ASRS 2026
McIntosh Habitat Enhancements

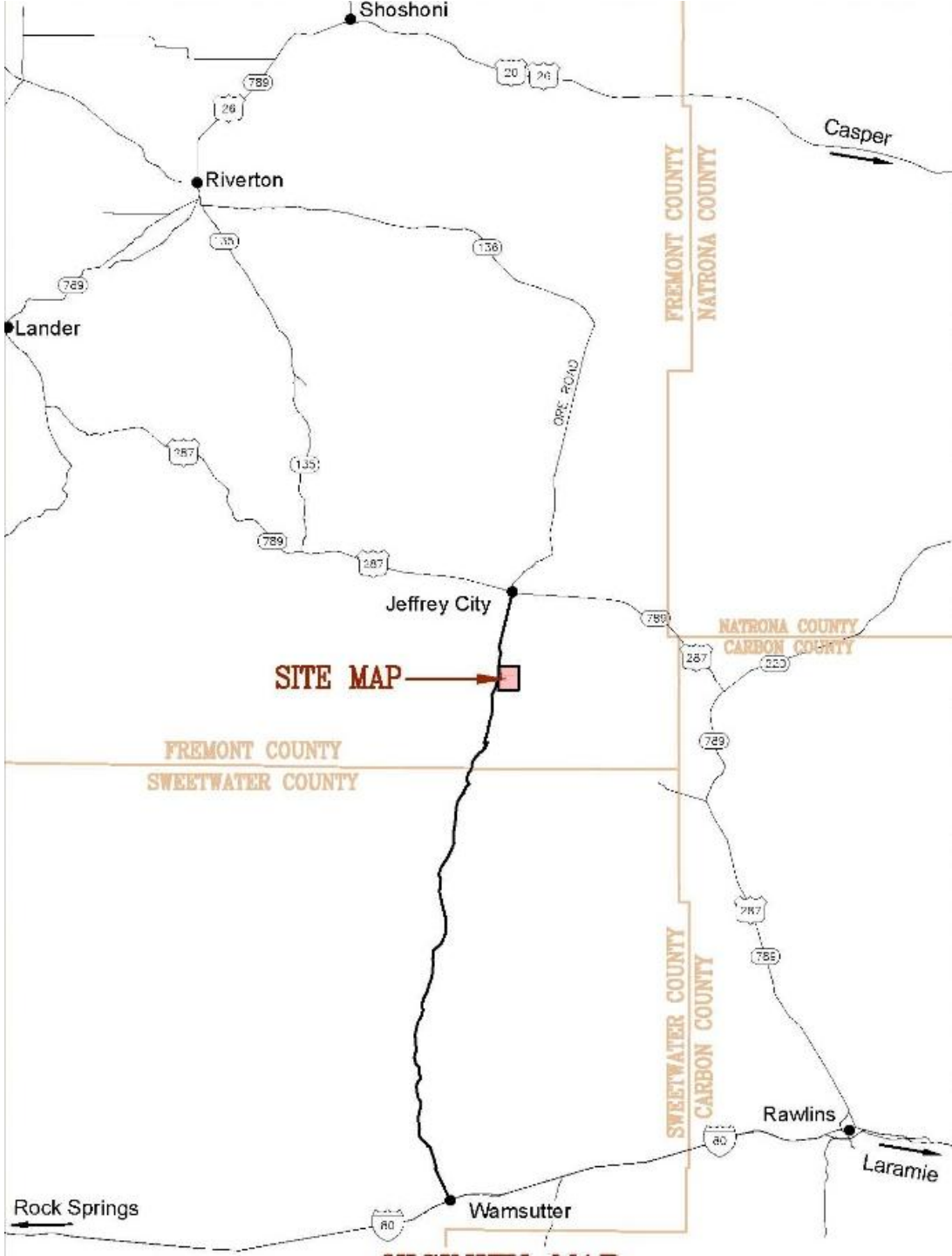
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

AML PROJECT 160
June, 2026

BRS ENGINEERING

McIntosh Location and History

- Project is located approximately 10 miles south of Jeffrey City, Wyoming
- Ore grade uranium discovered in Crooks Gap District in 1953
- Commercial production began 1957
- Production at McIntosh ceased 1982
- Ownership passed to current owner Energy Fuels in 2012



PHASE 2B DEEP SOIL MIXING (DSM) WALL

Background

- Mining activities filled Quaking Asp draw with spoils (South Spoils) creating an impoundment
- Pond known locally as Western Nuclear Pond
- Wyoming Game and Fish stocked pond with trout and smallmouth bass
- Seepage from pond was high as impoundment material was sandy mine spoils

Western Nuclear Pond with McIntosh Pit in Foreground and Filled Quaking Asp Draw on Right Taken 5-22-13

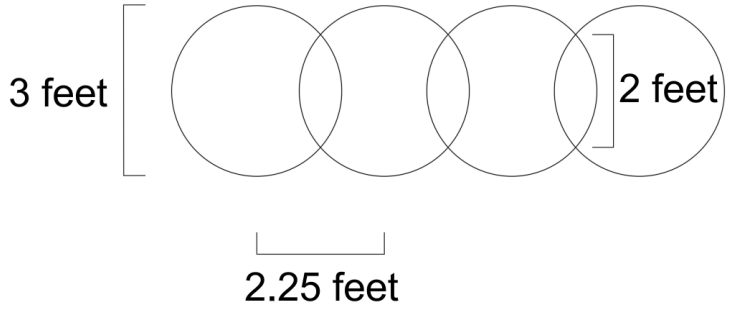
Reclamation Plan Goals

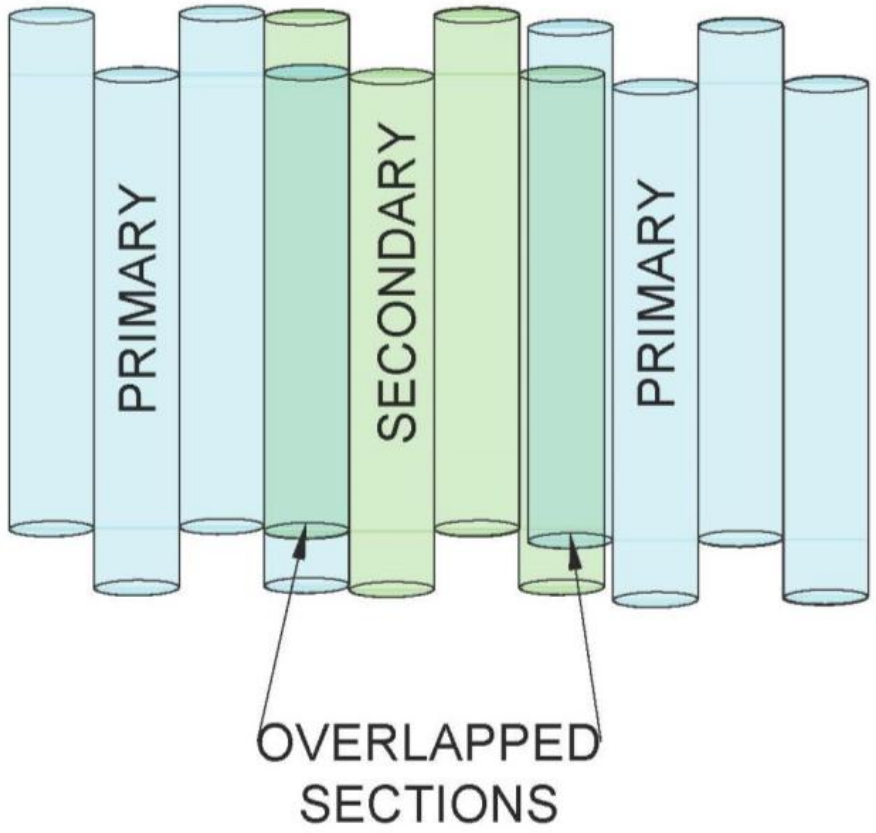
- Preserve and enhance Western Nuclear Pond (McIntosh Reservoir No. 2)
- Decrease permeability to limit seepage
- Increase water level to improve fishery
- Dry out South Spoils prior to excavation activities

