

# Original Landfill

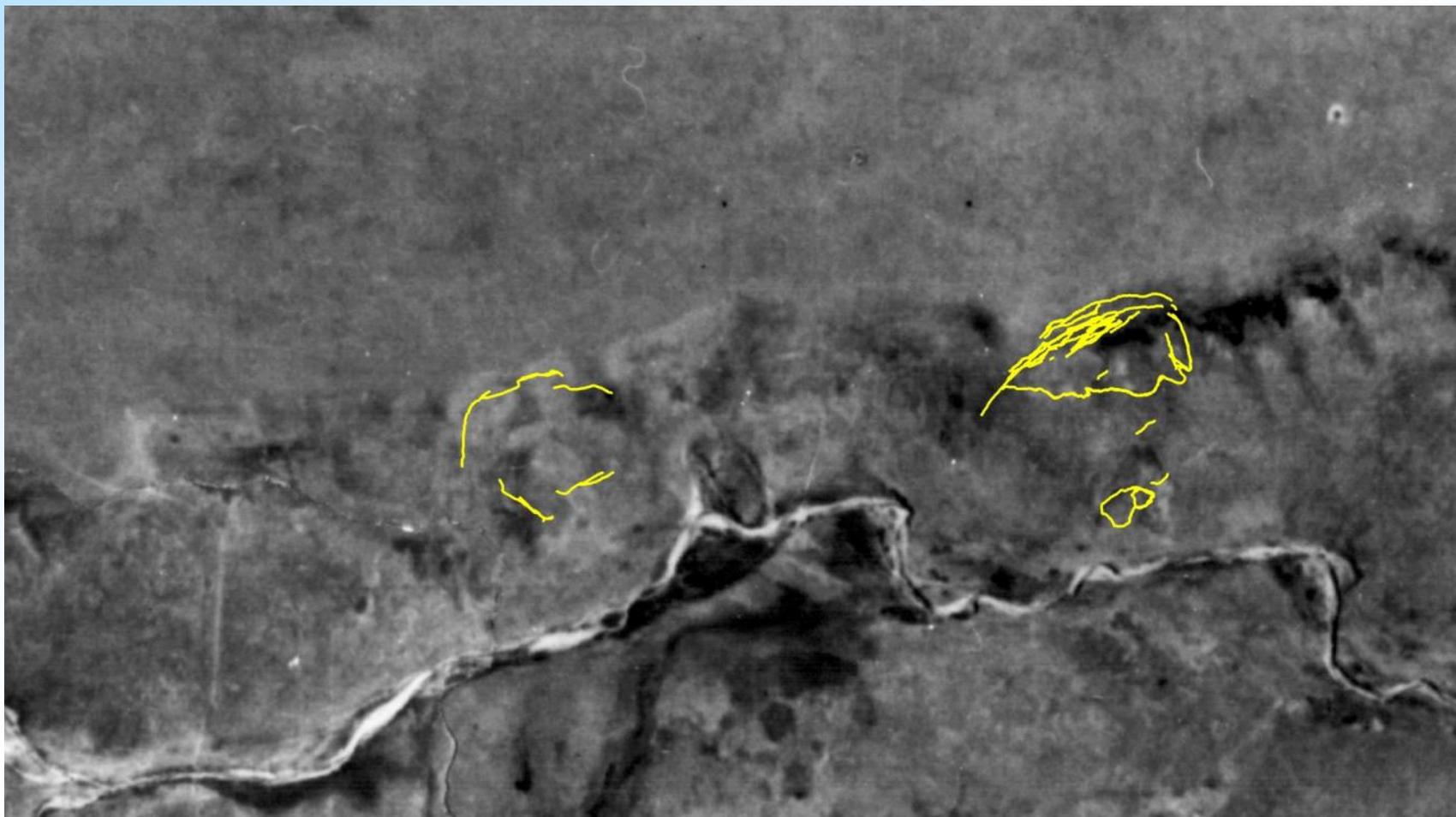
February 1, 2016



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# 1936 Aerial Photo (current movement areas noted)



