BUREAU OF RECLAMATION

Fresno Dam Safety Public Meetings

March 14-17, 2022

Milk River Project, Montana

Steven Darlinton, Project Manager

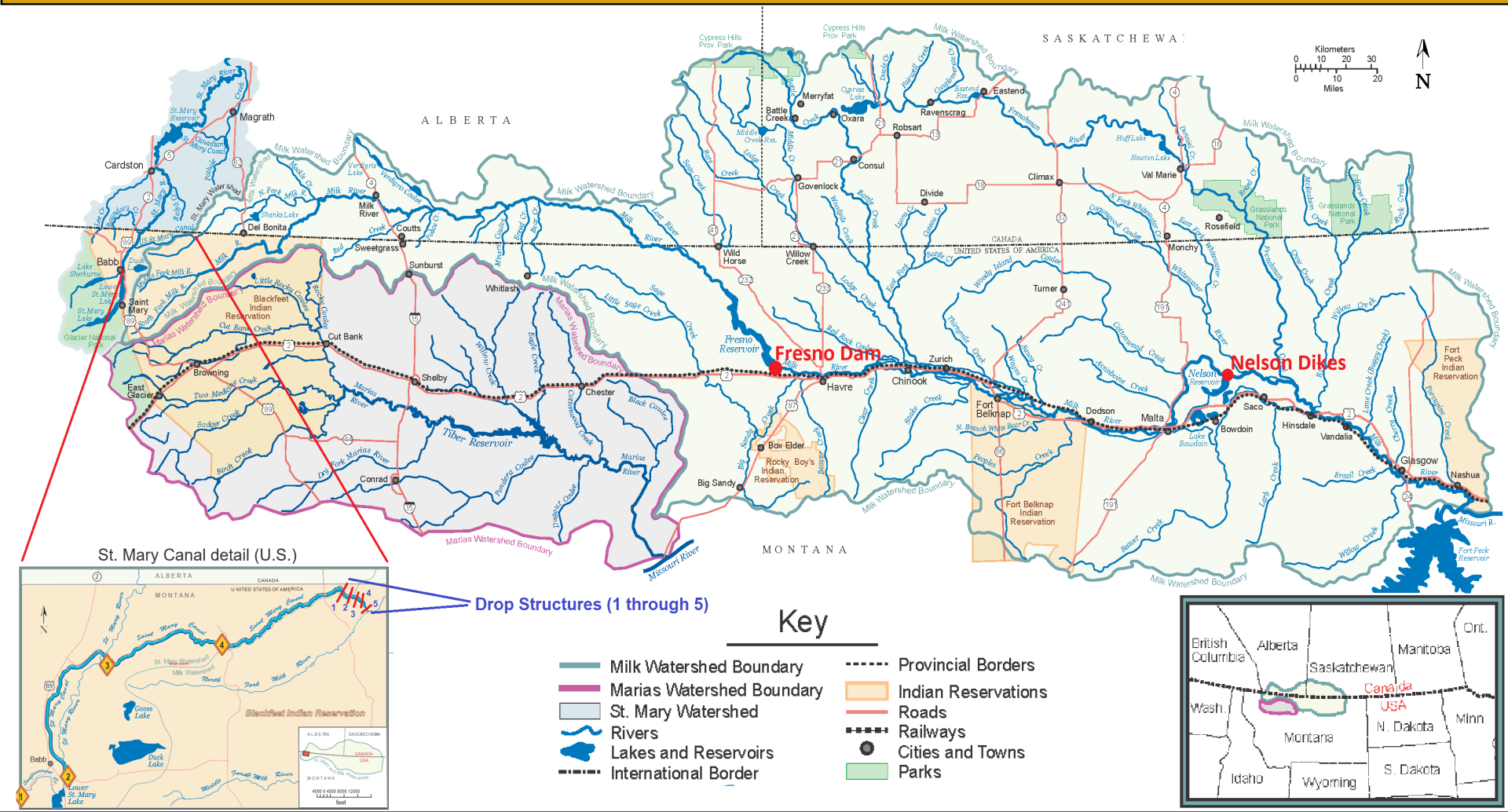
Agenda

- Project Overview
  - Reason for the Project
  - Scope of the Project
  - Current Schedule
- Operational Impacts
- Recreational and Local Impacts
- Repayment
- Questions

BUREAU OF RECLAMATION

MISSOURI BASIN REGION

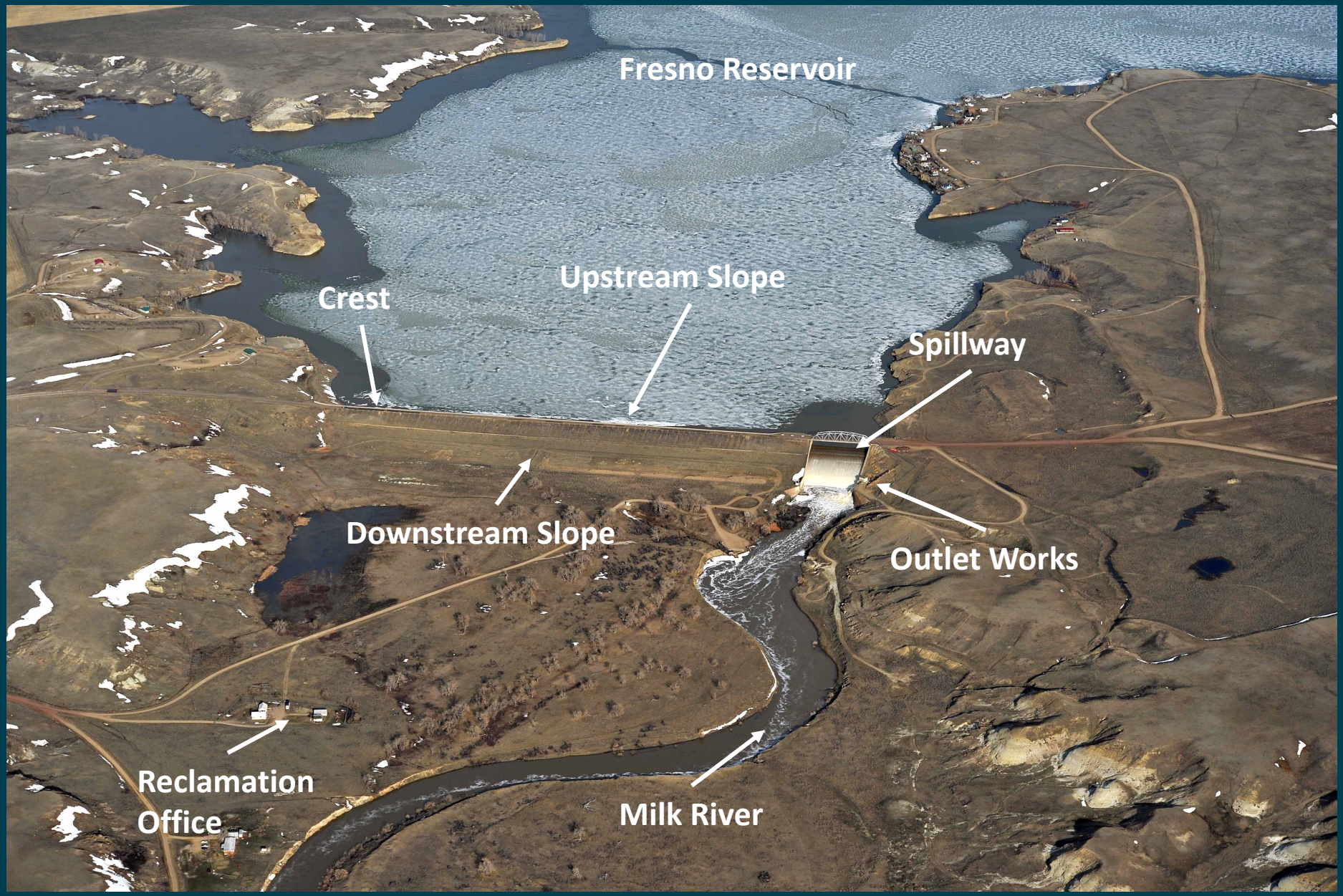
ST. MARY CANAL AND OVERALL MILK RIVER PROJECT