Reservoir No. 2 During 2B Contract

Reservoir Wall Design

- Deep Soil Mixing (DSM)
  - Low permeability barrier
  - Cement & bentonite mixed with sandy spoils
  - Keyed into the underlying sedimentary bedrock
  - Overlapping design



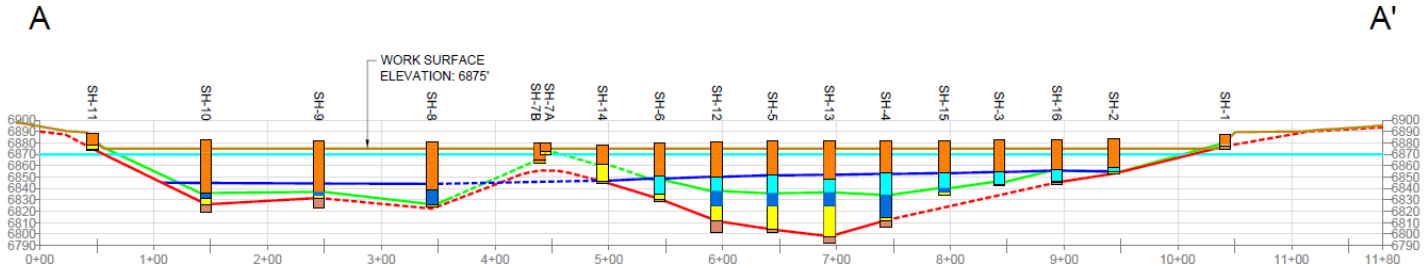


Overlapping Auger Pattern

DSM Wall Design

- Sonic coring
  - Characterize existing impoundment material
  - Samples taken to bedrock
  - Composites created for use in testing

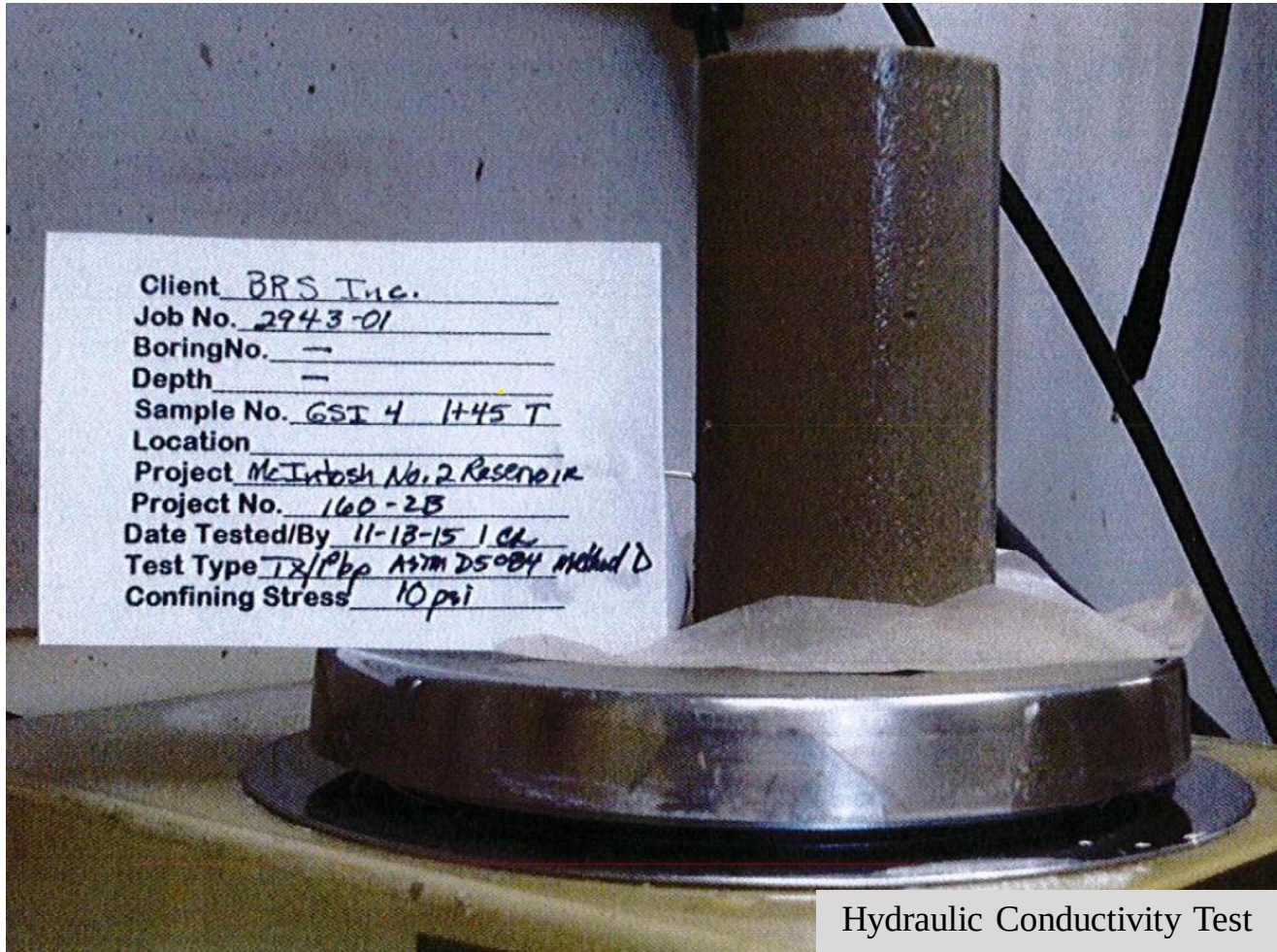
- Designed mixes tested before contract NTP was issued



