Current Status of the Bethel Valley Remediation Project

Presented to the 45th Annual Environmental Show of the South
Conference & Exhibition

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Presented by

John Long, P.E and Ray Tant, P.E.

SHIELD ENGINEERING, INC.

Speaker Introductions

- John Long, P.E.
  - Geotechnical Consultant w/ Shield Engineering
  - Member of remedial design team for BVRP
  - BSCE University of TN Knoxville 1981
  - MSCE (Geotechnical) University of Missouri-Rolla 1987
- Ray Tant, P.E.
  - Principal Engineer & Knoxville Branch Manager w/ Shield Engineering
  - Project manager for CQA for BVRP
  - BSCE University of TN Knoxville 1994
  - MSCE (Geotechnical) University of TN Knoxville 1996

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Acknowledgement of Project Team Members

- Owner – DOE
- Remedial Design – Pro2Serve
- Regulatory Oversite – via BV Core Team; DOE, EPA, & TDEC
- Remedial Construction – LATA-Sharp Remediation Services, LLC
  - CQA – Shield Engineering, Inc.
  - Earthwork CQC – Professional Engineers, Inc.
  - Monitor Wells – Boart Longyear
  - Geosynthetics Installation & CQC – American Environmental Group Ltd.
  - Layouts & As-built Land Surveys - Sterling Engineering, Inc.
  - Environmental Sampling – Commodore Advanced Sciences, Inc.
  - Professional Geologist for Monitoring Wells – Tetra Tech Inc.
  - CQA Geosynthetics Lab Testing - Precision Geosynthetics Laboratory
  - Non-intrusive Geophysical Surveys - GEL Geophysics, LLC

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Overview of Project

- ARRA funding
- Fast-track schedule
  - Remedial Design 10/2008-04/2010
  - Field Work 07/2010 – 08/2011
- Dynamic design process to support ARRA funding
- Construction schedule extended through a winter season; designed RCRA-type cap and sequenced work so that grading activities could continue through winter months
- Project Cost - $17.4 million

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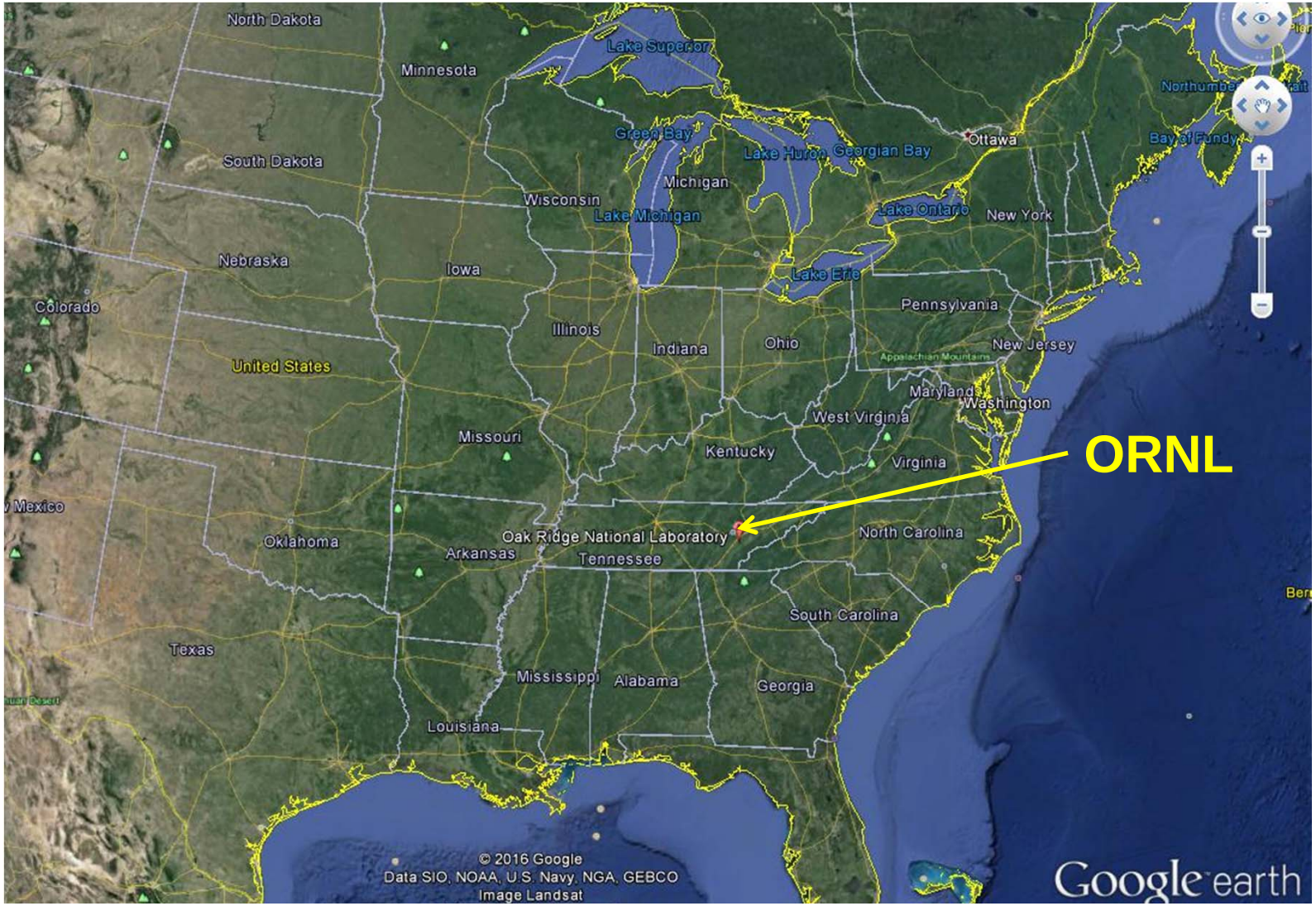

