Elevation-Derived Hydrography READ Rules 2022 rev. A

Introduction

This document is a copy of the Elevation-Derived Hydrography READ Rules 2022 rev. A as found on the USGS National Geospatial Program Standards and Specifications website. For the latest version of the specification, please visit the site: EDH READ Rules 2022 rev. A

Revision History

Version 2022 rev. A

Removal of AOCCs from EDH Specifications and from Task Orders.

Version 2021 rev. A

1. Drainageway Definition Updated
    a. Old Definition: A drainageway is a watercourse that conveys, or is likely to convey water but lacks a clearly defined channel or banks differentiating it from an ephemeral stream/river. Drainageways typically convey water for limited periods of time and do not carry perennial flow. Drainageways may follow natural topographic flow paths or constructed or human-made flow paths.
    b. New Definition: Drainageway features are flowlines delineated where terrain modelling indicates potential headwater drainage but no channel is detectable. The drainageway code must only be applied at the initiation of flowlines or confluence of other drainageway features. The drainageway code must not be applied downstream of other non-drainageway NHD flowlines or waterbody features.

2. Four New EDH Connector FCodes added to Connector Type
    a. Culvert (FCode: 33401)—A subsurface feature connecting upstream and downstream hydrography features under a constructed feature (Exception: See READ Rules "Connector" for Dam Features). Typically constructed of formed concrete or corrugated metal and surrounded on all sides; top, and bottom by earth or soil. The hydrographic features defined by this specification are intended to be suitable for elevation surface treatments such as hydro-enforcement. Culvert features are used to maintain connectivity of hydrographic network features, while providing attribution allowing the culverts to be easily identified for elevation surface treatments such as hydro-enforcement.
    b. Indefinite Surface (FCode: 33404)—Indefinite Surface Connectors are used where evidence of channelization is not present in the digital elevation model surface but connectivity between an upstream and downstream channel is indicated by terrain modelling. Situations where Indefinite Surface Connectors may be used include low confidence areas in the DEM or heavy vegetative cover in which the channel cannot be resolved. Indefinite surface connector features may also be used to connect through areas having conservation treatments such as grassed waterways, which are designed to

prevent soil erosion and the formation of channels. This FCode is recommended for use in situations where streams sink into the ground under low or normal flow conditions, but would flow over the surface during high flow or flood conditions and connect to downslope hydrographic features.

c. Terrain Breach (FCode: 33405)—Used to breach terrain (or elevation) features that block the flow in a drainage network, such as a small rise in elevation, landslides, moraines, glacial till, or berms. This connector is used to breach flow blockages on the elevation surface; with no known manmade feature such as a pipeline or culvert connecting upstream and downstream flow. Do not use the Terrain Breach to represent underground flowpaths in known karst, permafrost or thermokarst terrain (See READ Rules for "Underground conduit").
d. Non-NHD Dataset (FCode: 33410)— Used to provide network connectivity to or through a polygon feature that is represented in an external dataset maintained by another agency such as the National Wetlands Inventory, the Randolph Glacier Inventory, or other datasets related to hydrography. This connector will be used to traverse areas with no obvious network connections. Linear and polygon features that represent stream/river or canal/ditch flowpaths through the non-NHD dataset areas will be mapped as separate elevation-derived hydrography features. This connector shall be used with a dataset recognized by the USGS for these purposes.

Version 2020 rev. A

1. Underground Conduit FCode
    a. "Positional Accuracy Indefinite" (FCode 42002) — The underground conduit allows network connectivity through areas where there is some evidence the water flows underground in karst and thermokarst regions.

2. UniqueID Field
    a. The UniqueID field is meant to be populated by the contractor prior to delivery of data to the USGS. Unique IDs allow communication with contractors by providing a tracking system for individual features.

Artificial Path

An abstraction to facilitate hydrologic modeling through open waterbodies (figure 1 and figure 2).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of artificial path is the connection between the inflow and outflow points of an in-line polygon, the line through a head or terminal open waterbody that connects to the inflow (for terminal), or the outflow point (for head) (figure 1).

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

Artificial paths shall be placed in all polygons except isolated reservoirs, isolated lake/ponds, and isolated basins (reservoirs, lake/ponds, and basins not connected to the stream network). Artificial paths shall represent the shortest path from the inflow to the outflow without crossing through banks or islands.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 55800—Artificial path (abstraction to facilitate hydrologic modeling through open waterbodies).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Source Interpretation Guidelines

None.

Canal/Ditch

An artificial open waterway constructed to transport water, irrigate or drain land, connect two or more bodies of water, or serve as a waterway for watercraft (figure 3, figure 4, and figure 5).

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of canal/ditch is the top of the banks of the artificial waterway.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions:

To accommodate variations in the shortest axis of canal/ditch:

If the shortest axis of canal/ditch is:

- less than 50 feet (15 meters) but greater than or equal to 20 feet (6 meters) for a distance less than 1 mile (1.6 kilometers), and is connected at both ends to a 2-dimensionalcanal/ditch, then canal/ditch is represented as a 2-dimensional basic feature object.
- greater than or equal to 50 feet (15 meters) but less than 20 feet (6 meters) for a distance less than 1 mile (1.6 kilometers), or less than 20 feet (6 meters) regard- less of distance, and is connected at both ends to a 2-dimensional (polygon) canal/ditch, then canal/ditch is represented as a 1-dimensional (line) basic feature object.
- greater than or equal to 50 feet (15 meters) but less than 80 feet (24 meters) for a distance less than 1 mile (1.6 kilometers), and is connected at both ends to a 1-dimensional (line) canal/ditch, then canal/ditch is represented as a 1-dimensional (line) basic feature object.
- greater than or equal to 50 feet (15 meters) but less than 80 feet (24 meters) for a distance greater than or equal to 1 mile (1.6 kilometers), or greater than or equal to 80 feet (24 meters) regardless of distance, and is connected at both ends to a 1-dimensional (line) canal/ditch, then canal/ditch is represented as a 2-dimensional (polygon) basic feature object.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If canal/ditch is named, or

if canal/ditch is greater than or equal to 984 feet (300 meters) along the longest axis,

then capture.

If canal/ditch is needed to provide network connectivity,

then capture.

If canal/ditch is within agricultural fields and drains to another canal/ditch or other hydrologic feature,

then do not capture (see following exception).

The exception is if a project has a special need for canals and ditch features that are within agricultural fields and drain to another canal/ditch or other hydrologic feature, then these features should be coded with a separate Fcode (user defined) so that they can be excluded from the features to conflate to NHD.

Note that a hydrologic network should not be broken if features are excluded.

Attribute Information

FClass 2—Non-NHD Feature (outside of collection criteria).

FCode 33600—Canal/ditch (an artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft. May be a named feature).

EClass 0—Not used for elevation derivatives. Another possibility is the following:

FClass 1—NHD Feature (will be used for conflation).

FCode 33600—Canal/ditch (an artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft. May be a named feature).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Source Interpretation Guidelines

Do not capture underground aqueducts as canal/ditch. See “Pipeline” section.

Do not capture rivers that have been channelized to control flooding or erosion, or to maintain flow for navigation as canal/ditch. See “Stream/River” section (for example, Los Angeles River is a large channelized river, and coded as stream/river).

Do capture as canal/ditch only those inland navigation waterways that are cut through land to bypass outcrops or rapids, or to connect two bodies of water.

If a canal or ditch passes through a siphon that meets capture conditions for pipeline,

then do not capture canal/ditch. See “Pipeline” section.

Do not capture canal/ditch associated with a cranberry bog or rice paddy.

Connector

A known, but nonspecific, connection between two non- adjacent network segments. Connector feature types are used when two constructed surface-water features appear to interact but there is no discernable evidence of the interaction on the surface. A connector is used to show the connection between the lake/pond and the stream output through a dam (figure 6 and figure 7).

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of connector is the virtual line connecting two nonadjacent network segments.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help

determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If connector is required to maintain connectivity between two network feature objects that represent area of complex channels, canal/ditch, lake/pond, reservoir, sea/ocean, or stream/river,

then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 34400—Connector (a known, but nonspecific, invisible connection between two nonadjacent network segments).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Source Interpretation Guidelines

The following list of conditions indicates when and why the capture of connector is required:

1. When connector is part of a network that is represented as being connected.
2. When there is a gap with no collected network feature object between pieces of the network; for example, at a 2-dimensional (polygon) dam/weir that causes a gap between an upstream lake/pond and a downstream stream/river.

Connector: Culvert

Subsurface water conveyances under a transportation feature (figure 8 A, figure 8 B, and figure 9).

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of CULVERT is the edges of the water conveyance structure.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions:

CULVERT water conveyances may take many forms, such as a corrugated metal pipe running under a driveway, a massive concrete box under a superhighway or a platform suspended over flowing water. The purpose of the CULVERT feature in the stream network is to connect the water flowing across the conveyance to the flowing water downstream, without breaking the downstream flow in the network, therefore CULVERT features will be delineated as simple lines connecting the upstream and downstream segments of single-line streams or as a segment of an artificial path within 2-D features.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If the culvert is greater than 5 feet (1.5 meters) along the longest axis,

then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 33401— A subsurface feature connecting upstream and downstream hydrography features under a constructed feature (Exception: See READ Rules "Connector" for Dam Features). Typically constructed of formed concrete or corrugated metal and surrounded on all sides; top, and bottom by earth or soil. The hydrographic features defined by this specification are intended to be suitable for elevation surface treatments such as hydro-enforcement.

Culvert features are used to maintain connectivity of hydrographic networks, while providing attribution allowing the culverts to be easily identified for elevation surface treatments such as hydro-enforcement.

EClass 3—Culvert - used for hydro-enforcement.

Special Conditions:

Culverts running under other hydrography features.

Source Interpretation Guidelines

None.

Connector: Indefinite Surface

A connector feature used where evidence of channelization is not present in the digital elevation model surface but connectivity between an upstream and downstream channel is indicated by terrain modelling (figure 10). Situations where Indefinite Surface Connectors may be used include low confidence areas in the DEM or heavy vegetative cover in which the channel cannot be resolved. Indefinite surface connector features may also be used to connect through areas having conservation treatments such as grassed waterways, which are designed to prevent soil erosion and the formation of channels. This FCode is recommended for use in situations where streams sink into the ground under low or normal flow conditions but would flow over the surface during high flow or flood conditions and connect to downslope hydrographic features.

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of an indefinite surface connector is the space needed for connectivity between an upstream segment of a natural topographic flow-path and the downstream portion of that flowpath, where the channel becomes indiscernible over a distance and then picks up again downstream. May be determined by modelling techniques, but a clearly defined channel should not be found in locations where an indefinite channel connector is used. Indefinite surface connectors should never be used in headwater locations. For indiscernible channels in headwater locations, see DRAINAGEWAY.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

Indefinite surface connectors are used to bridge a gap cause where a clearly defined channel is lost on a topographic surface but picks up again downstream. Indefinite surface connectors should be captured only in locations with clearly defined channels upstream and downstream and should have no discernible channel.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 33404— Indefinite Surface Connector

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

OR

FClass 1—NHD Feature (will be used for conflation).

FCode 33404—Indefinite Surface Connector

EClass 0—Not used for elevation derivatives

Source Interpretation Guidelines

None.

Connector: Non-NHD Dataset

Attribute/Attribute Value

Delineation

Representation Rules

Data Extraction

Capture Conditions

Attribute Information

Source Interpretation Guidelines

Connector: Terrain Breach

Used to breach terrain (or elevation) features that block the flow in a drainage network, such as a small rise in elevation, landslides, moraines, glacial till, or naturally formed berms. A terrain breach connector is used to breach flow blockages on the elevation surface; with no known built feature connecting upstream and downstream flow. In contrast, the underground conduit (FCode 42002) is used to represent an underground flowpath in known karst, permafrost, and thermokarst terrain; the culvert connector (FCode 34401) is used to connect upstream and downstream flow through a transportation feature; and connector (FCode 34400) is used to connect underground flow from upstream to downstream through built environments such as a dam (figure 11 and figure 12).

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of TERRAIN BREACH CONNECTOR is the virtual line connecting two nonadjacent network segments, from the lowest point on one side of the obstruction to a point at or below the beginning point on the other side of the obstruction.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If TERRAIN BREACH CONNECTOR is required to maintain connectivity through a rise in elevation between two network feature objects,

then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 34400—Terrain Breach Connector: A known, but nonspecific, invisible connection between two nonadjacent network segments through a natural (non-built) rise in elevation.

EClass 3—Hydrographic feature used for hydro-enforcement.

Source Interpretation Guidelines

All

The following list of conditions indicates when and why the capture of TERRAIN BREACH CONNECTOR is required:

1. When TERRAIN BREACH CONNECTOR is part of a network that is represented as being connected.
2. When there is a gap caused by a rise in elevation greater than or equal to 2 meters in Alaska and greater than or equal to 1 meter in CONUS.

Special Conditions: none.

Dam/Weir

A barrier constructed to control the flow or raise the level of water (figure 13 and figure 14).

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help

determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If dam/weir is greater than or equal to 240 feet (73 meters) along the longest axis,

then capture.

Attribute Information

FClass 2—Non-NHD Feature (outside of collection criteria).

FCode 34300—Dam/Weir (a barrier constructed to control the flow or raise the level of water. No information on the predominant construction material).

EClass 0—Not used for elevation derivatives. Another possibility is the following:

FClass 1—NHD Feature (will be used for conflation).

FCode 34300—Dam/weir (a barrier constructed to control the flow or raise the level of water. No information on the predominant construction material).

EClass 0—Not used for elevation derivatives.

Source Interpretation Guidelines

None.

Drainageway

Drainageway features are flowlines delineated where terrain modelling indicates potential headwater drainage but no channel is detectable. The drainageway code must only be applied at the initiation of flowlines or confluence of other drainageway features. The drainageway code must not be applied downstream of other non-drainageway NHD flowlines or waterbody features.

Attribute/Attribute Value

Each feature requires domain codes and attributes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of a drainageway is the topographic flowpath or the approximate overland flow path between two disconnected drainage network features. May be determined by modelling techniques, but a clearly defined channel may not be easily recognized.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

To accommodate variations in the shortest axis of drainageway:

FOR EDH: If shortest axis of drainageway is

less than 20 feet (6 meters) regardless of distance, and is connected at both ends to a 2-dimensional (polygon) stream/river,

then drainageway is represented as a 1-dimensional (line) basic feature object.

If shortest axis of drainageway is greater than or equal to 50 feet (15 meters) and does not meet drainageway criteria, collect as appropriate feature for capture conditions (stream/ river, area of complex channels, playa, and others as needed).

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

Drainageways have no clearly defined capture conditions. Modelling techniques (flow models, elevation surface models, logistic regression models, and so on) expose features and, therefore, require further investigation to determine their status and categorization as hydrographic features.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 46800—Drainageway (a flowpath without a clearly defined channel).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Another possibility is the following:

FClass 1—NHD Feature (will be used for conflation).

FCode 46800—Drainageway (a flowpath without a clearly defined channel).

EClass 0—Not used for elevation derivatives.

Ice Mass

A field of ice formed in regions of perennial frost (figure 15 and figure 16).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of ice mass is the extent of ice or snow.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If ice mass is greater than or equal to 246 feet along the shortest axis (or approximately 75 meters), then capture.

Z-values (elevation values at a particular location) are measured at the boundary of the feature.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 37800—Ice mass (a field of ice usually formed in regions of perennial frost. Ice Mass primarily consists of glaciers).

EClass 0—Not used for elevation derivatives.

Source Interpretation Guidelines

None.

If glaciers are contiguous, then the dividing line is the approximate line of divergence or confluence, as determined by the topography of the ice masses, or by the changes in color or texture, or both.

Lake/Pond

A standing body of water with a predominantly natural shoreline surrounded by land (figure 17, figure 18 A, and figure 18 B).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Delineation

The limit of lake/pond where stream/river enters or leaves is determined by the conformation of the land.

The limit of lake/pond is the position of the visible edge of the waterbody (date of lidar collection).

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

For required lidar base specification breakline acquisition, waterbodies with a surface area of 2 acres (0.8 hectare) or greater (approximately equal to a round pond 328 feet [100 meters] in diameter) at the time of collection shall be flattened.

