SedPrePro

By:

Richard C. Warner

University of Kentucky

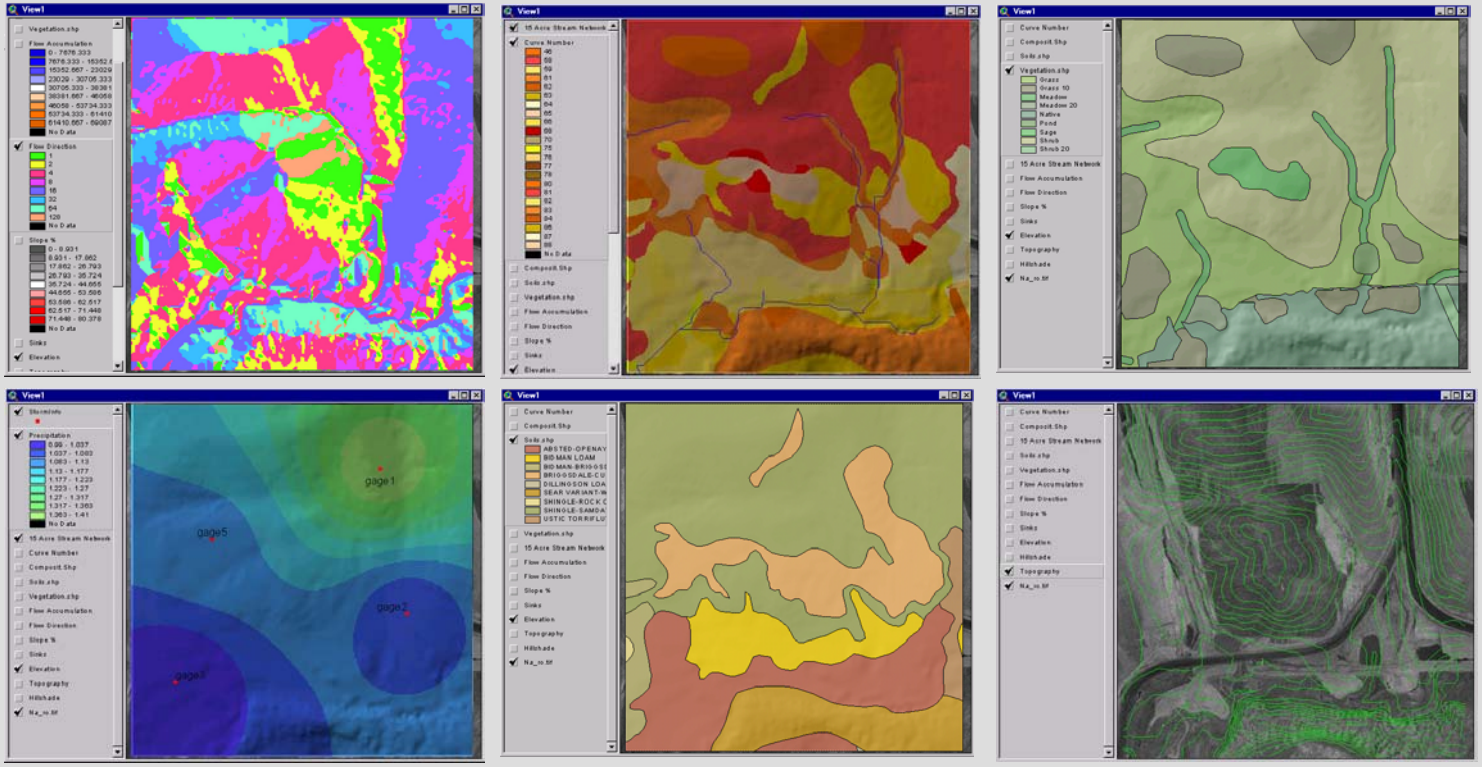
Michael E. Anderson

Fuller Mossbarger Scott & May

SedPrePro Overview

- Course Philosophy
- Hydrologic and Hydraulic Application
- Data Needs and Sources
- Topographic Data Processing
- Structure Designation and Placement
- SubWatershed Delineation

New Developments in Sedcad+ and GIS

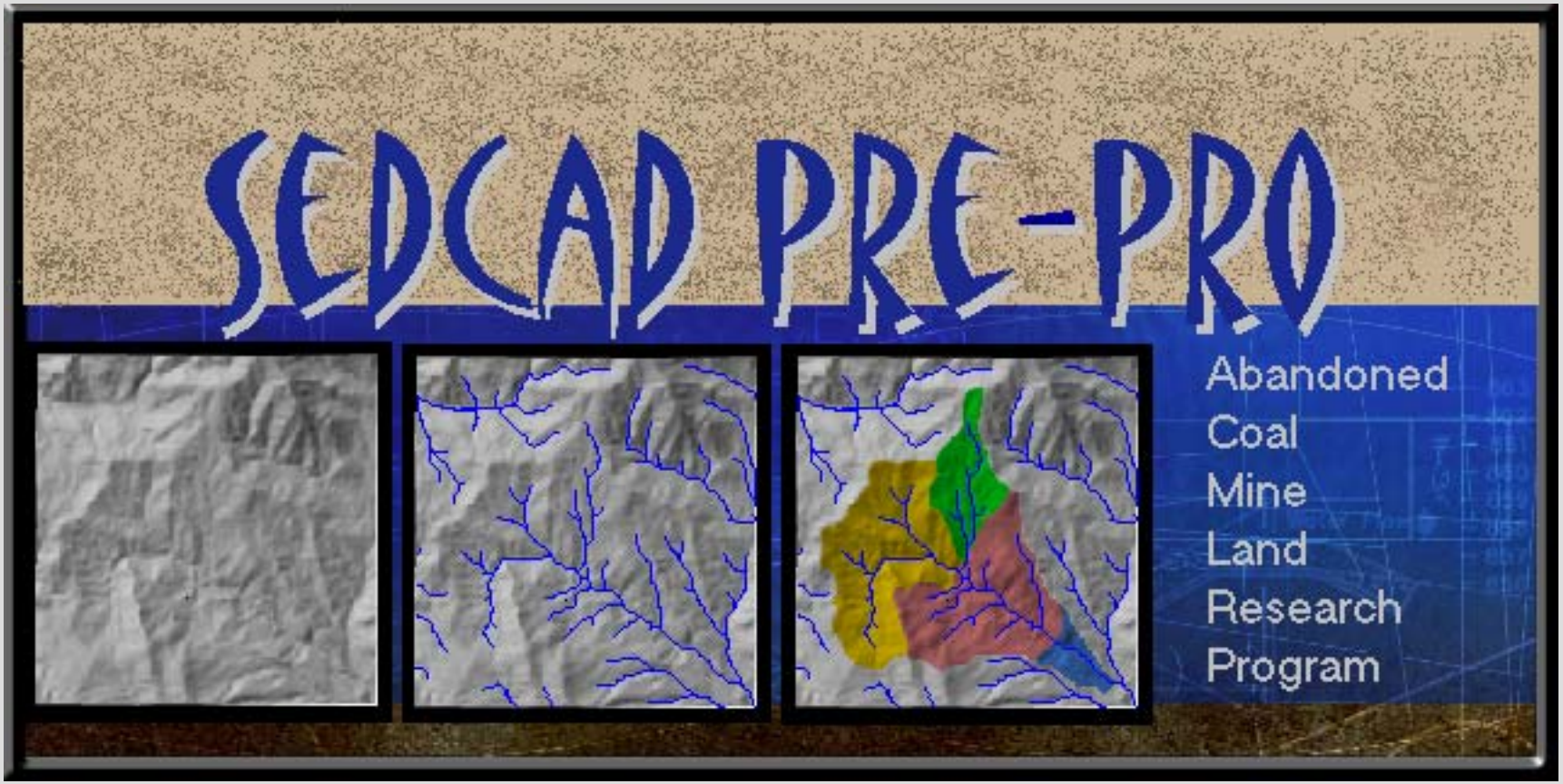


Richard Warner Michael Anderson

Hydrologic & Hydraulic Applications

- Distributed Watershed Models
  - SEDCAD
  - HEC-HMS
  - TR-55

Sedcad and GIS



SedPrePro

- ArcView Preprocessor for SEDCAD
  - Develops the majority of SEDCAD model hydrologic parameters and inputs
    - Precipitation
    - Curve Numbers
    - Structures
    - Watersheds
    - Time of Concentration
    - Routing Parameters

SedprePro Capabilities

- Channel Network
- Channel Length
- Channel Slope
- Surface Drainage Patterns
- Drainage Densities
- Channel Origins
- Stream Orders
- Drainage Divides
- Watershed Delineation
- Watershed Properties

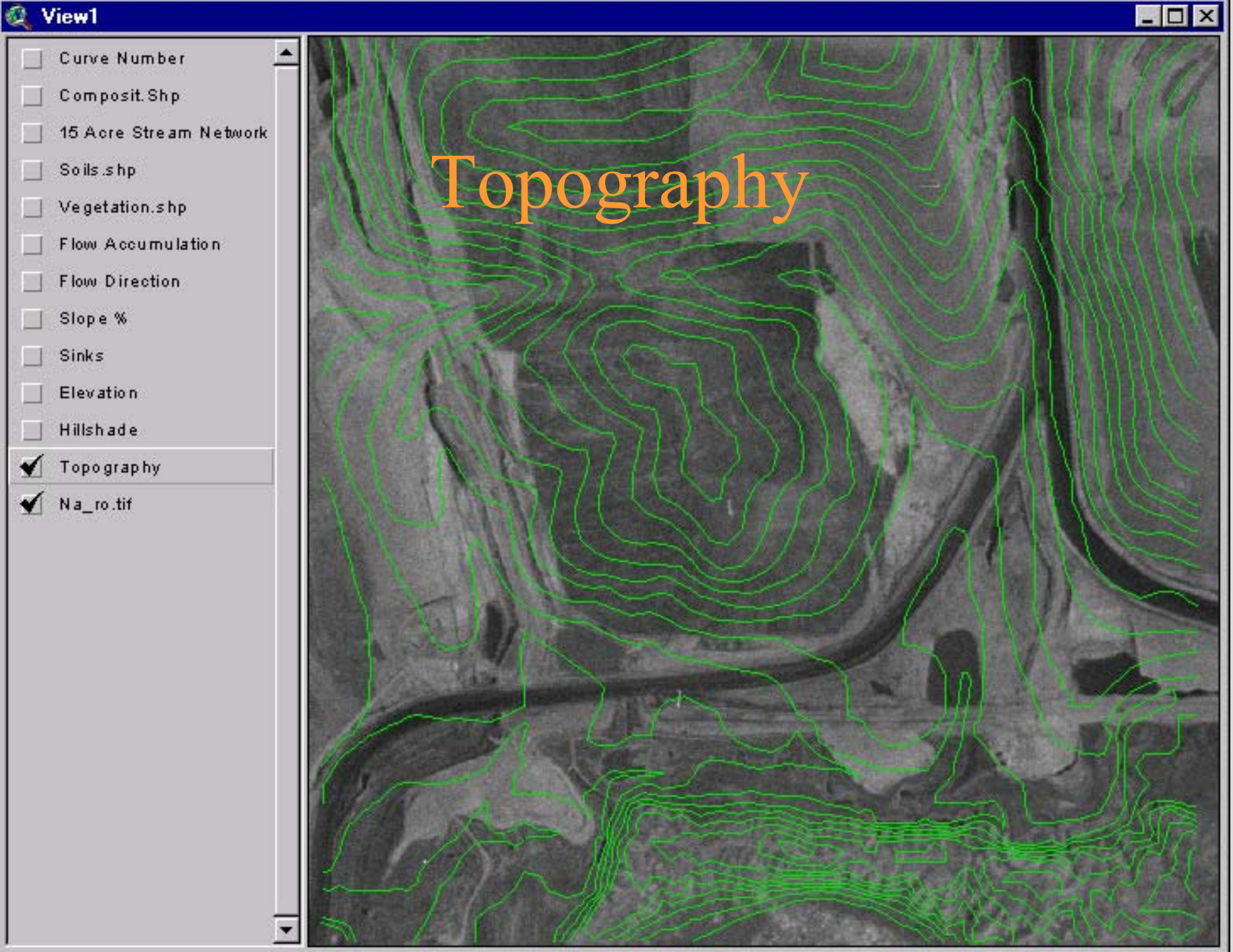
  Area, Elevation,

  Slope,

  Longest Flow Path

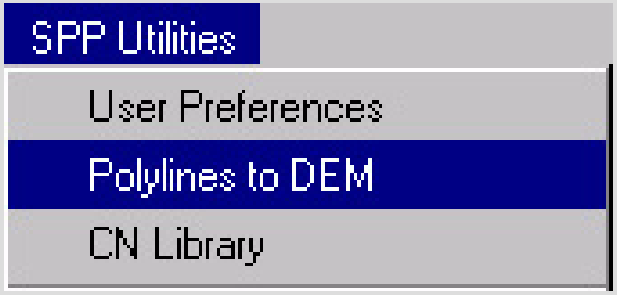
Data Needs and Sources

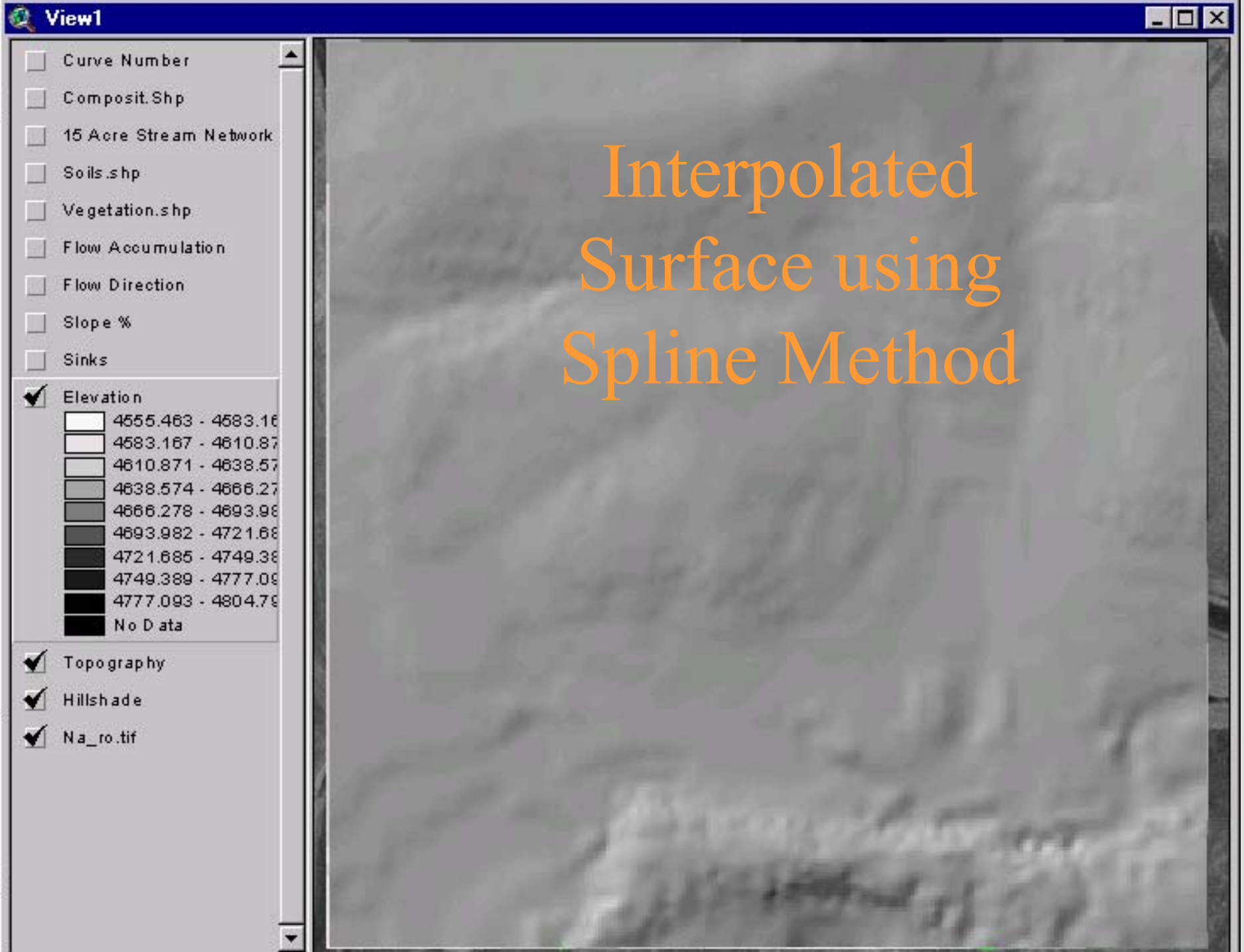
- Digital Elevation Model (DEM)
  - Digital representation of topography
  - Raster Network of cells with elevation values
- Indirect methods of obtaining a DEM
  - SedPrePro method converts topography line data to DEM.
    - Surveying, AutoCad, other Earthwork Packages
  - Topography Map
    - Scan & Filter Techniques to produce digital topography with elevation attributes


View1
Curve Number
Composit.Shp
15 Acre Stream Network
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
Hillshade
Topography
Na_ro.tif
Topography

Topography Lines to a Digital Elevation Surface

- WE'LL TAKE:
  - Any form of Topography Lines
  - From AutoCad or
  - From ArcView or ArcInfo
  - Must have elevation as an attribute
- WE CREATE:
  - Continuous Raster Elevation Surface




View1
Curve Number
Composit.Shp
15 Acre Stream Network
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
4555.463 - 4583.16
4583.167 - 4610.87
4610.871 - 4638.57
4638.574 - 4666.27
4666.278 - 4693.98
4693.982 - 4721.68
4721.685 - 4749.38
4749.389 - 4777.09
4777.093 - 4804.79
No Data
Topography
Hillshade
Na_ro.tif
Interpolated Surface using Spline Method

Resources

- DEM
  - USGS 7.5 min
  - 1:24,000 (1in = 2000ft)
  - UTM
- Quality
  - Level 2 RMS Error = ½ map contour interval
  - Level 3 RMS Error = 1/3 map contour interval
  - Ex
    - Level 2 10ft Interval = + or – 5 ft.
    - Level 3 10ft Interval = + or – 3.3 ft.

DEM Resources Continued

- National Imagery and Mapping Agency
- National Geophysical Data Center
- Other State Agencies

DEM INFORMATION

- Cells with Elevation
- Data Structure is Raster
- Matrix of square grid cells
  - Stored in a 2-D array
  - Mean cell elevation
- Location in geographic space
- Alternative Data Structure
  - Triangulated Irregular Network (TIN)
  - Enables Cut/Fill volume estimators
  - 3-D Modeling

DEM INFORMATION

- Cell Size
  - Default is roughly 200 x 200 columns/rows
  - 40 thousand cells
- Recommendations
  - Keep in mind the overall watershed area
  - What your needs are (accuracy versus computation time)
  - Minimum of 100 cells per subwatershed

DEM Data Processing Overview

- Adjacent Cell's Elevation
- Identify Sinks (depressions)
- Fill/Breach
- Adjust Cell's Elevation Difference
- D – 8 Method
- Flow Direction
- Flow Accumulation
- Threshold for Channel Initiation
- Watershed Delineation

Elevation Grid

87	76	75	77	69
80	72	73	55	50
74	66	45	38	39
69	64	60	30	34
72	68	65	32	28

D – 8 Method for Flow Direction

- Defines the flow direction among cells from a DEM using an overland flow analog
- Identifies steepest downslope flow path between each cell and its 8 adjacent neighbors
- Defines flow in one direction
- Excellent for delineation of drainage networks

Calculating Flow Direction

Dimensional D-8 Method

2^5	2^6	2^7
2^4	*	2^0
2^3	2^2	2^1

32	64	128
16	*	1
8	4	2

Elevation to Flow Direction

87	76
80	72

Flow Directions

32	64	128
16	*	1
8	4	2

D-8 Selection

2	x
x	x

Flow Direction Assignments

Elevation to Flow Direction (cont)

87	**76**	75
80	72	73

Flow Directions

32	64	128
16	*	1
8	4	2

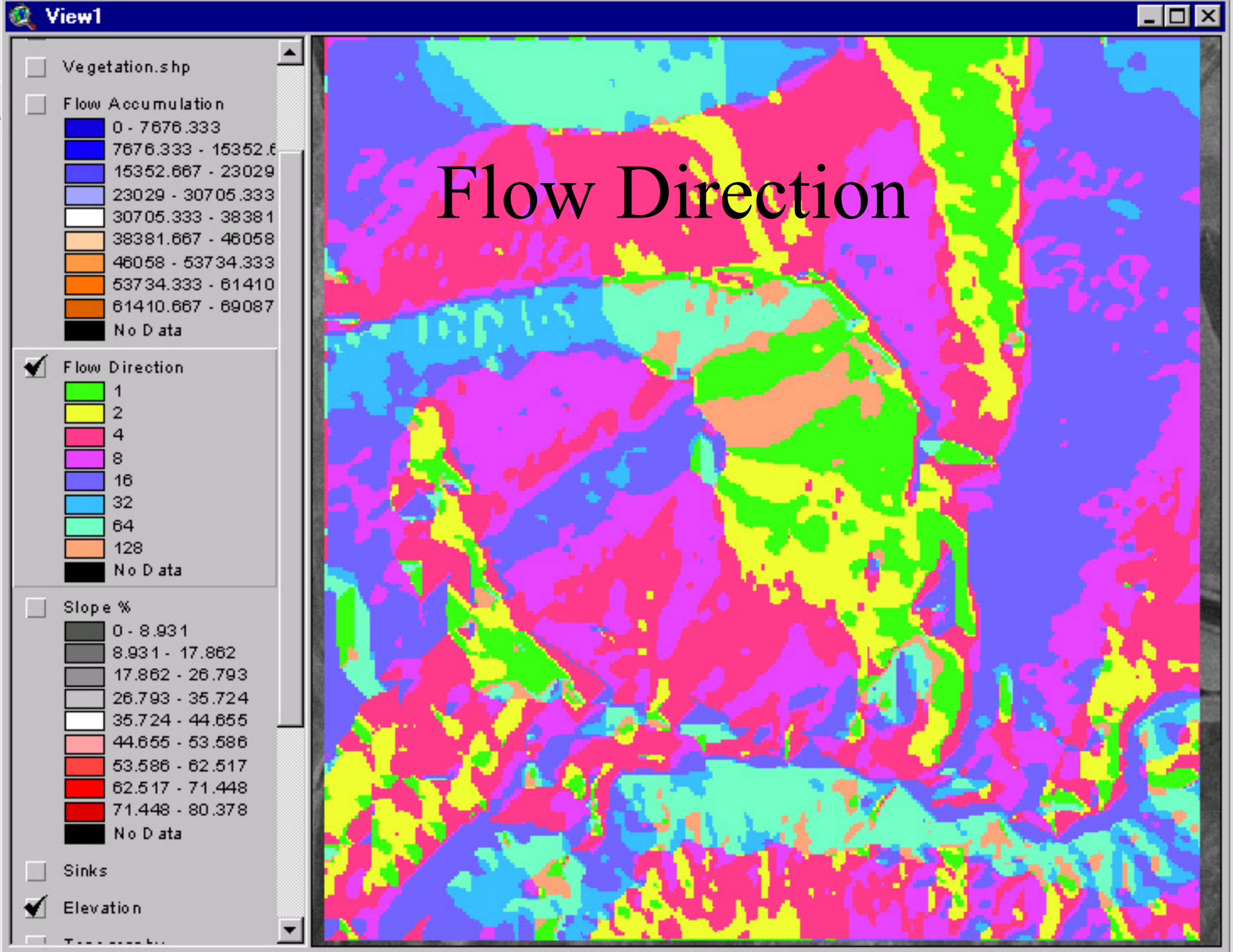
D-8 Selection

2	4	x
x	x	x

Flow Direction Assignments

Flow Direction Results

2	4	2	2	4
2	2	2	4	8
2	1	2	4	8
1	128	1	2	4
128	128	128	1	2


View1
Vegetation.shp
Flow Accumulation
0 - 7676.333
7676.333 - 15352.6
15352.667 - 23029
23029 - 30705.333
30705.333 - 38381
38381.667 - 46058
46058 - 53734.333
53734.333 - 61410
61410.667 - 69087
No Data
Flow Direction
1
2
4
8
16
32
64
128
No Data
Slope %
0 - 8.931
8.931 - 17.862
17.862 - 26.793
26.793 - 35.724
35.724 - 44.655
44.655 - 53.586
53.586 - 62.517
62.517 - 71.448
71.448 - 80.378
No Data
Sinks
Elevation
Flow Direction

Sinks / Depressions

- Cells that have all adjacent cells with higher elevation
- No downslope flow path to an adjacent cell
- Solution
  - Fill cell to an elevation higher than the lowest elevation of adjacent cell
  - Breach. Fill lowest adjacent cell to an elevation higher than the sink cell

Flat Areas

- Adjacent cells have some or higher elevation
- Sollution:
  - Search broader range than just adjacent cells and raise flat area cells to conform to overall flow directions