Milk River Project

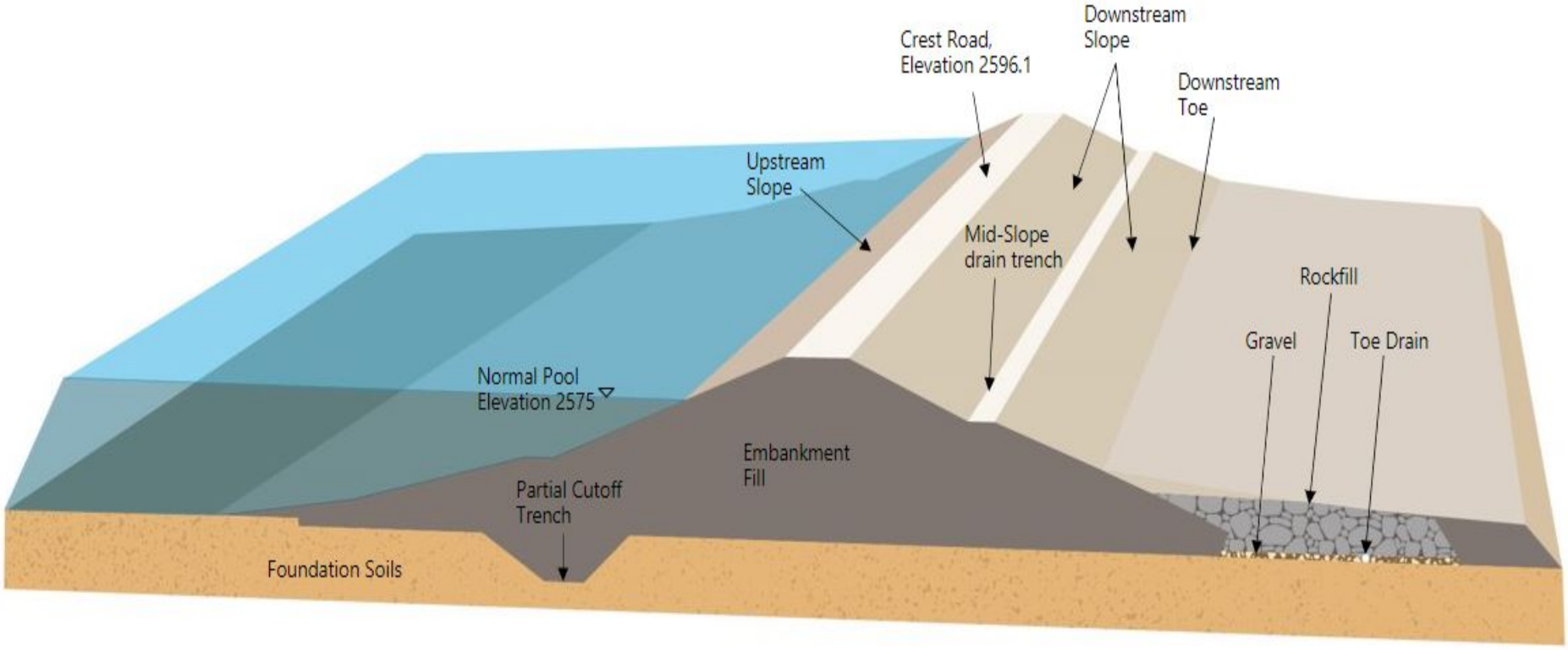
- Investigations begin in 1891 to supplement Milk River flow (dries up in summer)
- Project Authorized 1903
- Boundary Waters Treaty 1909
- Canal construction completed in 1915, modified in 1922
- Lake Sherburne Dam completed in 1921
- Fresno Dam completed in 1939

Fresno Dam


Fresno Reservoir
Crest
Upstream Slope
Spillway
Downstream Slope
Outlet Works
Reclamation Office
Milk River

Fresno Dam

- **Constructed 1937-1939**
- **Broad, homogeneous embankment**
- **Crest Length: 2070 ft, Crest Width: 22 ft**
- **Structural Ht. of 110 ft**



Benefits and Partners

- Owned and Operated by Reclamation
- Milk River Project benefits:
  - Irrigation
  - Municipal, Rural and Industrial Water Supply
  - Recreation
  - Fish and Wildlife
  - Flood Control
- Supplies 201,100 acre-feet of water annually to 120,000 acres
- The total project benefits are approximately $3.4 million annually

Safety of Dams Act 1978 PL 95-578 as amended

Seven major dam failures and incidents occurred in 1960s-1970s

- President Carter directed development of Federal Guidelines for Dam Safety
- Prompted US Congress to take action and passed Safety of Dams Act of 1978
  - Authorizes modifications of Reclamation Dams to preserve structural safety

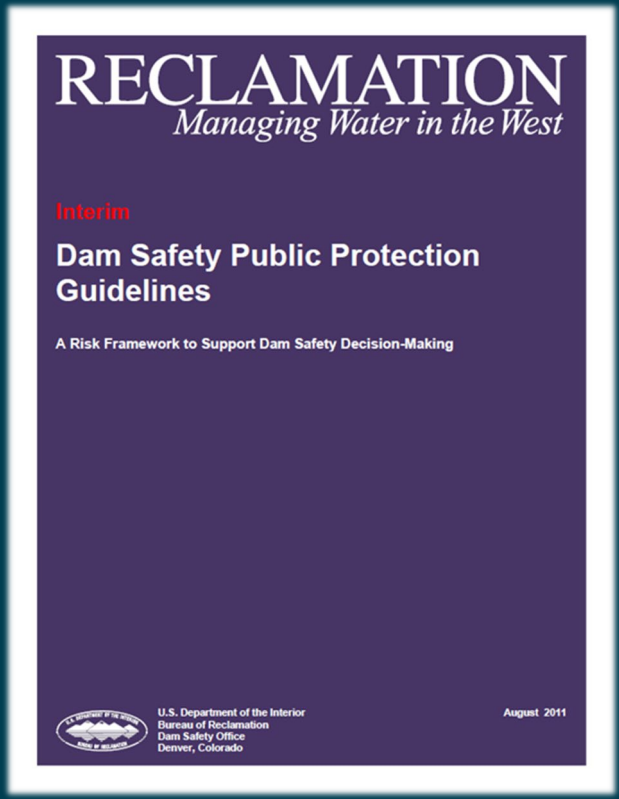
    "the cause of which results from new hydrologic or seismic data or changes in the state-of-the-art criteria"
  - 1984 Modification to establish modification costs are reimbursable and allocated to authorized purposes within 50 years of substantial completion

Teton Dam, ID

Risk Assessment

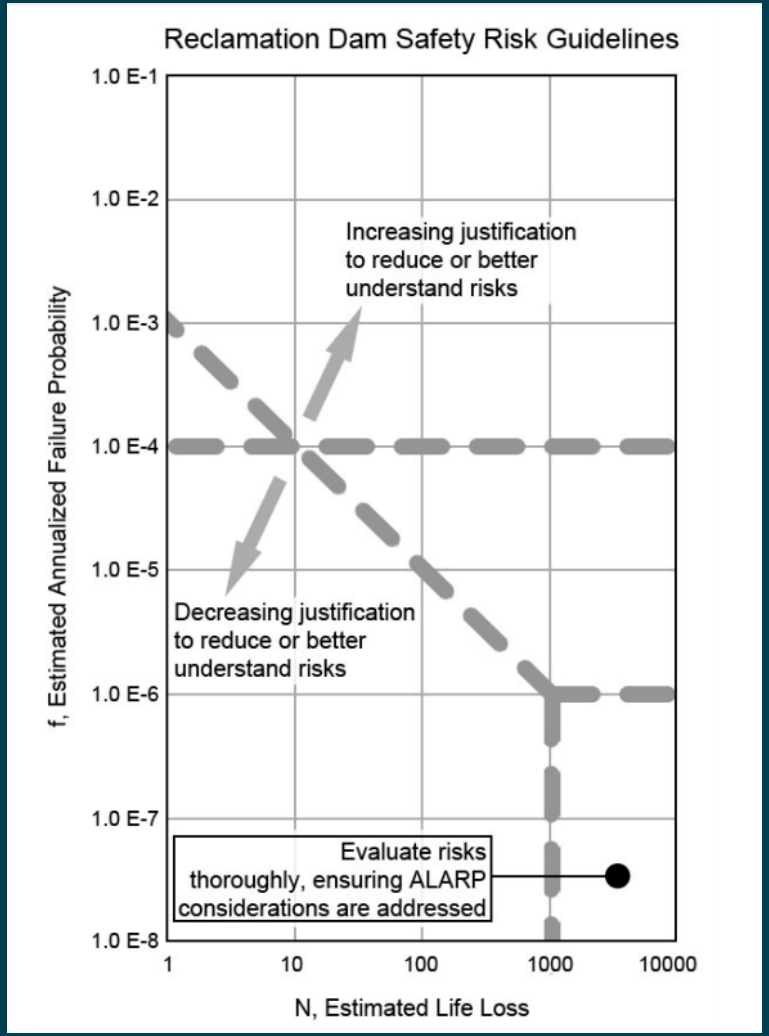
Public Protection Guidelines:

- Reclamation first instituted Public Protection Guidelines in 1997.
- Reclamations PPGs are influenced by risk guidelines of other organizations:
  - Australian National Committee on Large Dams
  - Canadian Dam Association
  - New South Wales Dam Safety Committee
  - Consistent with Risk Guidelines utilized by USACE, FERC, and other agencies
- Public Protection Guidelines were updated in 2011
- Currently being updated for 2022 publication