For EDH feature collection, if lake/pond is greater than or equal to 100 feet (30 meters) along the shortest axis (or approximately 0.4 hectare), then capture (for required hydro- flattening breaklines, not applicable).

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 39000—Lake/pond (a standing body of water with a predominantly natural shoreline surrounded by land or a flooded river system where a dam has been built to with- hold water).

EClass 1—Use for hydroflattening (3-dimensional polygon).

Source Interpretation Guidelines

Do not capture dry lakes as lake/pond. See “Playa” section.

Refer to the feature definition to decide how to categorize a given feature instance. Do not use the proper name of the feature as a guide. Many features that are known as “Reservoirs” or labeled on the topographic map as “Reservoirs” will be captured as lake/pond. “Stock Tanks” may be reservoir or lake/pond depending on their form. As a general rule, if a waterbody has a geometric shape or other information indicates it is contained by a constructed basin, capture it as reservoir. If it does not appear to be contained by a constructed basin, capture it as lake/pond.

The minimum size for islands within lake/pond is 60 feet (18 meters) along the shortest axis.

For lidar base specification hydroflattening, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies and excluded from hydroflattening.

For examples of islands and intermittently submerged islands that may be apparent on elevation surface, see “Additional Elevation-Derived Hydrography Treatments and Elevation Specific Features” section.

Low-Confidence Area, Predetermined

A reference polygon used by the 3D Elevation Program (3DEP) to define an area where lidar penetration to the bare- earth surface is expected to be difficult to determine. These areas would be established prior to the collection and agreed upon by the data producer and the customer. Examples might include known areas of mangroves or triple-canopy tropical rainforest (figure 19 and figure 20). Low-confidence areas may overlap other hydrographic features.

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help

determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

Established prior to the collection and agreed upon by the data producer and the customer.

Topology rules for adjacent features do not apply to low- confidence areas. For instance, they do not need to be snapped to adjacent features.

Attribute Information

FClass 9—Non-Hydrography Feature (elevation dataset limitation).

FCode 991—Low-confidence area (pre-determined).

EClass 9—Elevation dataset limitation.

Source Interpretation Guidelines

None.

Low-Confidence Area, Snow-Cover

A reference polygon used by the 3DEP to define where it can be determined that there was snow on the ground at the time of collection. Light dusting of snow that does not alter the ground elevation more than about 0.8 inch (2 centimeters) is inconsequential and should not be delineated. Low-confidence areas may overlap other hydrographic features (figure 21 and figure 22).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines

give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

If snow is greater than approximately 2 centimeters deep, then capture.

Topology rules for adjacent features do not apply to low- confidence areas. For instance, they do not need to be snapped to adjacent features.

Attribute Information

FClass 9—Non-Hydrography Feature (elevation dataset limitation).

FCode 993—Low-confidence area, snow-cover.

EClass 9—Elevation dataset limitation.

Source Interpretation Guidelines

None.

Low-Confidence Area, Sparse Bare Earth

At this time (2020), the 3DEP does not have a criterion for defining areas of low confidence based on the point cloud ground surface or derived DEM rasters. Any criteria for "low confidence," including how these areas shall be delineated, shall be established prior to the collection and agreed upon by the data producer, the customer, and the U.S. Geological Survey National Geospatial Program. Low-confidence areas may overlap other hydrographic features

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

Topology rules for adjacent features do not apply to low- confidence areas. For instance, they do not need to be snapped to adjacent features.

Attribute Information

FClass 9—Non-Hydrography Feature (elevation dataset limitation).

FCode 992—Low-confidence area, sparse bare earth.

EClass 9—Elevation dataset limitation.

Pipeline

A surface or subsurface, closed or open, constructed conduit for conveying water (figure 23 and figure 24).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Delineation

The limit of an underground pipeline is the edge of the ground scars or linear clearings, or other above ground arti- facts that can be detected from ancillary data or other methods.

The limit of a near-ground or elevated pipeline is the extent of the structure.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

If pipeline conveys water between natural water features such as stream/river or lake/pond features, is above ground, is not underwater, and is greater than or equal to 5 feet (1.5 meters) along the longest axis,

then capture.

Note that the pipeline must connect to existing water features or water conveyance on both ends.

If pipeline conveys water underground, and the pipeline is greater than 50 feet in length, then capture.

Note that the only required pipelines to capture are those that are above ground, but if an ancillary source is used, an underground pipeline can be added to connect above ground features. Source of the ancillary data must be cited.

If pipeline conveys water under a road, and the road is less than 50 feet in width, then capture as a culvert (add EClass of 3) see culvert description for FCode, and not as pipeline.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 42800—Pipeline (a closed conduit, with pumps, valves and control devices, for conveying water).

EClass 0—Not used for elevation derivatives.

OR

FClass 1—NHD Feature (will be used for conflation).

FCode 42800—Pipeline (a closed conduit, with pumps, valves and control devices, for conveying water).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Source Interpretation Guidelines

None.

Playa

The flat area at the lowest part of an undrained desert basin, generally devoid of vegetation (figure 25 and figure 26).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Delineation

The limit of playa is the extent of the lowest part of the basin.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If playa is greater than or equal to 200 feet (61 meters) along the shortest axis, then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 36100—Playa (the flat area at the lowest part of an undrained desert basin, generally devoid of vegetation. May be a named feature).

EClass 0—Not used for elevation derivatives.

Source Interpretation Guidelines

None.

Reservoir

A constructed basin formed to contain water or other liquids (figure 27 and figure 28).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of reservoir is the rim of the constructed basin.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

For required lidar base specification hydroflattening breakline acquisition, waterbodies with a surface area of 2 acres (0.8 hectare) or greater (approximately equal to a round pond 328 feet [100 meters] in diameter) at the time of collection shall be flattened.

For EDH feature collection, if lake/pond is greater than or equal to 100 feet along the shortest axis (or approximately 0.4 hectare), then capture (for required hydroflattening break- lines, not applicable).

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 43600—Reservoir (a constructed basin formed to contain water or other liquids. Function or purpose of reservoir is unknown. Predominant construction material used to build the reservoir is unknown. The portion of the year the feature contains water is unknown).

EClass 1—Use for hydroflattening (3D polygon).

Source Interpretation Guidelines

Refer to the feature definition to decide how to categorize a given feature instance. Do not use the proper name of the feature as a guide. Many features that are known as "Reservoirs" or labeled on the topographic map as "Reservoirs" will be captured as lake/ponds. "Stock Tanks" may be reservoir or lake/pond depending on their form. As a general rule, if a waterbody has a geometric shape or other information indicates it is contained by a constructed basin, capture it as reservoir. If it does not appear to be contained by a constructed basin, capture it as lake/pond.

If reservoir is less than 100 feet along the shortest axis and is within 40 feet of another reservoir with the same attribute values,

then capture as one reservoir only if the combined areas are greater than or equal to 100 feet along the shortest axis.

For lidar base specification hydroflattening, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies.

For examples of islands and intermittently submerged islands that may be apparent on elevation surface, see "Additional EDH Related Treatments and Elevation Specific Features" section.

Sea/Ocean

The great body of saltwater that covers much of the Earth (figure 29 and figure 30).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The limit of sea/ocean is the approximate line of mean high water.

In areas where rivers enter sea/ocean, the limit is where the conformation of the land and water makes the division obvious, or, if the land and water do not suggest an obvious limit, the limit is where the river reaches a width of 1 nautical mile (6,076.1 feet or 1.15 statute miles) with no further constrictions.

A boundary waterbody is any waterbody that contains the boundary of the collection (that is, the actual opposite bank or shore is not being mapped). Boundary waterbodies may be a single water surface elevation (for example, lake) or gradient (for example, river). Boundary waterbodies will contain either a centerline or an Elevation Terminus line, depending on circumstances.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature

should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

Capture all.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 44500—Sea/ocean (the great body of saltwater that covers much of the Earth. May be a named feature).

EClass 1—Use for hydroflattening (3D polygon).

Source Interpretation Guidelines

The minimum size for islands within sea/ocean is 1 acre (0.4 hectare) along the shortest axis.

For lidar base specification hydroflattening, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies.

For examples of islands and intermittently submerged islands, which may be apparent on elevation surface, see “Additional Elevation-Derived Hydrography Treatments and Elevation Specific Features” section.

Sink/Rise

The place at which a stream disappears into an under- ground conduit or reappears at the surface from an under- ground conduit, or an isolated depression where the network ends (figure 31 and figure 32).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Delineation

The limit of sink/rise is the place at which a stream disappears underground or reappears at the surface.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with "None."

Capture Conditions

If stream disappears and reappears downstream on stream/river,

then capture at the point of disappearance and reappearance.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 45000—Sink/rise (the place at which a stream disappears underground or reappears at the surface in a karst area. SinkRise also exists as an NHDPoint. May be a named feature).

EClass 0—Not used for elevation derivatives.

Source Interpretation Guidelines

None.

Stream/River

A body of flowing water (figure 33, figure 34, and figure 35).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See "Field Definitions and Domain Values for Attributes" section for more information on EDH code definitions.

Delineation

The delineation of stream/river features should adhere to the following rules, describing the boundary limits of the feature, and other delineation rules:

- The boundary limit of stream/river:

    - is determined by the position of the visible edge of the banks as depicted on the digital elevation model (as of date of lidar collection).
    - where it enters or leaves lake/pond
        - is determined by the conformation of the land.
    - where it enters sea/ocean
        - is determined by the location where the conformation of the land and water makes the division obvious, or, if the land and water do not suggest an obvious limit, the limit is where the stream reaches a width of 1 nautical mile (6,076.1 feet or 1.15 statute miles) with no further constrictions.
    - Where flattening is required,
        - flattened streams and rivers shall present a flat and level water surface bank-to-bank (perpendicular to the apparent flow centerline).
        - flattened streams and rivers shall present a gradient downhill water surface, following the immediately surrounding terrain.
- Other delineation rules
    - The upper limit of stream/river is where the feature first becomes evident as a channel.
    - In cases of sharp turns of rapidly moving water, where the natural water surface is notably not level bank-to-bank, the water surface will be represented as it exists while maintaining an aesthetic carto- graphic appearance.
    - The entire water surface edge shall be at or below the immediately surrounding terrain.
    - Stream channels shall break at culvert locations leaving the roadway over the culvert intact.
    - Streams shall be continuous at bridge locations.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions:

To accommodate variations in the shortest axis of stream/river:

- For lidar base specification collection (not collecting optional features), streams and rivers of approximately 100 feet (30 meters) or greater nominal width shall be flattened (captured as a polygon).
- For EDH feature collection, if shortest axis of stream/river is

  less than 50 feet (15 meters) but greater than or equal to 20 feet (6 meters) for a distance less than 0.6 mile (1 kilometer), and is connected at both ends to a 2-dimensional (polygon) stream/river,

  then stream/river is represented as a 2-dimensional (polygon) basic feature object.
- less than 50 feet (15 meters) but greater than or equal to 20 feet (6 meters) for a distance greater than or equal to 0.6 mile (1 kilometer), or less than 20 feet (6 meters) regardless of distance, and is connected at both ends to a 2-dimensional (polygon) stream/river, then stream/river is represented as a 1-dimensional (line) basic feature object.

- greater than or equal to 50 feet (15 meters) but less than 80 feet (24 meters) for a distance less than 0.6 mile (1 kilometer), and is connected at both ends to a 1-dimensional (line) stream/river,

  then stream/river is represented as a 1-dimensional (line) basic feature object.

- greater than or equal to 50 feet (15 meters) but less than 80 feet (24 meters) for a distance greater than or equal to 0.6 mile (1 kilometer), or greater than or equal to 80 feet (24 meters) regardless of distance, and is connected at both ends to a 1-dimensional (line) stream/river,

  then stream/river is represented as a 2-dimensional (polygon) basic feature object.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

If stream/river flows from lake/pond or spring/seep,

or

if stream/river is greater than or equal to 984 feet (300 meters) along the longest axis,

then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 46000—Stream/river (a body of flowing water.

Portion of the year the feature contains water unknown).

EClass 2—Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening.

Another possible option is the following:

FClass 1—NHD Feature (will be used for conflation). FCode 46000—Stream/river (a body of flowing water.

Portion of the year the feature contains water unknown).

EClass 1—Used for hydroflattening (3D polygon).

Source Interpretation Guidelines

The minimum size for islands within stream/river is 60 feet (18 meters) along the shortest axis.

If a stream flows in a braided pattern, then see “Area of Complex Channels” section.

For lidar base specification hydrographic breakline, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies.

Underground Conduit

A set of naturally occurring subsurface drainage channels formed from the dissolution of soluble rocks in karst terrain or in terrain similar to karst but formed in nonsoluble rocks, as by melting of permafrost or ground ice, collapse after mining, and by outflow of liquid lava from beneath its solidified crust (figure 36 and figure 37).

Attribute/Attribute Value

Each feature requires domain codes to be entered into the attribute table for the feature class (table 1). See “Field Definitions and Domain Values for Attributes” section for more information on EDH code definitions.

Delineation

The limit of Underground Conduit: Indefinite is the virtual line connecting two nonadjacent network segments where the National Hydrography Dataset has previously placed an underground conduit, or other data sources show the presence of karst terrain. Underground conduit may also be placed in locations where there is evidence of thermokarst terrain.

NOTE: A sink/rise point feature must be placed at the start of an underground conduit. If there is a known outflow location, a sink/rise point feature should be placed at the end of the underground conduit.

Representation Rules

When delineating a feature, it must be created with the appropriate geometry, either point, line, or polygon, which is determined by the size of the feature or the length along different axes of the feature (table 2, table 3, and table 4).

Special conditions: none.

Data Extraction

Data extraction rules fall into three categories: capture conditions, attribute information, and source interpretation guidelines. The capture conditions explain the requirements for a feature to be collected, and other pertinent information about acquisition. The attribute information explains the definitions of

the codes and attributes that must be applied to a feature if acquired, and the source interpretation guidelines give additional information for special circumstances to help determine whether a feature should be acquired or not. Not all features have source interpretation guidelines, and if this is the case, this will be indicated with “None.”

Capture Conditions

If UNDERGROUND CONDUIT is required to identify a known or highly probable groundwater flowpath with verified outflow location.

then capture.

Attribute Information

FClass 1—NHD Feature (will be used for conflation).

FCode 34400—Underground Conduit: Indefinite: A set of naturally occurring subsurface drainage channels formed from the dissolution of soluble rocks in karst terrain or in terrain similar to karst but formed in nonsoluble rocks, as by melting of permafrost or ground ice (thermokarst), collapse after mining, and by outflow of liquid lava from beneath its solidified crust.

EClass 0— Not used for elevation derivatives.

Source Interpretation Guidelines

All

The following list of conditions indicates when and why the capture of UNDERGROUND CONDUIT is required:

When UNDERGROUND CONDUIT is part of a network that is represented as being connected.

When there is a previously existing groundwater dataset, or other data indicating the presence of karst, thermokarst, mining systems, volcanic terrain, or similar groundwater terrain types disrupting the hydrographic network.

Special conditions: none.

Additional Elevation-Derived Hydrography Treatments and Elevation Specific Features

The following describes treatments and additional features that should be applied during the acquisition of reservoirs, sea/ocean, and other waterbody features and should be taken into consideration as treatments for the depiction of waterbodies. The treatments and additional features can also be used to convey additional information about the level of confidence for elevation data in certain acquisition areas.

Island

A permanent island is an area of exposed land, sur- rounded by water (figure 38 and figure 39). These are features to be collected in and of themselves but also are a treatment. Islands need to be erased from lake/pond features.

Delineation

Lake/Pond

The minimum size for islands within lake/pond is 60 feet (18 meters) along the shortest axis.

For lidar base specification hydroflattening, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies and excluded from hydroflattening.

Sea/Ocean

The minimum size for islands within sea/ocean is 1 acre (0.4 hectare) along the shortest axis.

For lidar base specification hydroflattening, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies.

Stream/River

The minimum size for islands within stream/river is 60 feet (18 meters) along the shortest axis.

If a stream flows in a braided pattern, then see “Area of Complex Channels” section.