Location of Oak Ridge National Laboratory

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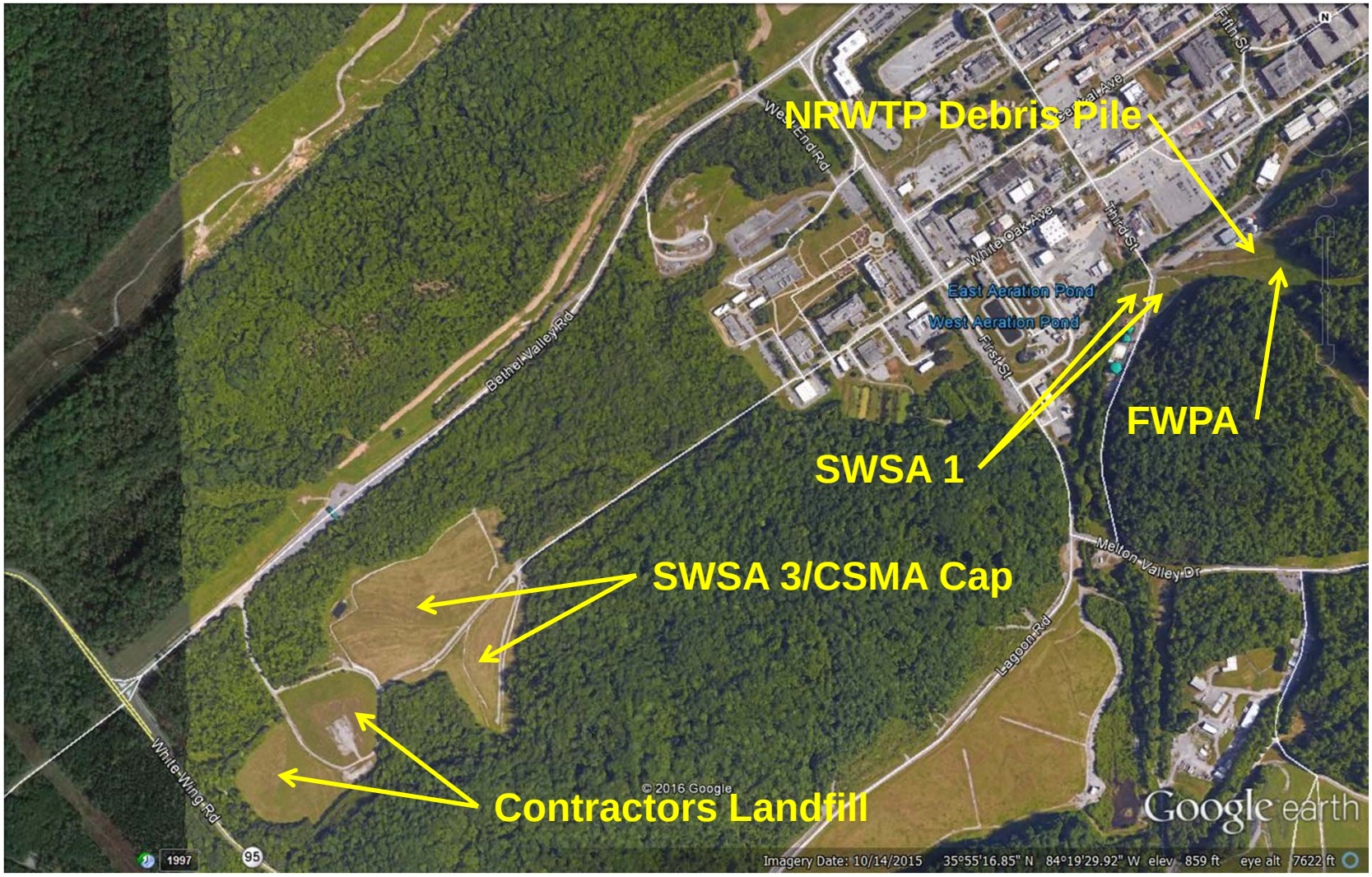