Risk Portrayal

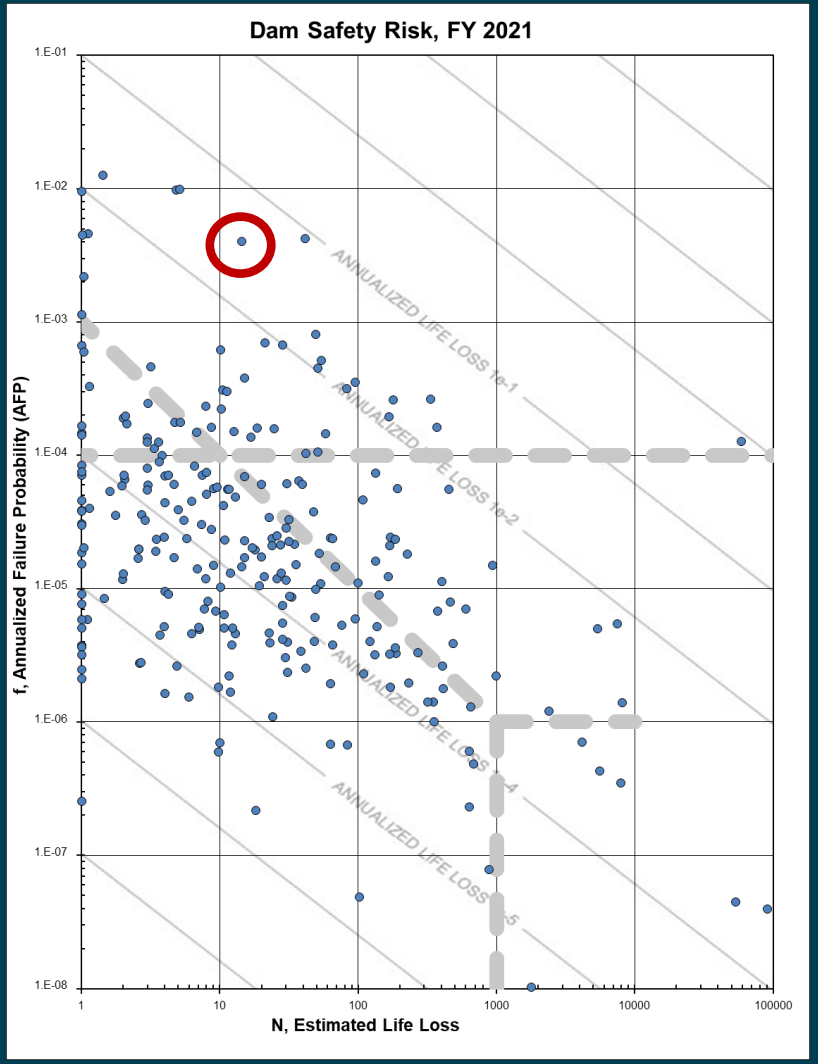
- Annualized Failure Probability-AFP
  - Reclamation uses a guideline of 1 in 10,000 per year to ensure a minimum level of safety when consequences are not high
  - AFP = (Probability of Load) x (Probability of Structural Response)
- Annualized Life Loss-ALL
  - Ensures our guidelines reflect societal aversion to large consequence events.
  - "Reclamation uses a guideline of 0.001 fatalities per year to address this measure of risk."
  - ALL = (AFP) x (Expected Life Loss due to Failure).



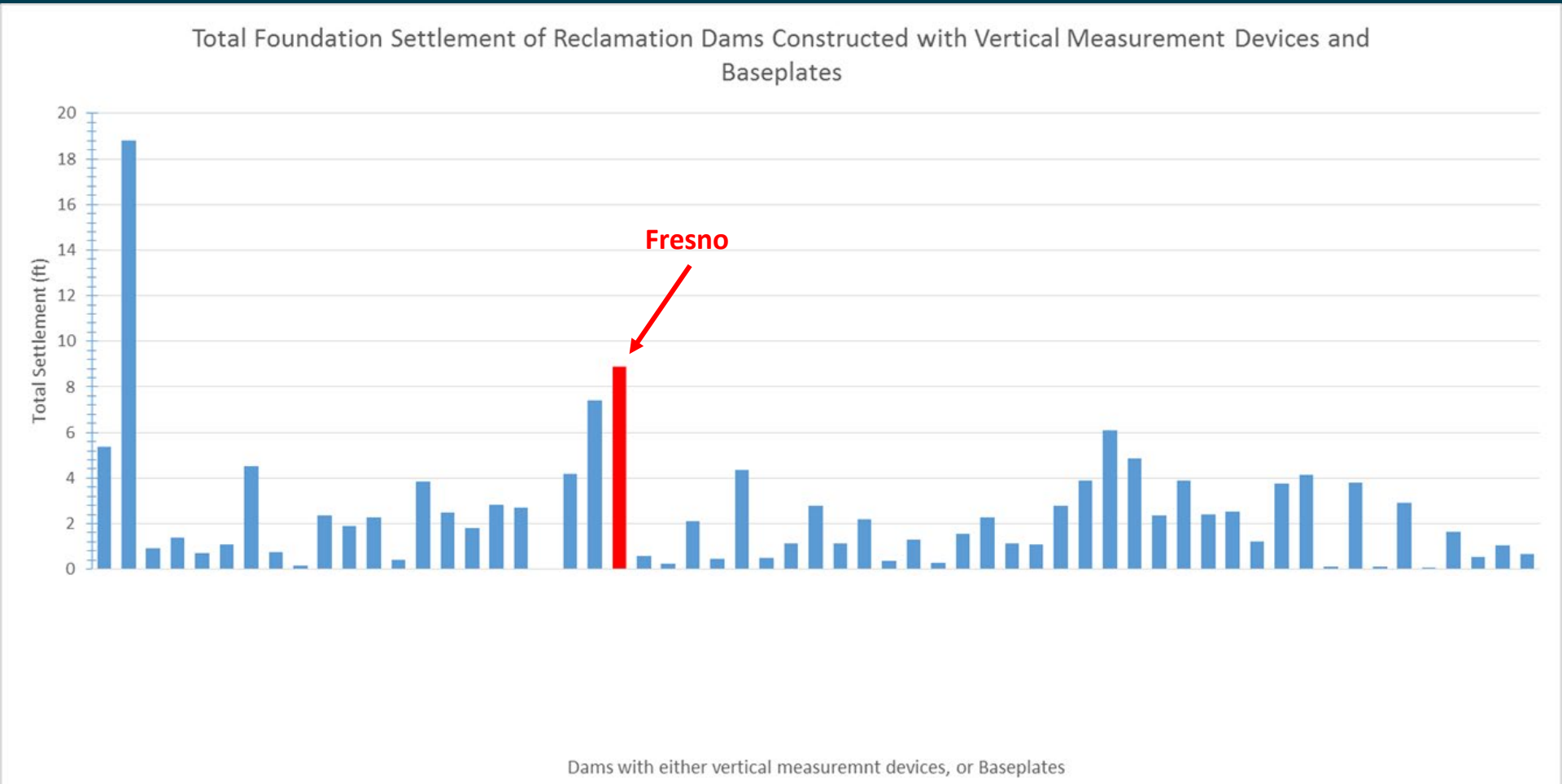
Reclamation Dam Safety Risk Guidelines f-N Chart

Reclamation Dams

- Fresno is one of the highest risk projects in the Missouri Basin Region
- Estimated risk is significantly above both the AFP and ALL guidelines to take action
- Covered under the Dam Safety Act for reimbursement due to changes in state-of-the-art

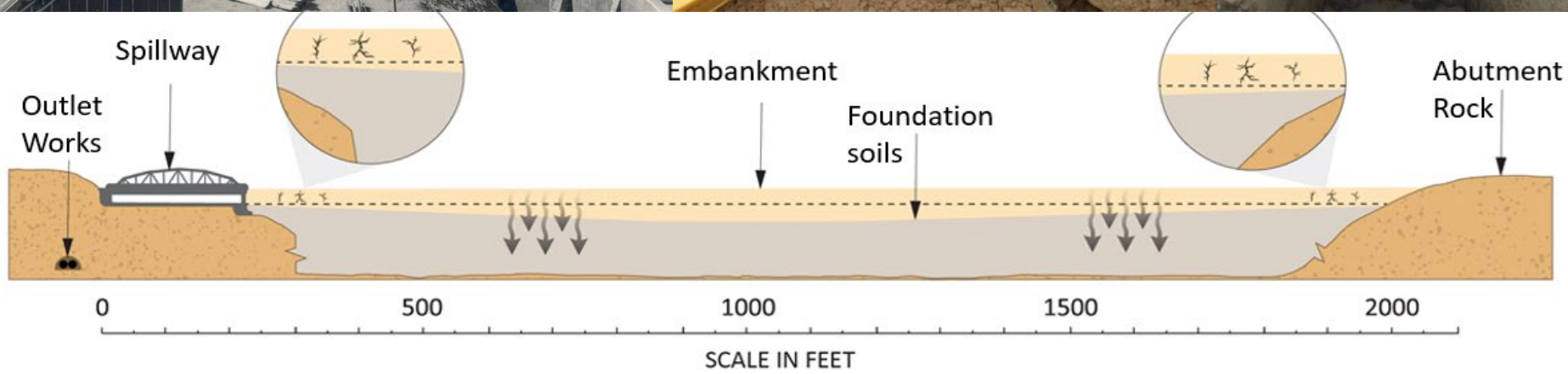


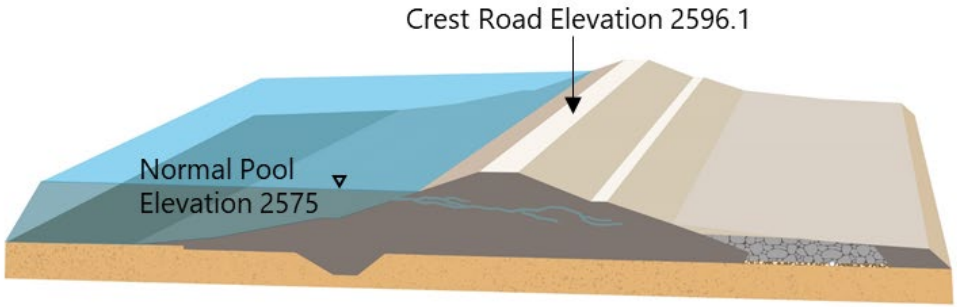
Fresno has experienced the second highest settlement of Reclamation Dams



Embankment Construction

- Founded on low strength, erodible soils that were too deep to construct a cutoff wall to bedrock
- Differential settlement between the abutments and foundation resulting in cracks in the embankment. Project has settled over 10 feet since construction
- Embankment materials are highly erodible





1) Cracking in the embankment due to settlement introduces reservoir water into embankment, erosion initiates through the cracks.