For lidar base specification hydrographic breakline, permanent islands 1 acre (0.4 hectare) (approximately equal to a round island 236 feet [72 meters] in diameter) or larger shall be delineated within all waterbodies.

Island/Sandbar

Intermittently/partially submerged islands or parts of islands are submerged at the time of collection (figure 40). These are most often found in coastal areas because of tidal variations during the collection, or in rivers collected while at a high flow. If island/sandbar is disconnected from the shore or is visible at the time of collection, then treat as an island (remove from lake/pond or sea/ocean feature). Otherwise, treat as shoreline.

References

1. Terziotti, S., and Archuleta, C.M., 2020, Elevation-Derived Hydrography Acquisition Specifications: U.S. Geological Survey Techniques and Methods, book 11, chap. B11, 74 p., https://doi.org/10.3133/tm11B11.

2. U.S. Geological Survey, 2020, USGS TNM Hydrography (NHD): accessed February 28,

2020, at https://hydro.nationalmap.gov/arcgis/rest/services/nhd/MapServer.

Tables

Table 1. Feature type description, associated geometry, and use classification.

Desc	FCode	Geometry type	EClass Domain value	EClass Feature attribute	FClass Domain value	FClass Feature attribute
Artificial Path	55800	3D line, polylineZ	2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening	1	NHD feature (will be used for conflation).
Canal/Ditch	33600	3D line, polylineZ (does not connect primary network features)	0	Not used for elevation derivatives	2	Non-NHD feature (outside of collection criteria).
		3D line, polylineZ (creates network connectivity)	2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening	1	NHD feature (will be used for conflation).
Connector	33400	3D line, polylineZ	3	Features below ground level. May be used for hydro-enforcement	1	NHD feature (will be used for conflation).
Connector: Culvert	33401	3D line, polylineZ	3	Features below ground level. May be used for hydro-enforcement	1	NHD feature (will be used for conflation).
Connector: Indefinite surface	33404	3D line, polylineZ	2	Linear hydrographic features that follow the elevation surface	1	NHD feature (will be used for conflation).
Connector: Non-NHD Dataset	33410	3D line, polylineZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
Connector: Terrain breach	33405	3D line, polylineZ	3	Features below ground level. May be used for hydro-enforcement	1	NHD feature (will be used for conflation).
Dam/Weir	34300	3D point, pointZ	0	Not used for elevation derivatives	2	Non-NHD feature (outside of collection criteria).
		3D line, polylineZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
		3D polygon, polygonZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
Drainageway	46800	3D line, polylineZ	2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening	1	NHD feature (will be used for conflation).
Ice Mass	37800	3D polygon, polygonZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
Lake/Pond	39000	3D polygon, polygonZ	1	Used for hydroflattening	1	NHD feature (will be used for conflation).
Low-confidence Area (predetermined)	991	3D polygon, polygonZ (accurate z-values not required)	9	Elevation dataset limitation	9	Nonhydrography feature (elevation dataset limitation).
Low-confidence Area (snow covered)	993	3D polygon, polygonZ (accurate z-values not required)	9	Elevation dataset limitation	9	Nonhydrography feature (elevation dataset limitation).
Low-confidence Area (sparse bare earth)	992	3D polygon, polygonZ (accurate z-values not required)	9	Elevation dataset limitation	9	Nonhydrography feature (elevation dataset limitation).

Pipeline	42800	3D line, polylineZ (does not connect primary network features)	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
		3D line, polylineZ (creates network connectivity)	2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening	1	NHD feature (will be used for conflation).
Playa	36100	3D polygon, polygonZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
Reservoir	43600	Polygon (less than 2 acres)	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
		Polygon (greater than or equal to 2 acres)	1	Used for hydroflattening	1	NHD feature (will be used for conflation).
Sea/Ocean	44500	3D polygon, polygonZ	1	Used for hydroflattening	1	NHD feature (will be used for conflation).
Sink/Rise	45000	3D point, pointZ	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).
Stream/River	46000	3D line, polylineZ	2	Hydrographic feature used for elevation purposes, other than culverts or those used for hydroflattening	1	NHD feature (will be used for conflation).
		3D polygon, polygonZ	1	Used for hydroflattening	1	NHD feature (will be used for conflation).
Underground Conduit	42002	3D line, polylineZ (creates network connectivity)	0	Not used for elevation derivatives	1	NHD feature (will be used for conflation).

Table 2. Point (0-Dimensional) Representation Rules.

Desc	Area	Shortest Axis	Longest Axis
Artificial Path			
Canal/Ditch			
Connector			
Connector: Culvert			
Connector: Indefinite surface			
Connector: Non-NHD Dataset			
Connector: Terrain breach			
Dam/Weir		less than 40 feet (for use on lines)	
Drainageway			
Ice Mass			
Lake/Pond			
Low-confidence Area (predetermined)			
Low-confidence Area (snow covered)			
Low-confidence Area (sparse bare earth)			
Pipeline			
Playa			
Reservoir			
Sea/Ocean			
Sink/Rise	greater than 0		
Stream/River			
Underground Conduit			

Table 3. Line (1-Dimensional) Representation Rules.

Desc	Area	Shortest Axis	Longest Axis
Artificial Path		greater than 0	
Canal/Ditch		less than 50 ft (15 m)	
Connector		greater than 0 but less than 50 ft (15 m)	

Connector: Culvert		greater than 0	
Connector: Indefinite surface		greater than 0	
Connector: Non-NHD Dataset			
Connector: Terrain breach		greater than 0	
Dam/Weir		less than 40 ft (for use on polygon waterbody features)	
Drainageway		greater than 0	
Ice Mass			
Lake/Pond			
Low-confidence Area (predetermined)			
Low-confidence Area (snow covered)			
Low-confidence Area (sparse bare earth)			
Pipeline		greater than 0	
Playa			
Reservoir			
Sea/Ocean			
Sink/Rise			
Stream/River		less than 50 ft (15 m) NHD less than 98 ft (30 m) hydroflattening breakline	
Underground Conduit		greater than 0	

Table 4. Polygon (2-Dimensional) Representation Rules.

Desc	Area	Shortest Axis	Longest Axis
Artificial Path			
Canal/Ditch		greater than 50 ft (15 m)	
Connector		greater than 50 ft (15 m)	
Connector: Culvert			
Connector: Indefinite surface			
Connector: Non-NHD Dataset			
Connector: Terrain breach			
Dam/Weir		greater than 40 ft (for use on polygon waterbody features)	
Drainageway			
Ice Mass	greater than 0		
Lake/Pond	greater than 0		
Low-confidence Area (predetermined)	greater than 0		
Low-confidence Area (snow covered)	greater than 0		
Low-confidence Area (sparse bare earth)	greater than 0		
Pipeline			
Playa	greater than 0		
Reservoir	greater than 0		
Sea/Ocean	greater than 0		
Sink/Rise			
Stream/River		greater than 50 ft (15 m) NHD greater than 98 ft (30 m) hydroflattening breakline	
Underground Conduit			

Figures

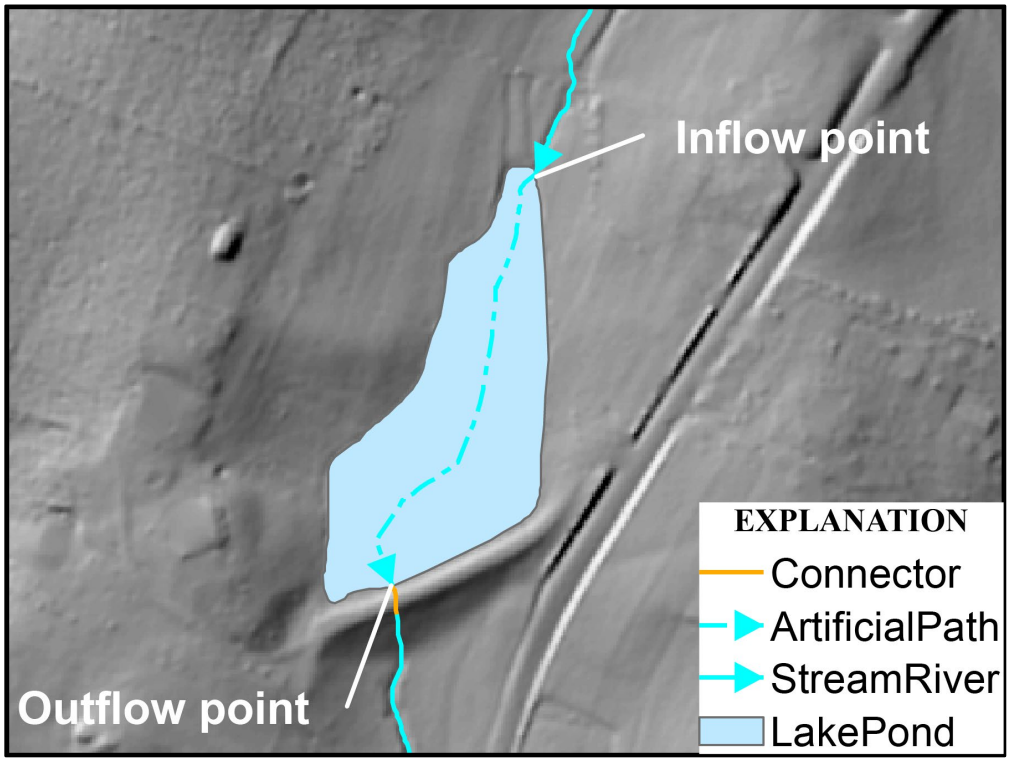

Figure 1. Diagram showing inflow and outflow points of a lake/pond feature.

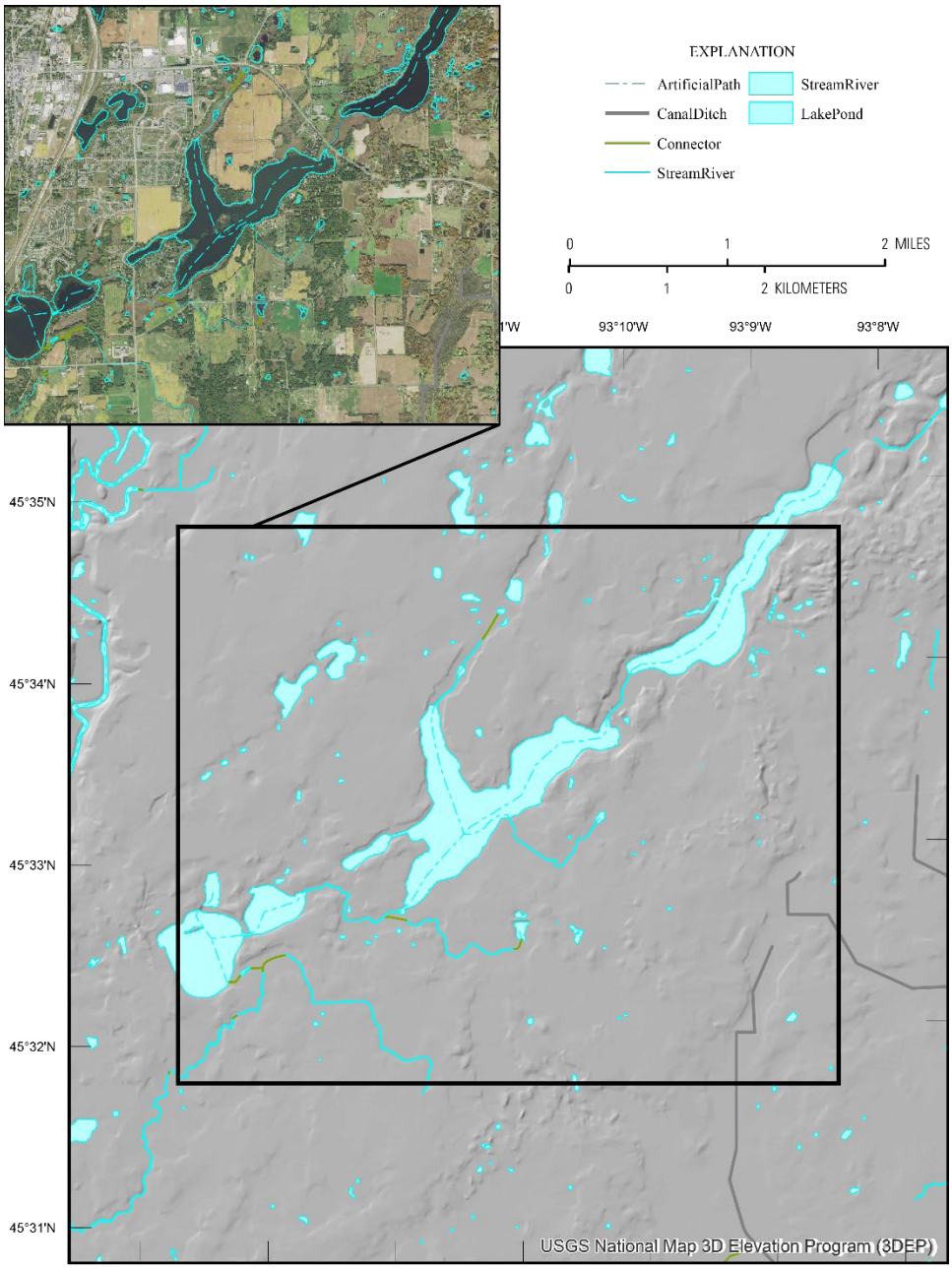

Figure 2. Example of artificial path features in Lake Fannie in Minnesota. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 3. Shadroe Canal Weir, Cape Coral, Florida, as an example of a canal. Photograph by Shane Prorok, U.S. Geological Survey.

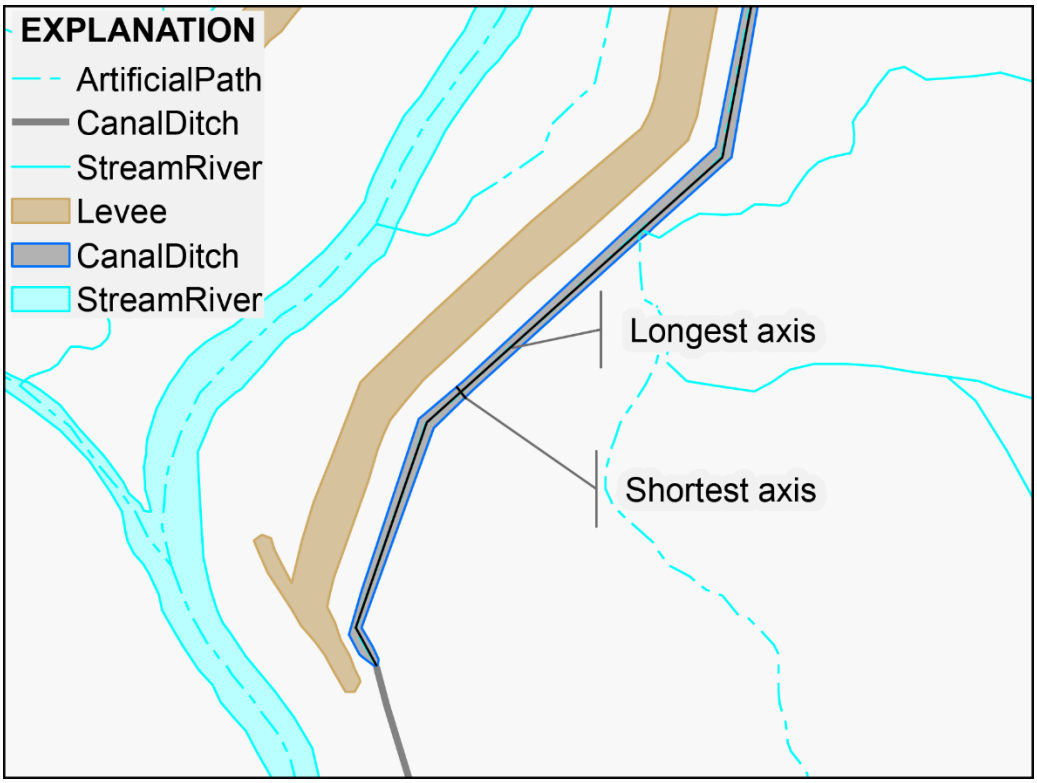

Figure 4. Diagram showing shortest and longest axes of a canal/ditch feature.

