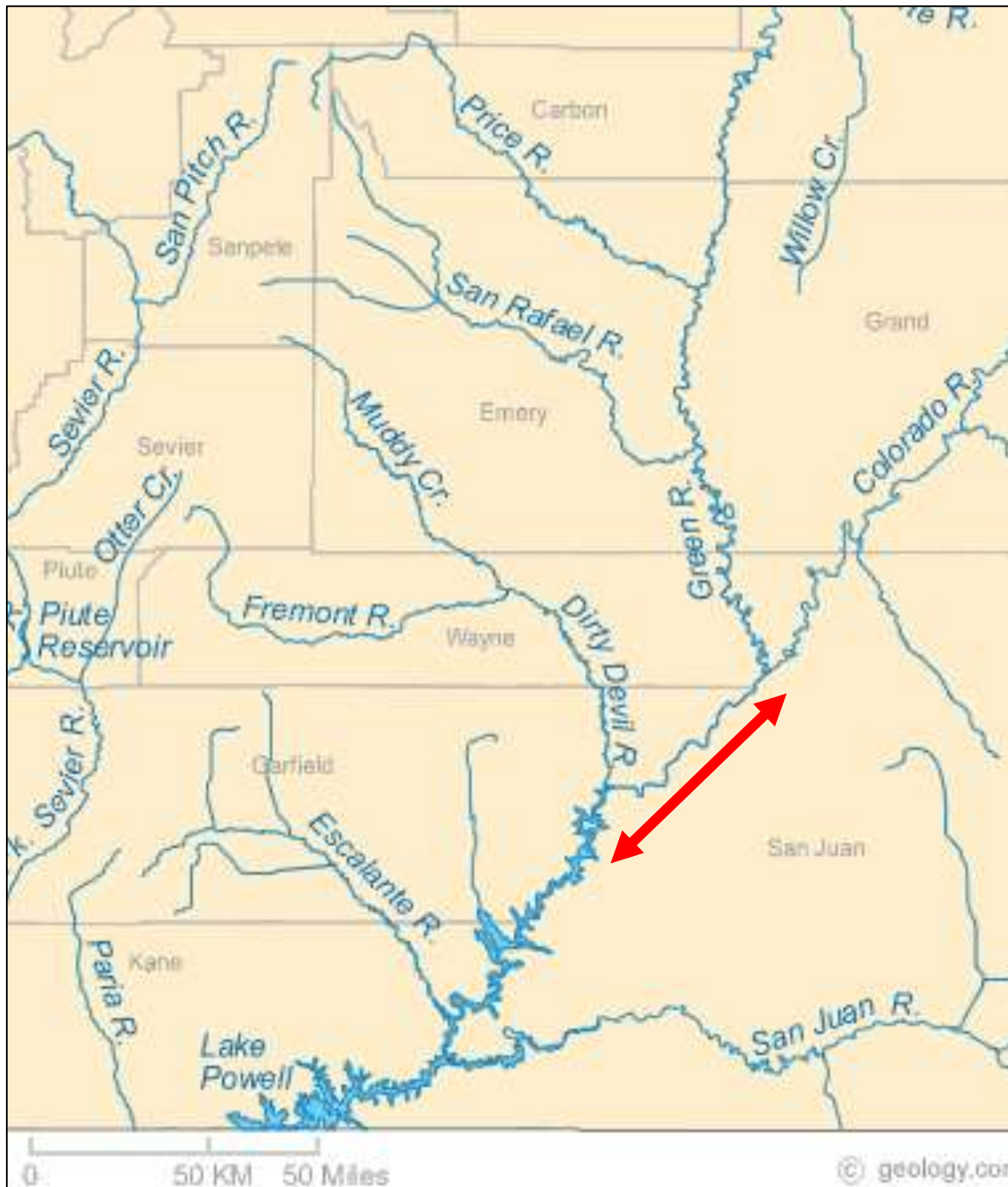


The Returning Rapids of Cataract Canyon



Cataract Canyon

41 miles long

From the Confluence of the Colorado and Green Rivers
to Mille Crag Bend

Narrow Canyon

6 miles long

From Mille Crag Bend to downstream of the Confluence
of the Dirt Devil and the Colorado

Glen Canyon

160+ miles long

From North Wash Canyon to Lee(s) Ferry

“the Major (Powell) had previously named Cataract Canyon, because the declivity within it is so great and the water descends with such tremendous velocity and continuity that the term rapid failed to interpret the conditions.”

-F.S. Dellenbaugh

A Canyon Voyage by Frederick S. Dellenbaugh
G.P. Putnam's Son 1908

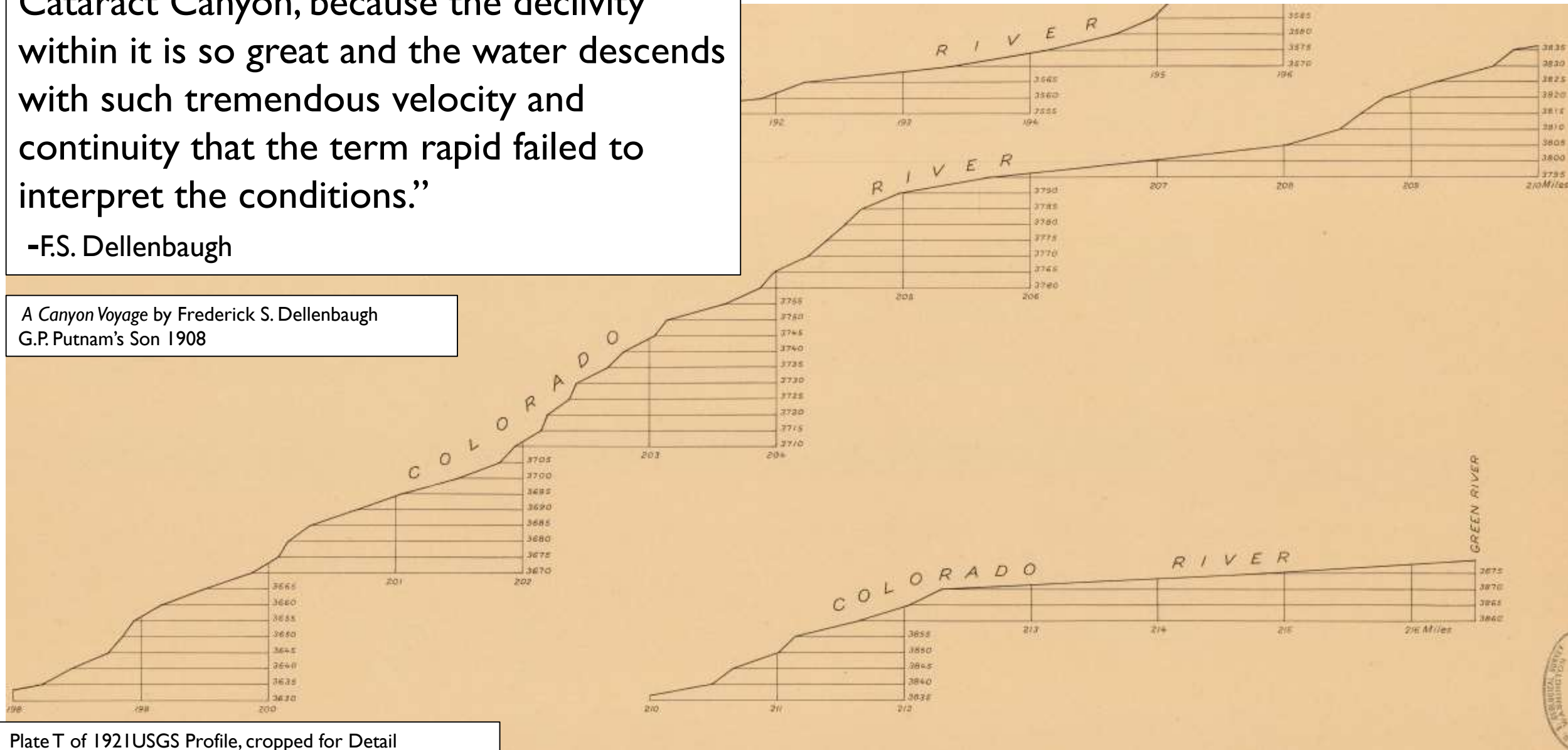


Plate T of 1921 USGS Profile, cropped for Detail
<https://pubs.usgs.gov/unnumbered/70191006/plate-T.pdf>

The Rapids of the Colorado River



Western River Expeditions rig in large wave
Jed Hazlett

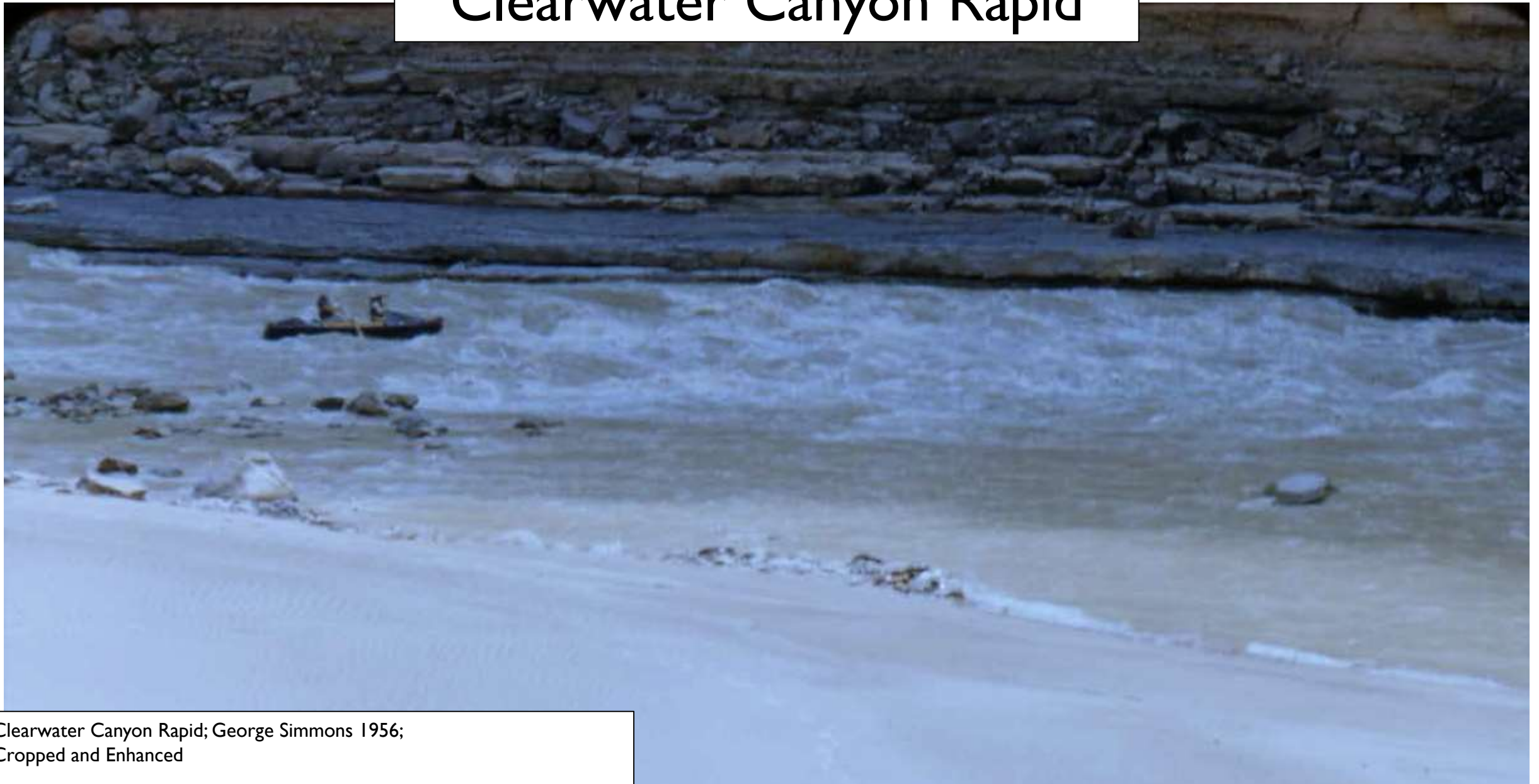
Dark Canyon Rapid

May 23, 1963



P0197n38_02_005_Dark Canyon Rapids; 05-23-1963; Crampton; cropped and enhanced
Special Collections, J. Willard Marriott Library; University of Utah

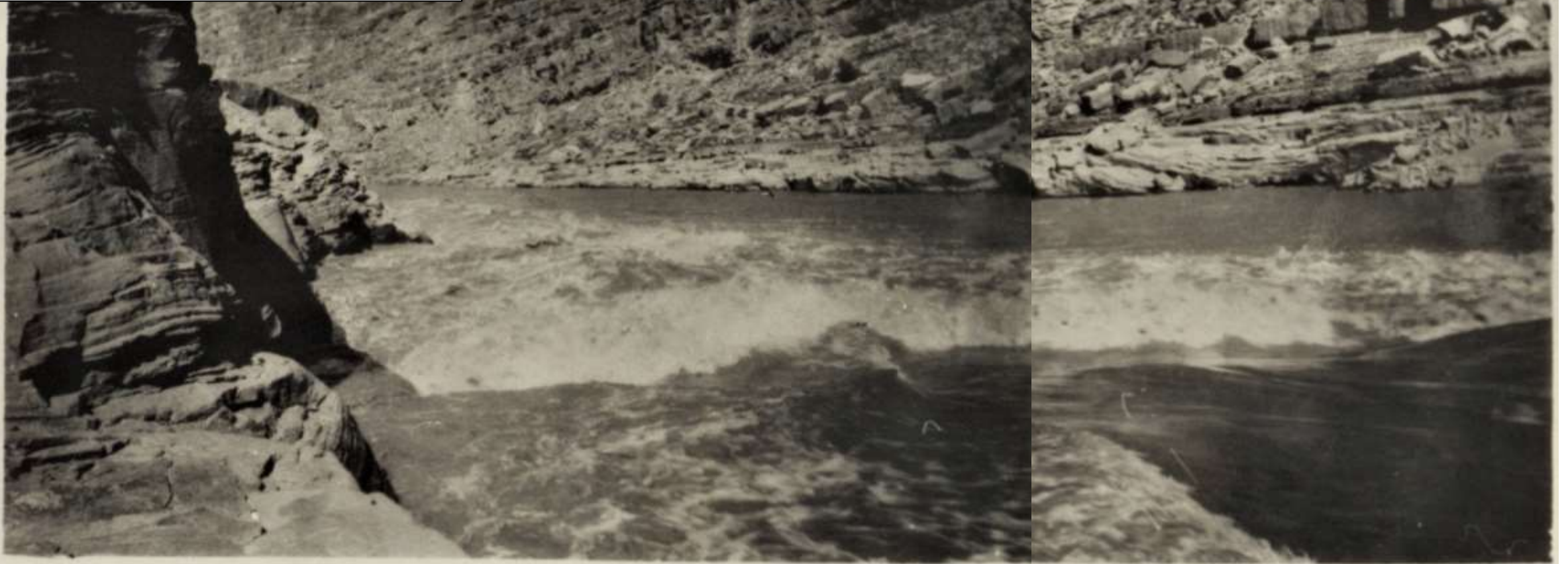
Clearwater Canyon Rapid



Clearwater Canyon Rapid; George Simmons 1956;
Cropped and Enhanced

Historic Rapid Elevation 3565'

Bed Rock Rapid



1444. Bed rock, Rapid No. 47, looking downstream. Panorama wioking downstream. Panorama wi

E.C. LaRue Photos of Bed Rock Rapid #'s 1444 and 1445 stitched together as a pair, enhanced,
Sourced from E.C. La Rue Collection, Doc Marston Papers, Huntington Digital Library, Public domain.




Sneakers and a big wave, Cataract Canyon 1969
Priscilla McKenna

The Graveyard of the Colorado



USGS boats in various states of trouble
Top left and right, SLC USGS offices
Center, Huntington Library



The Graveyard
of the
Colorado

1923

A Map without Boundaries;
A great length of undivided River



Cataract
Canyon

Glen Canyon Dam

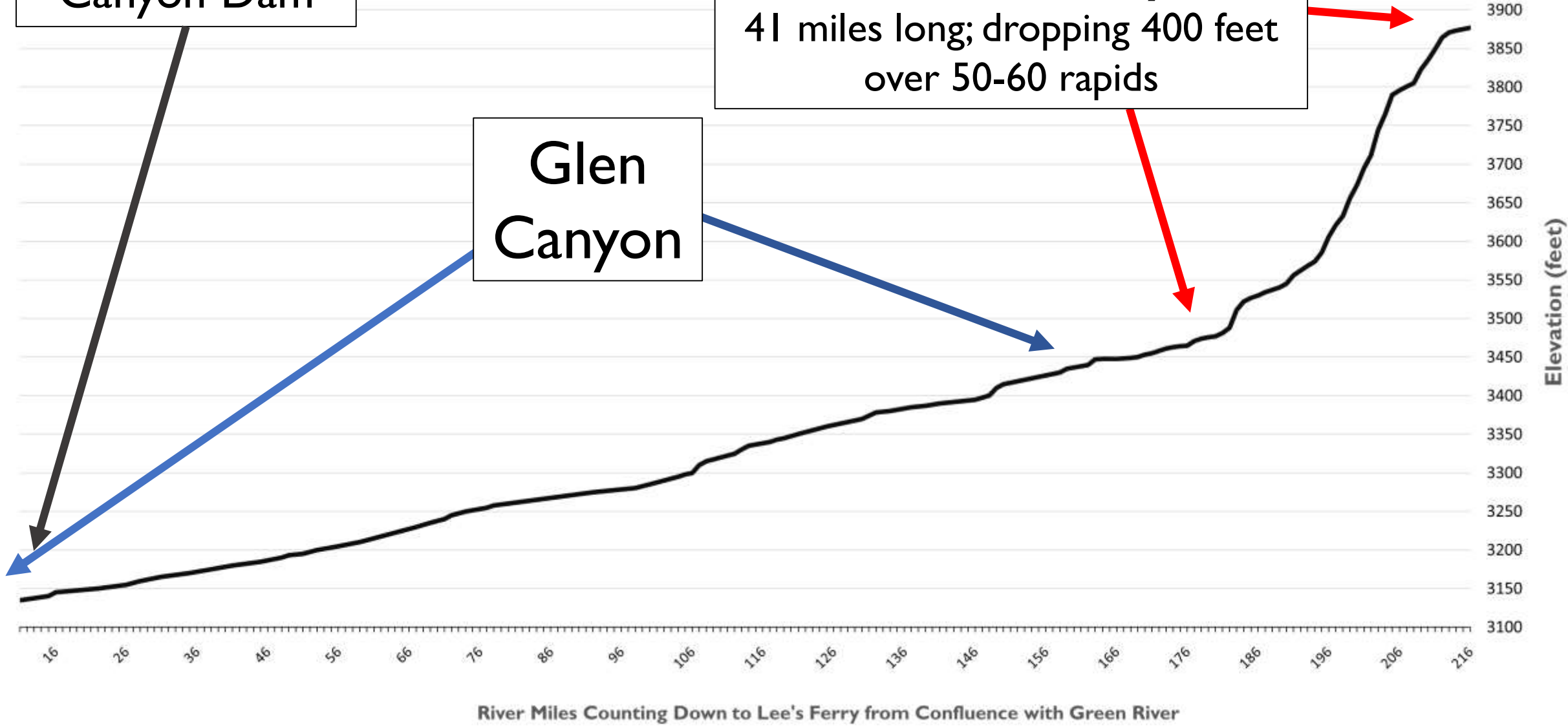
180 river miles downstream of Cataract Canyon

E. C. La Rue map of camera locations; 1923 survey; USGS
source: <https://library.usgs.gov/photo/#/item/5b3e4341e4b060350a0ef843>

