

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division



Washita Battlefield National Historic Site

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic
Data for Washita Battlefield National Historic Site

waba_geology.pdf

Version: 8/12/2022

Geologic Resources Inventory Map Document for Washita Battlefield National Historic Site

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Geologic Resources Inventory Map Document



Washita Battlefield National Historic Site, Oklahoma

Document to Accompany Digital Geologic-GIS Data

[waba_geology.pdf](#)

Version: 8/12/2022

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Washita Battlefield National Historic Site, Oklahoma (WABA).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

This document contains the following information:

- 1) **About the NPS Geologic Resources Inventory Program** – A brief summary of the Geologic Resources Inventory (GRI) Program and its products. Included are web links to the GRI GIS data model, and to the GRI products page where digital geologic-GIS datasets, scoping reports and geology reports are available for download. In addition, web links to the NPS Data Store and GRI program home page, as well as contact information for the GRI coordinator, are also present.
- 2) **GRI Digital Maps and Source Map Citations** – A listing of the GRI digital geologic-GIS maps produced for this project along with the sources used in their completion. In addition, a brief explanation of each source map was used is also provided.
- 3) **Map Unit List** – A listing of all geologic map units present on maps for this project, generally listed from youngest to oldest.
- 4) **Map Unit Descriptions** – Descriptions for all geologic map units.
- 5) **Ancillary Source Map Information** – Additional source map information presented by source map.

- 6) **GRI Digital Data Credits** – GRI digital geologic-GIS data and ancillary map information document production credits.

For information about using GRI digital geologic-GIS data contact:

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About the NPS Geologic Resources Inventory Program

Background

The Geologic Resources Inventory (GRI) provides geologic map data and pertinent geologic information to support resource management and science-informed decision making in more than 270 natural resource parks throughout the National Park System. Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The GRI is one of 12 inventories funded by the National Park Service (NPS) Inventory and Monitoring Program. The Geologic Resources Division of the NPS Natural Resource Stewardship and Science Directorate administers the GRI. The NPS Geologic Resources Division partners with the Colorado State University Department of Geosciences to produce GRI products. Many additional partners participate in the GRI process by contributing source maps or reviewing products.

The GRI team undertakes three tasks for each park in the Inventory and Monitoring program: (1) conduct a scoping meeting and provide a summary document, (2) provide digital geologic map data in a geographic information system (GIS) format, and (3) provide a GRI report. These products are designed and written for nongeoscientists.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: <https://www.nps.gov/articles/gri-geodatabase-model.htm>

Geologic Reports: GRI reports synthesize discussions from the original scoping meeting, follow up conference call(s), and subsequent research. Chapters of each report discuss the geologic setting of the park, distinctive geologic features and processes within the park, highlight geologic issues facing resource managers, and describe the geologic history leading to the present-day landscape. Each report also includes a poster illustrating these GRI digital geologic-GIS data.

For a complete listing of GRI products visit the GRI publications webpage: <https://go.nps.gov/gripubs>. GRI digital geologic-GIS data is also available online at the NPS Data Store: <https://irma.nps.gov/DataStore/Search/Quick>. To find GRI data for a specific park or parks select the appropriate park(s), enter "GRI" as a Search Text term, and then select the Search button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: <https://www.nps.gov/subjects/geology/gri.htm>. At the bottom of that webpage is a "Contact Us" link if you need additional information. You may also directly contact the program coordinator:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division. Learn more about I&M and the 12 baseline inventories at the I&M webpage: <https://www.nps.gov/im/inventories.htm>.

GRI Digital Maps and Source Map Citations

The GRI digital geologic-GIS maps and their source maps for Washita Battlefield National Historic Site, Oklahoma (WABA).

GRI Digital Geologic-GIS Map of Washita Battlefield National Historic Site and Vicinity, Oklahoma (*GRI MapCode WABA*)

Stahl, Julian, 2012, Geologic Map of the Washita Battlefield National Historic Site, Cheyenne, Oklahoma, Geological Society of America GeoCorps, unpublished, scale 1:24,000. ([Julian Stahl, unpublished, 2012](#)). (*GRI Source Map ID 75647*).

The full extent of the above source map was and all geologic features present on the source map were captured.