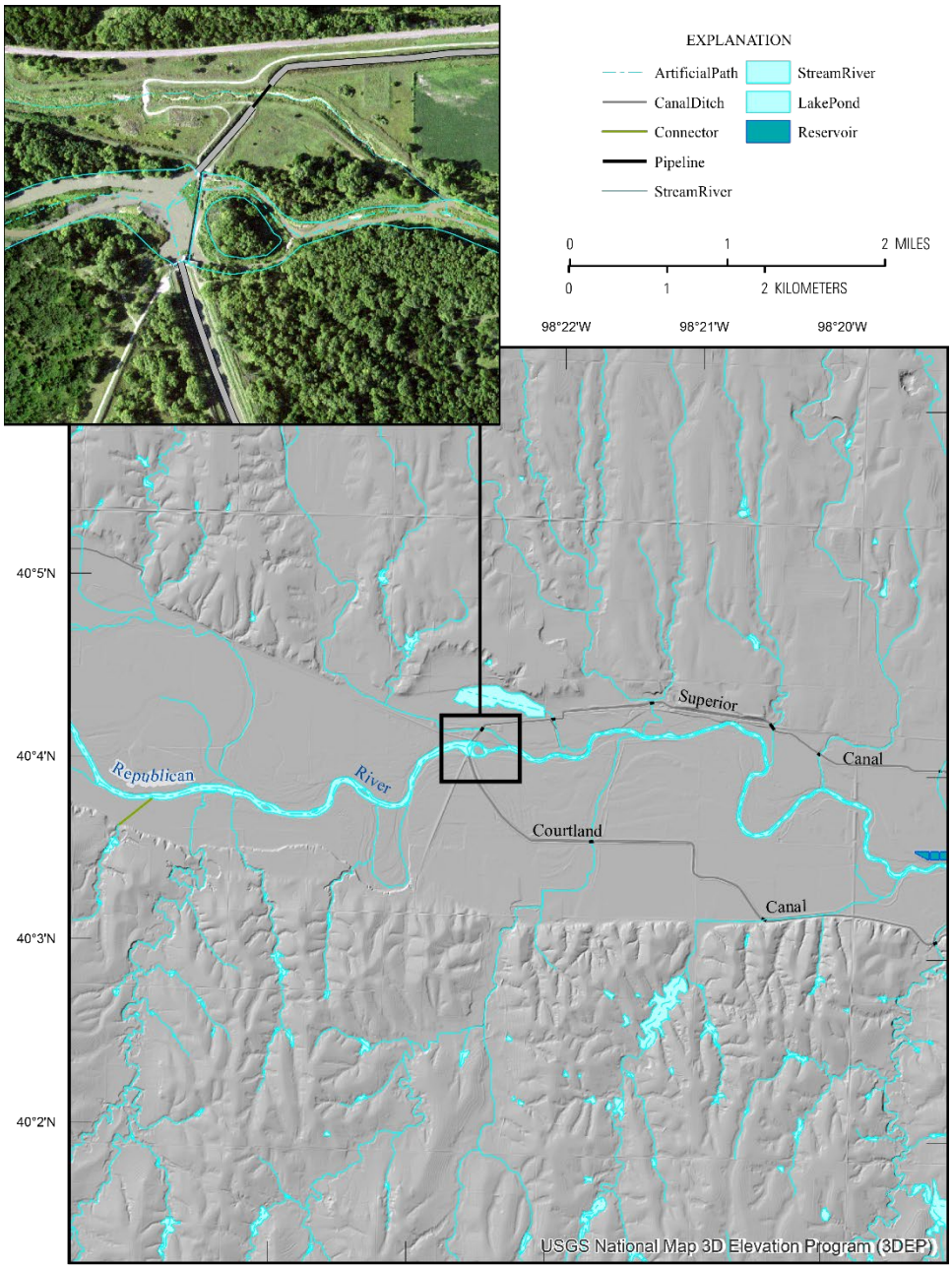

Figure 5. Courtland and Superior Canals near the Nebraska-Kansas Stateline, shown as examples of canal/ditch features. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 6. New Libby Dam, Kootenai River, Libby, Montana, is shown as an example of where a connector could be used to connect the flow of the river from the bottom left side of the image to the lake on the top right side of the image. Photograph by U.S. Army Corps of Engineers.

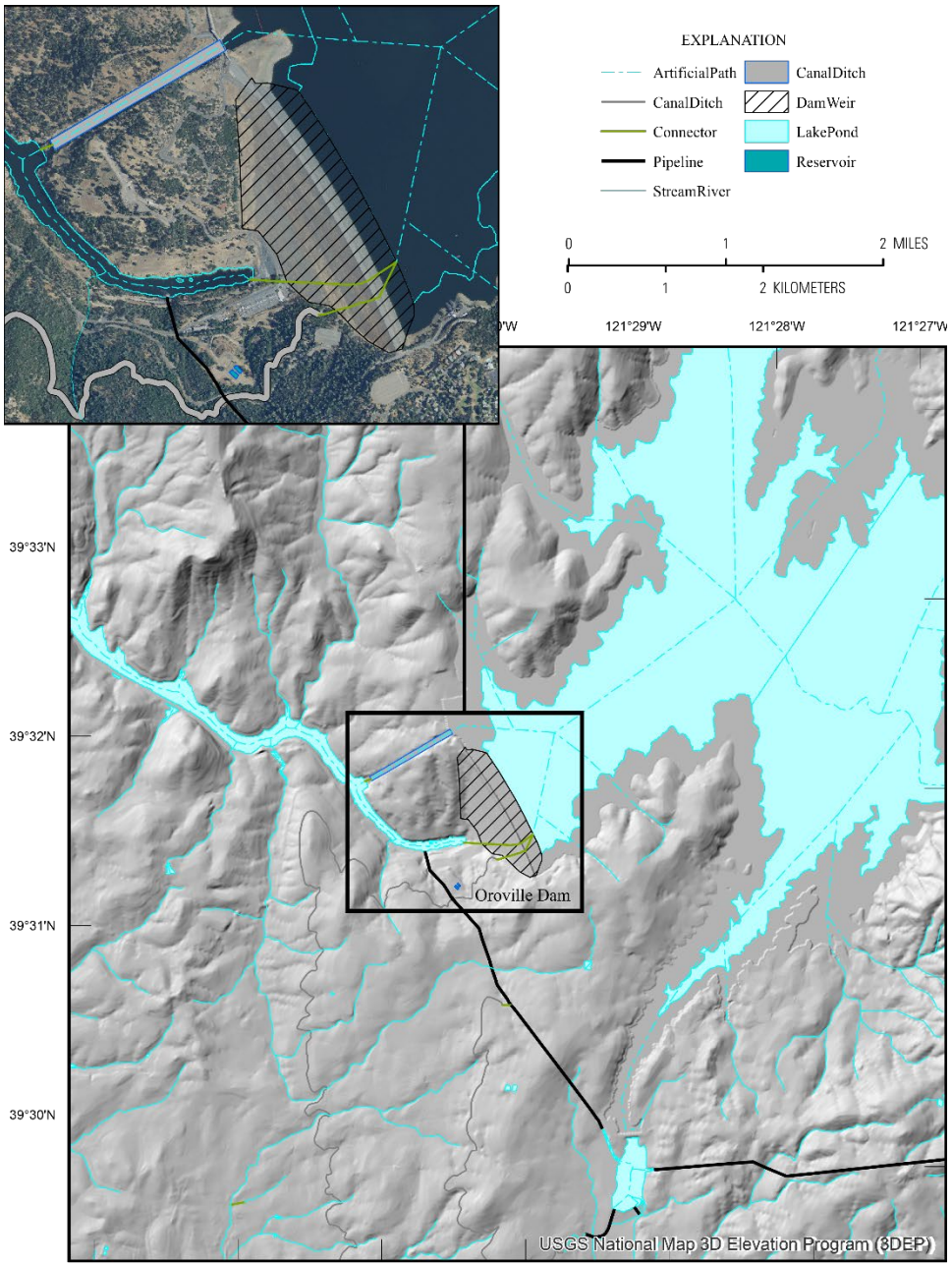

Figure 7. Oroville Dam, California, is shown to provide an example of a connector hydrographic feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 8 A. Examples of culverts, which can be many shapes and sizes and found in a variety of locations. Example A is a very large box culvert running underneath an interstate. (Photo credit: Christy-Ann Archuleta).

Figure 8 B. Examples of culverts, which can be many shapes and sizes and found in a variety of locations. Example B shows a much smaller culvert running under a two-lane residential road. (Photo credit: Christy-Ann Archuleta).

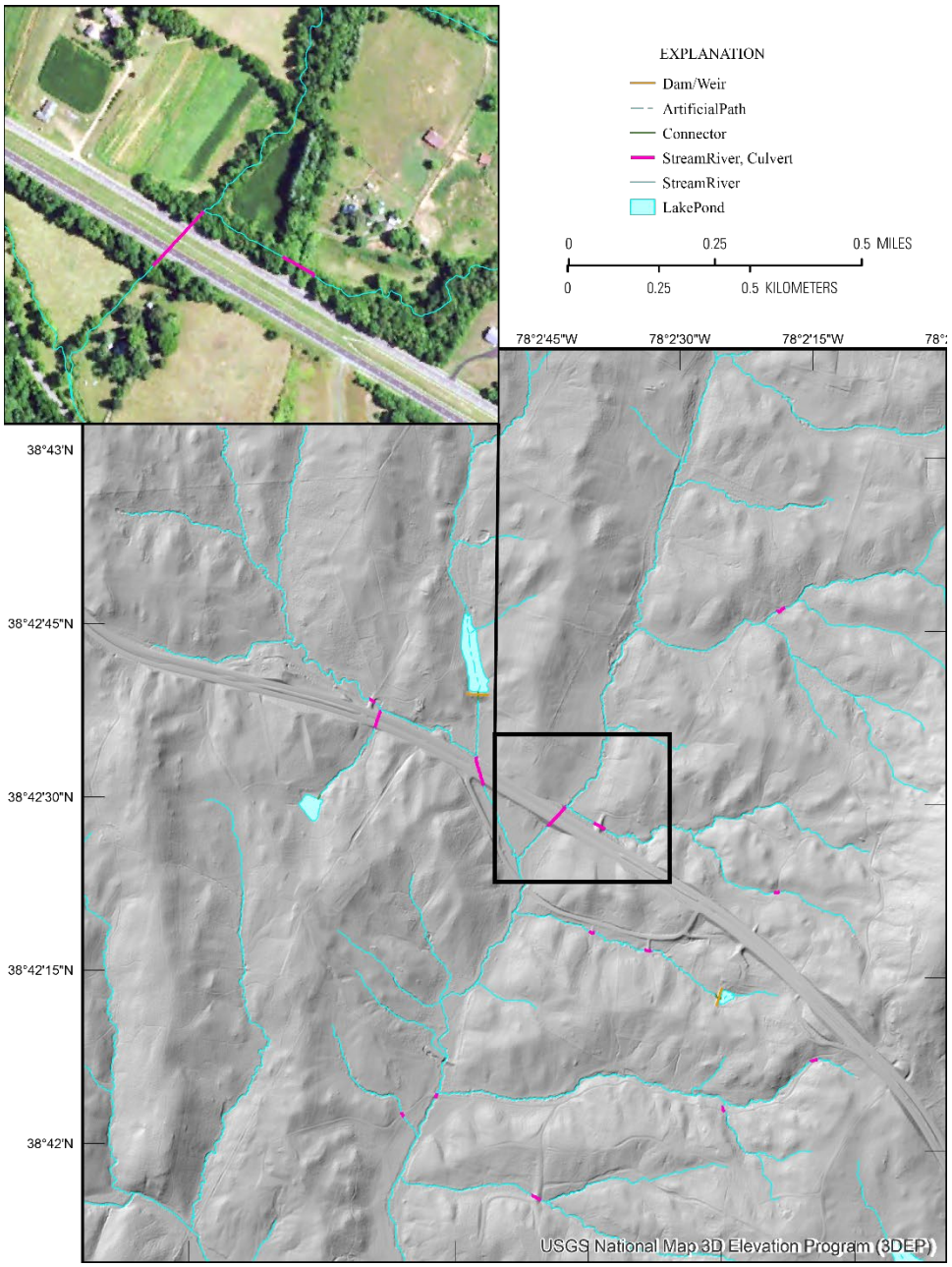

Figure 9. Highway 211 in Virginia crossing unnamed streams as examples of a culvert hydrographic feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types but may not have the same density and other characteristics of elevation-derived hydrography.

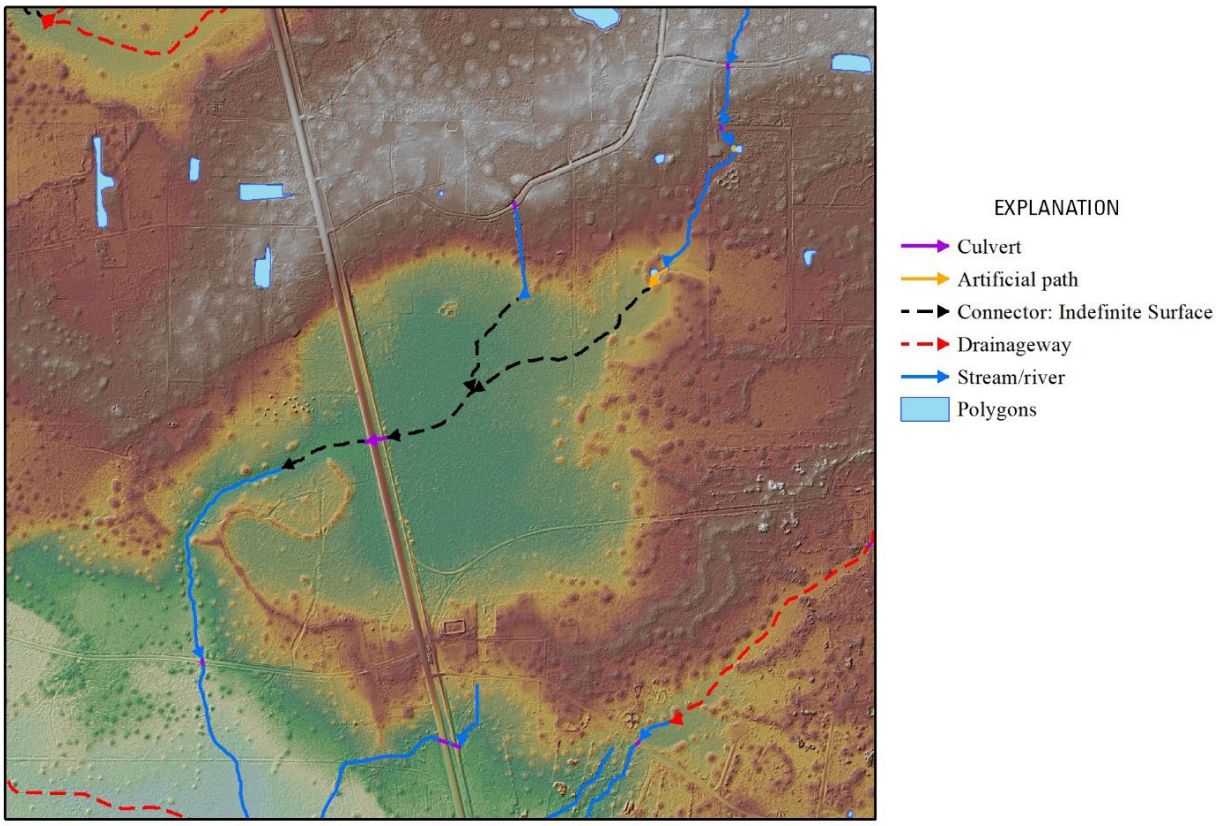

Figure 10. Example of indefinite surface connector features providing network connectivity through an area without clear channelization.

Figure 11. Large tree obstructing South Hominy Creek, in Candler, Buncombe County, North Carolina. Image courtesy of Roger Ehrlich. A terrain breach would be used to bypass this tree, which has a diameter over 2 meters.