Sinks Adjustments

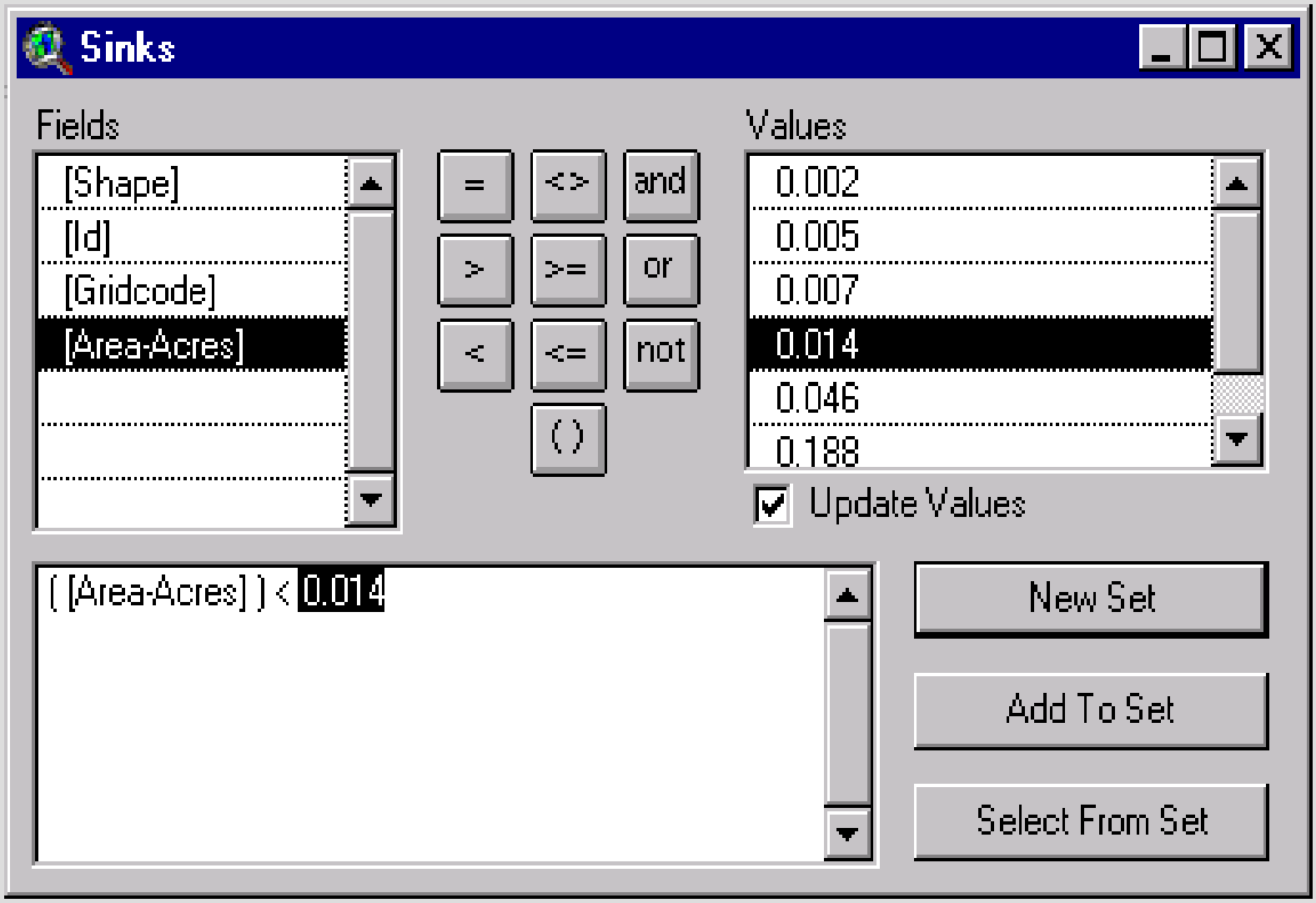
78	75	73
72	64 **(67)**	70
77	69	66

Increase cell to 65, 66, **67**

78	75	73
72	64	70
77	69	66 **(63)**

Decrease cell to 65, 64, **63**

Delete All Sinks Less Than ‘X’ Acres



Flow Accumulation

- Sums the number of upstream cells that contribute flow to each cell

Flow Direction to Flow Accumulation

2	4	2	2	4
2	2	2	4	8
2	1	2	4	8
1	128	1	2	4
128	128	128	1	2

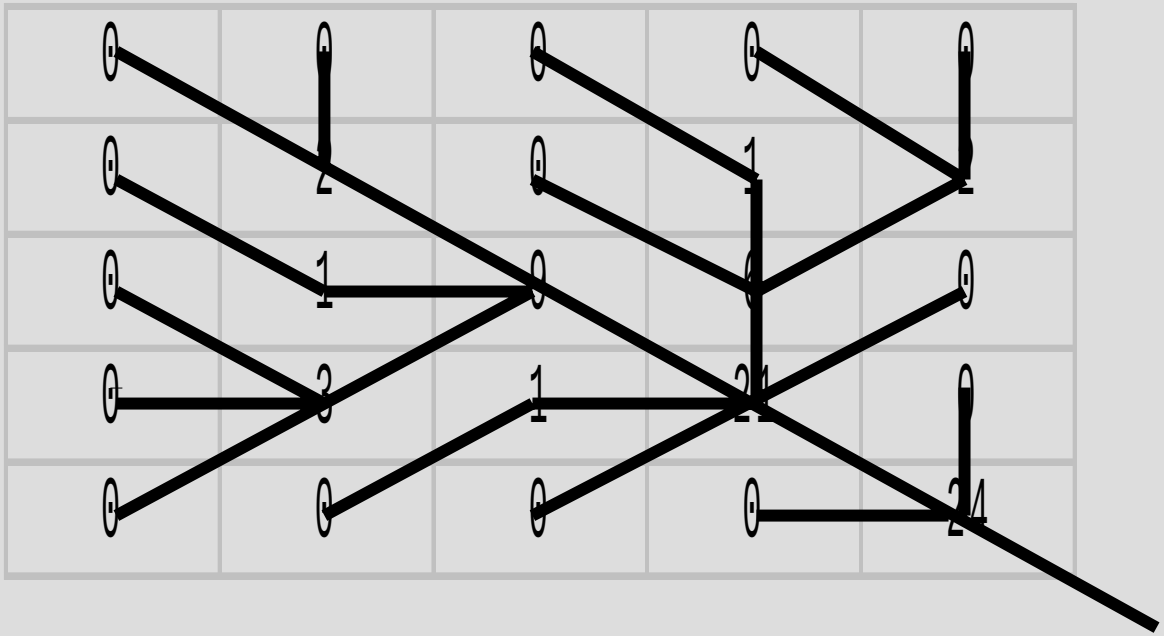
0	0	0	0	0
0	2	0	1	2
0	1	9	6	0
0	3	1	21	0
0	0	0	0	24

Number of Contributing Cells

Drainage Networks

- Constant threshold area method
- User selected threshold
- All cells with area greater than threshold area are part of drainage network
- Arbitrary drainage density
- Not linked with topology or morphometric characteristics of the drainage network

Stream Networks



For all cells

Stream Networks

0	0	0	0	0
0	2	0	1	2
0	1	0	6	0
0	3	1	21	0
0	0	0	0	24

For cells receiving 1 or more contributing cells

Stream Networks

0	0	0	0	0
0	2	0	1	2
0	1	0	6	0
0	3	1	21	0
0	0	0	0	24

For cells receiving 2 or more contributing cells

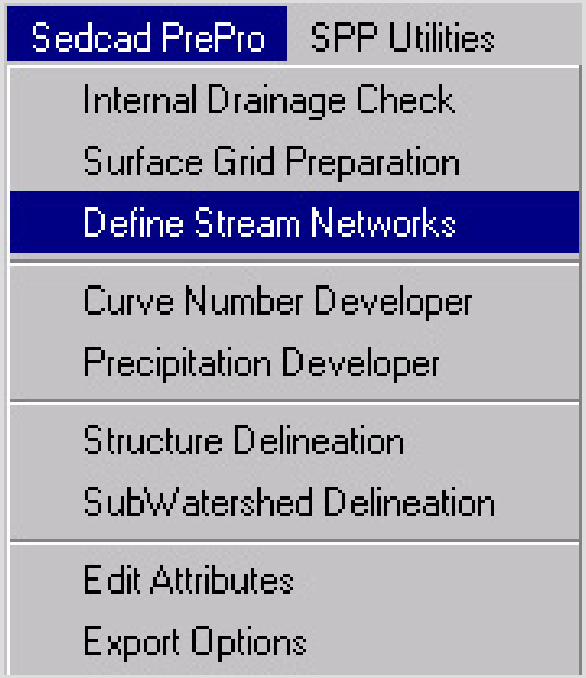
Stream Networks

0	0	0	0	0
0	2	0	1	2
0	1	9	6	0
0	3	1	21	0
0	0	0	0	24

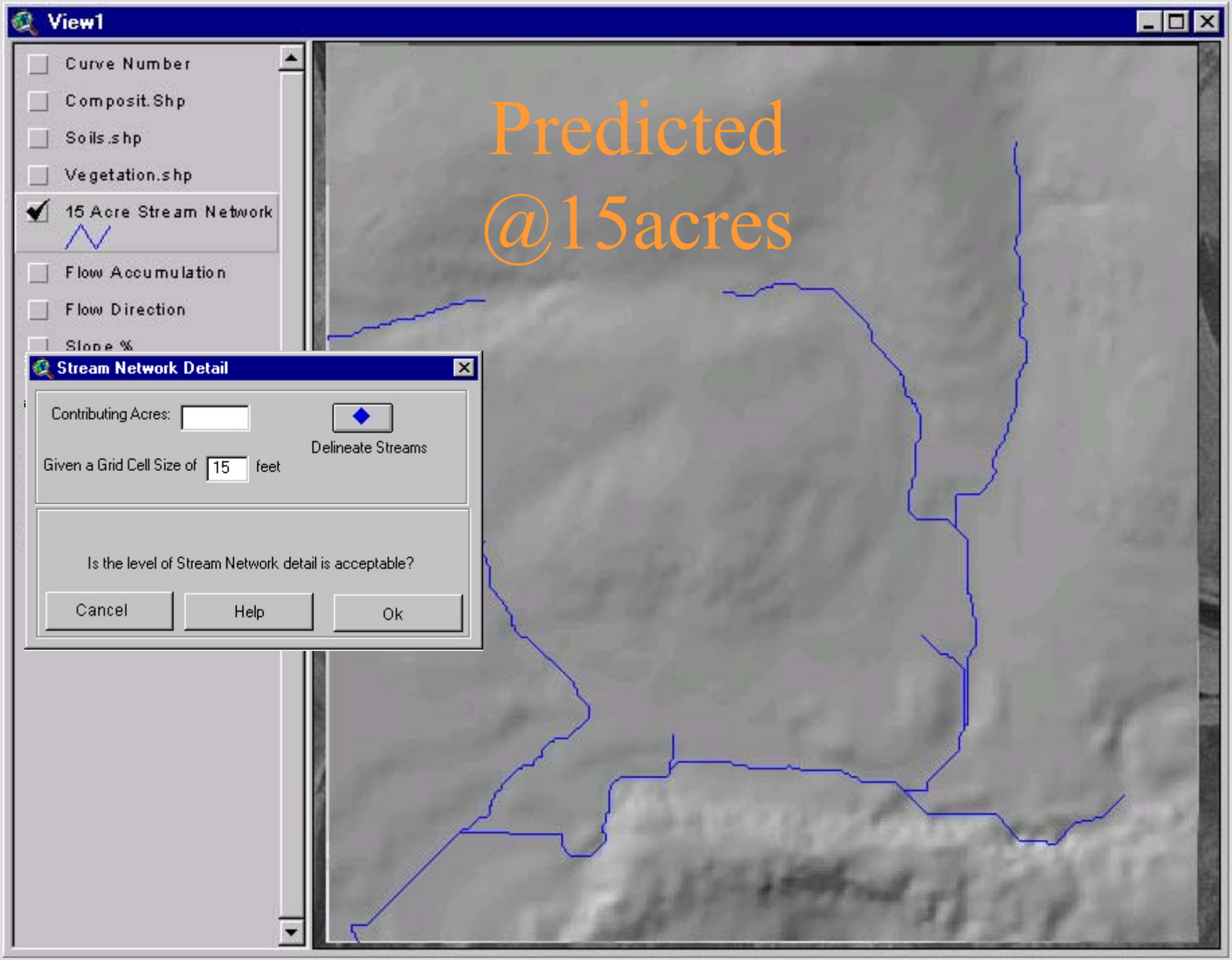
For cells receiving 3 or more contributing cells

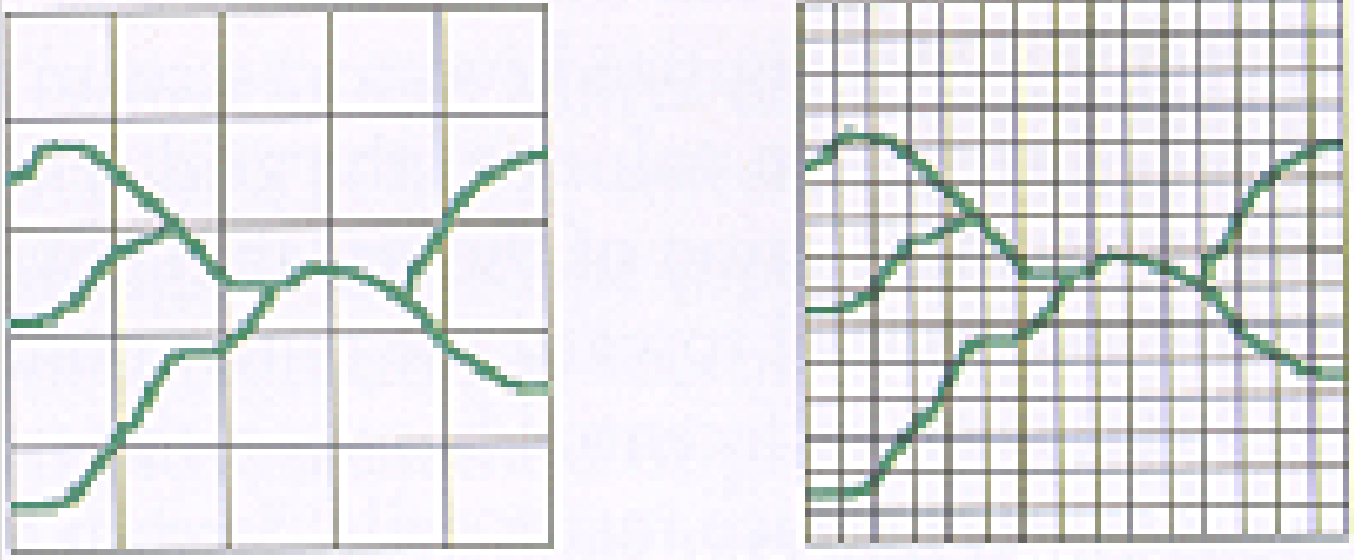
Stream Network Delineation

- Vector Networks
- Based on size of contributing area
- How many acres of contribution before a you have a stream channel?

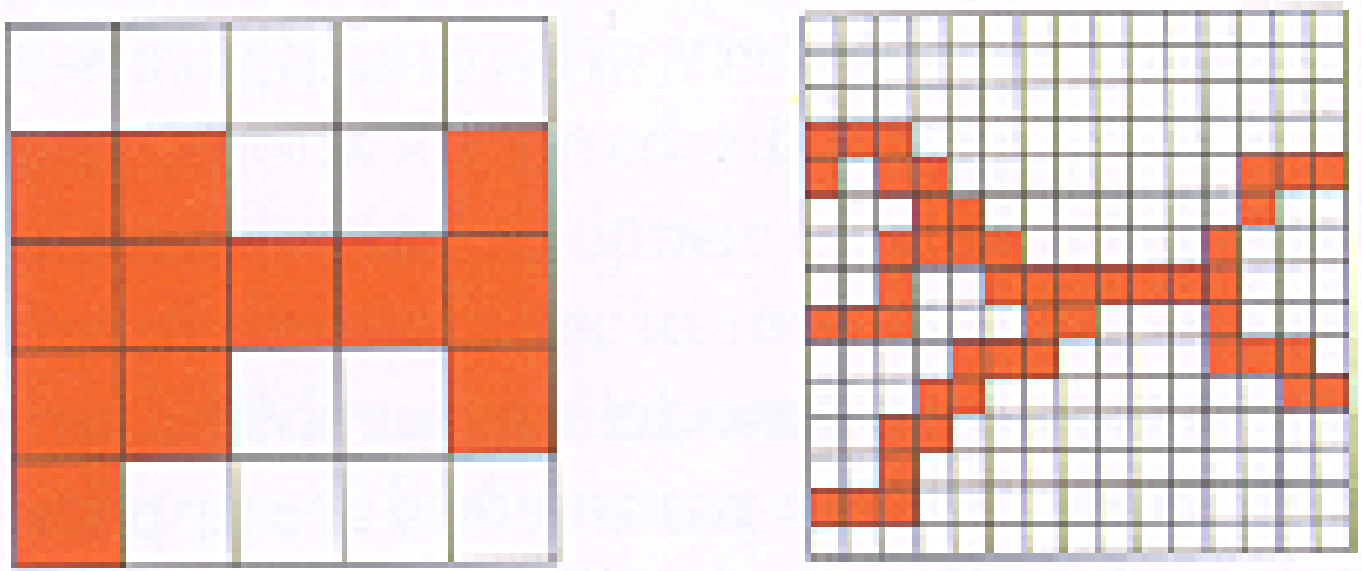


As Many as You Like

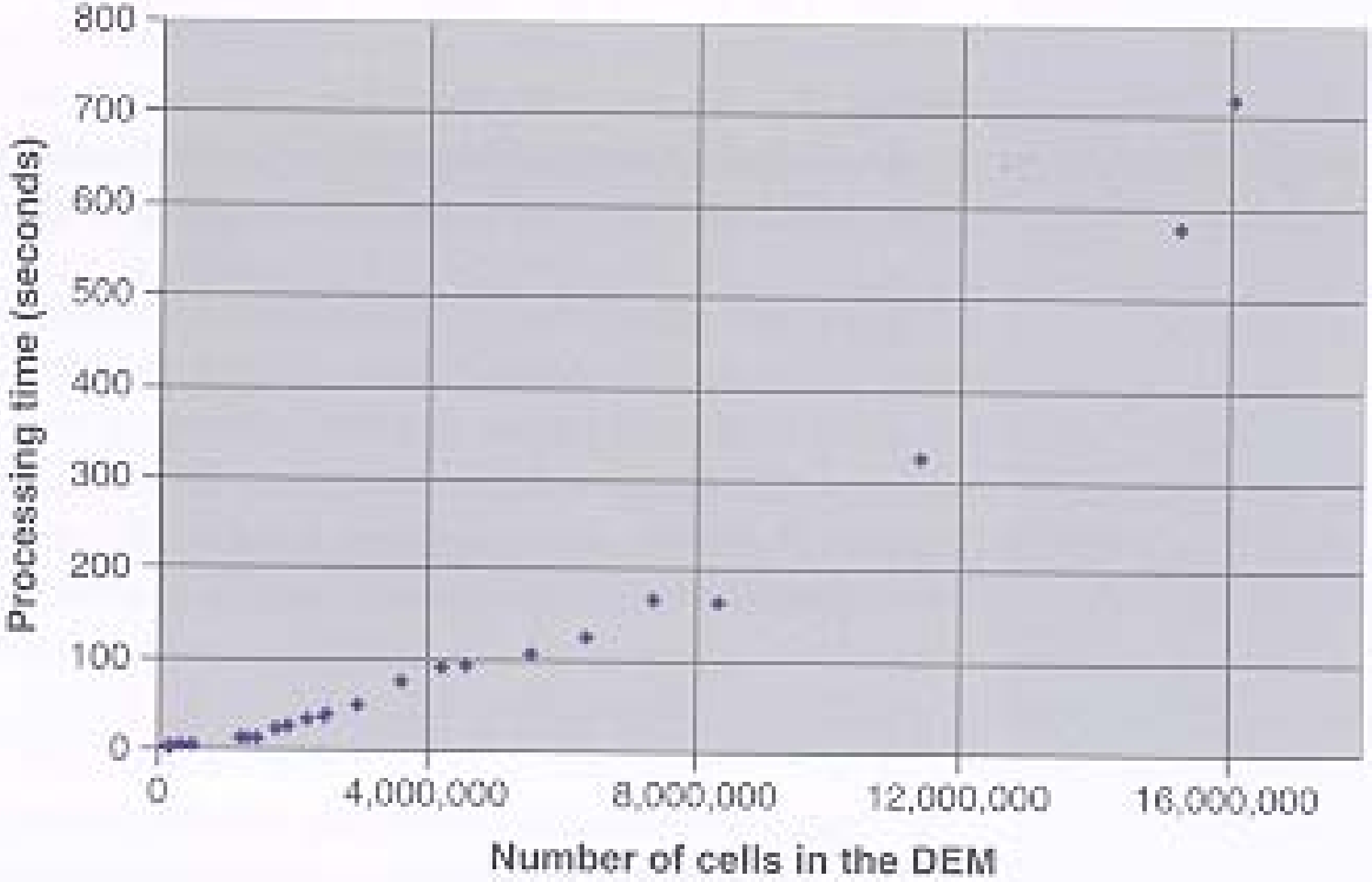

View1
Curve Number
Composit.Shp
Soils.shp
Vegetation.shp
15 Acre Stream Network
Flow Accumulation
Flow Direction
Slope %
Stream Network Detail
Contributing Acres:
Delineate Streams
Given a Grid Cell Size of 15 feet
Is the level of Stream Network detail is acceptable?
Cancel
Help
Ok
Predicted
@15acres



(a) Two conceptual grid layers with stream network superimposed

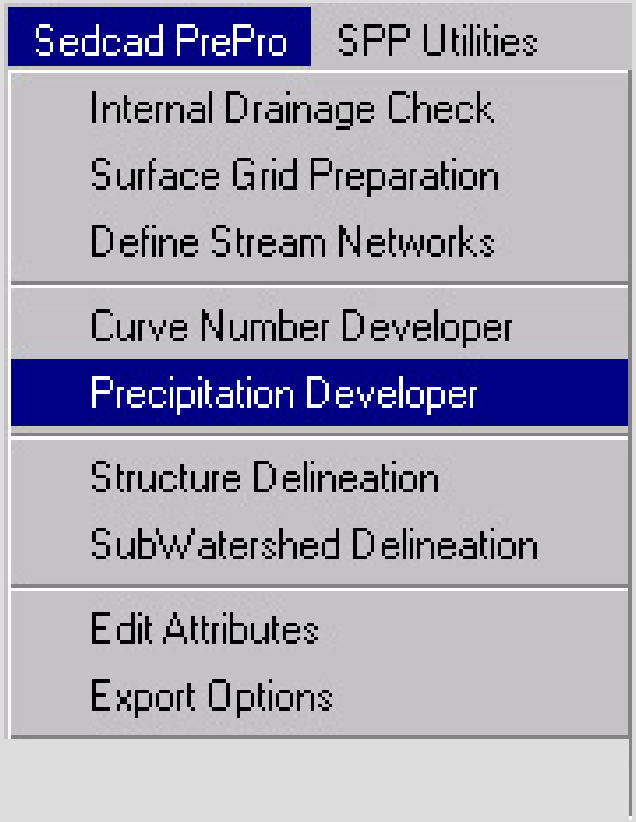


(b) Rasterization of the stream network

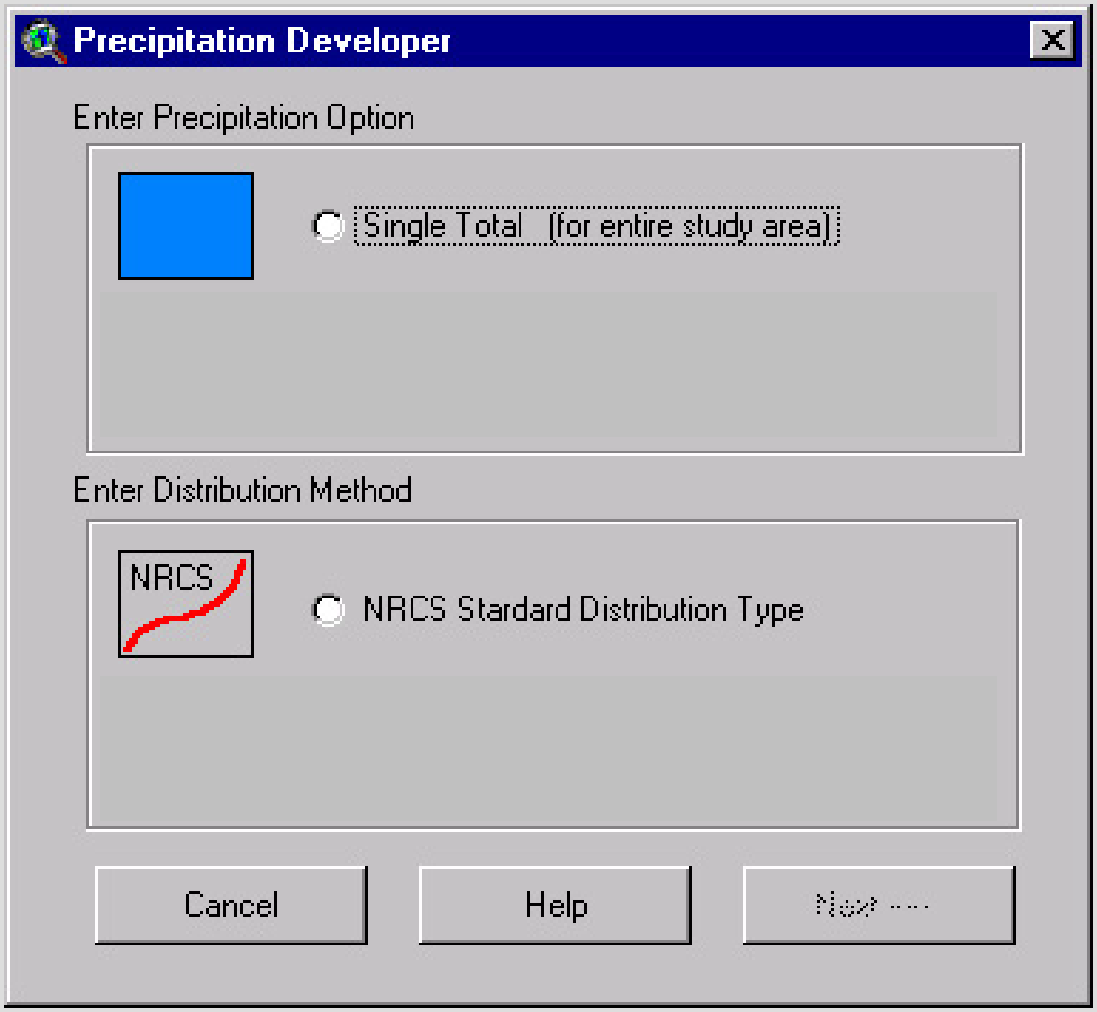

800
700
600
500
400
300
200
100
0
Processing time (seconds)
0
4,000,000
8,000,000
12,000,000
16,000,000
Number of cells in the DEM