2) Embankment soils erode through an unfiltered exit on the downstream slope.

3) Erosion continues through the unfiltered exit and sloughing of the downstream face begins.

4) As erosion continues and more of the downstream slope fails, eventually the dam is breached.

Internal Erosion through Embankment

Primary Risk Driver

Fresno Dam Spillway: Previous Repairs

2013 Spillway Repair: spillway floor slab and wall repair with largest repair along entire length of transverse contraction joint at Sta 10+63.5

2013 Spillway slab repair at station 10+63.50 (left). Void found near right wall looking upstream from station 10+63.50 (below).

Void looking downstrean
10+63.50 (left)

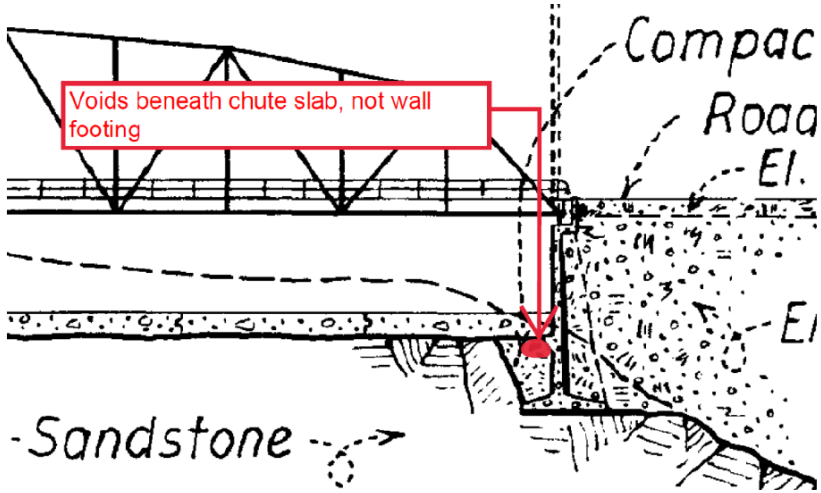


Figure 5 Illustration of the location of the spillway slab void in relation

Fresno Dam Spillway: Existing Conditions from 2018 CR

Figure 25.—Concrete damage creating unfavorable transverse offset for spillway flows (facing left) (CR photo CE-45) [2]

Photo CE-43 – Fresno Dam – Severe concrete damage and exposed steel rebar on left side of spillway chute slab (near stilling basin, facing downstream). 8/15/2018

Independent Reviews

- Robin Fell
  - New South Wales
- Consultant Review Board (AECOM)
  - Phase 1 (Dam Safety)
  - Phase 2 (Design)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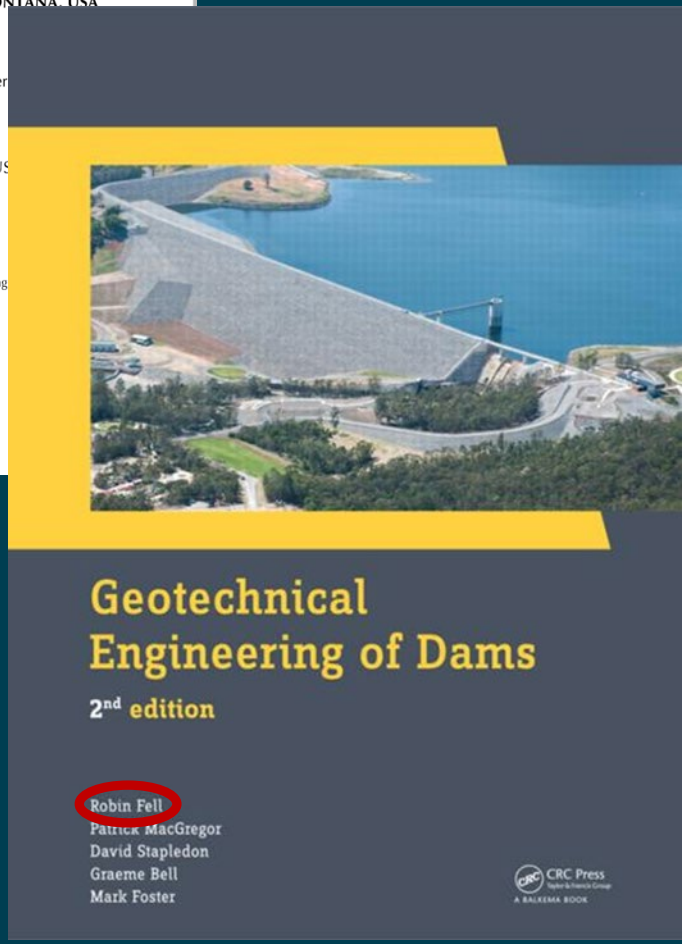
INDEPENDENT REVIEW OF THE RISKS
ASSOCIATED WITH SEEPAGE THROUGH
CRACKS AT FRESNO DAM, MONTANA, USA

for
United States Department of Inter
Reclamation

Through
URS Group, AECOM, Denver, US
Your reference: Michael May

by
Robin Fell
Emeritus Professor
School of Civil & Environmental Engineering
The University of New South Wales

Date of Issue: 10 April 2015
Our Reference: J086716



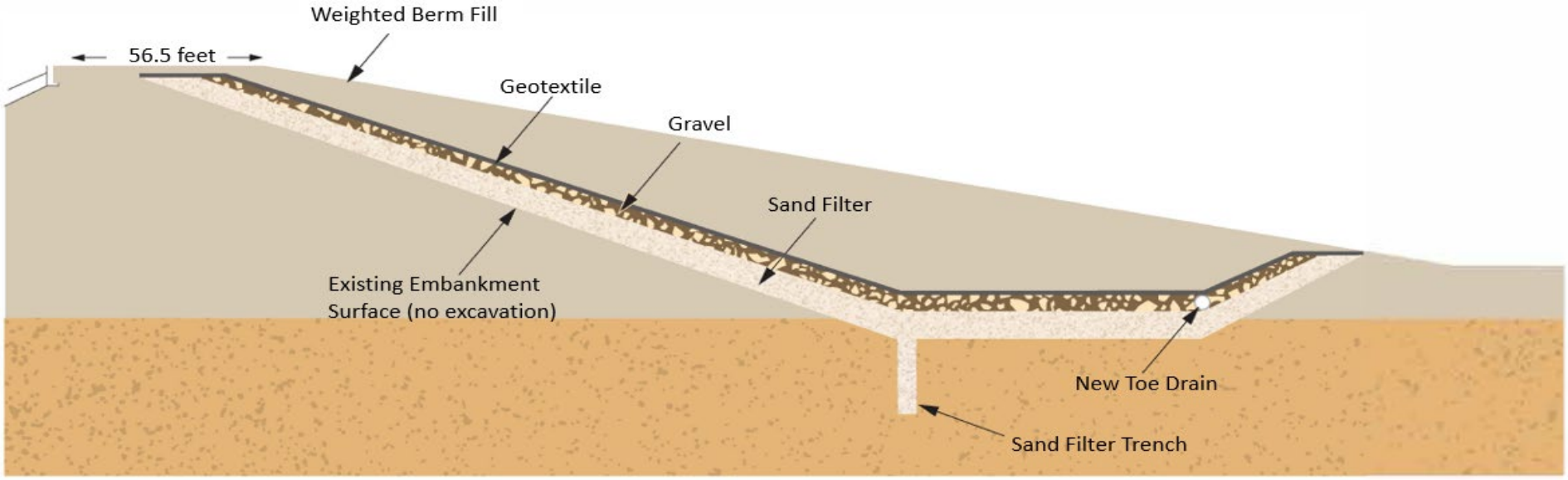
Reviews concurred with the Dam Safety Risks

Preferred Alternative – Buttressed Sand Filter and Drain without Excavation and Spillway Joint Replacement

Step 1: Install Dewatering and Excavate Sand Filter Trench

Step 2: Install Sand Filter and Gravel Drain

Step 3: Replace Spillway Joints



Other Alternatives Evaluated

- Embankment
  - Buttressed Sand Filter and Gravel Drain with Excavation and Spillway Joint Replacement
  - Embankment Cutoff Wall (both biopolymer and cement bentonite)
- Full Dam Breach
  - Complete loss of project benefits
  - Reservoir completely drained of water
- Reservoir Restriction
  - Reservoir completely drained
  - Complete loss of project benefits

