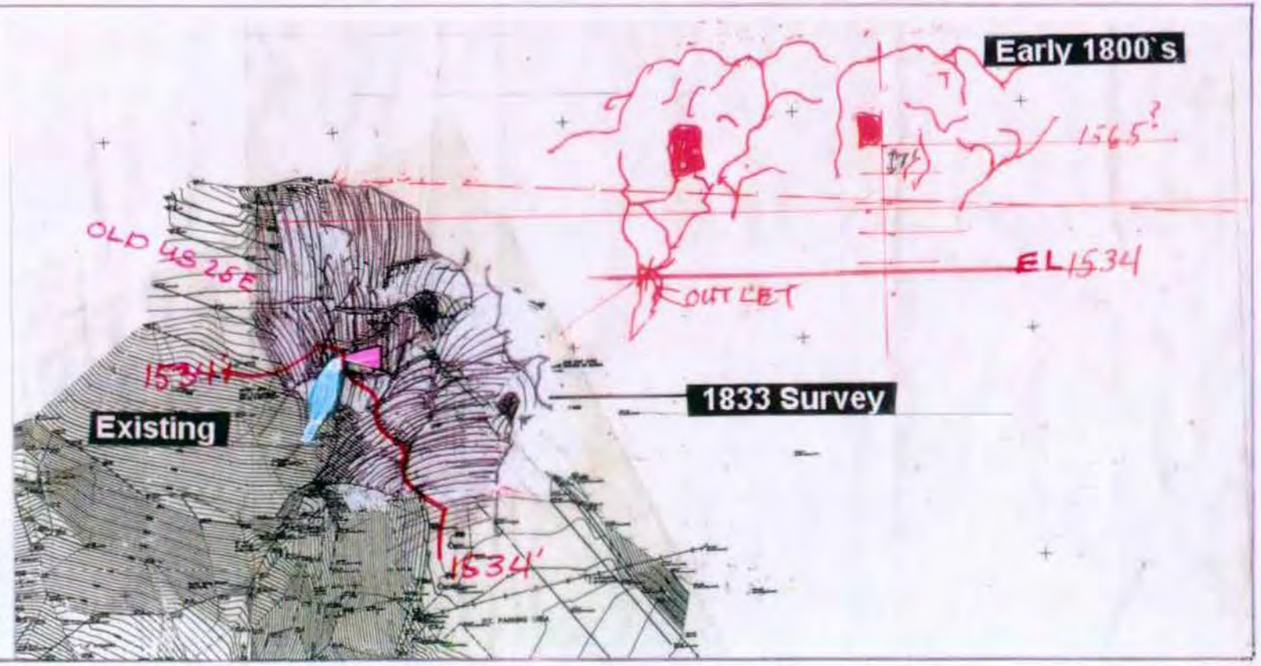
On the 1937 aerial photograph to the left, red lines enhance the delineation of topographic features around the original entrance to Cudjo Cavern. Even though road building on U.S. Route 25E removed rock formations, their "imprint" remains evident afterwards. These delineated imprints match the same features from the 1833 survey, providing yet another cross-check of the accuracy of the missing topography and cavern entrance.

TODAY`S MODERN SURVEY COMPARED TO THE OBSCURA PRINT OF THE 1800s AND THE 1833 SURVEY

Original Stream Resurgence

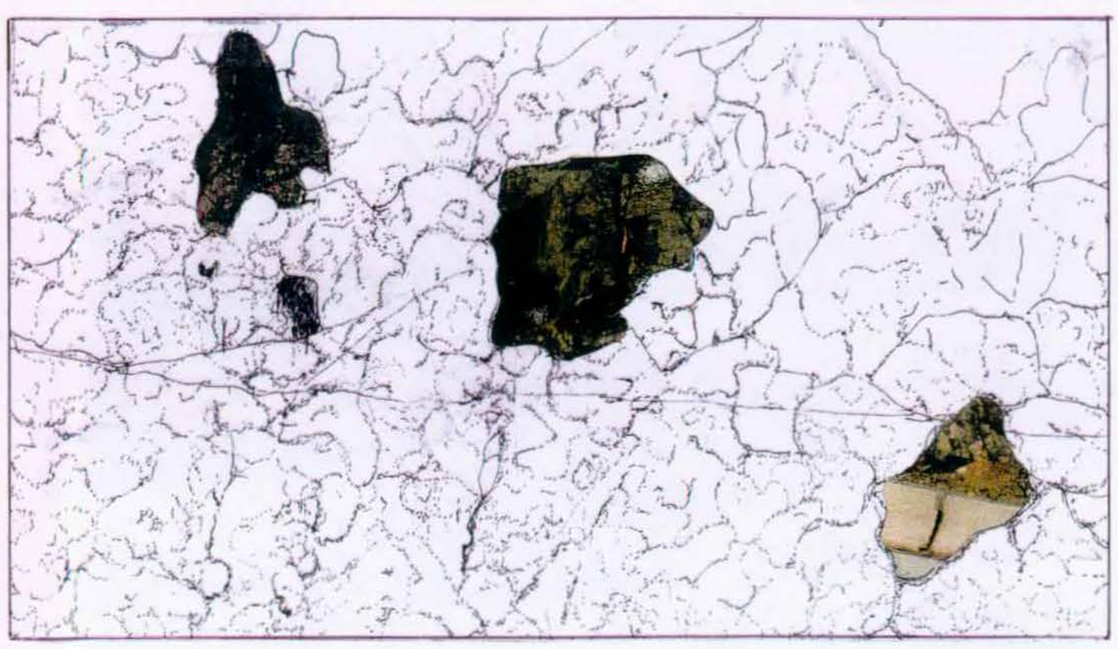


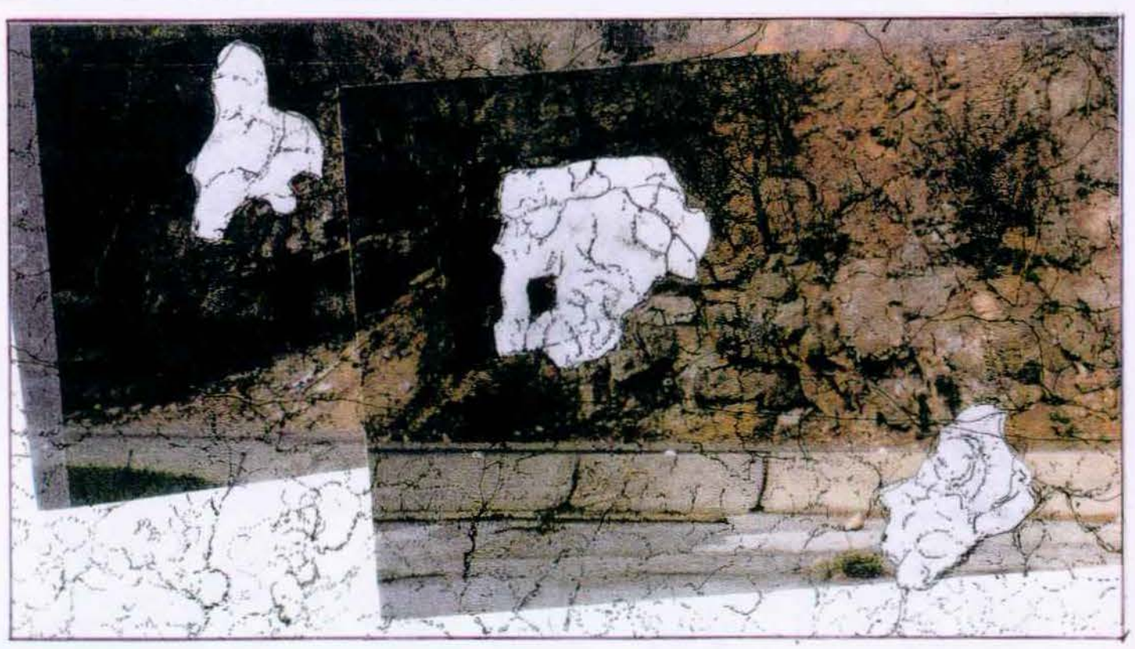




original entrance to cudjo cavern

These views of the face of Cudjo Cavern show not only the delineated precision of the missing topography, but also the original location of the cave entrance. The highlighted rock formations are interchangeable from image to image, from a current photograph on the right, to the early 1800's obscura view on the left.