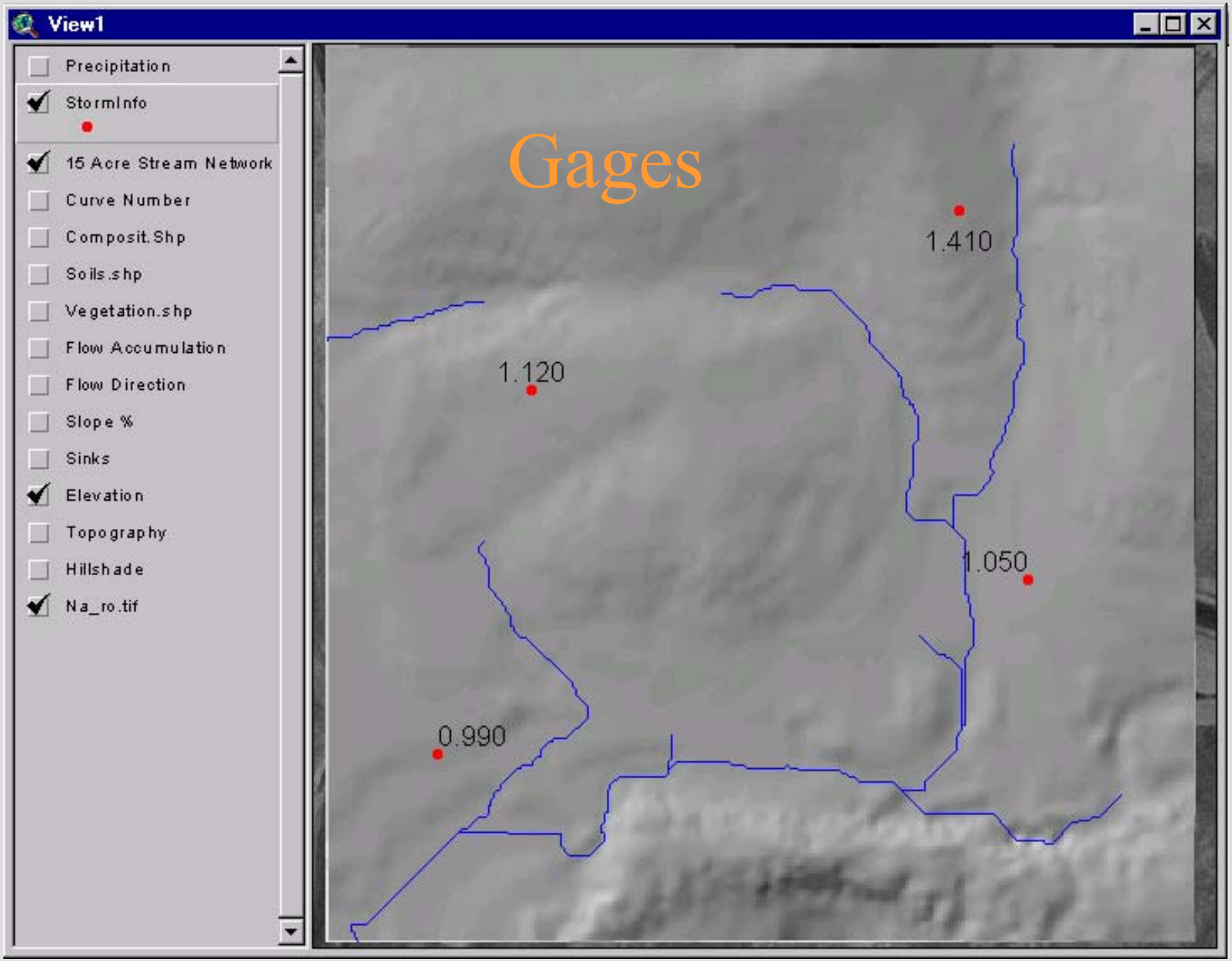
Precipitation Considerations

- Precipitation Developer
  - Single Storm Total w/ NRCS distribution

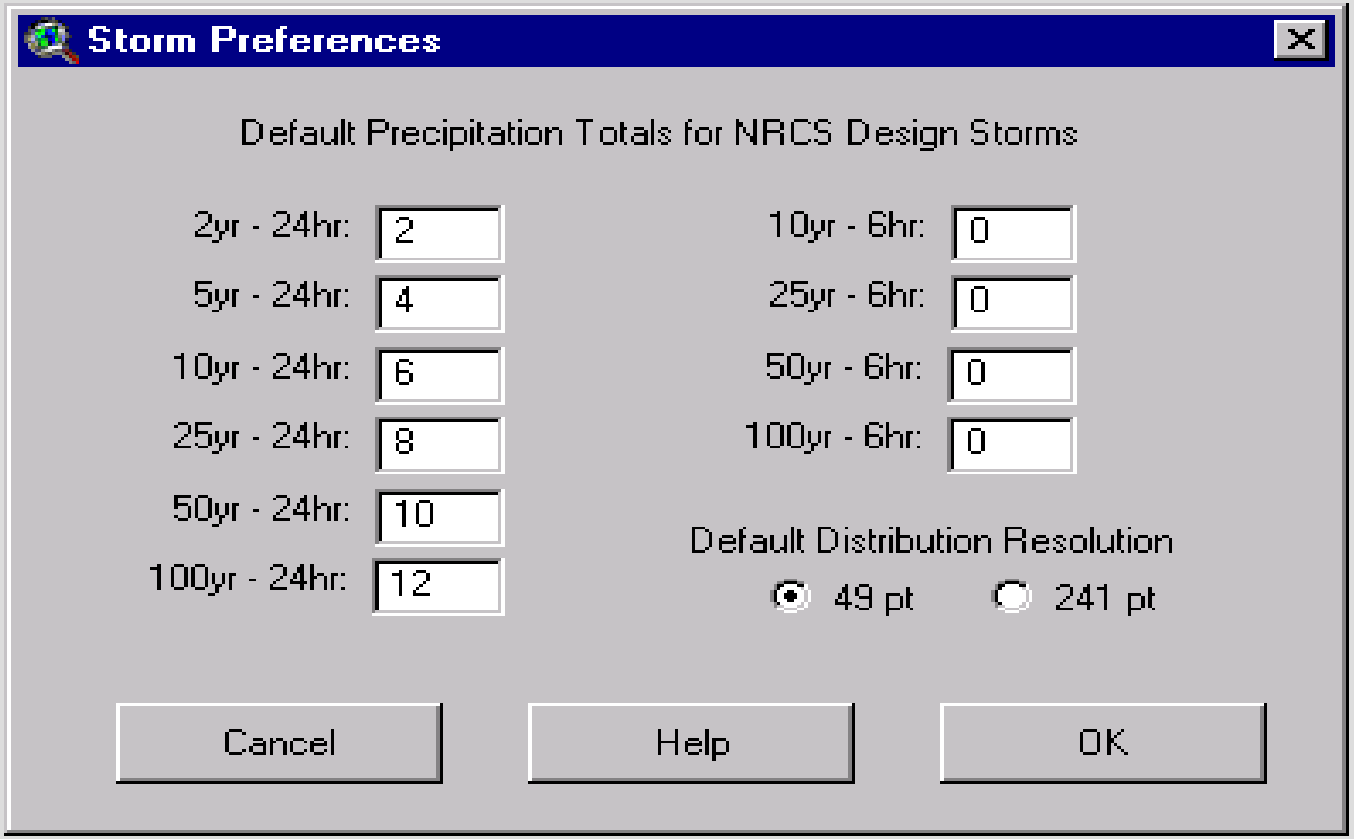


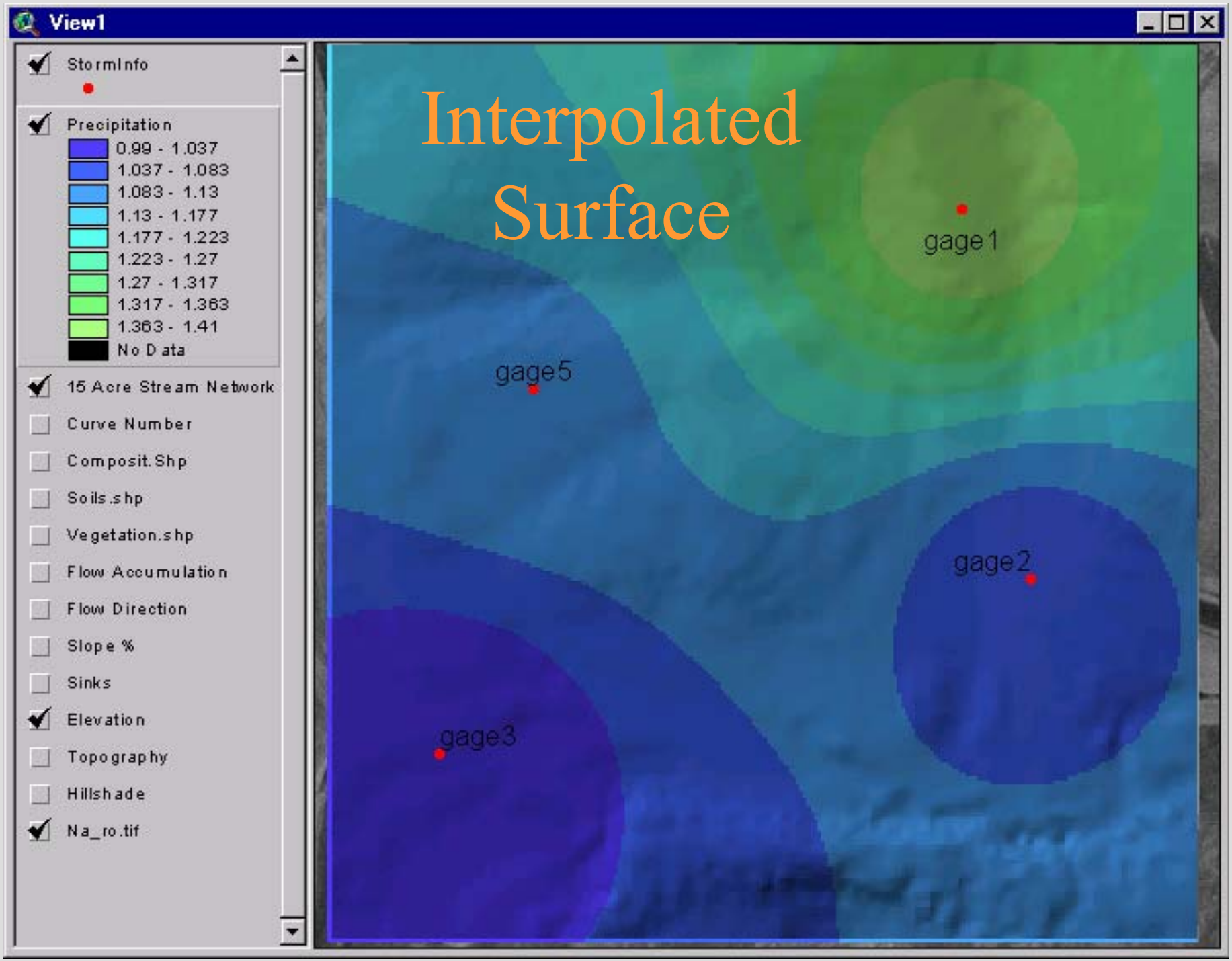
Single Total Precip




View1
Precipitation
StormInfo
15 Acre Stream Network
Curve Number
Composit.Shp
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
Topography
Hillshade
Na_ro.tif
Gages
1.410
1.120
1.050
0.990

Default Design Storm Inputs




View1
StormInfo
Precipitation
0.99 - 1.037
1.037 - 1.083
1.083 - 1.13
1.13 - 1.177
1.177 - 1.223
1.223 - 1.27
1.27 - 1.317
1.317 - 1.363
1.363 - 1.41
No Data
15 Acre Stream Network
Curve Number
Composit.Shp
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
Topography
Hillshade
Na_ro.tif
Interpolated Surface
gage1
gage5
gage2
gage3

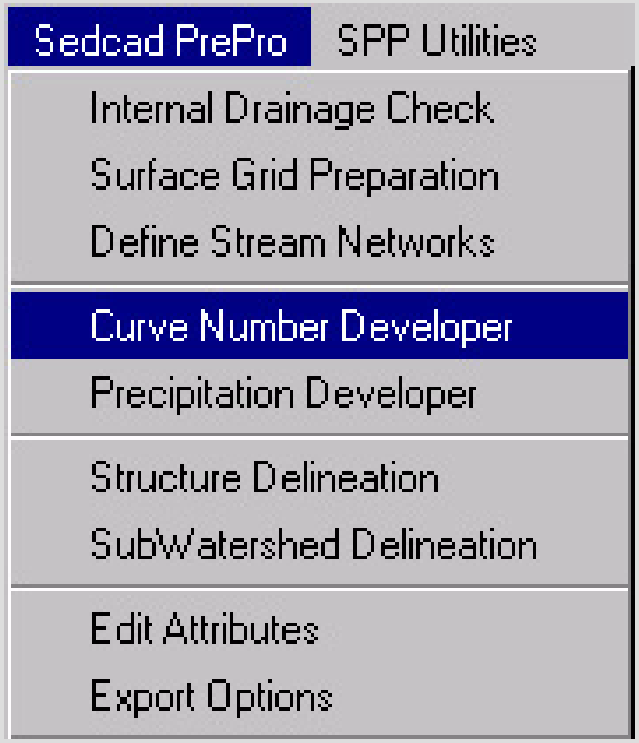
Curve Number Development

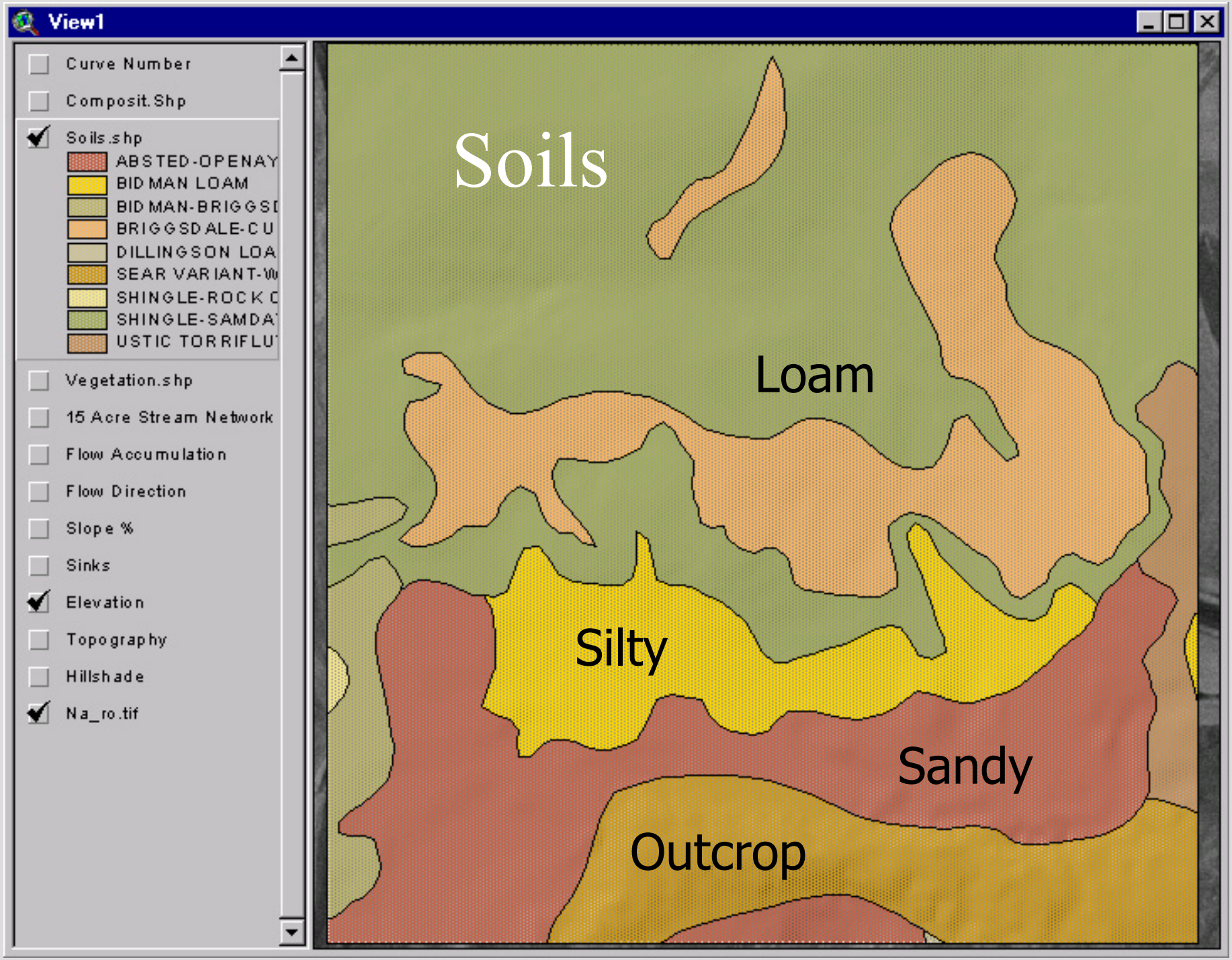
Soils Layer

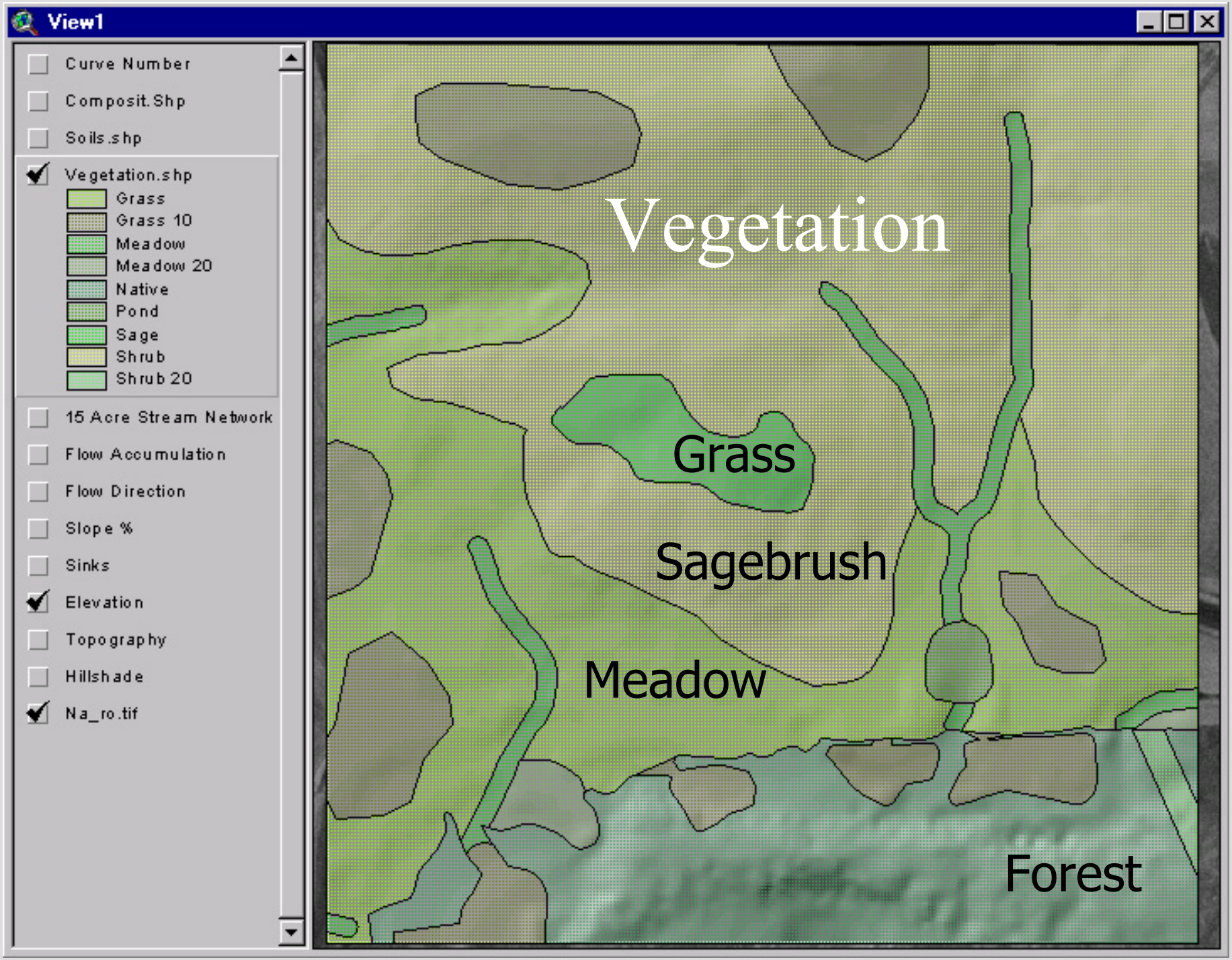
+ Vegetation / Landuse Layer

+ Curve Number Library

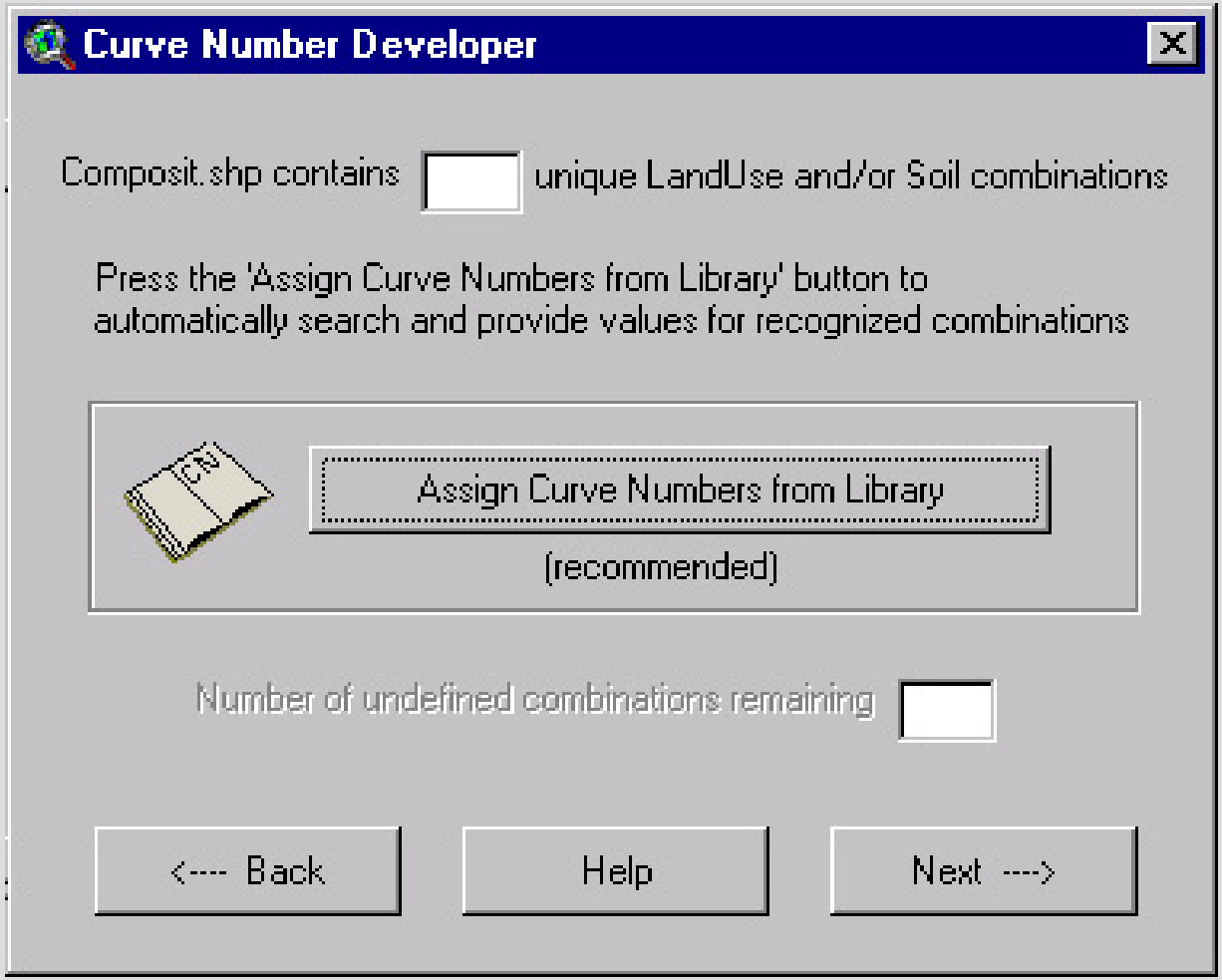
= Curve Number Coverage




View1
Curve Number
Composit.Shp
Soils.shp
ABSTED-OPENAY
BID MAN LOAM
BID MAN-BRIGGSD
BRIGGSDALE-CU
DILLINGSON LOA
SEAR VARIANT-W
SHINGLE-ROCK C
SHINGLE-SAMDA
USTIC TORRIFLU
Vegetation.shp
15 Acre Stream Network
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
Topography
Hillshade
Na_ro.tif
Soils
Loam
Silty
Sandy
Outcrop


View1
Curve Number
Composit.Shp
Soils.shp
Vegetation.shp
Grass
Grass 10
Meadow
Meadow 20
Native
Pond
Sage
Shrub
Shrub 20
15 Acre Stream Network
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
Topography
Hillshade
Na_ro.tif
Vegetation
Grass
Sagebrush
Meadow
Forest

The Curve Number Library



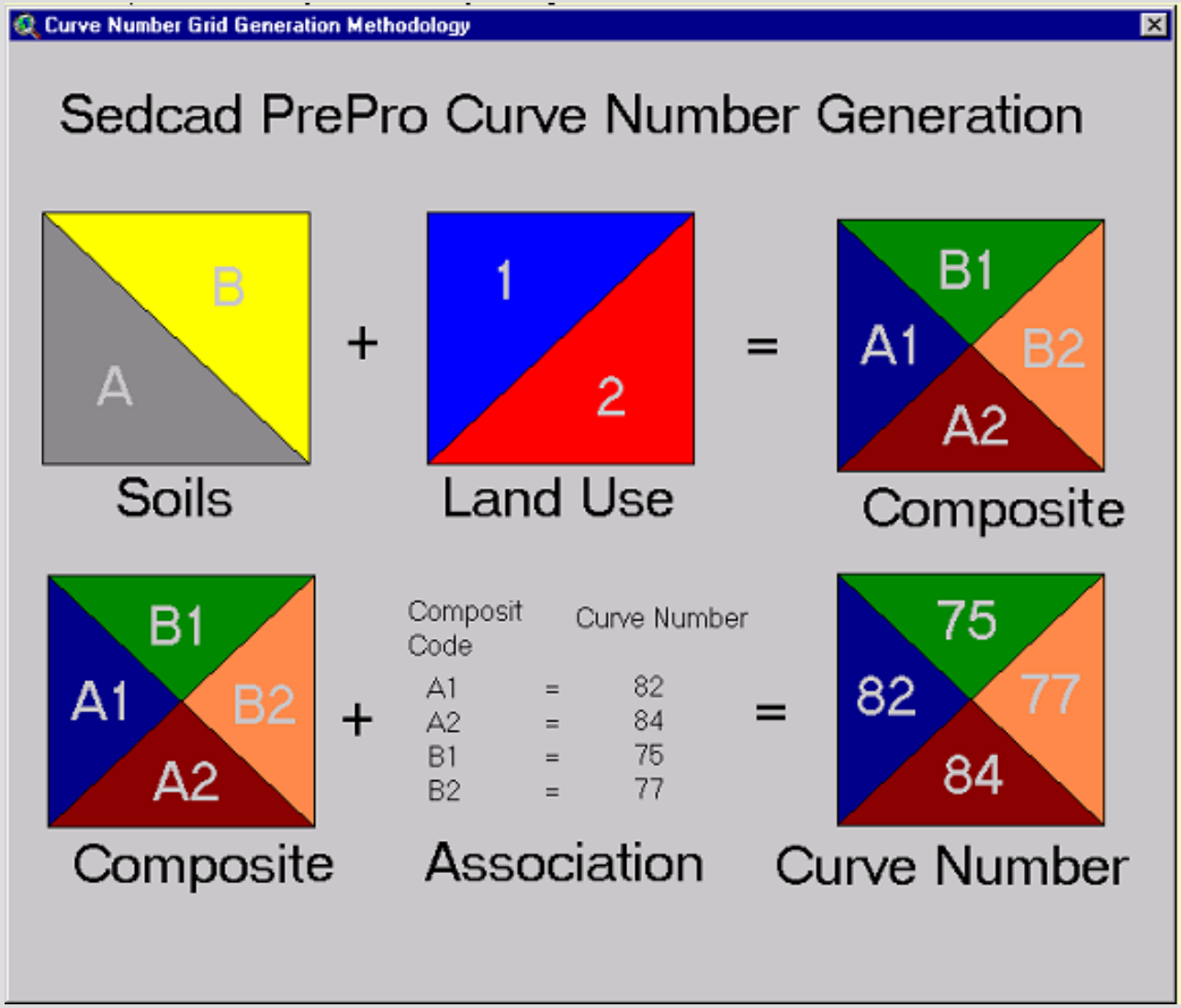
The Curve Number Library

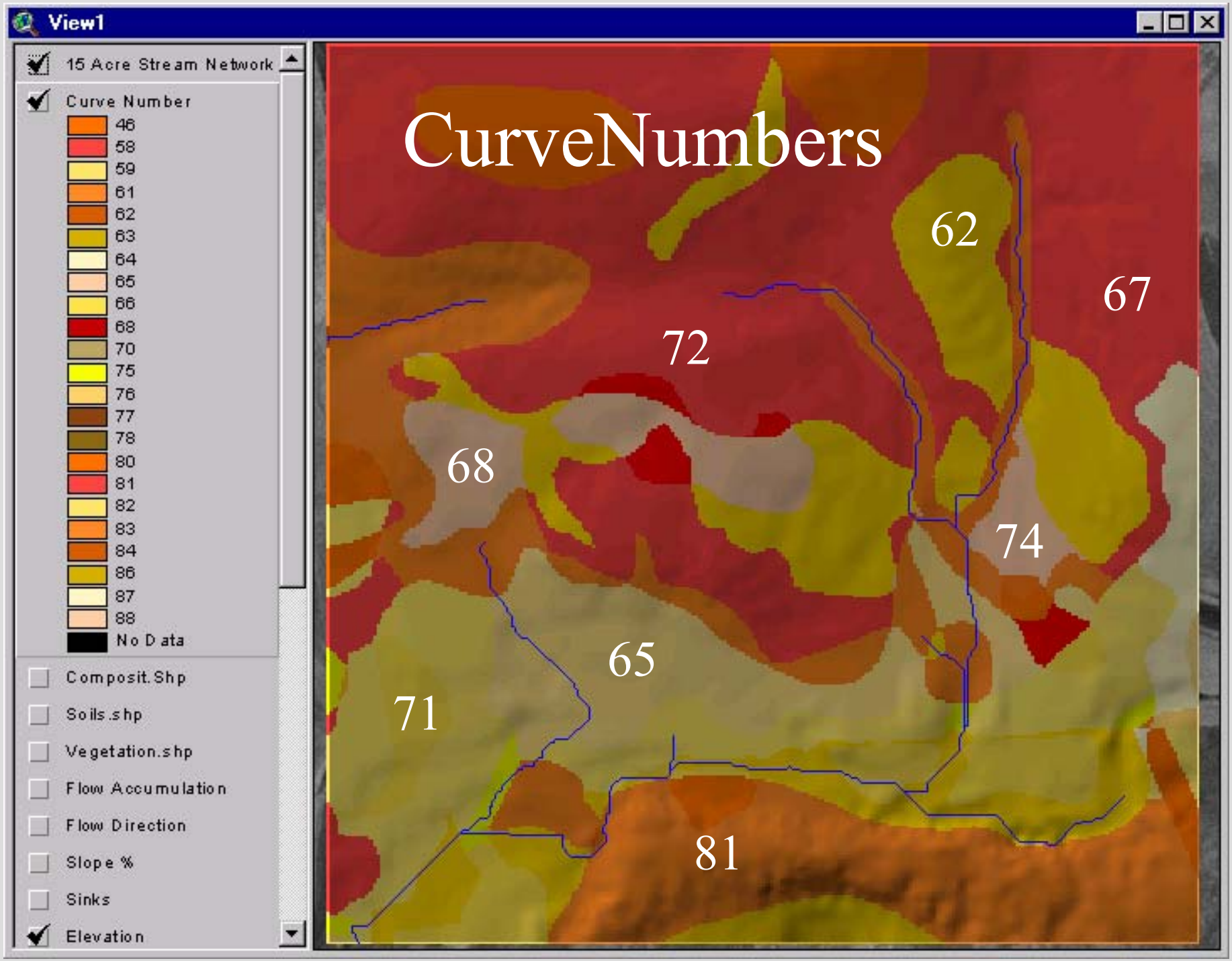
- A collection of user generated associations.
- The more you use it… the less it uses you
- Very Generic
- Easily Editable
- Extremely Fast