Sonic Coring Rig

DSM Wall Design Criteria

- Unconfined compressive strength: 100 psi minimum
  - ASTM D4832 standard test
- Hydraulic conductivity: 1x10^-6 cm/sec
  - ASTM D5084 standard test
- Type II cement used
- Bentonite to meet API 13A standard
- Mix design stamped by Professional Engineer



Hydraulic Conductivity Test

DSM Wall Mix Designs Tested

Failed Mixes

Selected mixes

Sample ID	10	8	13	13A	5A	5B	10-166	8-166	13-200	13A-200	5A-200	5B-200
Composite	10	8	13	13A	5A	5B	10	8	13	13A	5A	5B
Area	West	West	East	East	East	East	West	West	East	East	East	East
Estimated Soil Unit Weight (lb/cf)	125	125	125	125	125	125	125	125	125	125	125	125
Est. Soil Wt. (g/cc)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Grout w:cement ratio	2.5	2.5	2.5	2.5	2.5	2.5	1.8	1.8	1.8	1.8	1.8	1.8
Bentonite:Water Ratio	3.00%	3.00%	2.50%	2.50%	2.50%	2.50%	3.00%	3.00%	2.50%	2.50%	2.50%	2.50%
Grout Specific Gravity	1.256	1.256	1.253	1.253	1.253	1.253	1.334	1.334	1.332	1.332	1.332	1.332
Weight Soil (g)	5731	6418	9169	6418	6419	6418	6400	6400	6400	6400	6400	6400
Weight Water (g)	1398	1563	2978	2085	2087	2085	1494	1494	2025	2025	2025	2025
Weight Portland (g)	558	624	1193	835	836	837	830	830	1125	1125	1125	1125
Weight Bentonite (g)	42	75	75	53	53	53	45	45	51	51	51	51
Total Grout Weight (g)	1998	2262	4246	2973	2976	2975	2369	2369	3201	3201	3201	3201
Grout Vol:Soil Vol	0.556	0.562	0.740	0.740	0.741	0.741	0.556	0.556	0.752	0.752	0.752	0.752
(kg/(m³ of grout +soil)	125.3	125.2	149.8	149.7	149.9	150.1	166.9	166.9	200.9	200.9	200.9	200.9
7-day UCS	n/a	n/a	n/a	n/a	n/a	n/a	158.2	176.0	155.7	153.1	117.6	124.0
14-day UCS Test 1	43.4	58.3	59.6	60.8	42.6	48.0	180.9	177.6	173.2	165.6	132.5	131.9
14-day UCS Test 2	49.7	56.2	55.5	61.3	42.6	47.7	188.3	182.8	161.1	183.4	132.5	130.8
14-Day UCS Average	46.6	57.3	57.6	61.1	42.6	47.9	184.6	180.2	167.2	174.5	132.5	131.4
28-day UCS Test 1	71.2	86.0	82.9	99.6	57.9	65.2	201.4		184.4			
28-day UCS Test 2	69.6	85.7	82.4	90.5	62.0	65.8	238.9		218.4			
28 Day UCS Average	70.4	85.9	82.7	95.1	60.0	65.5	220.2		201.4			
Permeability (cm/sec)	n/a	n/a	n/a	n/a	n/a	n/a	5.3E-07		5.5E-07			

160-2B Contract Overview

- NTP for August 31, 2015
- Contractor was Geo-Solutions Inc.
- Certificate of Substantial Completion issued January 13, 2016
- Total cost: $959,385.89

Augers Mixing DSM Wall

DSM Wall Material Testing

- Cement bentonite grout tested daily during construction
- Tested for unit weight, temperature, and flow
  - API RP13B unit weight test
  - ASTM C1064 temperature test
  - ASTM C230 and C1437 flow tests
- Cylinders also made from samples for lab testing for unconfined compressive strength and hydraulic conductivity

Sampling of Impoundment Material for Daily Testing

Variance

- When contractor reached final 100 feet of wall cold weather was freezing grout lines on the auger
- Contractor proposed to construct slurry wall for final 100 feet
- Contractor dug a trench, mixed grout-bentonite slurry with sandy mine spoils in trench using long stick excavator

Long Stick Excavator Constructing Slurry Wall

DSM Wall Challenge

- DSM wall was designed to be keyed in to native sandstone below the mine spoils
- DSM wall did not reach target depth in all places
- Boulders and shot rock encountered by augers prohibited them from reaching full target depths