# Operating History

- Construction and other debris and general facility waste placed in 20-acre area from 1952 to 1968
  - Small amounts of waste with hazardous constituents
  - Asphalt, construction debris
  - Office and building debris
  - Commonly used VOCs
  - PCB waste such as carbonless copy paper, small capacitors
  - Metals such as beryllium, lead, and chromium
- Approximately 74,000 cubic yards of waste disposed
- Waste segregation was practiced, with most radioactive and hazardous waste disposed in other areas of Rocky Flats or in Idaho



# Operating History (continued)

- Filter backwash wastewater (from making potable water) discharged to evaporation pond; covered with fill by 1964
- 60 kg of burning depleted uranium dumped in landfill (1965); 40 kg recovered; further removal of DU in surface soil was completed in 2004
- Soil cover placed over disposed waste when OLF shut down in 1968
- Present Landfill opened to receive this type of waste
- South Interceptor Ditch (SID) built across southern portion of landfill in 1980



# 1964



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# 1974



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# 1974



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# Remedial investigation and early cleanup

- 1979: three locations of depleted uranium found and one box of soil removed
- Date unknown: Woman Creek near western portion of landfill relocated
- 1990: removal of barrel with radioactive materials followed by radiological survey of entire OLF area
- 1993: removal of pieces of radioactive debris (depleted uranium); small spherical pieces of rusty material and concrete coated with corroded metallic material
- 1996: Remedial investigation
- 2004: removal of surface soil contaminated with uranium above Wildlife Refuge Worker Action Levels



2002



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# 2002



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# Remedy Selection

- Final Interim Measure/Interim Remedial Action document (2005)
  - Page 5-1: “OLF has been closed for approximately 35 years with an inadequate soil cover and limited stormwater run-on and run-off controls, and very little maintenance applied, and yet the levels and extent of contamination in environmental media are quite low.”
  - Page 4-8: “...Groundwater quality is not significantly impacted by the OLF.”
  - Page 4-9: “frequency of occurrence (of downgradient surface water analytes above action levels) is not sufficient to indicate the OLF has a significant chronic impact on surface water quality.”



# Remedy Selection (continued)

- Remedial Action Objectives
  - Prevent direct contact with landfill soil and commingled waste
  - Control erosion caused by stormwater run-on and runoff
- Components of source containment remedy
  - Removal of uranium-contaminated surface soils
  - Stable landfill cover to prevent direct contact with soil or debris
  - Landfill cover that adequately controls erosion caused by stormwater run-on and runoff
  - Institutional controls to supplement engineering controls