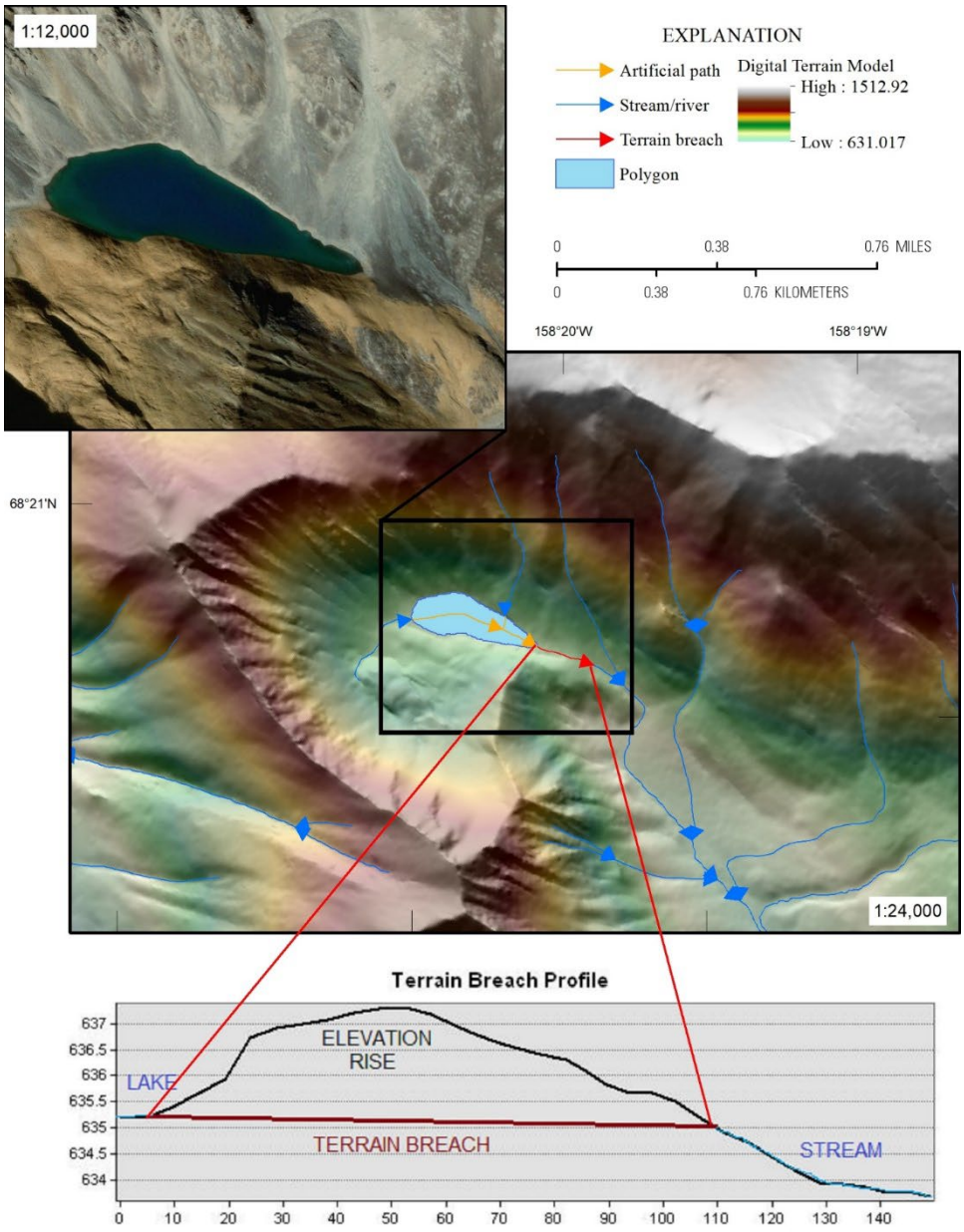

Figure 12. A high-altitude mountain lake formed by a naturally occurring berm, is shown to provide an example of a TERRAIN BREACH CONNECTOR feature. Source data for elevation is 3DEP Ifsar, and the imagery is from the State of Alaska Open Data Geoportal.

Figure 13. Hoover Dam on Lake Mead, Arizona, as an example of a dam feature. Photograph by Michael R. Rosen, U.S. Geological Survey.

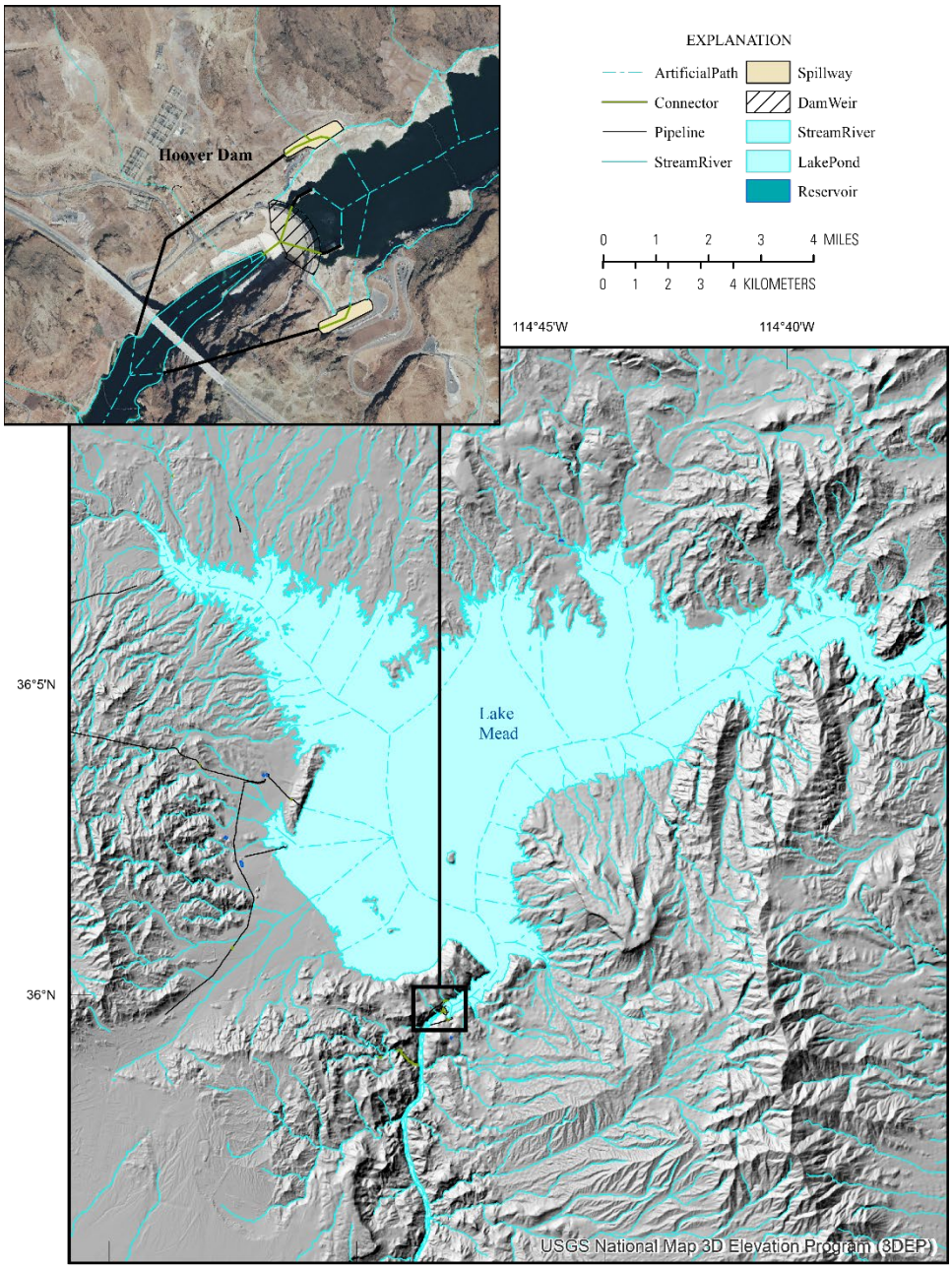

Figure 14. Hoover Dam on Lake Mead in Arizona, shown as an example of a dam/weir feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 15. Mendenhall Glacier, Alaska, shown as an example of ice mass feature type. Photograph by Matt Artz, U.S. Geological Survey.

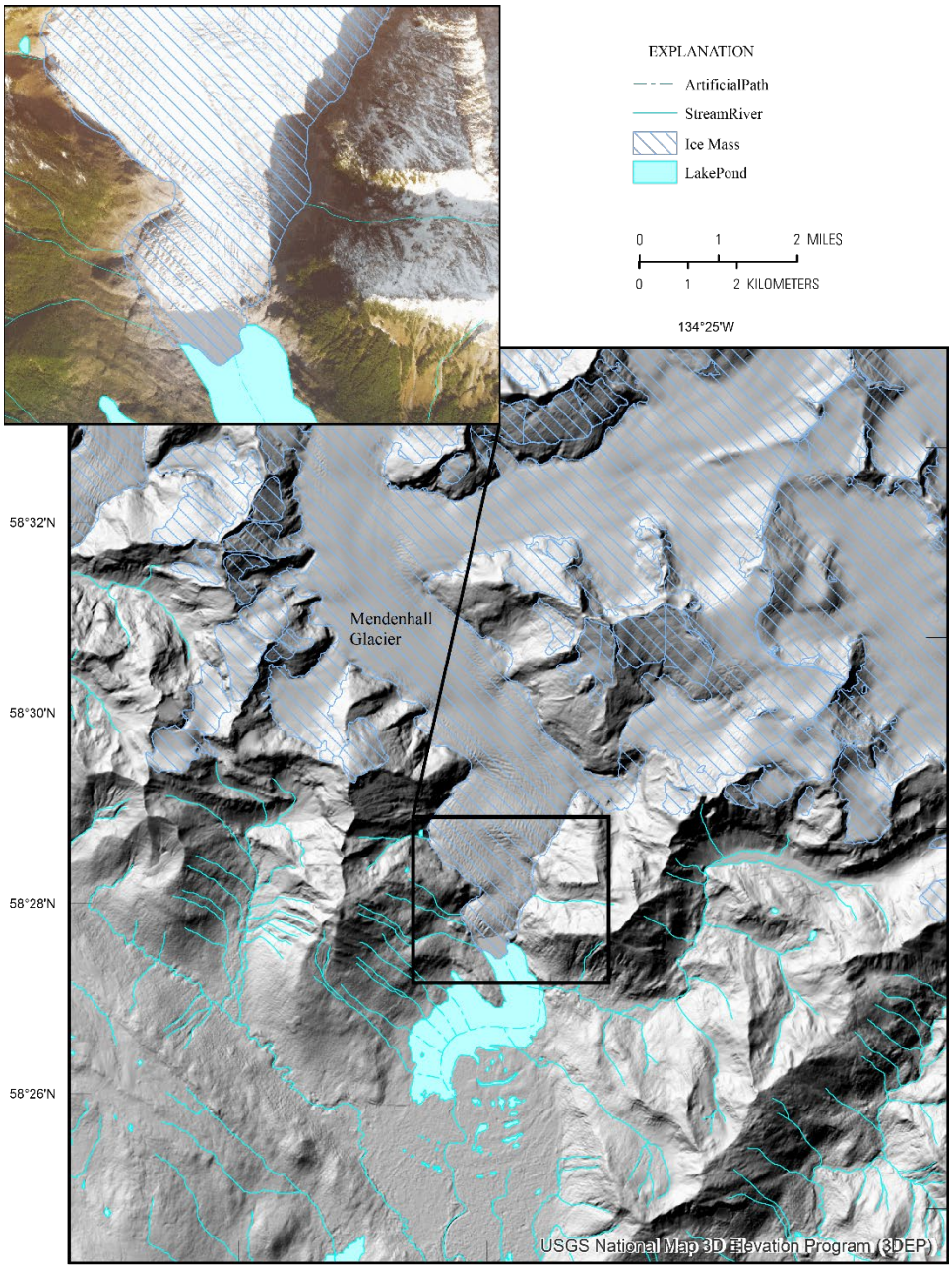

Figure 16. Mendenhall Glacier in Alaska is shown as an example of an ice mass feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 17. Crater Lake, Oregon, shown as an example of a lake/pond feature. Photograph by Willie Scott, U.S. Geological Survey.

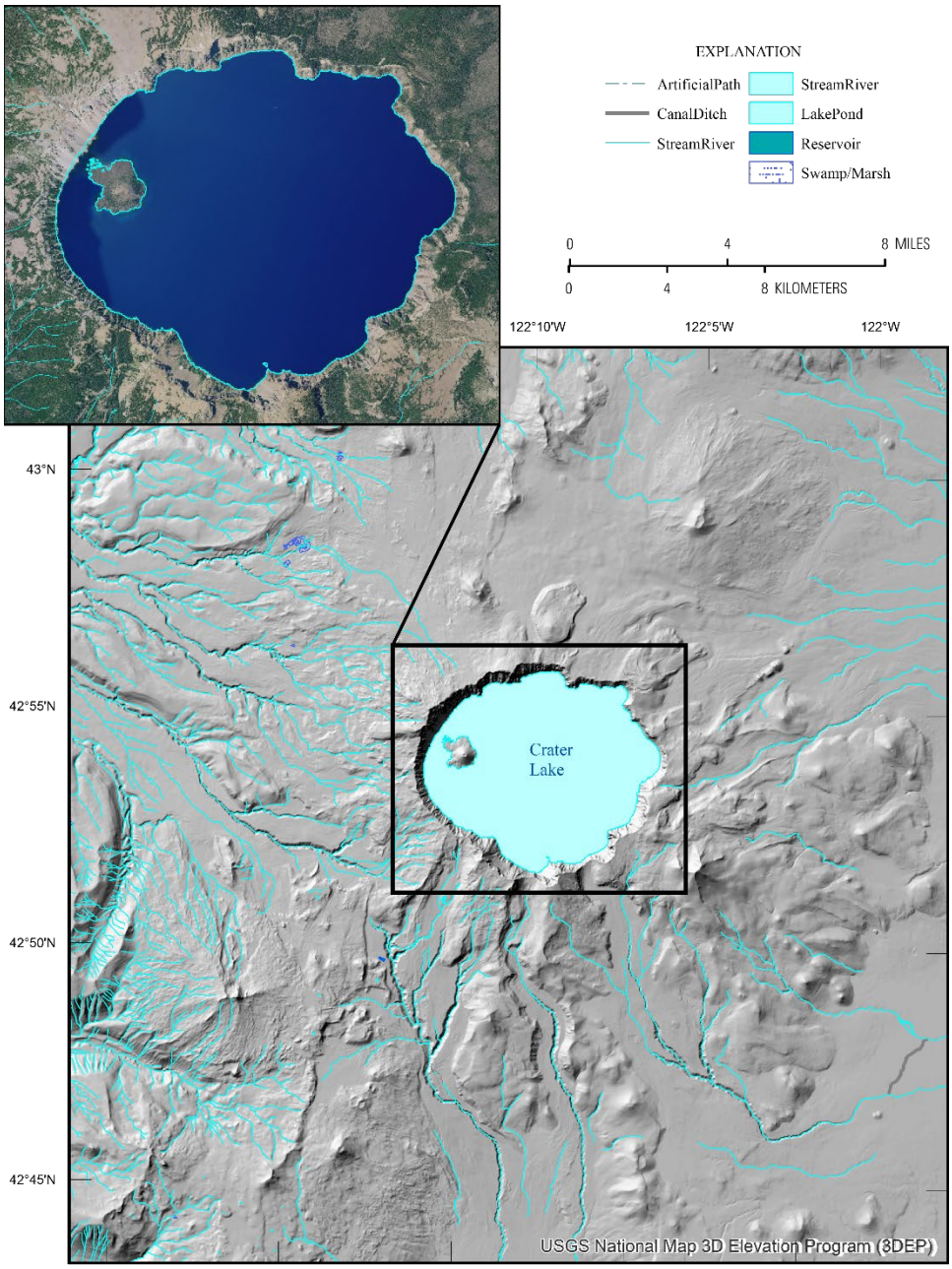

Figure 18 A. Crater Lake on Mount Mazama, Oregon, is shown as an example of natural lake/pond feature.