Bethel Valley Burial Grounds Remedial Action Site Locations

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Background of Remediation Sites

- SWSA 3 (7 ac) - Unlined Trenches
  - 126,500 yd^3 of hazardous materials including long-lived and short-lived radioactive isotopes
  - 1946–1951 received wastes from facilities such as Mound Laboratory, the University of Chicago, and others, as well as ORNL, Y-12, & K-25, SWSA 2, possibly explosive materials
  - After 1951 used as scrap yard for contaminated equipment until 1979, when the area was cleared of surface material
- Closed Scrap Metal Area (CSMA) (4 ac) – immediately south of SWSA 3, 1951-1976: store contaminated metal (e.g., equipment & scrap metal) & contractor's landfill, some was buried, former spring-fed ravine was filled with waste, debris, & soil

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Background of Remediation Sites (Cont.)

- Former Waste Pile Area (FWPA) – soil borrow area & disposal of 2,100 yd^3 construction/demolition debris
- Non-radioactive Waste Water Treatment Plant (NRWTP) Debris Pile - 4,150 yd^3 primarily constr./demolition debris
- Contractor's Landfill (7 ac) – 1975 to 1990: 138,000 yd^3 constr. debris & uncontam. demolition materials, uncontam. soil, fly ash from the ORNL coal-fired steam plant, and stabilized coal sludge
- SWSA 1 (1 ac) – Unlined Trenches, 16,200 yd^3 solid radioactive waste, slag residues, noncombustible laboratory debris, spent chemicals & sludges, equipment components & small experimental animal carcasses
- Several Radioactively Contaminated Soil Areas

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Scope of Work

- Prepare RDR/RAWP (including specifications & drawings)
- Prepare Explanation of Significant Differences
- Verify cover thickness & upgrade soil covers at NRWTP Debris Pile, FWPA), and Contractor's Landfill
- Characterize and remove contaminated soils from Contaminated Soil Areas (CSAs) 4 & 6 and the CSMA. Removed soils were placed under RCRA-type cap at SWSA 3.
- Construct RCRA-type cap (0.9 ac) and isolation cap (0.1 ac) over SWSA 1
- Construct RCRA-type cap (10.9 ac) and isolation cap (5.1 ac) over SWSA 3, CSMA, CSA 2, and CSA 3

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Scope of Work (Cont.)

- Install hydrologic (groundwater and surface water) controls at SWSAs 1 and 3, including
  - Plugging and abandoning 37 existing substandard or unneeded groundwater monitoring wells in the project areas
  - Installing 8 new piezometers & groundwater monitoring wells. Others installed 3 exit pathway monitoring wells in West Bethel Valley (Raccoon Creek) as a separate, but concurrent action.
  - Design & constructing upgradient French drains at SWSA 3/CSMA
- Restore ground surface of areas to meet the needs of planned land uses at each site.

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ARRA Impacts on Project

- Required projects to be “shovel ready”
- Resulted in site characterization and “dynamic design” during remediation
  - Geotechnical borings, sampling and analysis
  - Geophysical surveys (GPR, resistivity, magnetic surveys)
  - Radiation surveys
  - Dictated project completion dates
  - Required tracking of employed personnel

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Dynamic Design Process

- Required close coordination with DOE, TDEC, & EPA
- Scope of dynamic design:
  - Characterize and remediate contaminated soil areas
  - Treat groundwater spring at CSMA
  - Treat wet area in the ephemeral stream channel in CSA 3
  - Design and construct upgradient French drains, also referred to as UGTs, for the SWSA 3/CSMA cap, including performing subsurface exploration to support design
  - Determine horizontal limits of buried waste
  - Determine depths of existing soil covers over the NRWTP Debris Pile, FWPA, and Contractor's Landfill
  - Perform baseline groundwater and surface water sampling