GRI Digital Geologic-GIS Map of the Washita Battlefield National Historic Site Area, Oklahoma (*GRI MapCode WBAR*)

Fay, R.O., 2010, Preliminary Geologic Map of the Foss Reservoir 30' x 60' Quadrangle, Oklahoma, Oklahoma Geological Survey, Geologic Quadrangle Map, OGQ-78a, scale 1:100,000. ([Geologic Quadrangle Map OGQ-78A](#)). (*GRI Source Map ID 75552*).

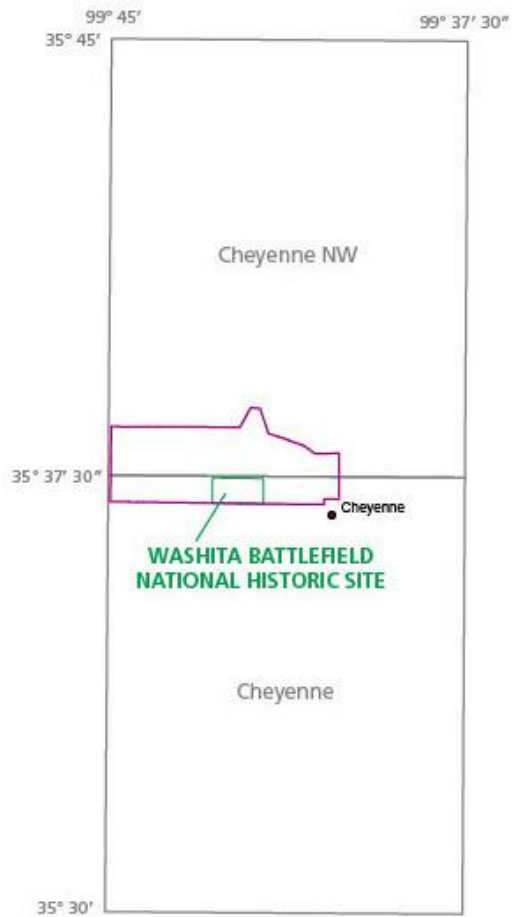
Only a portion of the above source map extent was used, however, all geologic features within this extent were captured.

The GRI Digital Geologic-GIS Map of Washita Battlefield National Historic Site and Vicinity map is a larger-scale map but smaller area map, and provides more detailed geologic information, whereas the GRI Digital Geologic-GIS Map of the Washita Battlefield National Historic Site Area map is a smaller-scale map, but provides geologic mapping in the greater area around Washita Battlefield National Historic Site.

Additional information concerning each source map can also be found in the Source Map Information (WABAMAP) table with the GRI digital geologic-GIS data.

Index Map

The following index map displays the extents of the GRI digital geologic-GIS maps produced for Washita Battlefield National Historic Site (WABA). The extent of the GRI Digital Geologic-GIS Map of Washita Battlefield National Historic Site and Vicinity map is displayed in purple, whereas the extent of the GRI Digital Geologic-GIS Map of the Washita Battlefield National Historic Site Area map is the extent (outlined in gray) of the Cheyenne NW and Cheyenne 7'5' quadrangles. The boundary for Washita Battlefield National Historic Site (as of August 2022) is outlined in green. The nearby town of Cheyenne, Oklahoma is also shown.



Index map by Stephanie O'Meara (Colorado State University).

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Washita Battlefield National Historic Site, Oklahoma (WABA) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qa - Alluvium). Units are listed from youngest to oldest. Information about each geologic unit is also presented in the GRI Geologic Unit Information (WABAUNIT) table included with the GRI digital geologic-GIS data.

Cenozoic Era

Holocene Period

[Qa](#) - Alluvium

Quaternary Period

[Qfp](#) - Floodplain

[Qtf](#) - Tributary Floodplain

[Qd](#) - Paleodunes

[Qt1](#) - Fluvial Terrace 1

[Qt2](#) - Fluvial Terrace 2

[Qt](#) - Terrace deposits

Tertiary Period

[PLMlo](#) - Ogallala Formation

Paleozoic Era

Permian Period

[Pec](#) - Elk City Sandstone

[Pd](#) - Doxey Formation

[Pcc](#) - Cloud Chief Formation

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Qa - Alluvium (Holocene)

Unconsolidated sand, silt, clay, and gravel in stream and river channels and on modern flood plains. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Qfp - Floodplain (Quaternary)