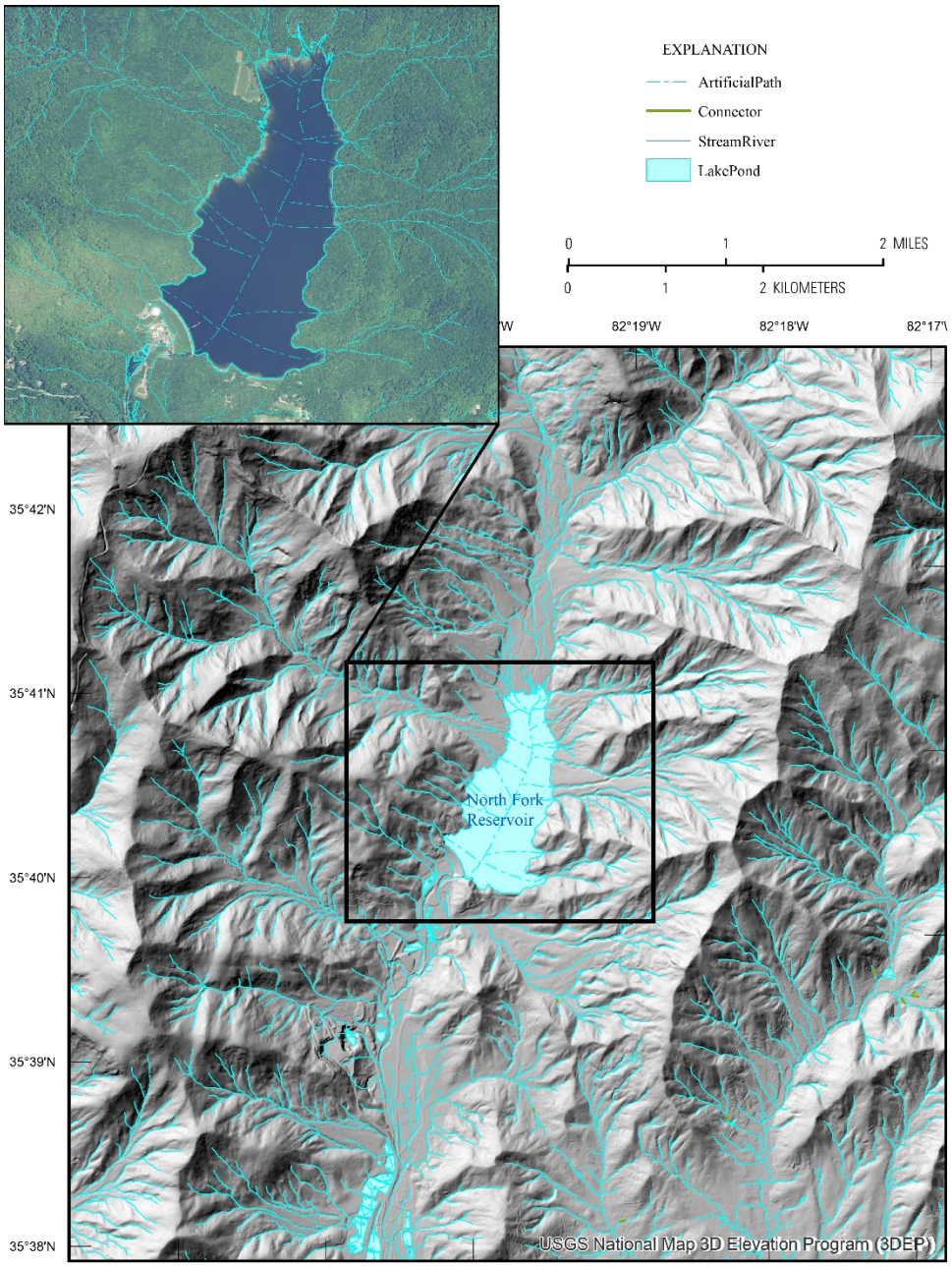

Figure 18 B. North Fork Reservoir, North Carolina, is shown as an example of constructed lake/pond feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 19. A great white heron standing atop mangrove roots, Boggy Key, a Florida Island. Photograph by Heather Henkel, U.S. Geological Survey.

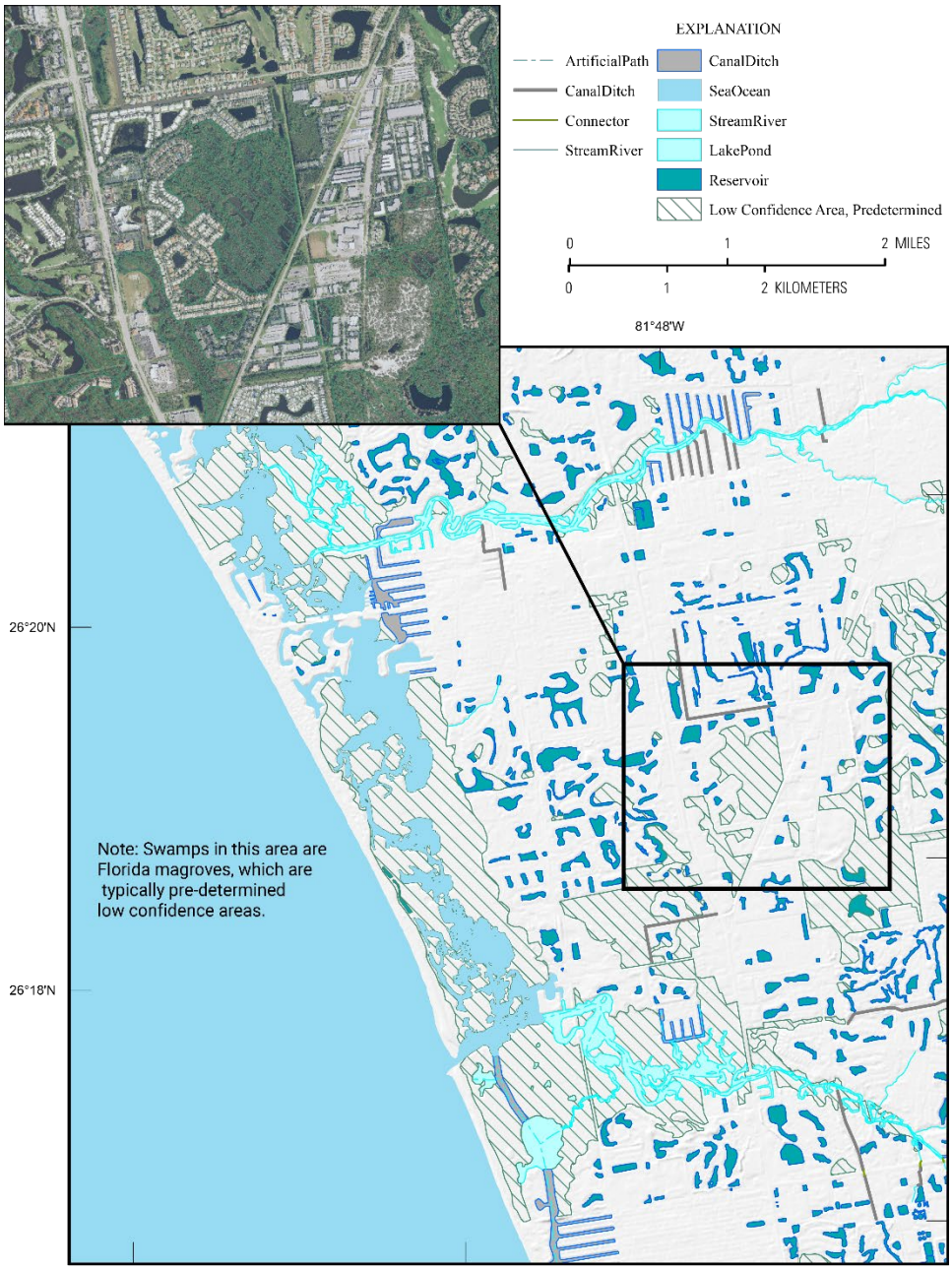

Figure 20. A mangrove forest in western Florida shown as an example of a predetermined area of low confidence. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 21. Snow cover in the Alaska Interior Mountain Range. Photograph by Shawn Carter, U.S. Geological Survey.

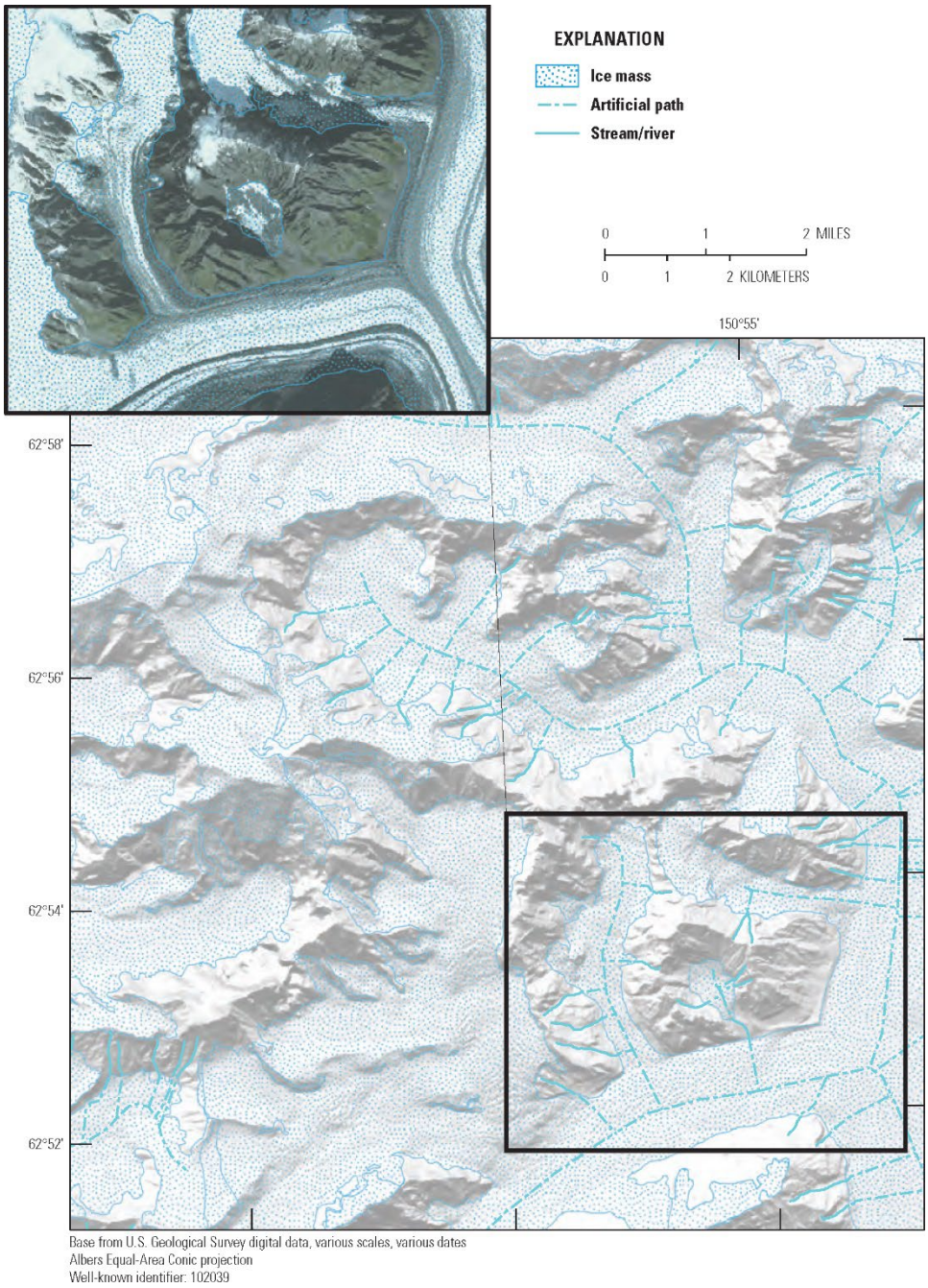

Figure 22. An area in the Alaska Range (150.8094829°W 62.9773695°N) shown as an example of a low-confidence area, snow-cover. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 23. Example of a pipeline feature. This example of a pipeline is an aqueduct pipeline feature in San Juaquin Valley, California. Photograph by U.S. Geological Survey.

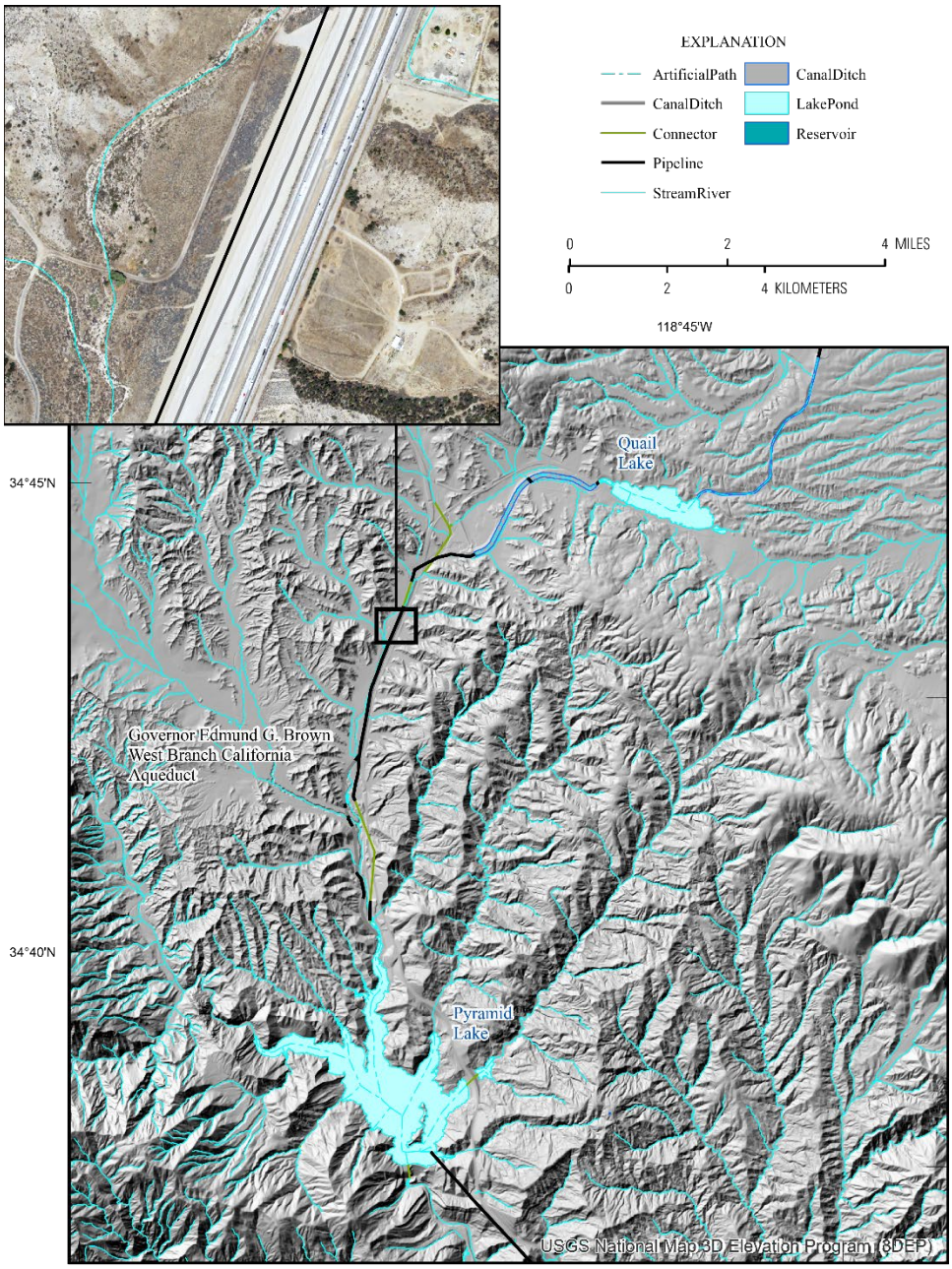

Figure 24. The various pipelines that form the Governor Edmund G. Brown West Branch California Aqueduct are shown as an example of pipeline features. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 25. Clayton Valley Playa, Nevada, as an example of a playa feature. Photograph by Lisa Stillings, U.S. Geological Survey.