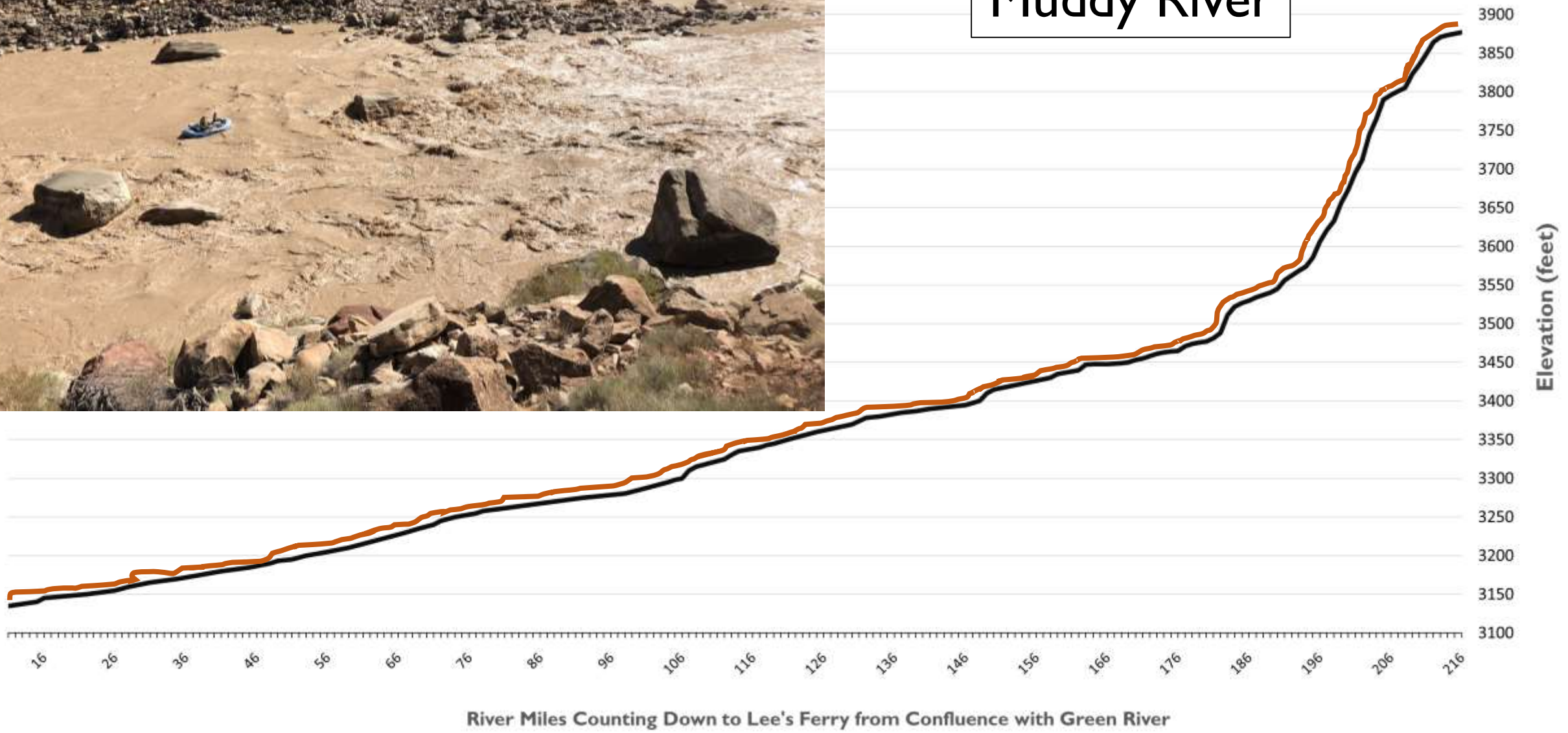
Site of the Glen Canyon Dam

Cataract Canyon
41 miles long; dropping 400 feet over 50-60 rapids

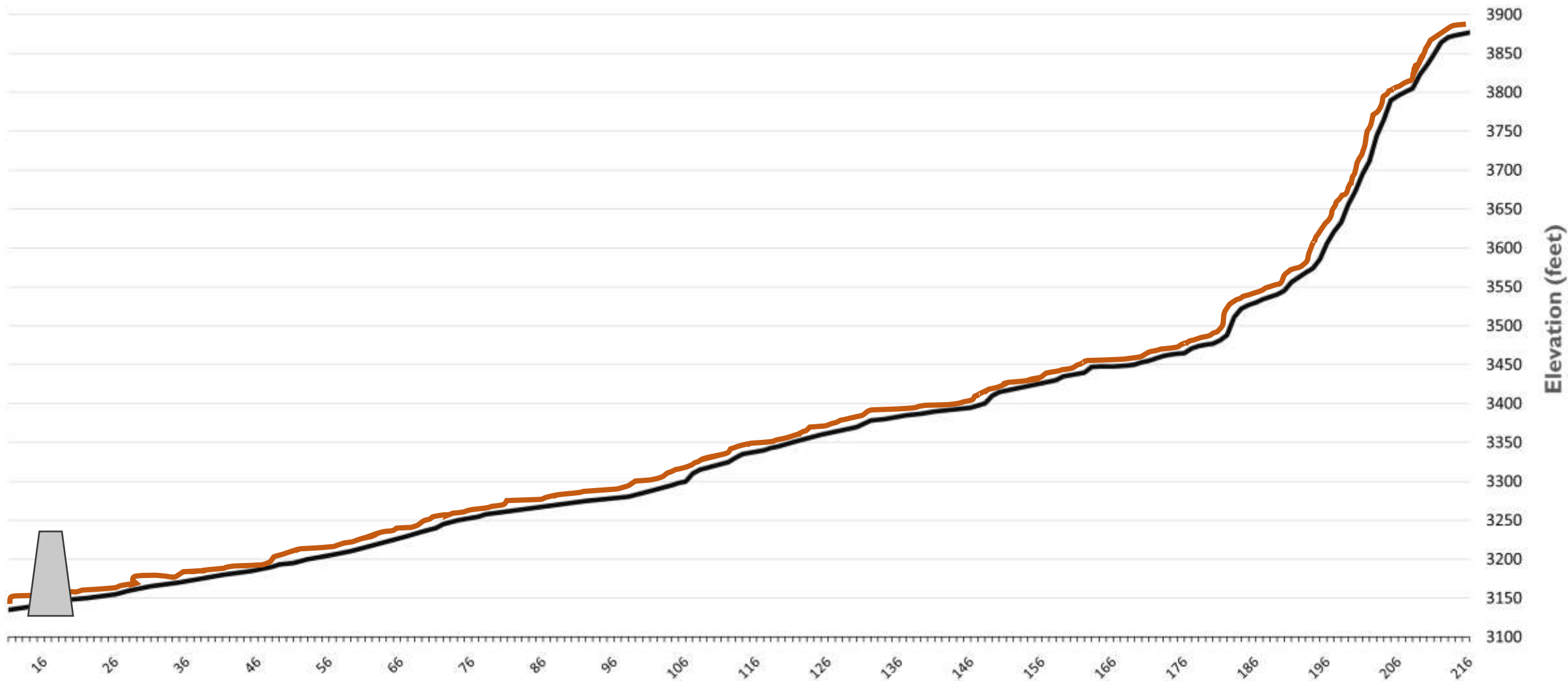
Glen Canyon



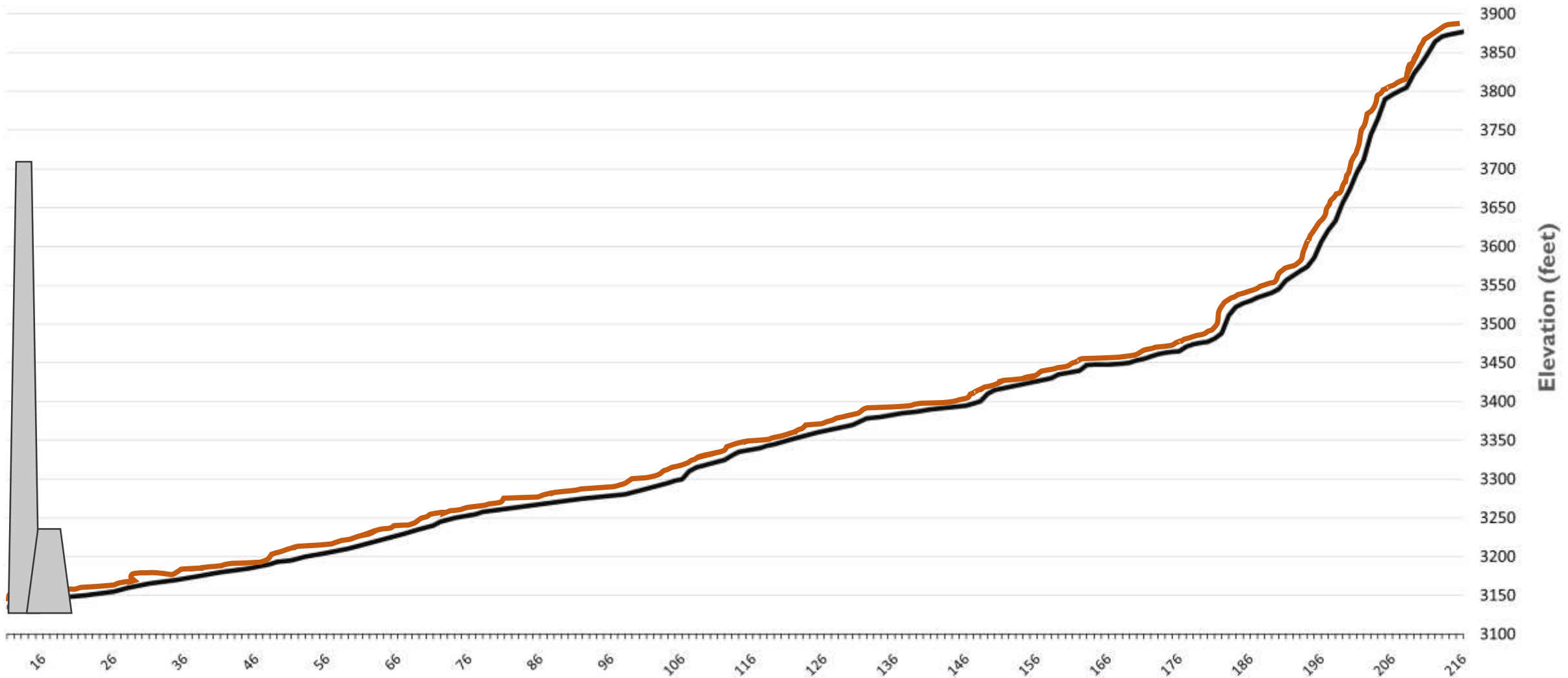
The Big Muddy River



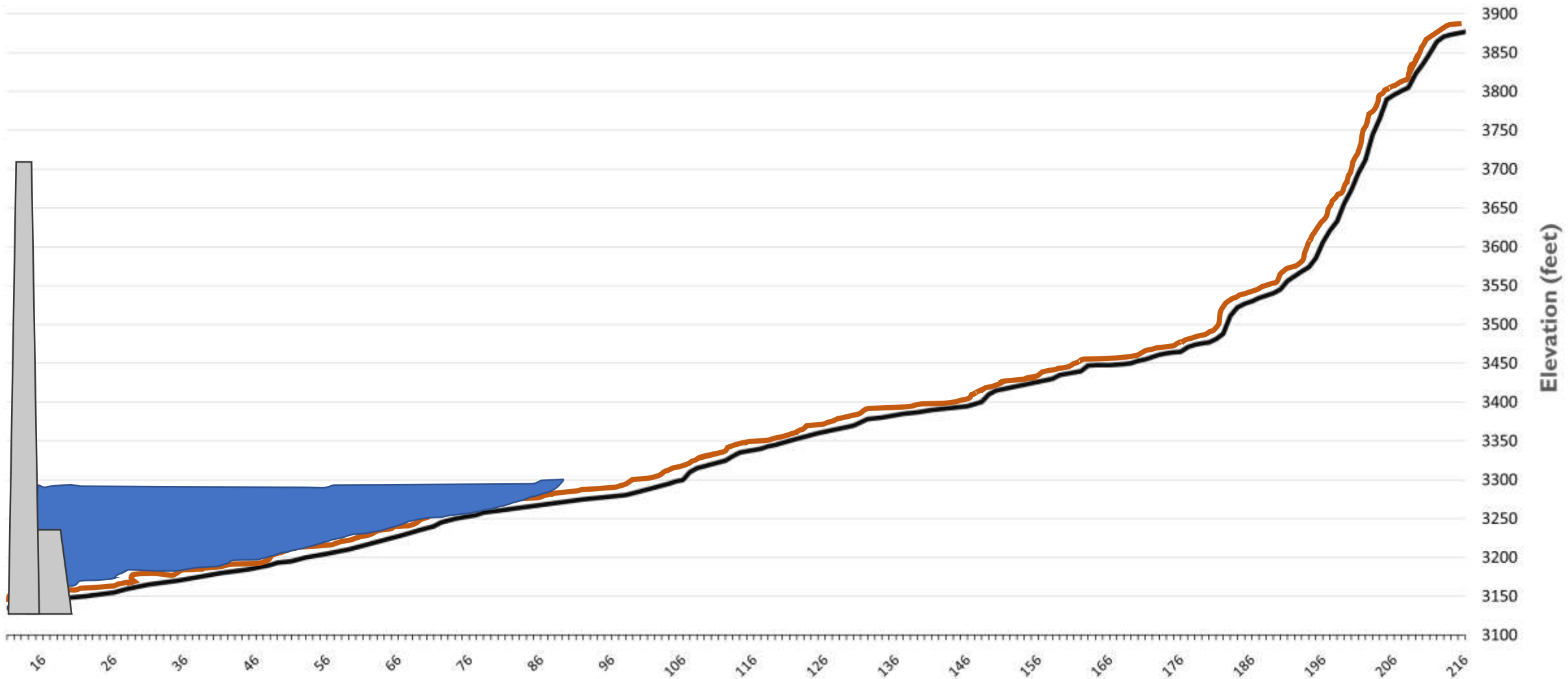
River Miles Counting Down to Lee's Ferry from Confluence with Green River



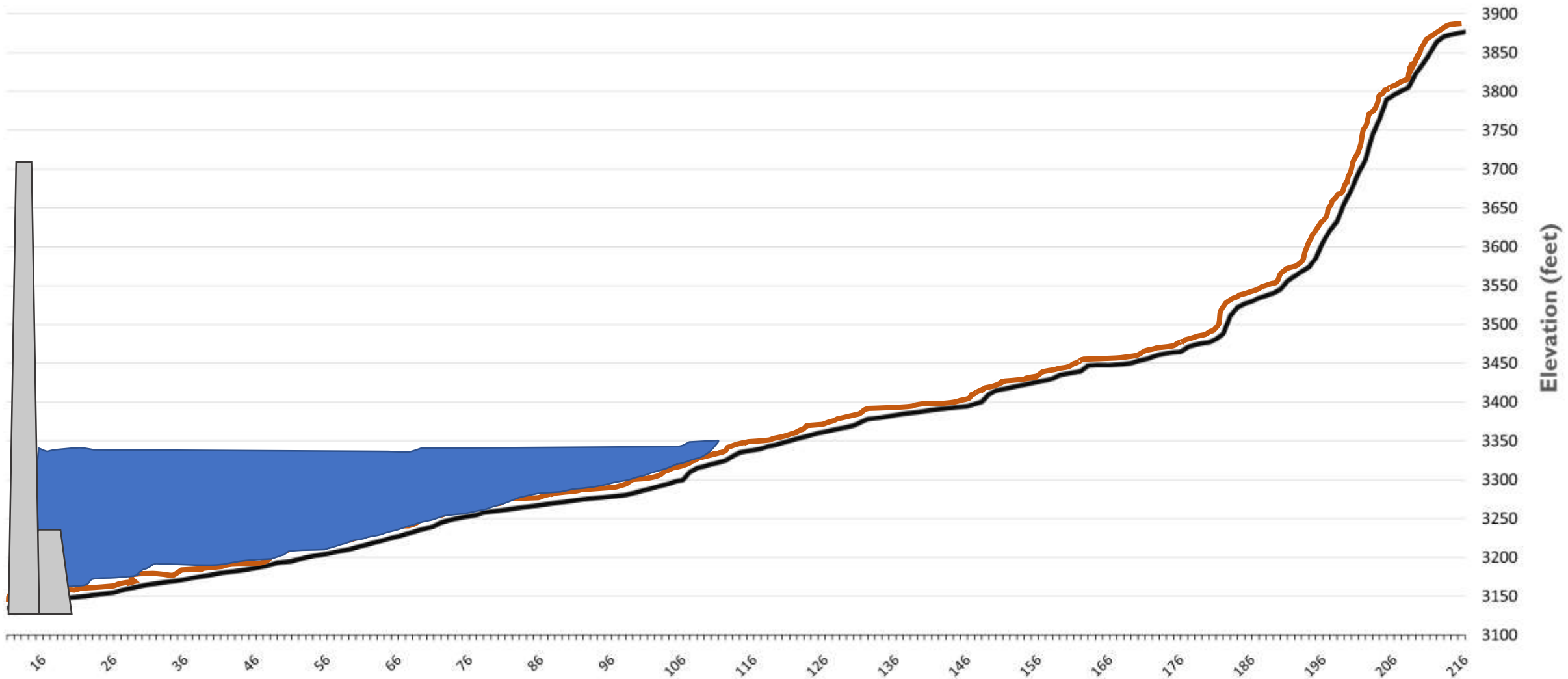
River Miles Counting Down to Lee's Ferry from Confluence with Green River



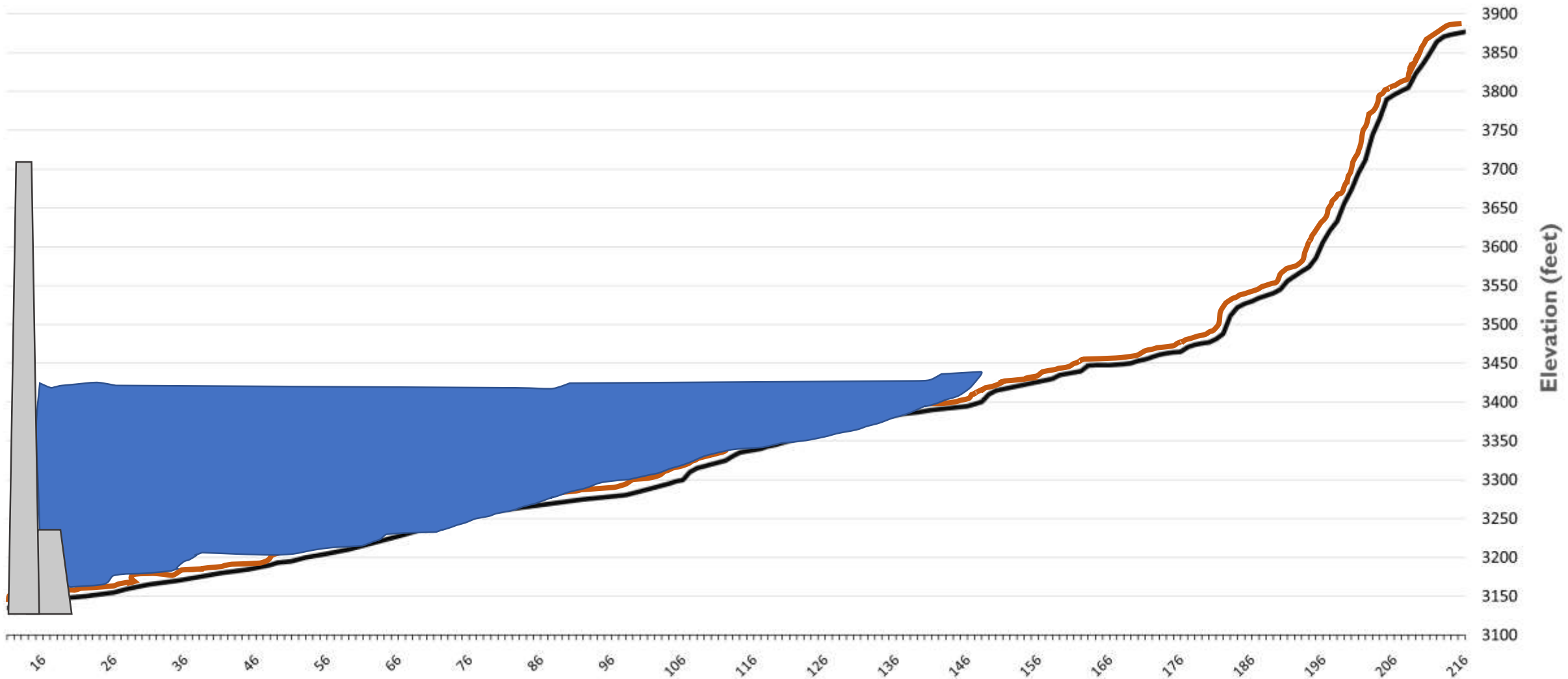
River Miles Counting Down to Lee's Ferry from Confluence with Green River



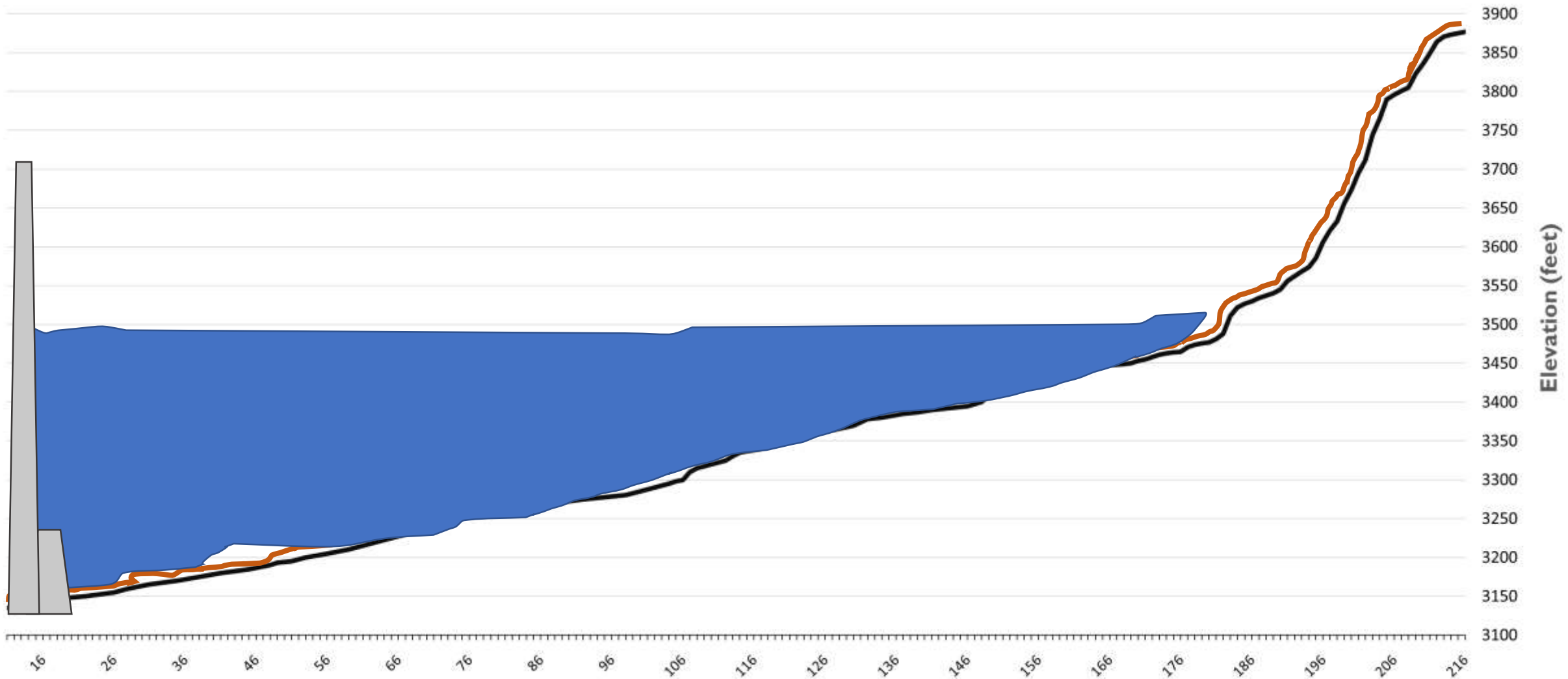
River Miles Counting Down to Lee's Ferry from Confluence with Green River



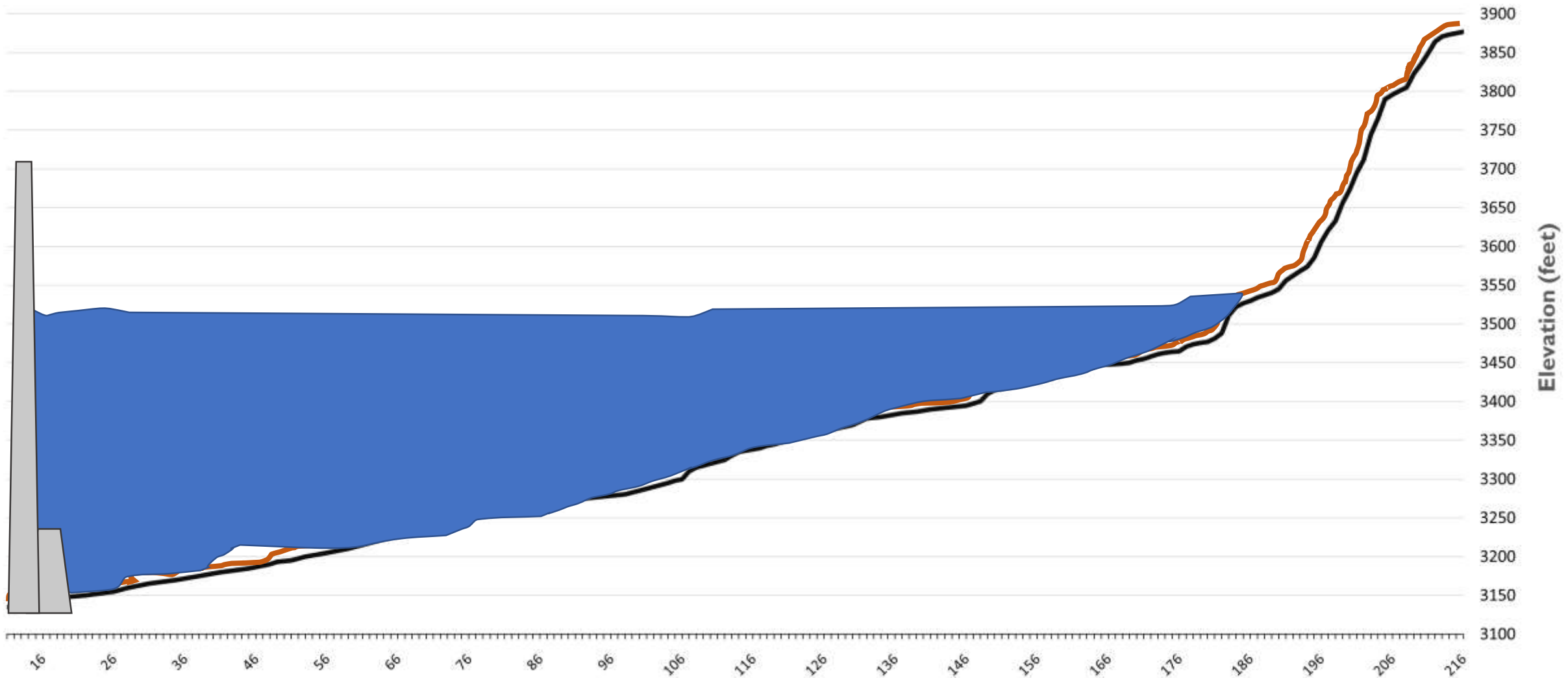
River Miles Counting Down to Lee's Ferry from Confluence with Green River