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Focus on SWSA 3/CSMA Cap

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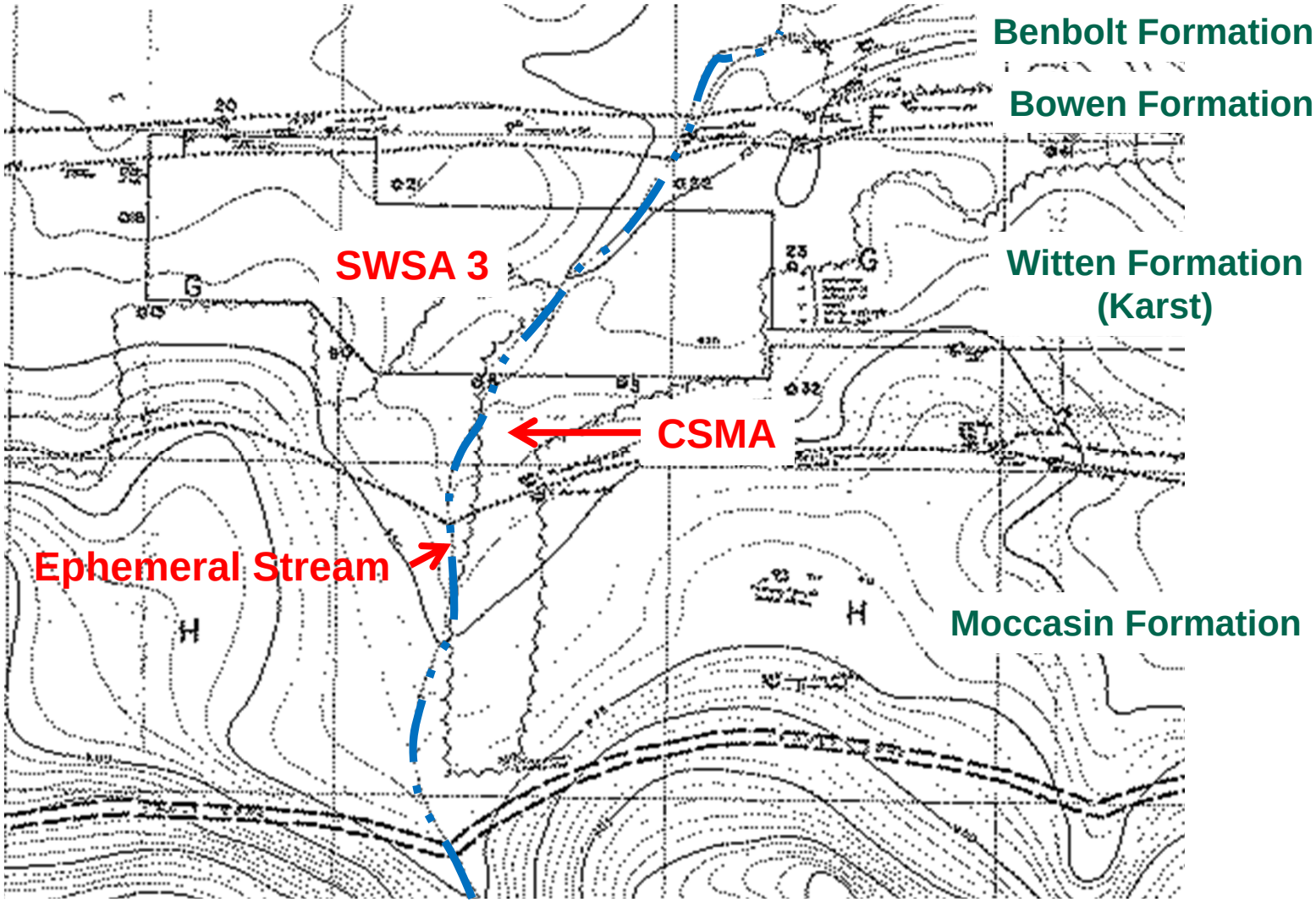