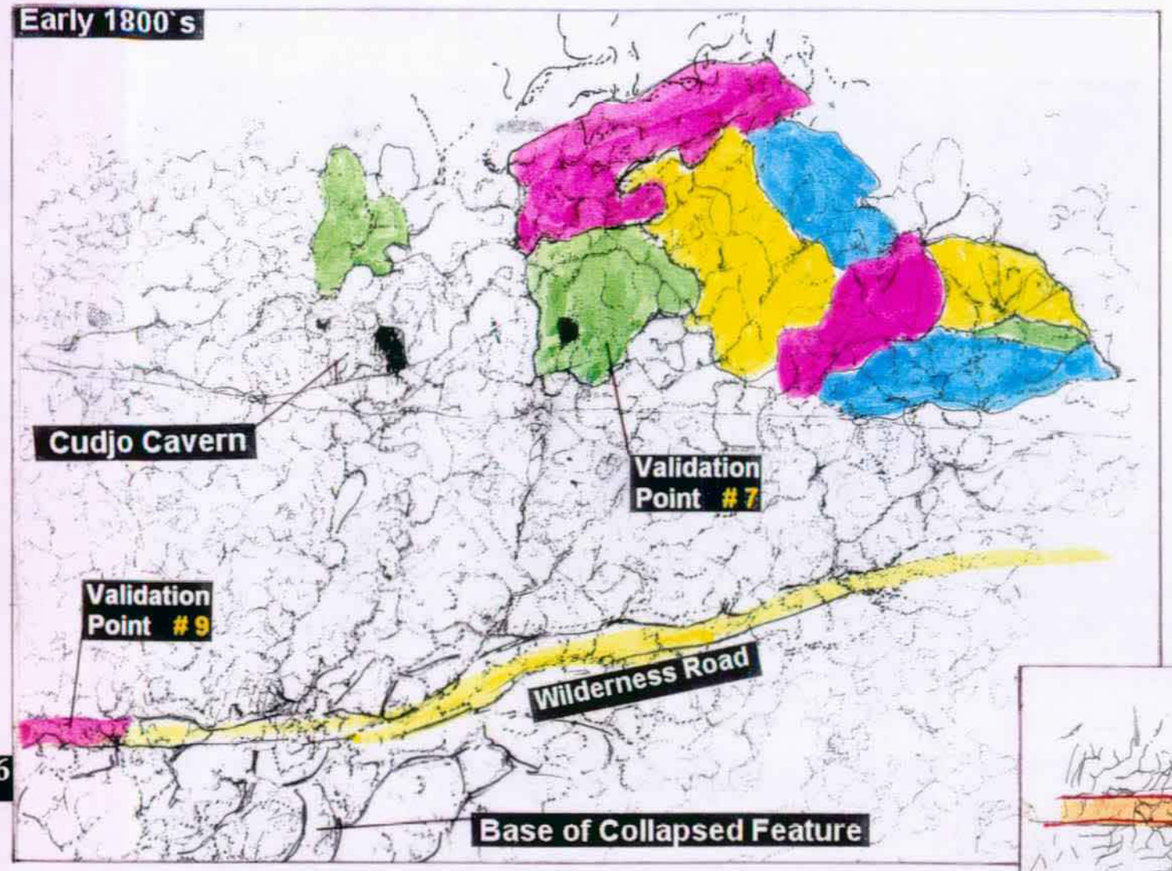




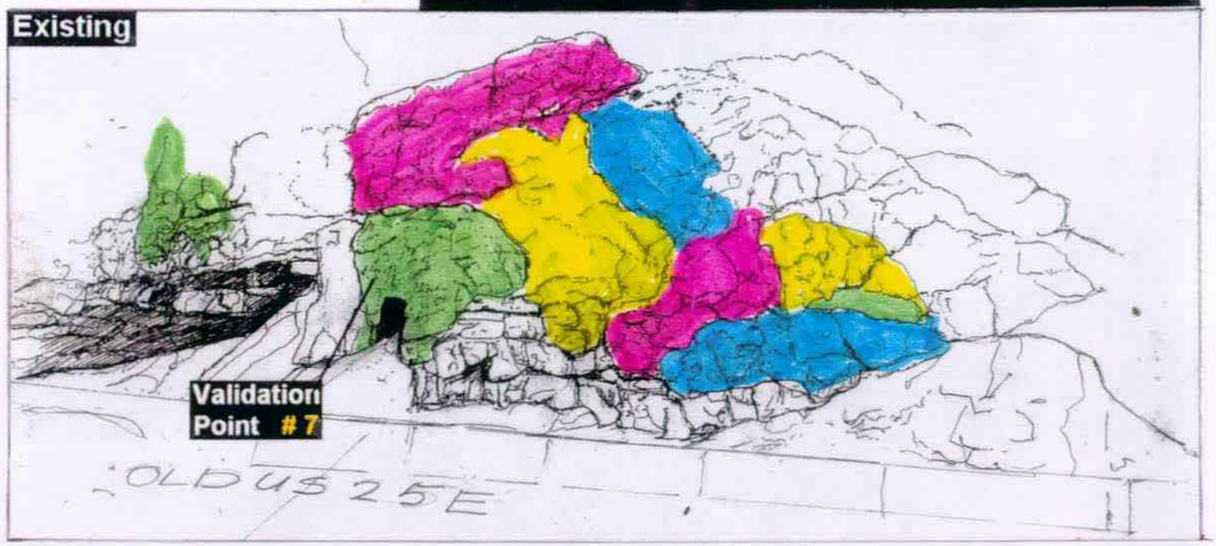
comparison of rock formations

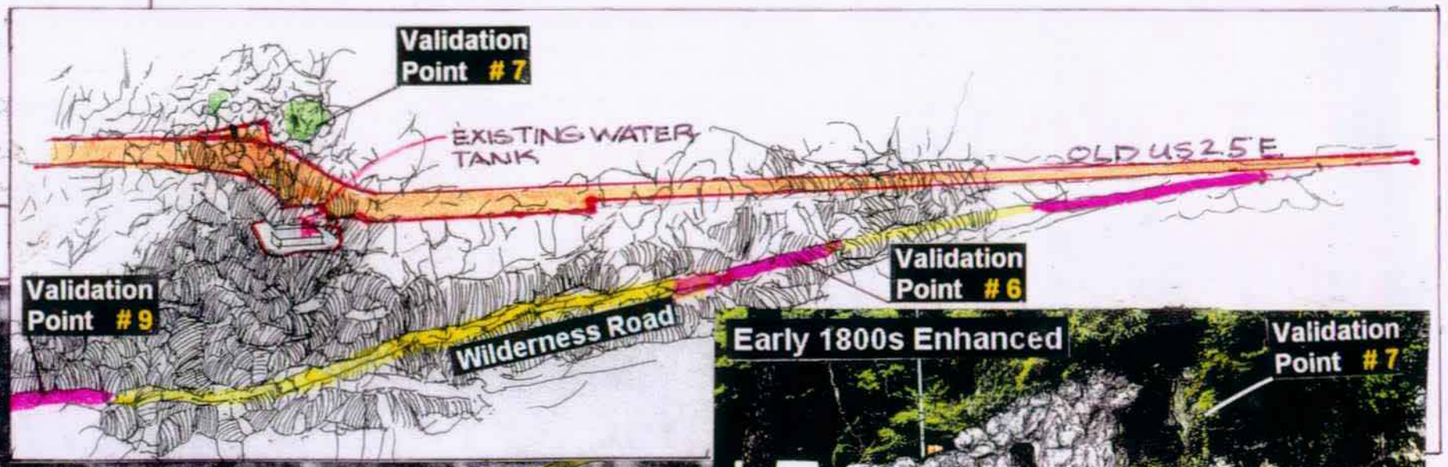
THE EARLY 1800`s COMPARED TO EXISTING

Early 1800`s

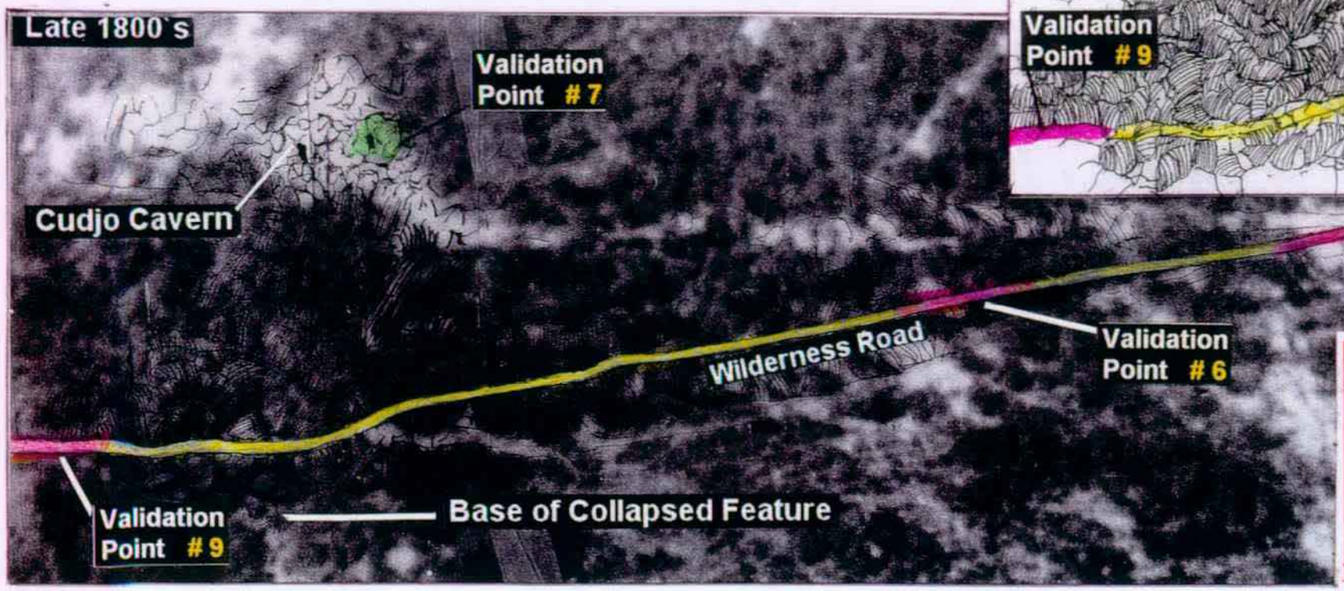


Existing



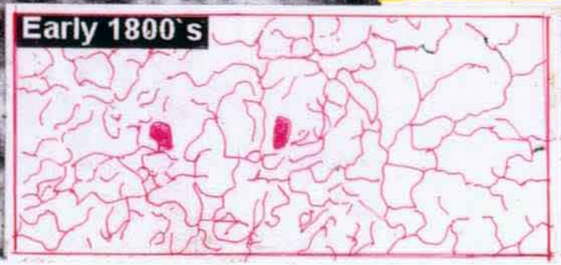


Late 1800`s

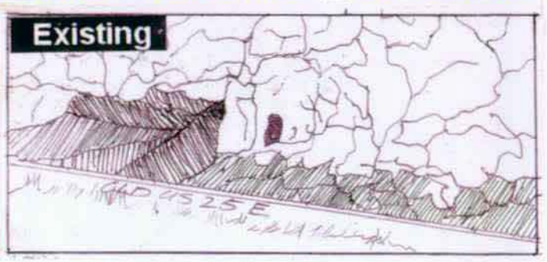


Early 1800s Enhanced

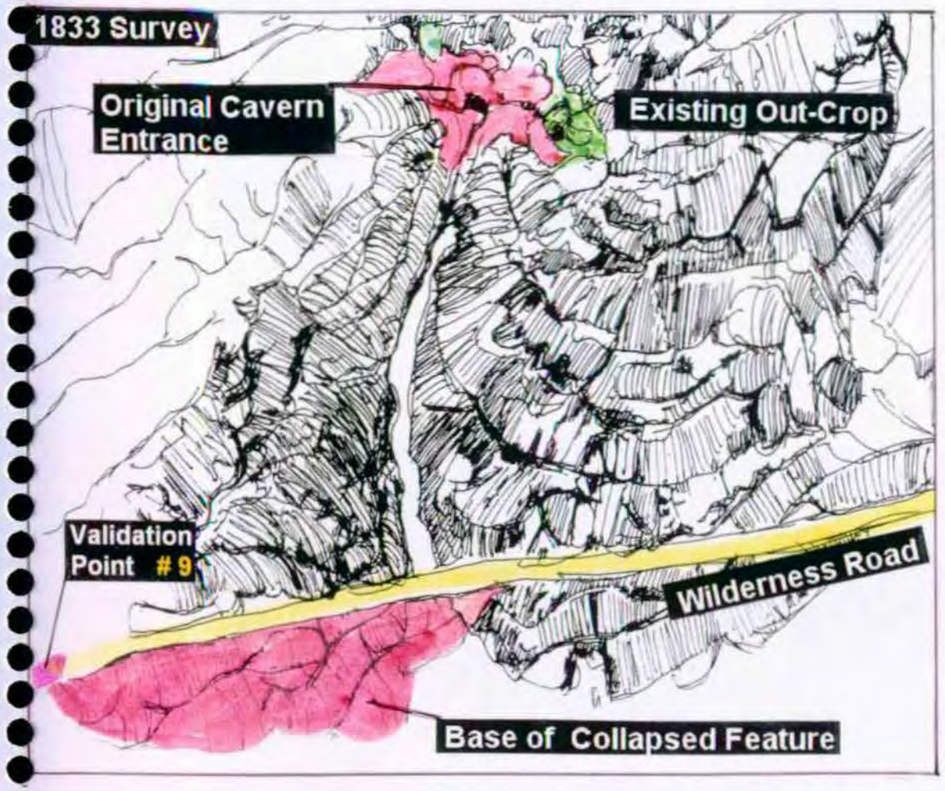
Early 1800`s

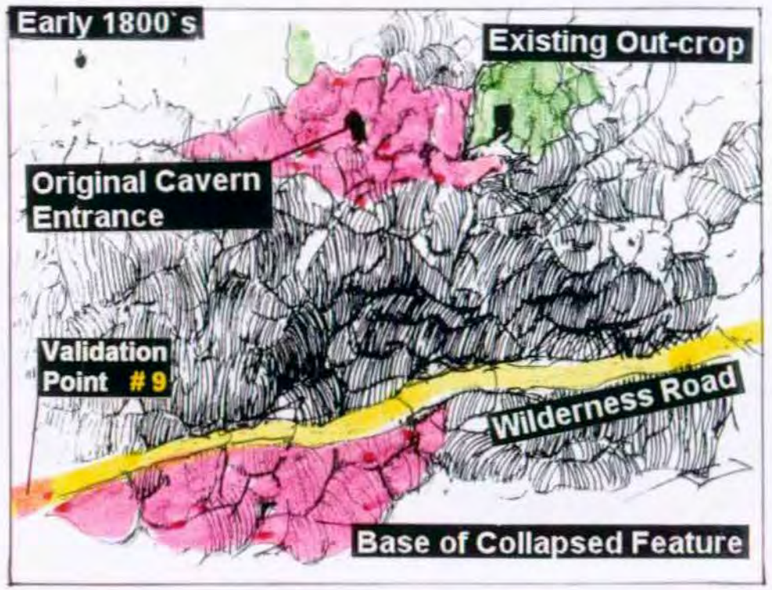


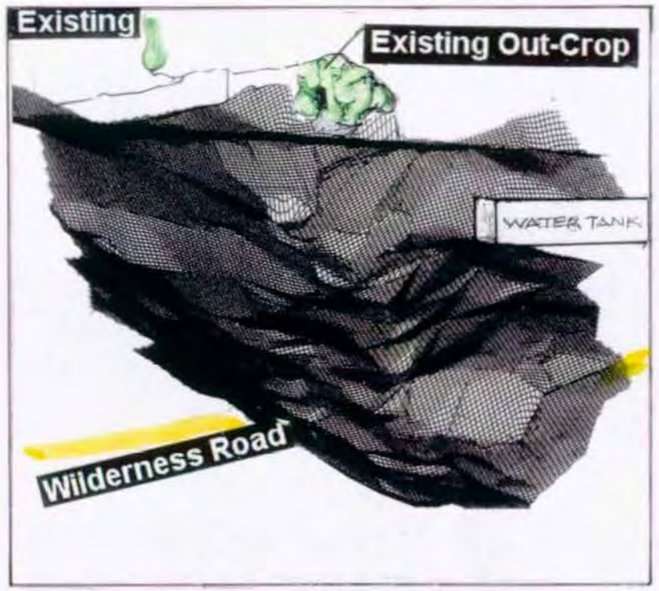
Existing

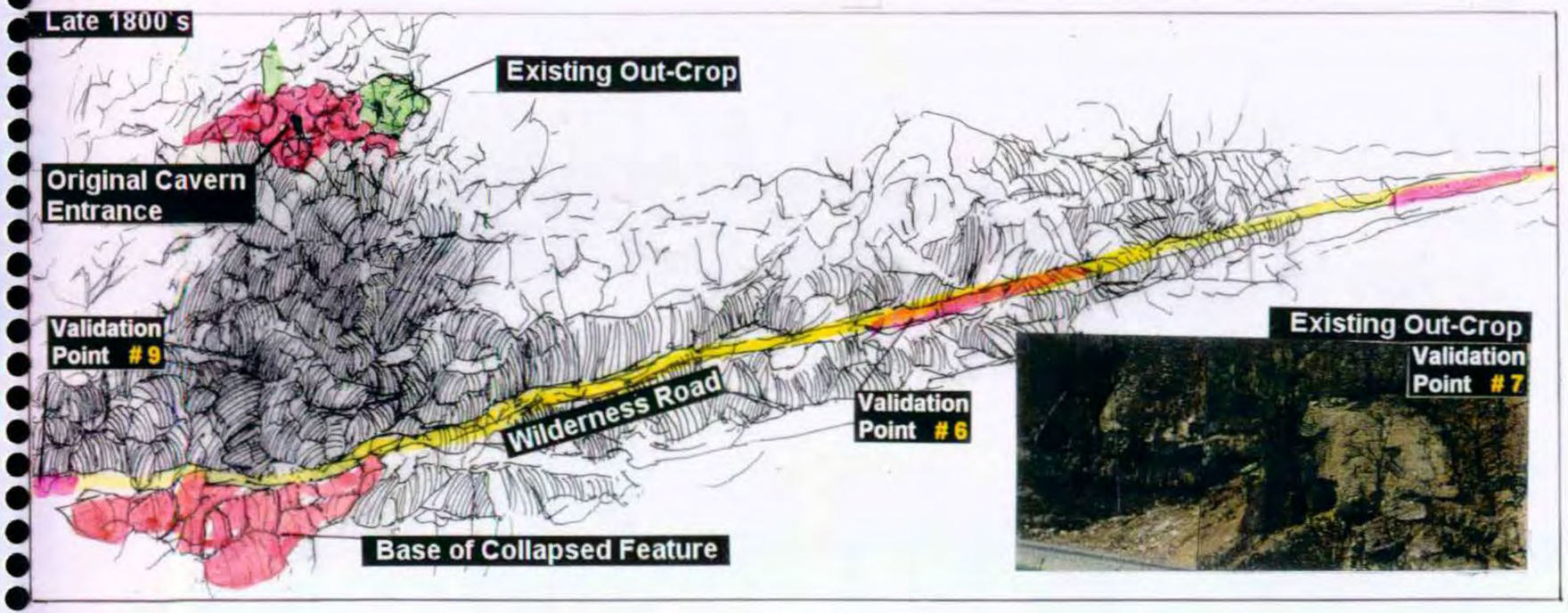


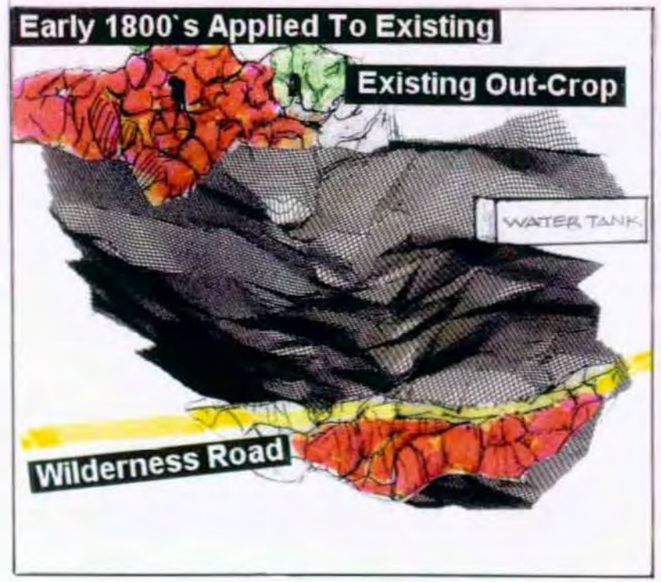
cavern area and geological feature











Geological Explanation of Cudjo Cavern

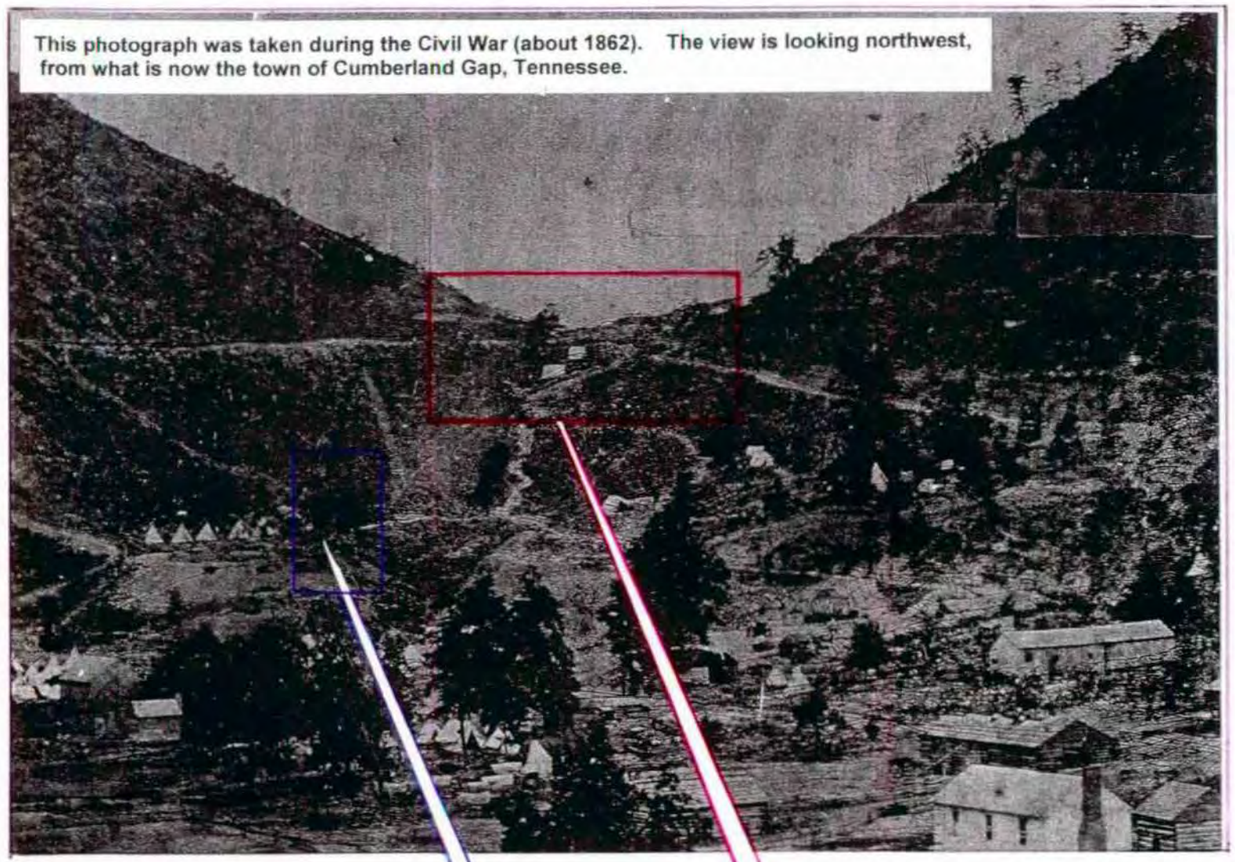
Cudjo Cavern is situated in the lower member of the Newman limestone formation, which outcrops along the southeast face of Cumberland Mountain's Pinnacle Peak. Mississippian Newman limestone, more than 275 million years old, overlays abedding of Grainer Shale and is topped by more recent sandstone. Fractured strata near the Gap have contributed to erosion of the sandstone overburden and exposed the underlying limestone, which may be up to 500 feet thick in some areas. These fractures allowed passage of ground water charged with carbon dioxide into the beds and joints of the underlying limestone. The water, now a weak form of carbonic acid, formed Cudjo Cavern by dissolving away the limestone.

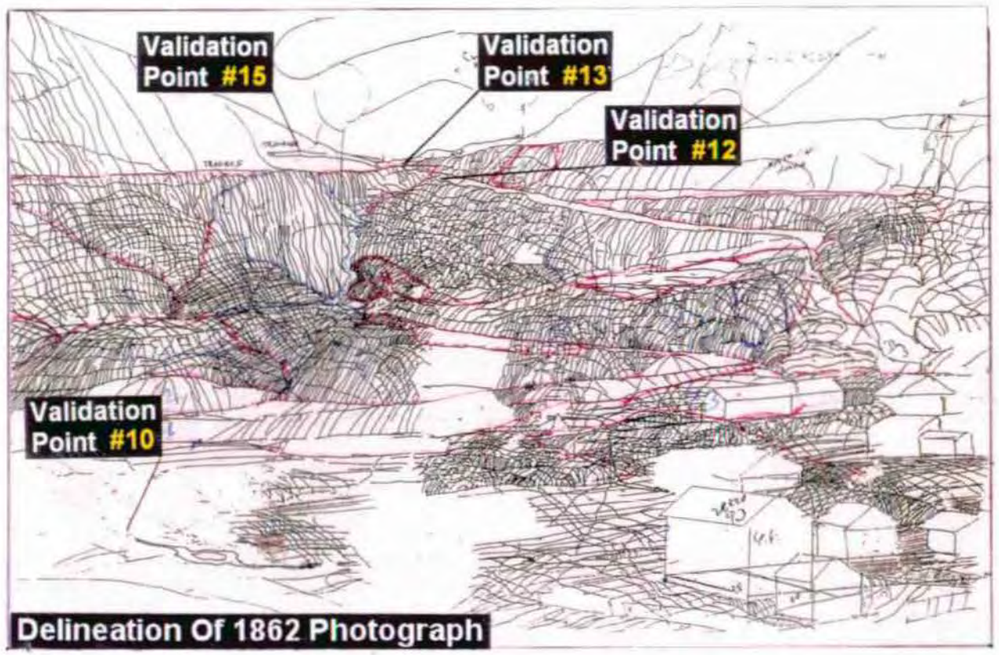
The active stream within the caverns contributes to continuation of the solution processes and enlargement of cave passages. The stream originally exited through the natural entrance to King Solomon's Cave and crossed the Wilderness Trace before flowing downhill towards the community of Cumberland Gap. Presently the cave stream has been redirected under the highway through a concrete conduit before descending the mountainside as Gap Creek.

Evidence seems to sugges that cave passage may hve extended beyond the current location of the entrance. In fact, such an occurrence in to karst areas. Karst is a process by which water dissolving away soluble rock such as limestone creates a landform typified by sinkholes, underground streams, caves, and spring.The major portions of the cave extend alsmost a mile beyond the end of the commercial route. The stream extends northeast along the strike through a large, steeply slanting breakdown (70 feet by 50 feet by 50 feet) passage along the dip of the rock. Another area outside the commercial route begins on the upper level of Soldiers Cave near the Big Room where a short stoopway opens into a large breakdown room. From here, there are several routes into a very large romm (circa 120feet long by 70 feet wide by 30 feet high.) several high leads extend outward from this room. One of these intersects an old stream side passage with well-scalloped walls. What is now known as Cudjo Cavern is only a small part of a much larger cave system, estending some five miles in surveyed length and connecting with Cumberland Gap Saltpeter Cave.

In closing, please refer to the collapsed feature in this, the graphic section of the Cavern Area. It is the karst processes, cave stream resurgence, and surface erosion that caused this Collapsed Feature.

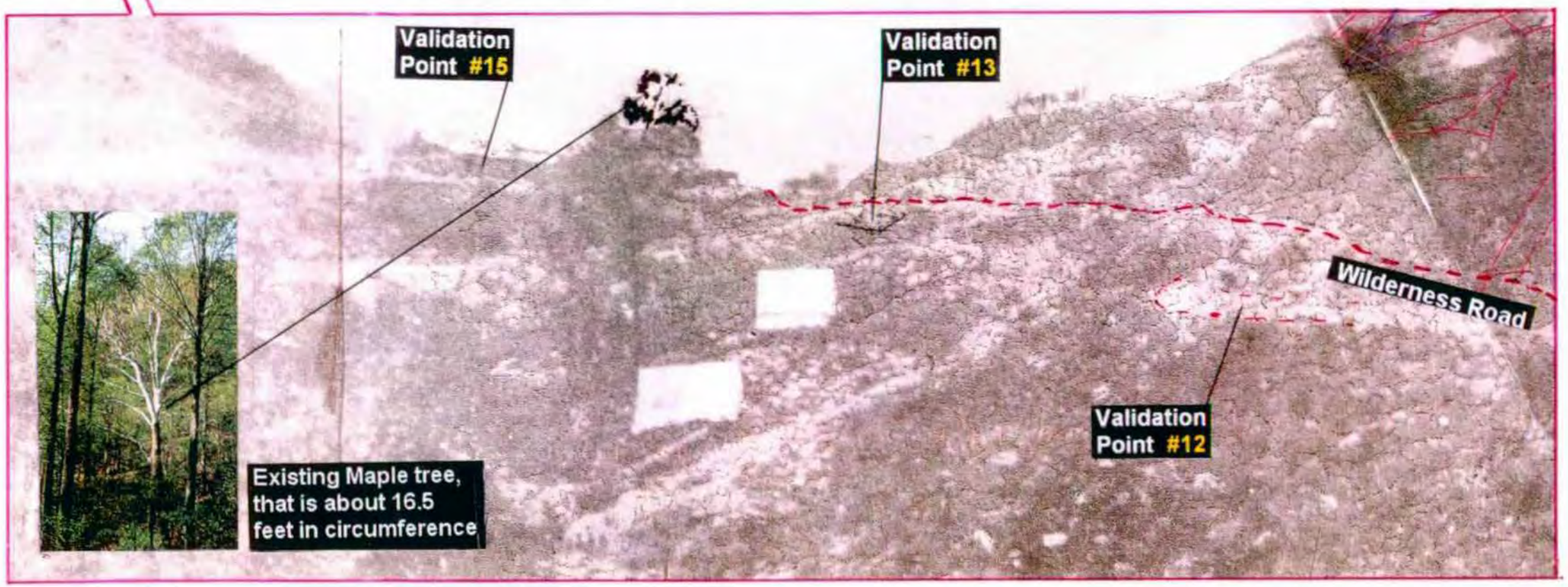
Ronal Kerbo
National Cave Management Coordinator
Geologic Resources Division
National Park Service



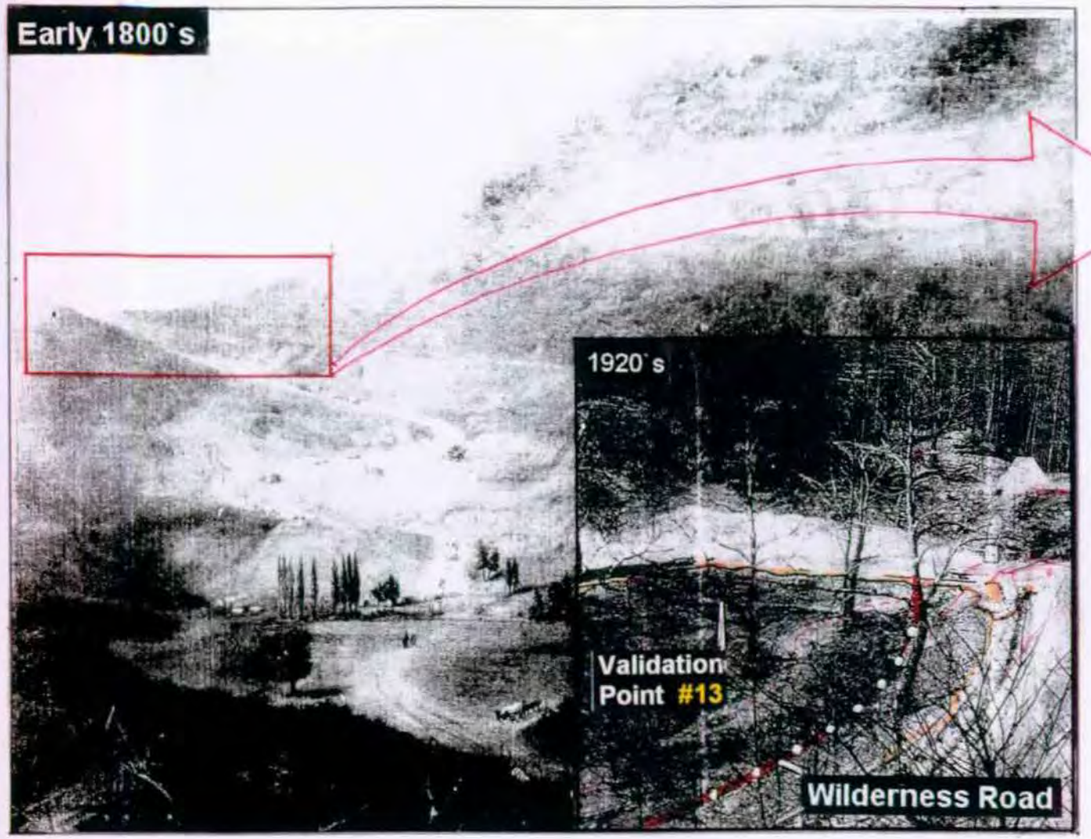


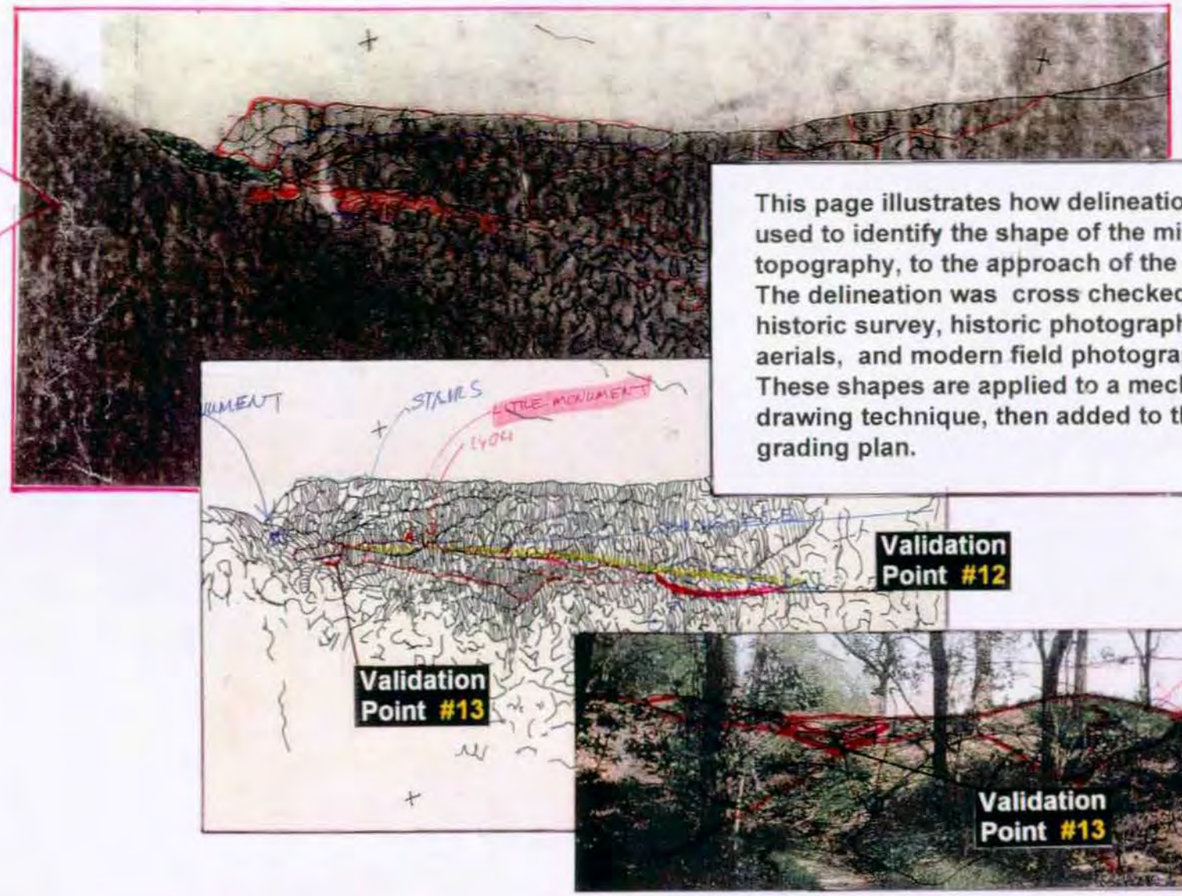
Delineation Of 1862 Photograph

Existing tree, visable in photograph above is a Red Oak (about 12.5 ft. in circumference) and gives another location cross check. Validation Point #11