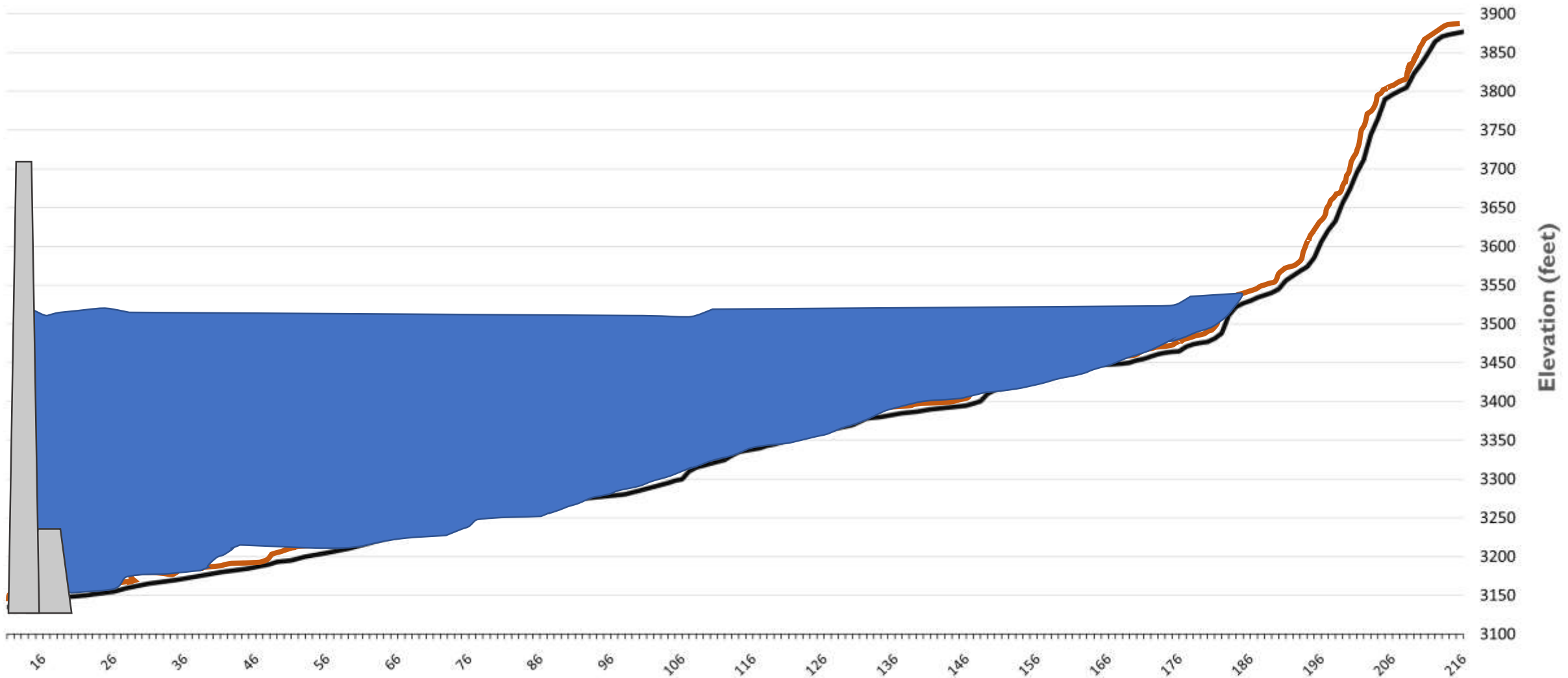
River Miles Counting Down to Lee's Ferry from Confluence with Green River



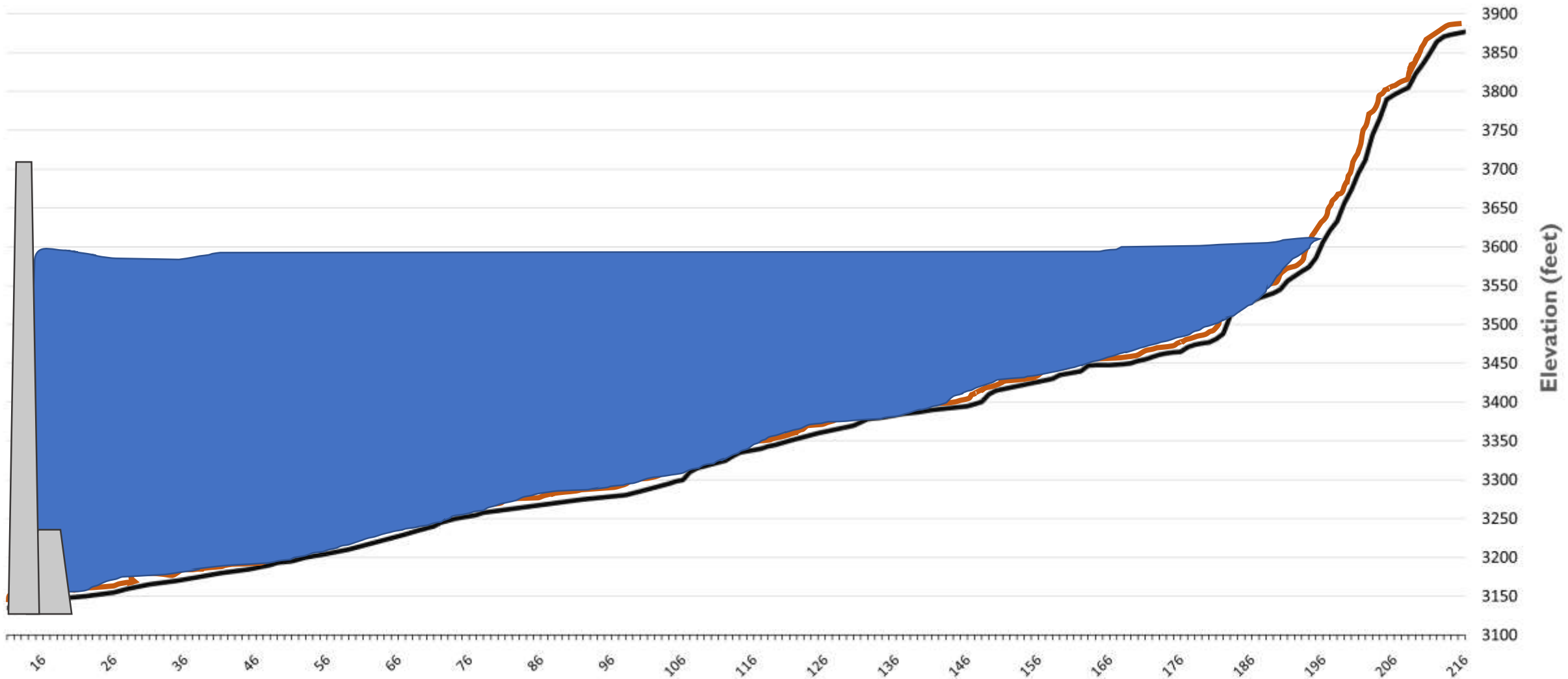
River Miles Counting Down to Lee's Ferry from Confluence with Green River



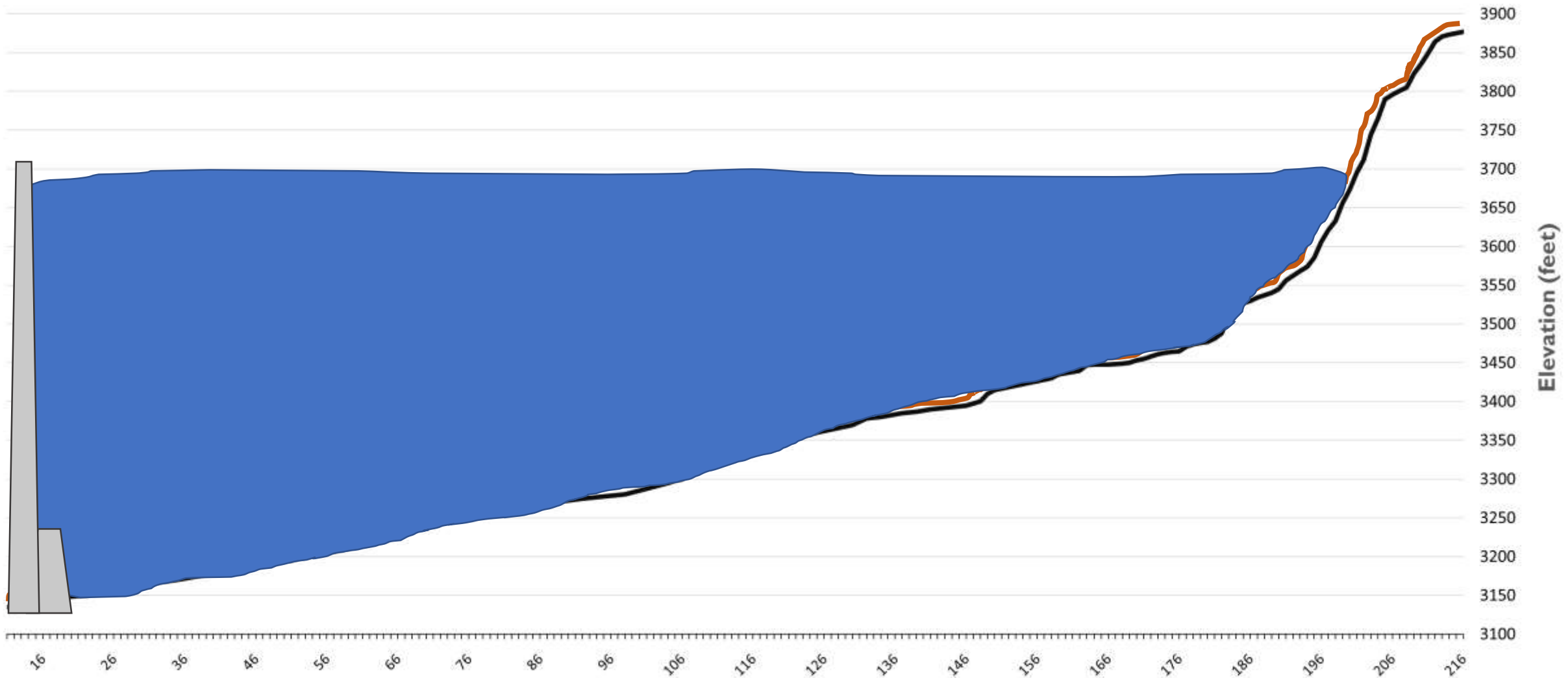
River Miles Counting Down to Lee's Ferry from Confluence with Green River



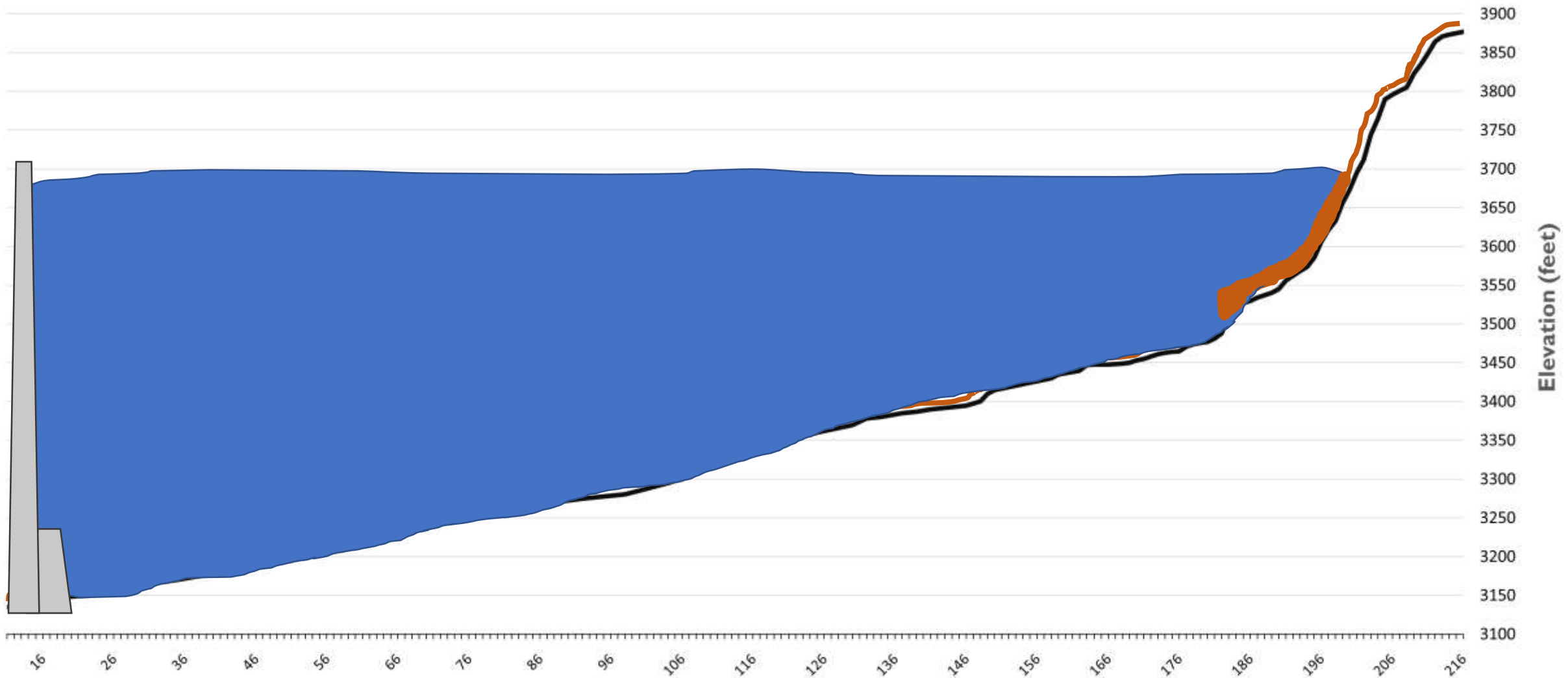
River Miles Counting Down to Lee's Ferry from Confluence with Green River



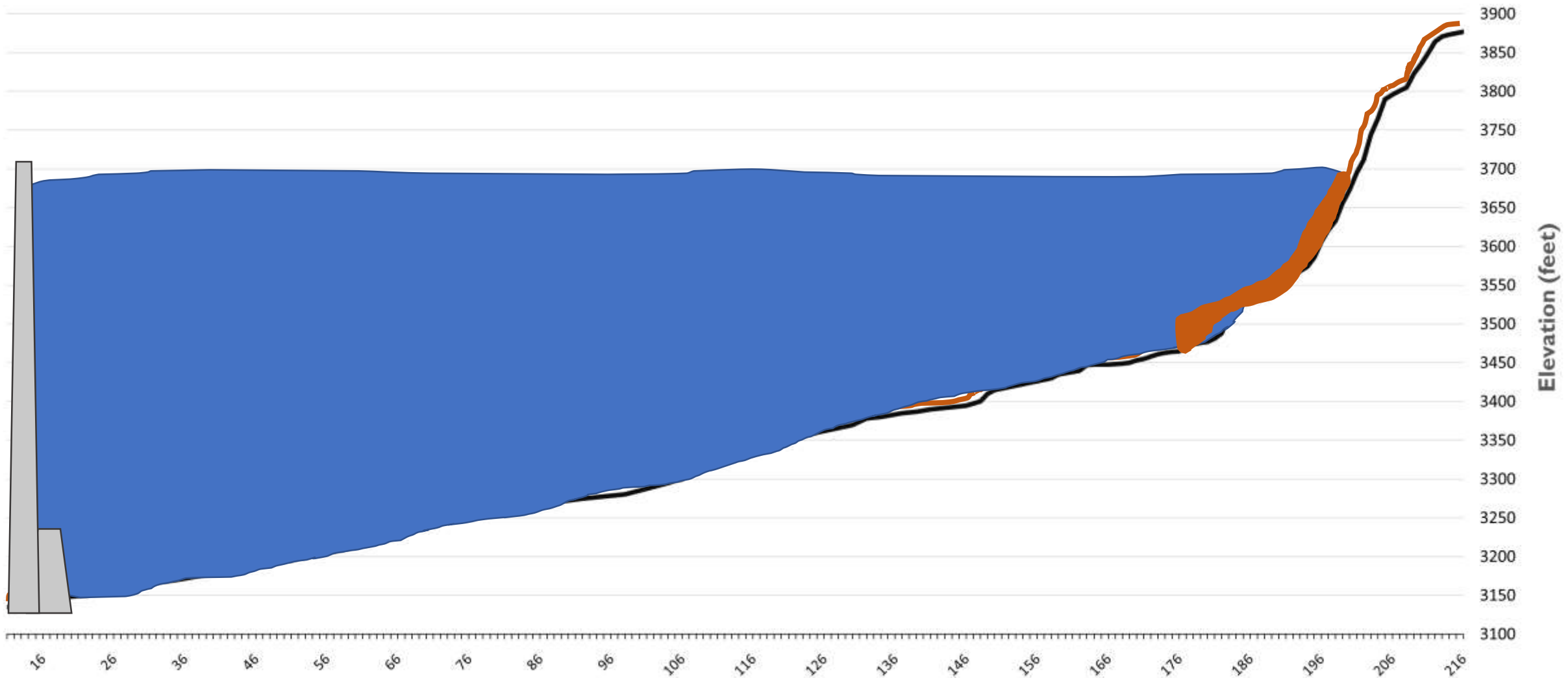
River Miles Counting Down to Lee's Ferry from Confluence with Green River



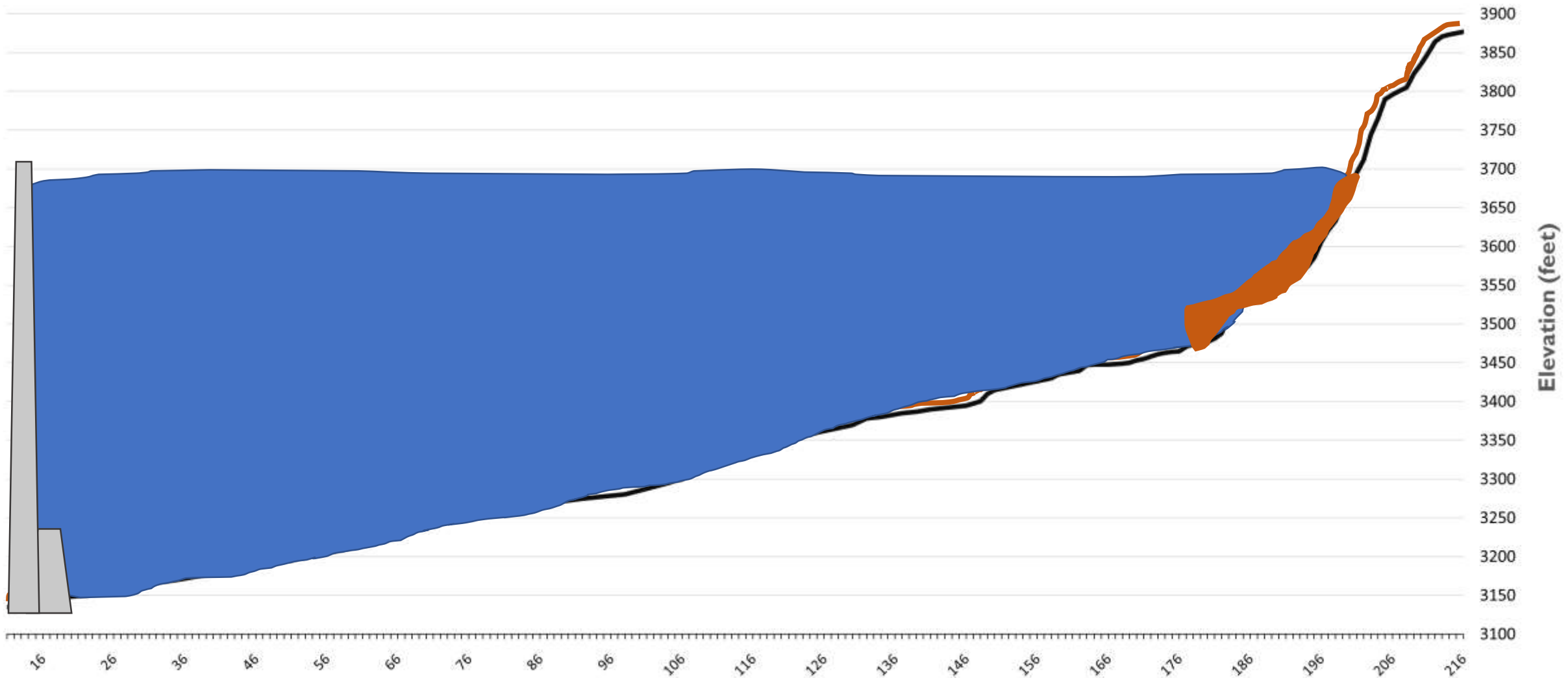
River Miles Counting Down to Lee's Ferry from Confluence with Green River



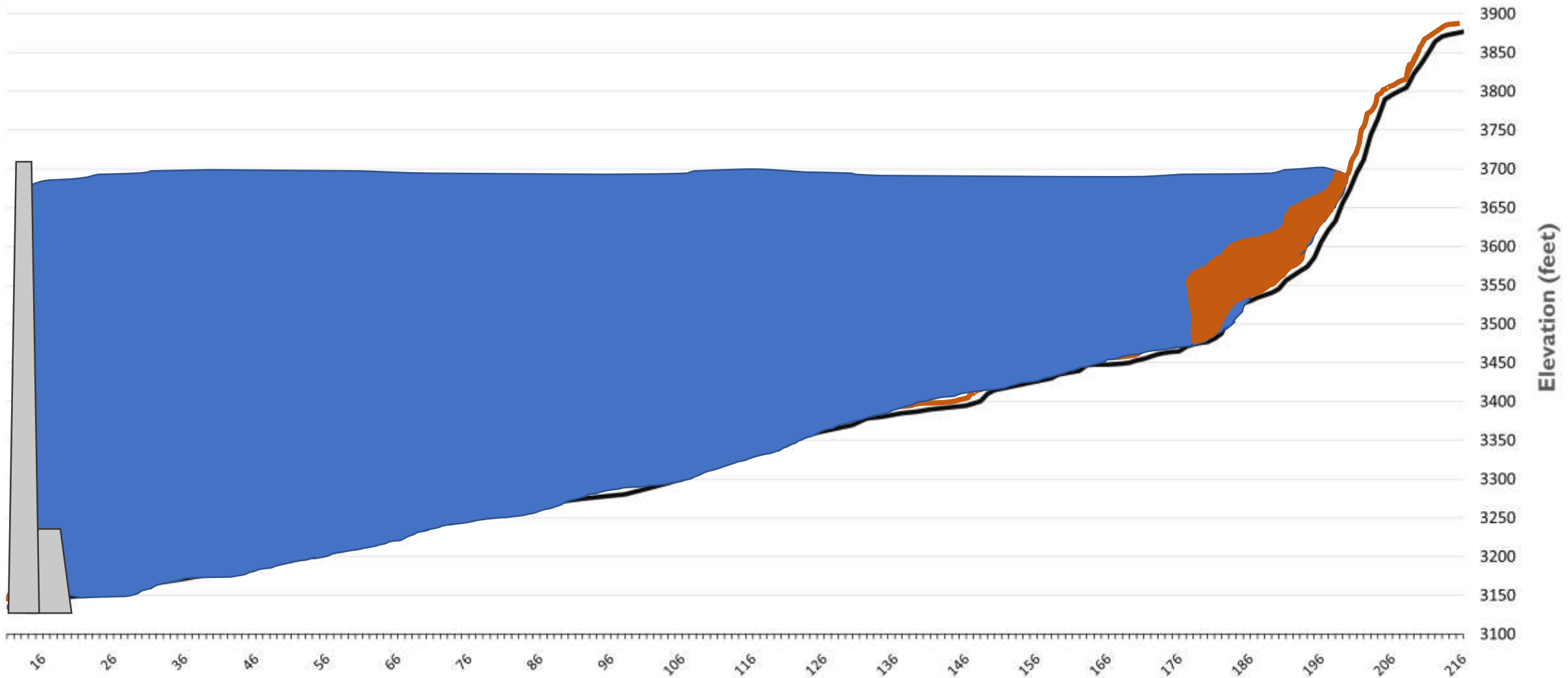
River Miles Counting Down to Lee's Ferry from Confluence with Green River