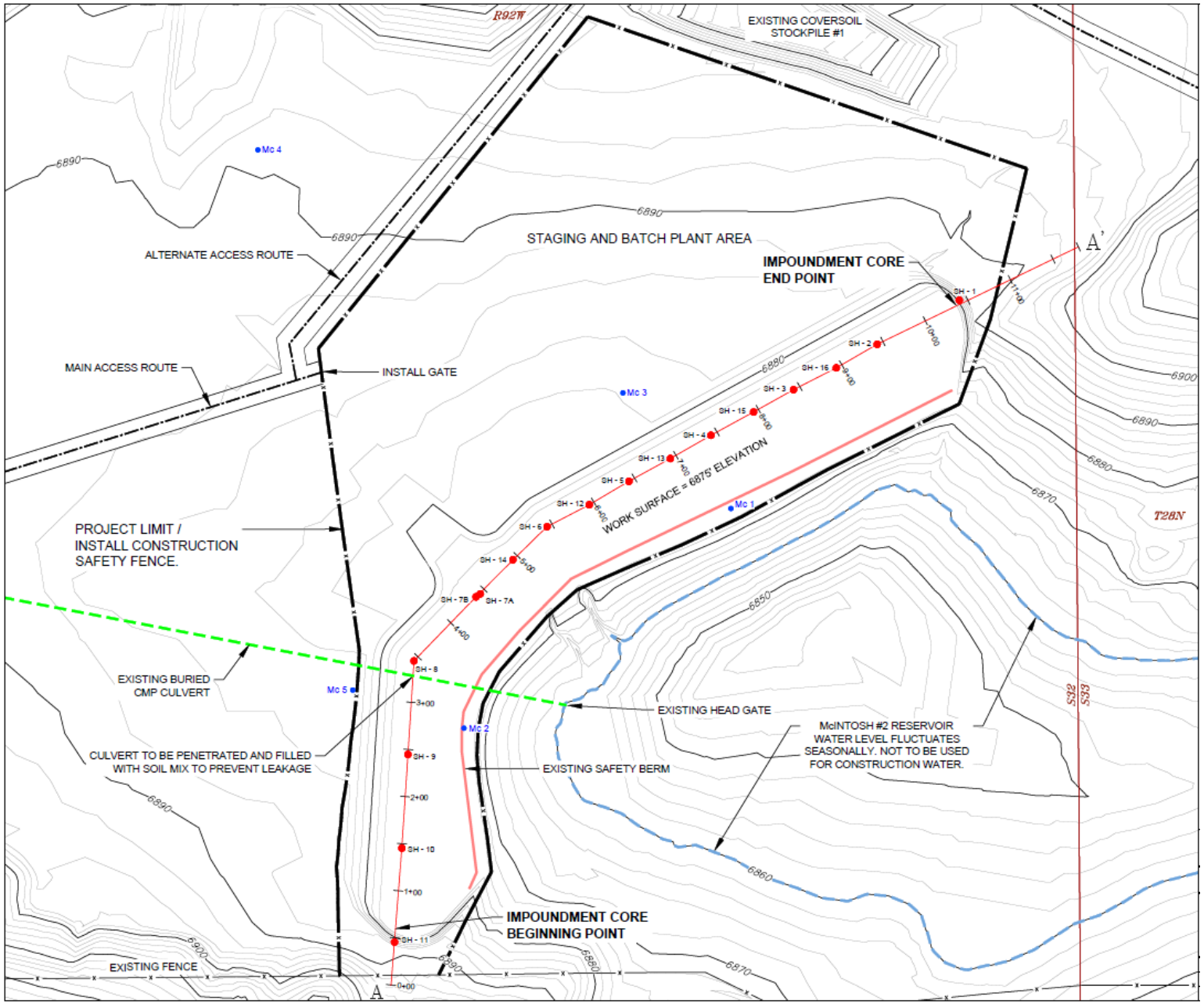
DSM Wall Construction in Progress

Piezometers

- Five piezometers installed in spring 2015
- Four piezometers monitored 2015 through 2024
  - One piezometer had bottom collapse and readings were discontinued
- Piezometers removed and fully reclaimed in fall 2025

MC-3 Piezometer near Reservoir No. 2

DSM Wall Alignment Piezometers



LEGEND

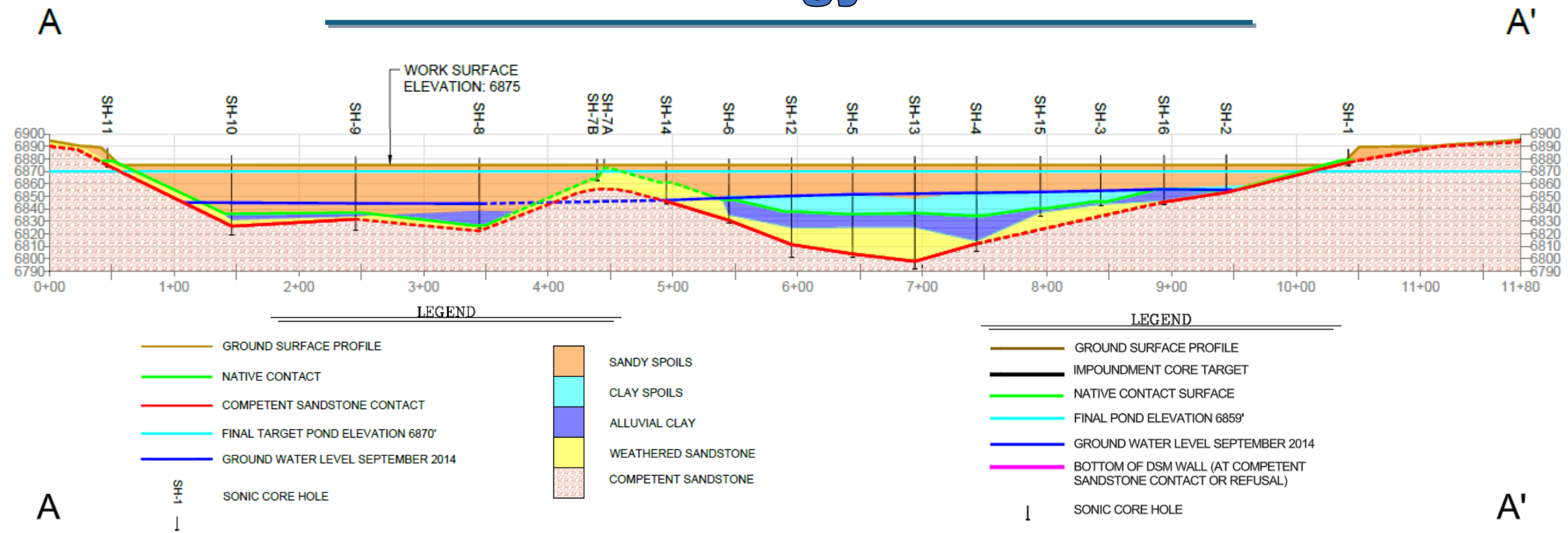
- EXISTING GROUND CONTOUR C.I.=2'
- SECTION LINE
- EXISTING ROAD
- EXISTING FENCE
- EXISTING BURIED CMP CULVERT
- CURRENT WATER LEVEL (3/15/15)
- PROJECT ACCESS
- PROJECT LIMIT & SAFETY FENCE
- CROSS SECTION ALIGNMENT SEE FIGURES O-2B.5 THRU O-2B.7
- EXISTING SONIC CORE HOLE & HOLE I.D., SEE FIGURE O-2B.5 — SH-10
- EXISTING GROUND WATER MONITOR WELL

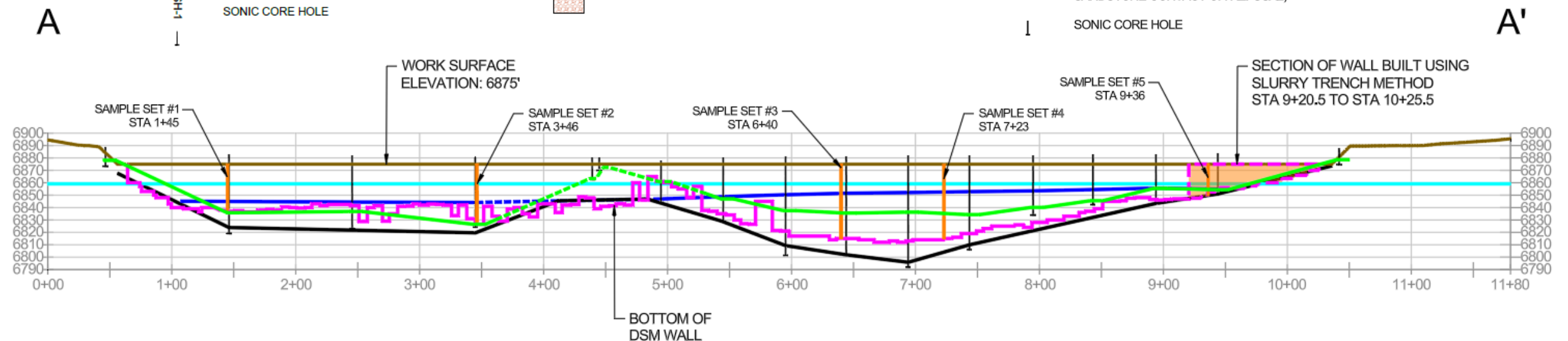
GRAPHIC SCALE

100' 0 50' 100'