1943 Topography and Geology Showing Ephemeral Stream Crossing SWSA 3 & CSMA

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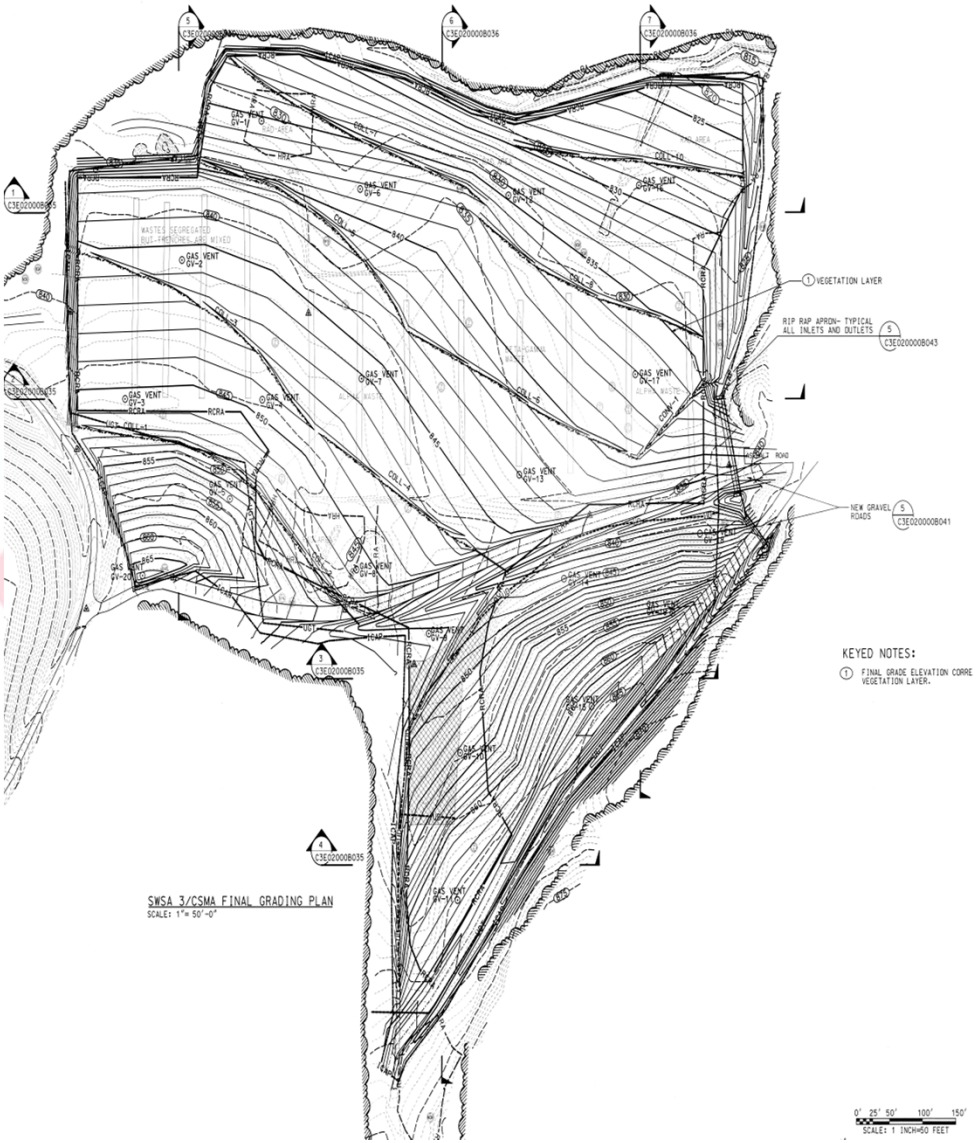

SWSA 3/CSMA Cap

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Objectives of SWSA 3/CSMA Cap

- Limit the amount of water that encounters buried wastes by reducing or eliminating percolation of precipitation and through-flow of shallow groundwater
- Groundwater - water table elevations under the cap are expected to decline over time
- Groundwater - downward trend in 90Sr concentration towards 8 pCi/L
- Surface water – 7500 Bridge weir, SWSA 3 sediment basin

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Performance Measures SWSA 3/CSMA Cap

- Remedial Action - Install multilayer cap and upgradient surface water & groundwater diversion trench
- Performance Objective (Protection Goals) – protect human health through access controls; minimize further impacts to groundwater
- Performance Measure (Demonstration of Effectiveness) - Cover entire area of buried waste w/ RCRA-type cap; stable or decreasing surface water concentrations; stable groundwater