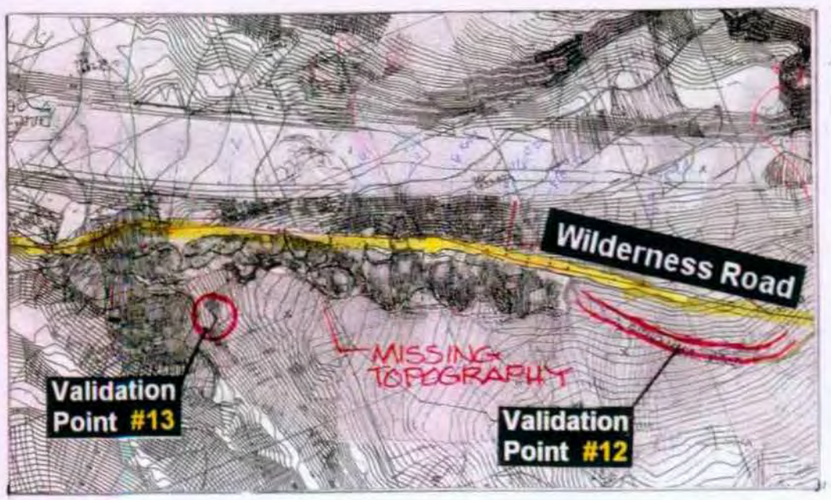


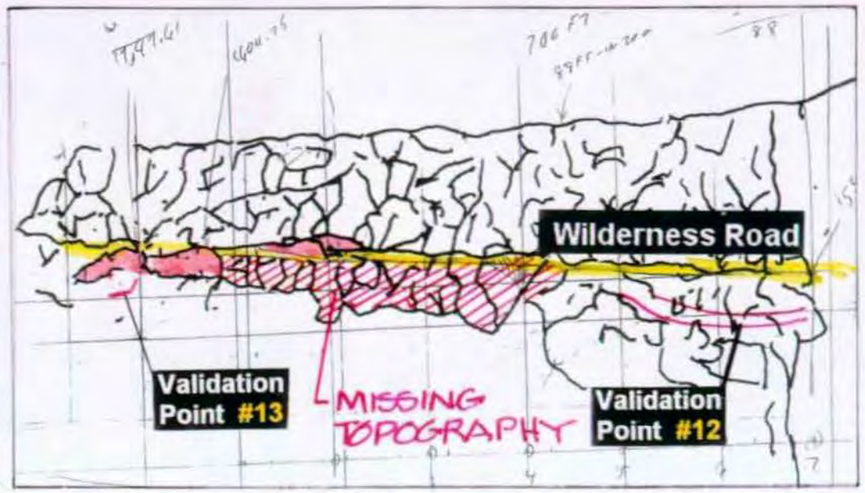
view northwest toward the saddle

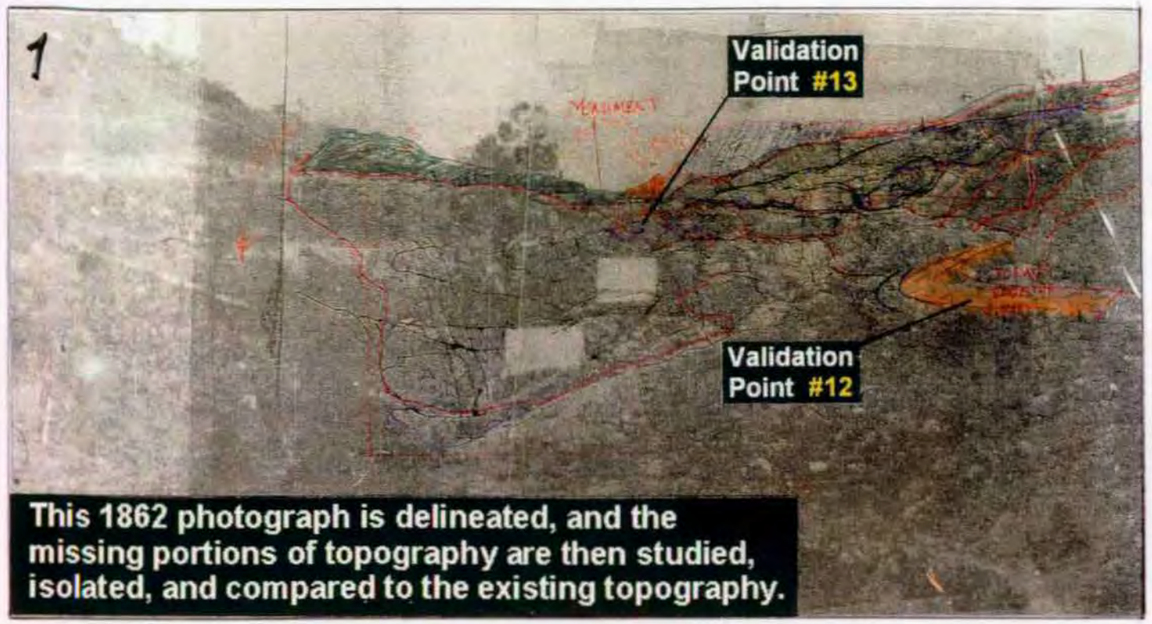




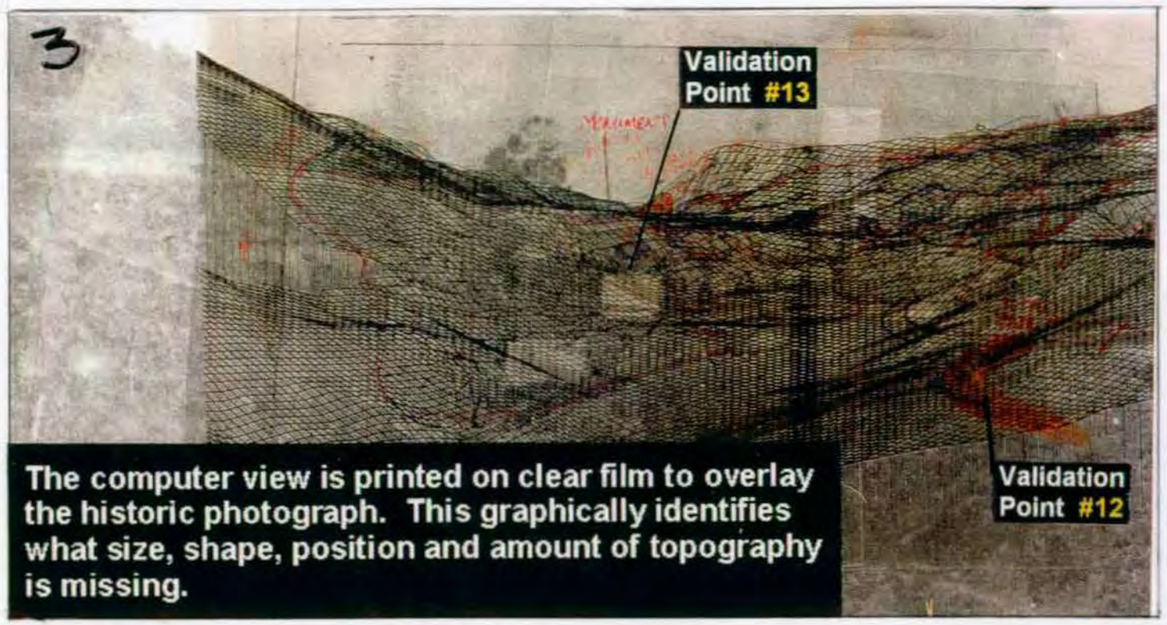
This page illustrates how delineation was used to identify the shape of the missing topography, to the approach of the saddle. The delineation was cross checked with historic survey, historic photographs, aerials, and modern field photographs. These shapes are applied to a mechanical drawing technique, then added to the grading plan.



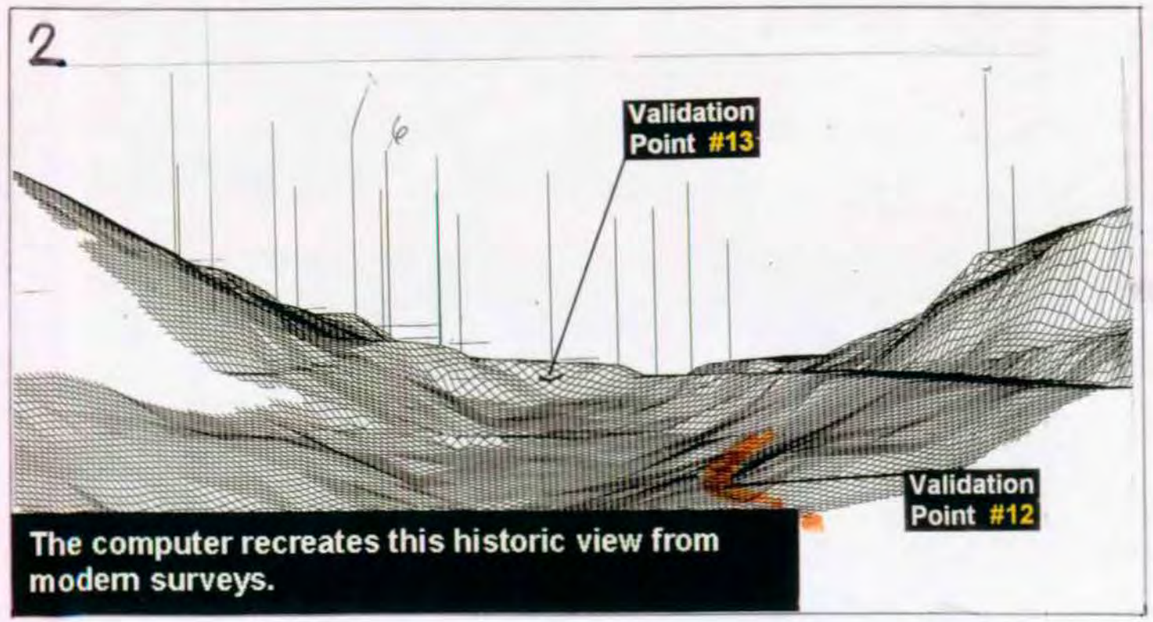




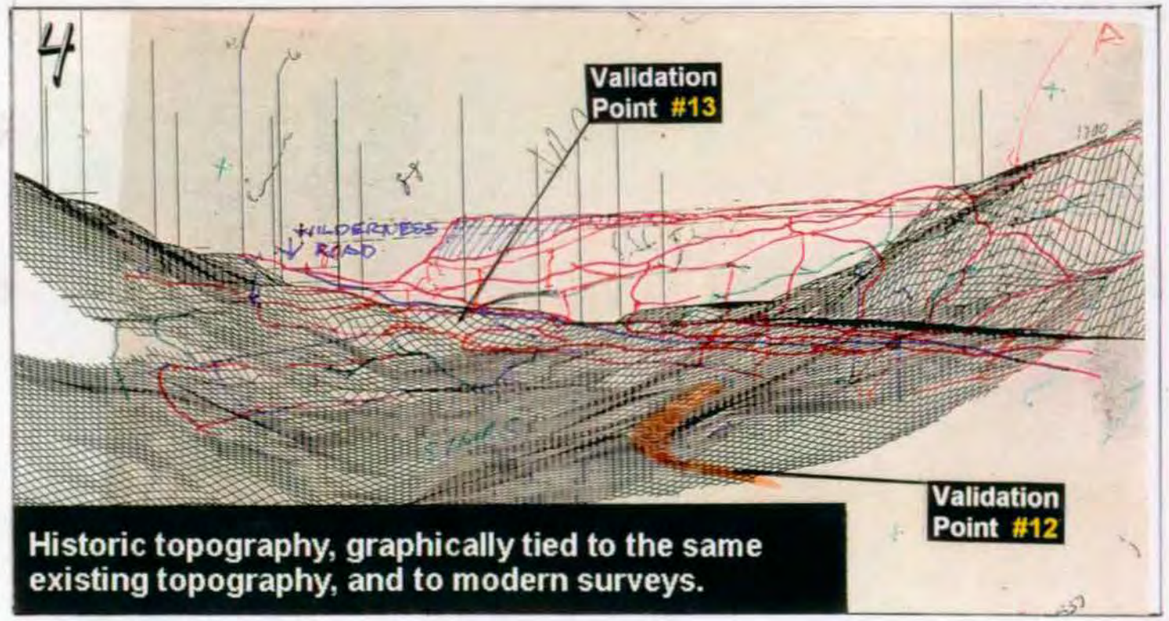
This 1862 photograph is delineated, and the missing portions of topography are then studied, isolated, and compared to the existing topography.



The computer view is printed on clear film to overlay the historic photograph. This graphically identifies what size, shape, position and amount of topography is missing.

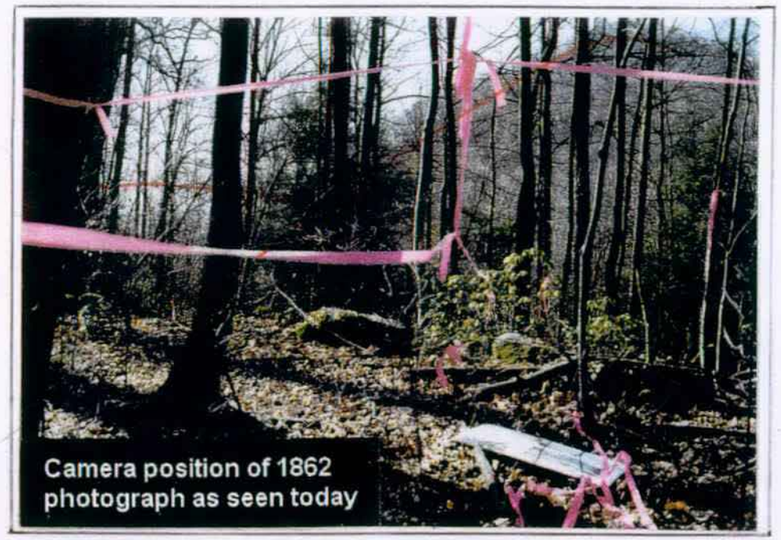


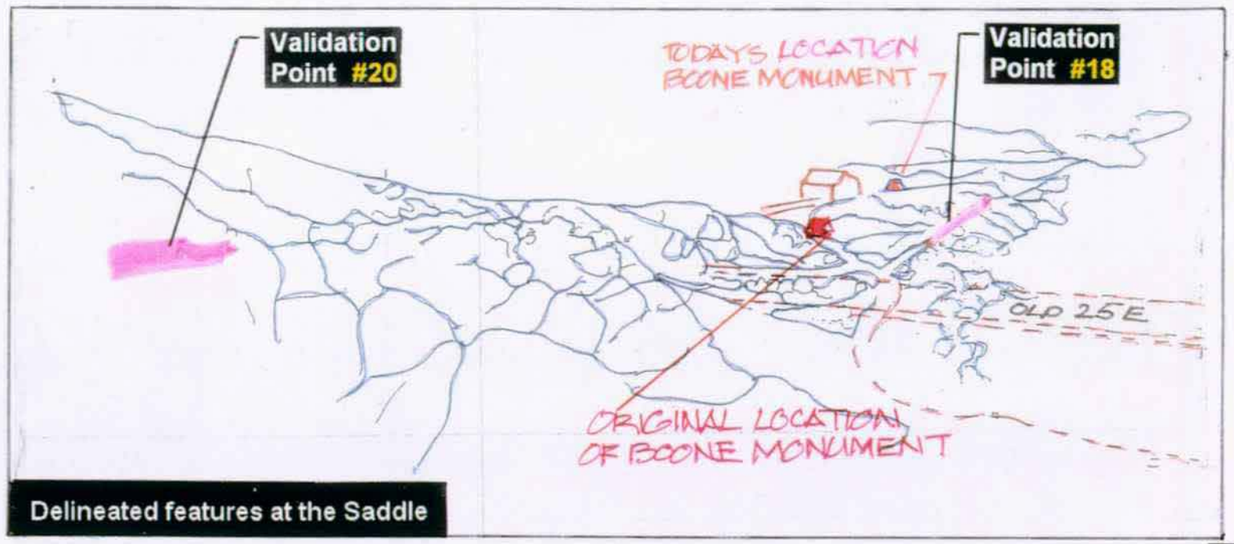
The computer recreates this historic view from modern surveys.

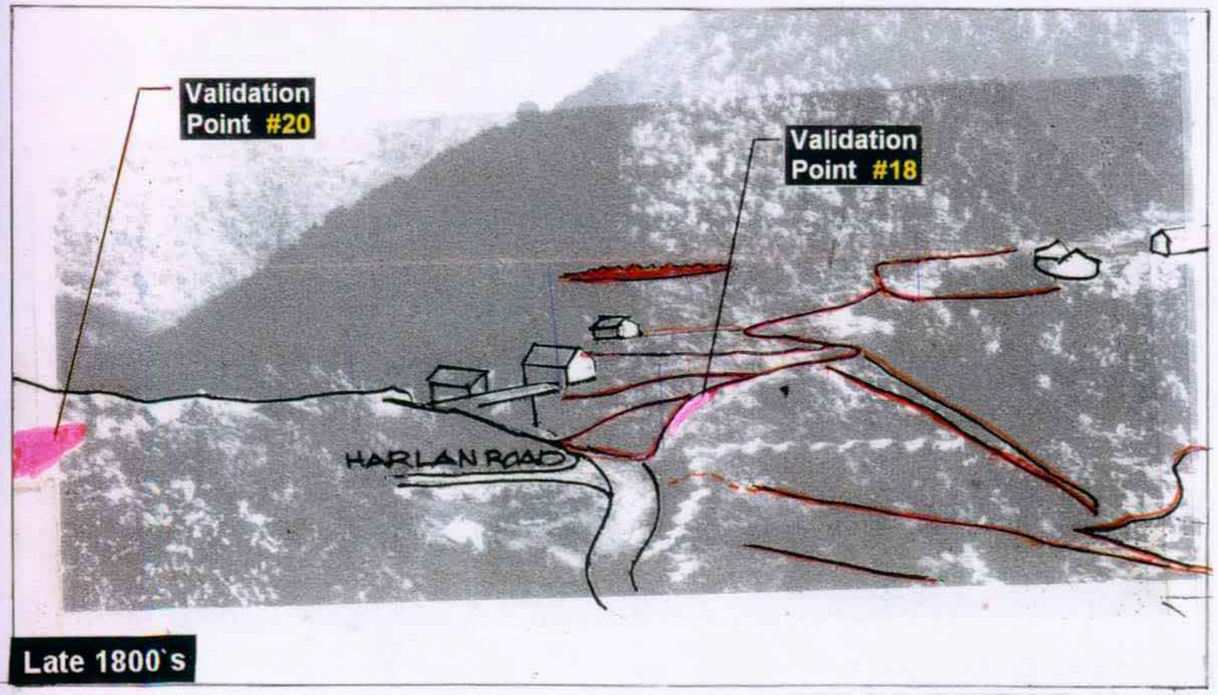


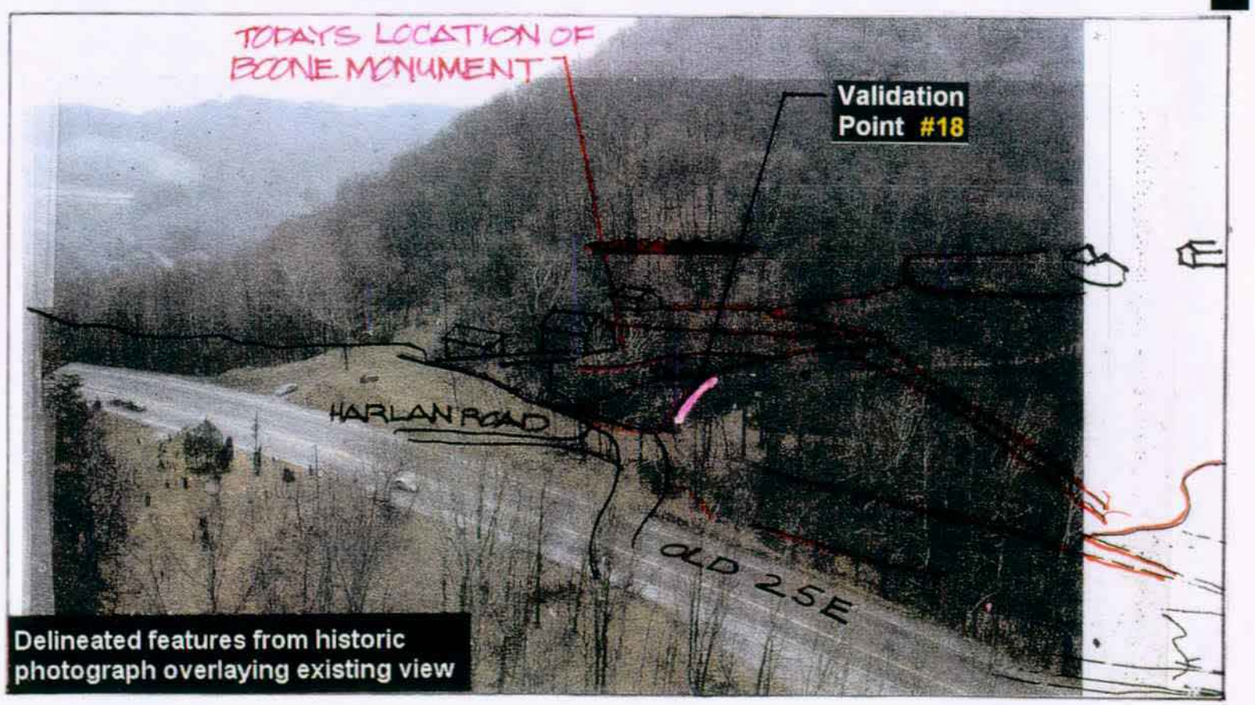
Historic topography, graphically tied to the same existing topography, and to modern surveys.