CN_library

Soil_id	Landuse_id	Cn
BRIGGSDALE-CUSHMAN (	Meadow 20	76
SHINGLE CLAY LOAM	Shrub	69
SHINGLE CLAY LOAM	Sage	58
SHINGLE CLAY LOAM	Grass 20	59
SHINGLE CLAY LOAM	Meadow	39
BOWBAC SANDY LOAM	Shrub	77
BOWBAC SANDY LOAM	Shrub 20	88
BOWBAC SANDY LOAM	Sage	75
ABSTED LOAM	Grass	75
ABSTED LOAM	Shrub	77
SHINGLE CLAY LOAM	Shrub 20	74
KISHONA CLAY LOAM	Sage	61
KISHONA CLAY LOAM	Shrub	63
KISHONA CLAY LOAM	Grass 20	63
DISTURBED	Shrub	65
TALUCE SANDY LOAM	Shrub	65
TALUCE SANDY LOAM	Sage	67
TALUCE SANDY LOAM	Shrub 20	87
HILAND SANDY LOAM	Grass	69

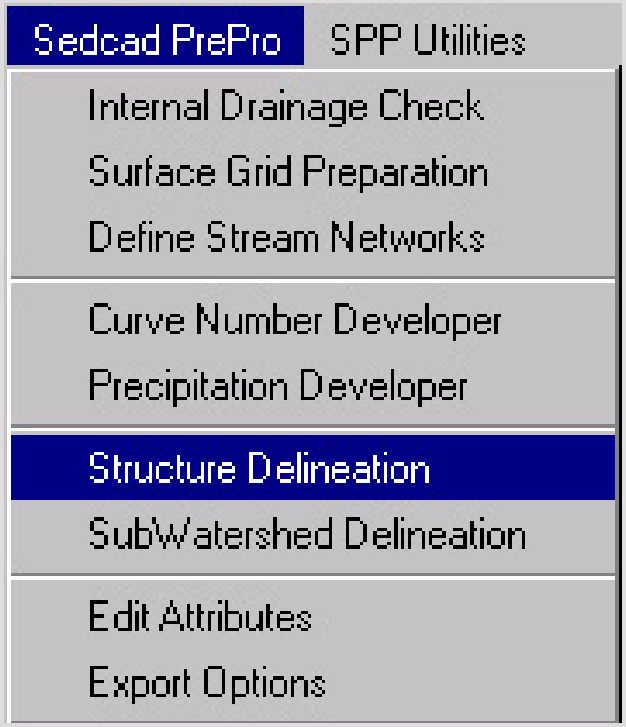
The Curve Number Library Methodology



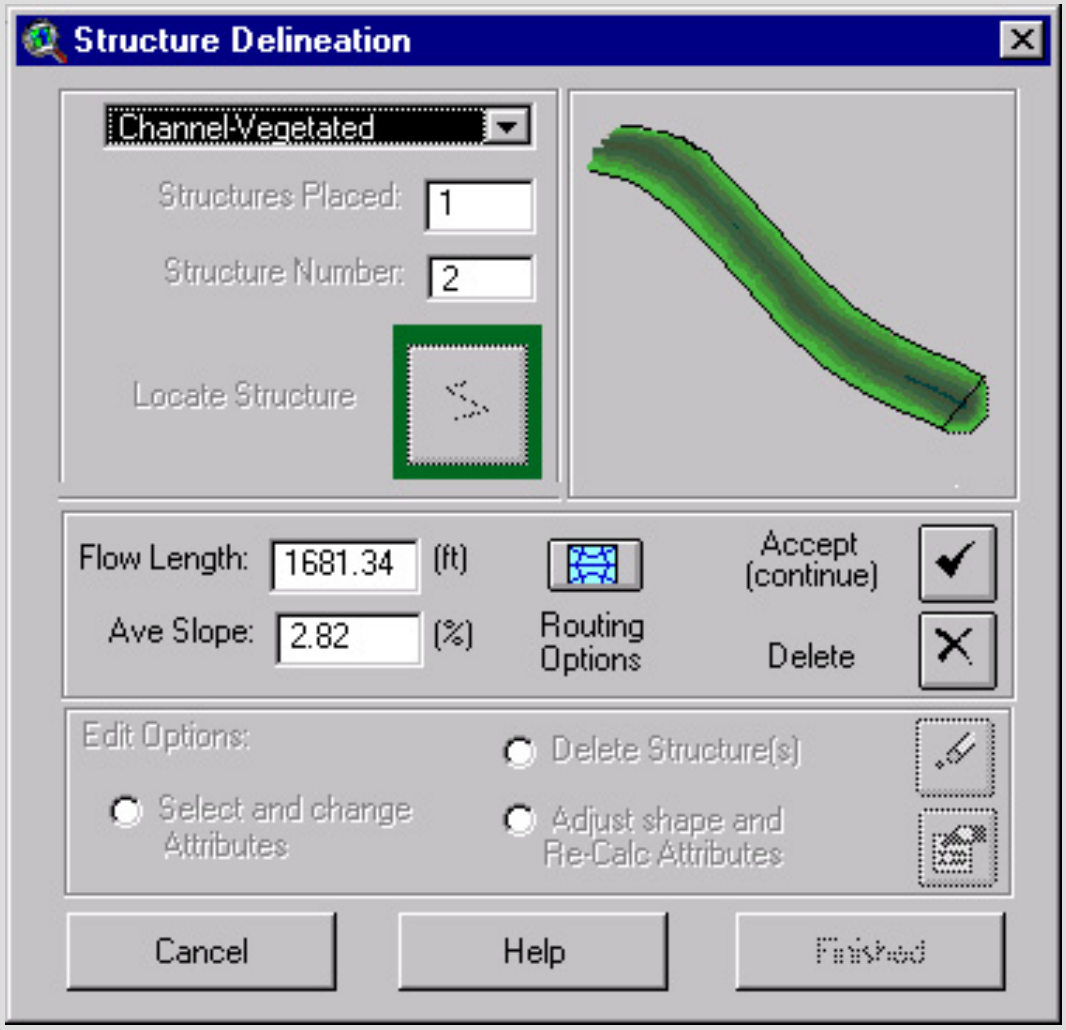

View1
15 Acre Stream Network
Curve Number
46
58
59
61
62
63
64
65
66
68
70
75
76
77
78
80
81
82
83
84
86
87
88
No Data
Composit.Shp
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation
CurveNumbers
62
67
72
68
74
65
71
81

Structure Delineation

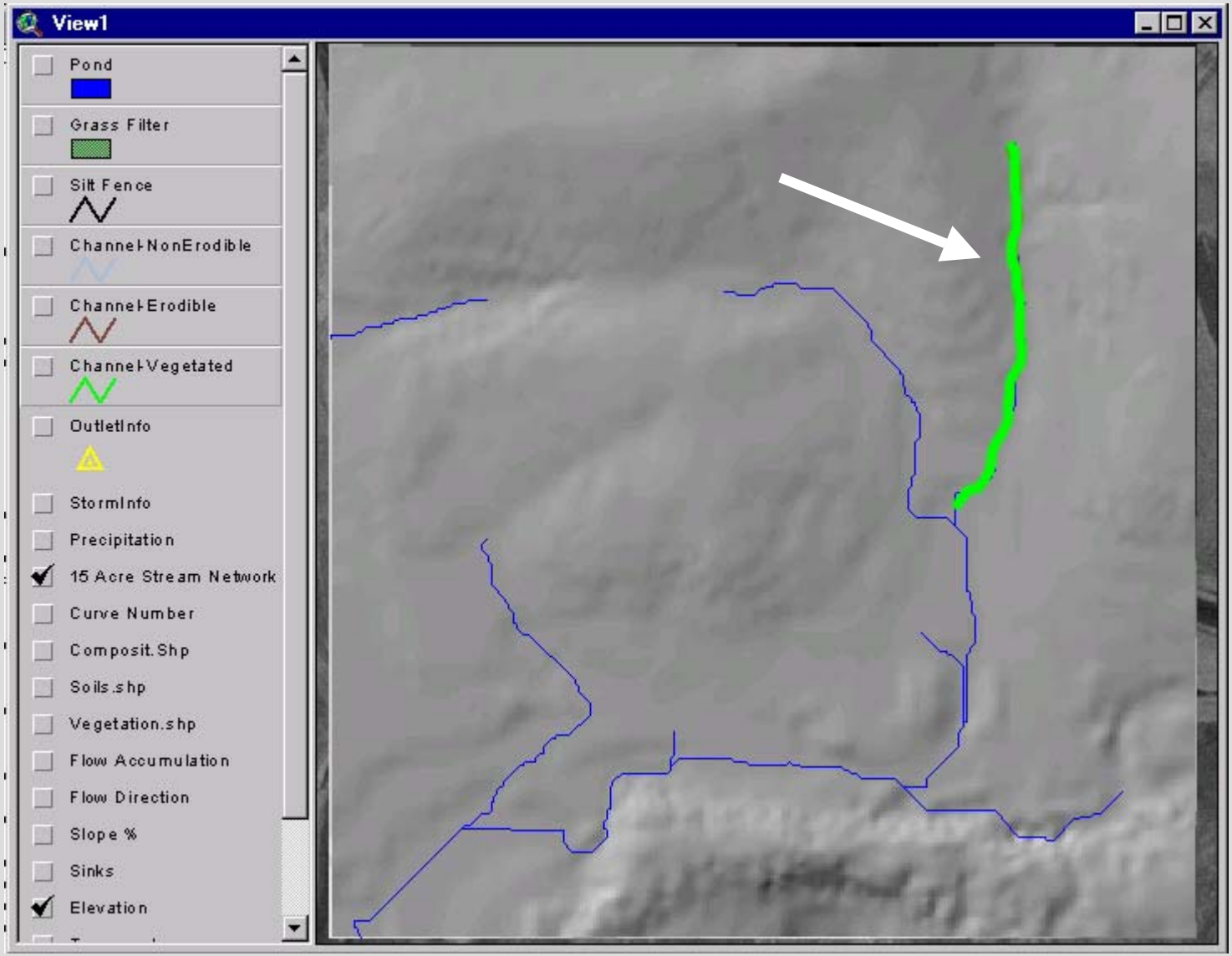
- Channels
- Ponds
- Silt Fences
- Grass Filters
- Culverts
- Check Dams