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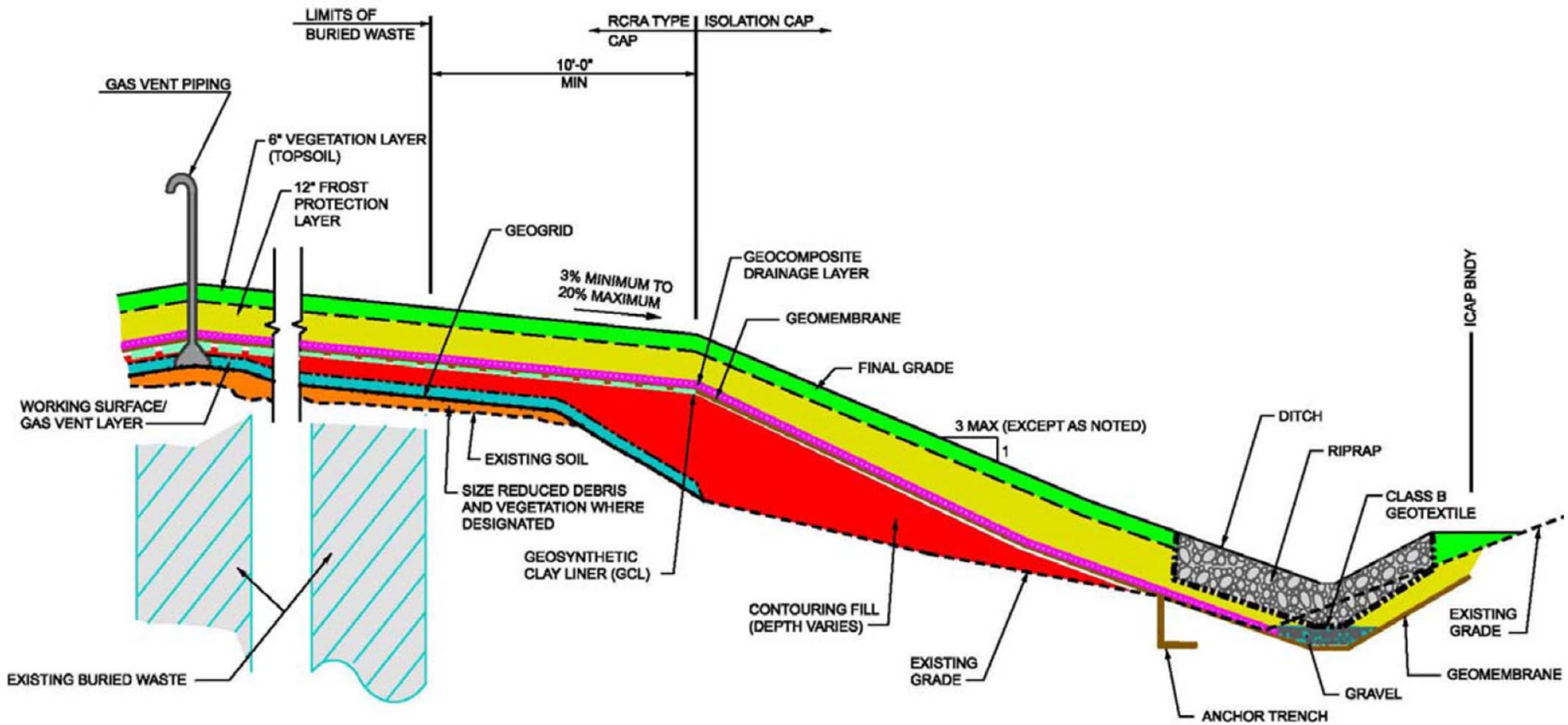