saddle area viewing south

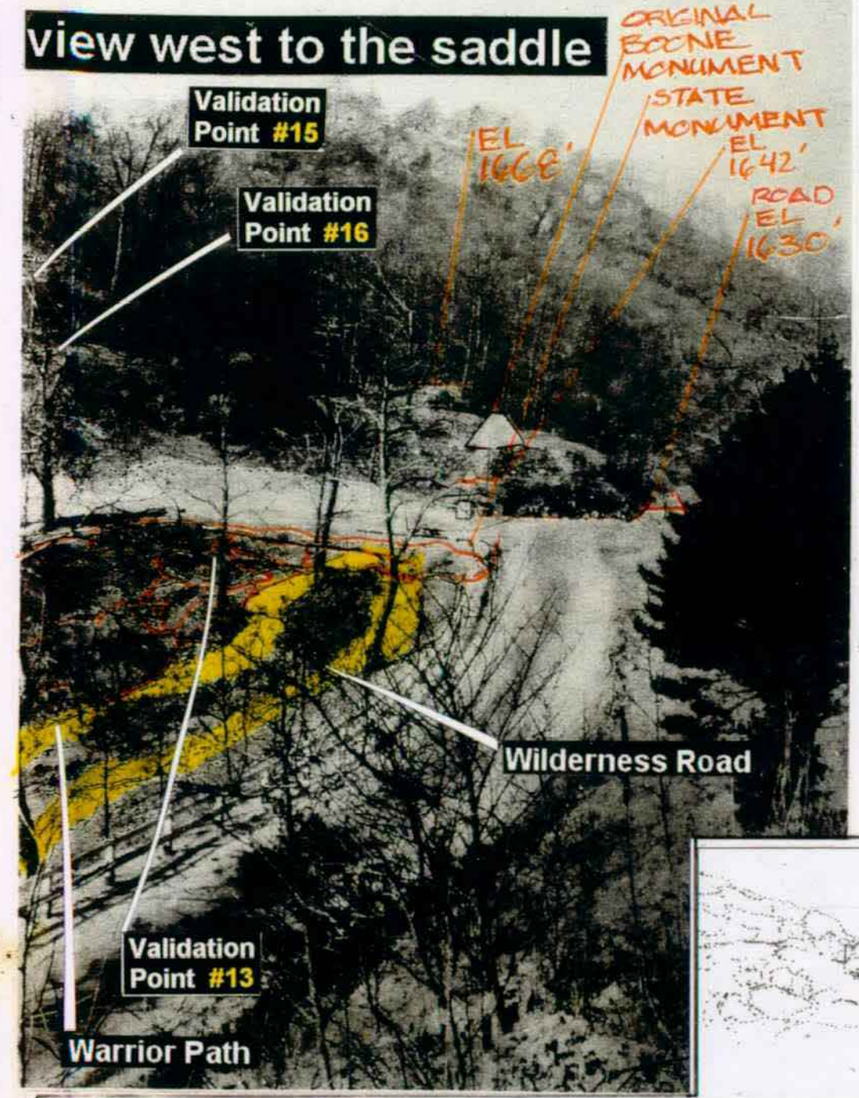


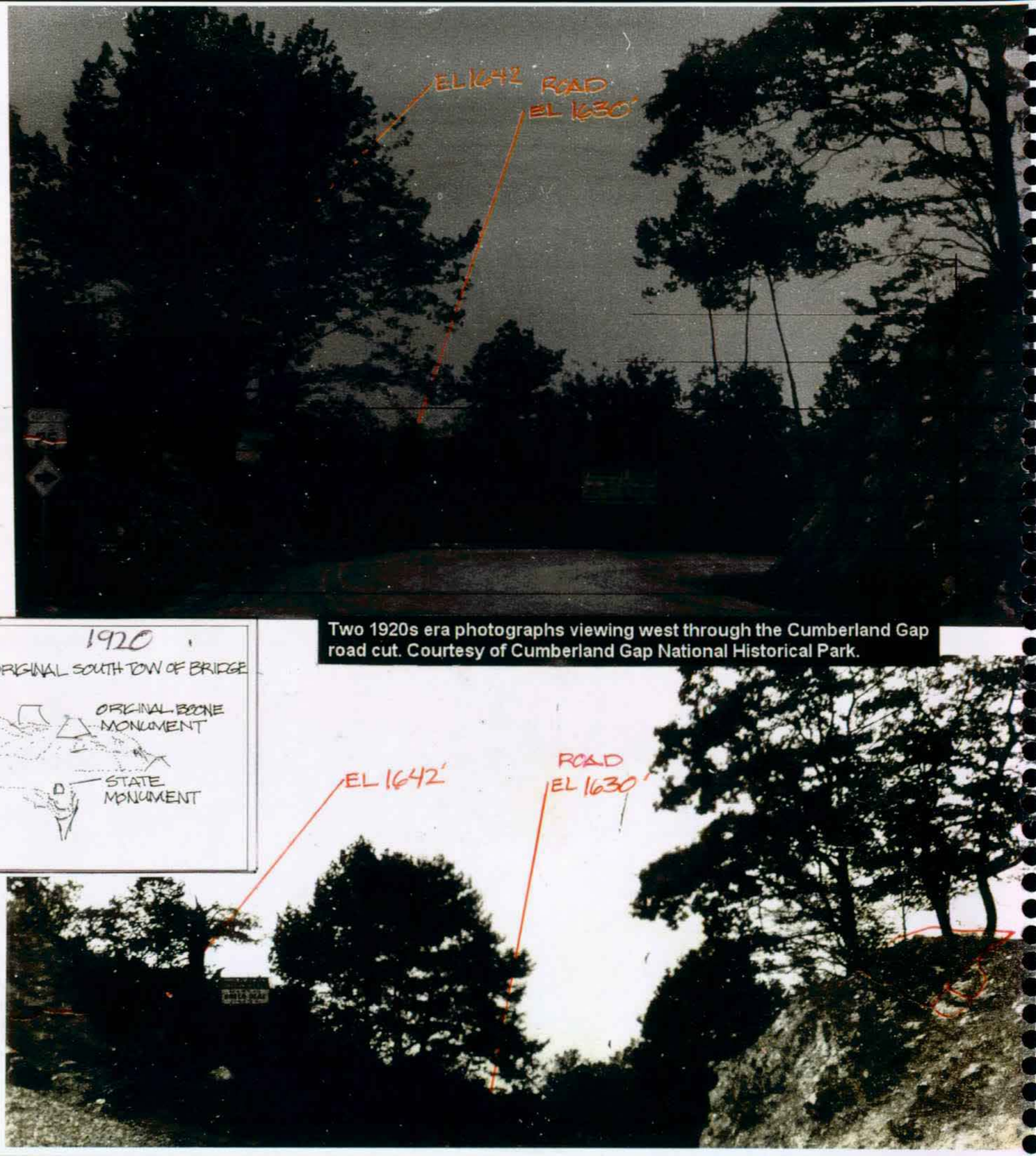




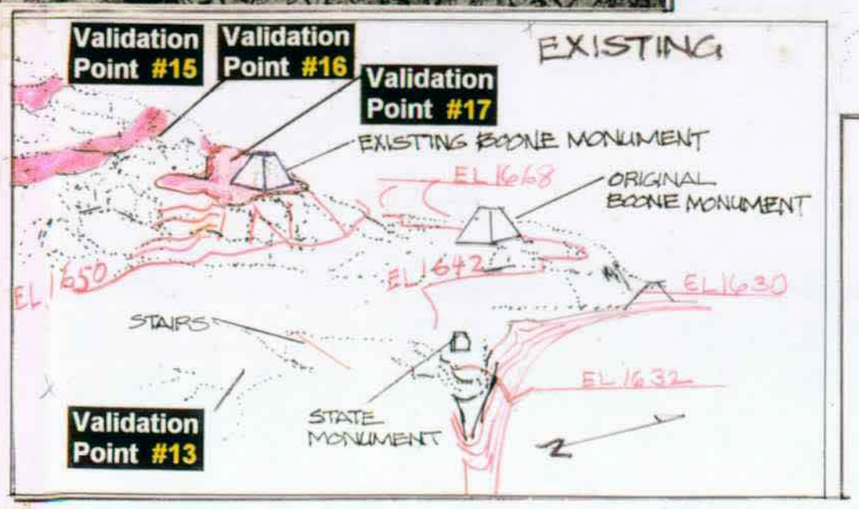


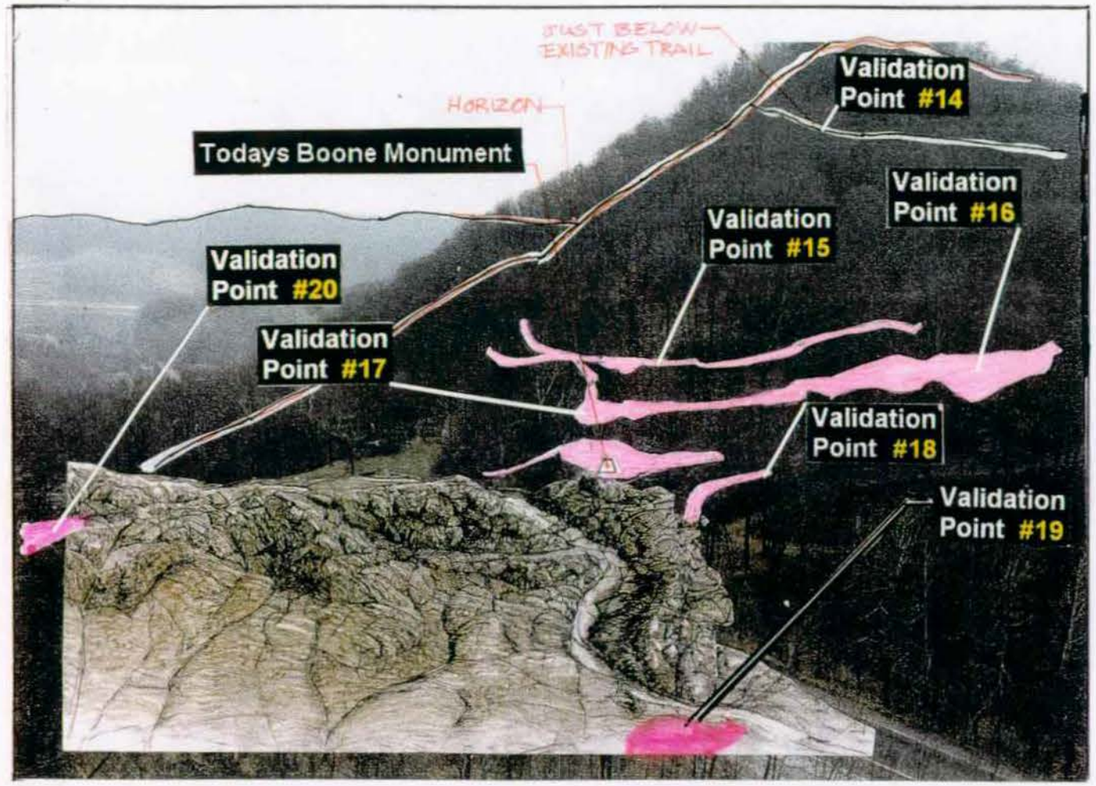
Remnants of the late 1800`s as they overlay their same location today



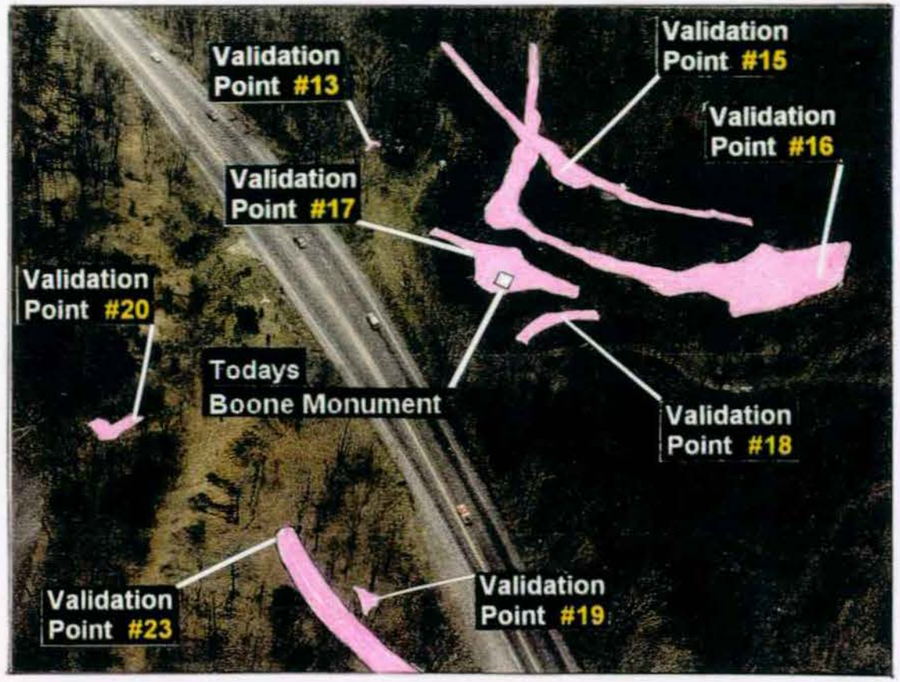


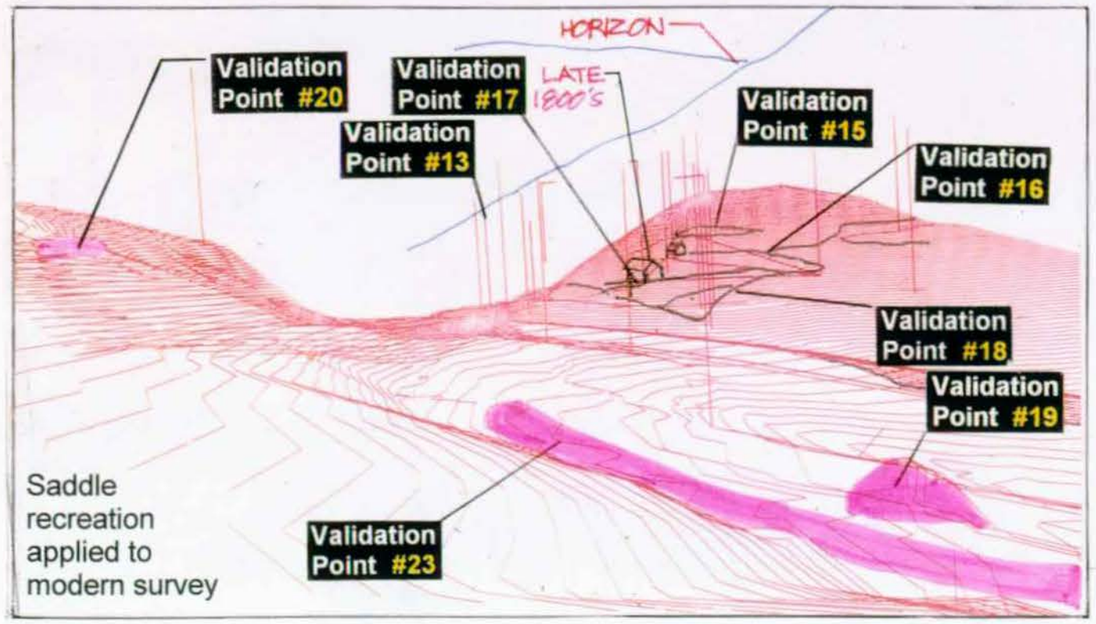
Two 1920s era photographs viewing west through the Cumberland Gap road cut. Courtesy of Cumberland Gap National Historical Park.