Economic Comparison of Alternatives

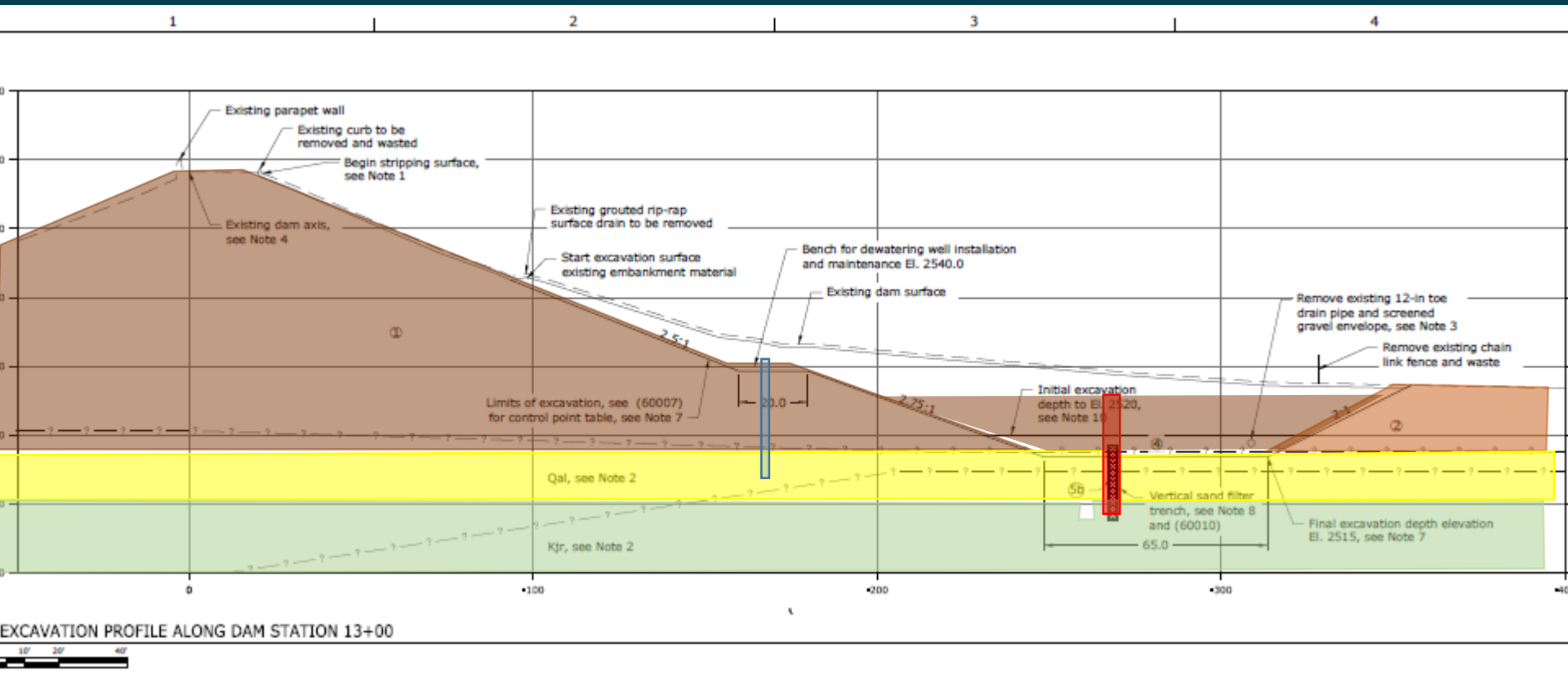
- Capital Cost
  = $77 million

- Preferred Alternative Total Economic Cost
  = $92.3 million

	Buttressed Sand Filter and Drain and Spillway Joint Replacement (Preferred Alternative)	Buttressed Sand Filter and Drain with Excavation[3] and Spillway Joint Replacement	Permanent Reservoir Restriction (2530)	Dam Breach
Capital costs[1]	$77.0	$81.0	$34.9	$125.4
Interest During Construction	$4.4	$4.6	$1.2	$5.9
Operation and Maintenance	$10.7	$10.7	$10.7	$0
EIS Costs			$3.0	$3.0
Lost Benefits[2]				
Irrigation	$0.1	$2.3	$32.3	$32.3
M&I	$0	$0.9	$12.9	$12.9
Recreation	$0.1	$2.0	$27.9	$27.9
Flood Control	$0	$1.2	$16.2	$16.2
Total economic cost including all lost benefits	**$92.3**	**$102.7**	**$139.1**	**$223.6**

[1] Capital costs for all alternatives include costs associated with the Corrective Action Study, National Environmental Policy Act, preparation of this modification report, and embankment modification field costs and are presented in 2021 dollars.