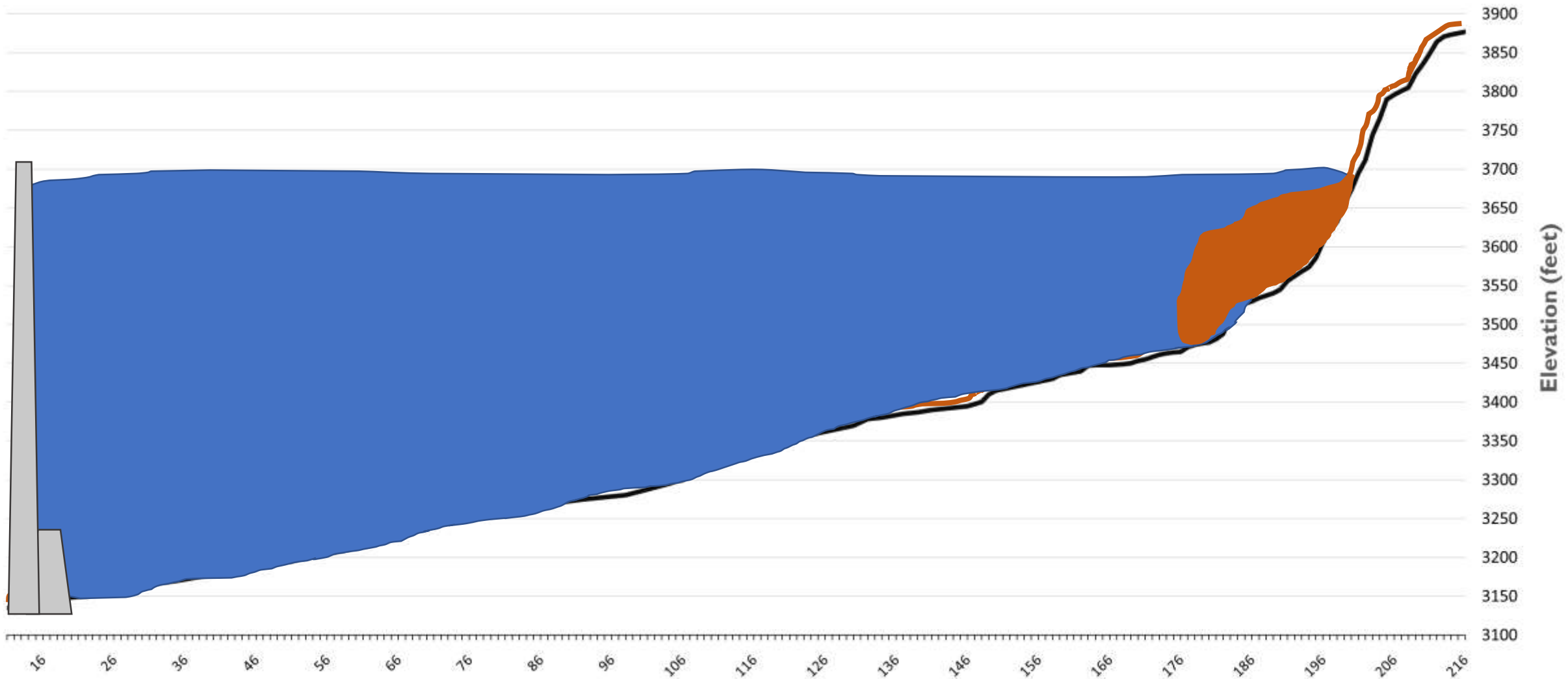
River Miles Counting Down to Lee's Ferry from Confluence with Green River



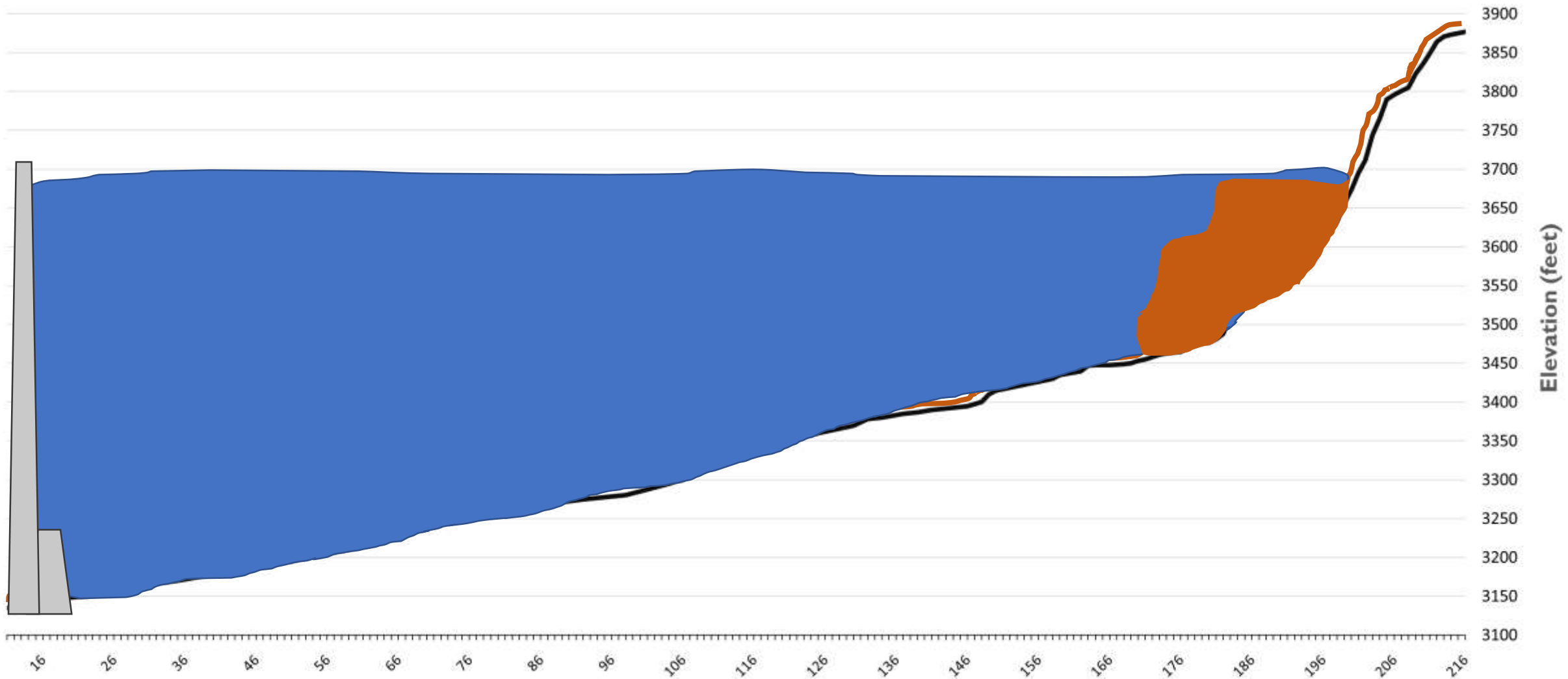
River Miles Counting Down to Lee's Ferry from Confluence with Green River



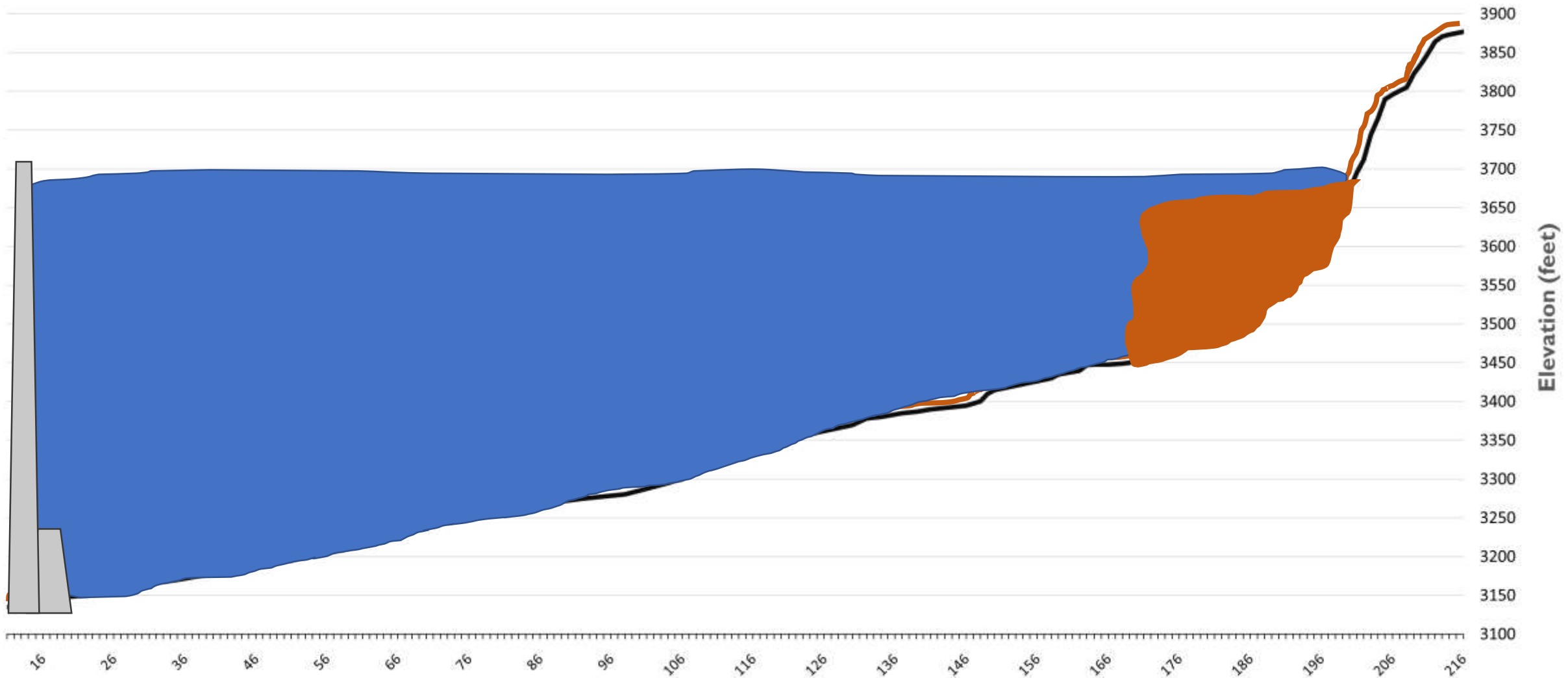
River Miles Counting Down to Lee's Ferry from Confluence with Green River



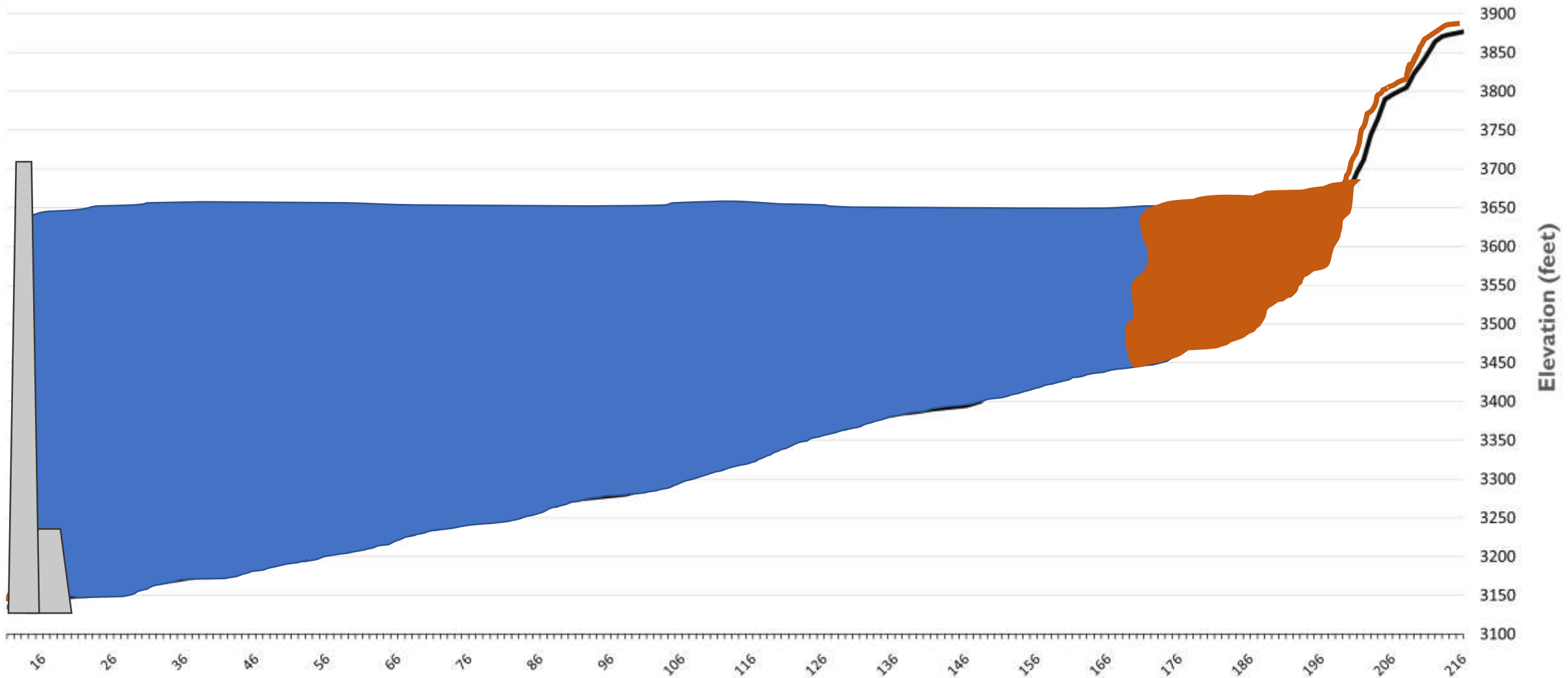
River Miles Counting Down to Lee's Ferry from Confluence with Green River



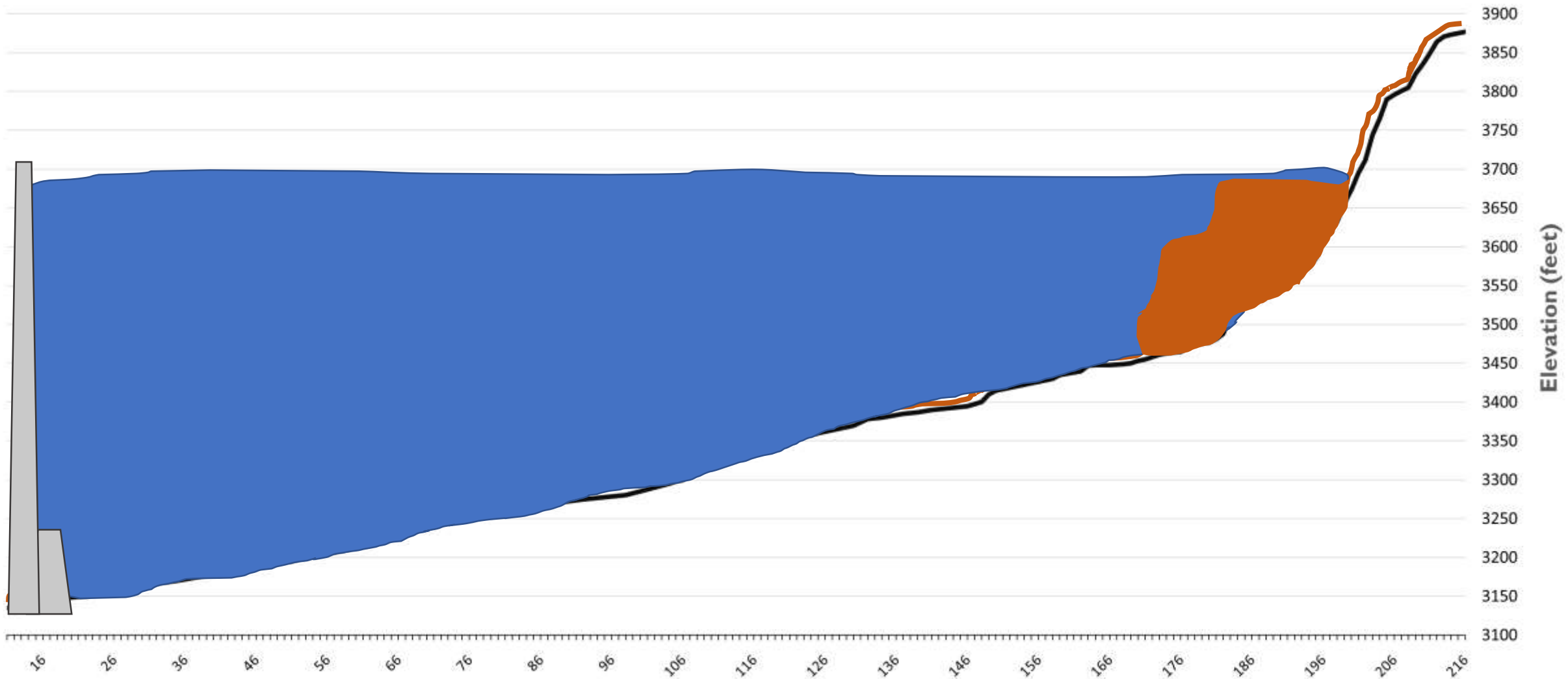
River Miles Counting Down to Lee's Ferry from Confluence with Green River



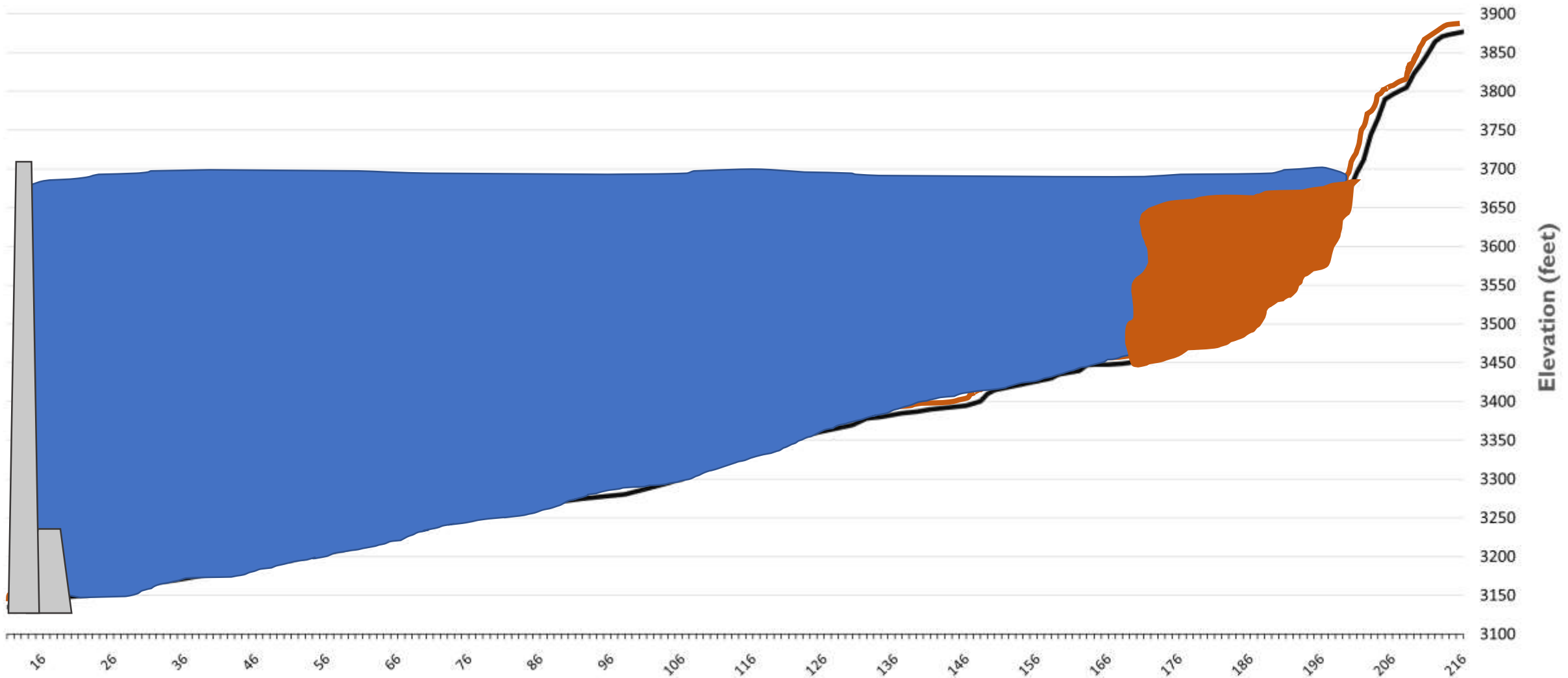
River Miles Counting Down to Lee's Ferry from Confluence with Green River



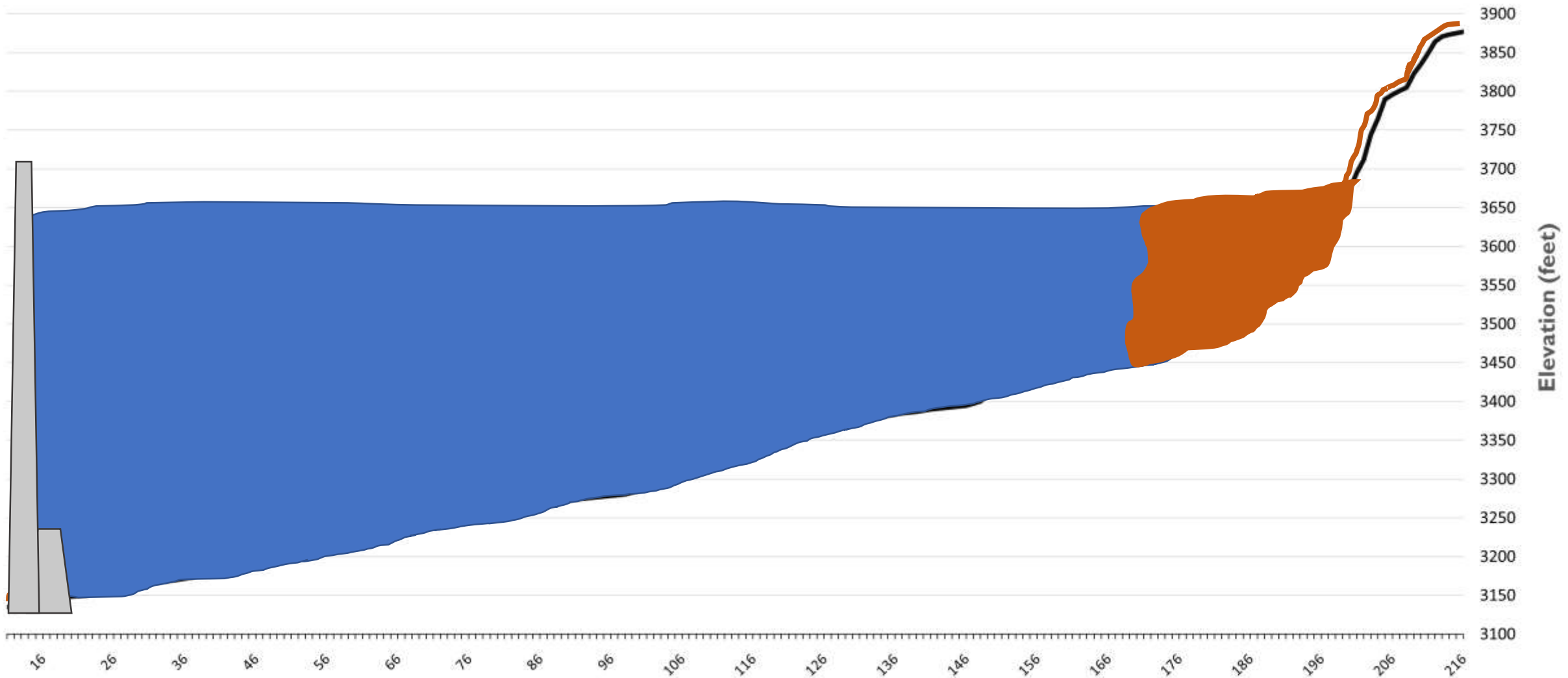
River Miles Counting Down to Lee's Ferry from Confluence with Green River