# 2005 Closure



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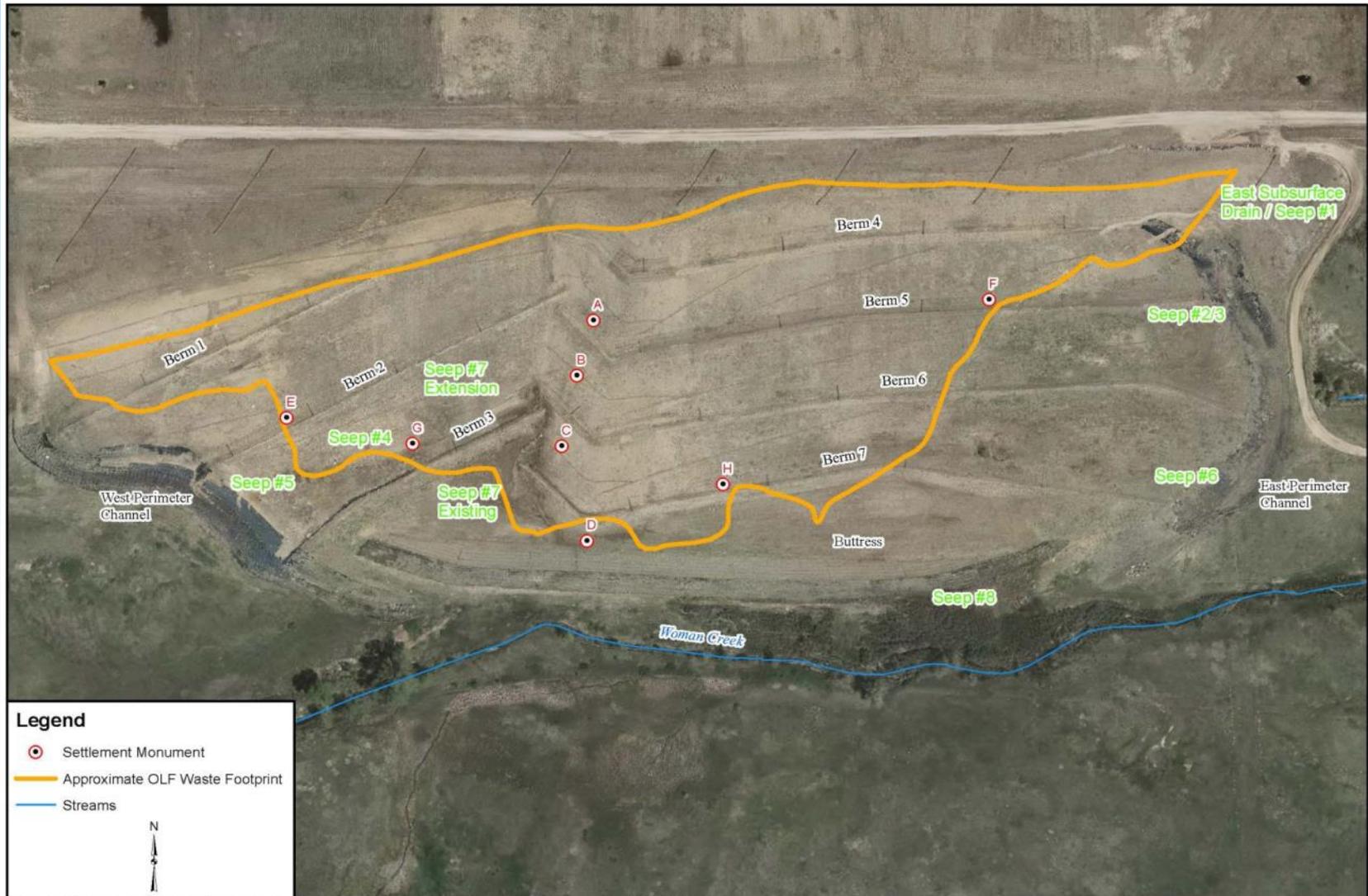
# 2005 Closure



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# Current landfill features



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# 2007 to 2010

- 2007: localized cover slumping and settling, primarily on west side, and Seep 8 at eastern toe of buttress appeared
- 2008: geotechnical investigation
  - Evaluate possible causes of localized slumping
  - Develop feasible alternatives for mitigating localized slumping
  - Consider seep impacts and evaluate berm heights and channel slopes



# 2007 to 2010 (continued)

- Results of 2008 geotechnical investigation
  - Clay layer containing organic materials at bedrock contact appears to be weak interface area
  - Modeling predicts small-scale instability when percolating moisture lubricates weak layer
  - Buttress provides stability and no large-scale instability predicted
  - Selected path forward was filling cracks and repairing localized movement if necessary; no large-scale actions
  - Berm heights re-evaluated



## 2007 to 2010 (continued)

- Seep 7 drain extension
- West perimeter channel reconfiguration
- Drain in the west perimeter channel opened
- Subsurface drain added to west perimeter channel and berm 3 channel
- Berm and channel maintenance



# 2010 to 2013

- After 2009 west perimeter channel reconfiguration, no significant movement or cracking;
- Occasional small cracks were filled in accordance with the Monitoring and Maintenance Plan



# September 2013 flood

- 100-year rainfall event
- Cracking through berm 4 and into berm 5 on east side;
- No significant erosion; minor gullying and erosion at ends of some berm channels where connected to perimeter channels
- The surface water management features performed well
- Filled cracks and installed temporary drain at berm 4
- Larger scale re-grade designed for east perimeter channel; implementation delayed by early winter weather



# 2014 Construction

- Cracking and slumping, mostly associated with the east perimeter channel and the berm 4 area, continued through spring of 2014
- DOE re-evaluated the design for the east perimeter channel reconfiguration
- East perimeter channel reconfiguration construction completed second week of January 2015
- All soil disturbance and regrading was performed outside the waste footprint