The floodplain defines a broad flat depositional plain directly adjacent to the current Washita River. Due to its recent development, its extent is easily mapped by the first appearance of a sharp increase in slope perpendicular to the Washita River. According to the USDA Web Soil Survey, the floodplain contains both Lincoln and Westola fine sandy loam. Its parent material is calcareous sandy alluvium (Soil Survey Staff). Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Qtf - Tributary floodplain (Quaternary)

Tributary floodplain units were mapped along the three larger intermittent streams entering the Washita River. At each river junction the floodplains perpendicular to the main stream were the combined result of both tributary creek and Washita River floodplain. In order not to bias average floodplain elevations for the Washita River, they were mapped separately from the floodplain. The soil also consists of clay to silt. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Qd - Paleodunes (Quaternary)

The eolian paleodunes are composed of light grey to salmon colored, quartz rich, medium to coarse sand. They are easily distinguished based on their geomorphology observed on the LIDAR base map. They display a convex, crescent shape, rising between 10-25 feet above the surrounding surface. South of the Washita River, the dunes form elongate strips parallel to the Washita River Valley. To the north of the Washita River, the dunes are more common and occur in larger dune fields. A particularly dense accumulation of dunes occurs to the northeast of the major river bend where dunes overlie both of the terraces, the Cloud Chief and the Doxey Formation. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Qt1 - Fluvial terrace 1 (Quaternary)

The terrace 1 riser was prominent enough to trace across the majority of the mapping area. At the eastern edge of the WBNHS younger dunes cover the terrace riser. Widespread dunes were also found in the northwestern section of the map. The soil consists of silt to fine sand. A section of terrace 1 to the northeast of the Washita Battlefield contains approximately 30% gravel fragments sourced from the underlying Cloud Chief Formation. The fluvial terrace displays broad, gently sloping terrain before transitioning to the steeper slopes of terrace 2. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Qt2 - Fluvial terrace 2 (Quaternary)

Terrace 2 was mapped as the first appearance of well-rounded, quartzite pebbles to cobbles as well as an increase in elevation. The quartzite clasts are scattered on the surface with varying

concentrations and degrees of sorting. The clasts are a surface deposit and do not persist at depth. Clay to silt sized material dominates the terrace 2 deposits with local areas of sandy soils. As a locality on the western end of the study area, the quartzite cobbles appear on the top of a Doxey Formation knoll. Due to extensive erosion, terrace 2 deposits form elongate, discontinuous mounds perpendicular to the Washita River. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Qt - Terrace deposits (Pleistocene)

Unconsolidated sand, silt, clay, gravel, and volcanic ash above modern flood plains. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

PLMlo - Ogallala Formation (Pliocene - Miocene)

Gray to light-brown, fine-to medium grained sand with some clay, silt, gravel, volcanic ash, and caliche beds; locally cemented calcium carbonate. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Pec - Elk City Sandstone (Permian)

Reddish-brown, fine-grained sandstone with minor amounts of siltstone and claystone, weakly cemented by iron oxide, calcium carbonate, and gypsum. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Pd - Doxey Formation (Permian)

Dx - Doxey Formation (Permian)

The weak red (10R 5/6) Doxey Formation overlies the Cloud Chief Formation. It outcrops at higher elevations to the north on the flanks of the Washita River Valley as well as on the many knolls within the valley. Centimeter scale shale layers are interlayered within sub meter scale, silt to fine sandstone beds. Sedimentary structures within the Doxey Formation include planar, wavy, and ripple cross lamination as well as climbing ripples. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Pd - Doxey Formation (Permian)

Reddish-brown, silty shale and siltstone. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Pcc - Cloud Chief Formation (Permian)

Cc - Cloud Chief Formation (Permian)

The yellow red (5YR 5/6), Permian Cloud Chief Formation underlies most of the fluvial terraces. Depending on the lateral and vertical position in the stratigraphic section, beds range from cm scale, fine-grained claystone to sub-meter scale siltstone. Several meter scale, resistant gypsum beds within the Cloud Chief also crop out south and north of the river. Both green/gray unoxidized shale and evaporite gypsum are discontinuously interbedded within the unit. Well-preserved sedimentary structures are found in the Cloud Chief Formation and include ripple cross laminations, and wavy laminations. The Cloud Chief Formation outcrops are rare so mapping of the unit was often based on

soil containing high fractions of Cloud Chief Formation fragments. Description from source map: [GSA unpublished digital data \(Washita Battlefield NHS\)](#).