River Miles Counting Down to Lee's Ferry from Confluence with Green River

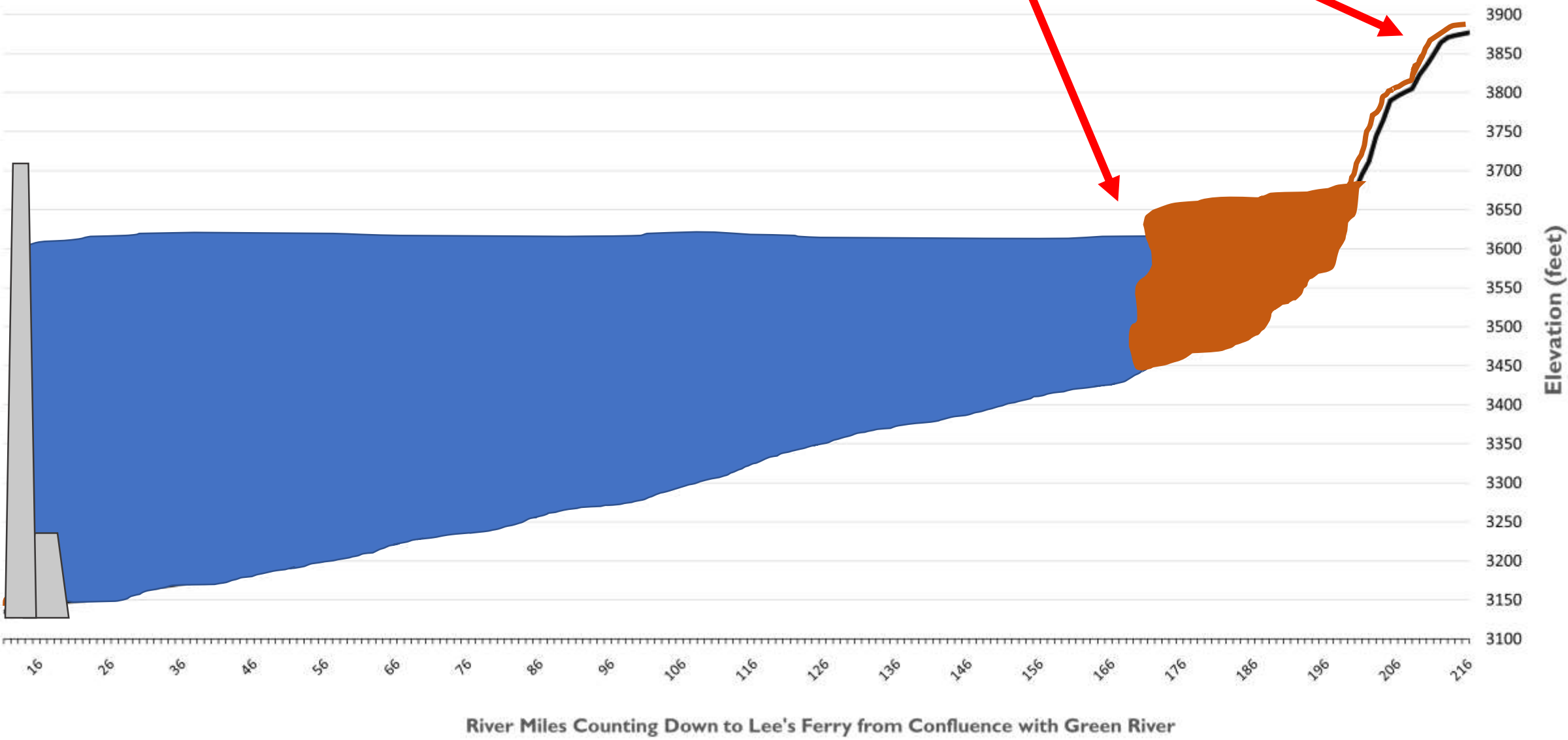


River Miles Counting Down to Lee's Ferry from Confluence with Green River



River Miles Counting Down to Lee's Ferry from Confluence with Green River

Cataract Canyon in 2004-2005





The Colorado below the Dirty Devil River
2004-06, Dohrenwend/Weisheit



Same Spot



Sheep Canyon Photos 2004-06, Dohrenwend/Weisheit



Mud Rapid near Rock Canyon in Narrow Canyon just upstream of the Hwy 95 bridge near Hite Marina, 2004/5
John Dohrenwend/ John Weisheit

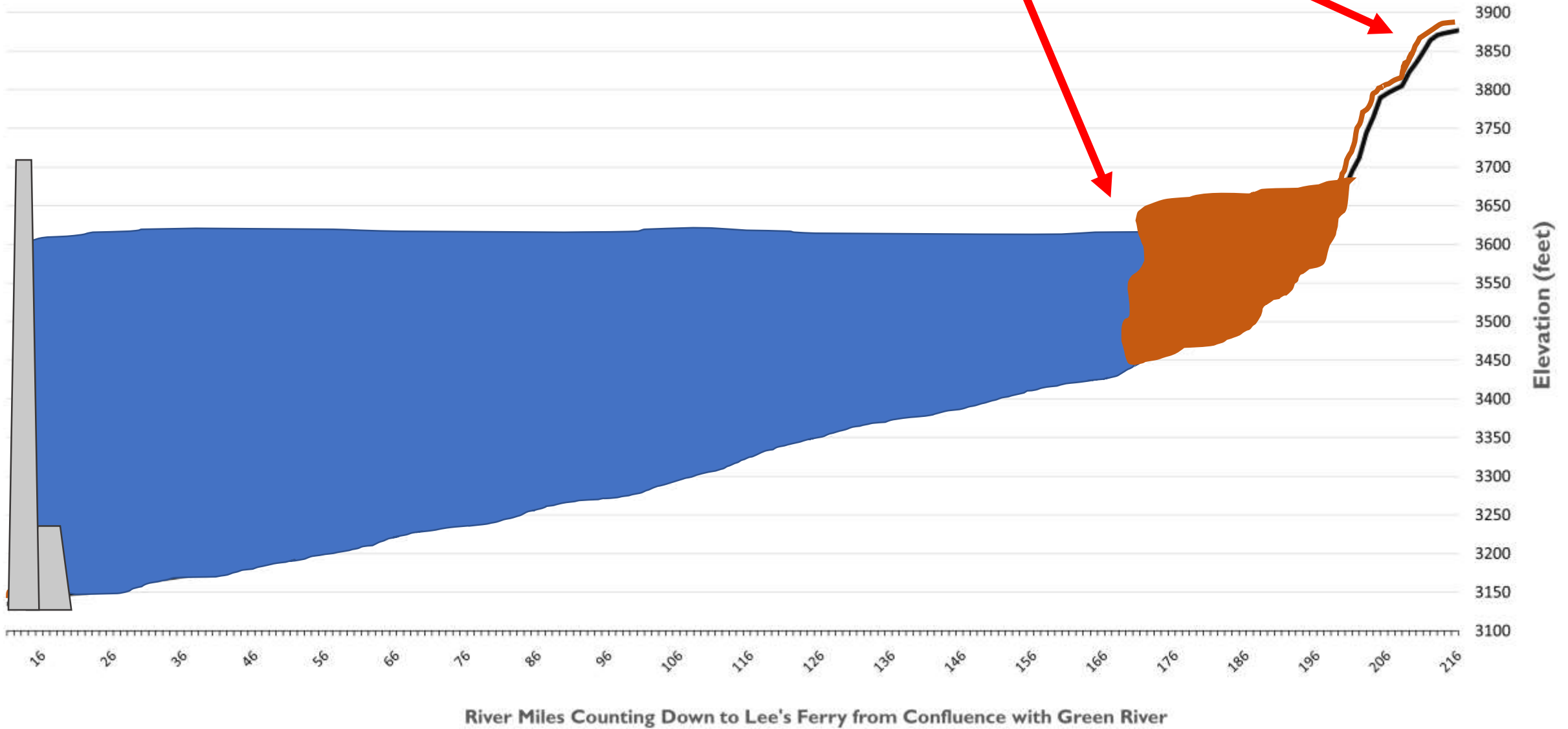


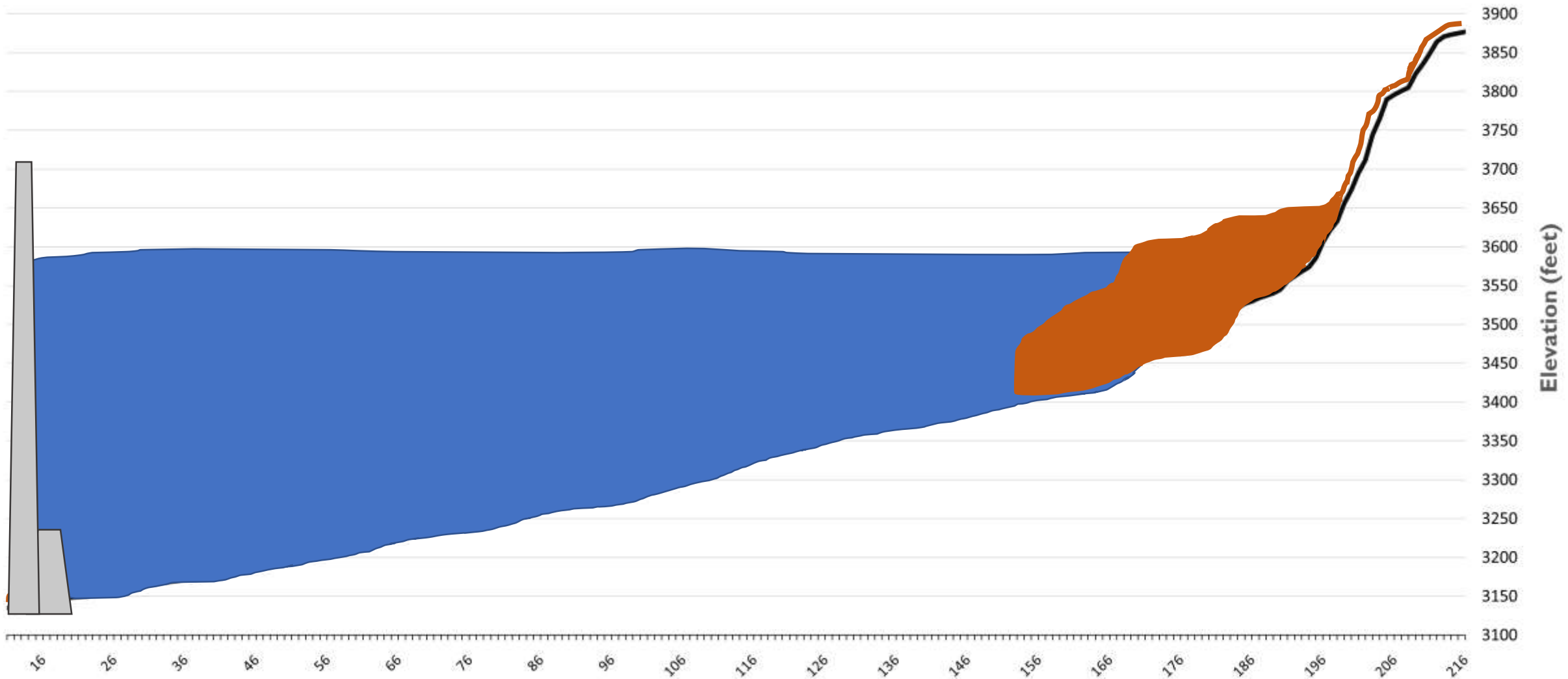
s3619_1968_Unkown (Barrs?)_Cataract Clearwater: Repeat of E.O. Beaman's 1871 Picture
USGS Flagstaff Archive



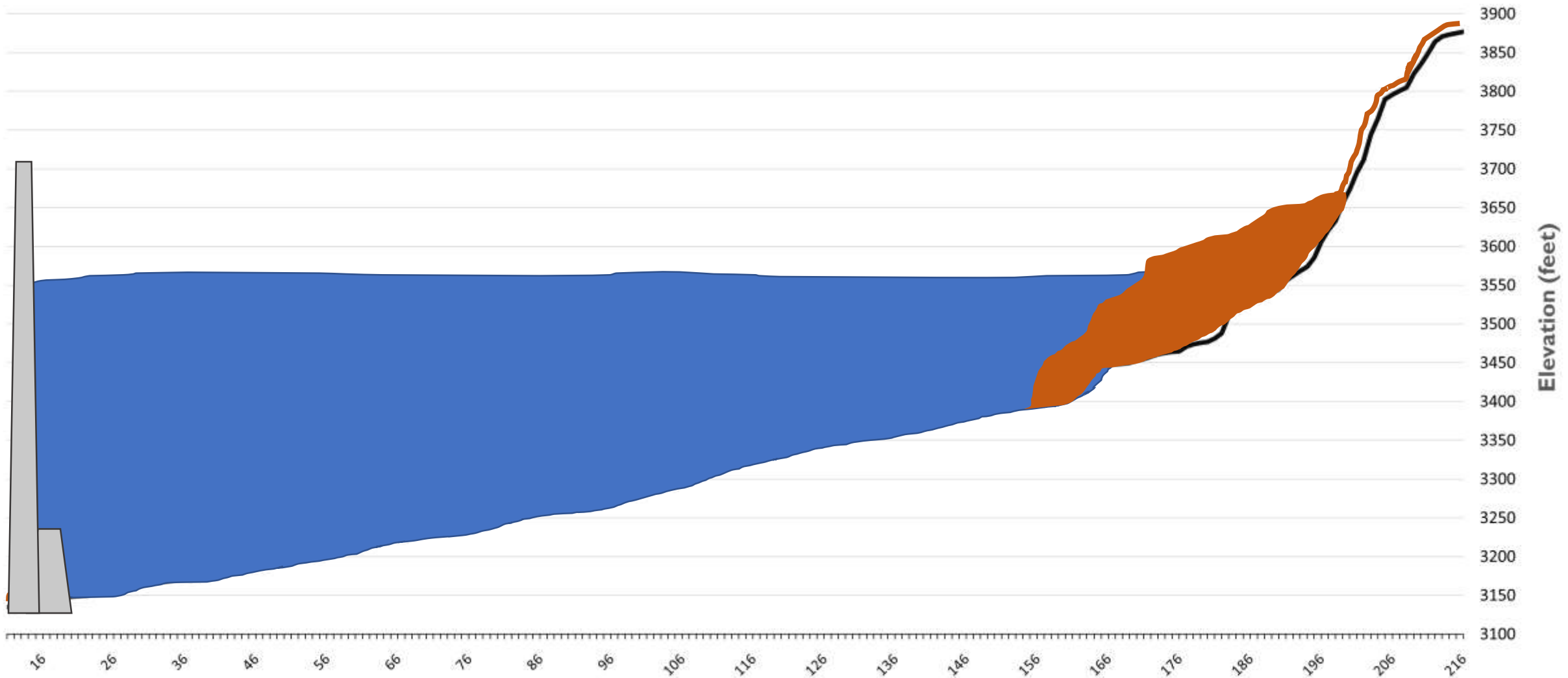
Is3619_1998c_Oldershaw_Cataract_Clearwater Repeat of E.O. Beaman's 1871 Picture
USGS Flagstaff

Cataract Canyon

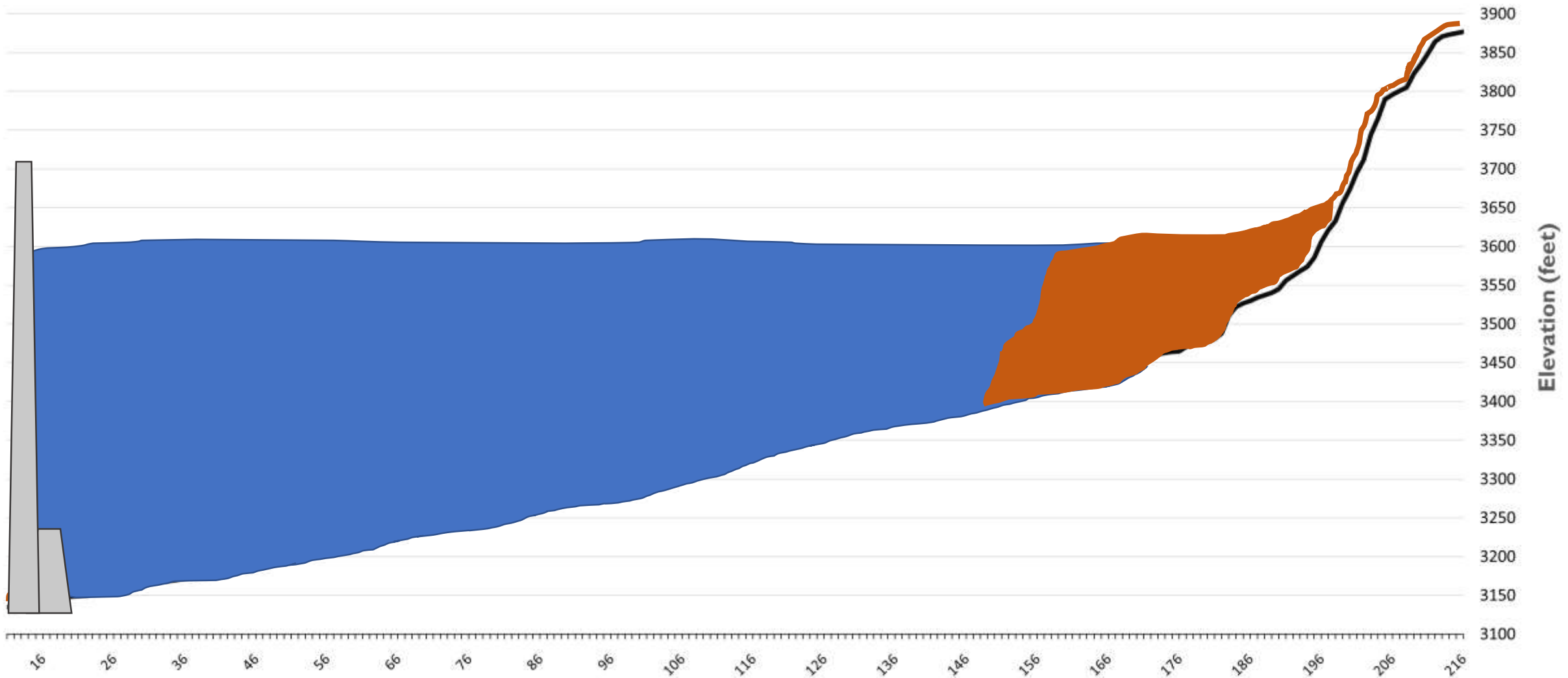




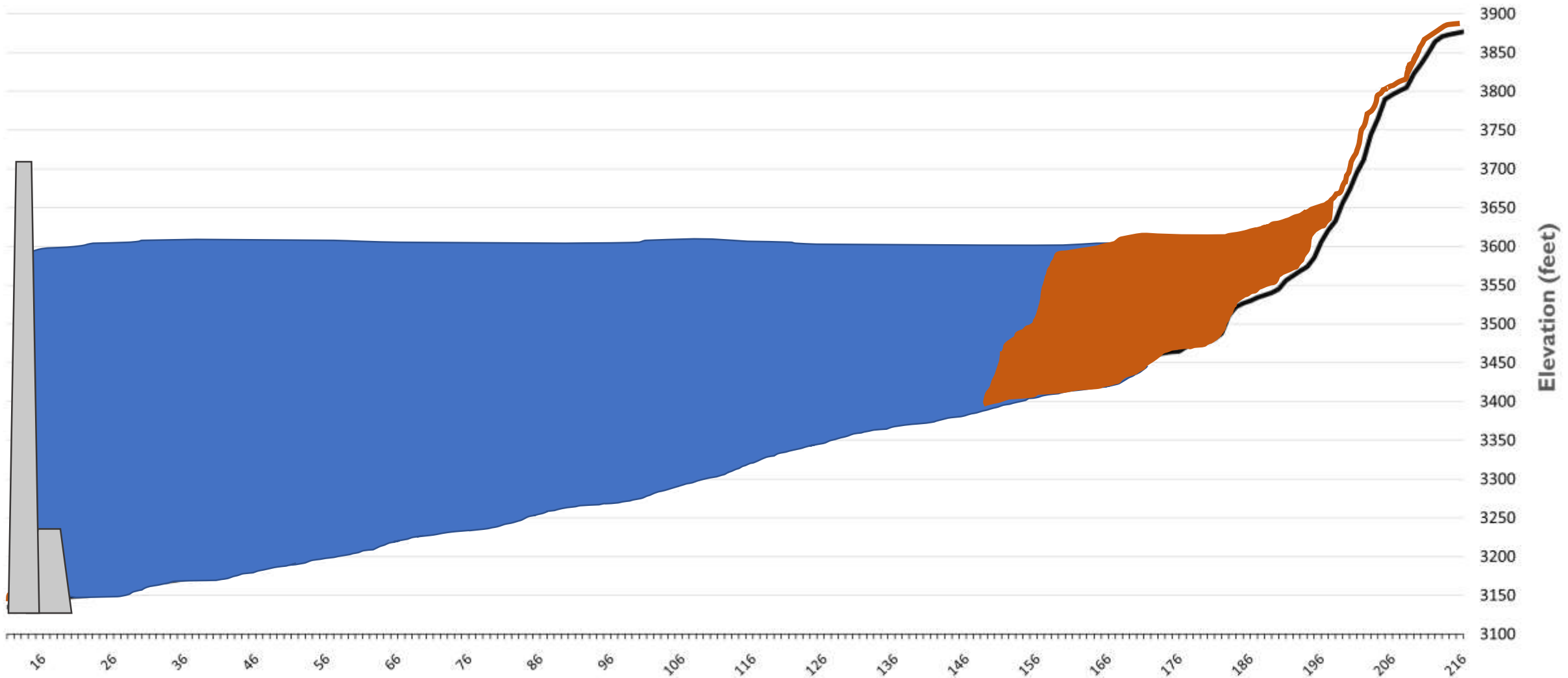
River Miles Counting Down to Lee's Ferry from Confluence with Green River