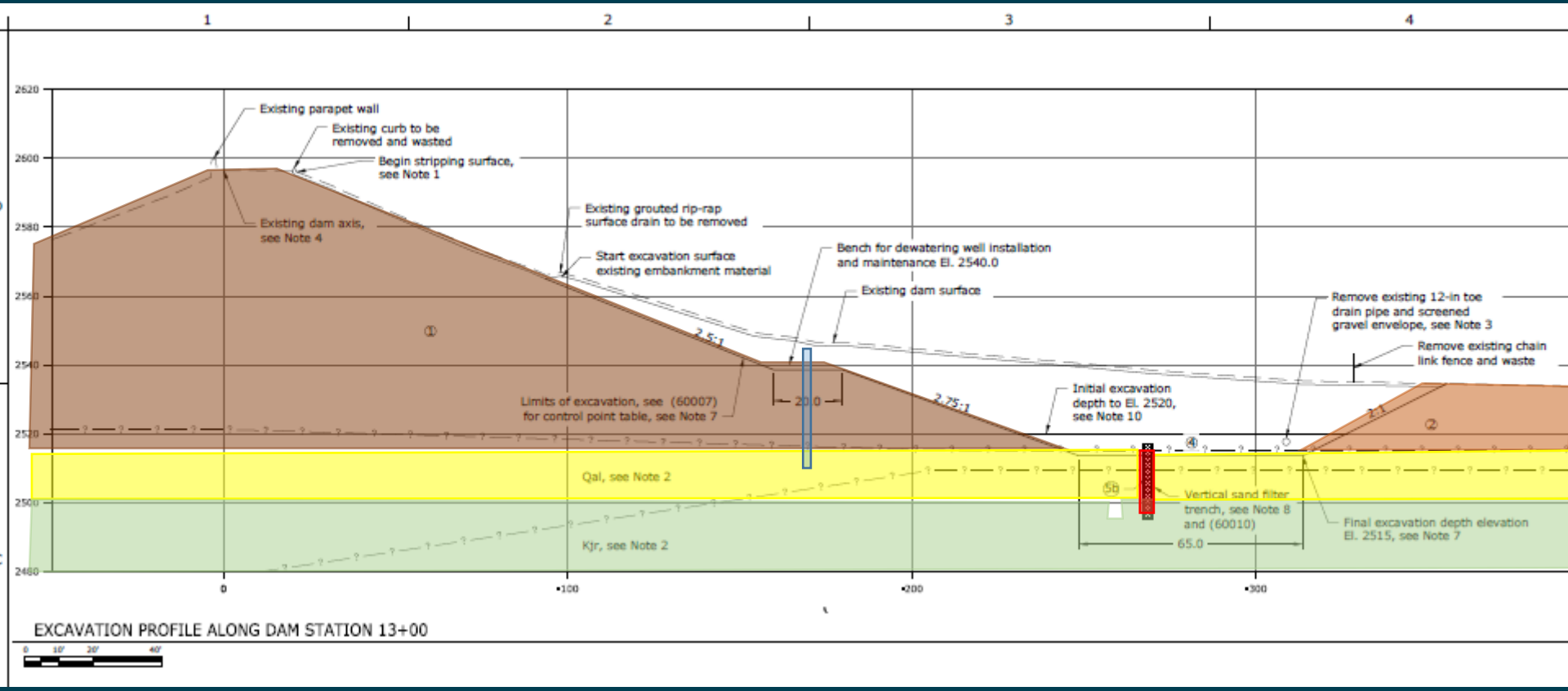
Fresno Dam Vertical Sand Trench



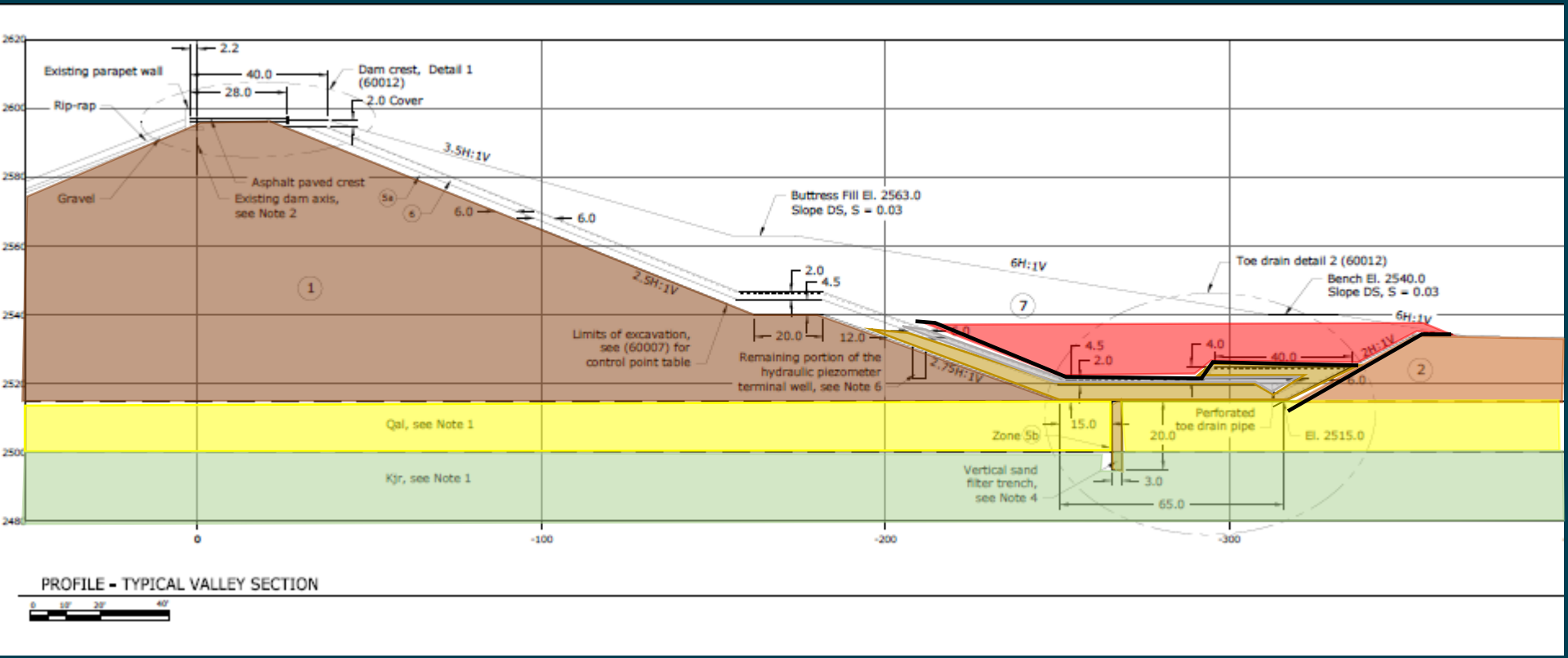
EXCAVATION PROFILE ALONG DAM STATION 13+00

Fresno Dam Vertical Sand Trench

Fresno Dam Final Excavation



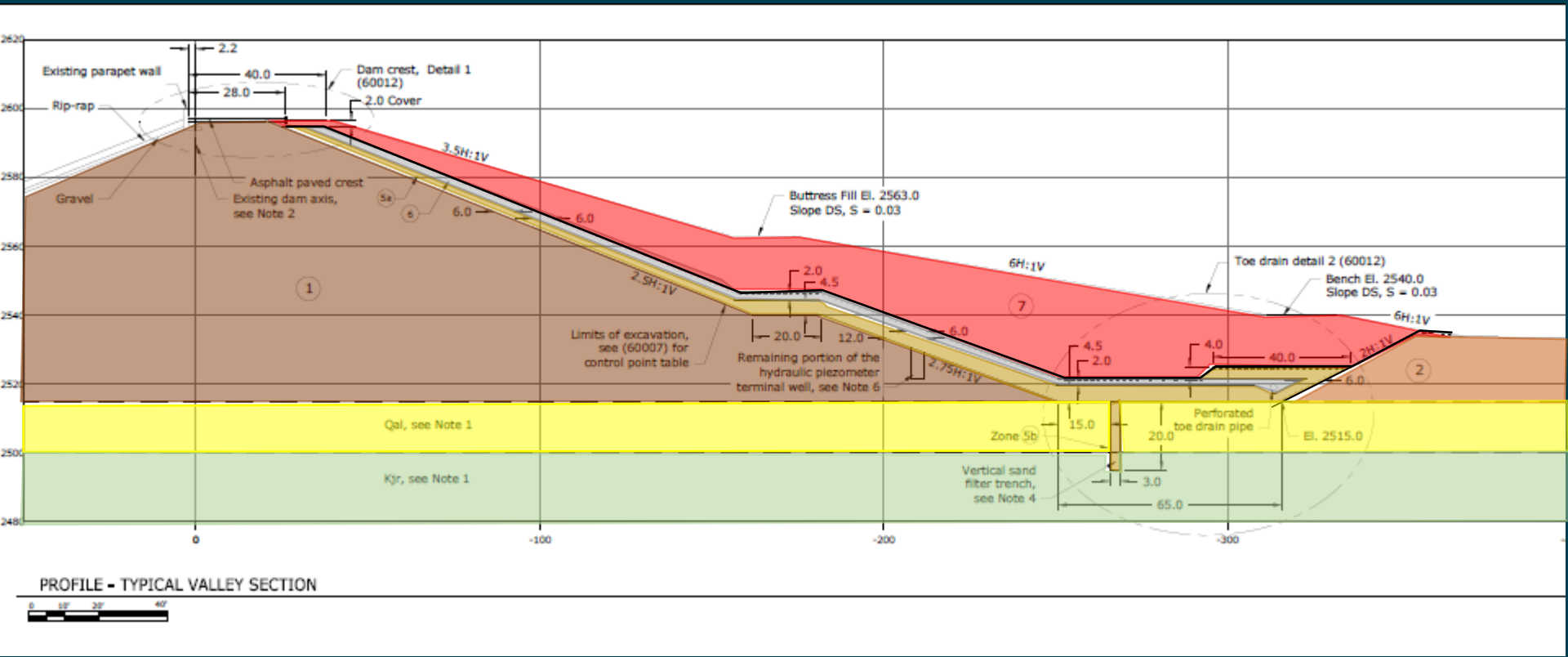
Fresno Dam Modification



PROFILE - TYPICAL VALLEY SECTION

0 10' 20' 40'

Fresno Dam Modification



PROFILE - TYPICAL VALLEY SECTION

Fresno Dam Modification

Fresno Dam Estimated Quantities

- Excavation
  - Zone 1
    - 165,000 CY
  - Qal
    - 26,000 CY
  - Rockfill
    - 29,000 CY
  - Borrow Areas
    - 165,000 CY
- New 24-inch diameter HDPE pipe
  - 2,000 ft perforated
  - 600 ft non-perforated
- Fill
  - Embankment filter sand
    - 85,000 CY
  - Vertical trench filter sand
    - 7,500 CY
  - Embankment filter gravel
    - 46,000 CY
  - Buttress fill
    - 310,000 CY
- Geotextile - 98,000 yd^2