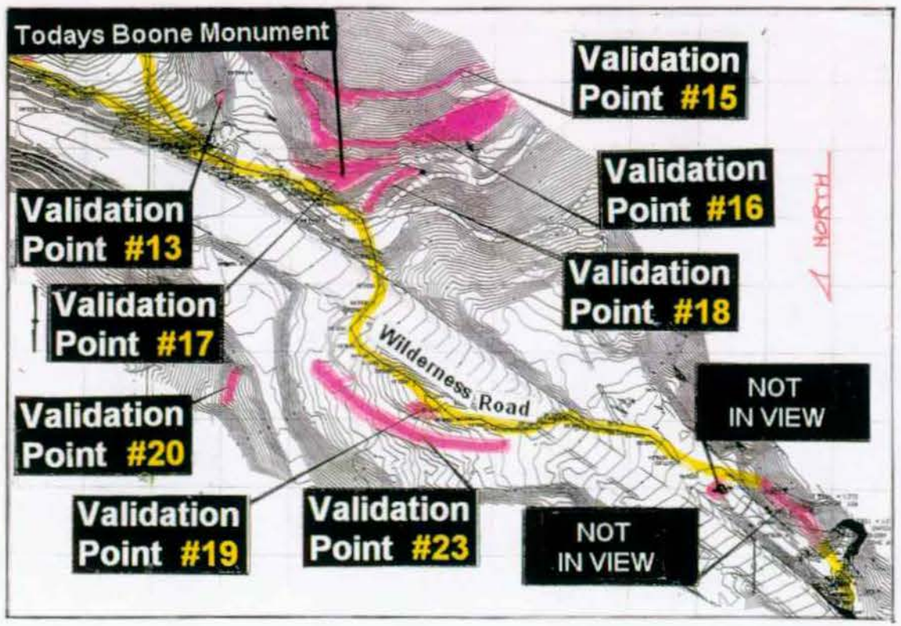




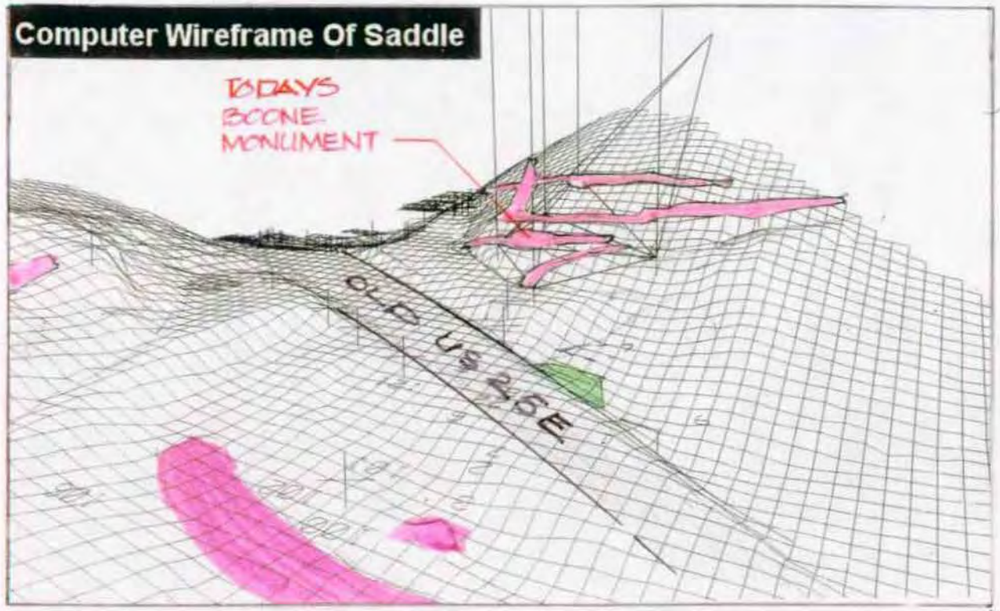
saddle area viewing south

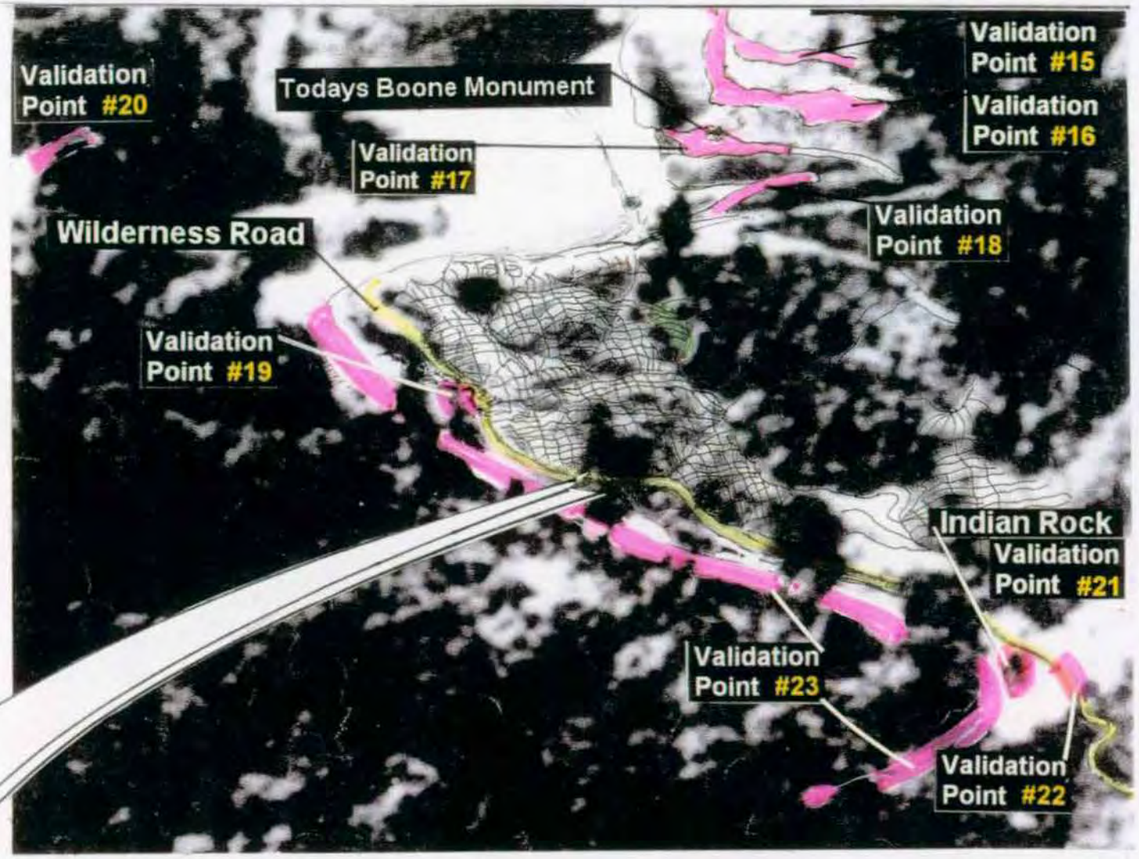


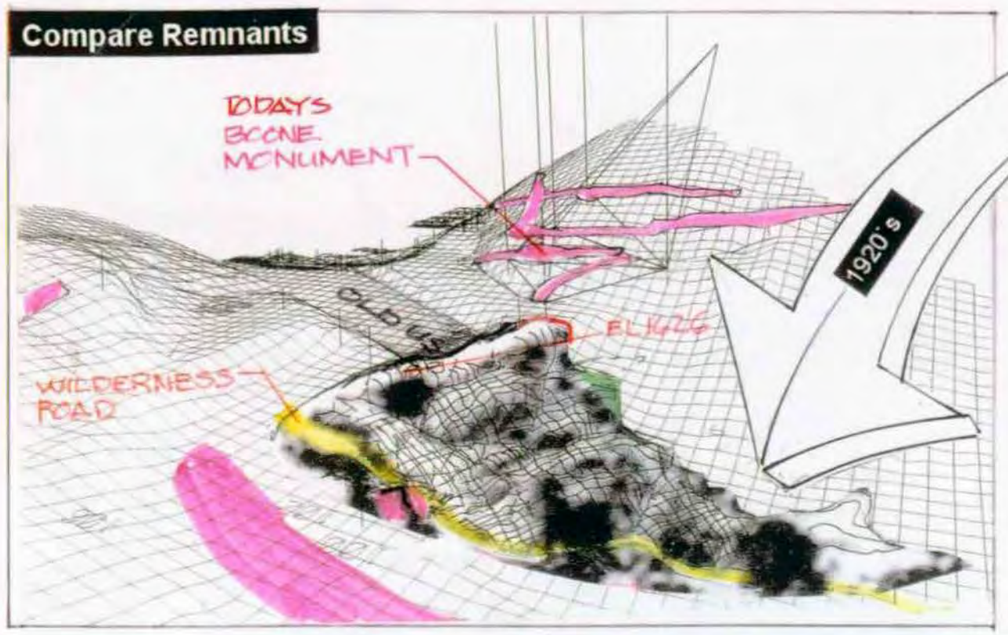


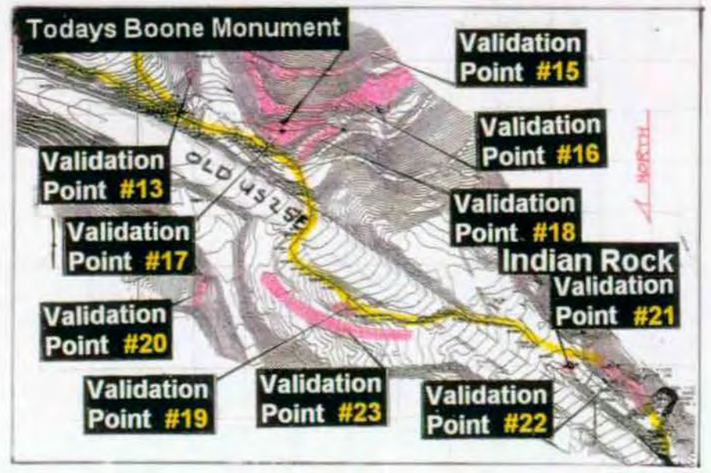


saddle area viewing south



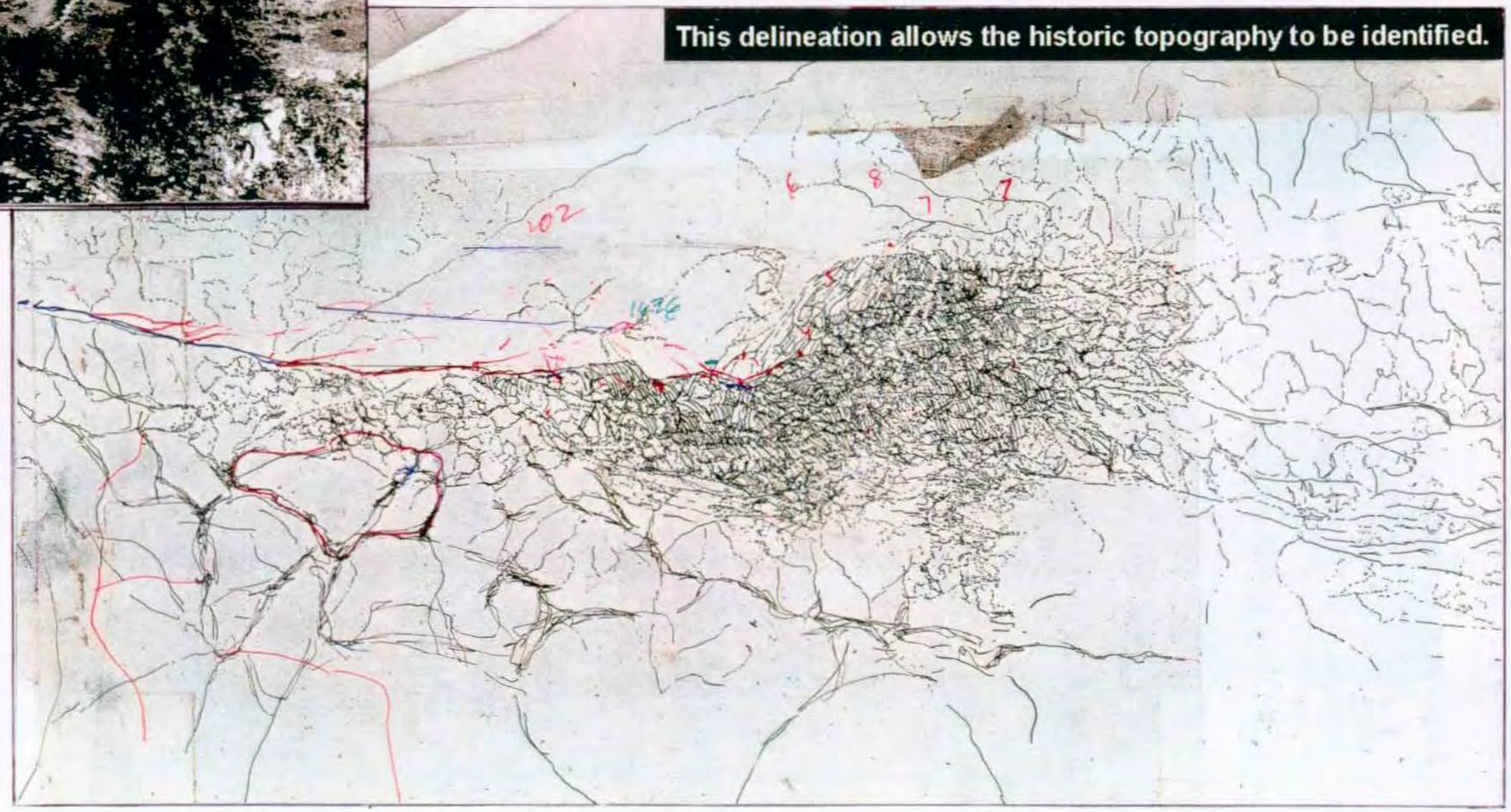


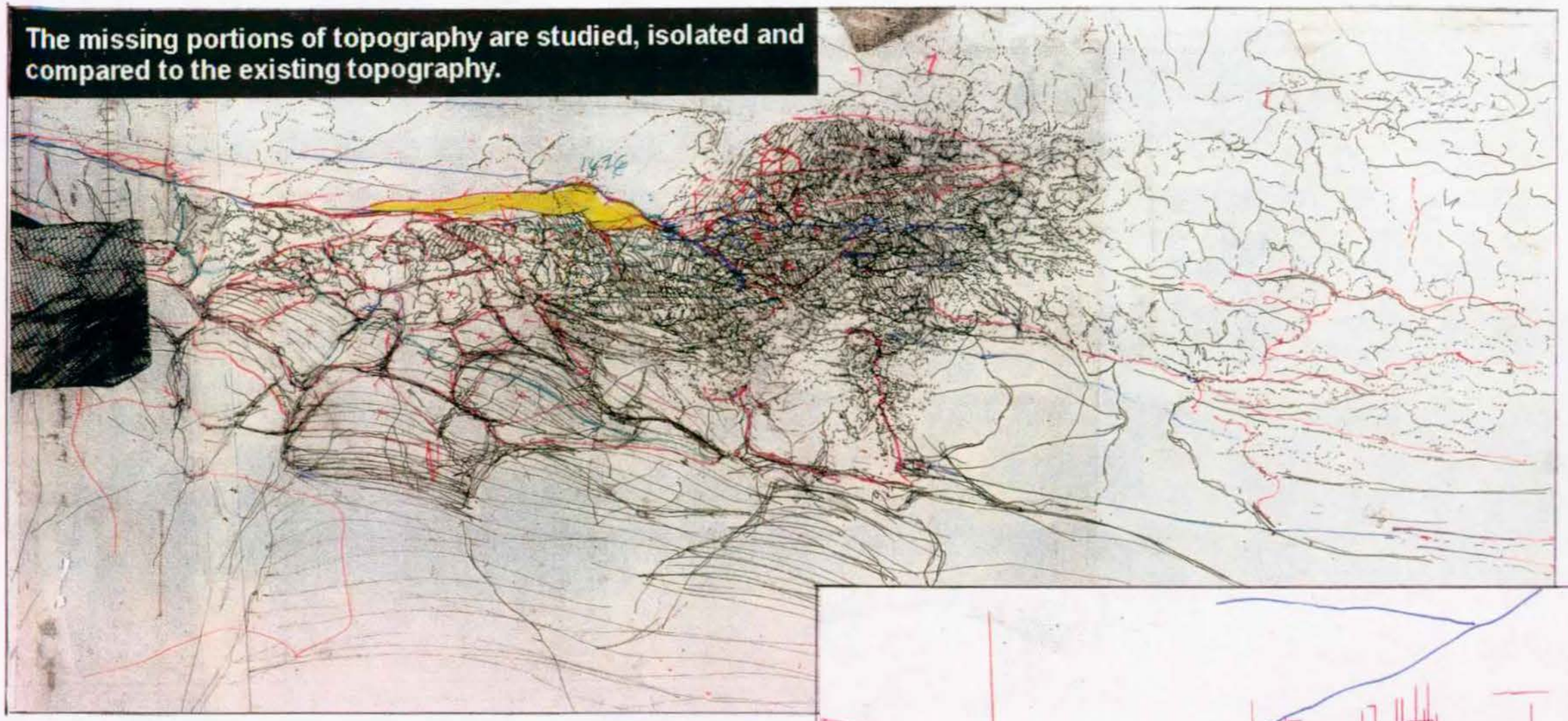




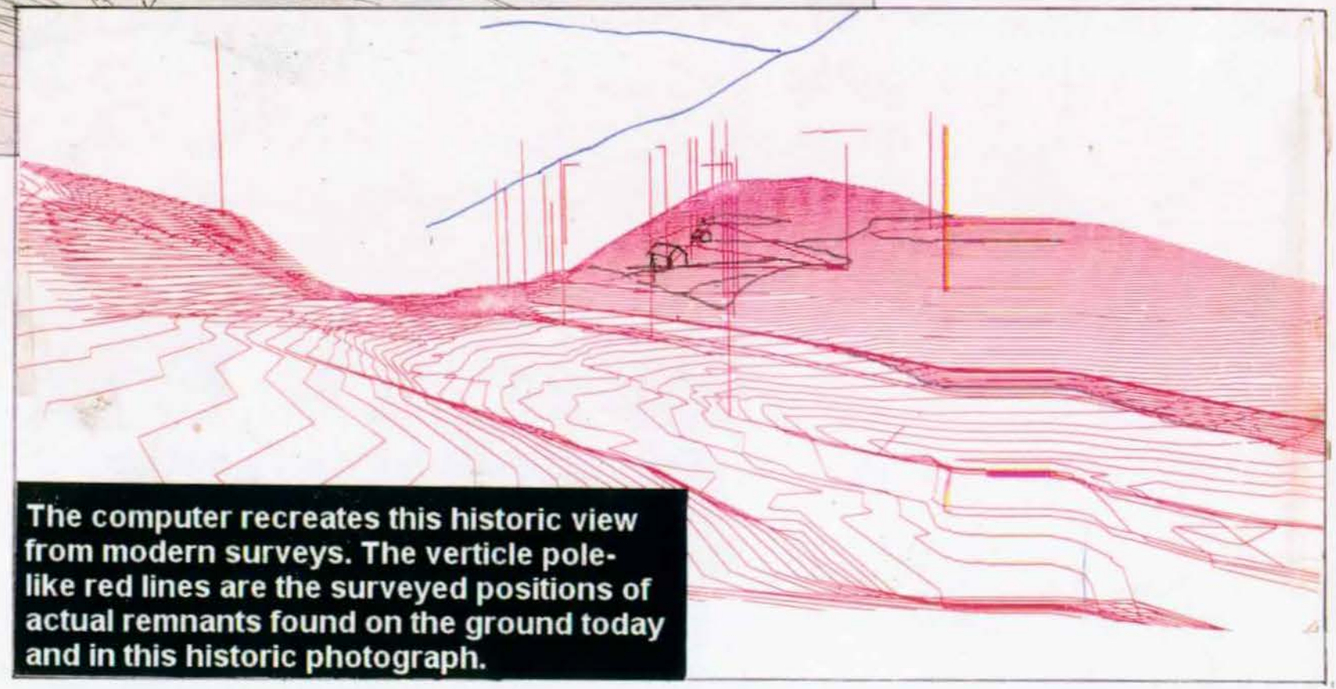
view south to the saddle

Refinement For Final Grading Plan



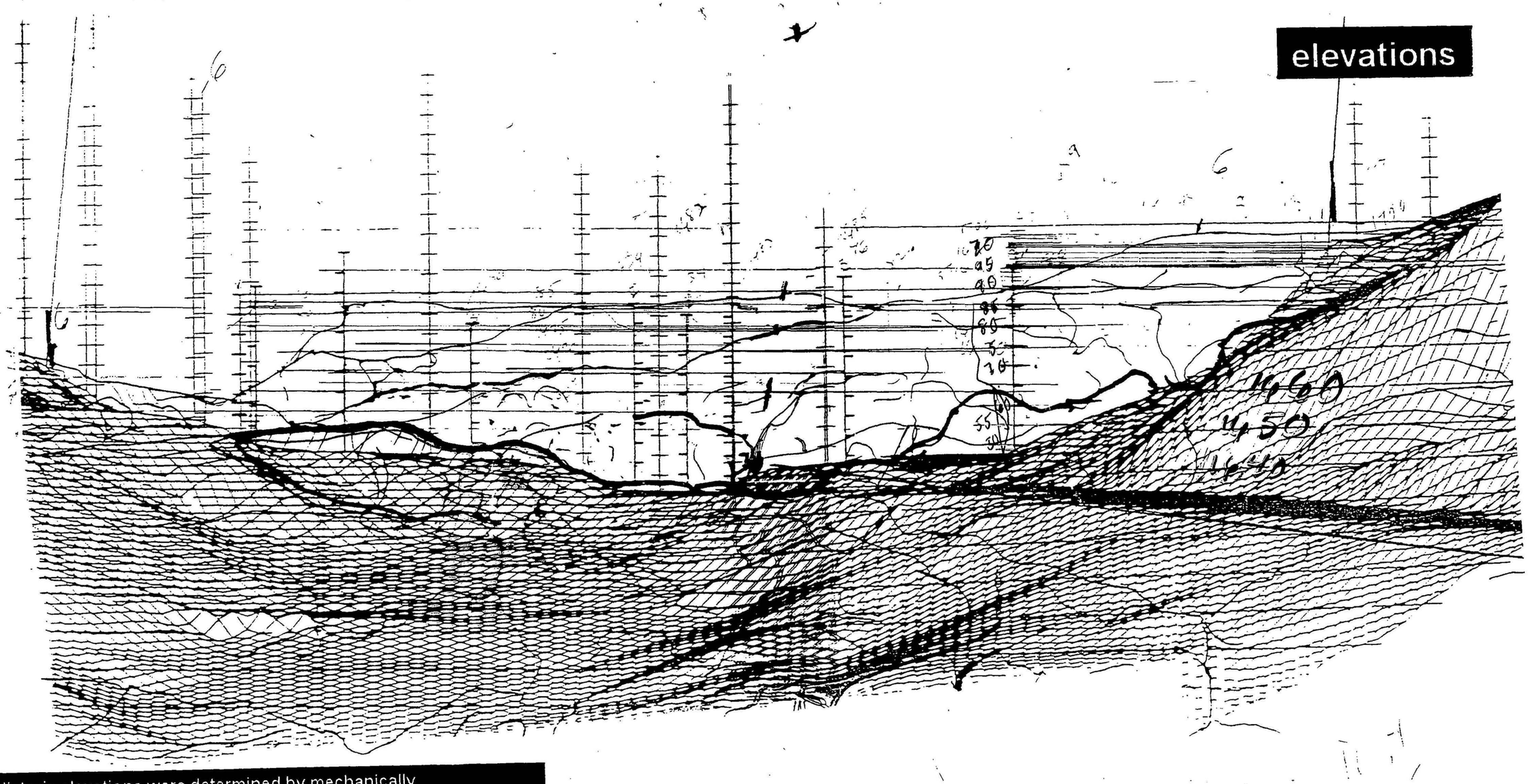


The missing portions of topography are studied, isolated and compared to the existing topography.

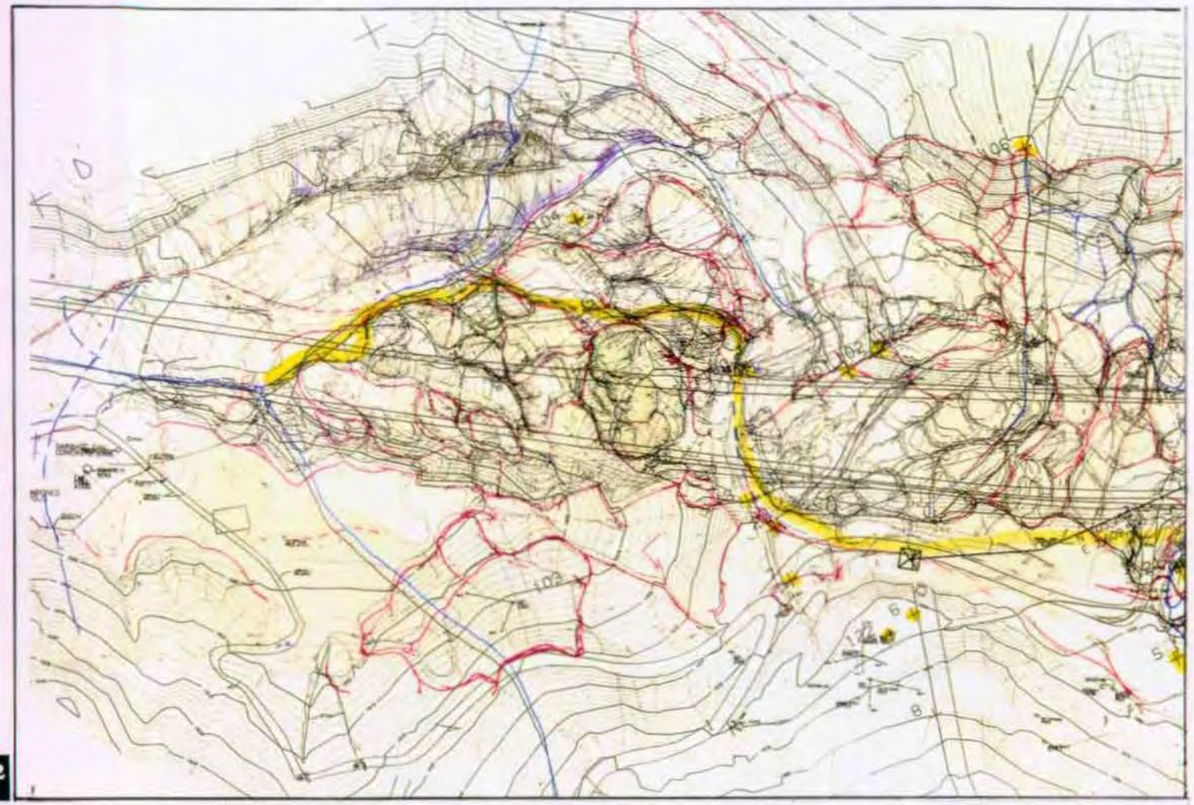


The computer recreates this historic view from modern surveys. The verticle pole-like red lines are the surveyed positions of actual remnants found on the ground today and in this historic photograph.

elevations

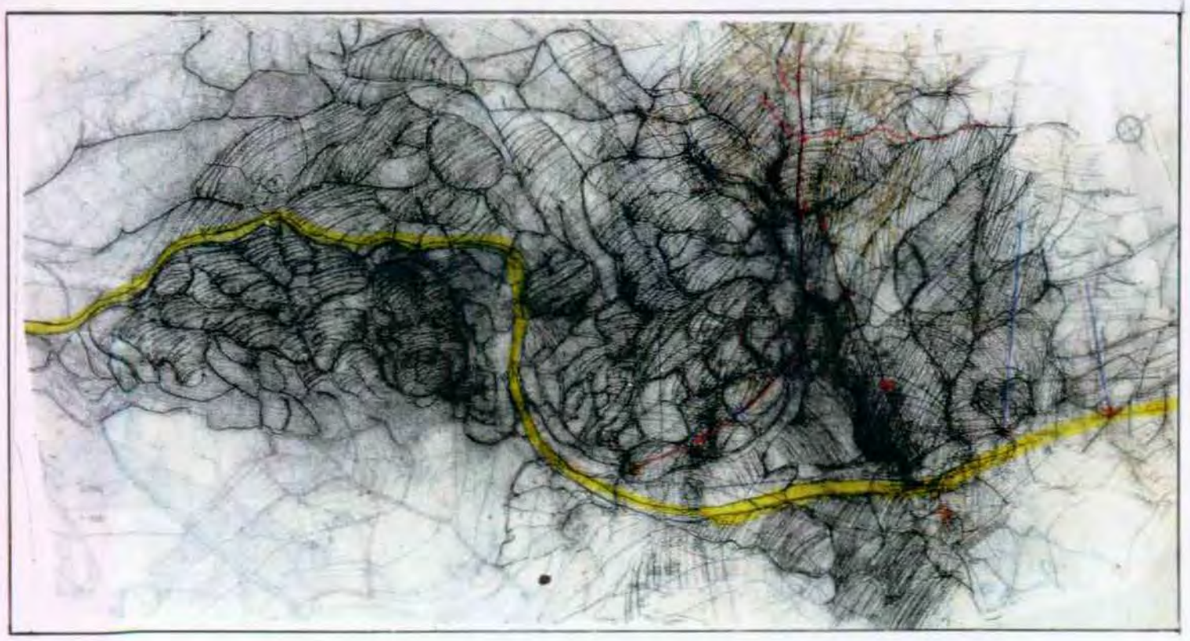


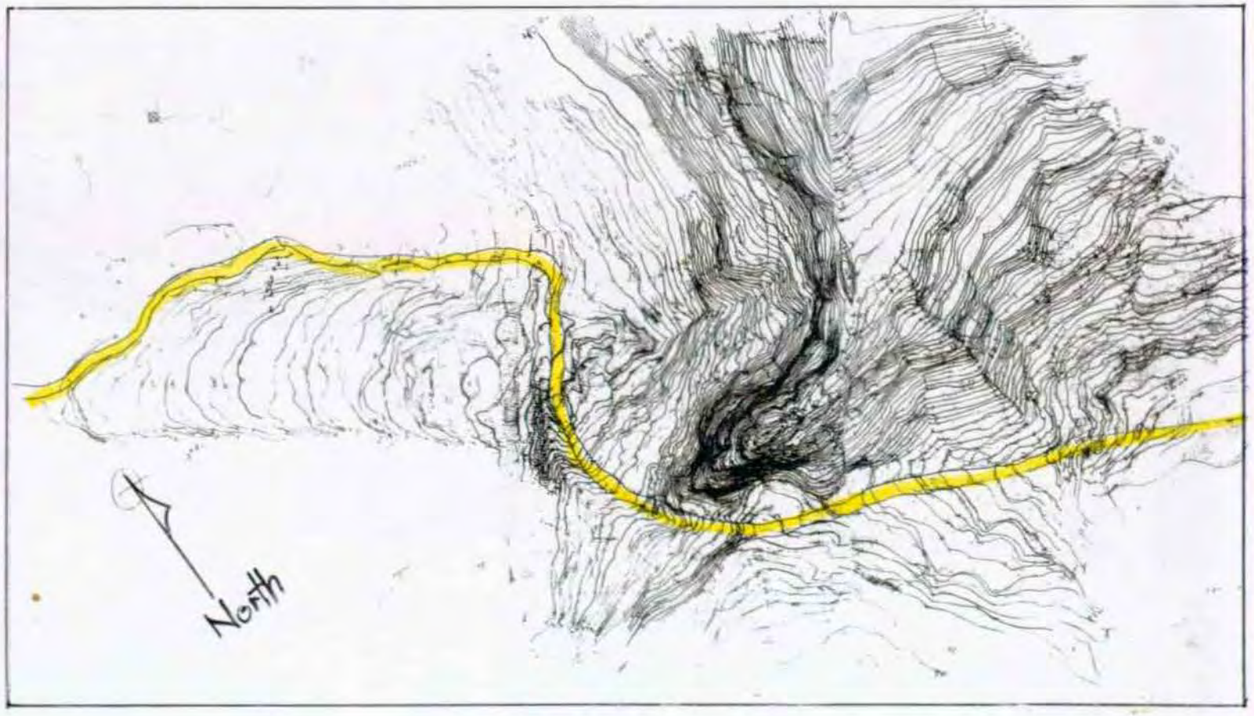
Historic elevations were determined by mechanically drawing intersecting points from a composite of the computer wireframe and major landforms delineated from the 1862 Civil War photograph.