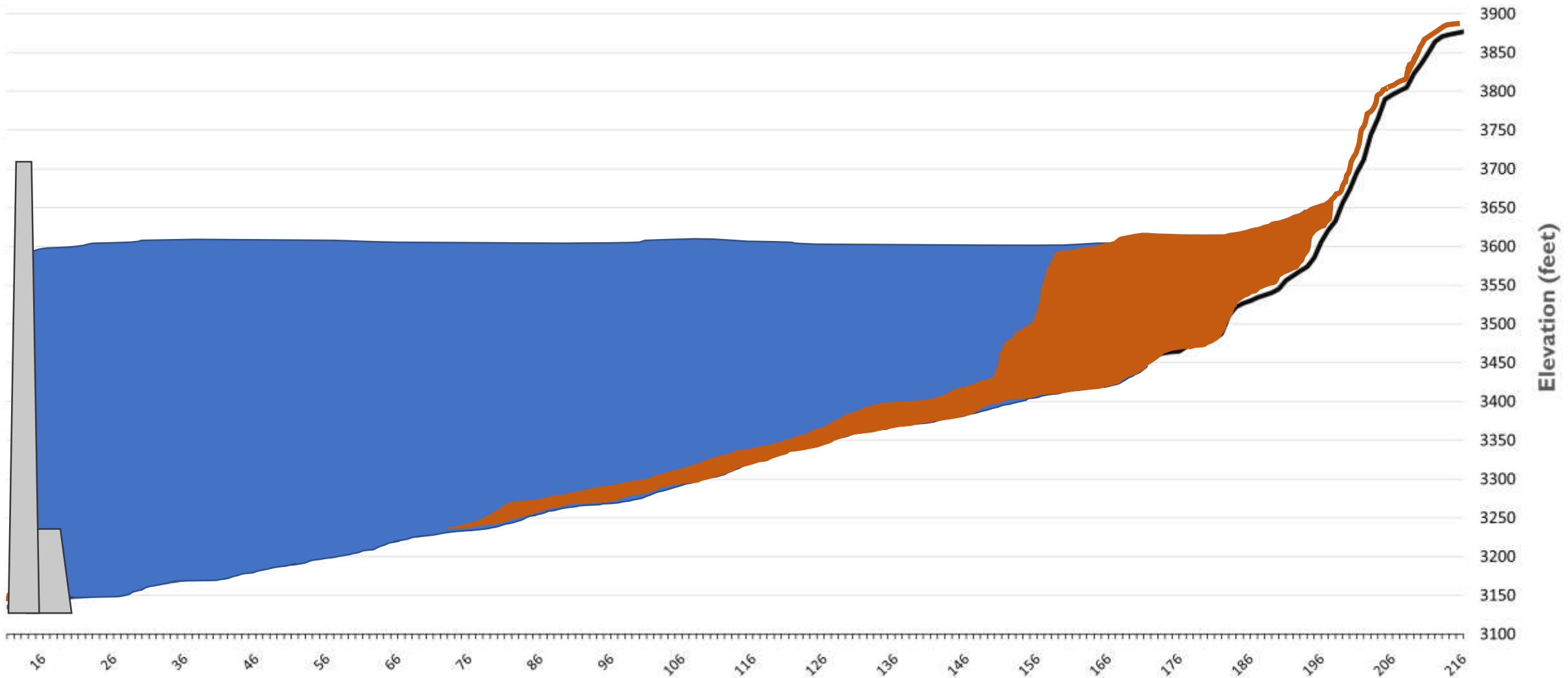
River Miles Counting Down to Lee's Ferry from Confluence with Green River



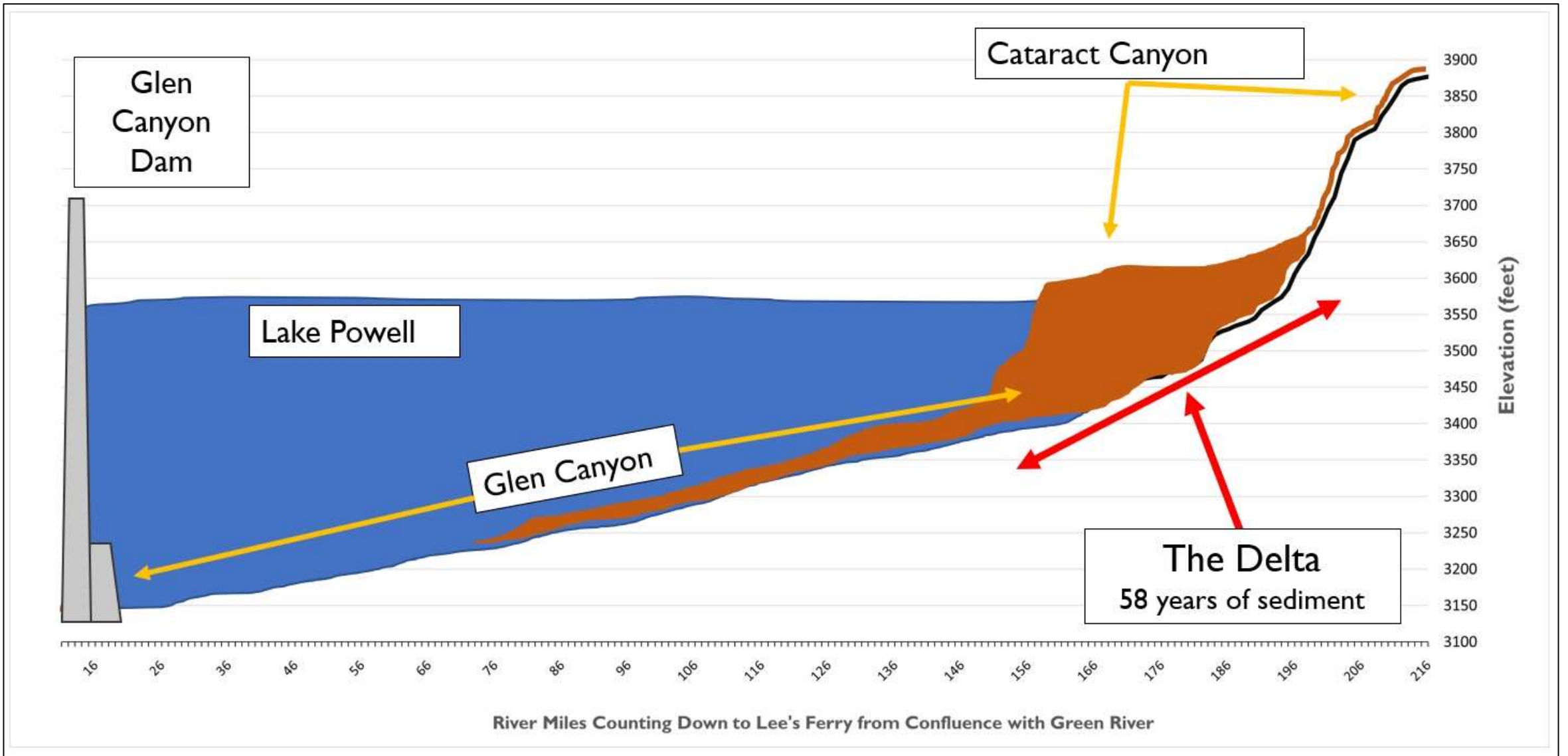
River Miles Counting Down to Lee's Ferry from Confluence with Green River



River Miles Counting Down to Lee's Ferry from Confluence with Green River



River Miles Counting Down to Lee's Ferry from Confluence with Green River





Lake Powell High Water Line 3,700 ft

River Mile 200-199

Historic River Level 3670 ft

2019



1889



s2343_1889_Nims_Powell_Cataract_USGS Flagstaff

1991



s2343_1991_Webb_Powell_Cataract-2_USGS Flagstaff

The First Returned Rapid

2011



s2343_2011c_Webb_Powell_Cataract_USGS Flagstaff

2019



River Mile 199.1, River Left, Looking Downstream into The Chute, 6500 cfs, 8-27-2019
Historic River Elevation ~3655

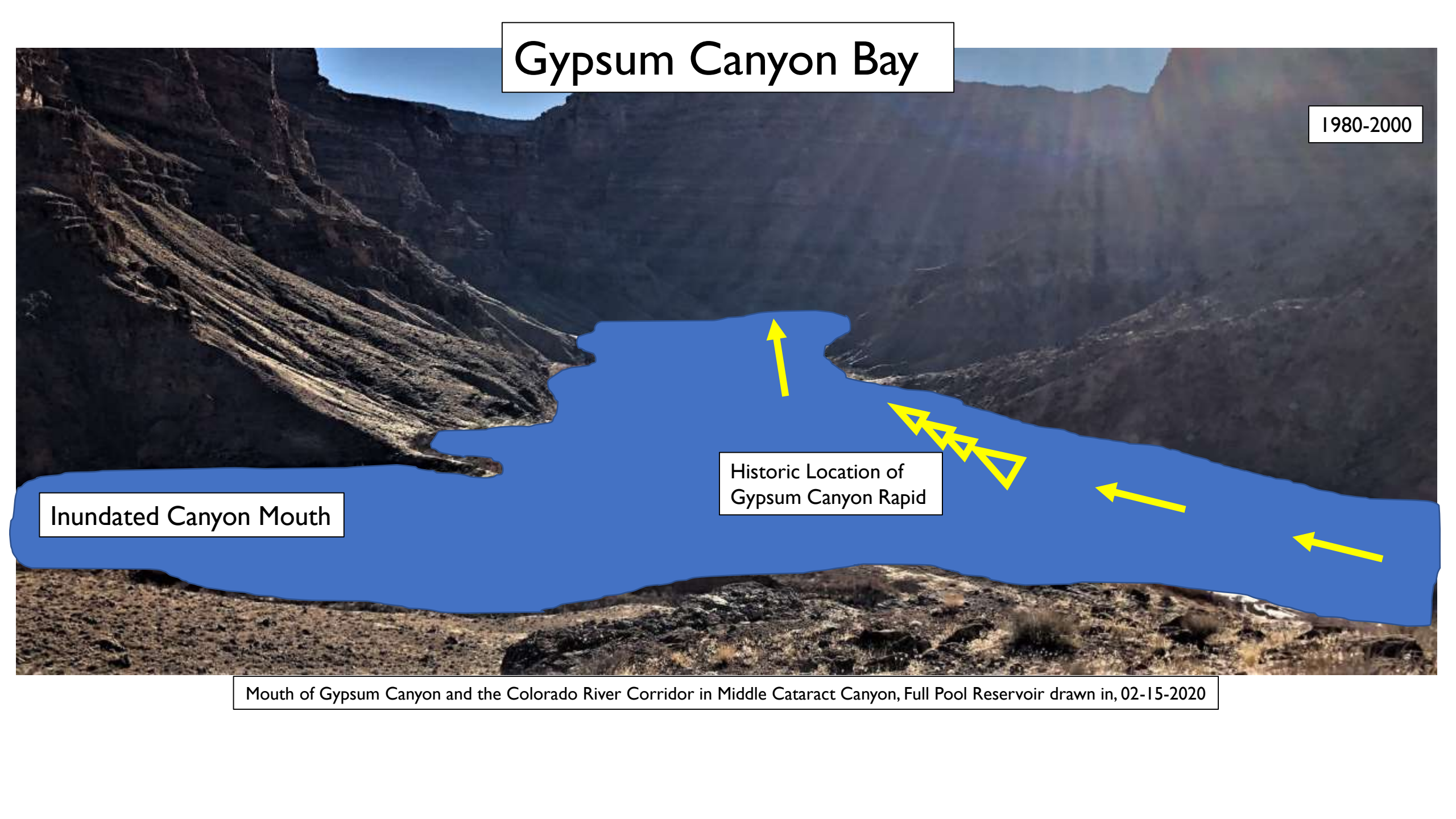
Gypsum Canyon Bay

1980-2000

Inundated Canyon Mouth

Historic Location of
Gypsum Canyon Rapid

Mouth of Gypsum Canyon and the Colorado River Corridor in Middle Cataract Canyon, Full Pool Reservoir drawn in, 02-15-2020



Gypsum Canyon Area

2020



Gypsum Basin overview 6600 cfs_ 3604 res level_ Mike DeHoff 02-15-2020

Changes near Gypsum Canyon



Above Gypsum 7-23-2015_ 12,000 cfs_ Res 3613_ Peter Lefebvre



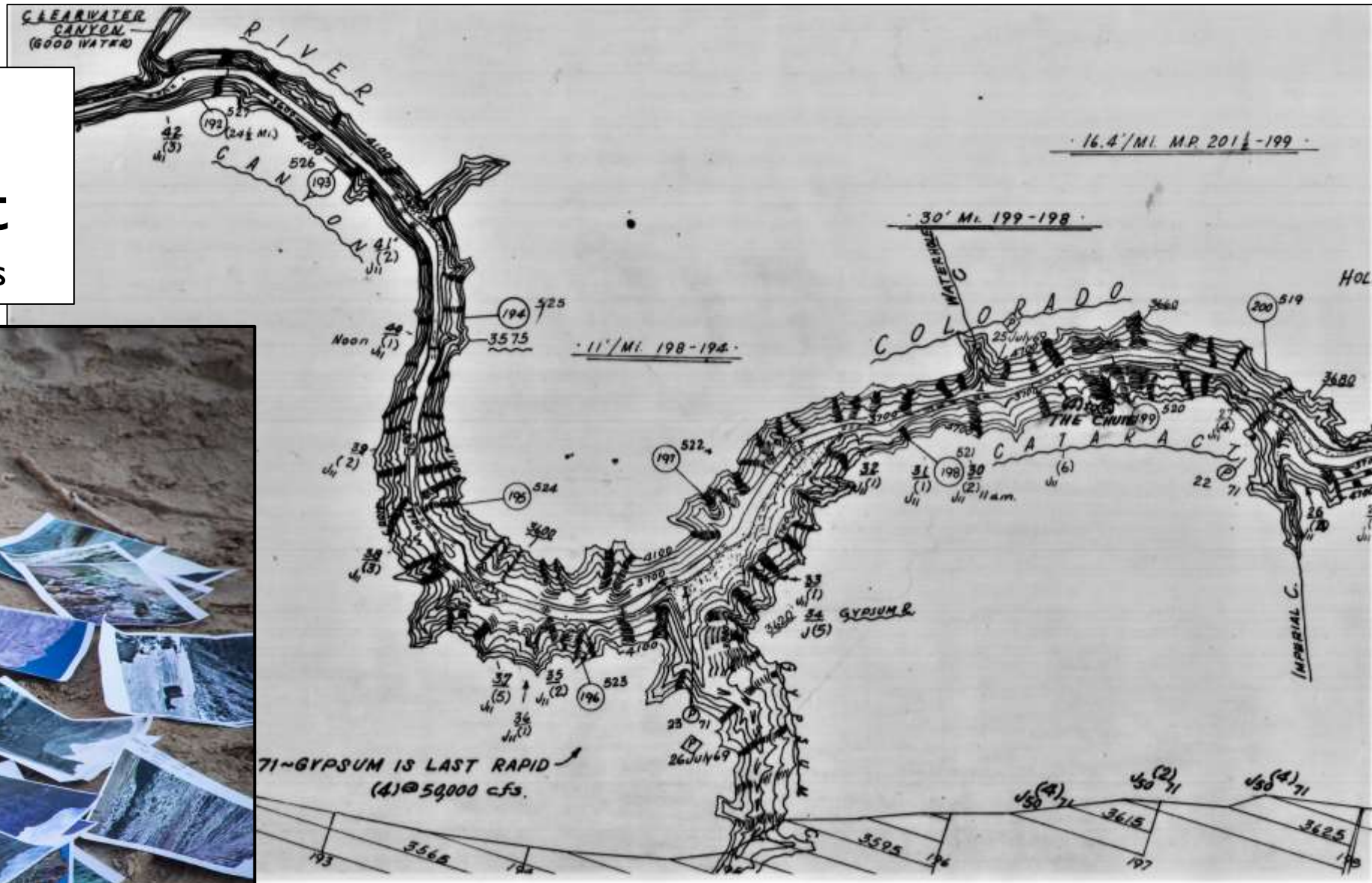
Above Gypsum match 10-10-2019_ 6400 cfs_ Res 3617_ Peter Lefebvre

The Start of a Treasure Hunt

Historic Maps and Photos



Historic Photos on Beach; October 2020; Paul Richer



Les Jones Cataract Canyon Scroll Map;
Cropped to show detail Imperial to Clearwater Canyon;
Courtesy of Les Jones' Family



120

120-E.L.Kolb in Rapid #31, just above Gypsum
Canyon. 12:25 p.m. 9-21-21. E.C.L.

The First Match

1921

2021



120-E.L.Kolb in Rapid #31, just above Gypsum Canyon. 12:25 p.m. 9-21-21. E.C.L.

E.L. Kolb in Rapid #31, just above Gypsum Canyon. 12:25 p.m. 9-21-1921, E.C. La Rue Collection - photo #120
Doc Marston Papers, Huntington Digital Library, Public domain

<https://hdl.huntington.org/digital/collection/pl6003coll5/id/15278/rec/106>

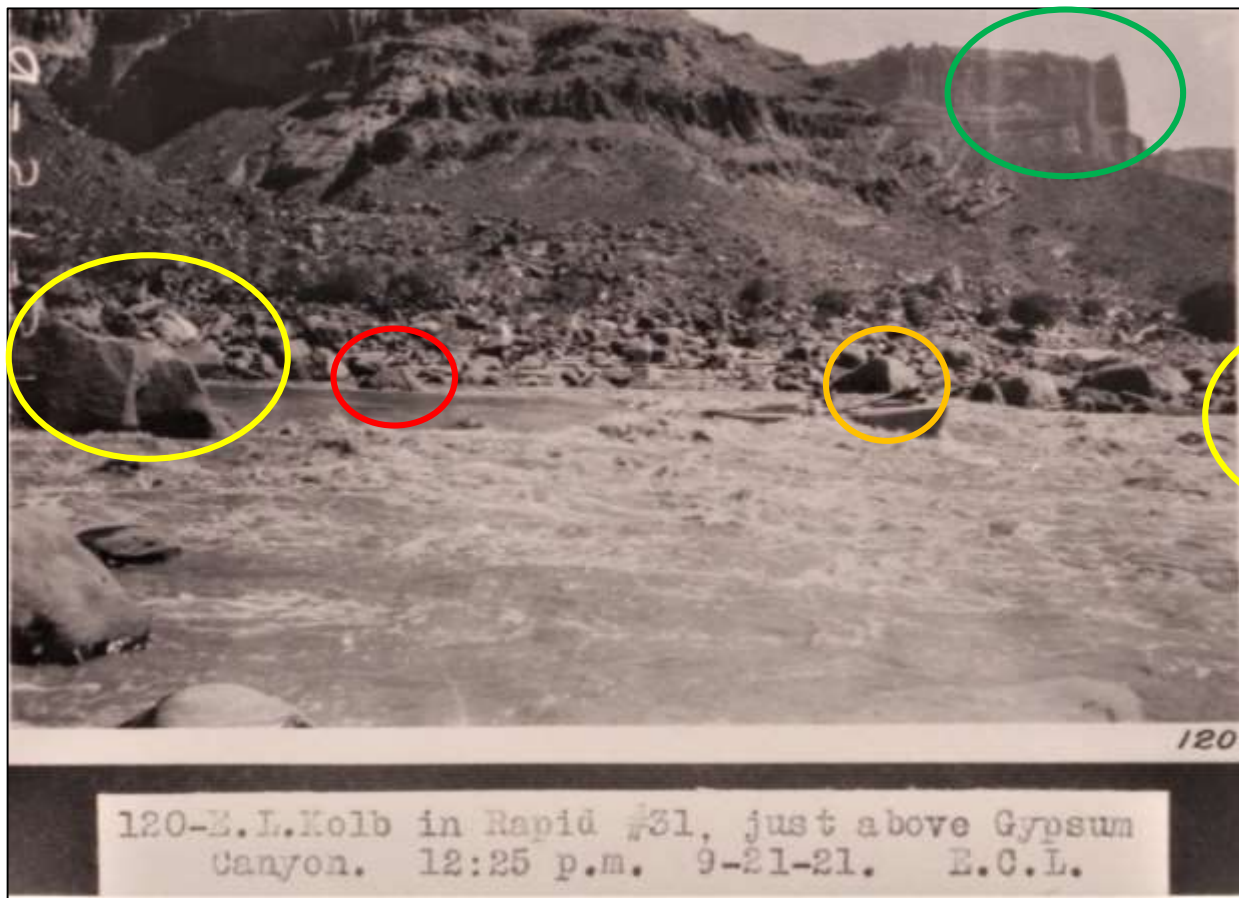


Best La Rue's Riffle Match - Mike Freeman in Rapid just upstream of Gypsum Canyon. 12:25 p.m. 9-21-2021, Meg Flynn

The First Match

1921

2021



120-E.L.Kolb in Rapid #31, just above Gypsum Canyon. 12:25 p.m. 9-21-21. E.C.L.

E.L. Kolb in Rapid #31, just above Gypsum Canyon. 12:25 p.m. 9-21-1921, E.C. La Rue Collection - photo #120
Doc Marston Papers, Huntington Digital Library, Public domain

<https://hdl.huntington.org/digital/collection/pl6003coll5/id/15278/rec/106>



Best La Rue's Riffle Match - Mike Freeman in Rapid just upstream of Gypsum Canyon. 12:25 p.m. 9-21-2021, Meg Flynn



2018

Gypsum Riffle RR 07-24-2018_ 3900 cfs_ 3605 Reservoir Level at the Dam



Winter 2020

Gypsum Canyon Riffle_ 02-14-2020_ 6600cfs_ 3604 Reservoir level at the Dam



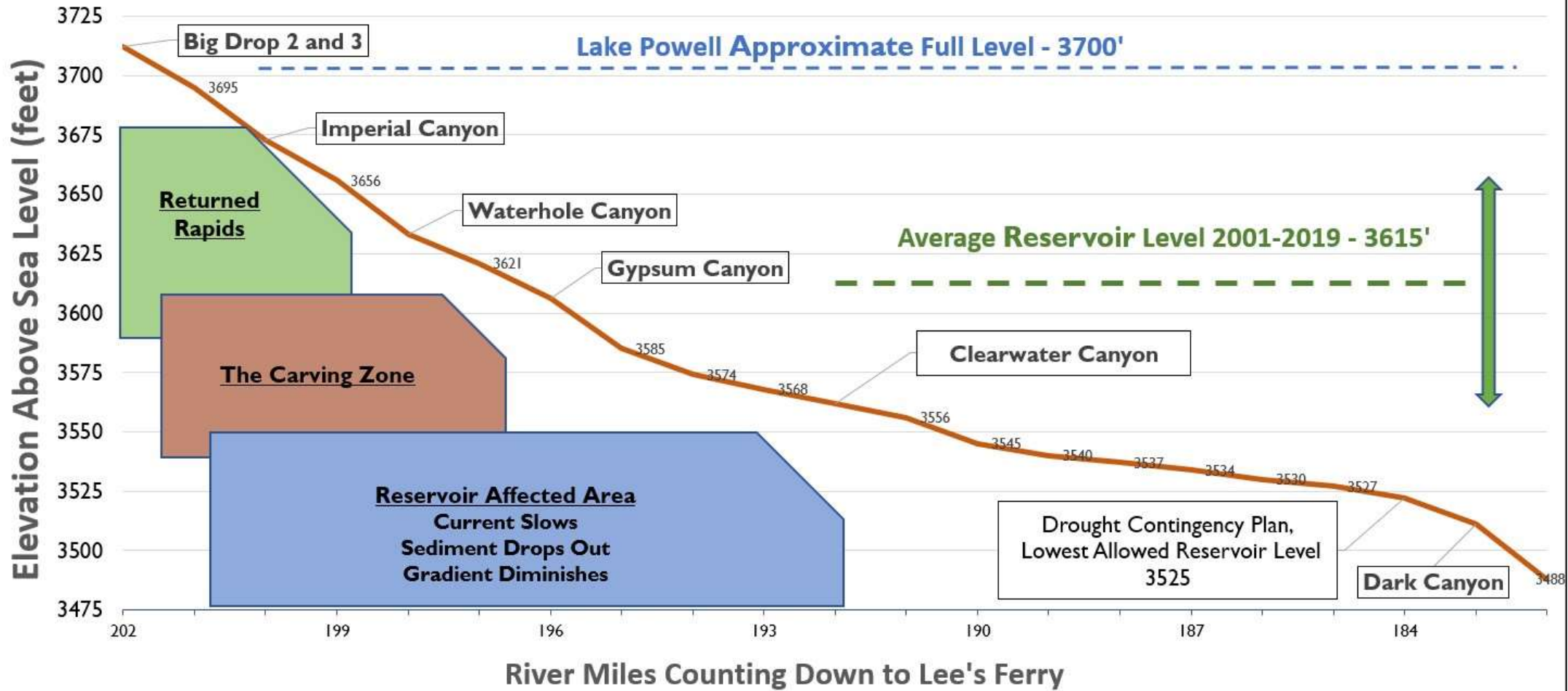
Summer 2020

Gypsum Canyon Riffle/Rapid_ 7-26-2020 approx. 4600cfs_ 3607 Reservoir level at the Dam