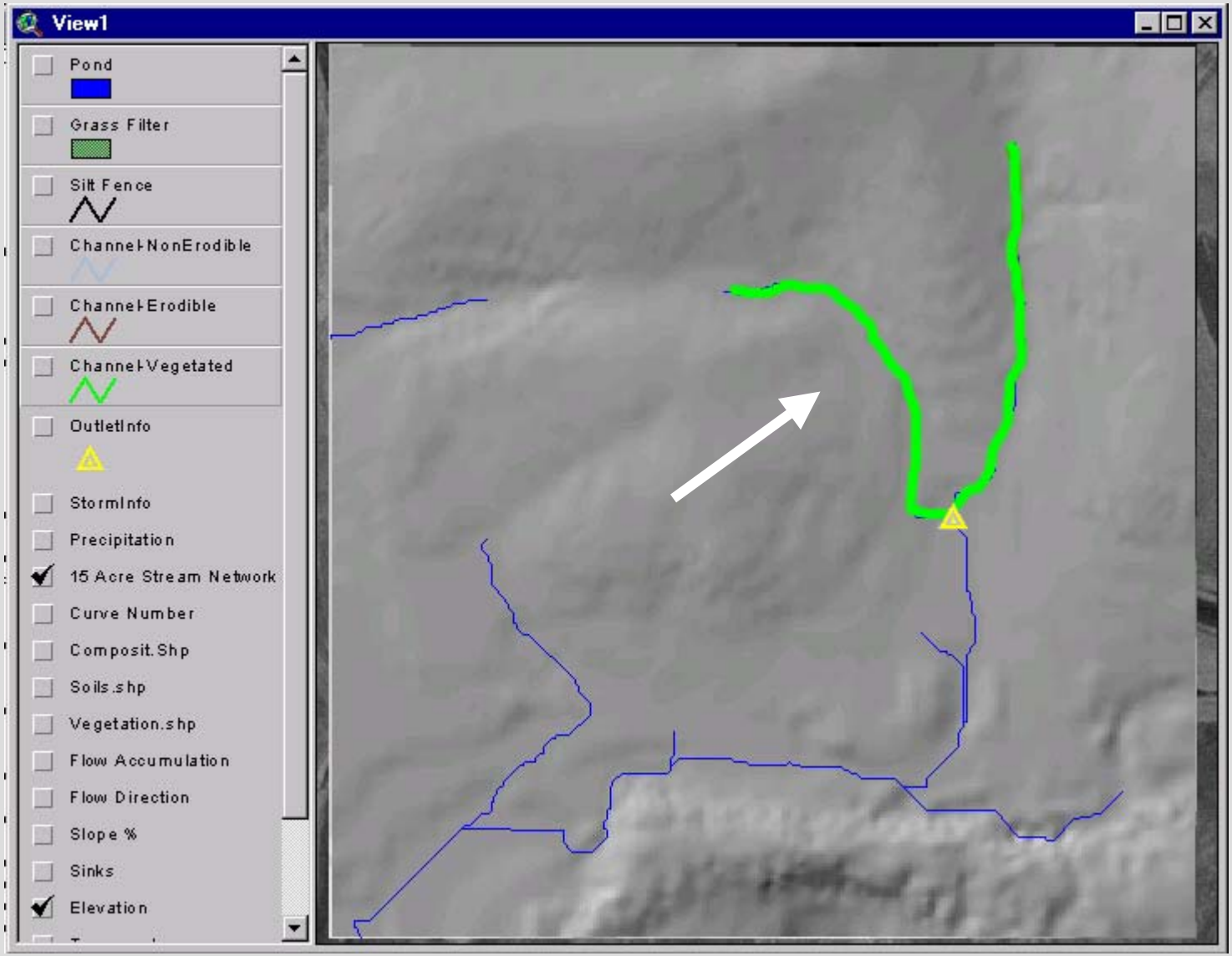
Structure Example



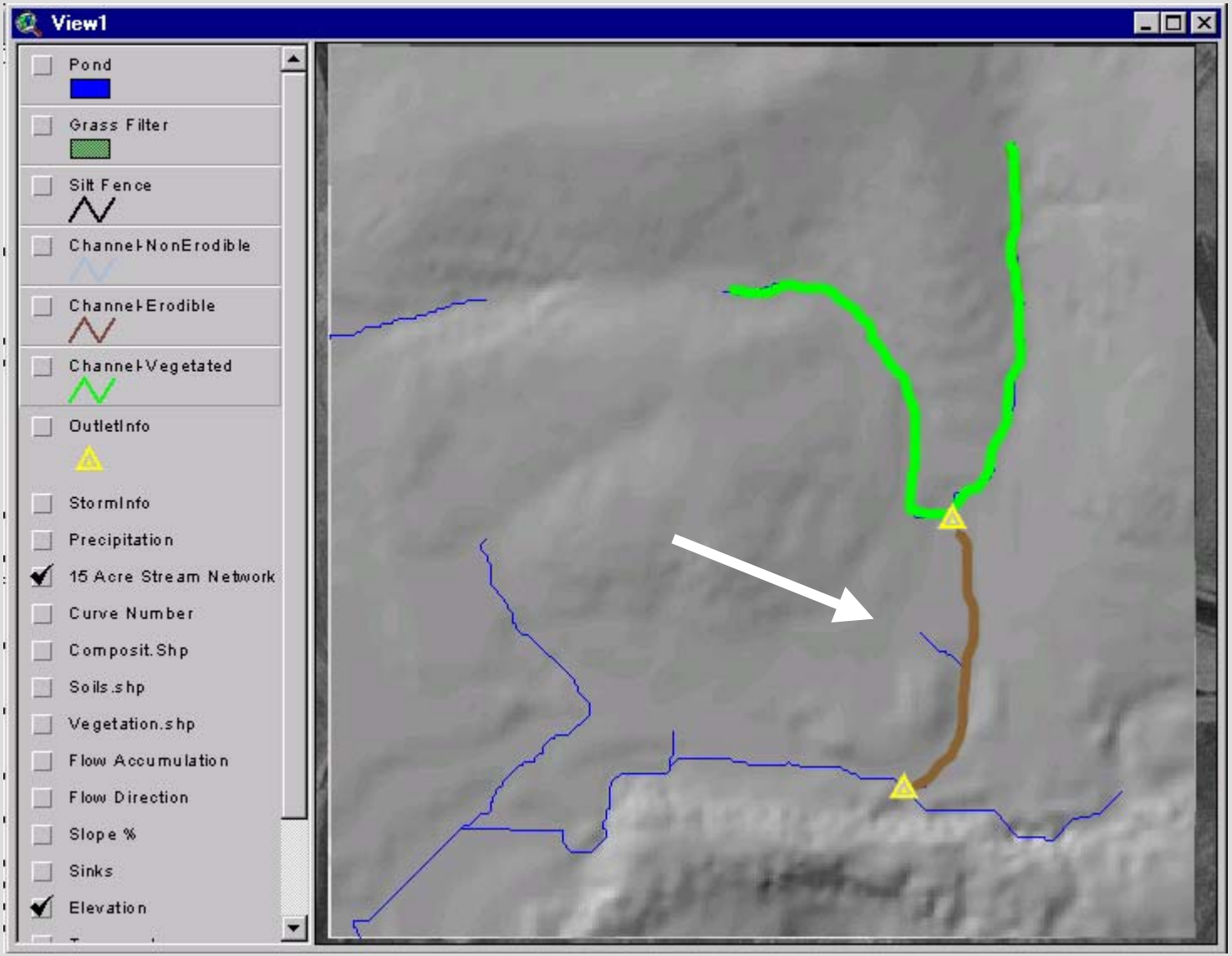
Add a Vegetated Channel



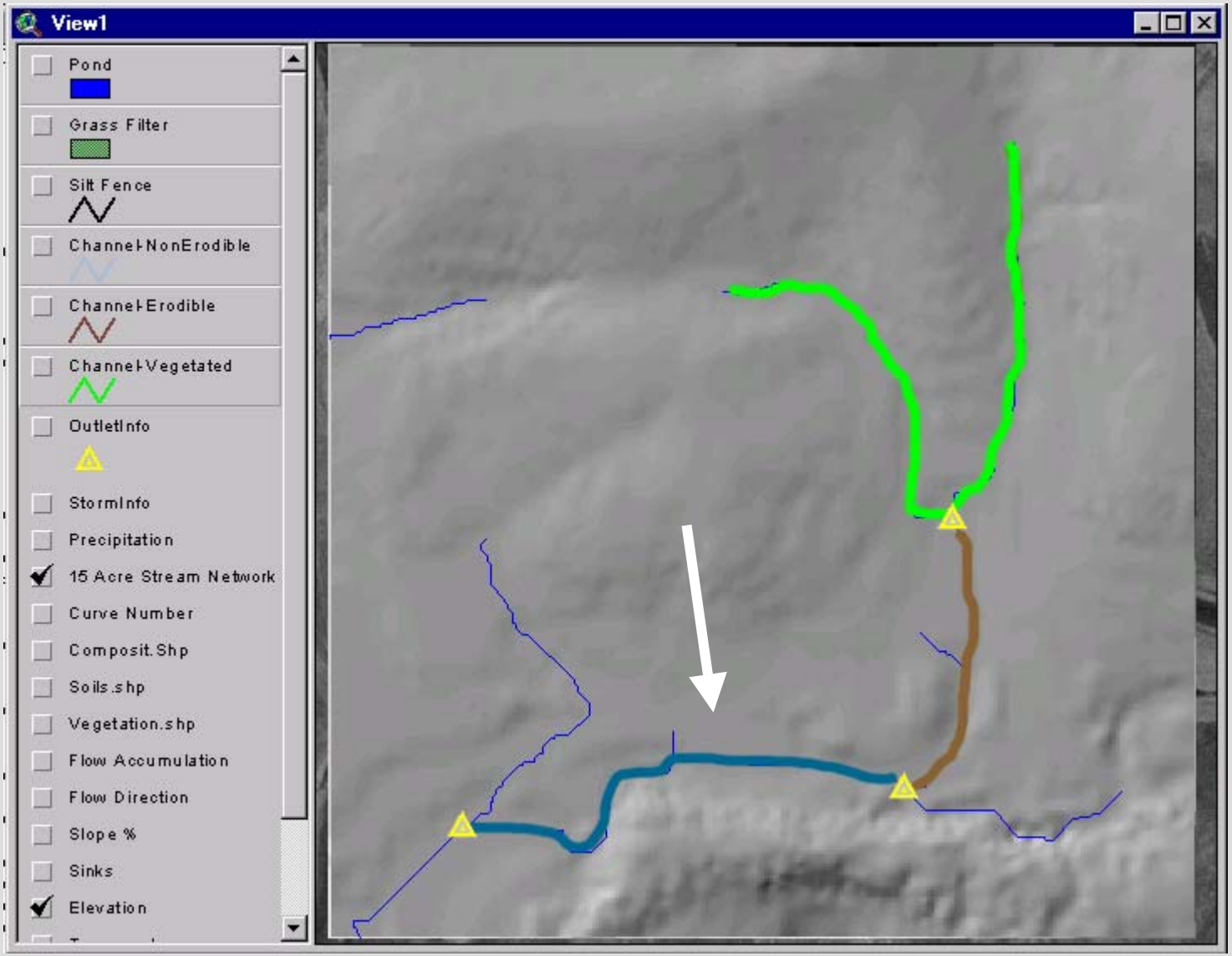
Add Another Veg-Channel



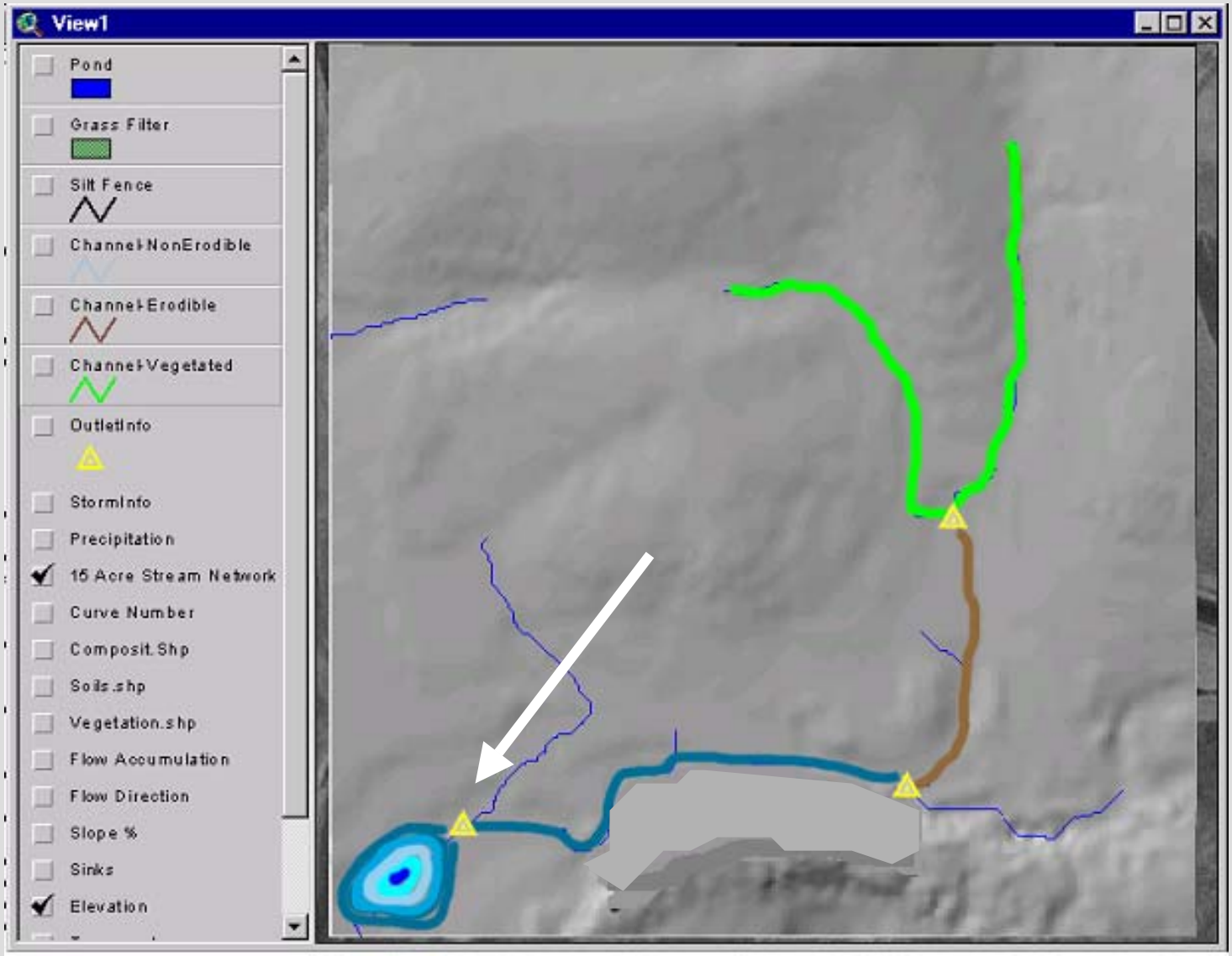
Add an Erodible Channel



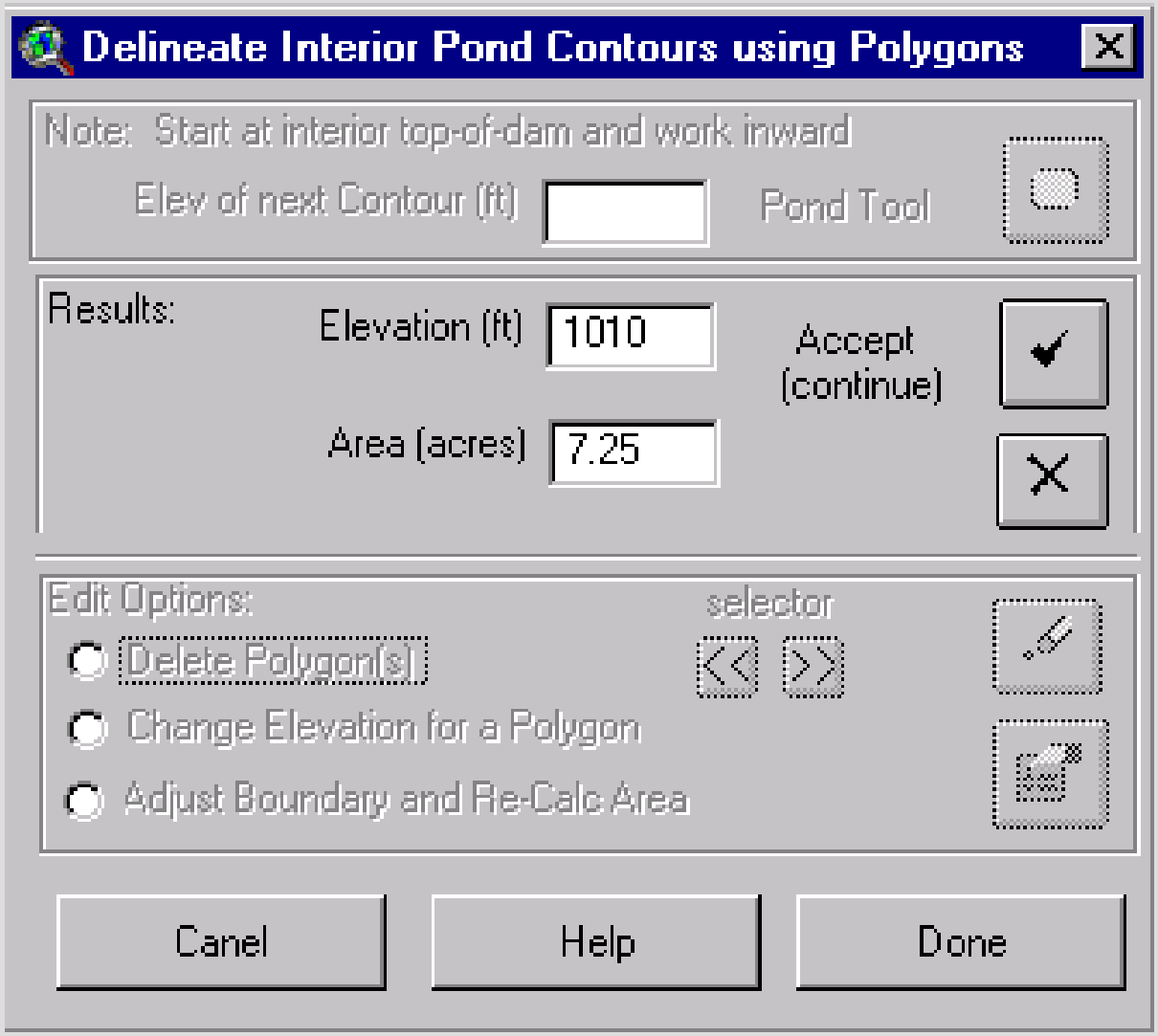
Add a Non Erodible Channel



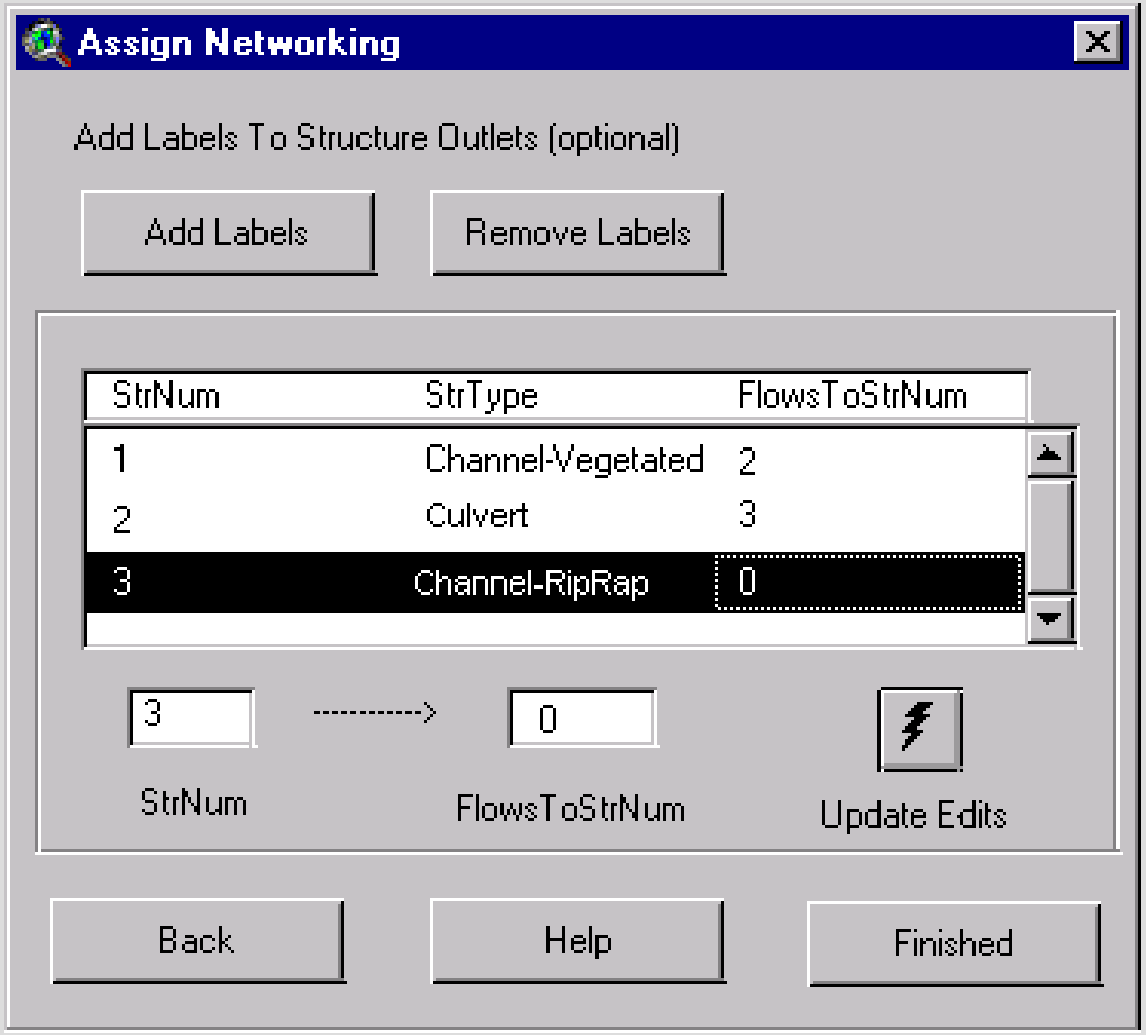
Add a Pond


View1
Pond
Grass Filter
Silt Fence
Channel-NonErodible
Channel-Erodible
Channel-Vegetated
OutletInfo
StormInfo
Precipitation
15 Acre Stream Network
Curve Number
Composit.Shp
Soils.shp
Vegetation.shp
Flow Accumulation
Flow Direction
Slope %
Sinks
Elevation

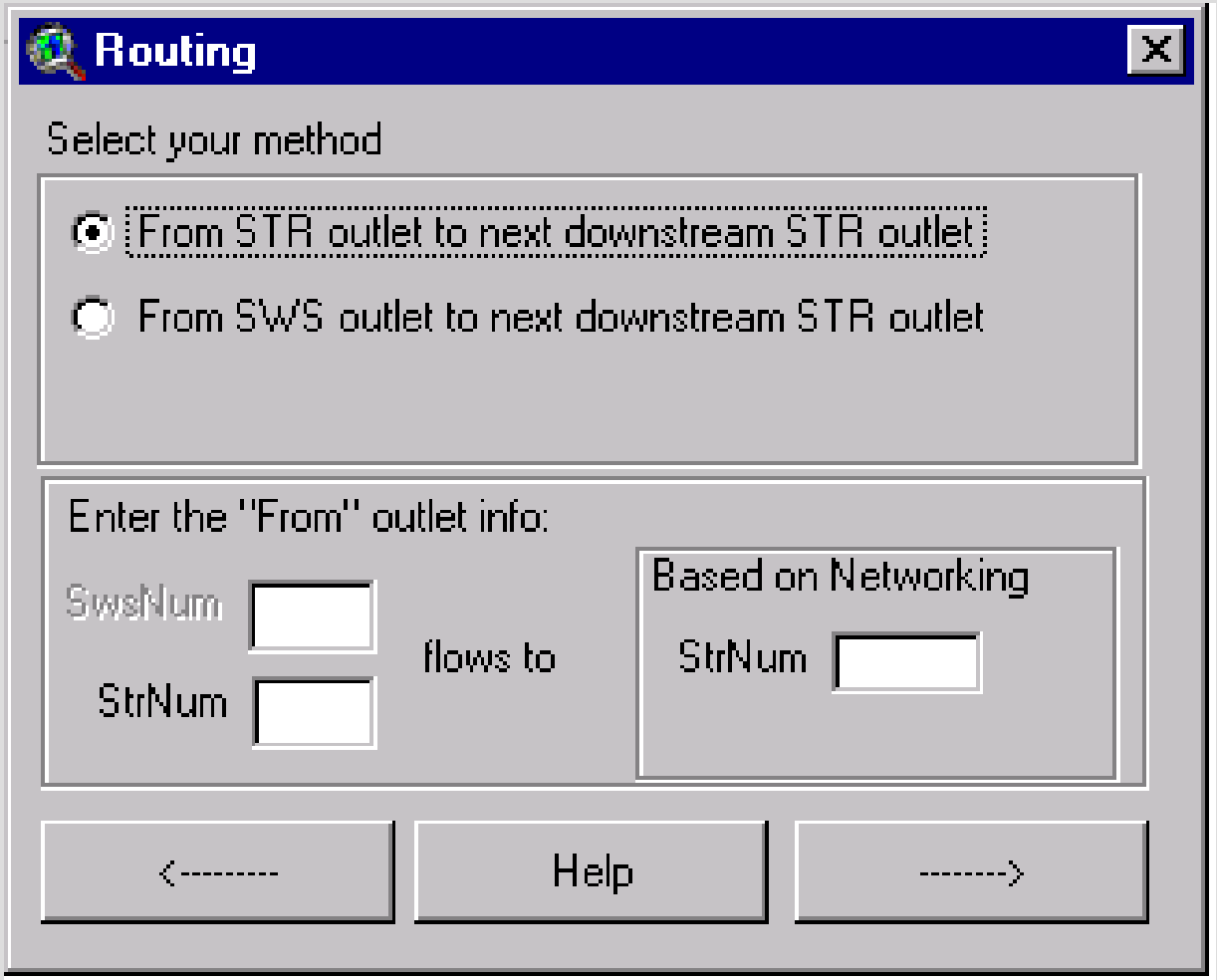
Pond Elevation – Area Inputs



Linkage of Structures



Muskingum's Routing



Subwatershed

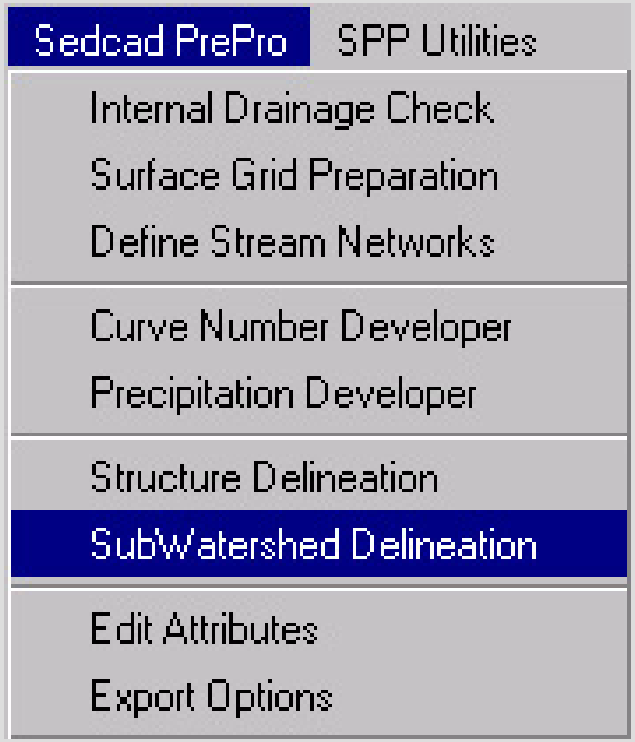
- Subwatersheds are delineated by the user selecting an outlet point to which all upstream cells contribute flow
- Length
  - Average travel distance
    - every cell to first downstream channel
  - Average flow-path length
    - Every cell on a divide to first downstream channel

Subwatershed

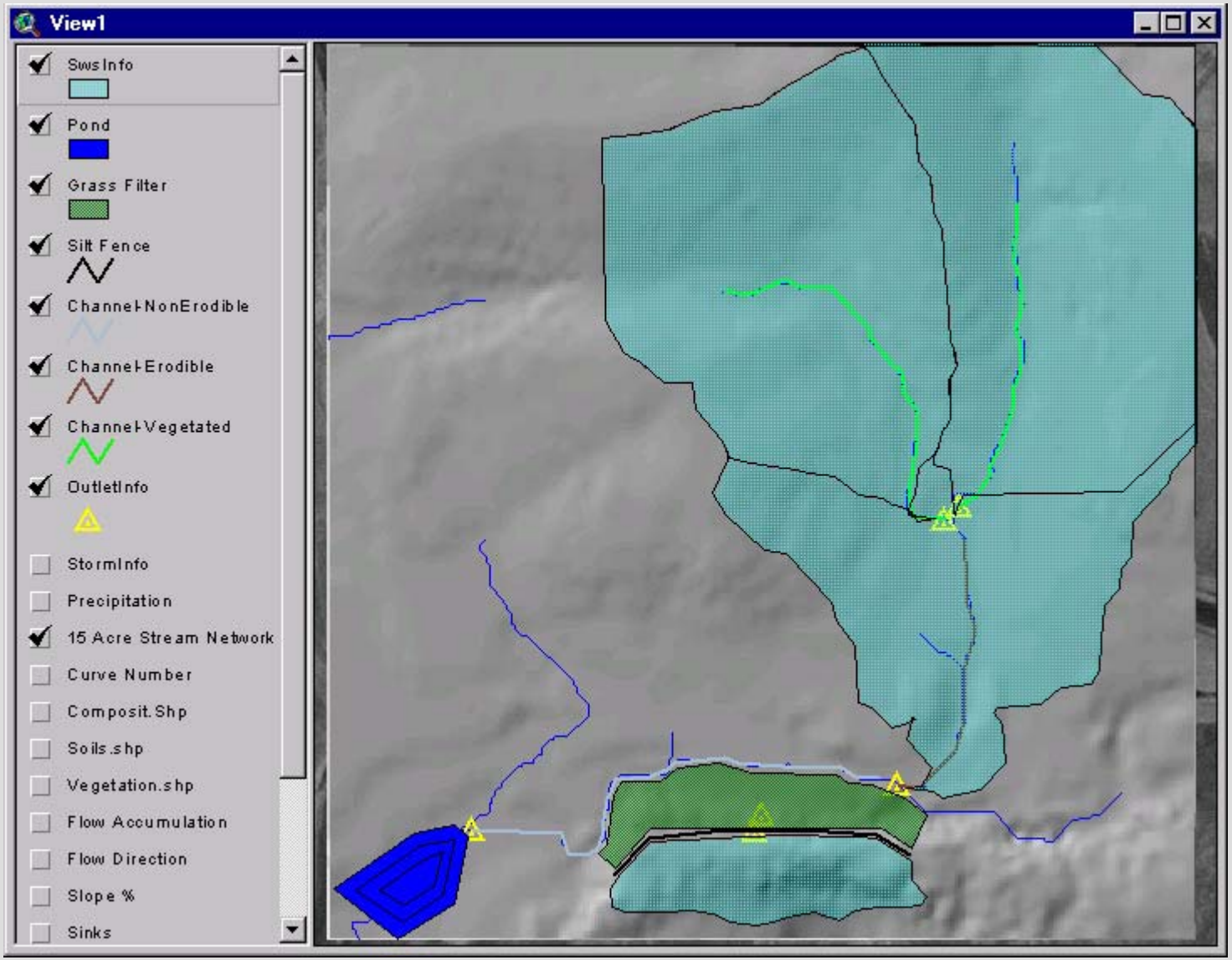
- Slope
  - Average travel distance slope
    - Every cell to first downstream channel
  - Average flow-path slope
    - Every cell on a divide to first downstream channel
- Uses
  - Overland Flow

SubWaterShed Delineation

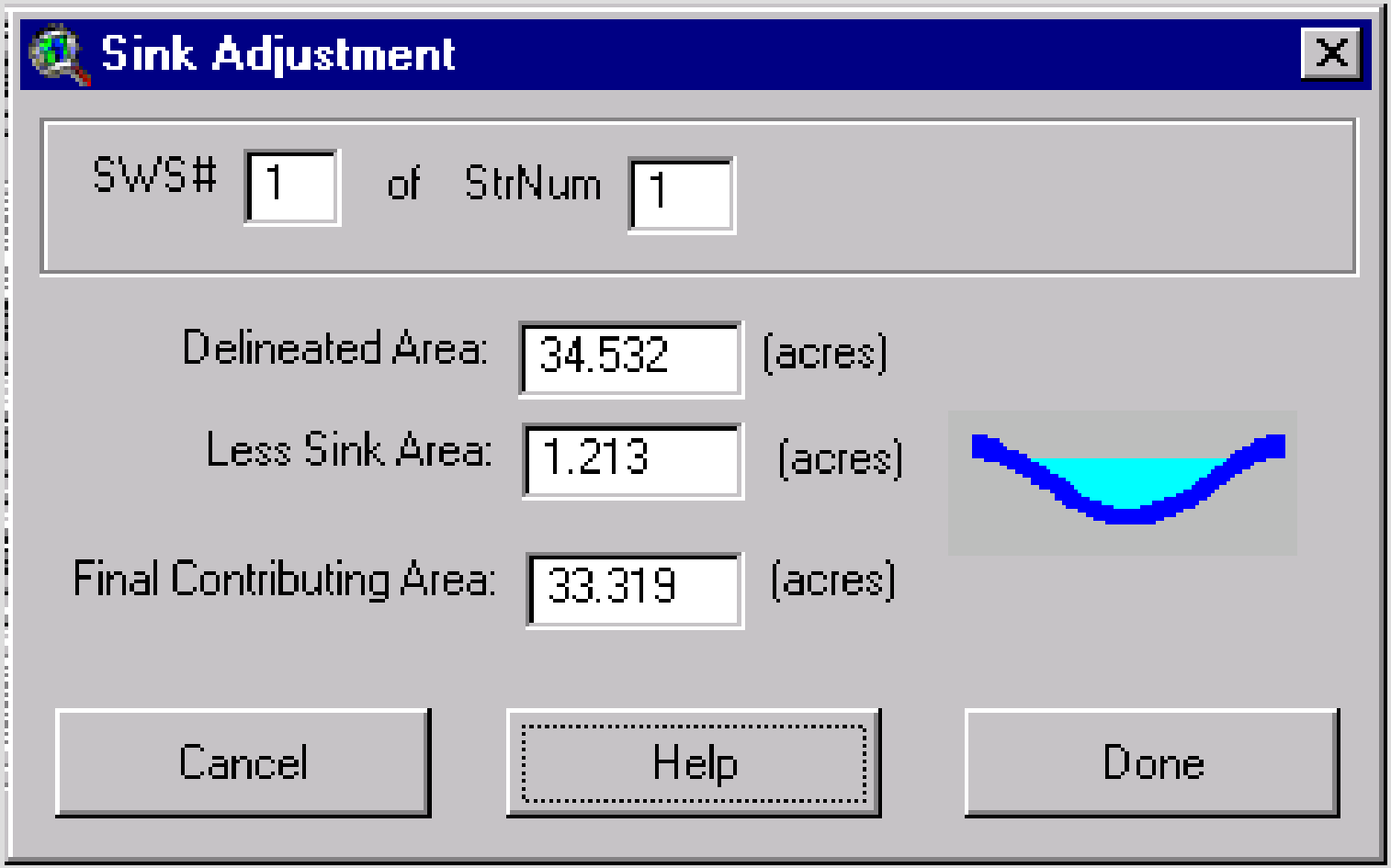
- Auto-Delineate the contributing SWS from any point.
- Auto-Delineate the contributing SWS from any line (i.e. silt fence)



SWS Delineation

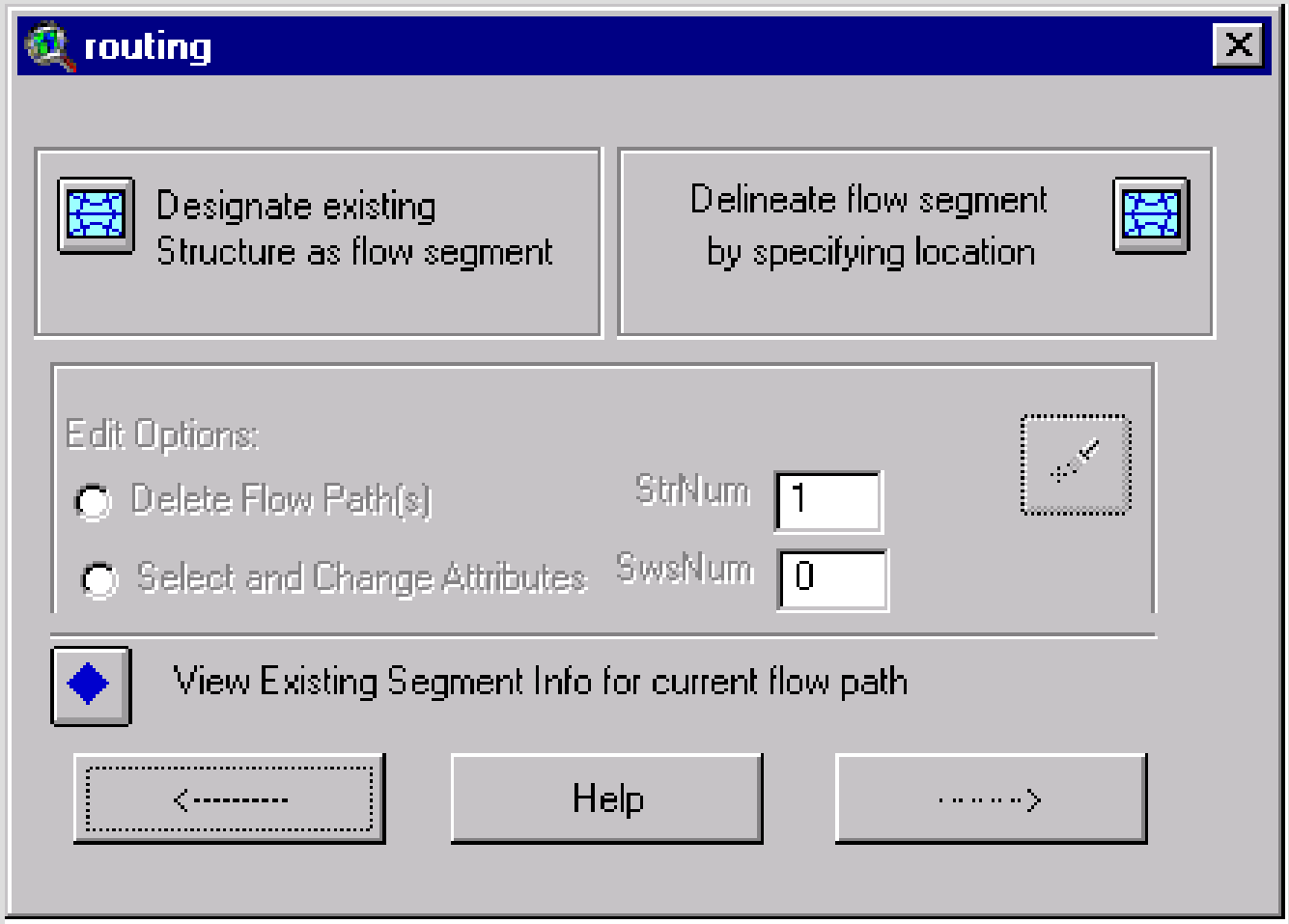


Remove Sinks from a Subwatershed



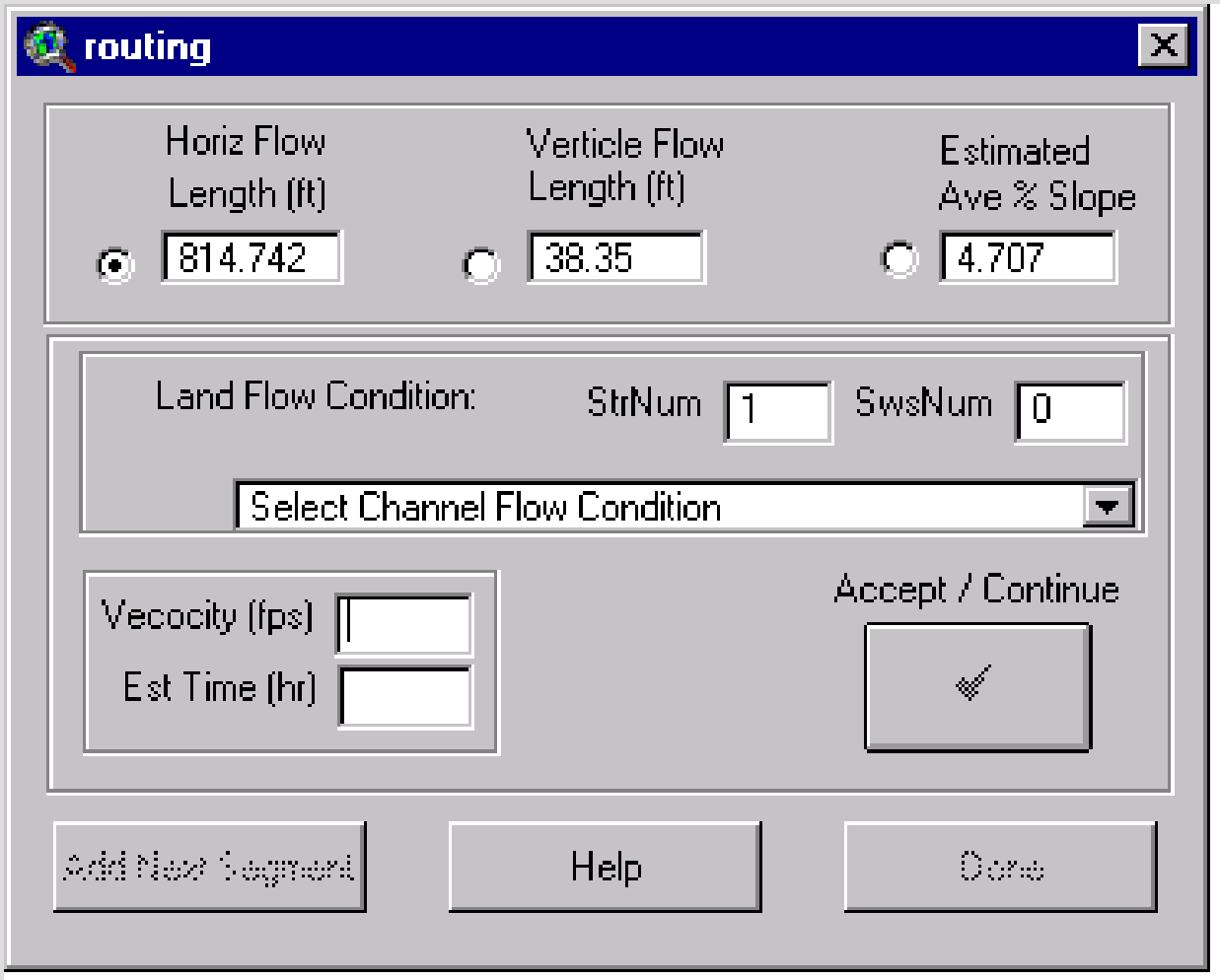
Flow Segment

(Existing Channel or Specify)