1 inch = 100'

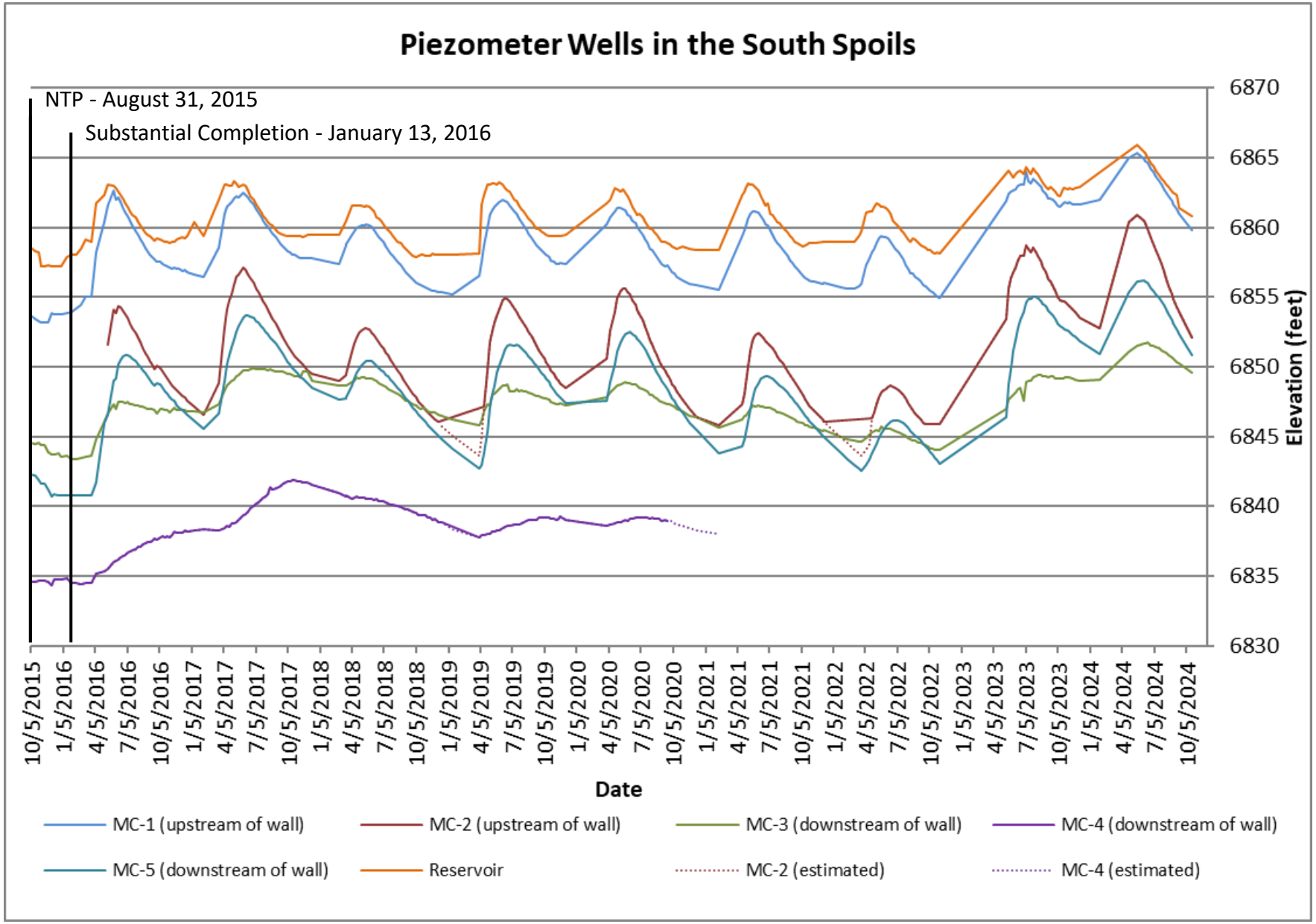
DSM Wall Geology and As-Built





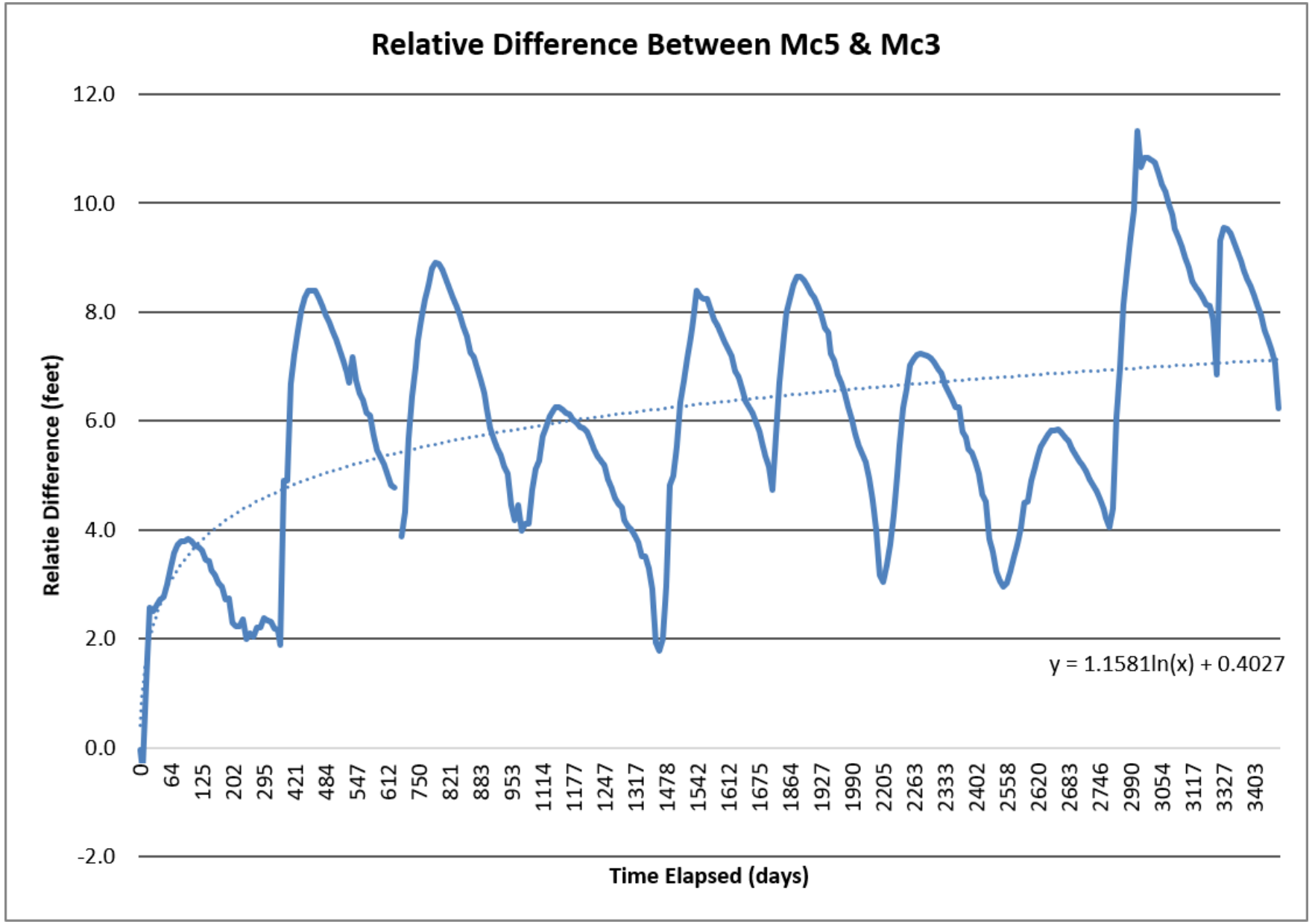
Water Levels

- Elevated Water Table Baselines
  - NTP – August 31, 2015
  - Substantial Completion – January 13, 2016