TYPICAL CAP PERIMETER

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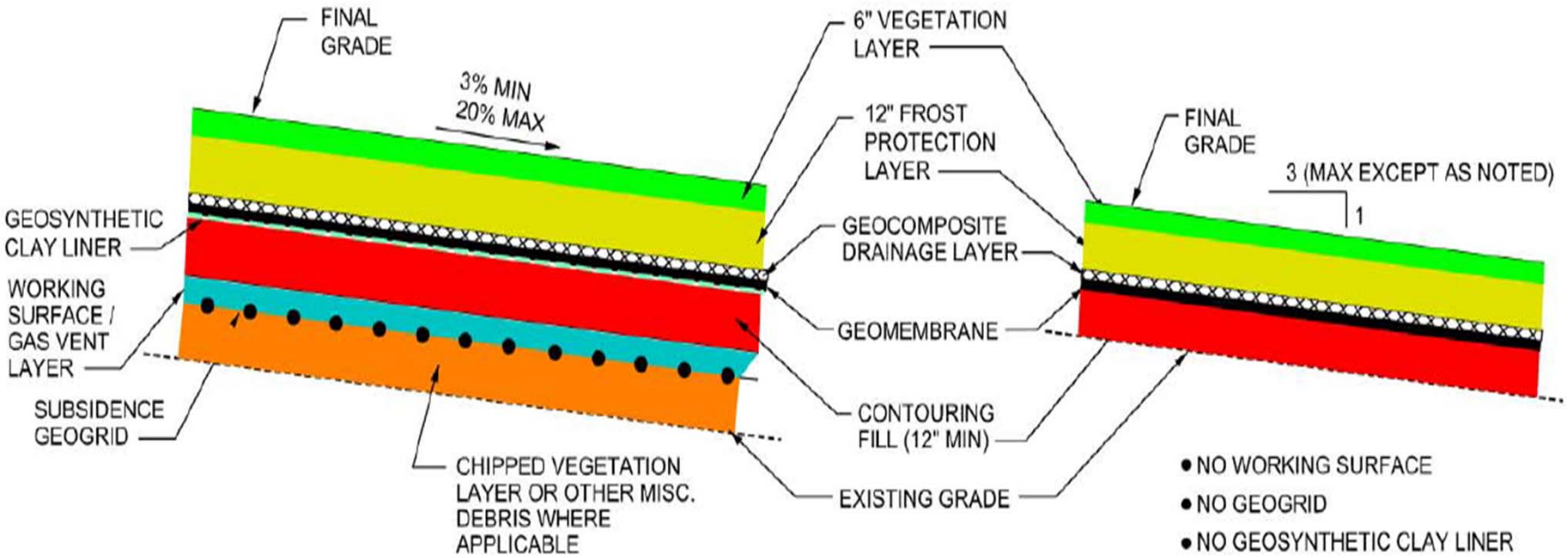

TYPICAL RCRA-TYPE CAP SECTION

TYPICAL ISOLATION CAP SECTION

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Performing non-intrusive geophysical surveys to determine horizontal limits of buried wastes

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Field-locate existing wells, piezometers, and cased boreholes
Inspect existing groundwater monitoring wells

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Drilling new groundwater monitoring well NSW7 west of CSMA

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Demolition and clearing ongoing at SWSA 3

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SWSA 3 after demolition and clearing

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Installing upgradient French drain along western side of SWSA 3

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Constructing shallow underdrain from French drain #1 toward CSMA

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Water flowing from spring at CSMA during initial excavation for shallow underdrain

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Constructing shallow underdrain from spring at CSMA

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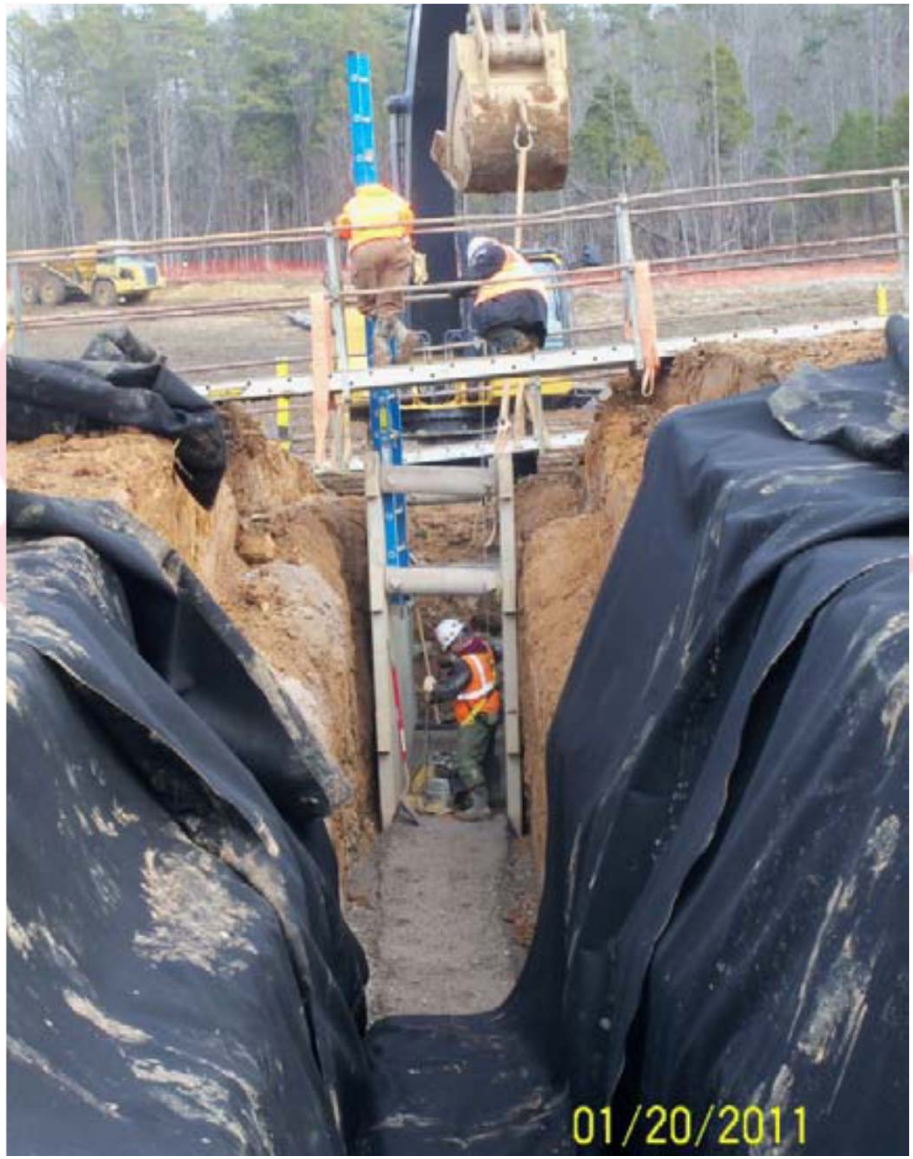
Placing bedding stone and geotextile for upgradient French drain #2