Gypsum Canyon Rapid Location

Returning Rapids and the Recovering River Corridor

Colorado River Profile in Cataract Canyon River to Reservoir Zone



Profile of the Colorado River in Cataract showing 3 zones: Big Drops to Dark Canyon

Rapids, Current, and Beaches



Fiddlehead Beach Camp, Oct 2019 Peter Lefebvre



Can Opener Rapid (#31) May 2020
Mike DeHoff

Returning Flora and Fauna



River Otters near Gypsum Canyon, Peter Lefebvre



Enjoying the shade of a willow, Lunch Stop at Clearwater, July 2019, Mike DeHoff



Native Plants on mud flats, Peter Lefebvre

Re-emerging Archeology

2018



Small Ruin in sediment, July 2018

2019



Petroglyphs on Boulder, March 2019

The boulder w petroglyphs is submerged by the reservoir at lake level ~3635, the ruin at ~3650

Changes in Side Canyons

1871



s3619_1871_Beaman_Cataract_Clearwater-lowrez

1998



s3619_1998c_Oldershaw_Cataract_Clearwater
USGS Flagstaff

2020



Beaman's Clearwater Photo 5-29-2020
18250 cfs, Res Level 3604-Dam, 3608-Bridge

Clearwater Canyon

Dories at Peak Reservoir Level and Restored Canyon

1983



Lunch Break, Clearwater Canyon, 1983, when the reservoir was at its highest elevation, Tim Cooper

2019



Dory Lunch Stop Match, Clearwater Canyon, 10-11-2019, Peter Lefebvre

Permits, Partnerships, and Science Trips

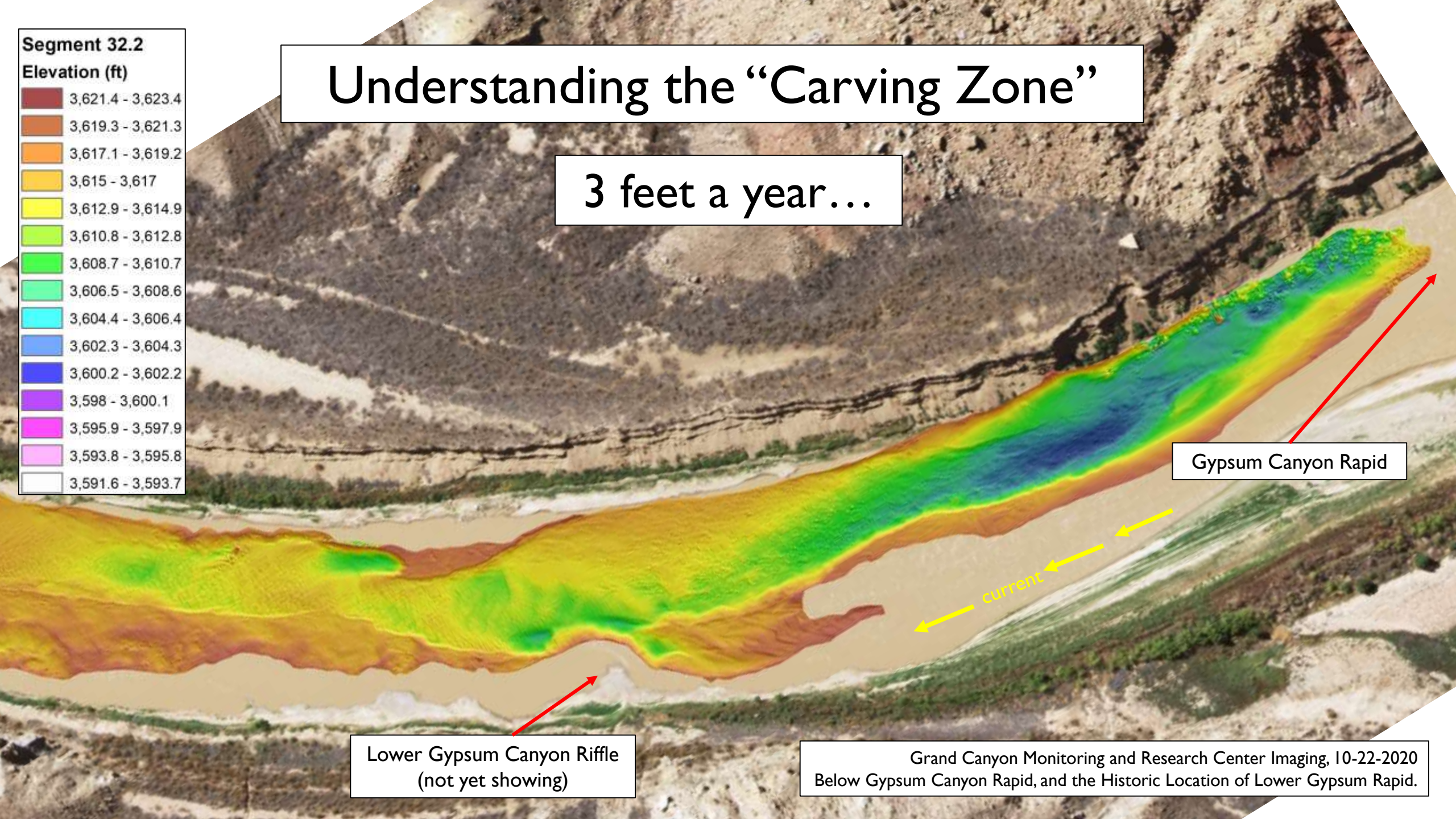


Segment 32.2
Elevation (ft)

3,621.4 - 3,623.4
3,619.3 - 3,621.3
3,617.1 - 3,619.2
3,615 - 3,617
3,612.9 - 3,614.9
3,610.8 - 3,612.8
3,608.7 - 3,610.7
3,606.5 - 3,608.6
3,604.4 - 3,606.4
3,602.3 - 3,604.3
3,600.2 - 3,602.2
3,598 - 3,600.1
3,595.9 - 3,597.9
3,593.8 - 3,595.8
3,591.6 - 3,593.7

Understanding the "Carving Zone"

3 feet a year...

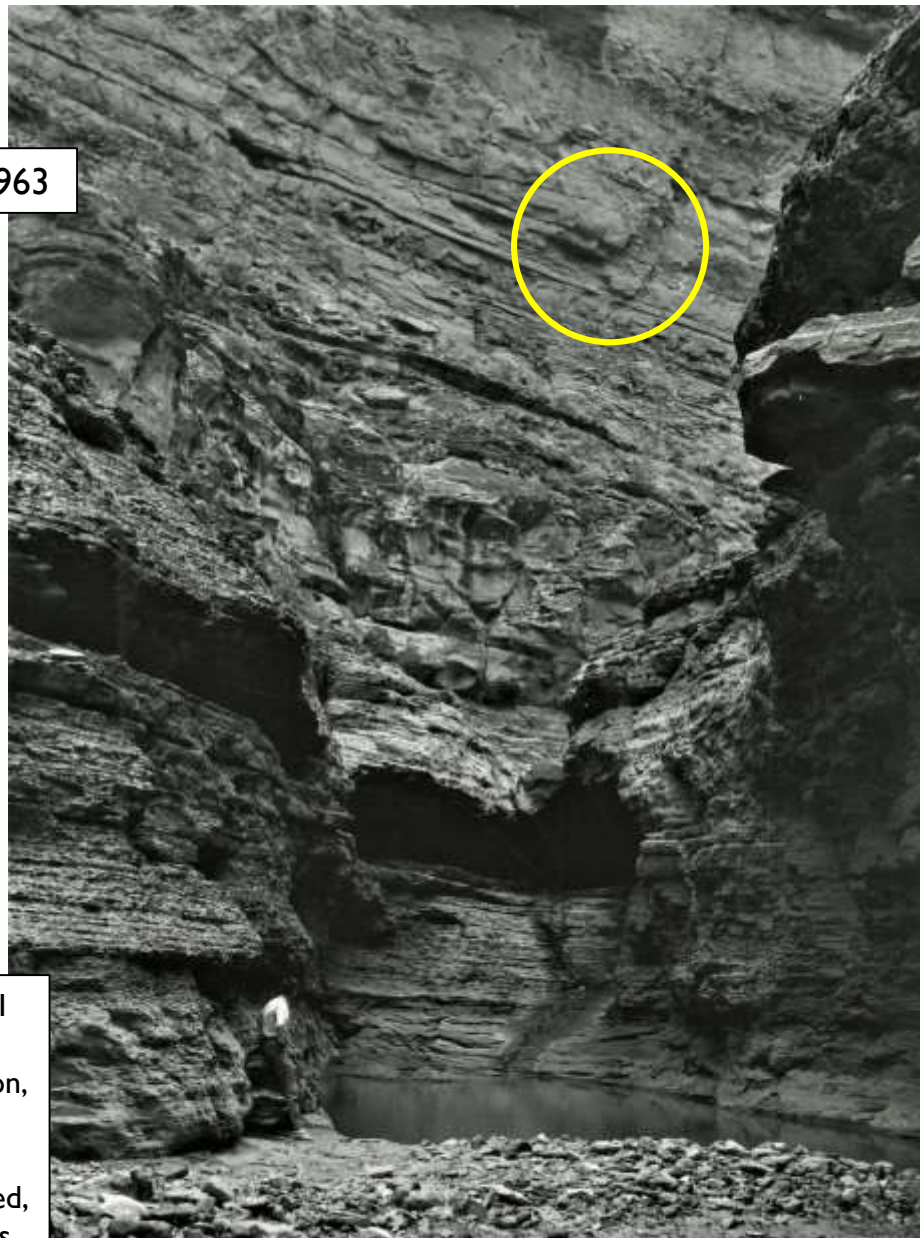


Gypsum Canyon Rapid

Lower Gypsum Canyon Riffle
(not yet showing)

Grand Canyon Monitoring and Research Center Imaging, 10-22-2020
Below Gypsum Canyon Rapid, and the Historic Location of Lower Gypsum Rapid.

May 1963



P0197n24_10_001
Mouth of
Clearwater Canyon,
05-23-1963
Crampton
Collection, cropped,
Special Collections,
J. Willard Marriott
Library, University
of Utah

Clearwater Canyon

Oct 2019



Clearwater Canyon,
near mouth;
Susan Bush,
University of Utah,
10-11-2019

Dark Canyon Rapid



Dark Canyon Rapid Overview;
George Simmons 1956 Cropped and Enhanced;
Courtesy of John Weisheit
Historic Rapid Elevation 3510'

Dark Canyon Rapid

Historic Rapid Location
Will it Ever Be Seen Again?

Mouth of
Dark Canyon

Maximum Reservoir
Level ~3700'

Dark Canyon Rapid Location
in main River Corridor

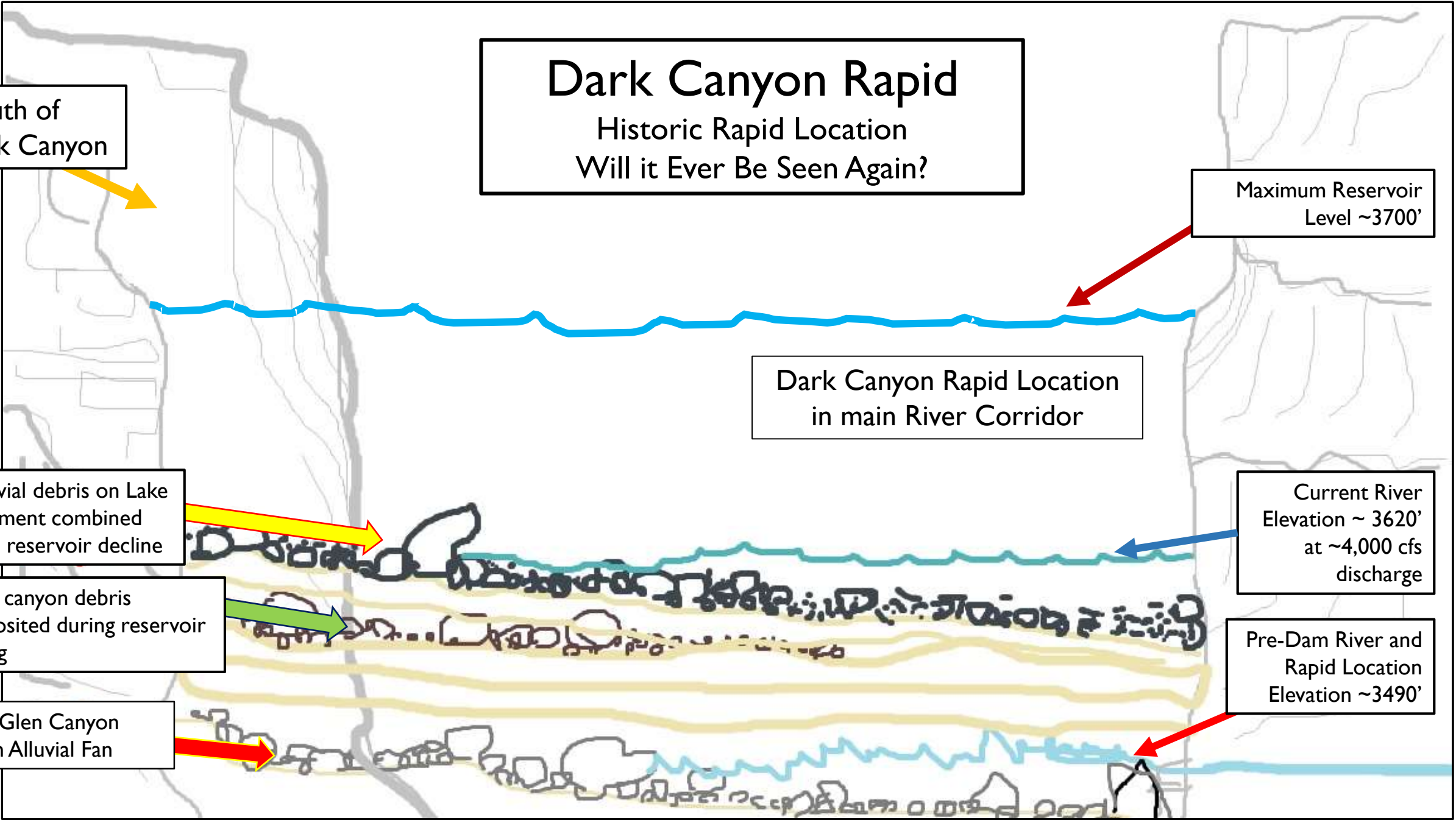
Alluvial debris on Lake
Sediment combined
with reservoir decline

Current River
Elevation ~ 3620'
at ~4,000 cfs
discharge

Side canyon debris
deposited during reservoir
filling

Pre-Dam River and
Rapid Location
Elevation ~3490'

Pre-Glen Canyon
Dam Alluvial Fan



Mouth of the Dirty Devil River

Stanton Expedition, Frank A. Nims photo 1889

Take note of the person sitting on this rock outcrop as reference point for the next page

1889

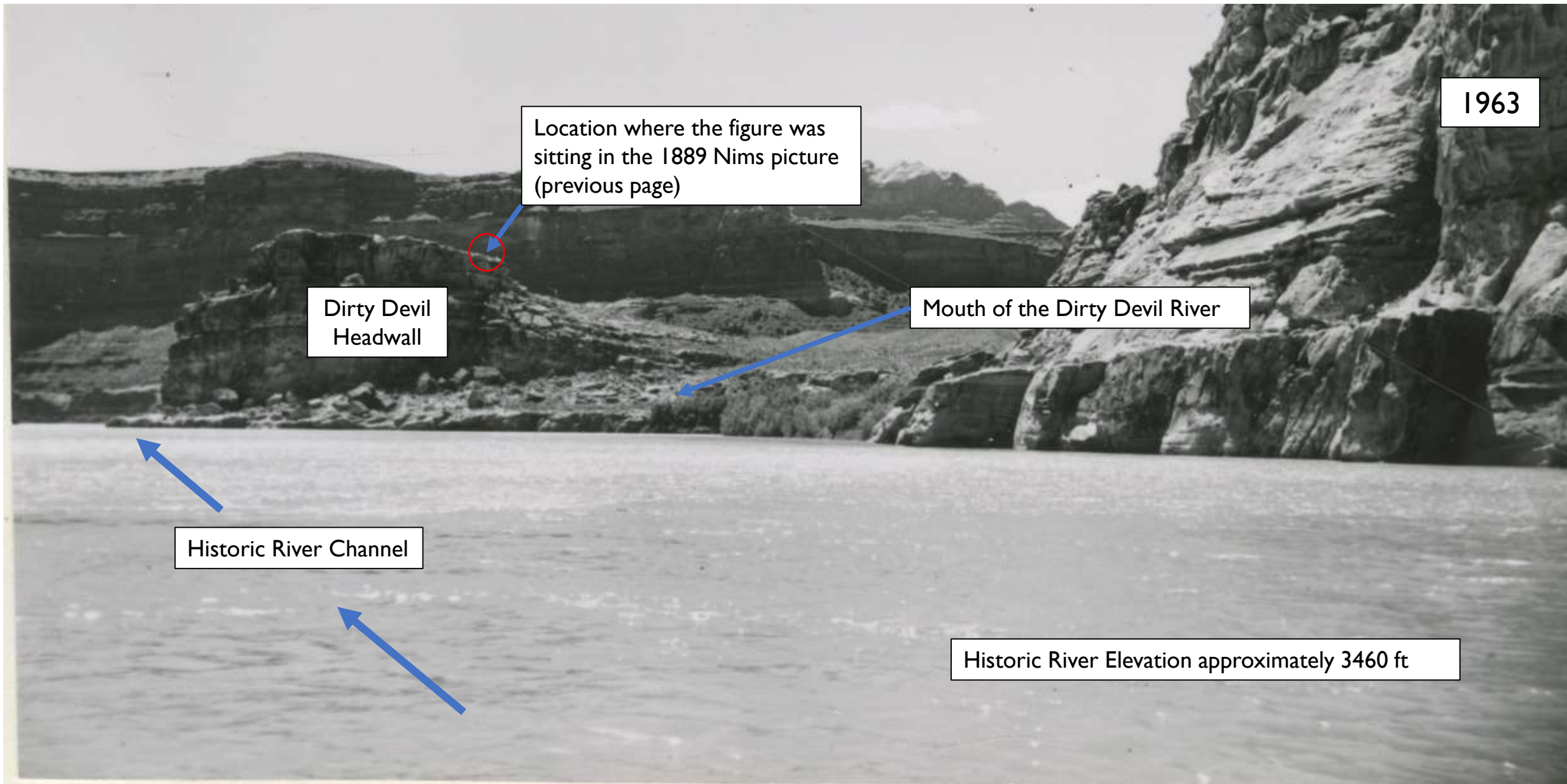
2020



Mouth of the Dirty Devil River

s3053_1889_Nims_Powell_DirtyDevil-2
USGS Flagstaff archive

Match of Nims photo,
Looking out across the perched river towards the mouth of the Dirty Devil
Peter Lefebvre, June 2020



1963

Location where the figure was sitting in the 1889 Nims picture (previous page)

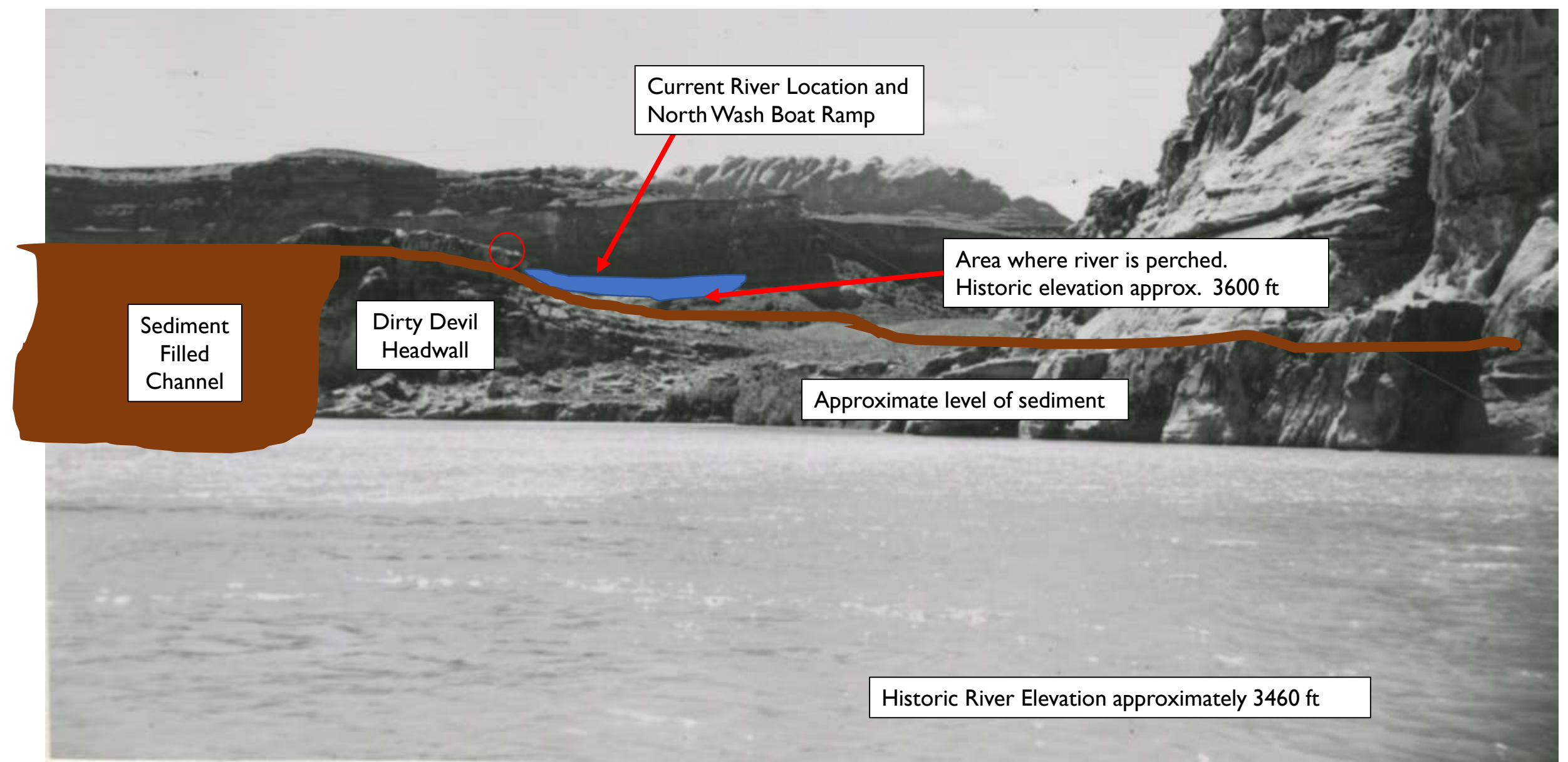
Dirty Devil Headwall

Mouth of the Dirty Devil River

Historic River Channel

Historic River Elevation approximately 3460 ft

P0197n38_02_019_Narrow Canyon mile 169.7_Just above mouth of Dirty Devil, comes in on right above bluff left center, 05-24-1963, Cropped/Altered C. Gregory Crampton Collection, Special Collections, J. Willard Marriott Library, University of Utah



Sediment Filled Channel

Dirty Devil Headwall

Current River Location and North Wash Boat Ramp

Area where river is perched. Historic elevation approx. 3600 ft

Approximate level of sediment

Historic River Elevation approximately 3460 ft

P0197n38_02_019_Narrow Canyon mile 169.7_Just above mouth of Dirty Devil, comes in on right above bluff left center, 05-24-1963, Cropped/Altered C. Gregory Crampton Collection, Special Collections, J. Willard Marriott Library, University of Utah

An aerial photograph showing a wide river channel that branches out into a complex network of smaller channels and distributaries. The terrain is rugged and appears to be composed of sedimentary or volcanic material, with various shades of gray and brown. The river channels are dark, contrasting with the lighter, textured land. The overall scene depicts a natural, unaltered river delta system.