Water Levels

- MC-5 compared to MC-3
  - MC-5 – Boulders prevented DSM from reaching base of sandy spoils
  - MC-3 – DSM reached well below sandy spoils and native contact
  - Distance between MC-5 increases relative to MC-3



South Spoils Seepage

- Seepage continues in the South Spoils due to impoundment structure not reaching bedrock in all places
- South Spoils was wet but manageable for construction
- Seepage provides continuous low flow in Quaking Asp Draw

Revegetation Tractor Sliding in South Channel Mud

Natural Flow From Seepage in South Channel

LIMBER PINE AND JUNIPER TREE TRANSPLANTING

Before Reclamation

- Previous AML Project 16-L
  - Nursery bare root trees planted
  - None survived
- Volunteer trees on abandoned spoils
- Limber pines and junipers
- Native trees salvaged due to higher likelihood of survival compared to imported trees

Targeted Tree to be Salvaged

Tree Salvage
Task Order 16-14

- P&F Services in May 2014 salvaged 106 limber pine trees
  - 71 small 1-2” diameter
  - 35 large 2-4” diameter

- Tree spade - flatter ground

- Mini excavator - on steep slopes

- Trees were dug, wrapped in burlap, and placed in wire baskets

Tree Spade and Salvaged Trees

Temporary Nursery

- Sheltered location selected between coversoil pile and reclaimed spoils pile
- Root balls placed tightly together and covered with coconut erosion control blanket
- Drip irrigation lines used to water trees
- 40 of 106 of the salvaged trees survived to planting
  - High mortality attributed to trees salvaged with the mini excavator breaking up root balls

Salvaged Trees in the Nursery

2015 Tree Planting Task Order 22-15

- Surviving trees planted on East and West Highwall slopes
- Trees planted by digging a hole with a mini excavator, placing wrapped root ball in hole, and filling with water two times during backfill

Salvaged Trees Being Planted

Tree Salvage
Task Order 8-19

- P&F Services in May 2019 salvaged 150 additional trees
  - 46 junipers, 104 limber pines
- 44” tree spade used for salvage
- Mini excavator was not used due to root damage seen in first salvage project
- Salvage procedures matched methods used the first time

TREE HEIGHT	SPECIES		Total
	LIMBER PINE	JUNIPER	
<24"	51	35	86
24"-48"	27	10	37
48"-72"	14	1	15
72" +	12	0	12
Total	104	46	**150**

Temporary Nursery Improvements

- Reused nursery site
- Perimeter berms installed for wind protection
- Straw packed between root balls
- Coconut erosion control blanket and drip irrigation system remained as before

Trees in Nursery From Second Salvage Operation

2021 Tree Planting Task Order 24-21

- 139 of the 150 trees survived to planting
- Planted in the West Spoils, South Spoils, Lower East Channel
- Planting conducted using same methods

Tree Health Monitoring

- After 2021 trees were monitored once every spring and fall

- 67% overall survival rate since planting as of Fall 2025

- Task Order 16-14
  - 38% survived the nursery
  - 28% survived from salvage through 2025
  - 78% of trees planted survived through 2025

- Task Order 8-19
  - 93% survived the nursery
  - 59% survived from salvage through 2025
  - 65% of trees planted survived through 2025

Transplanted Trees in Fall 2024

Cost Breakdown

- Task Order 16-14 tree salvage
  - $32,612.50

- Task Order 22-15 tree planting
  - $13,553.74
  - $1,154.16 per tree that survived to planting
  - $1,538.87 per tree that survived through 2025

- Task Order 8-19 tree salvage
  - $29,035.80

- Task Order 24-21 tree planting
  - $57,123.50
  - $619.68 per tree that survived to planting
  - $979.08 per tree that survived through 2025

- Total for all salvage and planting
  - $132,325.54

Mini Excavator Transporting Tree to be Planted

REVEGETATION SEEDING

Seeding Mixes

- 2015 through 2019 used same seed mix
  - Developed by rangeland agronomist based on species observed growing near the site

- 2020 Wyoming AML Vegetation Evaluation Standards (WAVES) implemented and used through 2024
  - Seed mix changed each year

- WAVES led to seed mixes with more species for diversity
  - Relied on ecological site descriptions

Pit Seeding in 2024

Seed Mix Comparison

Table x – ROI Limber Pine/Sage Seed Mix

Common Name	PLS/Acre
Bluebunch Wheatgrass	9.1
Idaho Fescue	1.7
Sandberg Bluegrass	0.5
Douglas Rabbitbrush	0.6
Wyoming Big Sagebrush	0.1
Total PLS/Acre	**12.0**

Table x – ROI Lower Slopes Sage Seed Mix

Common Name	PLS/Acre
Bluebunch Wheatgrass	9.1
Idaho Fescue	1.0
Sandberg Bluegrass	0.9
Rubber Rabbitbrush	1.1
Wyoming Big Sagebrush	0.1
Total PLS/Acre	**12.2**

Seed mix 2015-2019

Table 4.11.15 – 2024 A Channel Mix

Common Name	PLS/Acre
Basin Wildrye	1.17
Green Needlegrass	1.05
Quickguard Sterile Triticale	24.00
Bluebunch Wheatgrass	0.69
Indian Ricegrass	1.38
Bottlebrush Squirreltail	0.84
Little Bluestem	0.38
Western Wheatgrass	0.88
Muttongrass	0.15
Blue Grama	0.16
Aster	0.45
Fernleaf Biscuitroot	7.14
Beardtongue	0.45
Wyoming Big Sagebrush	5.00
Winterfat	1.57
Total PLS/Acre	**45.31**

Table 4.11.14 – 2024 Meander Channel Mix

Common Name	PLS/Acre
Basin Wildrye	1.47
Green Needlegrass	0.84
Buckwheat	2.03
Alkali Sacaton	0.23
Bottlebrush Squirreltail	0.84
Sandberg bluegrass	0.19
Western Wheatgrass	1.35
Quickguard Sterile Triticale	12.00
Fernleaf Biscuitroot	6.12
Little Bluestem	0.61
Plains Aster	0.38
Yarrow	0.36
Wyoming Big Sagebrush	5.05
Total PLS/Acre	**31.47**