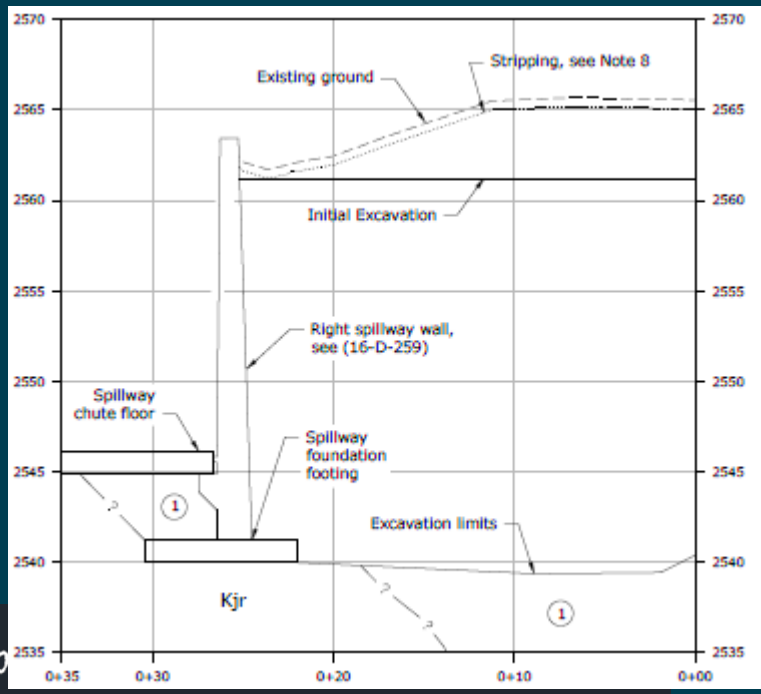
Schedule

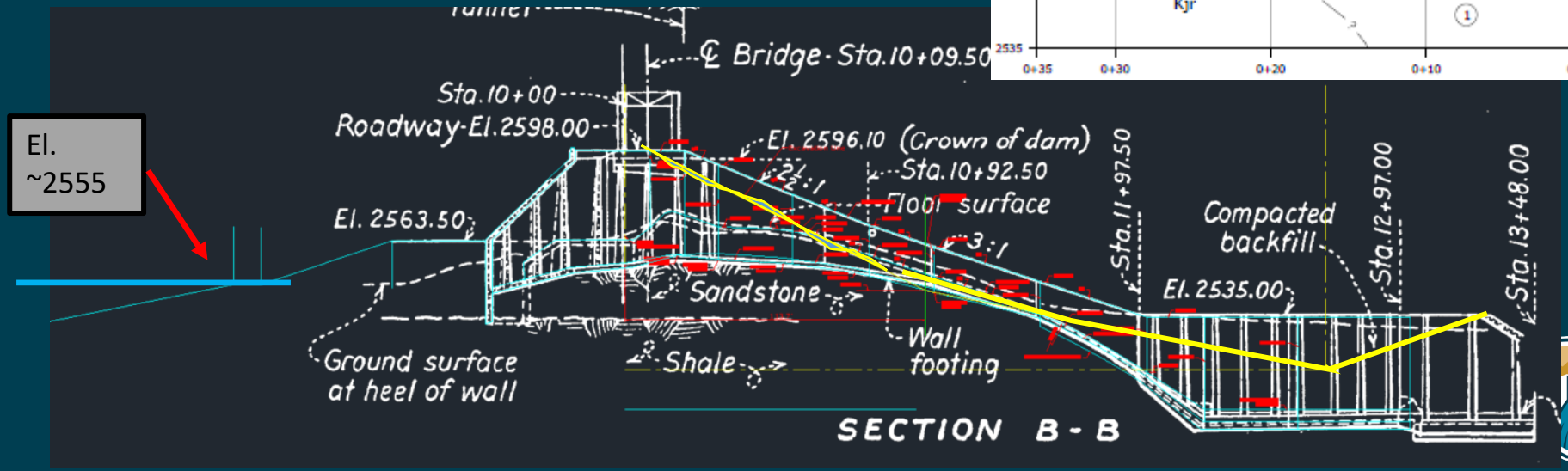
- Complete Milestones
  - Industry Day: March 16, 2021
  - Consultant Review Board Phase 2: July 22, 2021
  - NEPA Public Comment Period: August 4, 2021
  - FONSI: Sept 20, 2021
  - BON: January 18, 2022

- Upcoming Milestones
  - MOD Report to OMB: March 28, 2022
  - Specifications to Acquisitions: March 25, 2022
  - Award: February 14, 2023
  - Construction Completion: October 2026

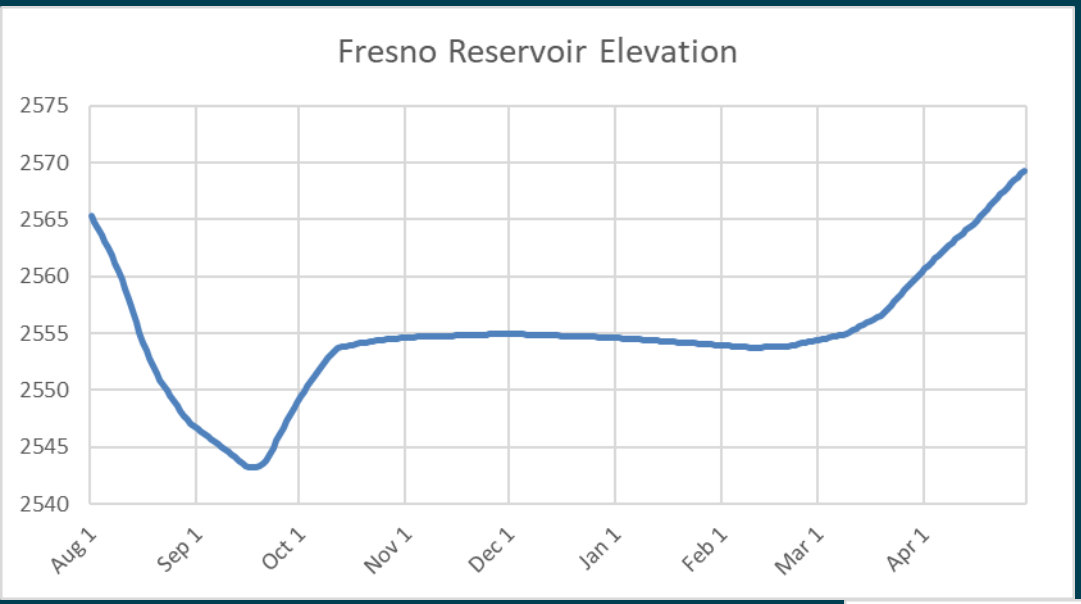
Construction Risk Mitigation Measures

- Restrict reservoir to 2555 for spillway wall excavation
  - Spillway work starts August 15 when reservoir elevations are lowest and in the dry season



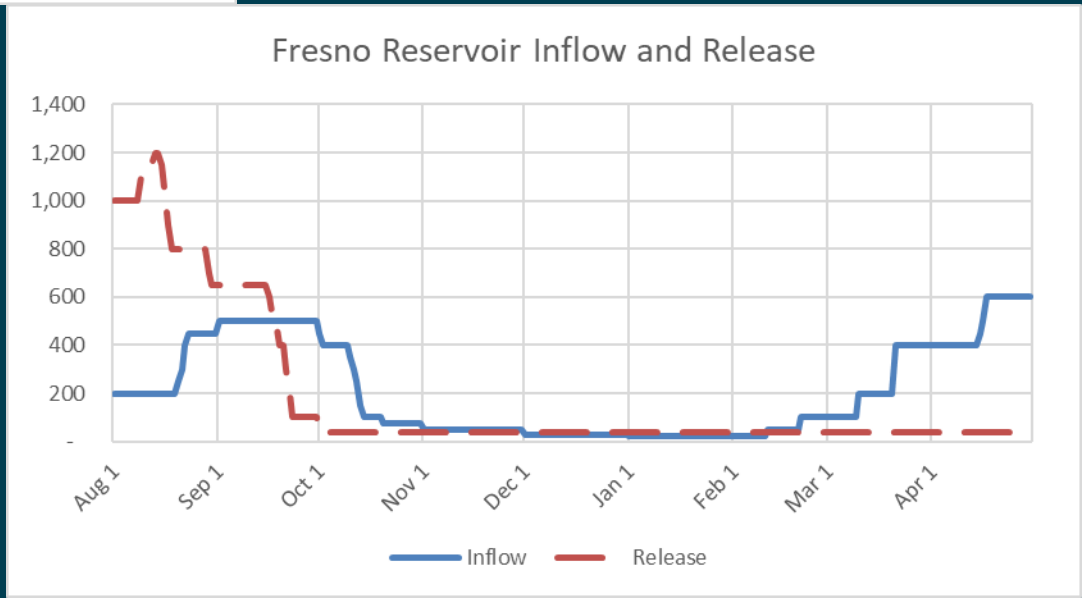


Water Operations



- 2555 feet elevation by Aug. 15
- Maintain irrigation releases as water supply allows
- Regain storage to 2555, if available water supply in St. Mary
- 40 cfs release through winter

- Storage Levels will be a little lower than winter of 2021-2022
- Refill will depend on natural runoff and St. Mary water supply



Recreation and Public Access

- River Fishing Access Closure
  - For public safety site be closed during the entire construction project
- Crest Road Limitations/Closure
  - Single lane restriction throughout construction
  - Closed August 15 through December 1 for spillway wall work
    - Season of closure will be contractor's decision
  - Will repair road from Highway 2 to bridge
- North Borrow Area Road Closures
  - Will only be required if there is not enough material in the South Borrow Area