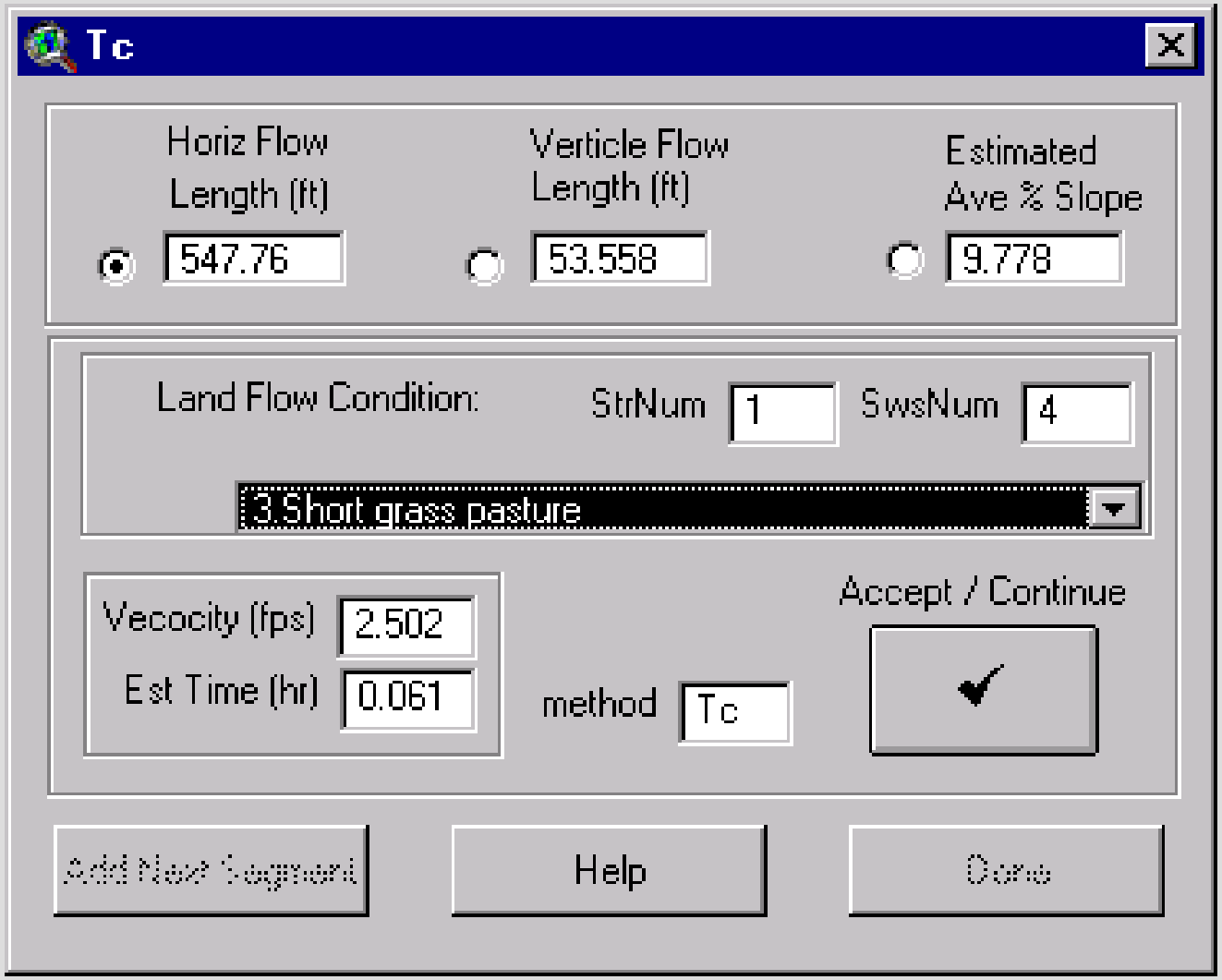


Horizontal, Vertical or Slope

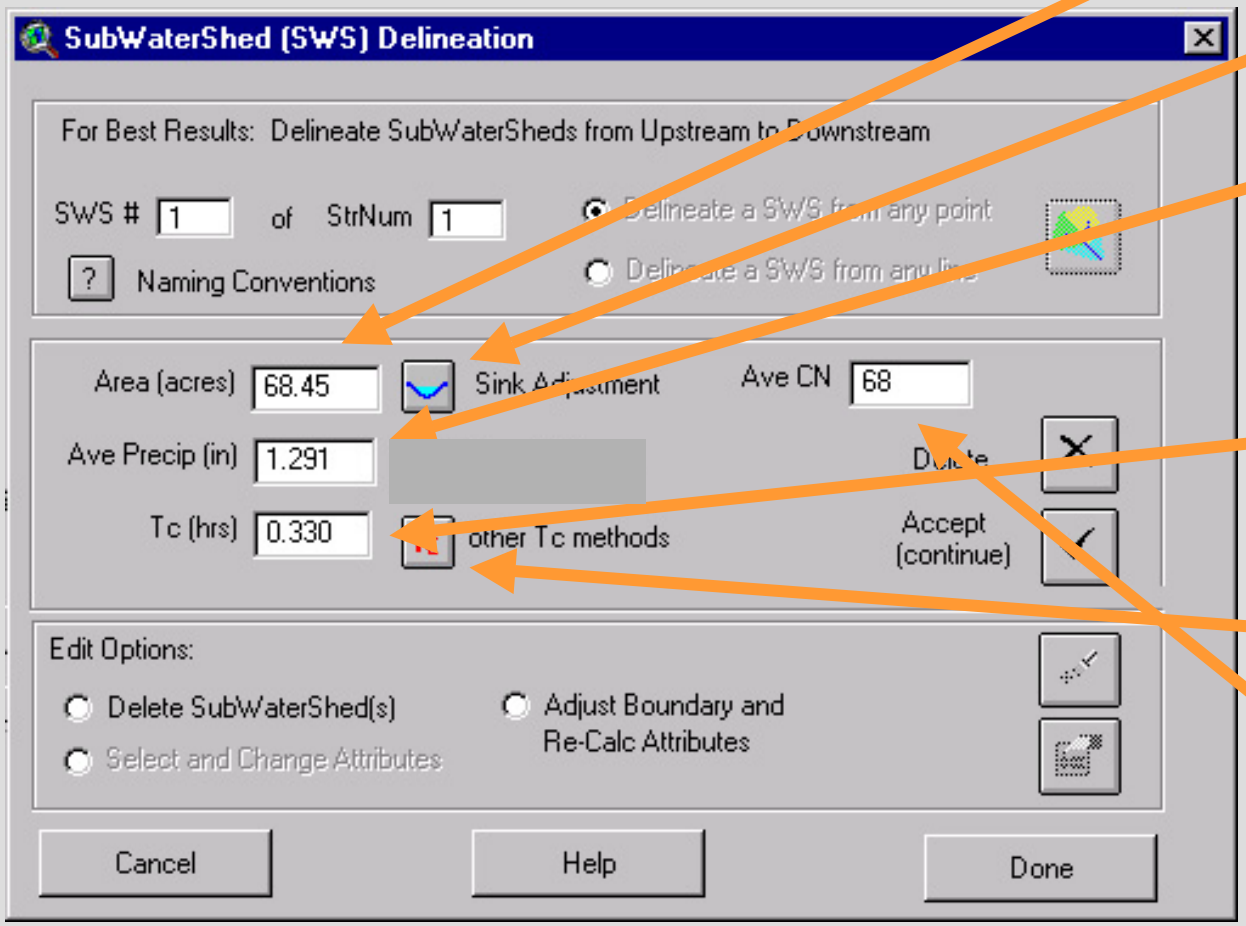
(2 of 3 Inputs)



Time of Concentration



Averages and Options



Area (acres)

Sink Adjustments

Ave Precip (in)

Time of Concentration

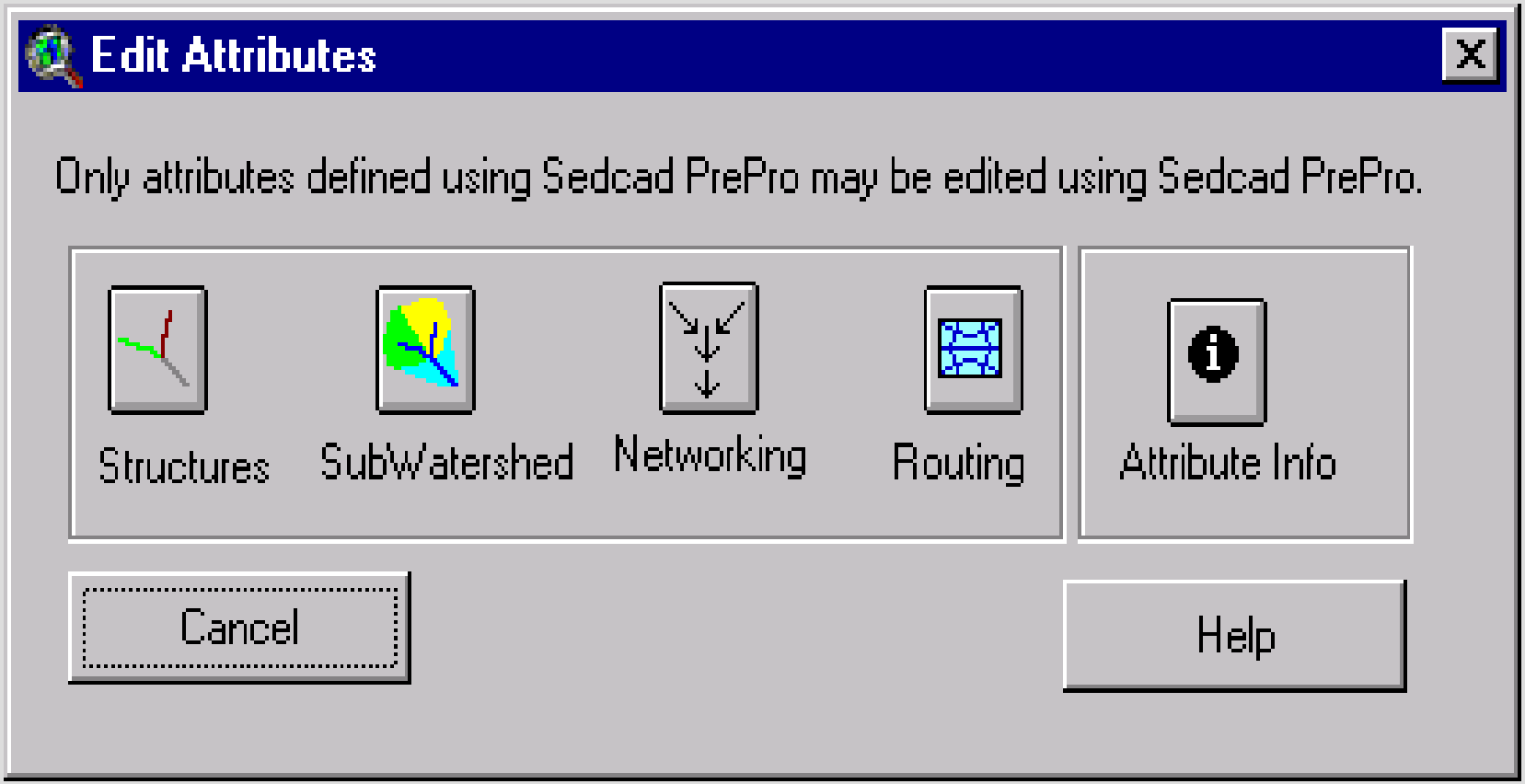
Tc Options

Ave NRCS CurveNumber

Editing and Reviewing

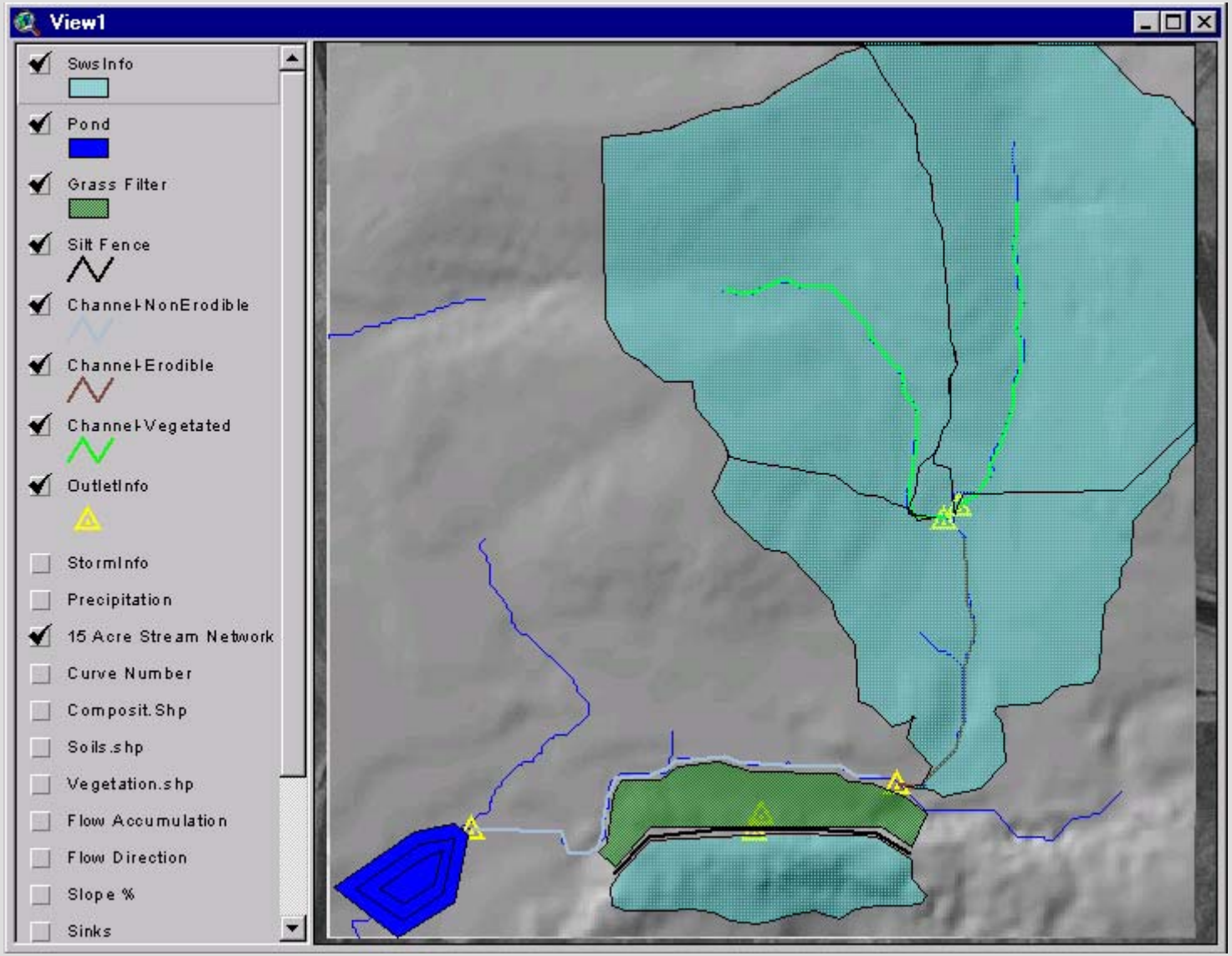
- View or adjust Structure and SubWaterShed Attributes
  - Change values to test different hydrologic scenarios
  - Change size or shape of structures and watersheds to accommodate phased operations
- Point and Click on any model component and instantly display all attributes

Editing Options (Relocate and/or Resize)

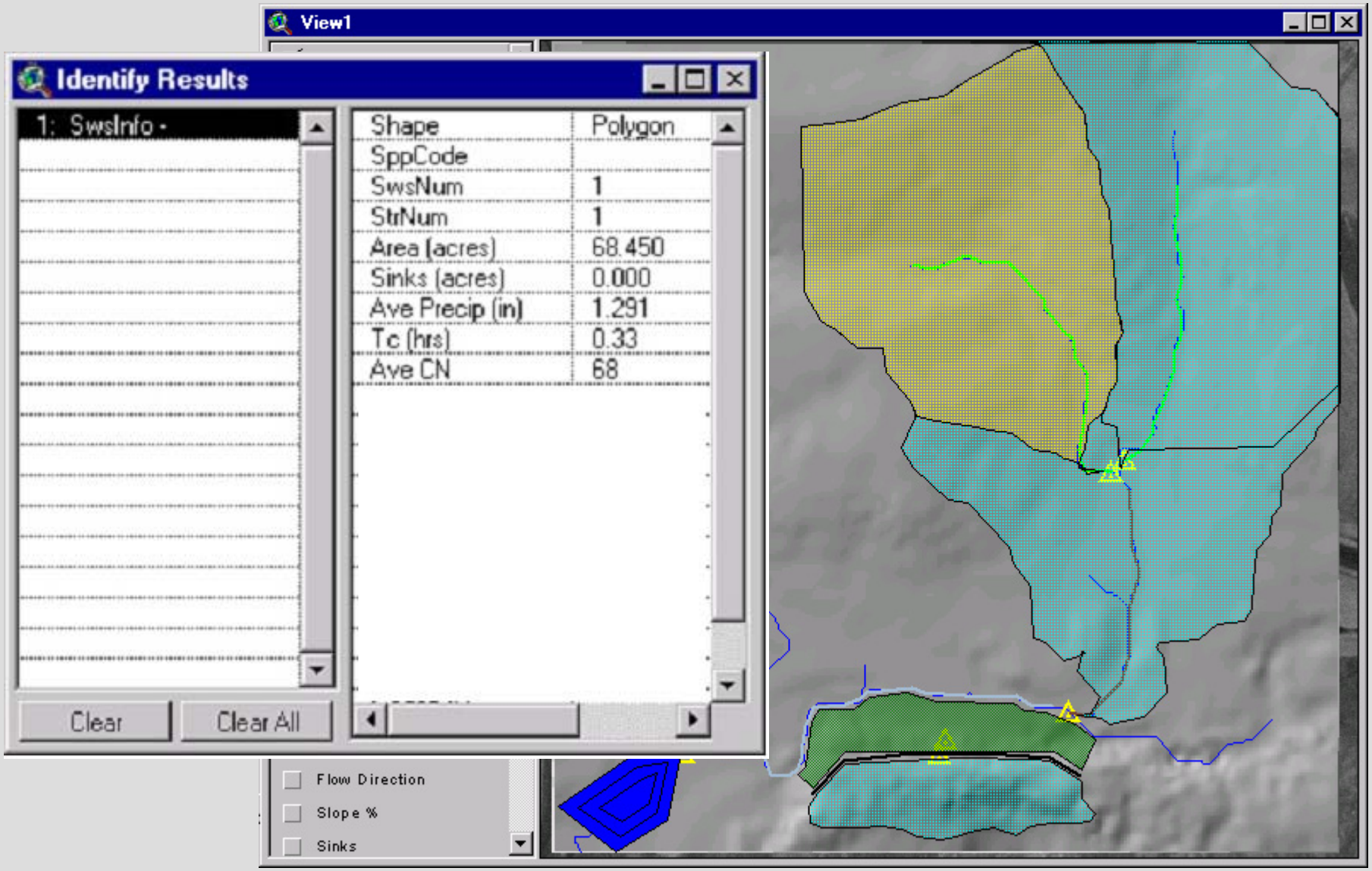


Attributes for Review

Click and View



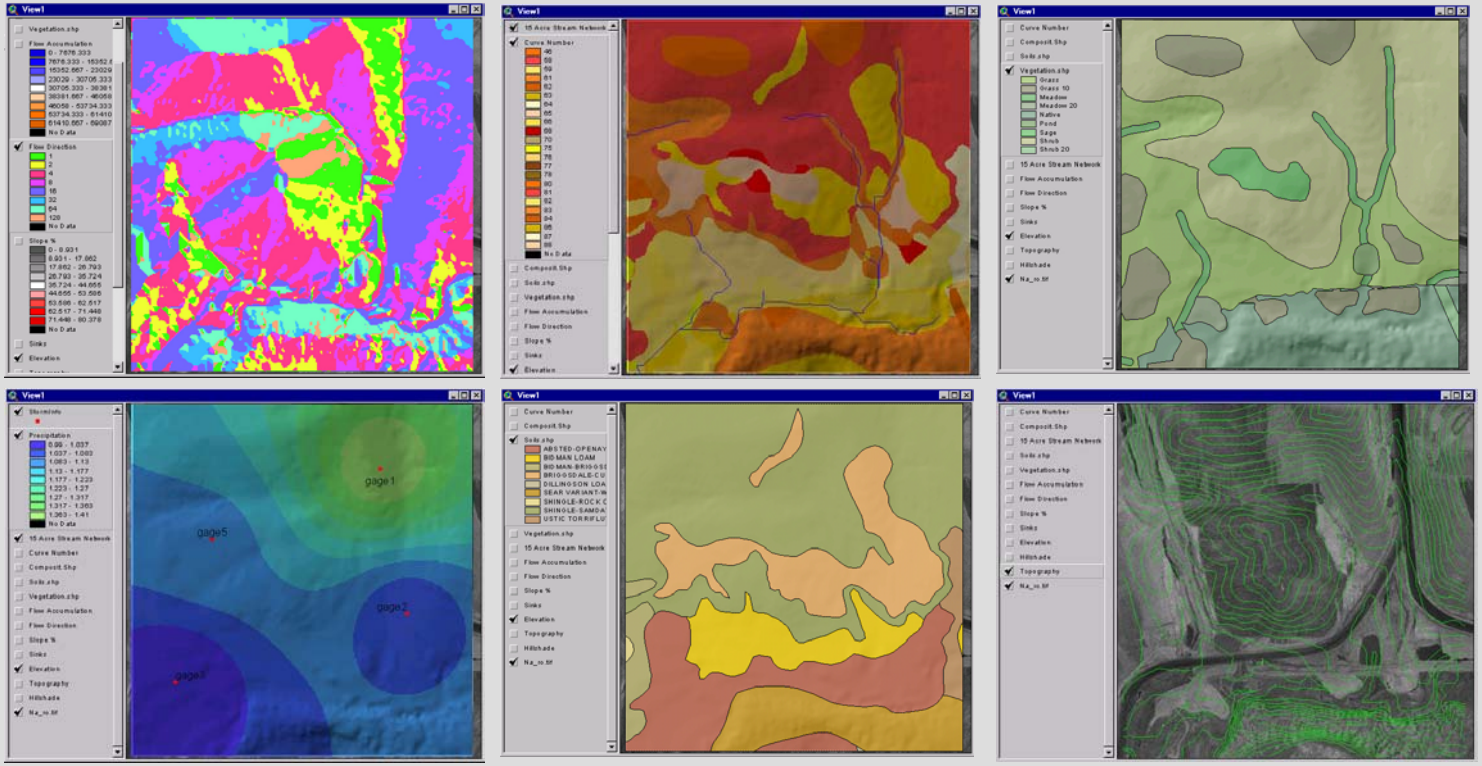
Attributes for Review



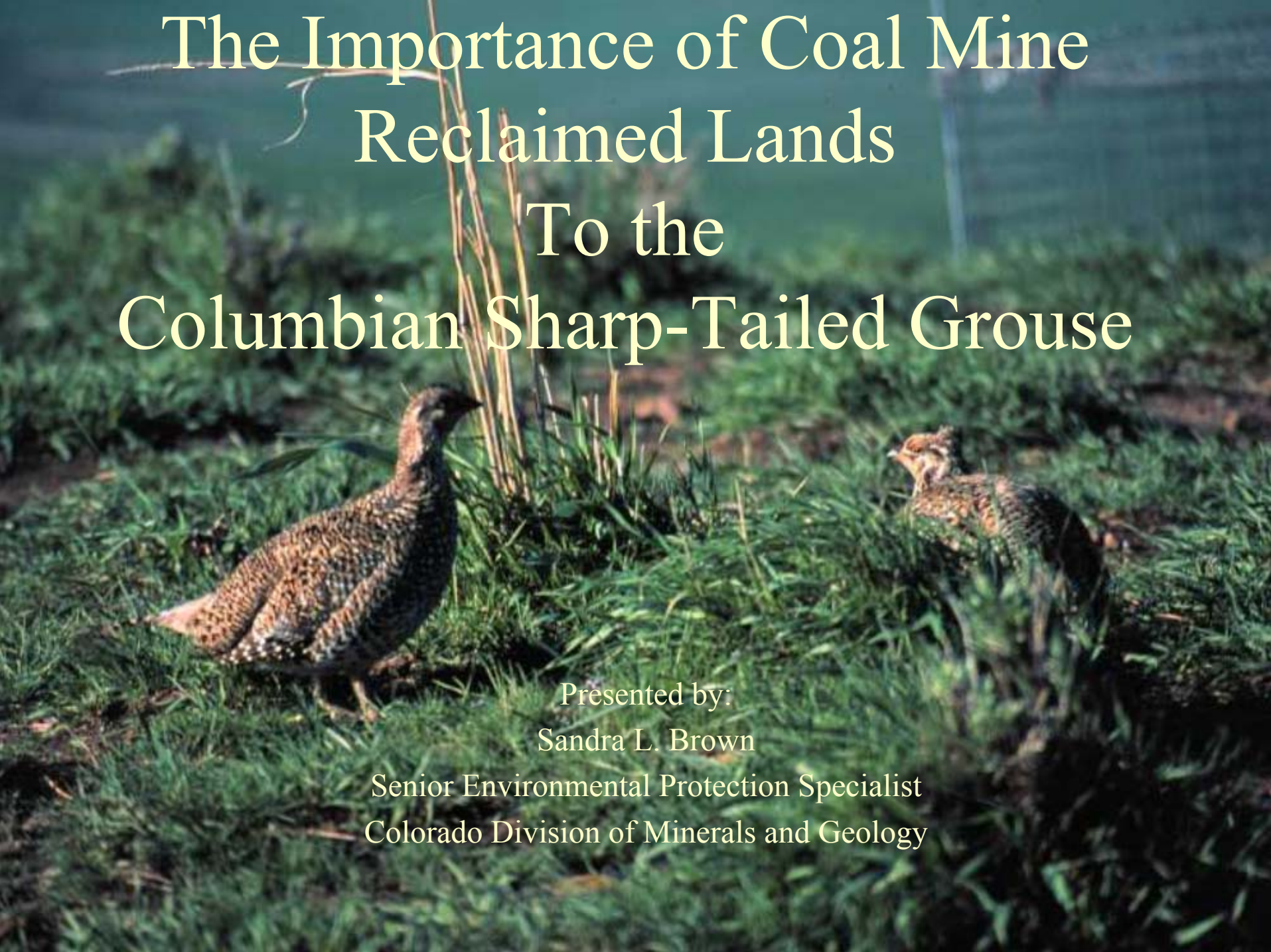
SedPrePro Potential

- Design Complete Hydrologic Models
- Visualize Each and Every Step of the Model Process
- Easy adjustments allow for optimization of Structure Design and Storm Water Predictions
- Produce Presentation Quality Maps
- Potential for Electronic Permitting