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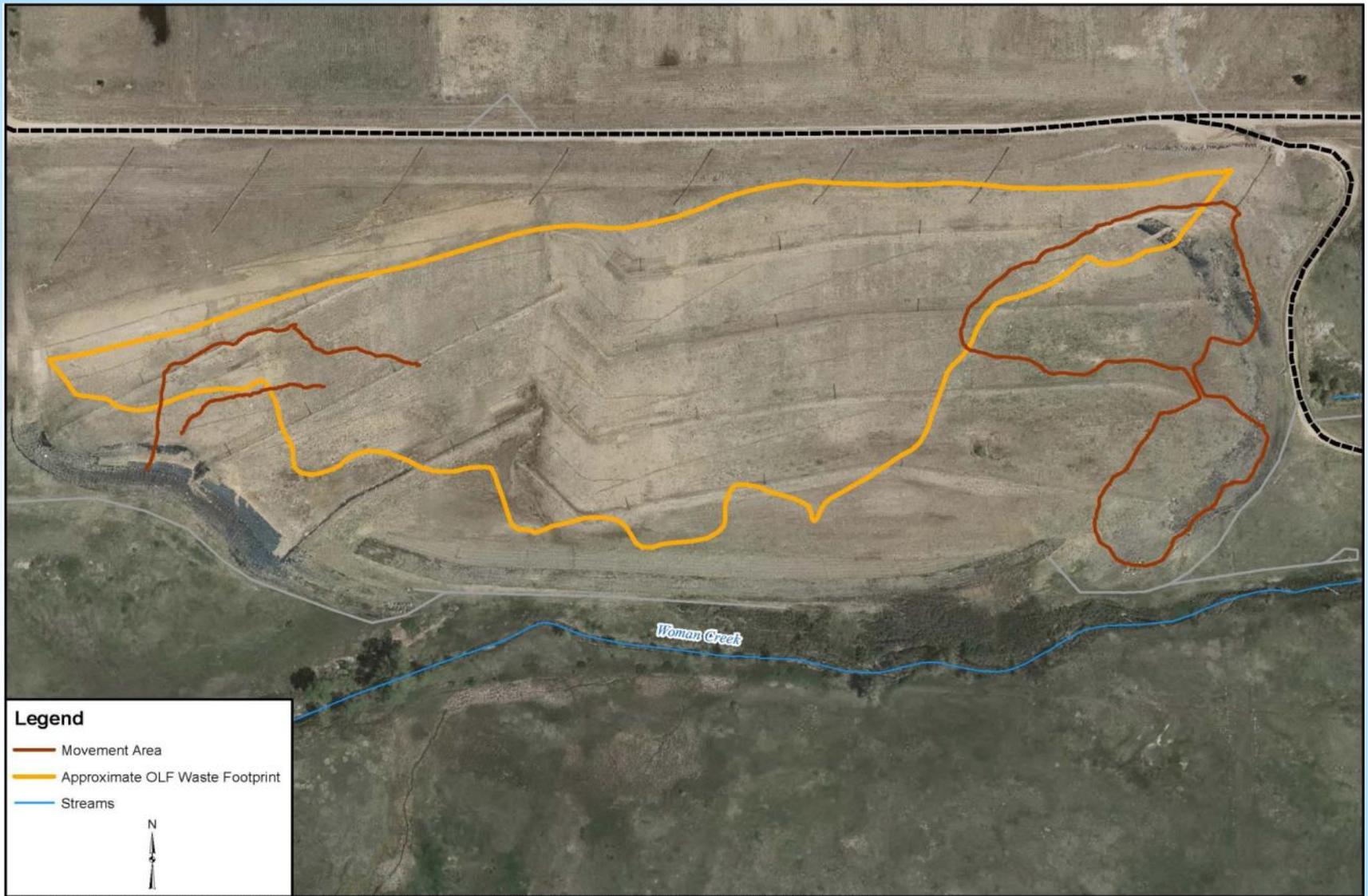


# 2015 extended heavy precipitation

- Extended heavy precipitation over several months in spring of 2015
  - Significant cracking, slumping, and movement on the east side.
  - West side experienced some movement on the west end of berms 1 and 2
  - Center section of the landfill experienced no visible movement (small cracks in a few locations)
- Immediate actions included installing overland drain pipe and developing small drainage channels to conduct water off the cover