Pcc - Cloud Chief Formation (Permian)

Reddish-brown to orange-brown shale with siltstone and sandstone in middle part and some dolomite and much gypsum in lower part. Description from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Ancillary Source Map Information

GSA unpublished digital data (Washita Battlefield NHS)

The formal citation for this source.

Stahl, Julian, 2012, Geologic Map of the Washita Battlefield National Historic Site, Cheyenne, Oklahoma, Geological Society of America GeoCorps, unpublished, scale 1:24,000. (*GRI Source Map ID 75647*).

The report associated with this source map is provided as an embedded document (double-click the following link to open): [Stahl_Julian_NPS_WBNHS_NPSReport.docx.pdf](#)

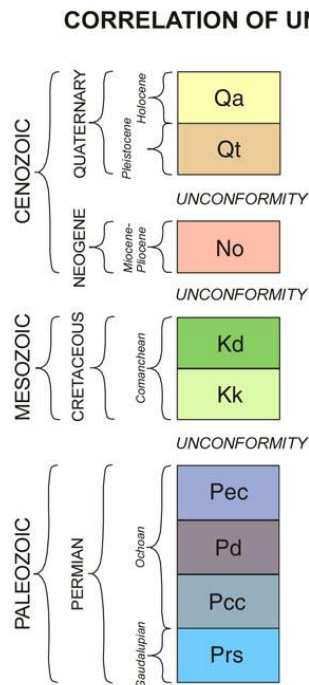
Oklahoma Geologic Quadrangle Map OGQ-78A

The formal citation for this source.

Fay, R.O., 2010, Preliminary Geologic Map of the Foss Reservoir 30' x 60' Quadrangle, Oklahoma, Oklahoma Geological Survey, Geologic Quadrangle Map, OGQ-78a, scale 1:100,000. (*GRI Source Map ID 75552*).

Prominent graphics and text associated with this source:

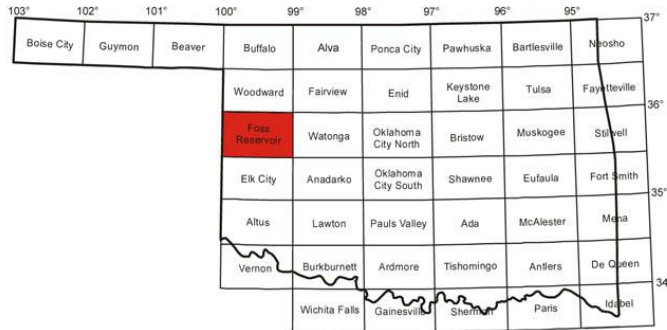
Correlation of Units



Of note, only a subset of units presented in the above figure are actually within the extent of the GRI digital geologic-GIS map.

Graphic from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

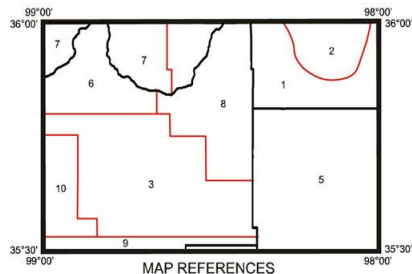
Quadrangle Location Map



Map of Oklahoma showing the locations of the 30' X 60' quadrangles. Red shaded quadrangle represents the current map

Graphic from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Map References



MAP REFERENCES

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- Miser, H.D., et al, 1954, Geologic map of Oklahoma: U.S. Geological Survey, scale 1:500,000.

Graphic and text from source map: [Foss Reservoir 30' X 60' Quadrangle](#).

Source Map Document

The following source map document, which provides information about the source map including data quality information and a disclaimer on map and data use, is available as an embedded document (double-click the following link to open): [OGQ-78A Foss Reservoir 100K.pdf](#).

GRI Digital Data Credits

This document was developed and completed by Stephanie O'Meara (Colorado State University) and Georgia Hybels (NPS GRD, Lakewood, Colorado) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by Stephanie O'Meara.

The information in this document was compiled from GRI source maps, and is intended to accompany the digital geologic-GIS maps and other digital data for Washita Battlefield National Historic Site, Oklahoma (WABA) developed by Georgia Hybels and Stephanie O'Meara (see the [GRI Digital Maps and Source Map Citations](#) section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS maps.

GRI finalization by Stephanie O'Meara.

GRI program coordination and scoping provided by Bruce Heise, Jason Kenworthy and Tim Connors (NPS GRD, Lakewood, Colorado).