Sedcad+ and GIS

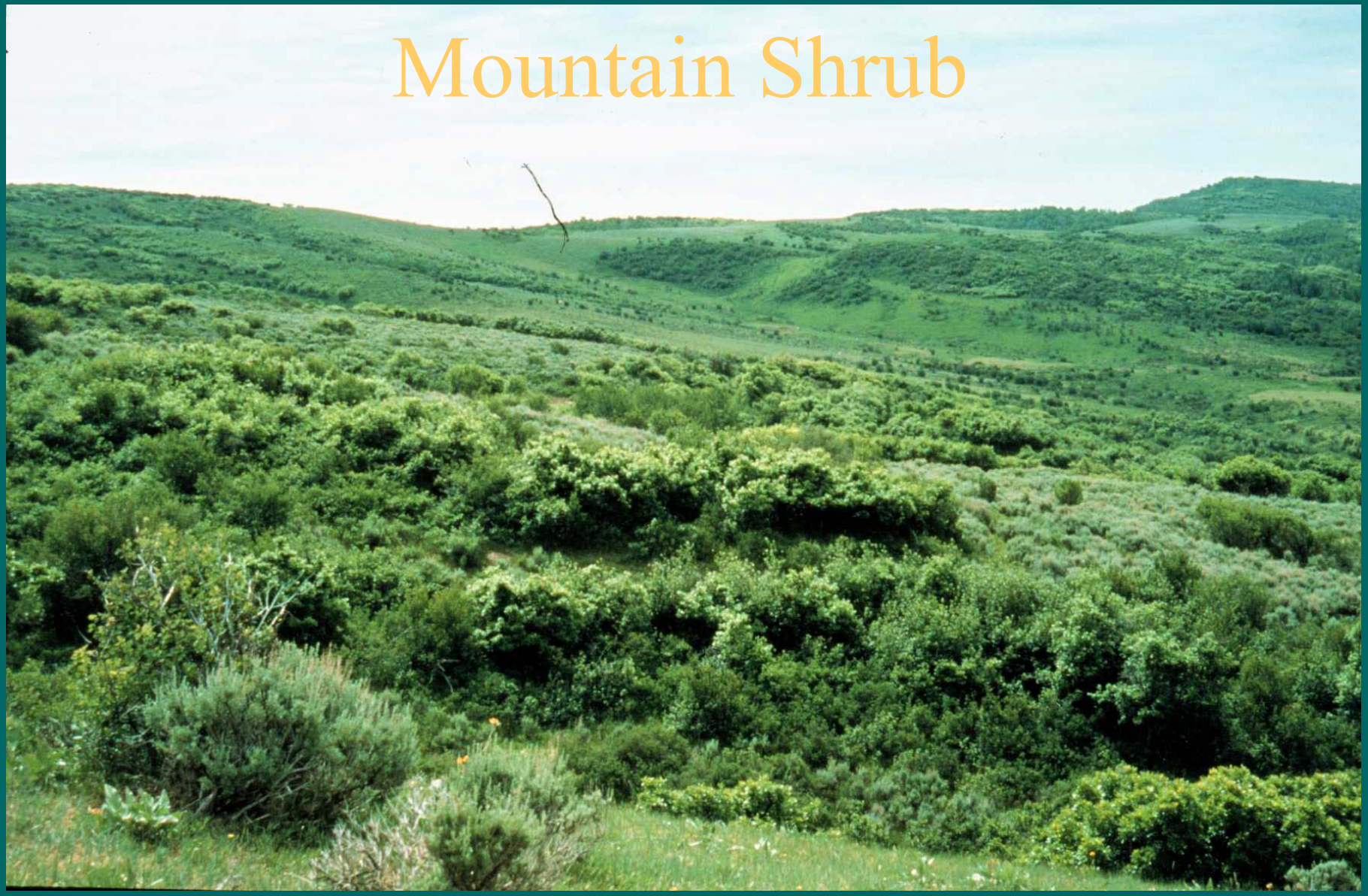


The Importance of Coal Mine Reclaimed Lands To the Columbian Sharp-Tailed Grouse

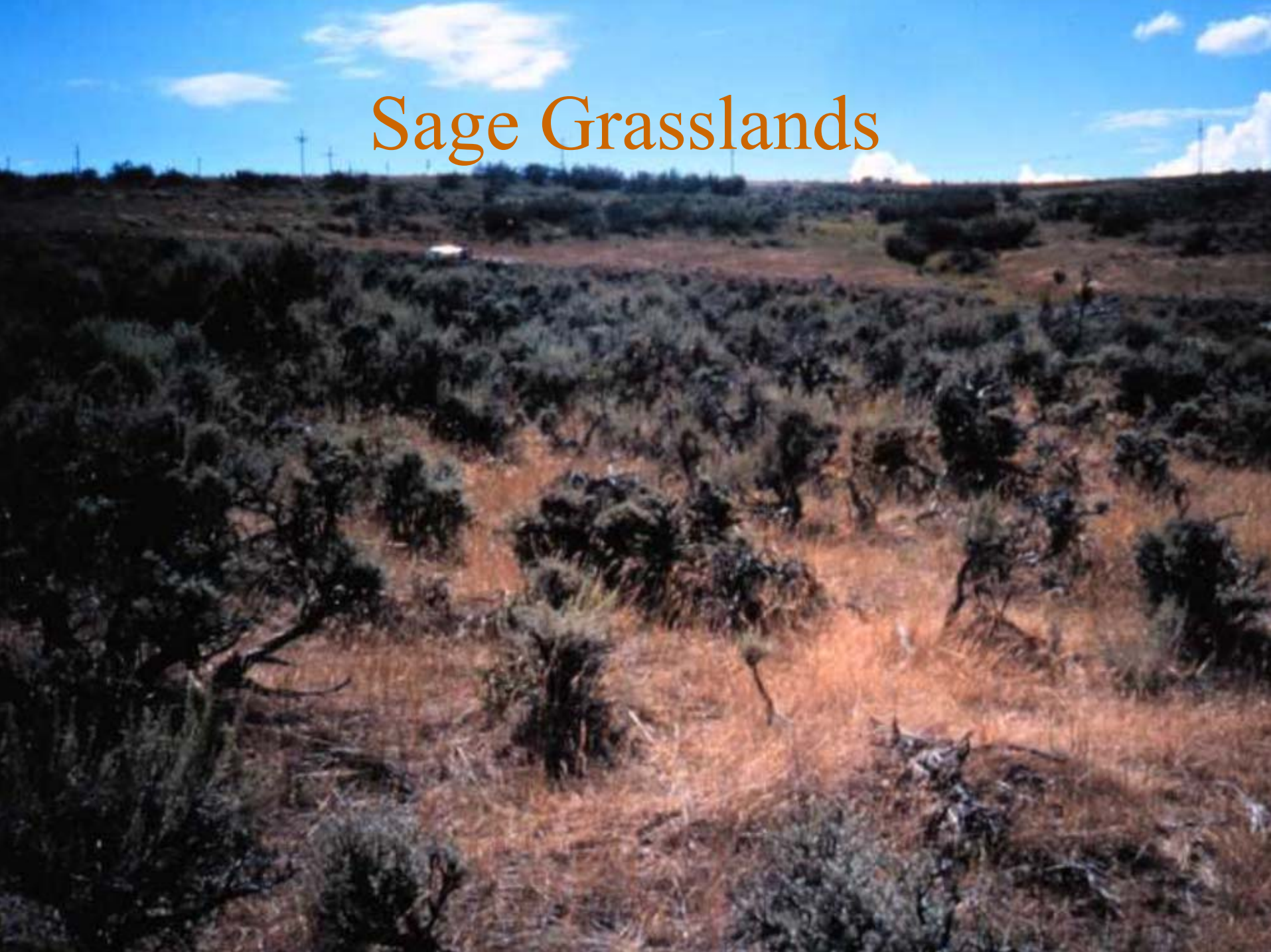


Presented by:
Sandra L. Brown
Senior Environmental Protection Specialist
Colorado Division of Minerals and Geology

Mountain Shrub



Sage Grasslands

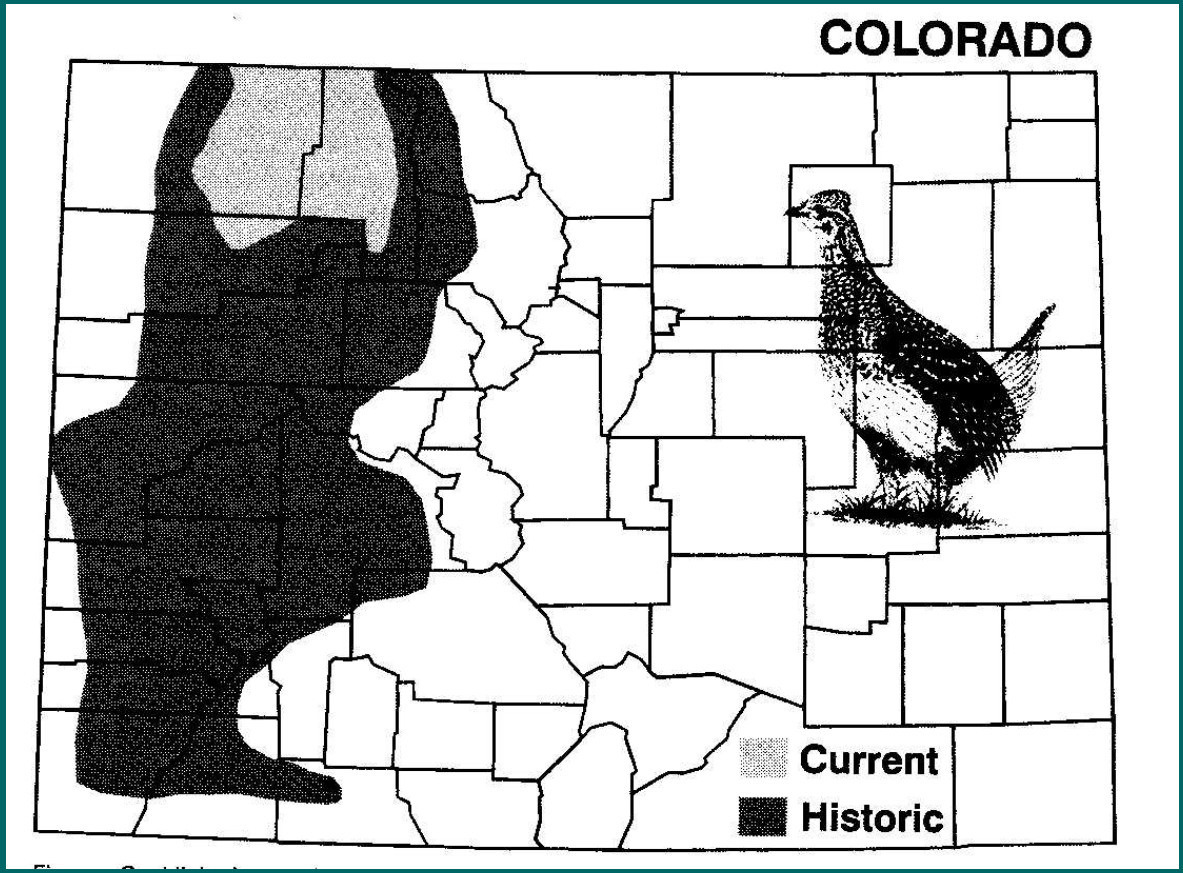


Columbian Sharp-Tailed Grouse
CSTG
Tympanuchus phasianellus columbianus

CSTG native habitat

Columbian Sharp-Tailed Grouse Range

R. Hoffman 2001



Possible listing as threatened species

- 1995 - Petition filed with the U.S. Fish and Wildlife Service under the Endangered Species Act
- 1999 - U.S.F.W.S. determined petition warranted a full assessment of species status
- 2000 - U.S.F.W.S. found the petition was not warranted.

CONSERVATION PLAN

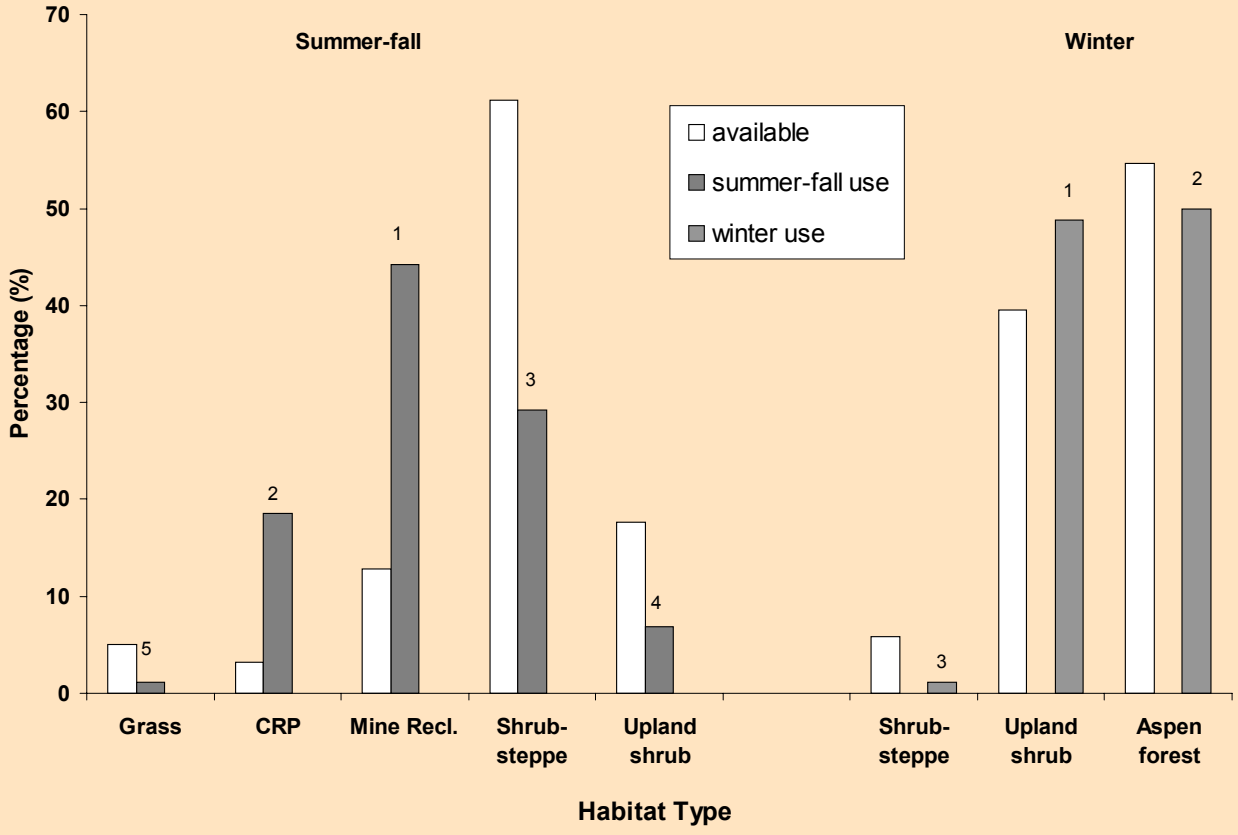
DOW researches CSTG use of reclaimed coal mine lands.

Funnel traps set up
on CSTG leks

HP OfficeJet

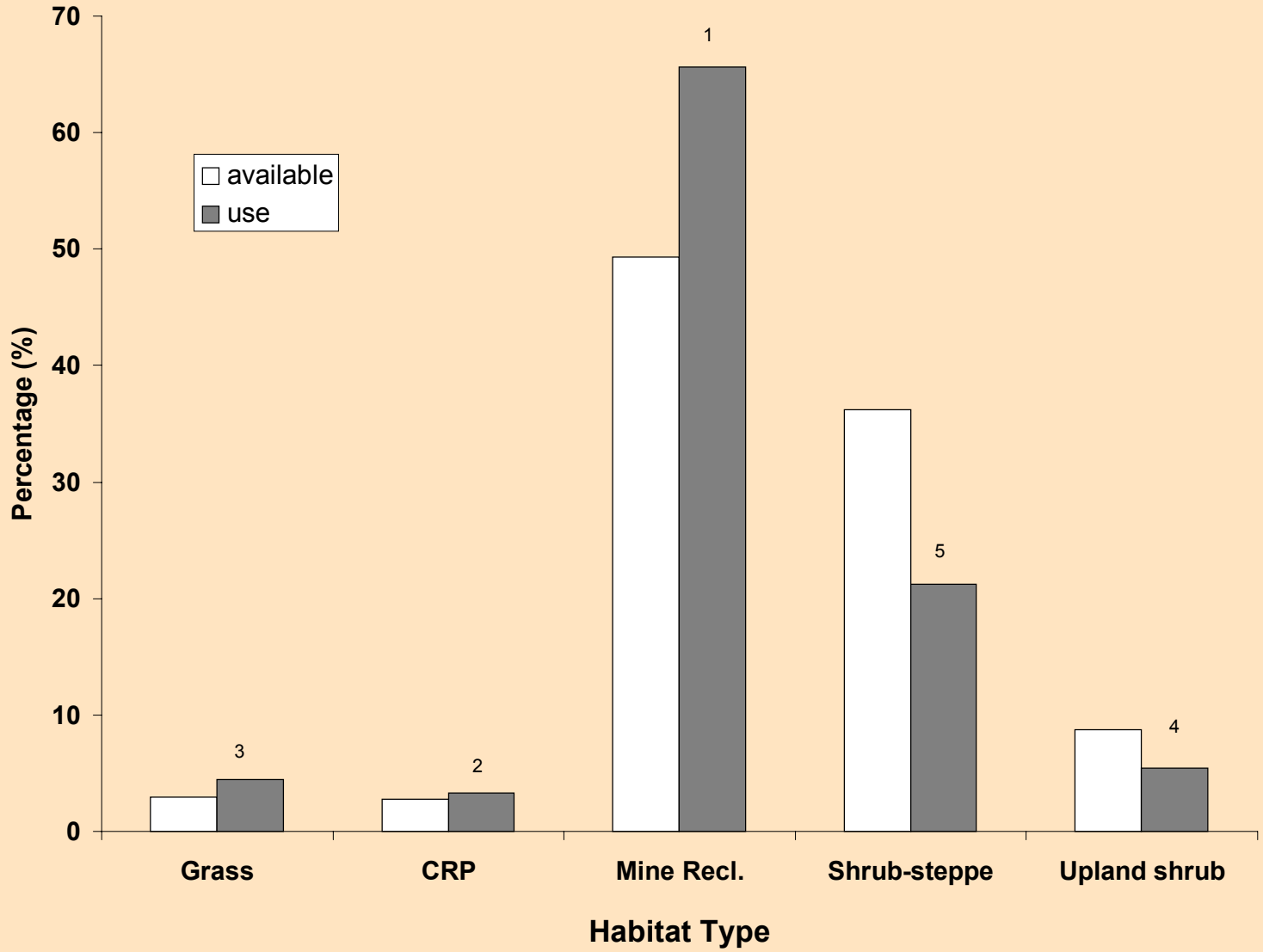
Overall Habitat Selection

J. Boisvert 2001

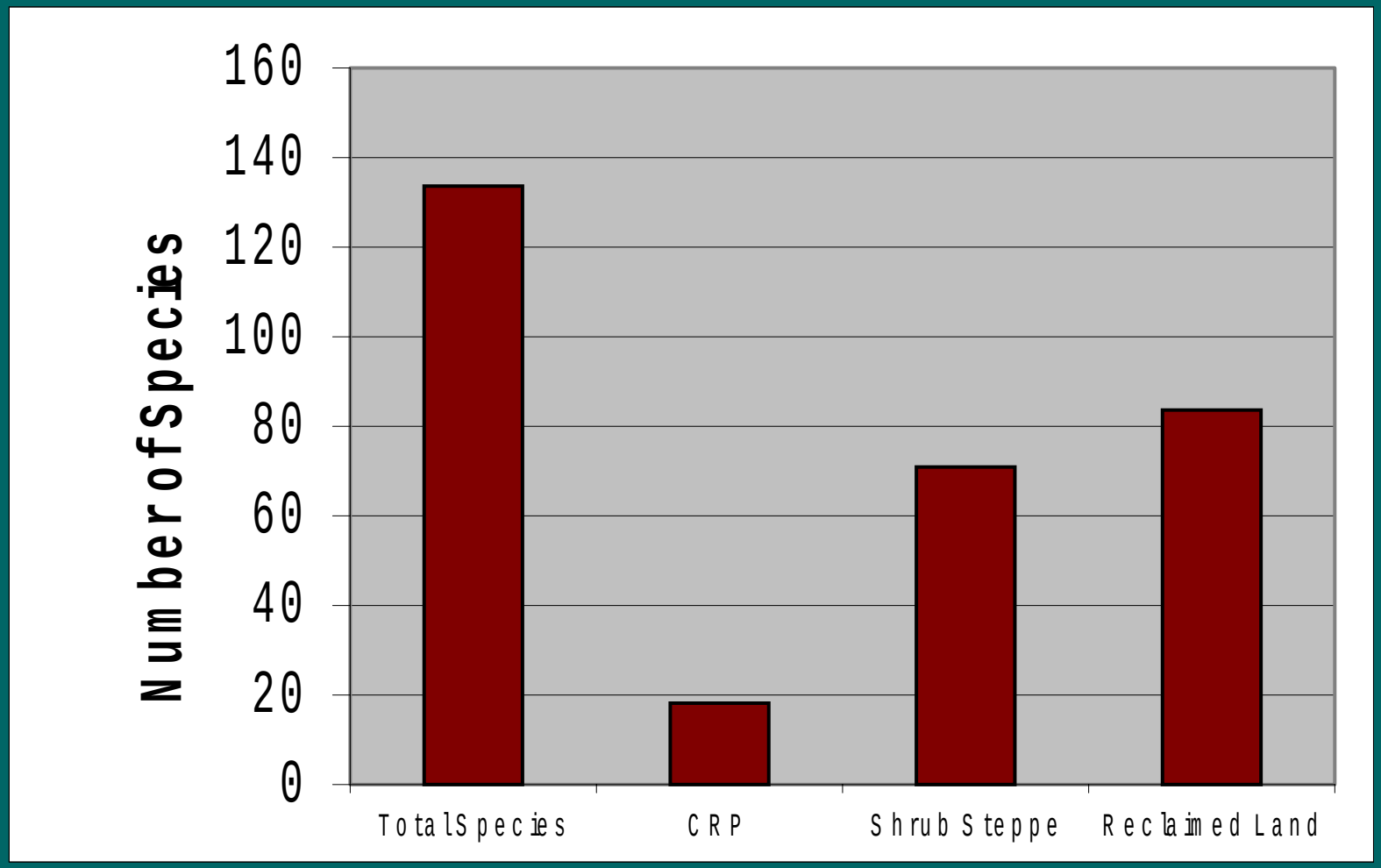


Brood Rearing Habitat Selection

J. Boisvert 2001



Plant Diversity



Typical Reclamation Seed Mix

- Western wheatgrass
- Beardless wheatgrass
- Mountain brome
- Green needlegrass
- Big bluegrass
- Sandberg bluegrass
- Basin wildrye
- Canada bluegrass
- R. mountain penstemon
- White yarrow
- Pacific aster
- Arrowleaf balsamroot
- Tailcup lupine
- Cicer milkvetch
- Antelope bitterbrush
- Serviceberry
- Chokeberry
- Mountain snowberry
- Wood's rose
- Big sagebrush

Possible factors contributing to CSTG decline

- Conversion of native grasslands to:
  - agriculture
  - ranch and;
  - urban development
- Fire suppression in shrub steppe habitat

Reclamation designs for grouse ecology

- Grading to create elevated knolls, ridges and benches for leks
- Create elevated features approximately 1 km apart
- Diverse, native seed mixes
- Mosaic pattern of native shrubs to create edge effect
- Control access to leks and brooding areas

Evaluate shrub establishment techniques

- Non-topsoiled spoil with strip seeding
- Strip seeding with shrubs and low-competitive native forbs
- Vary topsoil depths
- Surface manipulations
- Non-topsoiled spoil seeded with relatively unpalatable shrubs, low-competitive grasses and native forbs
- Fencing

Colorado's reclamation goals for wildlife habitat

- Create ecological diversity to respond to changes in natural conditions through the use of:
- topographic diversity
- water harvesting and improvements
- spatial redistribution of topsoil
- various plant growth mediums
- specialized plantings and seedings
- focus on native plant species
- vary seeding techniques - strip seeding, inter-seeding
- herbicide treatments
- retreatment techniques

Permitting And Construction Of An Important Wildlife Habitat
A Case Study

By:
Scott Benson, Triton Coal Company

Presented at OSM Bond Release Forum
August 2001

WDEQ Rules and Regulations

- Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) Rules and Regulations mandate that a plan be prepared and implemented to protect and enhance important habitats for fish and wildlife.

WDEQ Rules and Regulations

- The regulations further require that wildlife habitat be restored commensurate with or superior to habitat conditions which existed before the land became affected.

Important Habitats

- "Important habitats" are defined by WDEQ/LQD regulations as habitat, which in limited availability, supports or encourages a maximum diversity of wildlife species or fulfills one or more living requirements of a wildlife species. Specific examples of important habitats listed by the WDEQ/LQD include, but are not limited to, playas, wetlands, riparian areas, rimrocks, areas offering special shelter or protection, reproduction and nursery areas, and wintering areas.

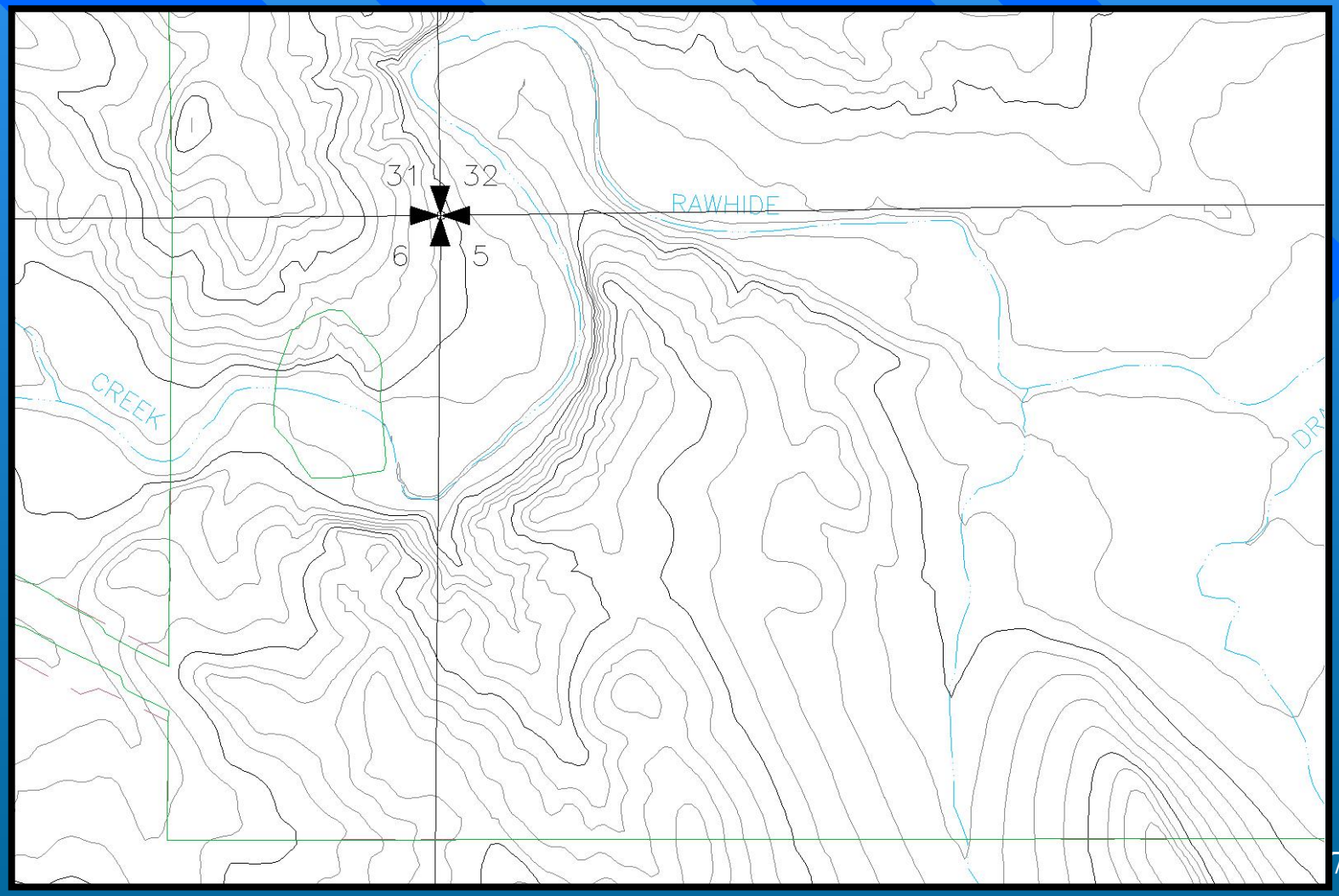
Inventory of Important Habitats

- While no specific inventory of "important habitats" was conducted during wildlife baseline inventories, habitat currently defined as "important" did occur in various locations within the Buckskin Mine permit boundary.