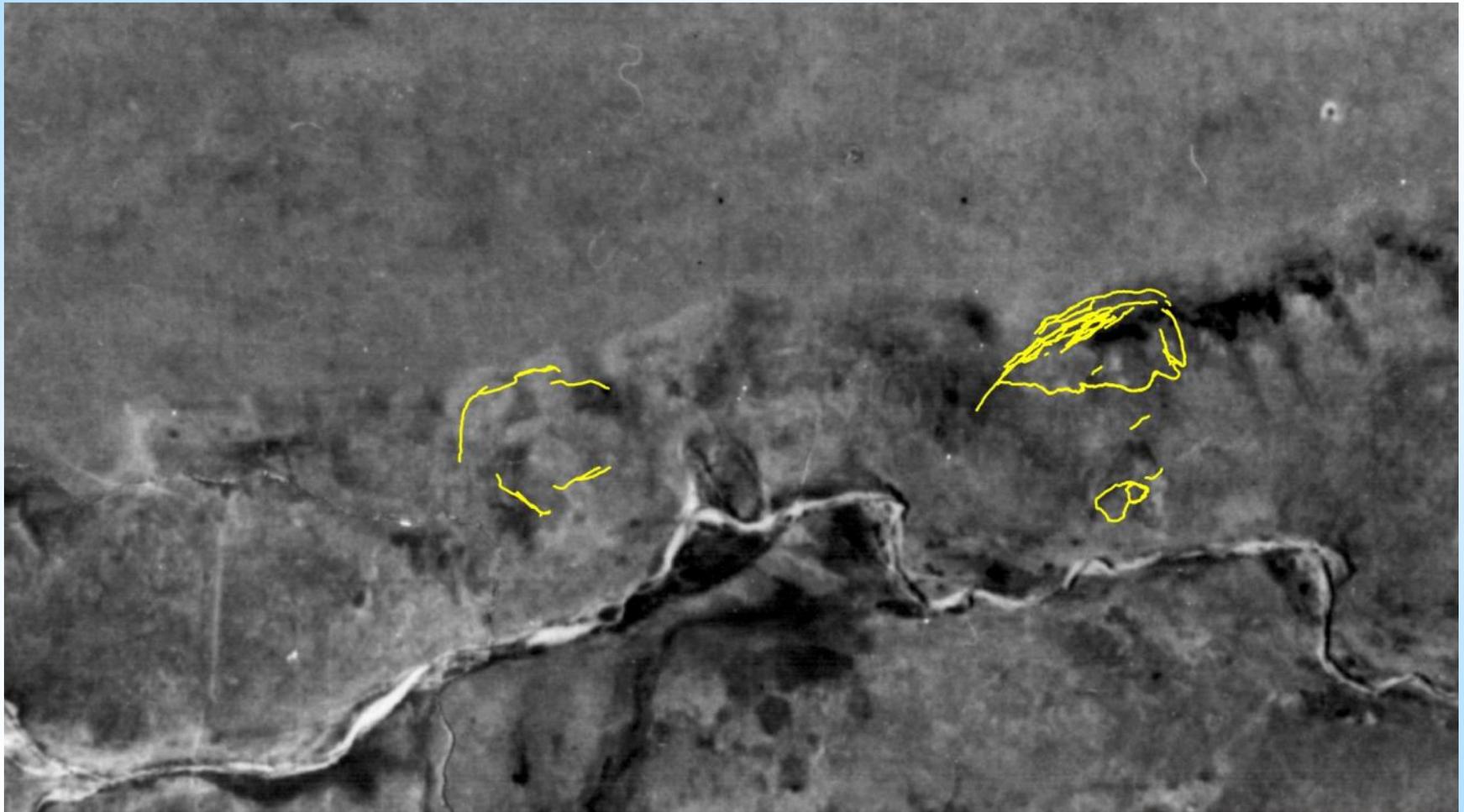
# OLF Movement Areas



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# 1936 Aerial Photo



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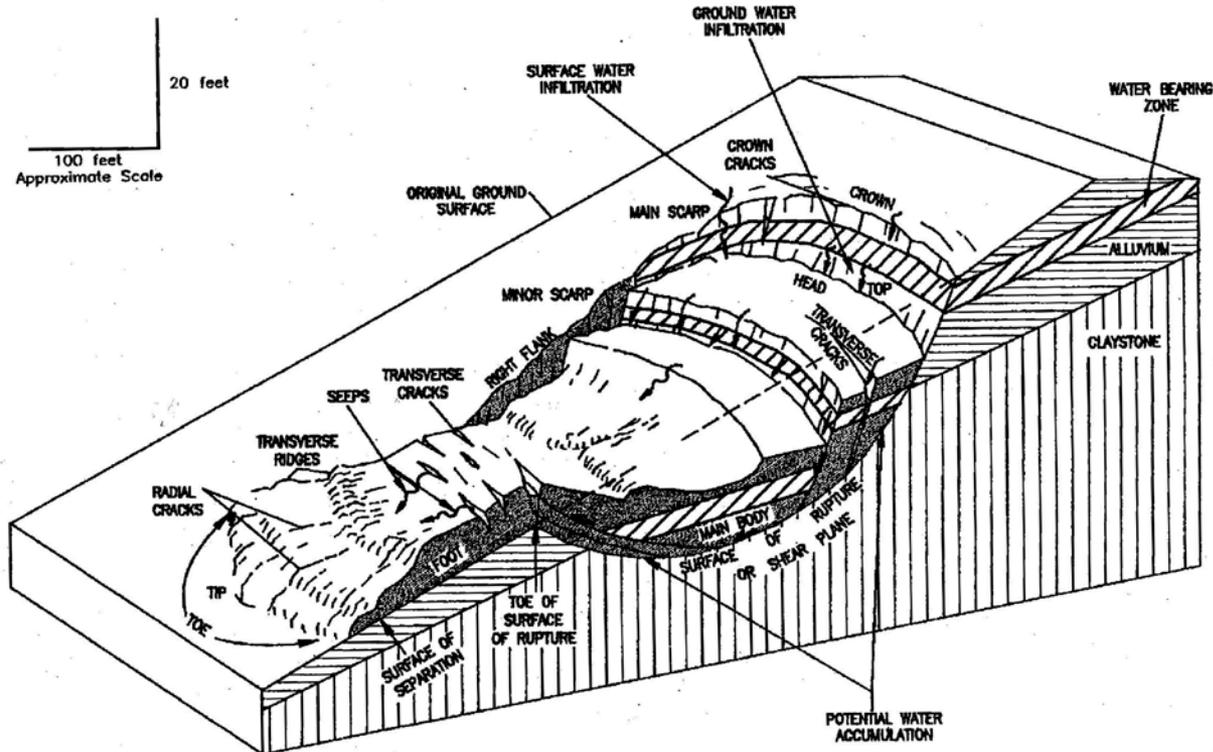




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# Typical Slump



Adapted from Schuster and Krizek, see references.

 Rocky Flats Site, Golden, Colorado	
<b>Potential Hydrogeologic Conditions of a Typical Slump</b>	
Hydrogeologic Characterization Report	
April 1995	Figure 6-14



# 2015 interim action

- Re-graded affected areas to restore the water management functions of the cover and close cracks
- Two-foot cover requirement was not maintained in some areas, primarily outside the waste footprint
- A few pieces of debris were noted during regrading; none were radiologically contaminated





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# October 2015



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# Path forward evaluation

- Engineering evaluation of technical alternatives to increase slope stability and evaluate water management features
- Cost estimates and regulatory implications will be developed for short-listed technical alternatives



# Monitoring and Maintenance

- Prescribed by RFLMA and detailed in the OLF Monitoring and Maintenance (M&M) Plan
- Inspections
  - Monthly as required by RFLMA
  - Currently performed weekly as a best management practice
  - Performed after 1 inch of rain in 24 hours or significant melt of a 10-inch or more snow accumulation
- 8 settlement monuments surveyed quarterly
- Inclinometer monitoring discontinued
- Topographic survey every two years
- Berm and channel maintenance every two years