1959

USGS Overflight Picture
August 7, 1959

Dirty Devil
Headwall

Pre Dam River Channel

Historic Elevation ~3465

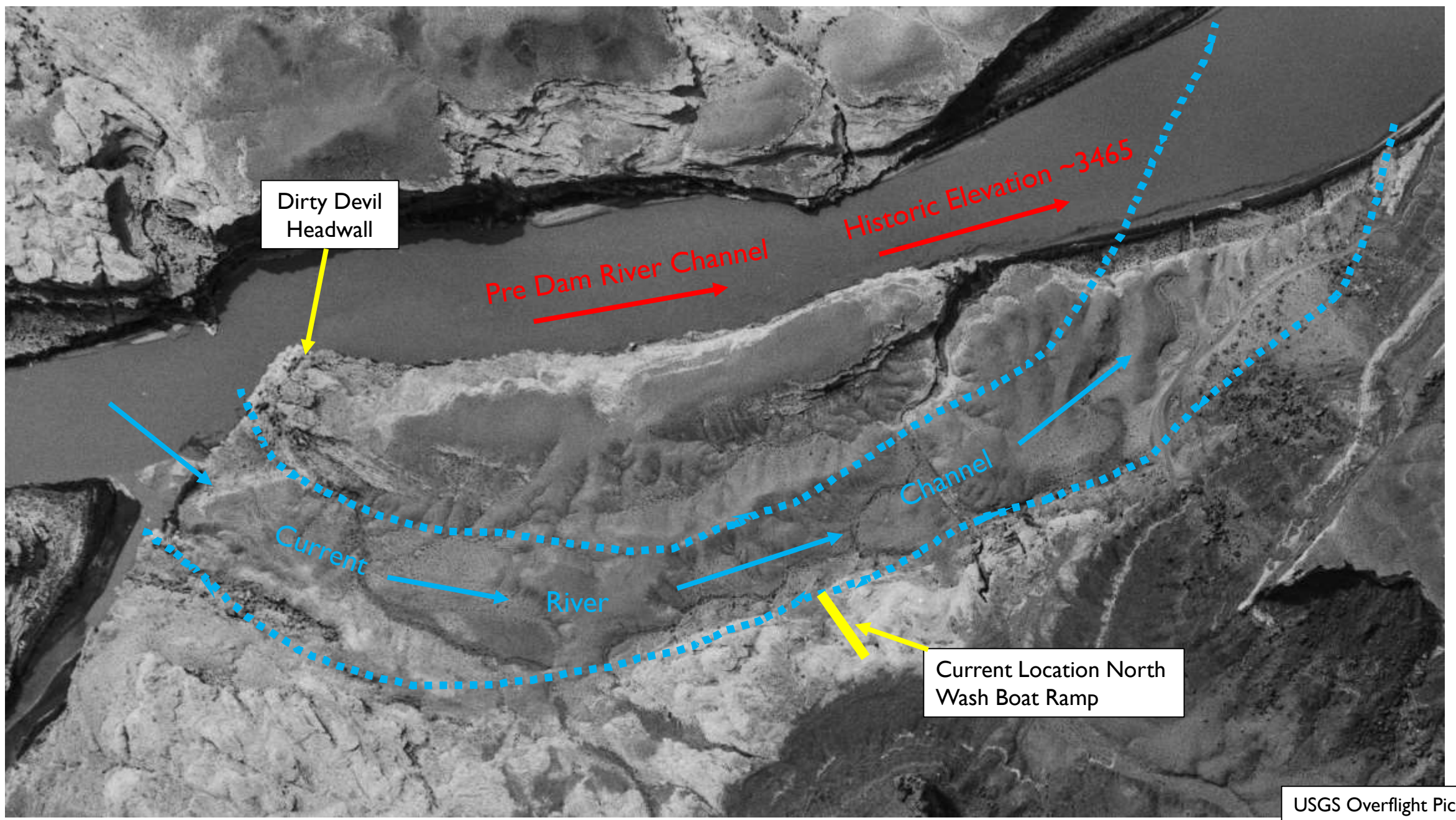
Current

River

Channel

Current Location North
Wash Boat Ramp

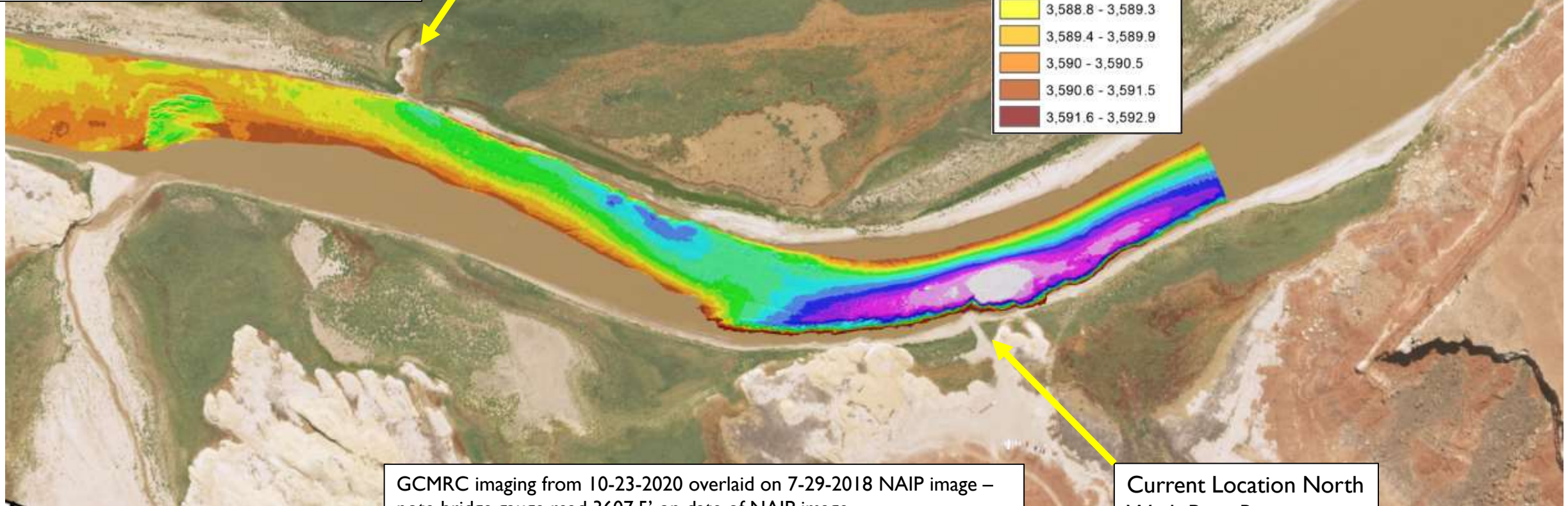
USGS Overflight Picture
August 7, 1959



North Wash Channel Mapping

Depth by Elevation
Overlaid on Google Earth Image

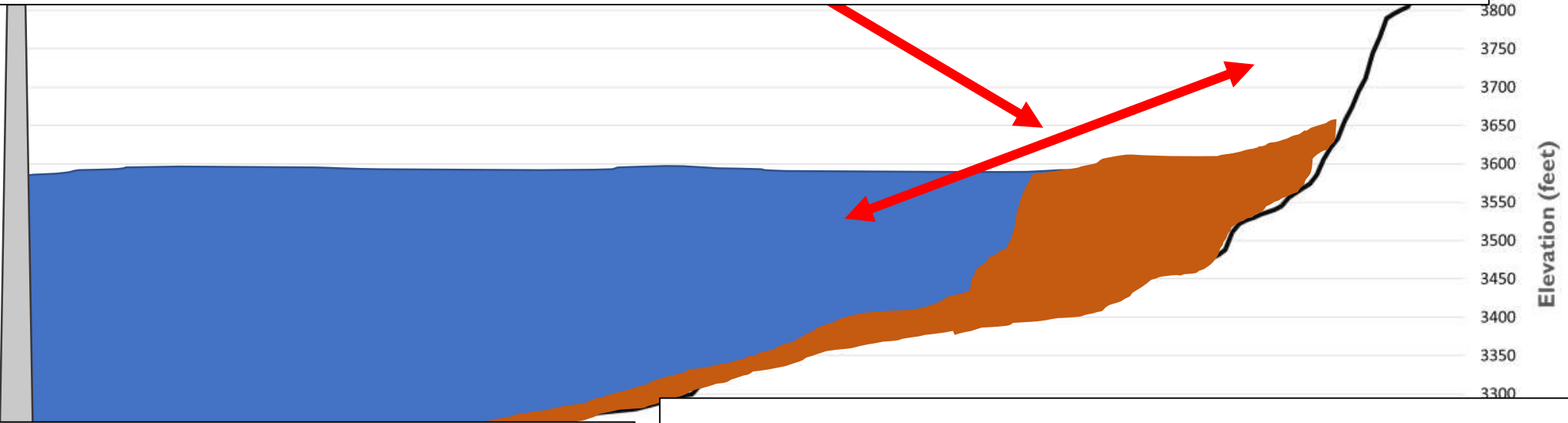
USGS water surface elevation at the bridge:
3598.42 ft on October 21, 2020



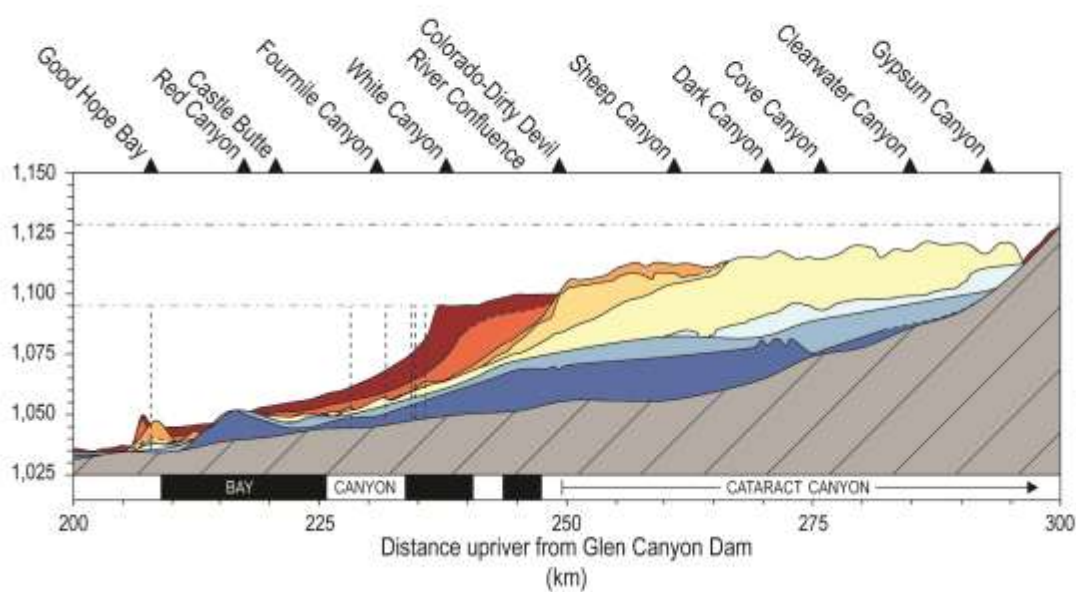
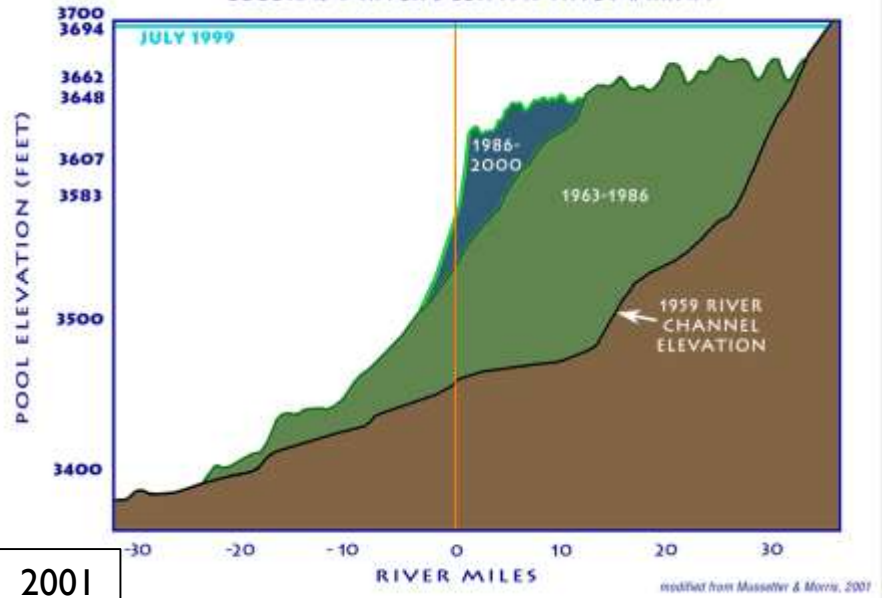
GCMRC imaging from 10-23-2020 overlaid on 7-29-2018 NAIP image – note bridge gauge read 3607.5' on date of NAIP image

Current Location North Wash Boat Ramp

The Sediment Delta of the Colorado at the current average elevation of Lake Powell 3,600 ft
58 years of sediment, 35-40 miles long



COLORADO RIVER DELTA AT HITE MARINA



- 1963 - PreGCD (Root et al., 2019)
- 1970 (USBR, 1973)
- 1973 (USBR, 1973)
- 1976 (Condit et al., 1978)
- 1986 (Ferrari, 1988)
- 1998 (Hart et al., 2005)
- 2001 (Hart et al., 2005)
- 2005 (OMG-UNB, 2005)
- 2017-2018 (Poppenga et al., 2020)
- ▲ Landmarks
- Full pool (1,128m)
- Coring lake level (1,095m)
- ⋮ Longitudinal core location

1932



CK_Steward_Expedition_1932_White_Canyon_P_1

1963



P0197n41_01_02Crampton Ft Moki flipped and lightened, Special Collections, JWillard Marriot Library, University of Utah

2004

Delta not showing
at reservoir level
3,555 ft



Tom McCourt Ft Moki Nov 2004

A Photo Match on the Colorado River Delta Near White Canyon



P0197n41_01_02 Crampton, June 1960; flipped, lightened, and cropped
Ancient Settlement Site above the mouth of White Canyon
Special Collections, J Willard Marriott Library, University of Utah

Historic River Elevation approximately 3,440 ft
The pre-reservoir town of White Canyon was in the cottonwoods in the
bottomlands on the right.

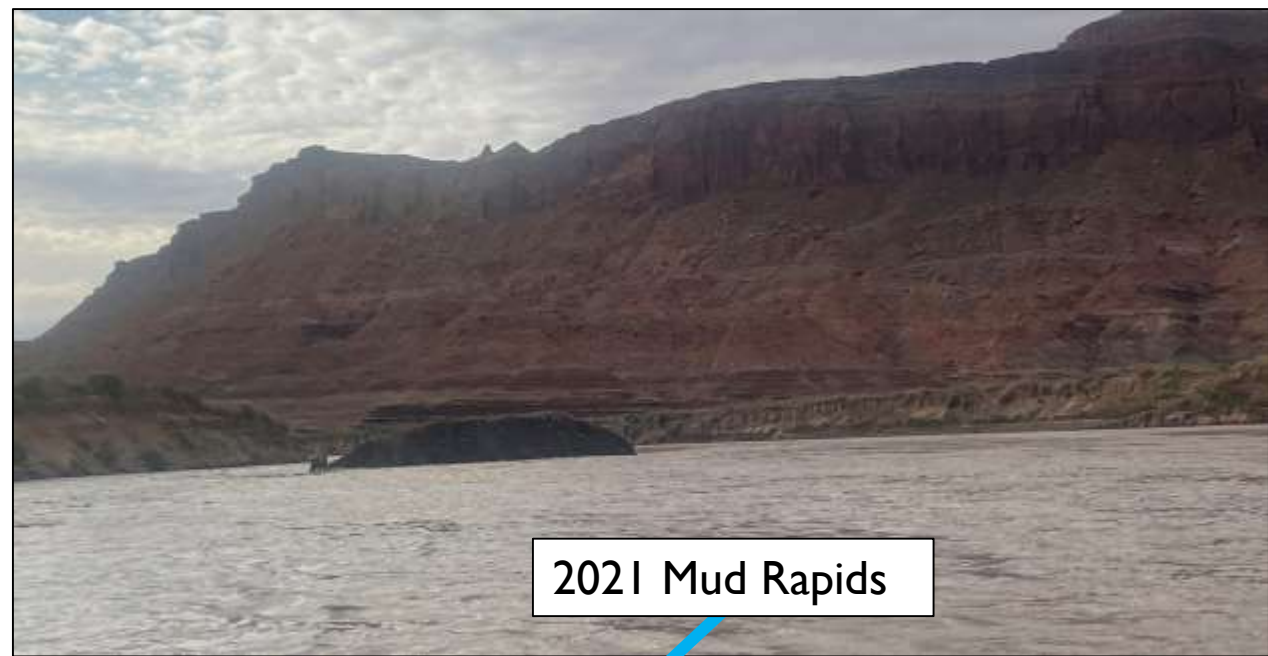


White Canyon Area, a close match; 01-16-2021;
Reservoir Elevation at Dam 3579.14'
Mud bank was 6-8 feet above water level

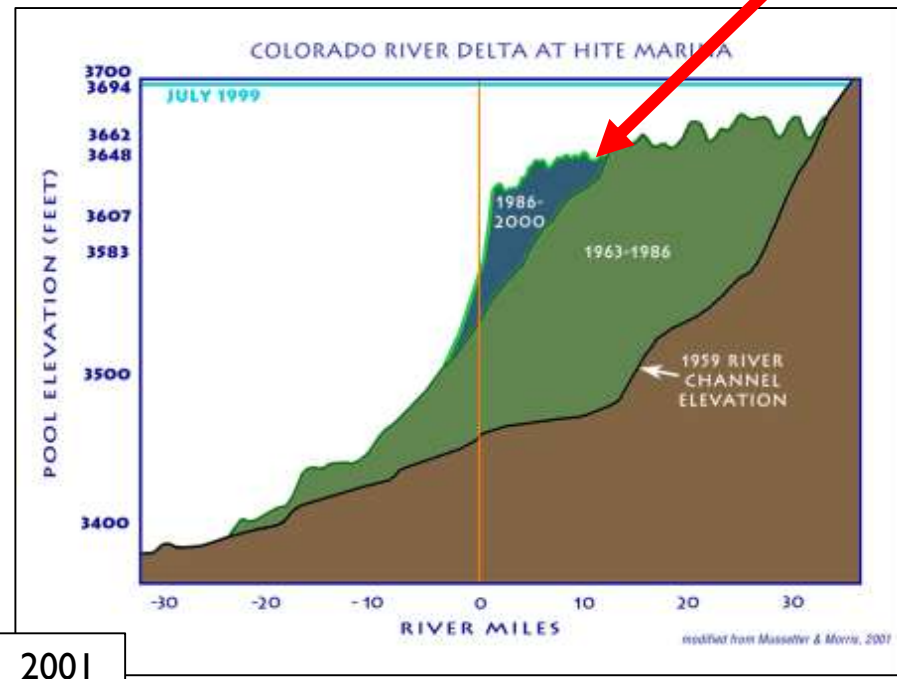
The location of the pre-reservoir town White Canyon is directly underneath
picture location –
now covered by approximately 145 feet of sediment.



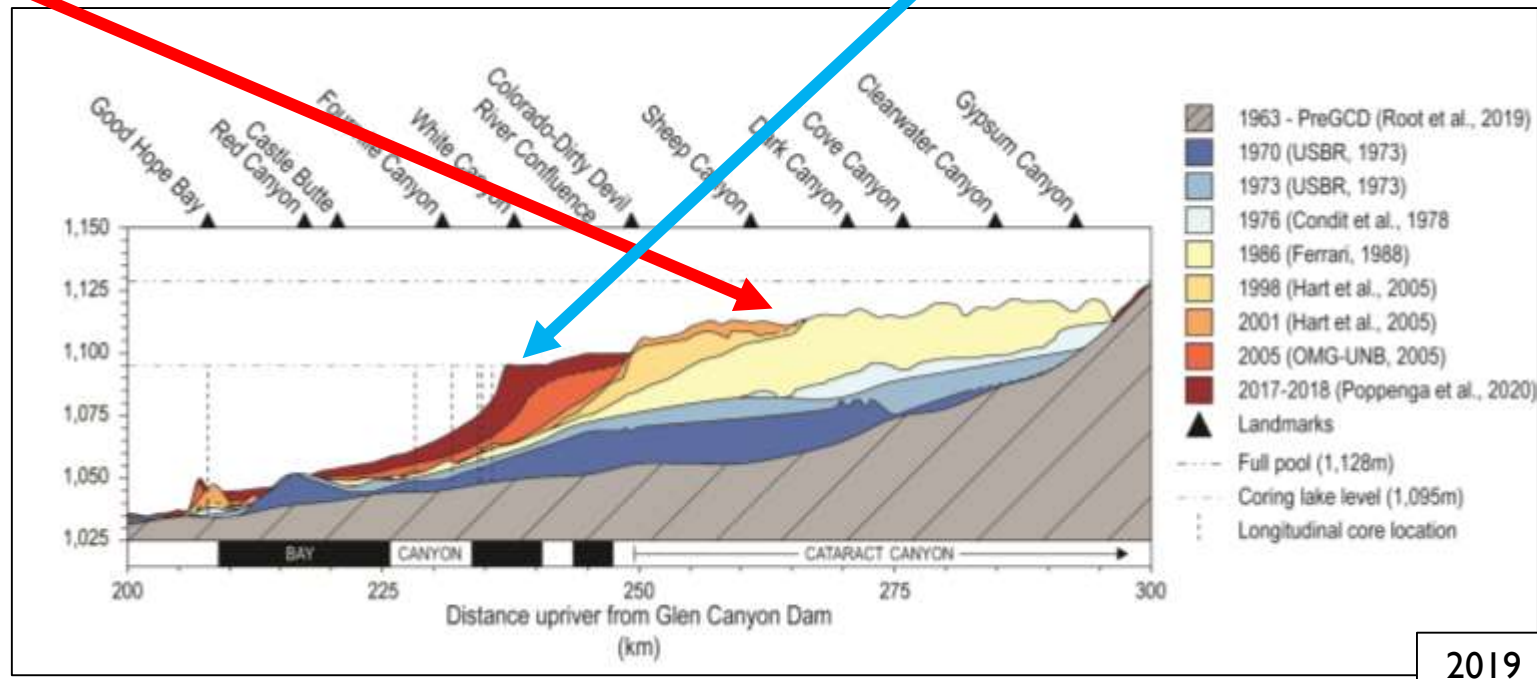
2002-2005 Mud Rapids



2021 Mud Rapids



2001



2019

March 2016



White Canyon

Google Earth Image, Colorado River Bridge to White Canyon, 3/17/2016, Lake Level 3593'

January 2021



White Canyon

Two Mile Canyon

2021-01-14-00_00_2021-Colorado Delta, Copernicus

August 2021

Two Mile Canyon



The advancing delta moving past Two Mile Canyon's mouth
NPS overflight pic
Late summer 2021
The green water is 80-100 ft in depth



A Delta Panorama



Trying to capture the enormity of the sediment delta at White and Farley Canyons; The original river channel was 145-150 feet below the current delta level; New Year's Day, 2021

Returning Rapids



Project



Returning Rapids Project
is a program of
Glen Canyon Institute

This presentation was compiled by:

Mike DeHoff, Principal Investigator, Returning Rapids Project

Editing and consultation assistance from **Meg Flynn**, Investigator, Returning Rapids Project

Additional support from:

Peter Lefebvre, Investigator, Returning Rapids Project

Chris Benson, Investigator, Returning Rapids Project

Ariana Lowe, Administrative Ace, Returning Rapids Project

More to come.

Contact the Returning Rapids Project research team at:
contact@returningrapids.com

For more information, project updates, or to make a donation please visit our website: returningrapids.com