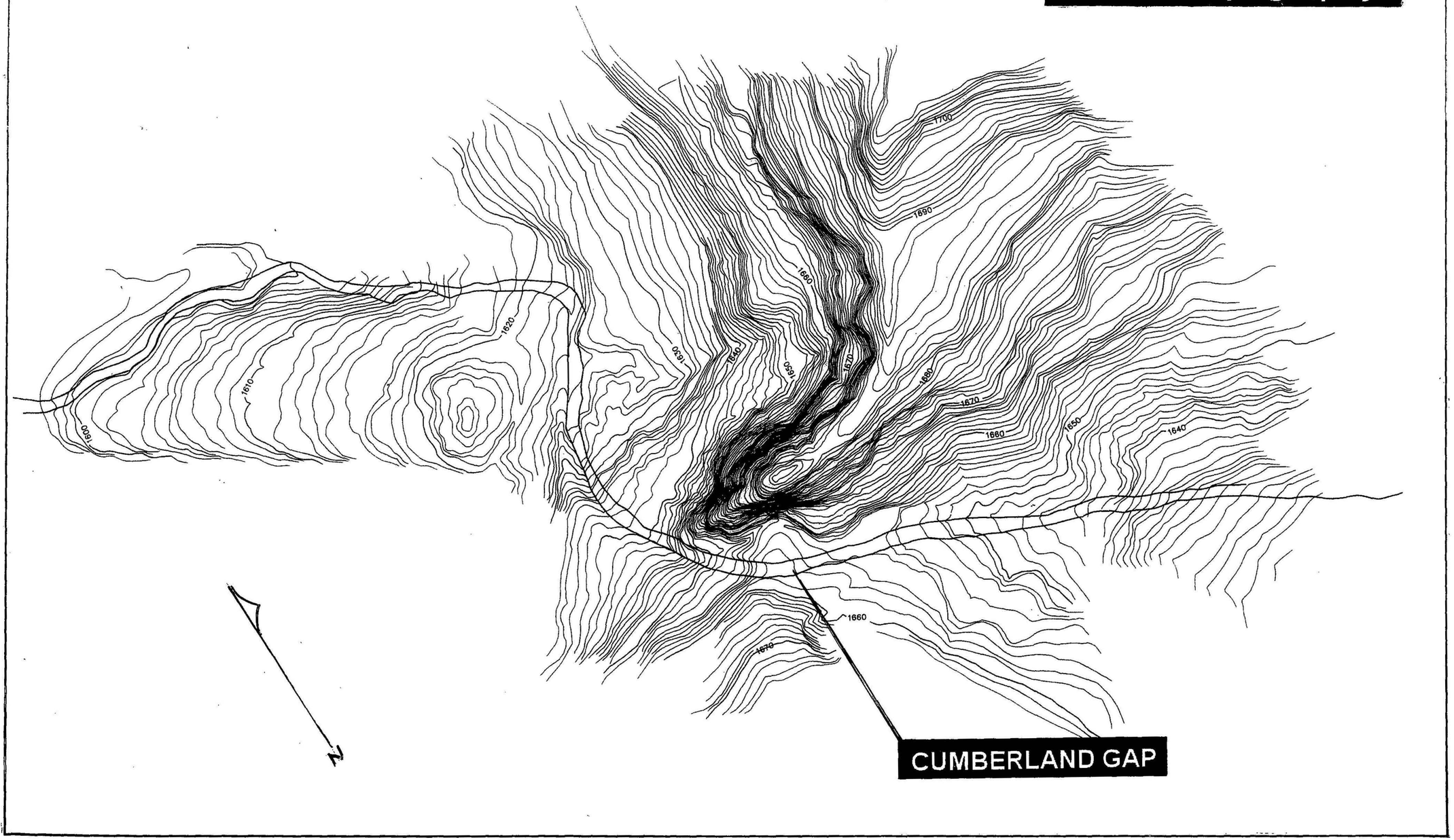
saddle plan view

All three plan view images on this sheet are oriented with Virginia/Tennessee to the right side, Kentucky to the left, and north at the top. The shapes in the left hand images evolved into the contour map on the right hand side. Determining what topography was missing resulted from intense cross checking and melding of all the different sources of information - historic and recent surveys, photographs, and maps; field discovery; graphic enhancement and delineation in the studio. This sheet shows three stages of refinement overlaying modern surveys, which were eventually put into a format that could be computerized. Once the information was in the computer, the three-dimensional wireframe output was then cross checked against the historic photographs for accuracy. The final result was a grading plan in 1790 contours which were added into Federal Highway Administration contract drawings.

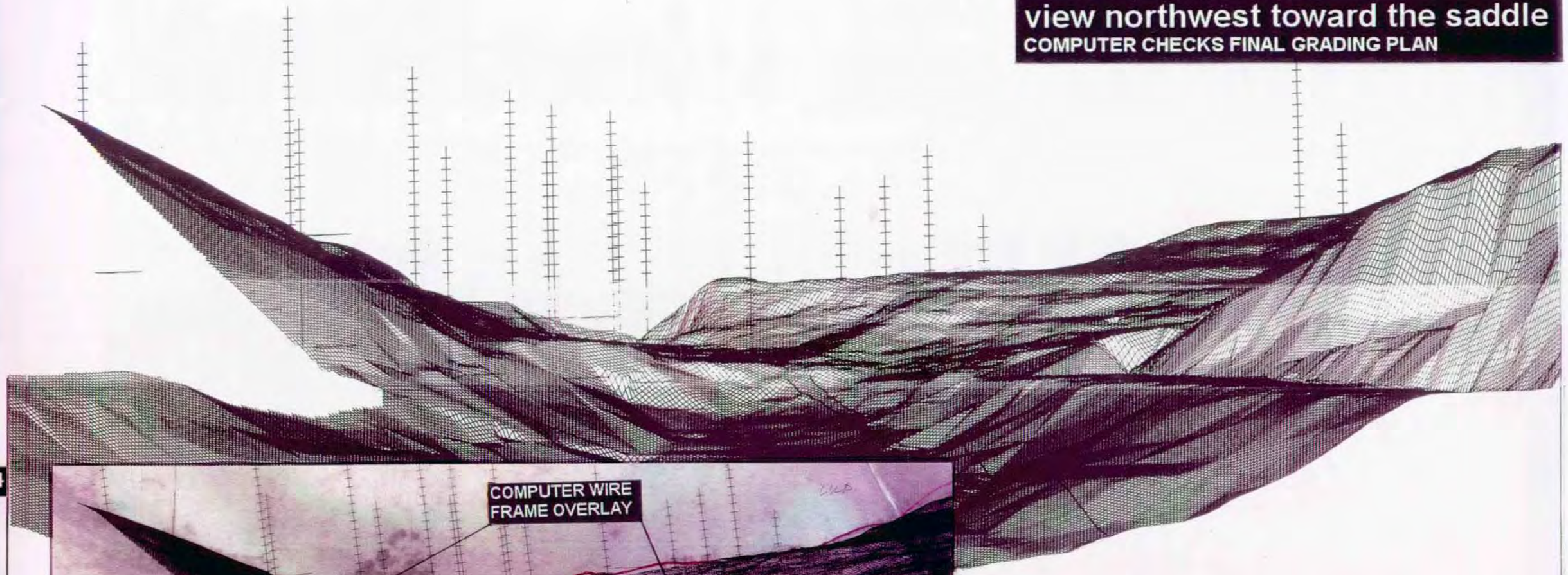


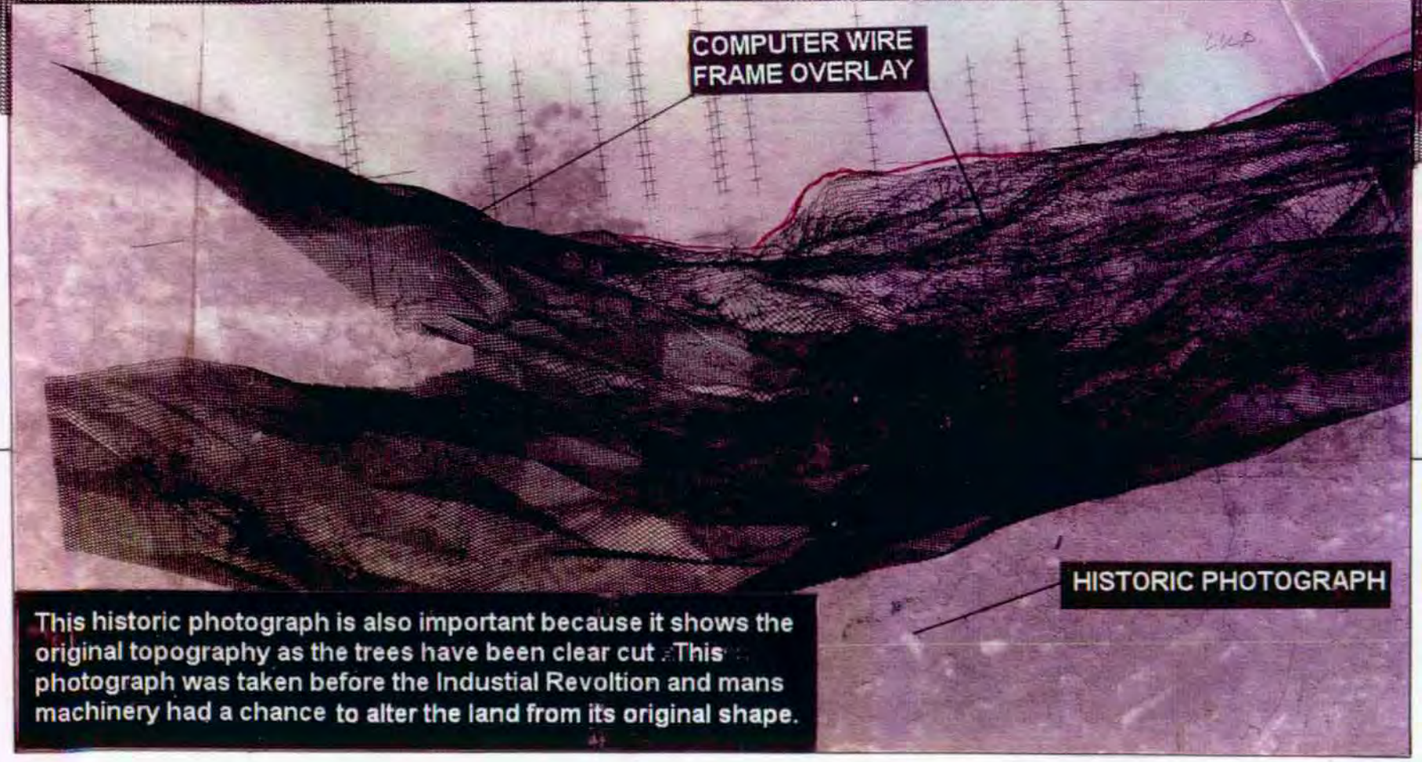


final grading plan of historic topography



view northwest toward the saddle
COMPUTER CHECKS FINAL GRADING PLAN

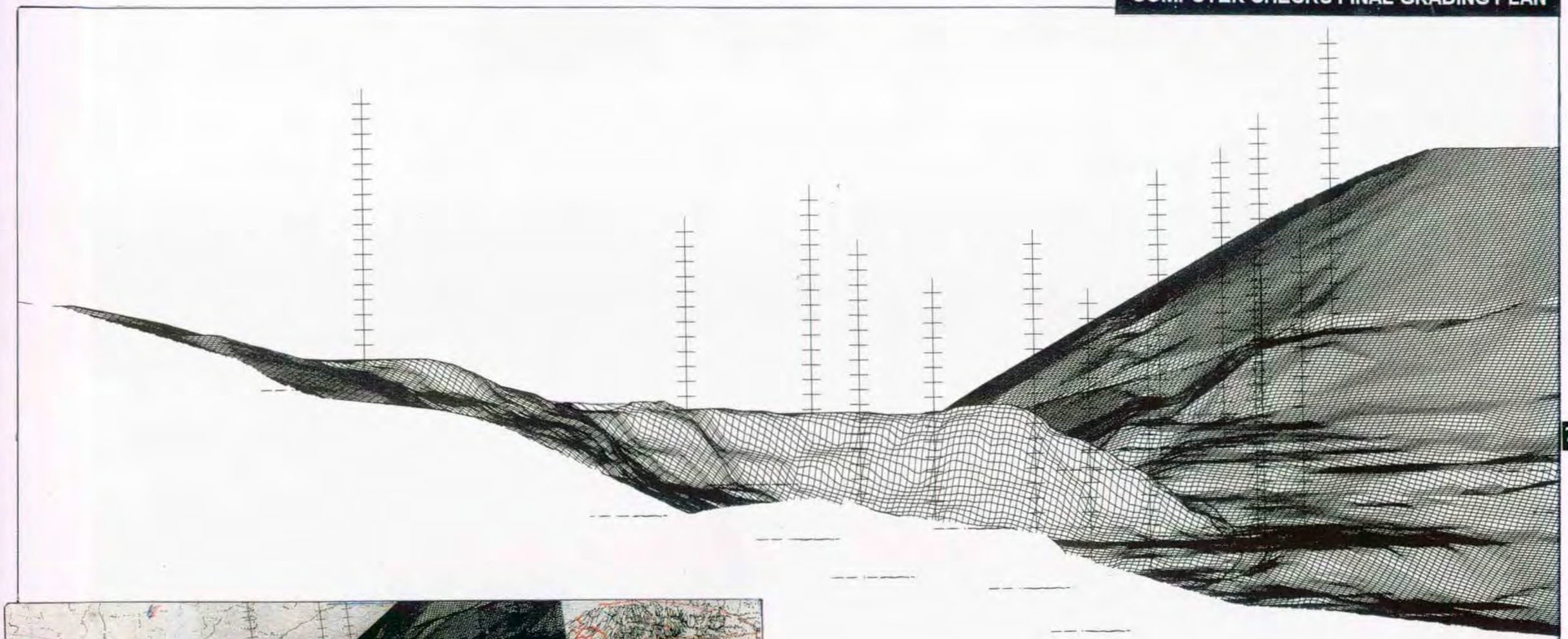


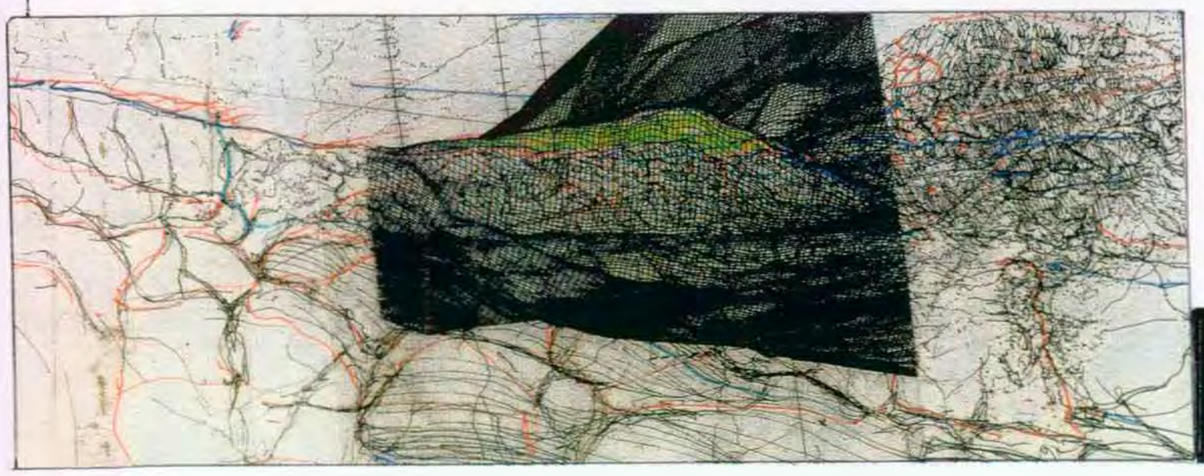


This historic photograph is also important because it shows the original topography as the trees have been clear cut . This photograph was taken before the Industial Revoltion and mans machinery had a chance to alter the land from its original shape.

This final step of refinement shows how accurate the (graphic) rehabilitation of the Gap is. The grading plan from the previous sheet has been transformed into a computerized wireframe image. The image is shown from the same viewpoint as the 1862 Civil War photograph, from Tennessee, looking northwest to the Gap and toward Kentucky. This view nearly matches the red horizon line taken from the 1862 photograph. Considering the age and quality of the source materials, tempered by 200 years of erosion and man-caused landscape modifications, this slight deviation, caused by the computer's skewed viewpoint, is as accurate as anyone will ever achieve.