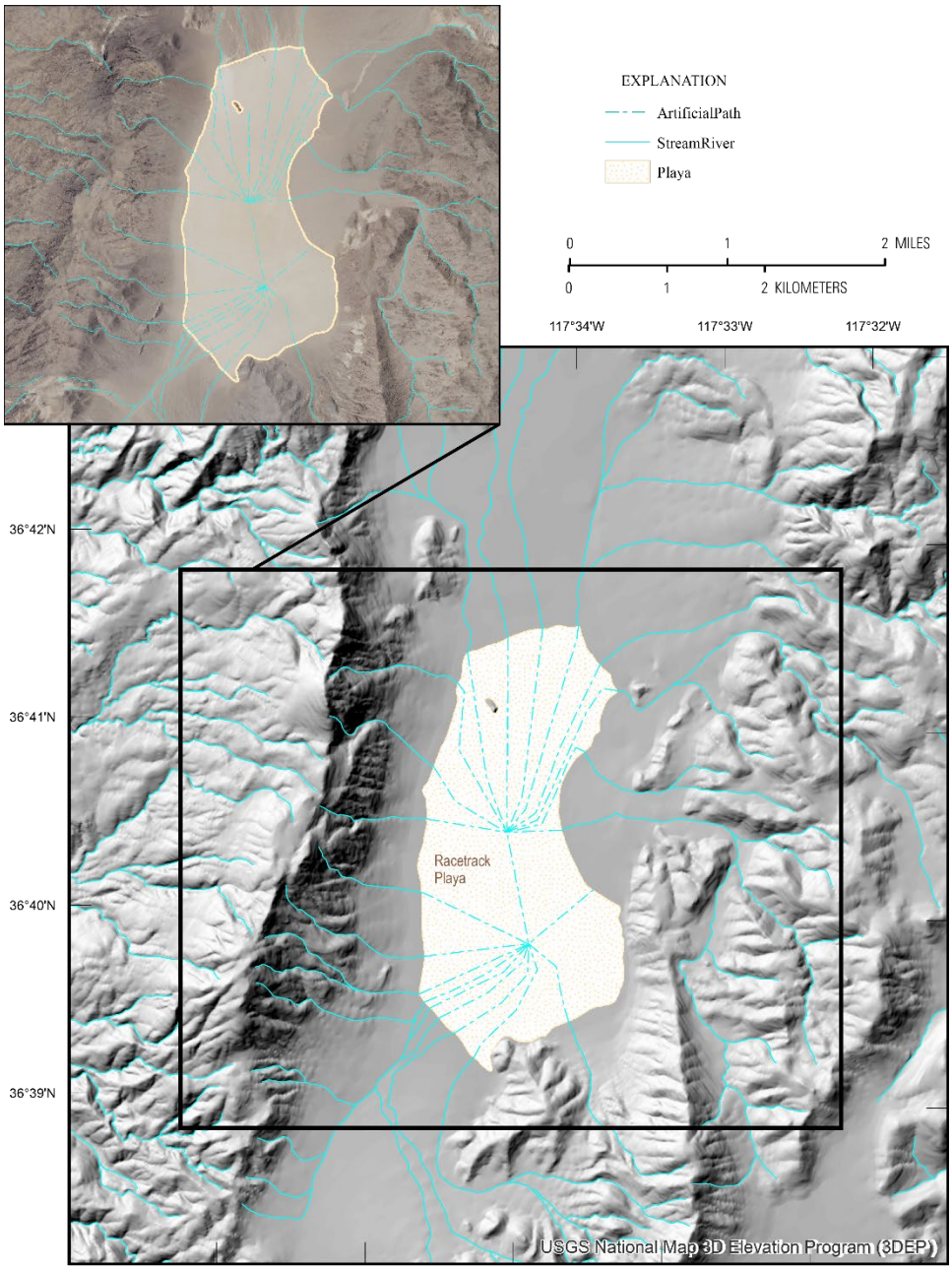

Figure 26. Racetrack Playa in Death Valley, California, is shown as an example of playa feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 27. U.S. Department of Agriculture Harry K. Dupree Stuttgart National Aquaculture Research Center, Arkansas, shown as an example of a reservoir feature. In the example, the reservoir is an aquaculture pond with a constructed shoreline. Photograph by U.S. Geological Survey.

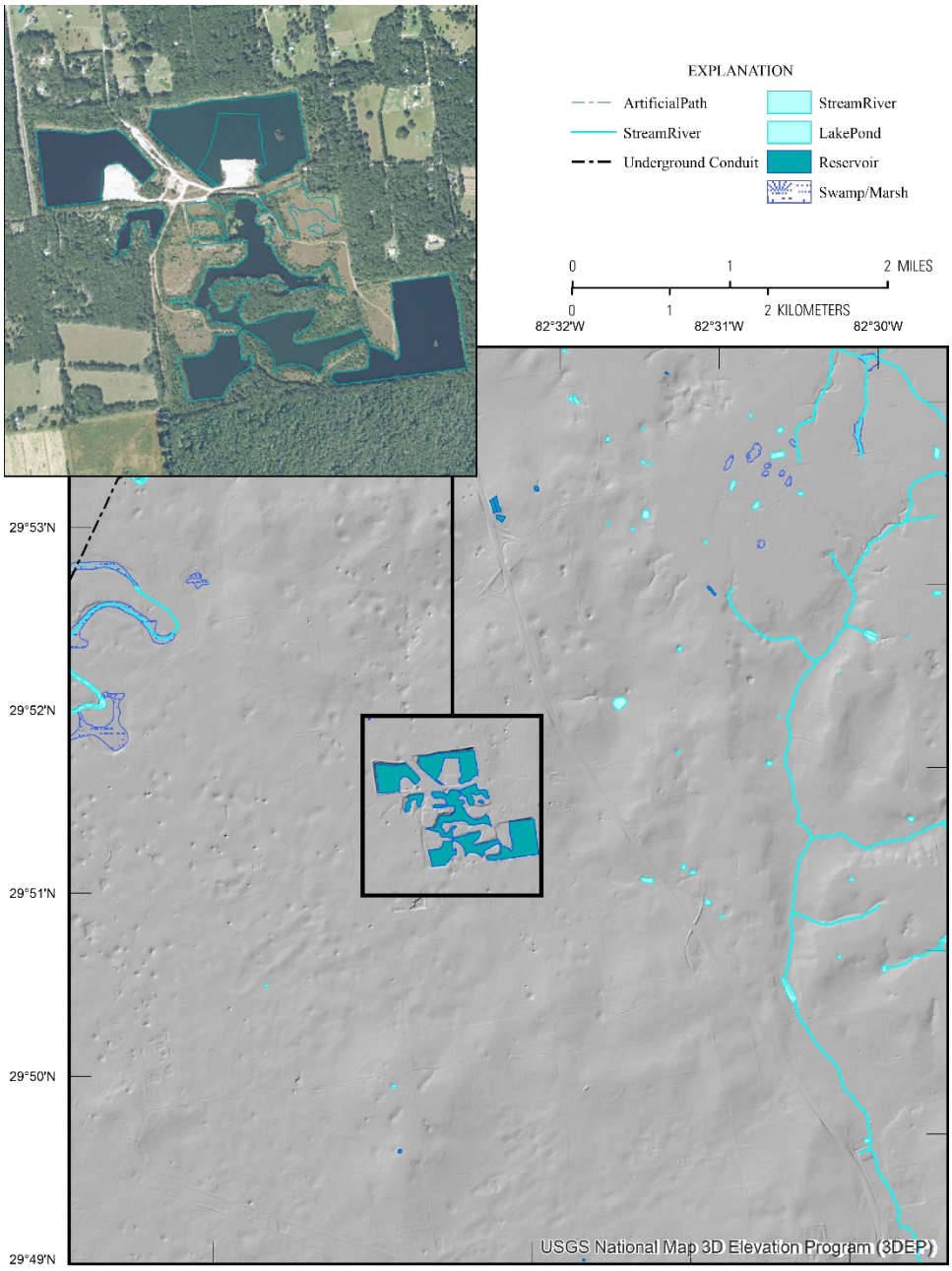

Figure 28. Unnamed reservoir in Florida shown as an example of reservoir hydrographic feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 29. Photograph of an ocean wave (Photograph by S. Lee, National Park Service, 2015).

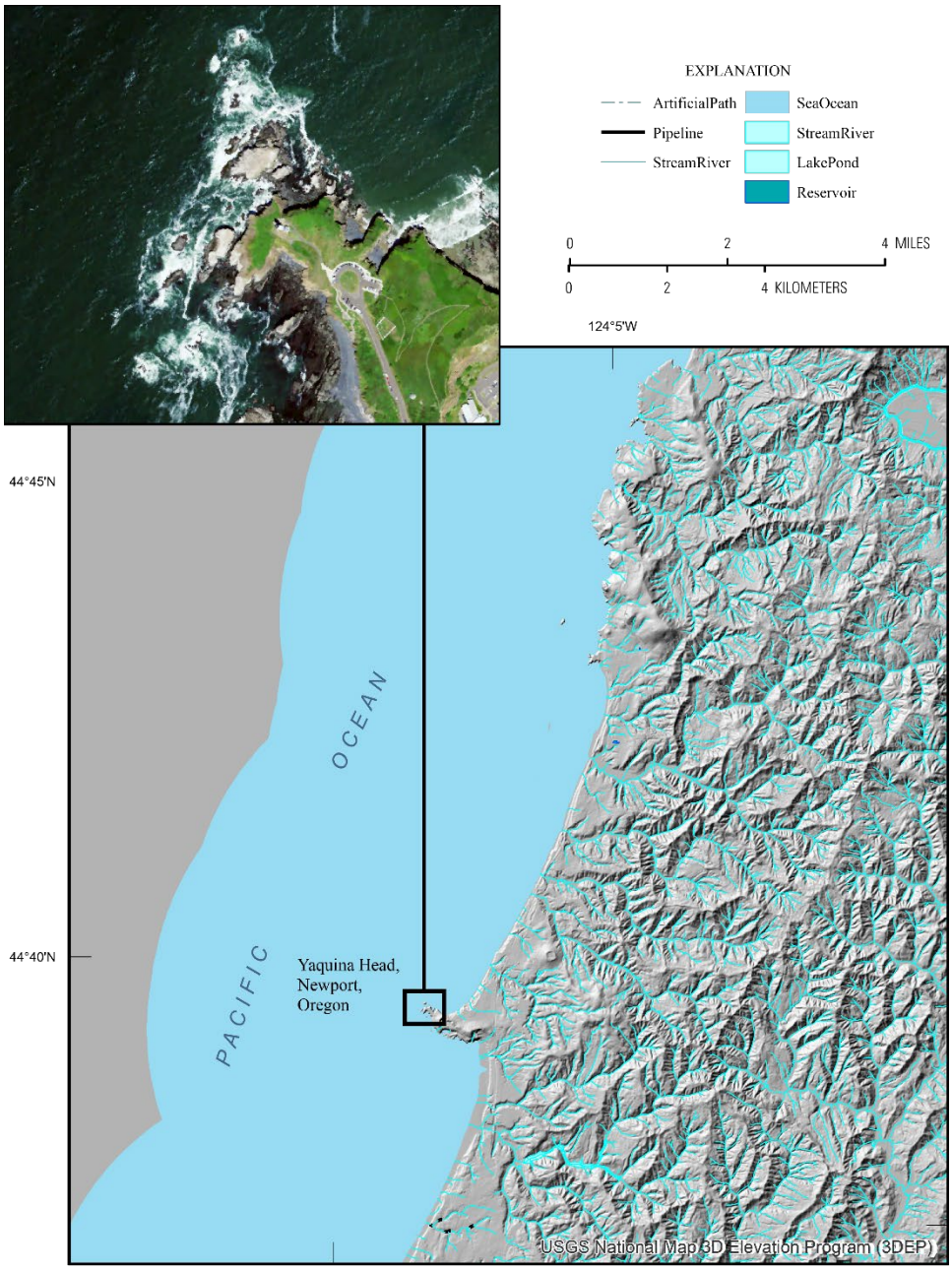

Figure 30. The Pacific Ocean near Yaquina Head, Newport, Oregon, is shown as an example of a sea/ocean hydrographic feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 31. Ephemeral sinking stream in Winchester, Virginia. Photograph by Benjamin V. Miller, U.S. Geological Survey.

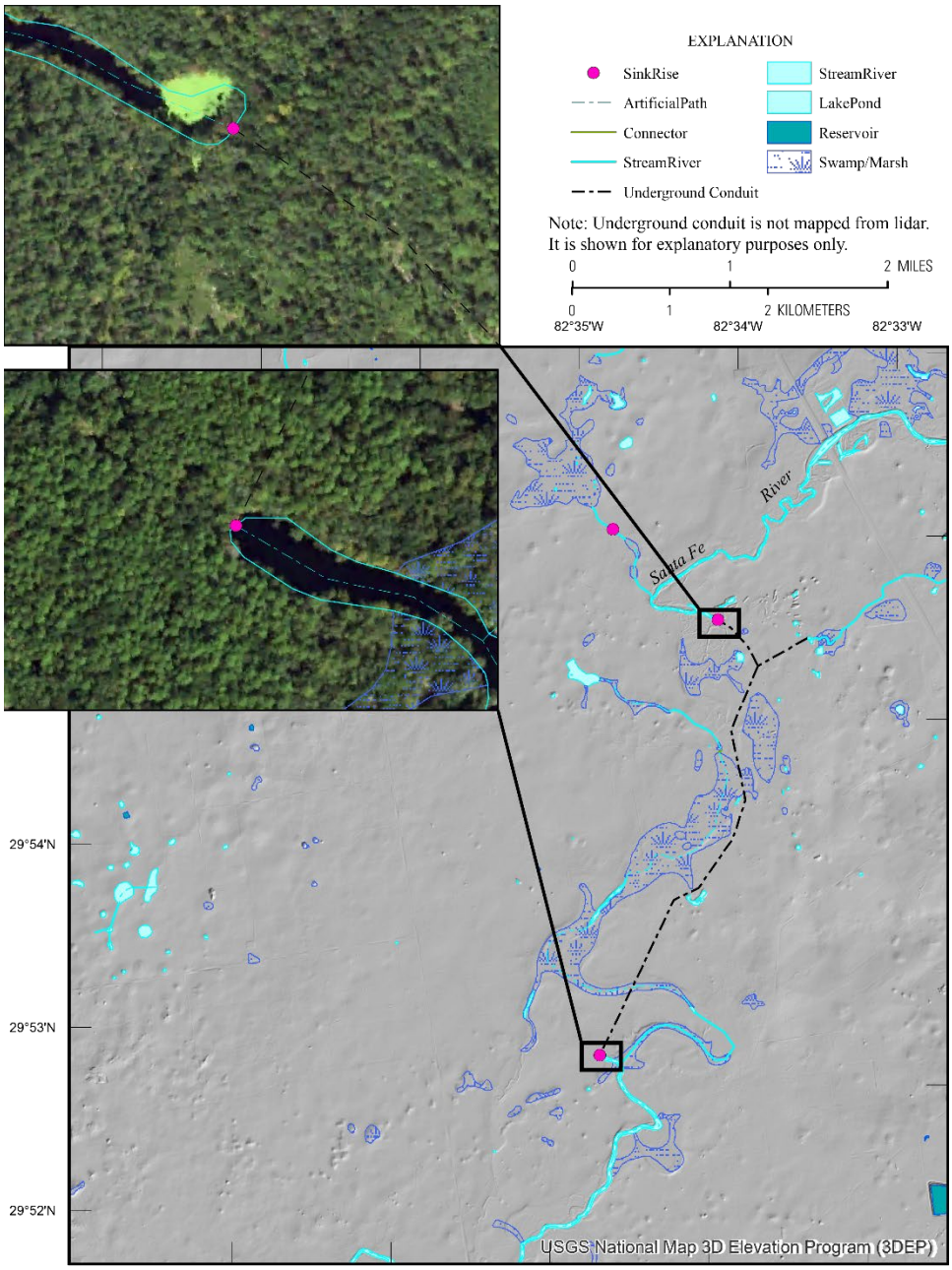

Figure 32. Sink and rise features on Santa Fe River, Florida, shown as examples of sink/rise hydrographic features. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 33. Eagle Creek at Zionsville, Indiana, shown as an example of a river. Photograph by U.S. Geological Survey.