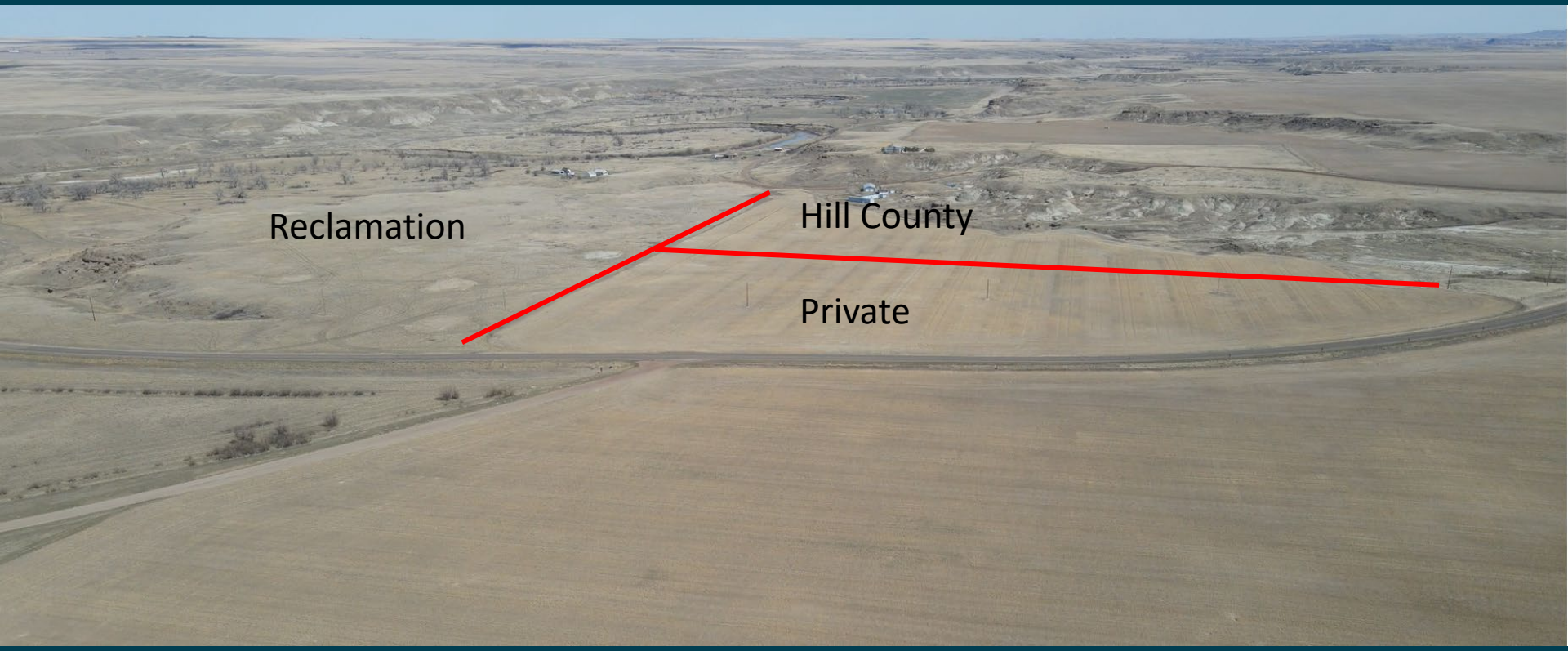
River Fishing Access Site

- Closed during entire construction project
- No other recreation closures

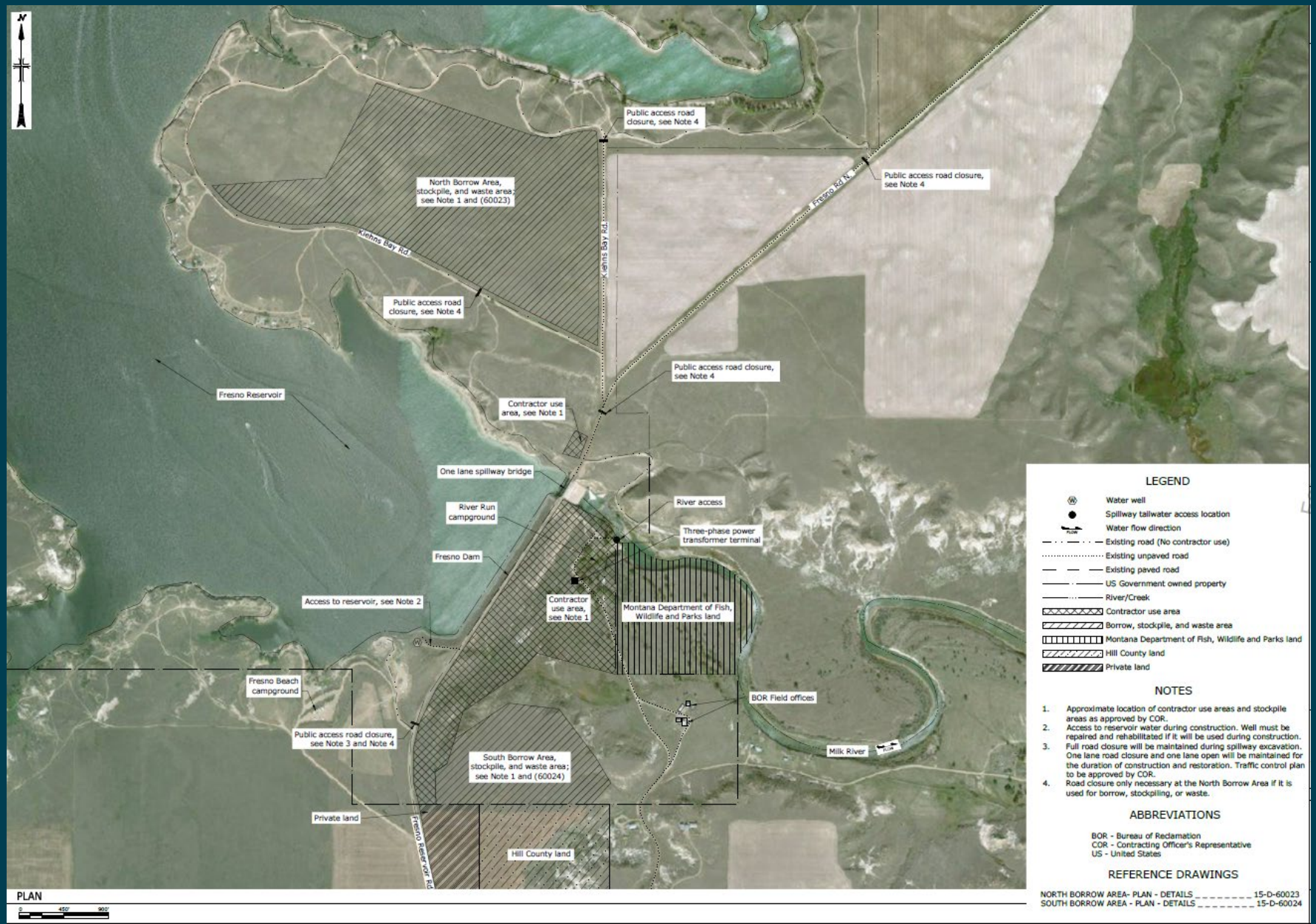
Crest Road Closure

- Crest road closed August 15 through December 1
  - Emergency Vehicles only
- Season of closure will be a contractor's decision

South Borrow Area



North Borrow Area



Project Repayment

Repayment

- All project costs initially funded by Federal appropriations
- Reclamation Safety of Dams Act of 1978 (Public Law 95-578) as amended requires cost recovery
  - 15% of the total SOD modification costs
- Allows for repayment of costs over time.
  - Option for Repayment contract or upfront payment

How is the Repayment Computed

- 15% of the final project costs less Statutory credits
- Resulting costs allocated to the project beneficiaries based on benefits received from the Milk River Project
  - Irrigation Districts/Pump Contracts (~84%)
    - Interest free
  - Municipalities (~2%)
    - Interest bearing (to be determined)
  - Ft. Belknap Indian Community (~14%)
    - Interest free

Repayment Allocation for Fresno SOD

Municipal	Allocation
City of Chinook	0.627%
City of Havre	1.075%
GSA	0.005%
North Havre County Water District	0.030%
Grandview Cemetery Association of Saco	0.004%
City of Harlem	0.164%
Total	1.905%

Irrigation	Allocation
Fort Belknap Indian Reservation	14.014%
Malta Irrigation District	34.308%
Glasgow Irrigation District	13.780%
Dodson Irrigation District	0.769%
Fort Belknap Irrigation District	4.959%
Alfalfa Valley Irrigation District	2.803%
Zurich Irrigation District	5.863%
Paradise Valley Irrigation District	6.361%
Harlem Irrigation District	8.529%
Individual Pump Contractors ****	6.709%
Total	**98.095%**

What are Statutory Credits

- Examples of statutory credits (revenues) on Milk River Project:
  - Grazing Leases
  - Oil and gas leases (Hill & Phillips County)
  - Water Sales
  - Nelson and Fresno Cabin Leases
- Approximately $280k available as of December 31, 2021
  - Accumulating at approximately $80k/year
  - Variable year to year

Statutory Credits Continued

- Statutory credits are applied to the Project as a whole and not associated with a district or municipal user
  - Per Reclamation Policy PEC 03-01.

How is Repayment Executed

- Upfront or Repayment Contract
- Based on Basis of Negotiation approved by the Commissioner (January 18, 2022)
  - Formulates the terms and conditions of a proposed contract(s), including authorities, payments, and other obligations for Reclamation.
- Fresno Repayment Options
  - 10, 20, 30, 40 or 50-years repayment periods
  - Upfront (based on estimated costs)
- User selected Repayment Options

How is Repayment Executed

- Upon selection of repayment option Reclamation will draft contract for signature
- Contract(s) need to be executed before the construction contract is awarded.
  - Initial notifications of repayment obligation: August 2021
  - Contract option notifications: February 2022
  - Requested Response by April 1, 2022
  - Targeting execution of contracts by September 2022

When Will Repayment Start

- Upon completion of all construction and administrative tasks
  - Estimating repayment will begin in 2027
  - Regional Director will send a written notification to the repayment entities notifying them of the final costs and their repayment obligation.

Estimated Repayment

- Estimated Total Cost of Project = $77 Million
- Reimbursable Share (15%) = $11.55 Million
- Statutory credits = $0*

- Total estimated repayment obligation
  - $11,550,000 - $0 = $11,550,000

Irrigation Repayment by Acre

- Per Acre Cost to irrigators based on estimated costs:
  - No Contract = $88.36 per Acre
  - 10 Year Repayment = $8.84 per Acre/year
  - 20 Year Repayment = $4.42 per Acre/year
  - 30 Year Repayment = $2.95 per Acre/year
  - 40 Year Repayment = $2.21 per Acre/year
  - 50 Year Repayment = $1.77 per Acre/year

Municipal Repayment by Acre-Foot (AF)

- Per Acre-Foot Cost to municipalities based on estimated costs:
  - No Contract = $36.52 per AF
  - 10 Year Repayment = $3.91 per AF/year
  - 20 Year Repayment = $2.18 per AF/year
  - 30 Year Repayment = $1.62 per AF/year
  - 40 Year Repayment = $1.34 per AF/year
  - 50 Year Repayment = $1.18 per AF/year

Questions

- For additional and future information please visit: www.usbr.gov/gp/mtao/fresno/