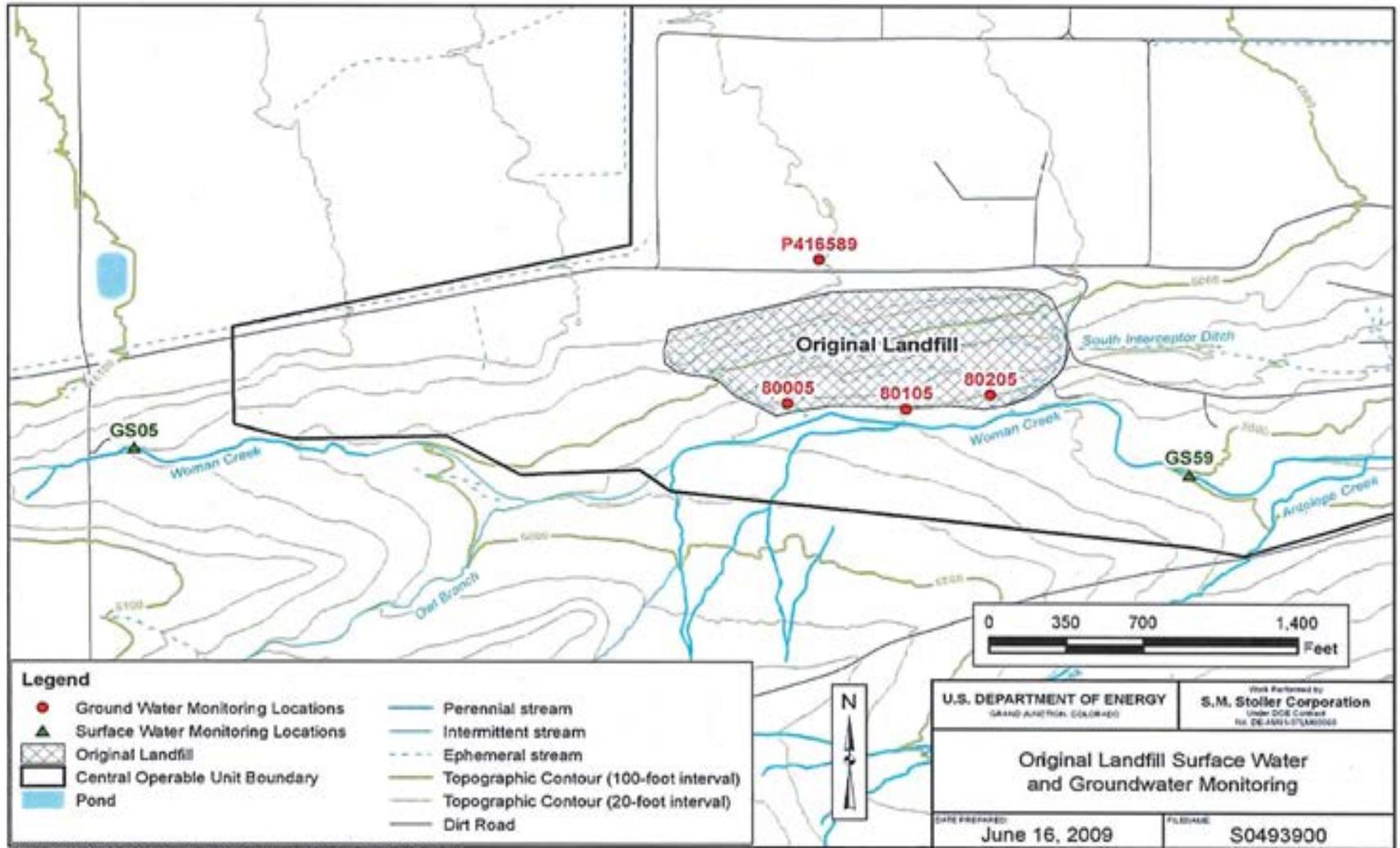


# Monitoring and Maintenance (continued)

- Consultation with geotechnical engineer triggered by specified events
- Institutional controls
- Four RCRA monitoring wells
- Surface water monitoring at GS05 and GS59
- Reporting in quarterly and annual environmental monitoring reports



# Monitoring Locations



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# Water quality monitoring results

- Analyze for VOC, SVOC, metals including U
- Results consistent year to year
- VOCs and SVOCs rarely detected
- Monitoring does not indicate water quality impacts from landfill