Seed mix 2024

Table 4.11.12 – 2024 Upland Seed Mix

Common Name	PLS/Acre
Little Bluestem	0.81
Sandberg bluegrass	0.28
Antelope Bitterbrush	7.06
Blue Grama	0.33
Scarlet Globemallow	0.45
Winterfat	1.18
Wyoming Big Sagebrush	3.27
Bluebunch Wheatgrass	2.48
Indian Ricegrass	2.48
Green Needlegrass	2.04
Western Wheatgrass	2.11
QuickGuard Sterile triticale	6.00
Buckwheat	1.13
Basin Wildrye	1.54
Total PLS/Acre	**31.16**

Table 4.11.13 – 2024 Lowland Seed Mix

Common Name	PLS/Acre
Green Needlegrass	1.36
Indian Ricegrass	1.65
Blue Grama	0.16
Basin Wildrye	0.88
Bluebunch Wheatgrass	1.65
Black Sagebrush	1.44
Western Wheatgrass	1.41
Sandberg bluegrass	0.19
QuickGuard Sterile triticale	4.00
Little Bluestem	0.38
Aster	0.21
Beardtongue	0.21
Winterfat	0.79
Wyoming Big Sagebrush	3.48
Western Yarrow	0.22
Total PLS/Acre	**18.03**

Amendments

- Biosol originally recommended by rangeland agronomist
- Amendments were changed with the implementation of WAVES
- Amendments disced into ground ahead of seeding

Year	Amendment	Rate (lbs/acre)
2017 & 2019	Biosol	400
2020	Biosol used first	400
	Richlawn 7-2-1 on rest of ground	400
2021	Richlawn 7-2-1 used first	400
	Biosol on rest of ground	400
2022	Biosol	400
2024	Concentrated compost*	1000
	Humic acid*	325
	Mycorrhizal fungi*	100

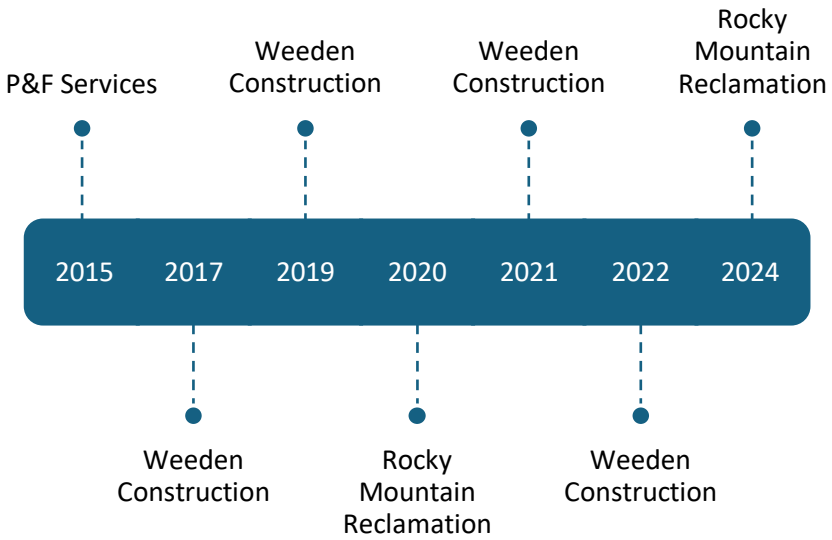
*all three amendments applied to all seeded ground

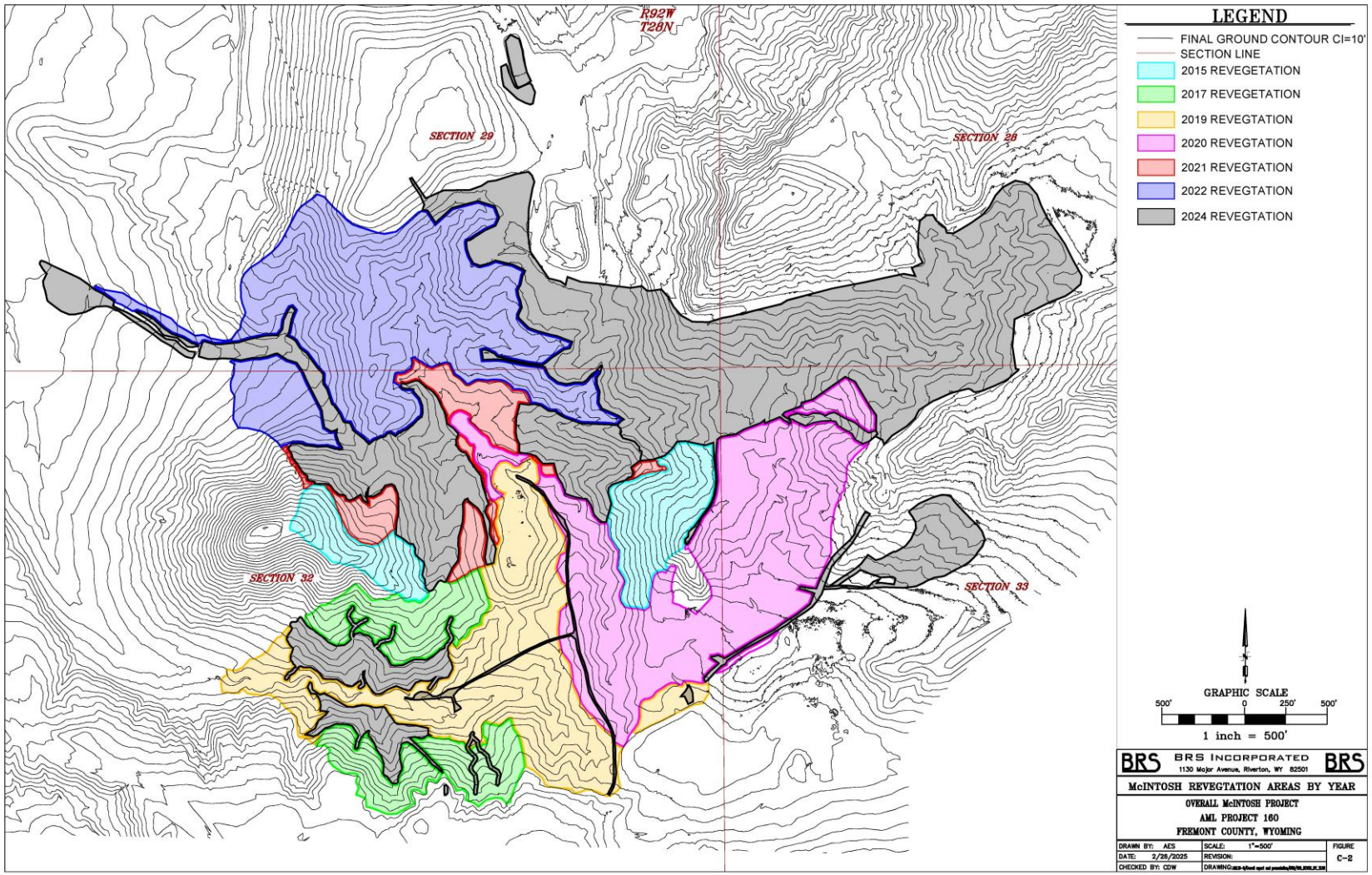
Methodology

- 2015 seeding ground ripped and drill seeded without amendments
- 2017 through end of project ground was ripped, amendments placed and disced, ground then pit seeded
- In 2017 previously seeded ground was reseeded and amendments spread