view south to the saddle
COMPUTER CHECKS FINAL GRADING PLAN

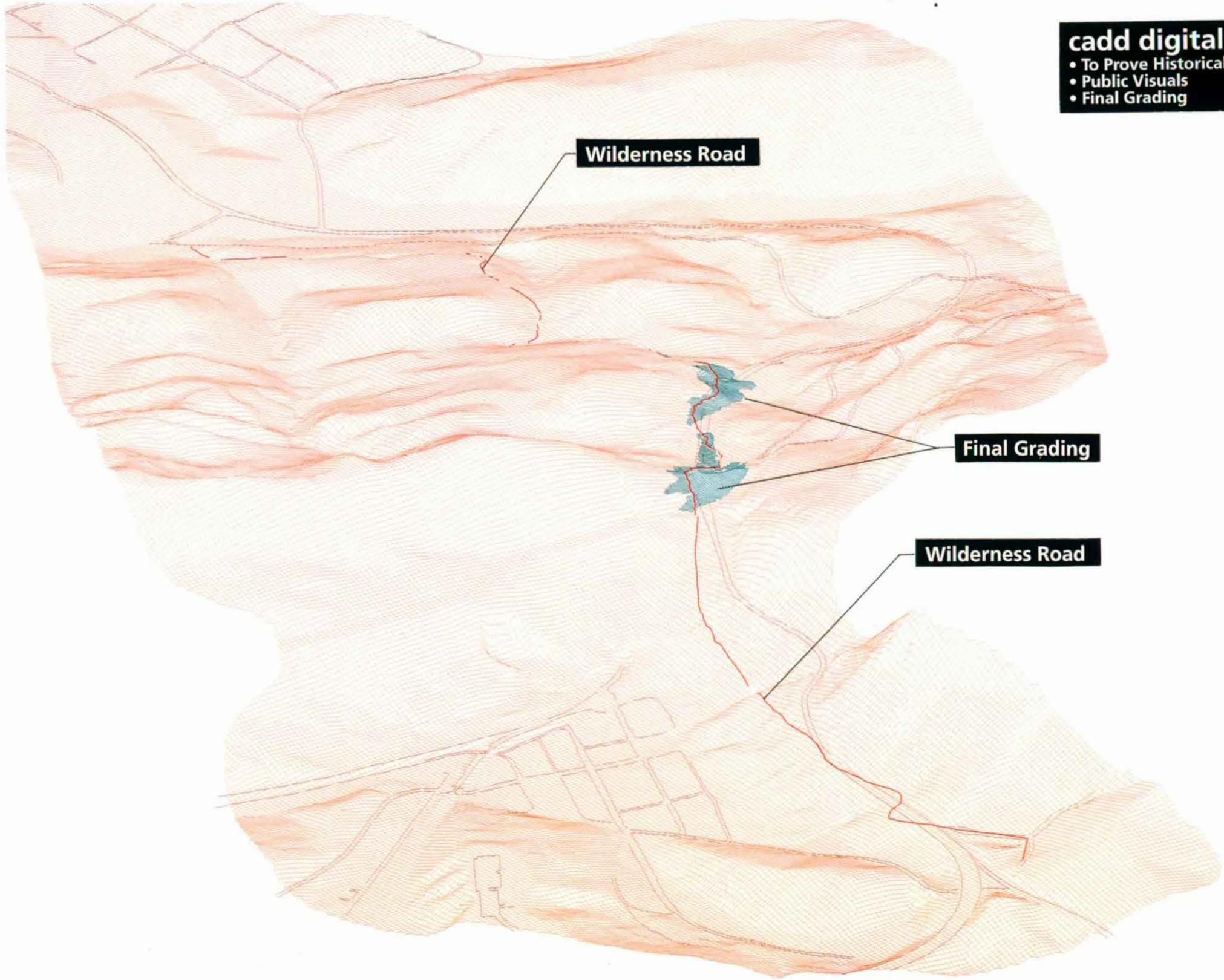


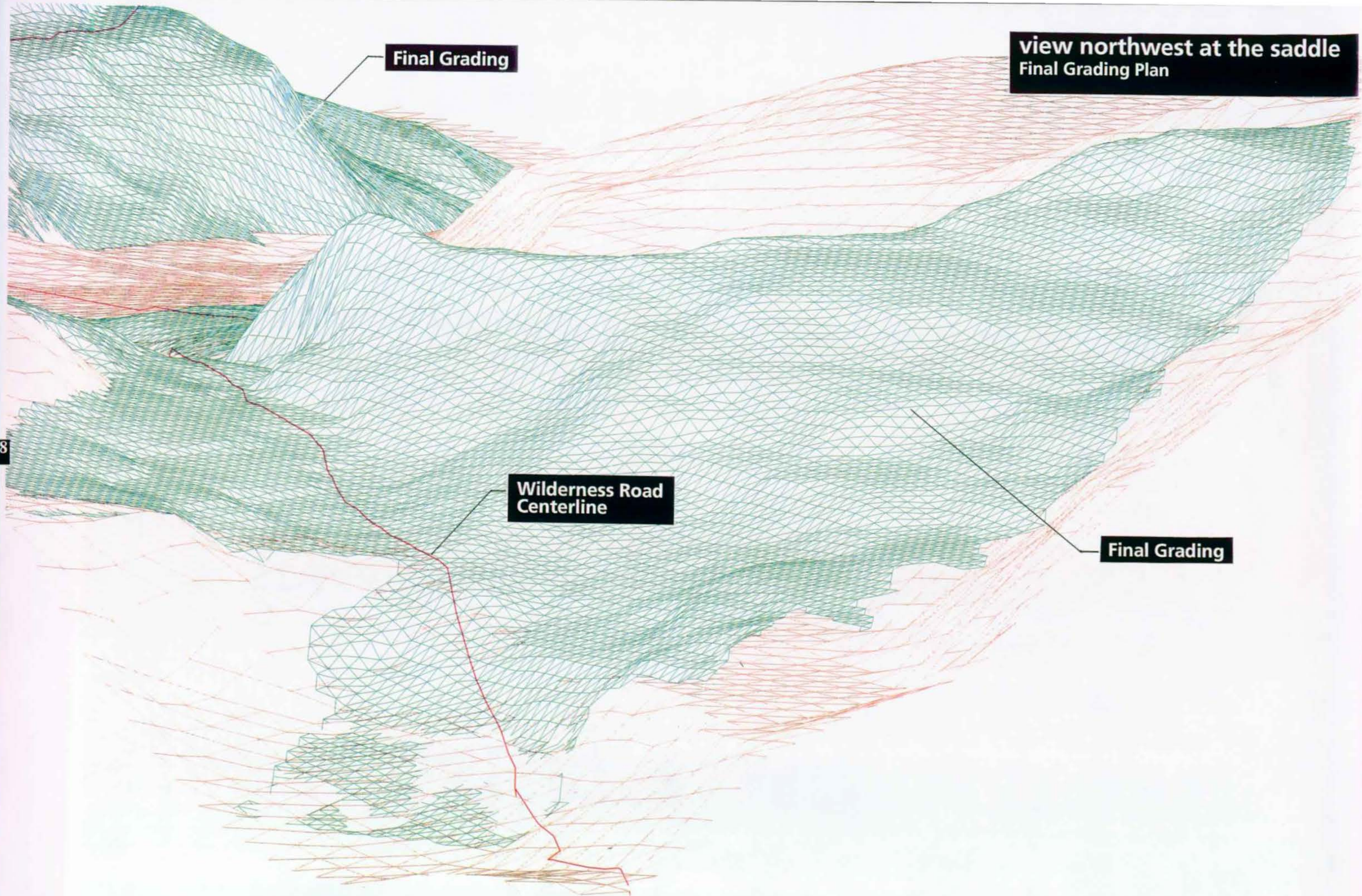


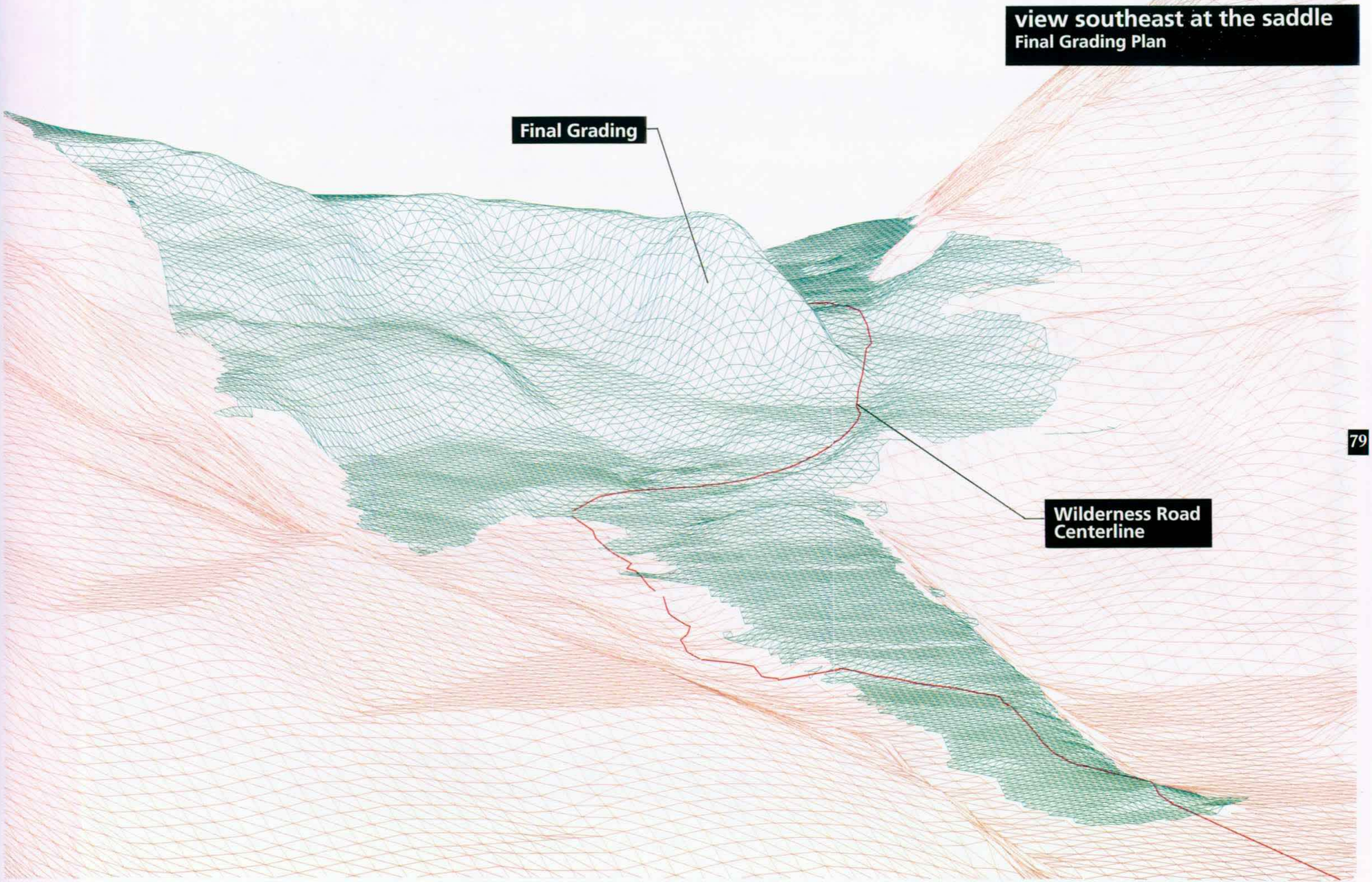
The Kentucky side was also checked by the computer to insure that the grading plan was not only historically correct from the Virginia/Tennessee side of the Gap but that it also matched the Kentucky side of the mountain.

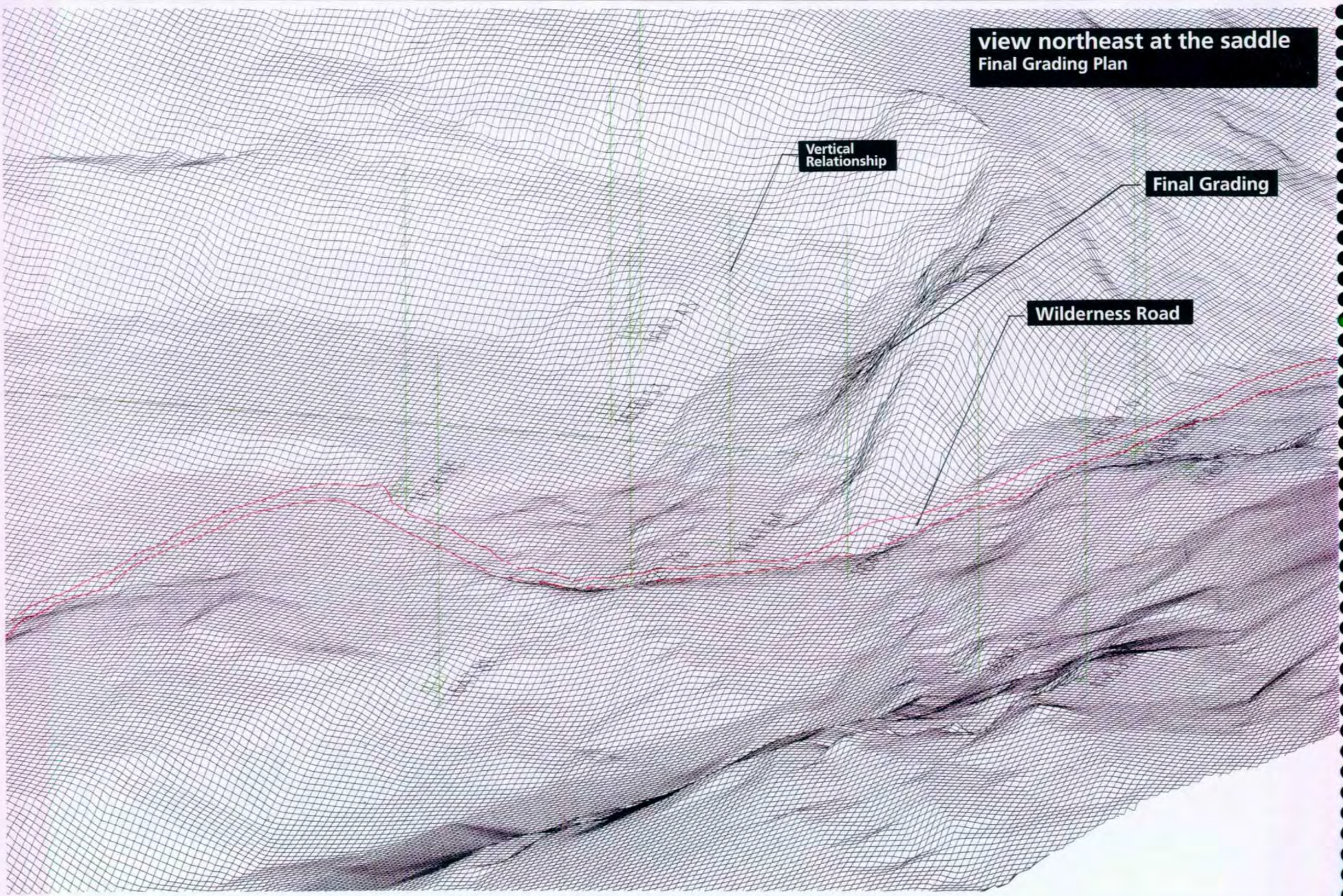
cadd digital terrain models

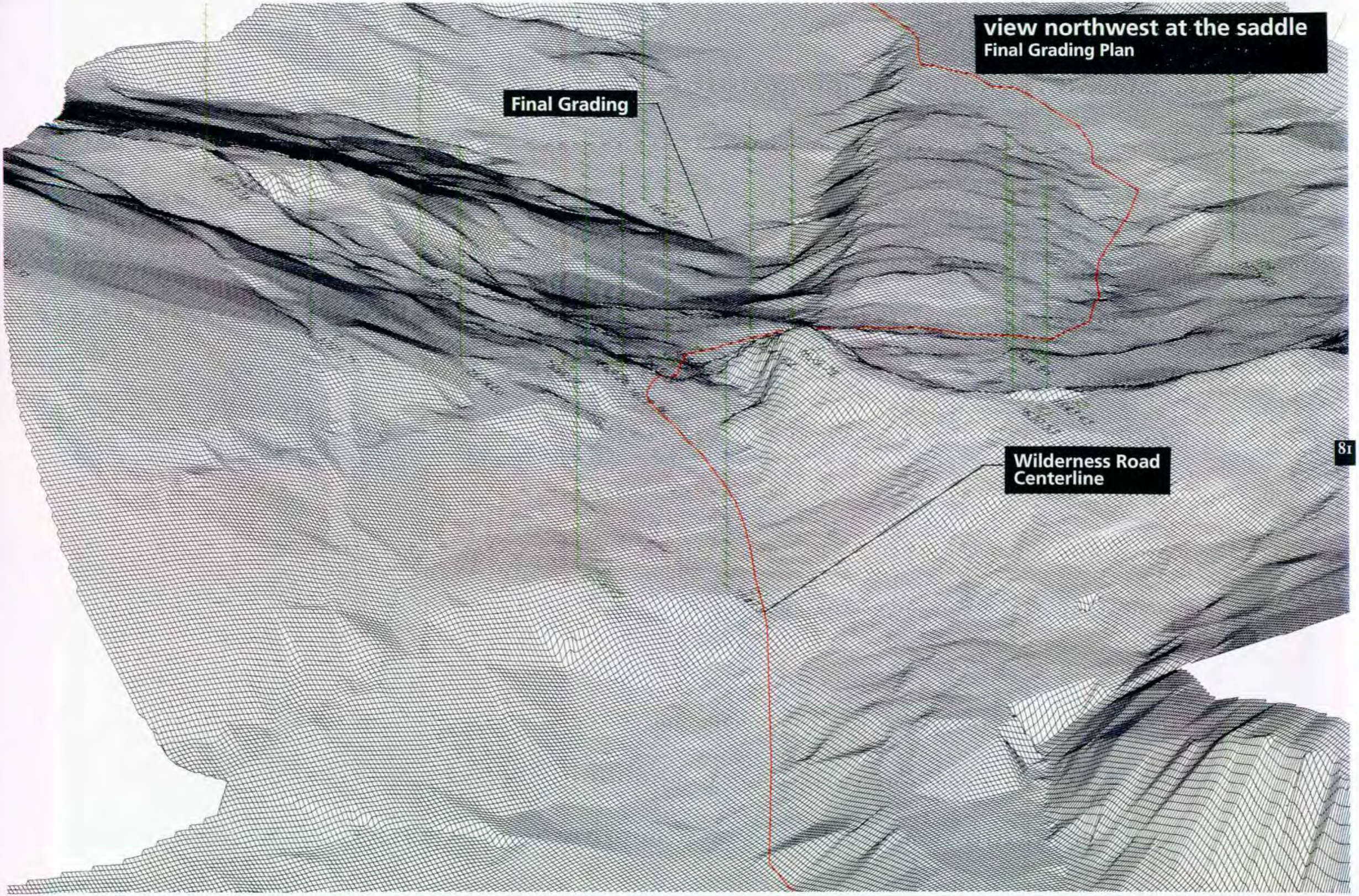
- To Prove Historical Photograph Views
- Public Visuals
- Final Grading



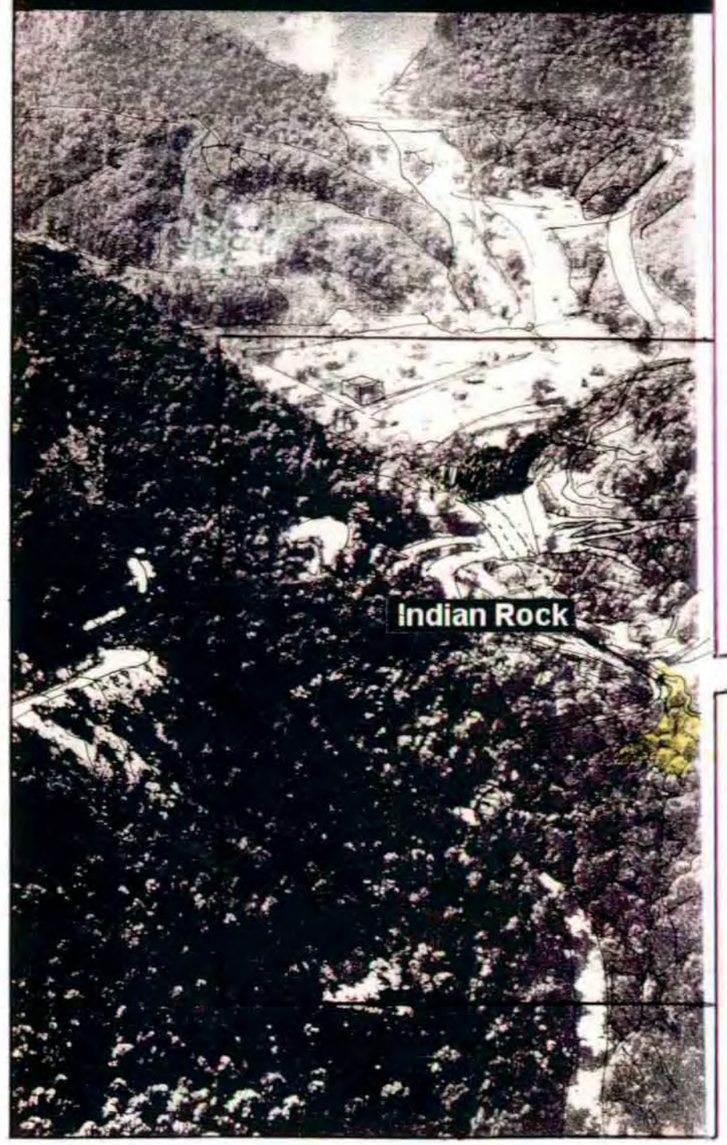

Final Grading
view northwest at the saddle
Final Grading Plan
Wilderness Road
Centerline
Final Grading


view southeast at the saddle
Final Grading Plan
Final Grading
Wilderness Road
Centerline

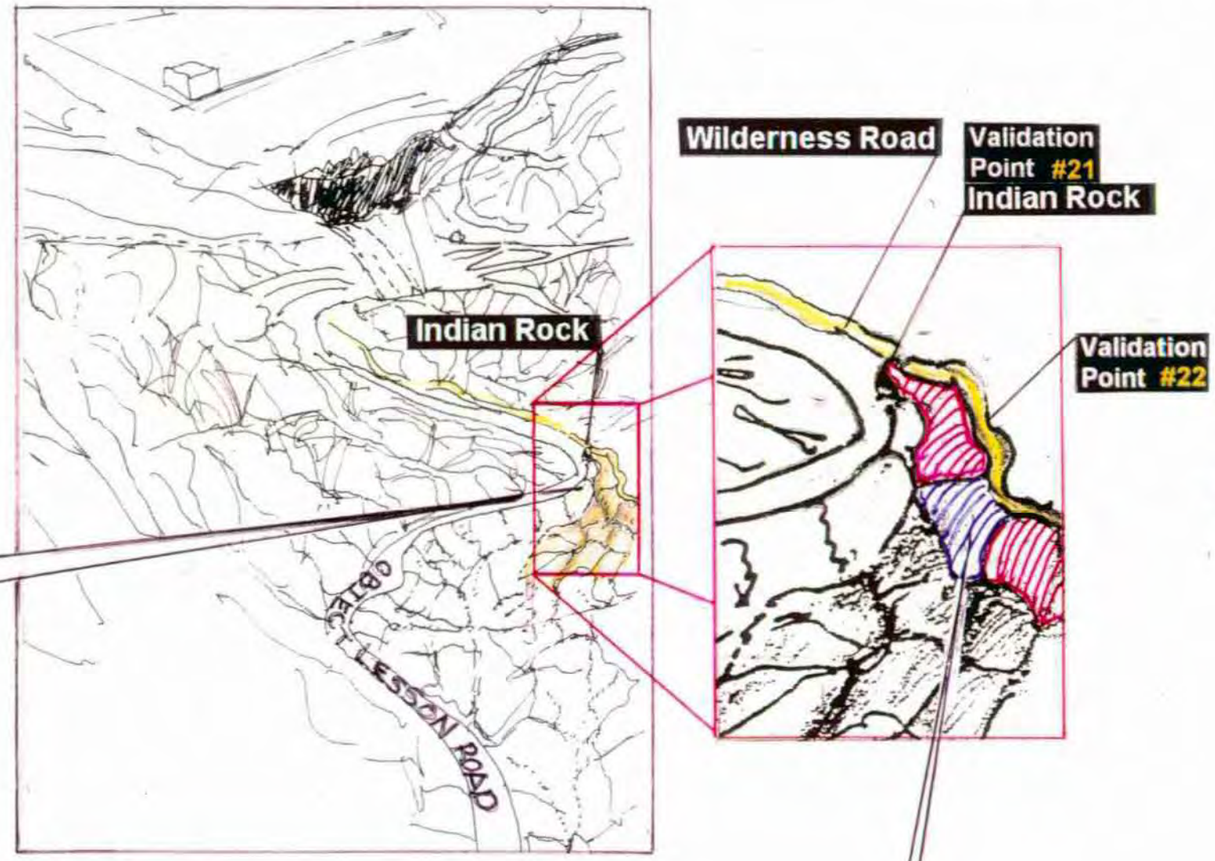

view northeast at the saddle
Final Grading Plan
Vertical Relationship
Final Grading
Wilderness Road


view northwest at the saddle
Final Grading Plan
Final Grading
Wilderness Road
Centerline

Photograph of the ridge before the earth was removed to construct what is now old US. 25 E.