Figure 34. Diagram showing shortest and longest axes of a stream/river feature.

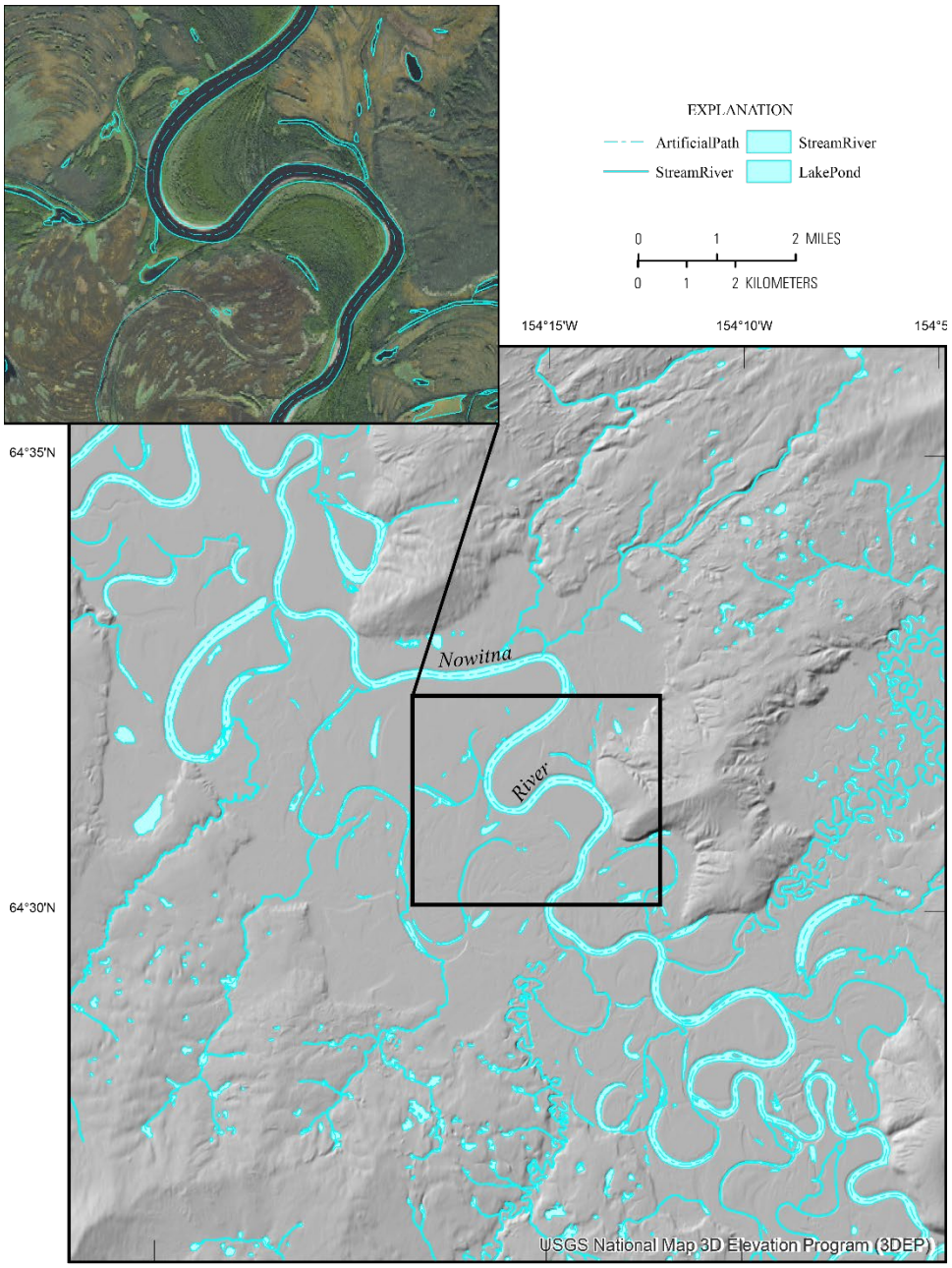

Figure 35. Nowitna River, Alaska, shown as an example of a stream/river hydrographic feature. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

Figure 36. Ephemeral sinking stream in Minnesota, Rocky Spring, central Kentucky. Photograph by Charles J. Taylor, U.S. Geological Survey.

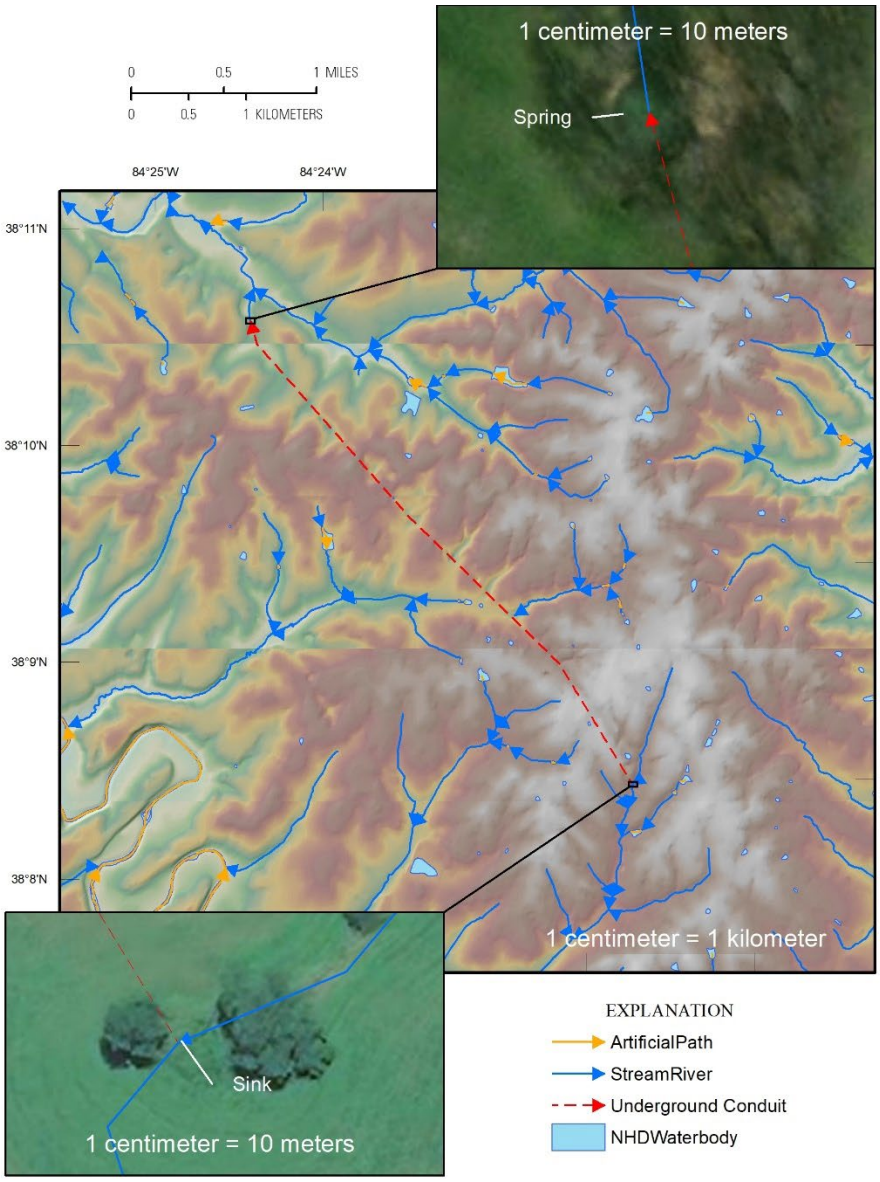

Figure 37. Example of an underground conduit feature, Fayette County, Kentucky. Note how the surface topography does not provide information or clues as to the direction of groundwater flow within the underground conduit. The flow direction was determined by dye-tracing and provided to the USGS Hydrography program.

Figure 38. Image of Rikers Island, New York. The National Map Viewer, U.S. Geological Survey.

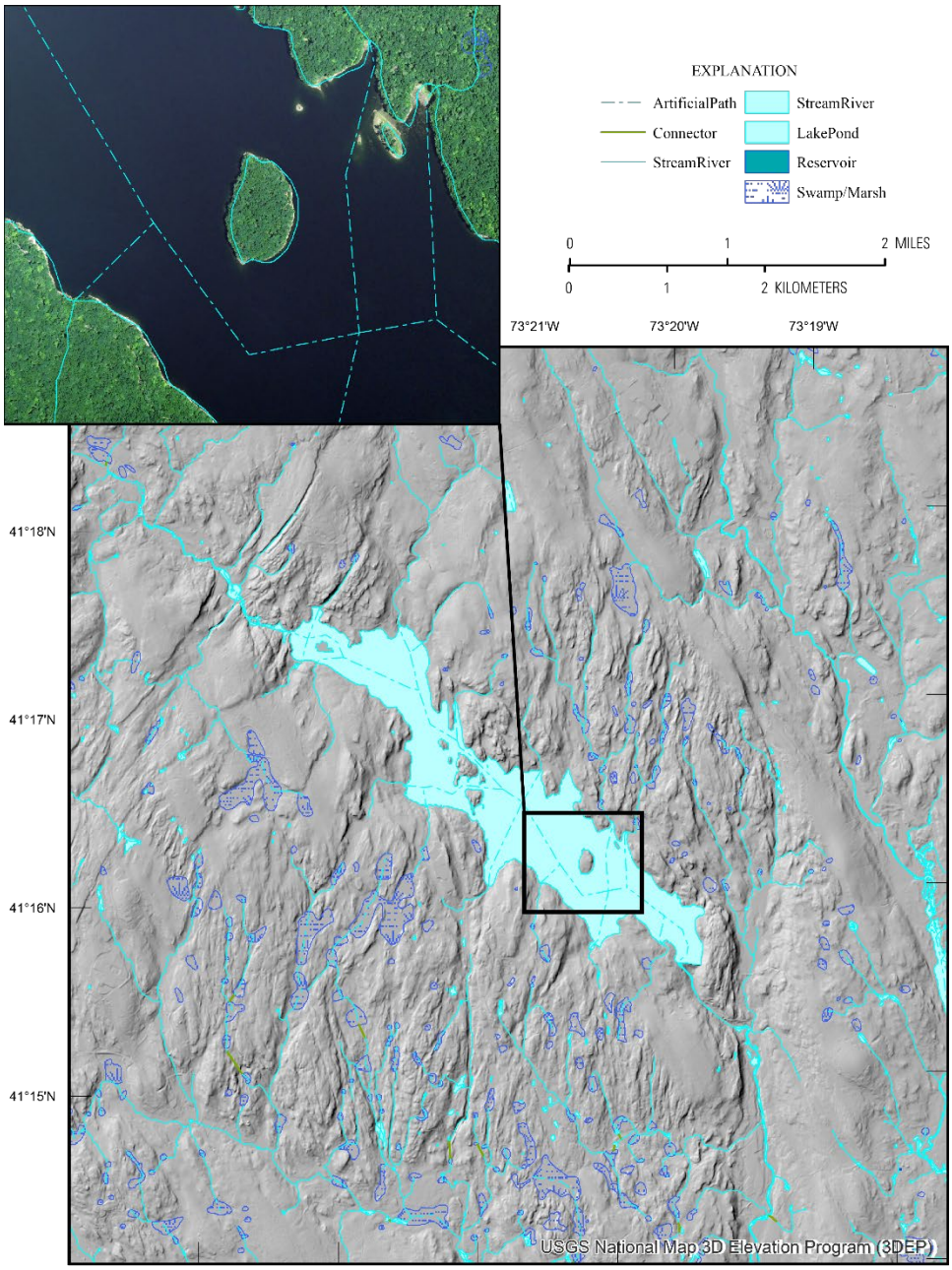

Figure 39. An island in the Saugatuck Reservoir in Connecticut shown as an example of treatment for lake/pond features. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.

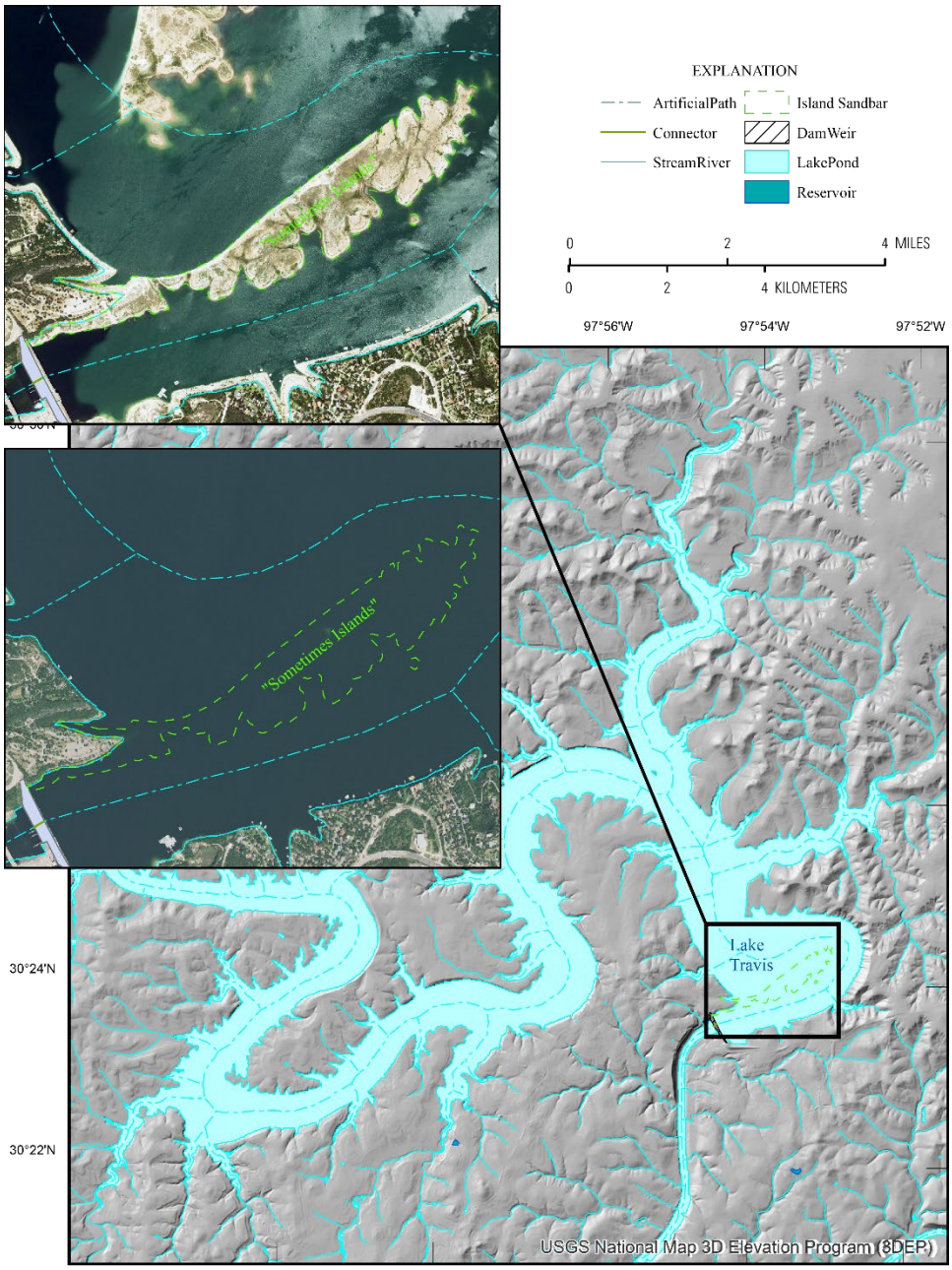

Figure 40. "Sometimes Islands" in Lake Travis, Texas, shown as an example of an intermittent island/sandbar. Source data are from the National Hydrography Dataset (U.S. Geological Survey, 2020), which is used to provide examples of hydrographic feature types, but may not have the same density and other characteristics of elevation-derived hydrography.