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Excavation for Upgradient French Drain #2 northeast of CSMA

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Laying perforated drain pipe for UGT #2 along western side of CSMA

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Contaminated and potentially contaminated soil and debris disposed on SWSA 3

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Spreading contaminated/potentially contaminated soil and debris over SWSA 3

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Spreading and Compacting shredded vegetation layer for SWSA 3/CSMA cap

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Installing subsidence geogrid for SWSA 3/CSMA cap

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Placing working surface/gas vent layer on SWSA 3

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Installing gas vent for SWSA 3/CSMA cap

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Installing gas vent for SWSA 3/CSMA cap

Placing weathered shale contouring fill for SWSA 3/CSMA cap

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View of typical prepared subgrade for GCL (photo from SWSA 1)

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Installing geosynthetic clay liner for SWSA 3/CSMA cap

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Installing geomembrane for SWSA 3/CSMA cap

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Geomembrane boot being installed around gas vent pipe (photo from SWSA 1)

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Installing geocomposite drainage layer for SWSA 3/CSMA cap

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Spreading frost protection layer for SWSA 3/CSMA cap

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Typical collector drain for lateral drainage system of cap after wrapping with geotextile

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Placing vegetative soil (i.e., topsoil) for SWSA 3/CSMA cap

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Installing elliptical reinforced concrete culvert "D" for SWSA 3/CSMA cap

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Monitoring well NSW2

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Hydroseeding and cap road construction underway for SWSA 3/CSMA cap

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Performance Results SWSA 3/CSMA Cap

(from 2015 Remedial Effectiveness Report)

- Since completion of capping of SWSA 3 in 2011:
  - Average 90Sr activity levels and fluxes have decreased 75% at Northwest Tributary
  - During the winter season (December – April) get the maximum groundwater recharge and leachate formation/discharge to surface water – the inter season discharge of 90Sr to the Northwest Tributary has been reduced by 90%
  - 90Sr levels in the Raccoon Creek headwaters have decreased by 50 – 60% from values measured in the previous several years
- Comparison of pre-remediation to FY 2014 groundwater contaminant concentrations shows that levels are decreasing or stable

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Performance Results SWSA 3/CSMA Cap

(from 2015 Remedial Effectiveness Report) (Cont.)

- 3 of 9 wells have not reached target groundwater levels; however, groundwater level fluctuations within the waste depth zone in the capped area show that direct infiltration of rainwater into buried waste has been controlled. The 3 wells are located in the eastern portion of SWSA 3. There are gradual groundwater elevation declines in these 3 wells.
- groundwater elevation fluctuations within the waste depth zone below the cap show that direct infiltration of rainwater into buried waste has been controlled

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SWSA 3 / CSMA 2008

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SWSA 3 / CSMA 2010

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SWSA 3 / CSMA 2015

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