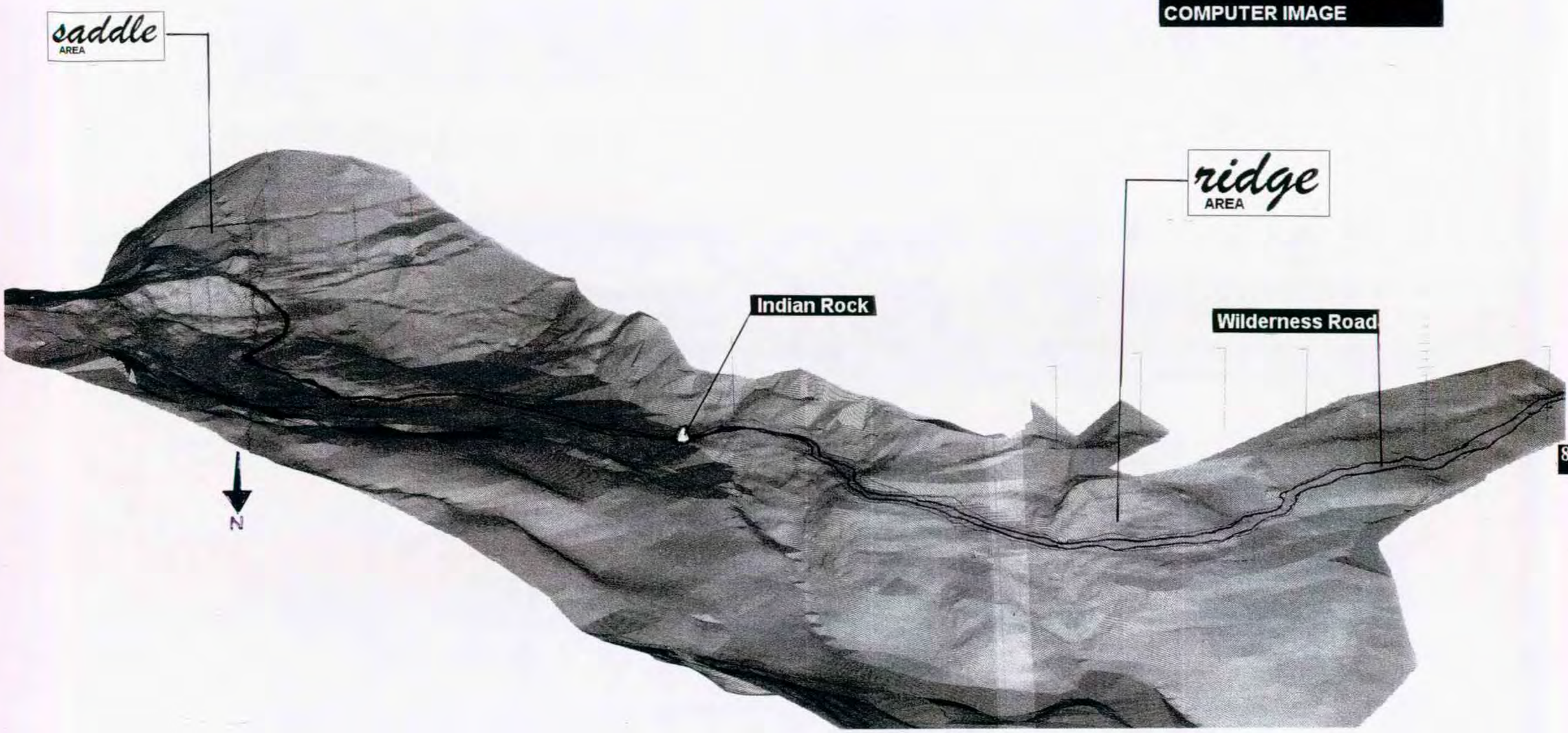


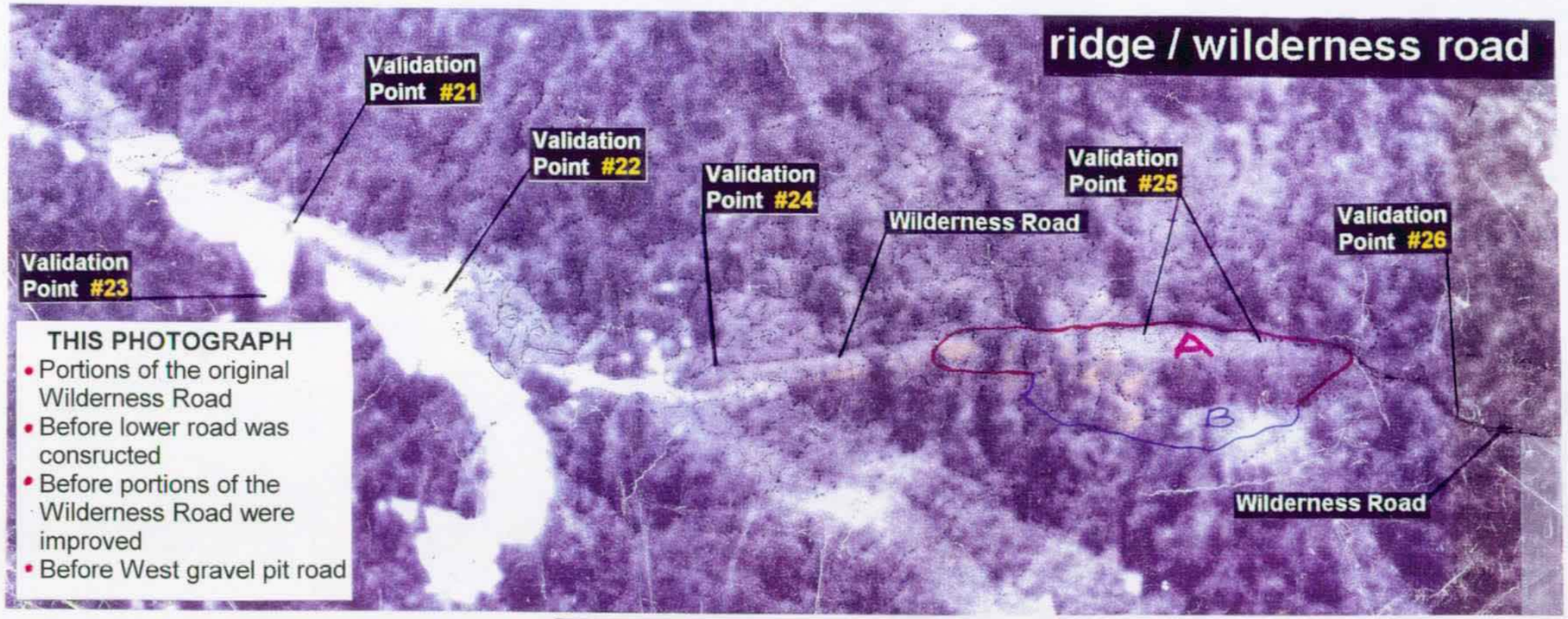
ridge
AREA



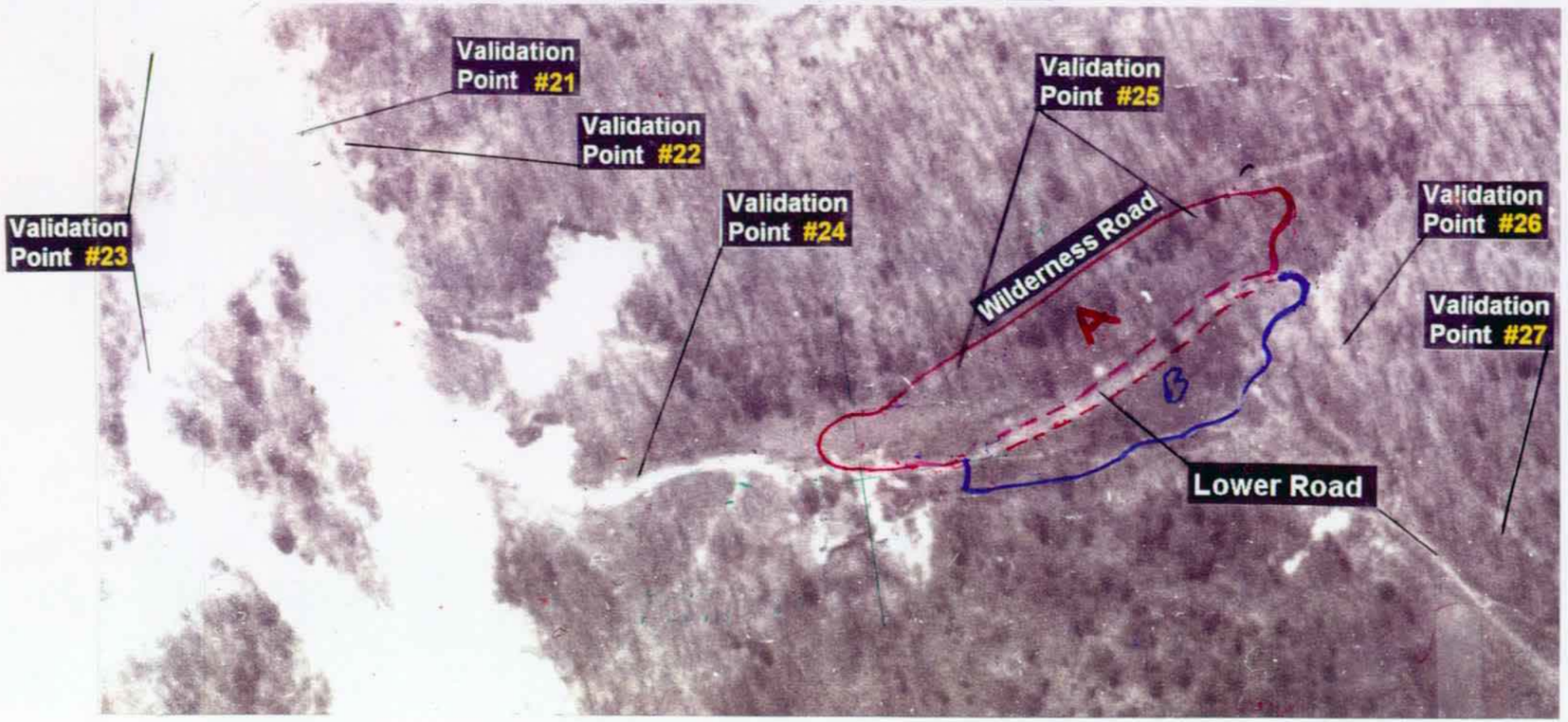
The shape and location of topography that was removed.

final grading plan
COMPUTER IMAGE

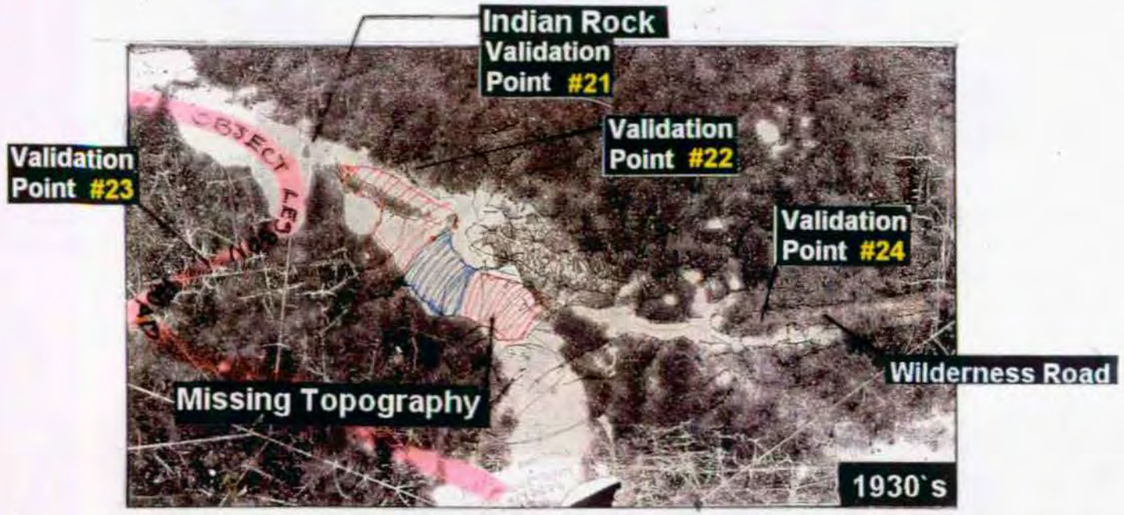


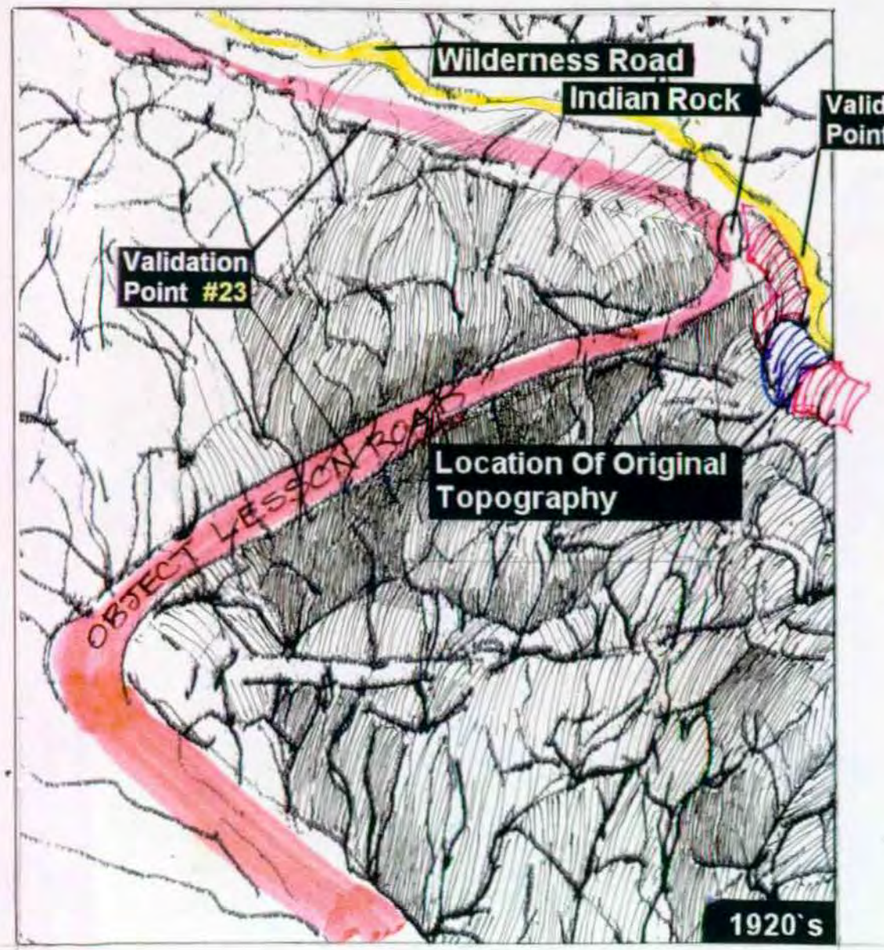


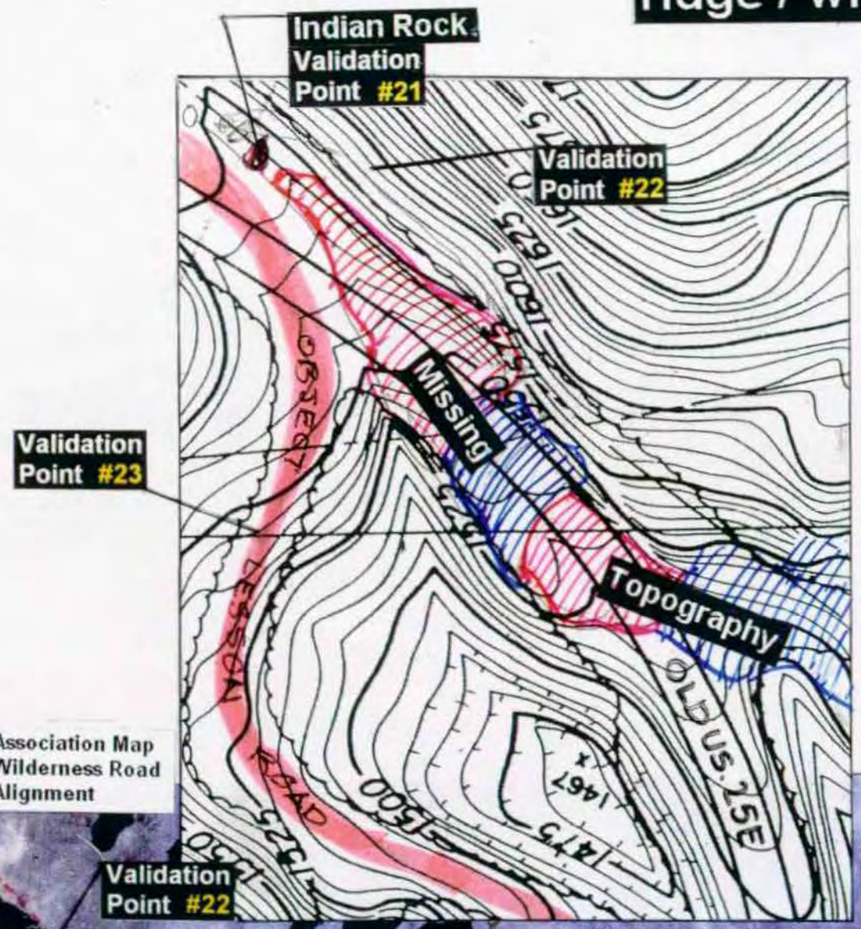
Compare Corresponding Areas Of Topography (A and B)



Lower road access was not possible for wagons without the removal of a large amount of earth, which permitted entry to the lower drainage. Even more restrictive was the steepness of the descent from the lower road. Railroad construction probably cut off the slow natural descent around 1880. By this time, more modern road building methods had been developed, and the lower road was built. Another basic reason is that no historic mapping matching any ground evidence has been found. The alignment, without more modern construction to compensate for the steepness, would have resulted in many curves in the configuration.


Indian Rock
Validation
Point #21
Validation
Point #22
Validation
Point #23
Validation
Point #24
Wilderness Road
Missing Topography
1930`s


Wilderness Road
Indian Rock
Validation
Point #22
Validation
Point #23
Location Of Original
Topography
1920`s


Indian Rock
Validation
Point #21
Validation
Point #22
Validation
Point #23
Missing
Topography

Indian Rock
Validation
Point #21
Association Map
Wilderness Road
Alignment
Validation
Point #22
Validation
Point #23
1862 Wilderness
Road Alignment
Road Improvement
Wilderness Road
Validation
Point #24
Validation
Point #26
Road Remnant
Validation
Point #25
Lower Road
Missing
Topography
1930`s

wilderness road`s descent into kentucky

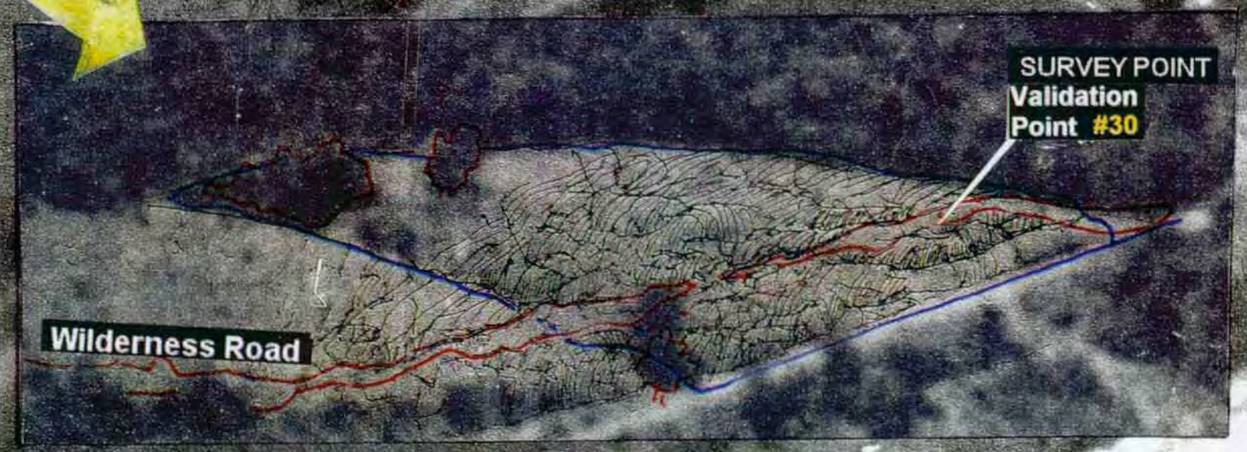
Plan View Delineation

MATCH SHAPES BELOW

Perspective View Delineation

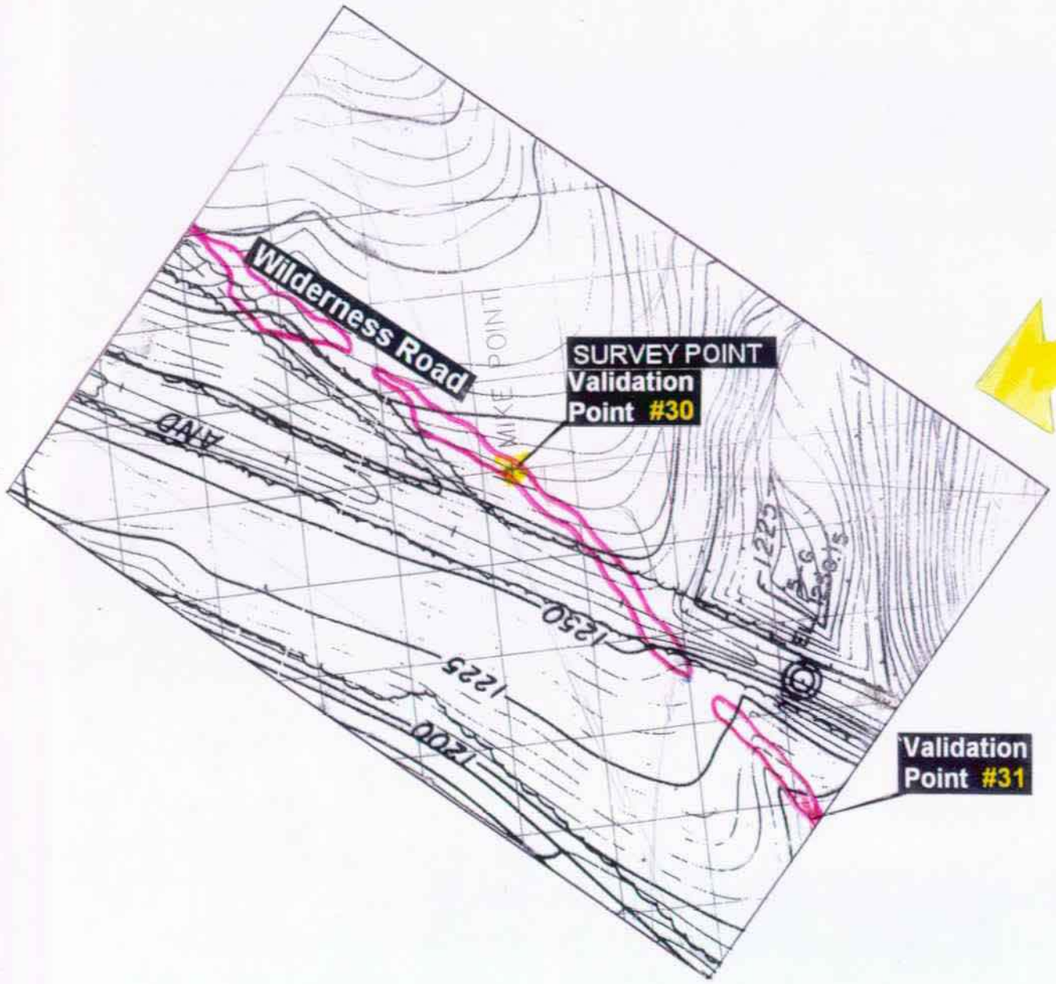
SURVEY POINT
Validation
Point #30

Wilderness Road



The original upper road alignment used a slight climb in elevation to allow a gradual descent into Kentucky. This area of descent (shown here) was not only level enough for farming in the 1920s, but provided a gradual descent suitable for wagons and horseback without earth removal. The historical mapping not only graphically matches modern mapping, but also matches the topographical remnants on the ground. After the delineation of these two historical photographs, it is evident that the shapes (shown on the 1862 survey) are themselves surveyed. Most of them exist on the ground today. The last cross-check is that the aforementioned research is applied to modern survey points on each end of this alignment.

wilderness road`s descent into kentucky



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preservingthe environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-106, September 2002