Pit Seeding in 2017

Seeding Years





Cost Breakdown

Phase	Year	Revegetation Cost (avg $/acre)
16O-2	2015	1,417.88
16O-3	2017-2018	2,253.77
16O-4	2019	1,082.76
16O-5	2020	1,923.62
16O-6	2021	1,734.92
16O-7	2022	2,577.63
16O-9	2024	3,050.40

Revegetation Development

From 2022 to 2024 (the 2020 seeding area was not monitored in 2023), native cover increased from 9.1% to 30.4%, as shown in **Figure 4**. This increase was largely driven by perennial grasses, which increased from 5.6% to 23.2%, and increases in shrub cover and native forb cover were also observed. Invasive annual grass increased slightly, from 0.3% to 0.7%, while non-native cover decreased from 15.4% to 3.2%.

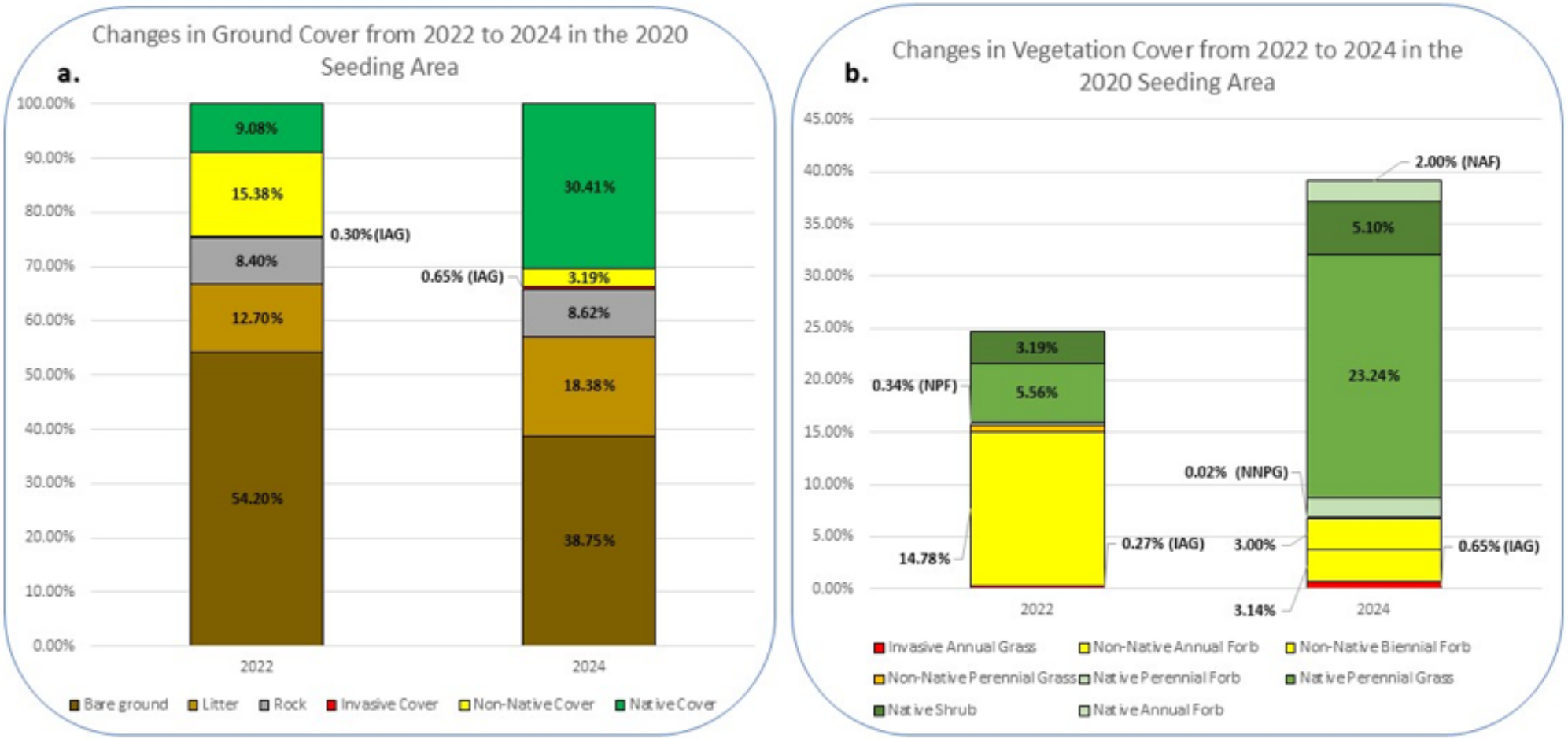


Figure 4: Changes in Ground Cover between 2022 and 2024 in the 2020 Seeding Areas at the McIntosh Mine Site (Years 2 and 4)

(Tetra Tech 2025)

2025 WILLOW AND ASPEN TREE PLANTING

Willow Harvesting

- Established willows in Quaking Asp Draw trimmed to create cuttings for planting
- Multiple starts trimmed from each larger branch cut from the plant
- Branches dead or damaged by moose avoided

Harvesting Willow Cuttings

Willow Trimming

- Majority of foliage trimmed from cuttings, at least 15” of the bottom left free of growth to create whip
- Whips placed in bucket with water from flowing meander channel and root starter
- Stakes cut from main part of branches without foliage and placed in bucket
- Approximately 300 whips and 50 stakes harvested

Trimmed Willow Whips

Willow Planting Channel

- Willow whips planted in groups along meander channel
- Approximately six per group, groups placed at most bends along length of wetted channel
- A few willow stakes put in the first third of groups along the channel


Willow Stake Planted


Willow Whip Planted

Willow Planting Reservoirs

- Willow whips planted at Reservoirs No.1 and No. 2
- Flat area around reservoir No.1 planted
- Western side of reservoir No. 2 planted as willows were already present on eastern and northern sides

Willow Whips Planted Reservoir No

Aspen Planting

- Aspens from Popo Agie conservation district purchased
- Planted in groups along the meander channel and around Reservoir No. 2
- Long term survivability to be determined

Aspen Starts Planted Along Meander Channel

Questions?