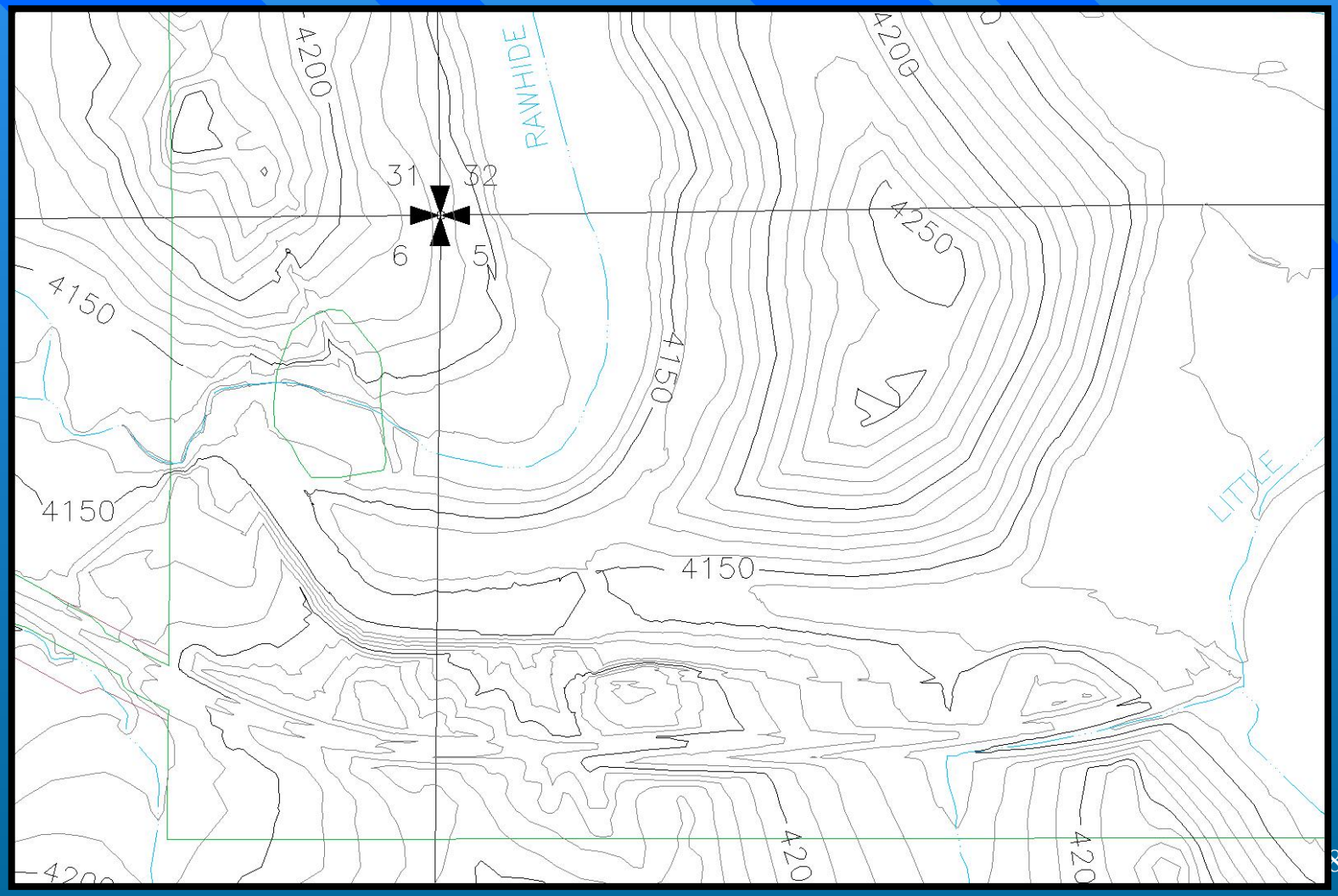
Inventory of Important Habitats

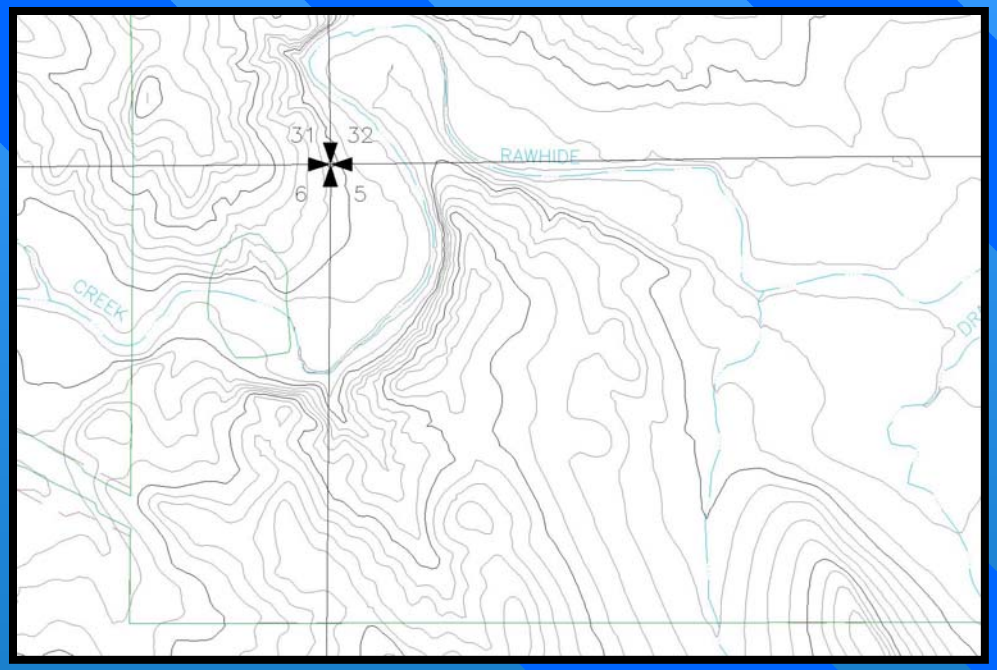
- Much of this important habitat consisted of erosional landforms including **badlands, gullies, cut banks, head cuts, incised streambeds, rough breaks, cliffs, rimrocks, and steep slopes**. A major goal of the Buckskin Mine's reclamation plan is to reestablish topography, vegetation, and landscape features that enhance wildlife habitat.

Premine Topography



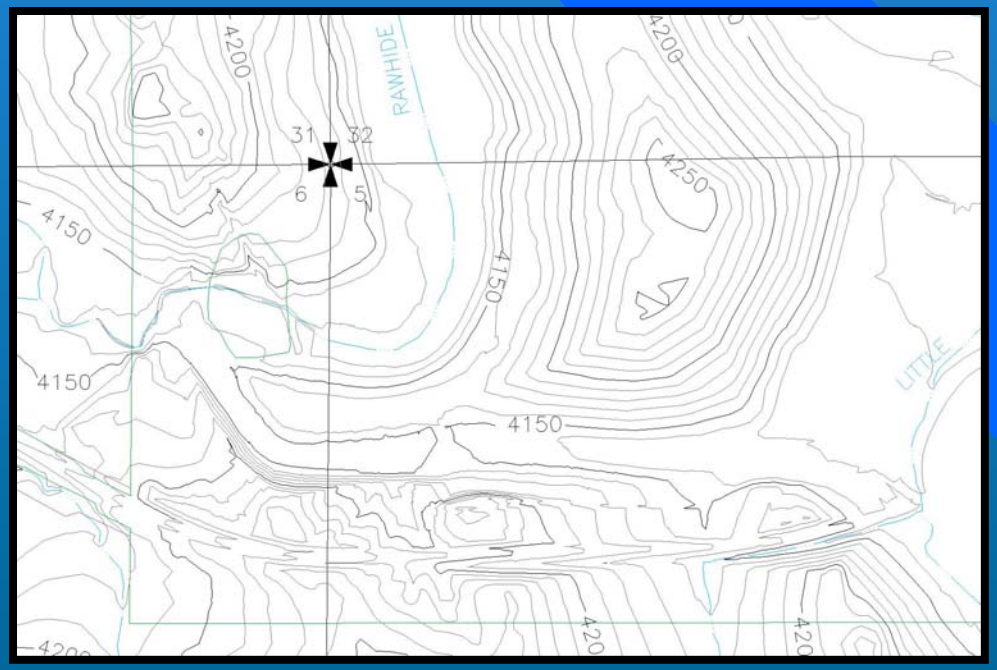
Proposed Postmine Topography





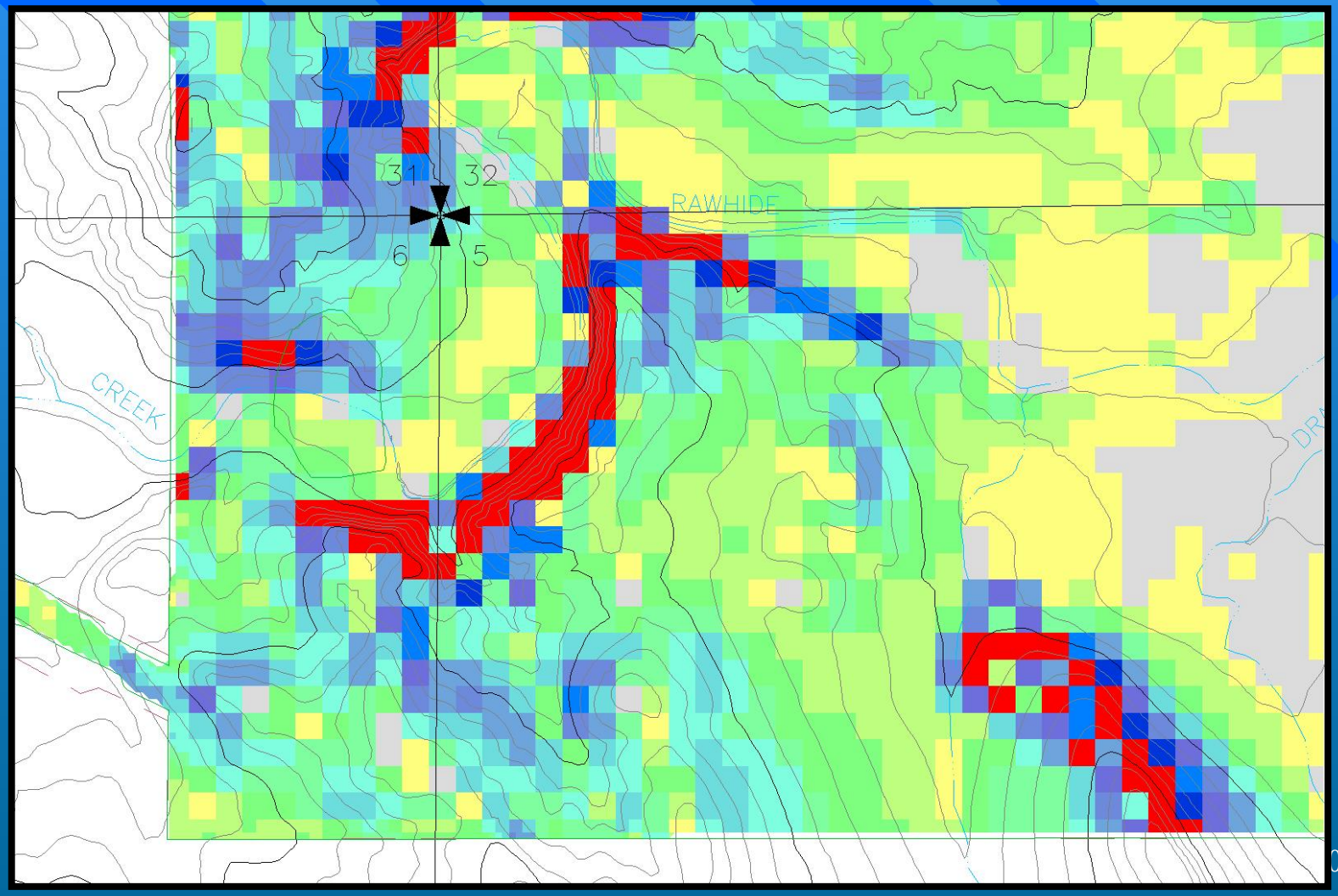
Premine Topo

vs.

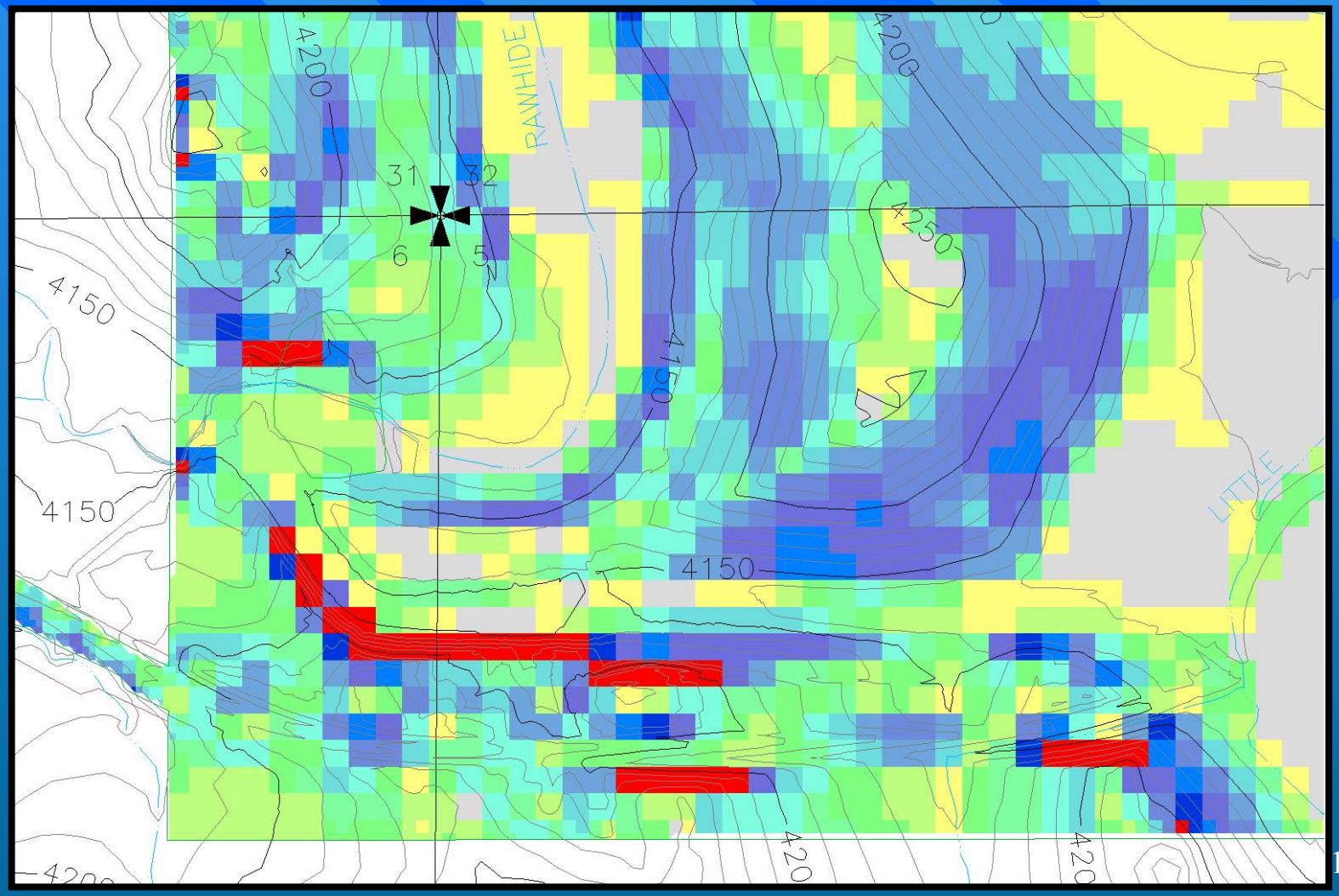


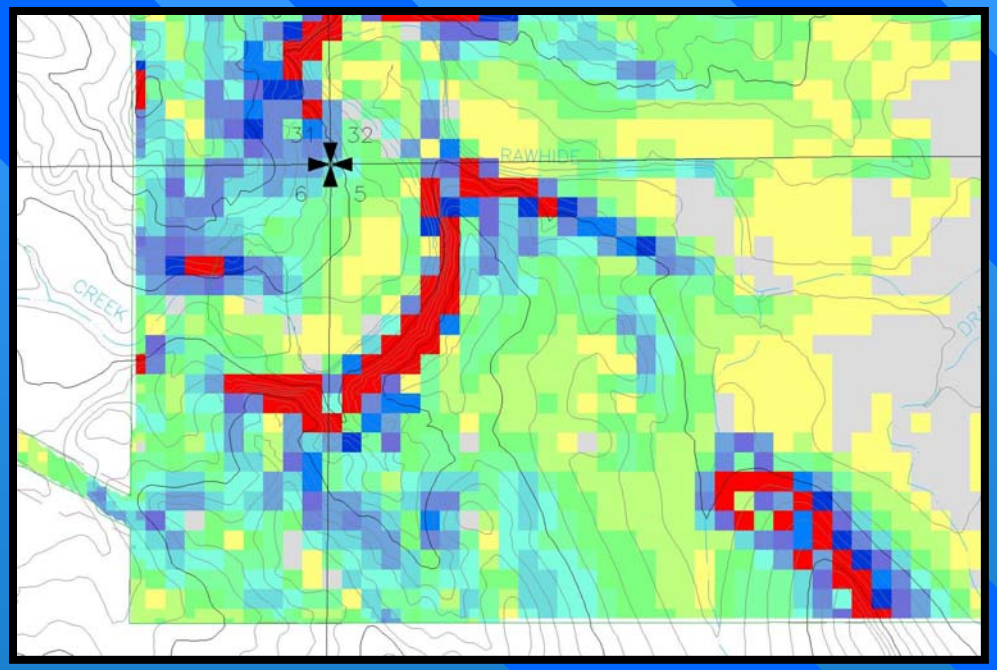
Postmine Topo

Premine Slopes



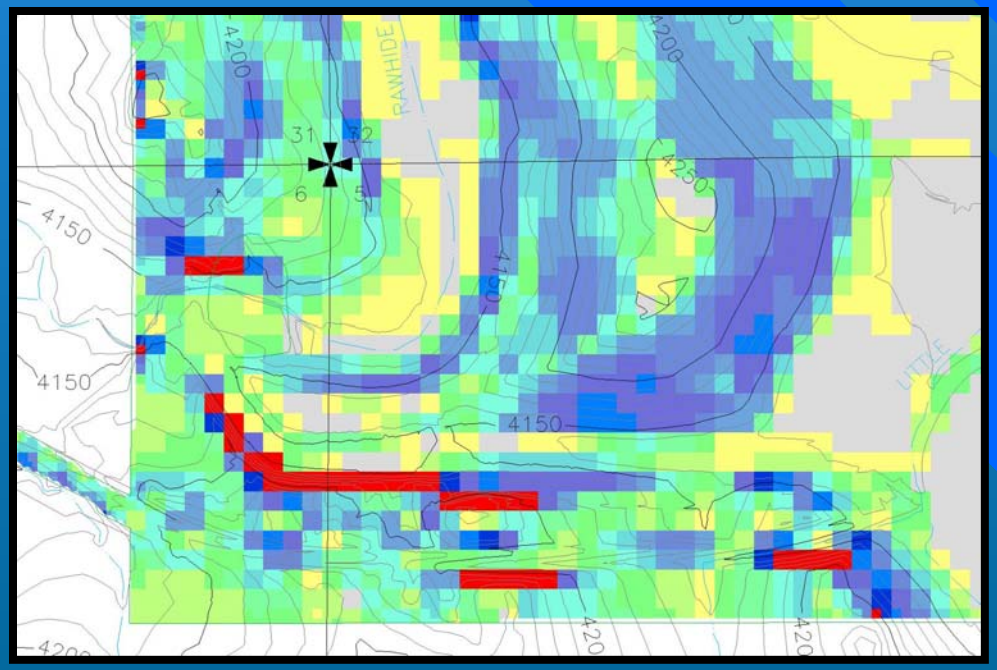
Proposed Postmine Slopes



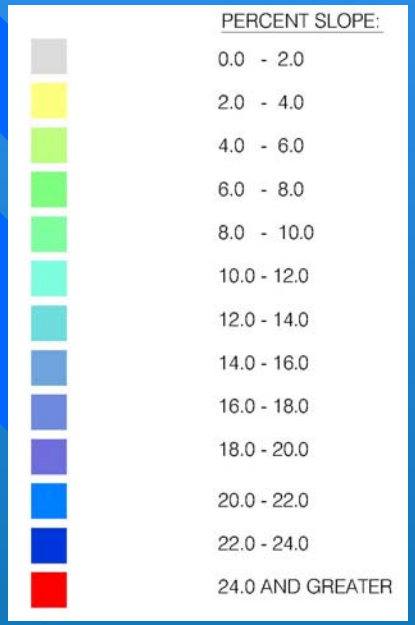


Premine Slopes

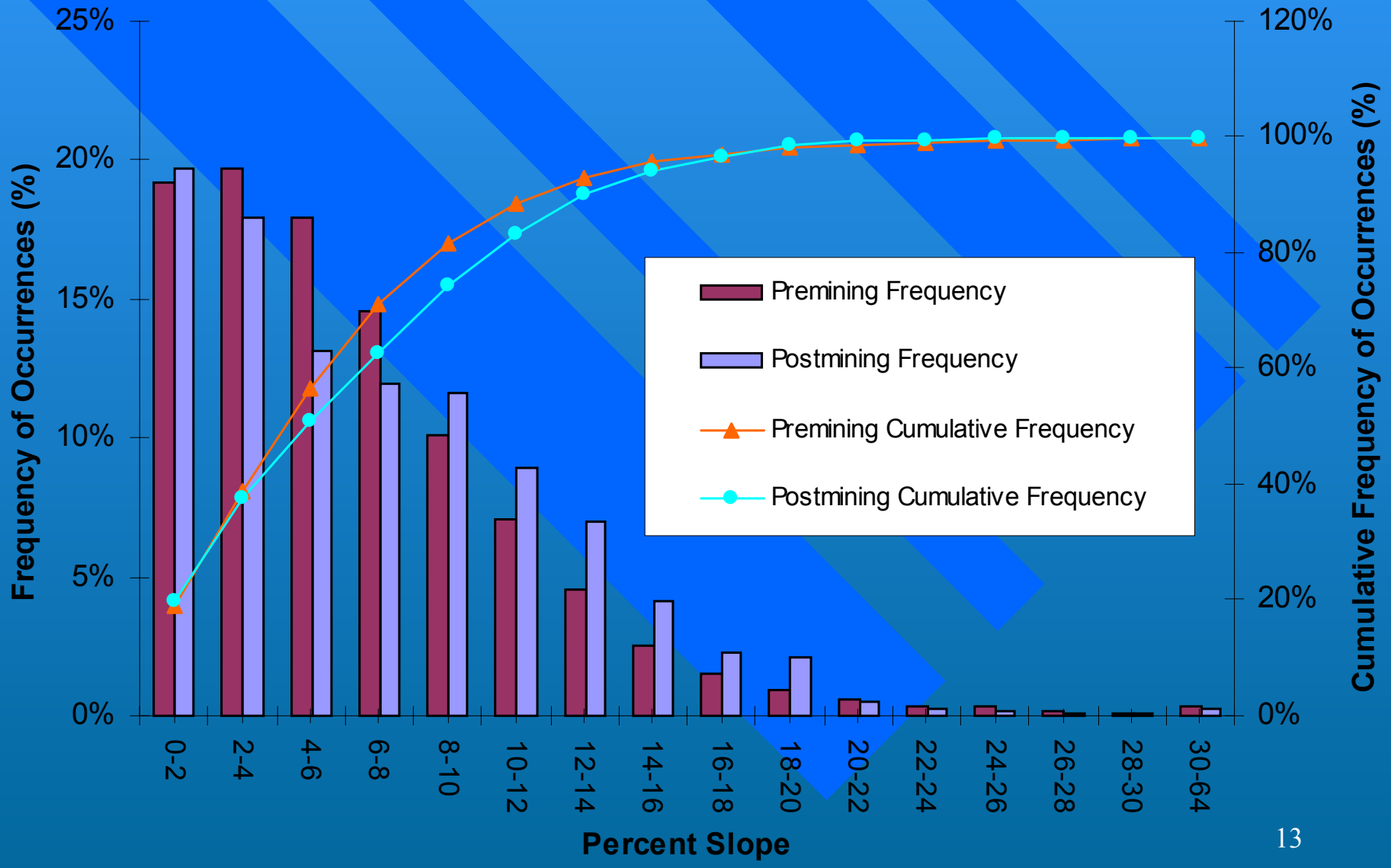
vs.



Postmine Slopes

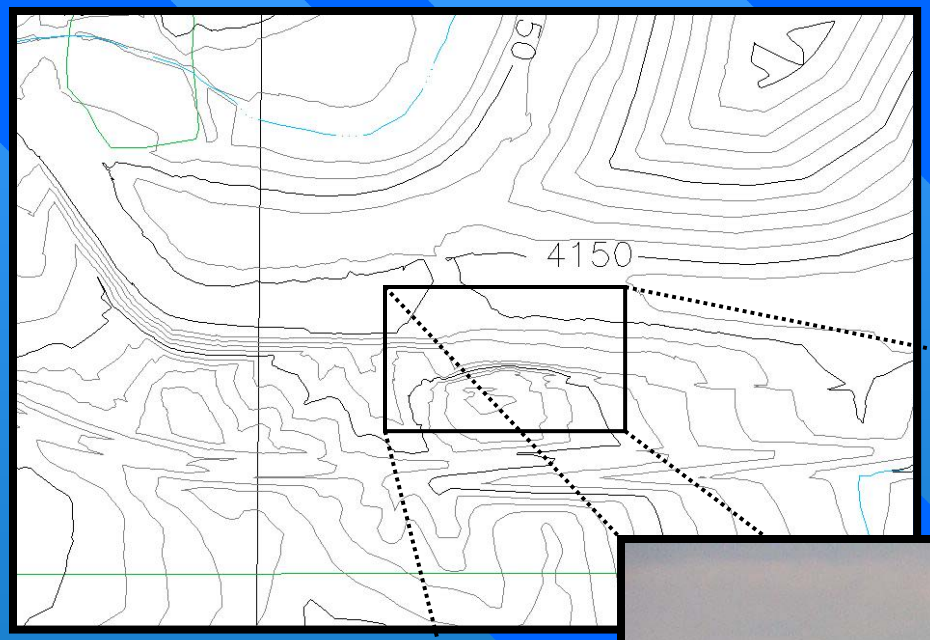


Pre- and Postmining Slope Distribution



Proposed PMT

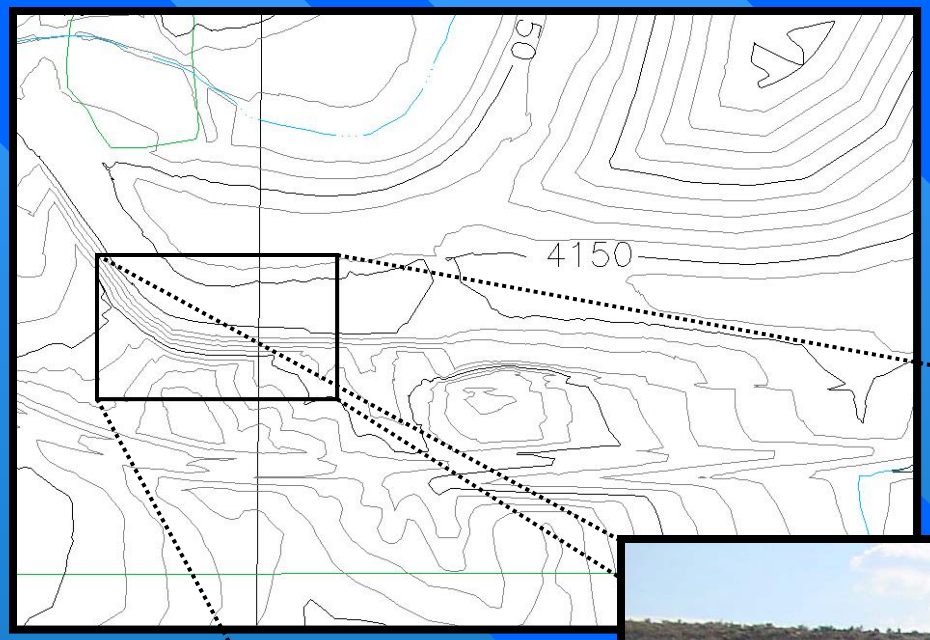
Proposed Bluff



Proposed Bluff

Premine Bluff

Steep Slopes



Steep Slopes

Proposed PMT

Diverse Landforms??

Diverse Landforms??

Permitting Concerns

- Steep Slope 2:1
- No Topsoil Replacement
- No Seeding

- Highwall Remnant = Rimrock / Bluff Habitat

Reclaiming Wildlife Habitat at the Buckskin Mine

by
Scott Benson
Triton Coal Company

Presented at OSM Bond Release Forum
August 2001

Landform Diversity

Cut Bank

Bluffs

Steep Slopes

Diversion Slope 1

Diversion Slope 2

Diversion Slope 3

Diversion Slope 4

Rock Piles 1

Rock Piles 2

Rock Piles 3

Rock Piles 4

Premine Bluff

Permitted Bluff

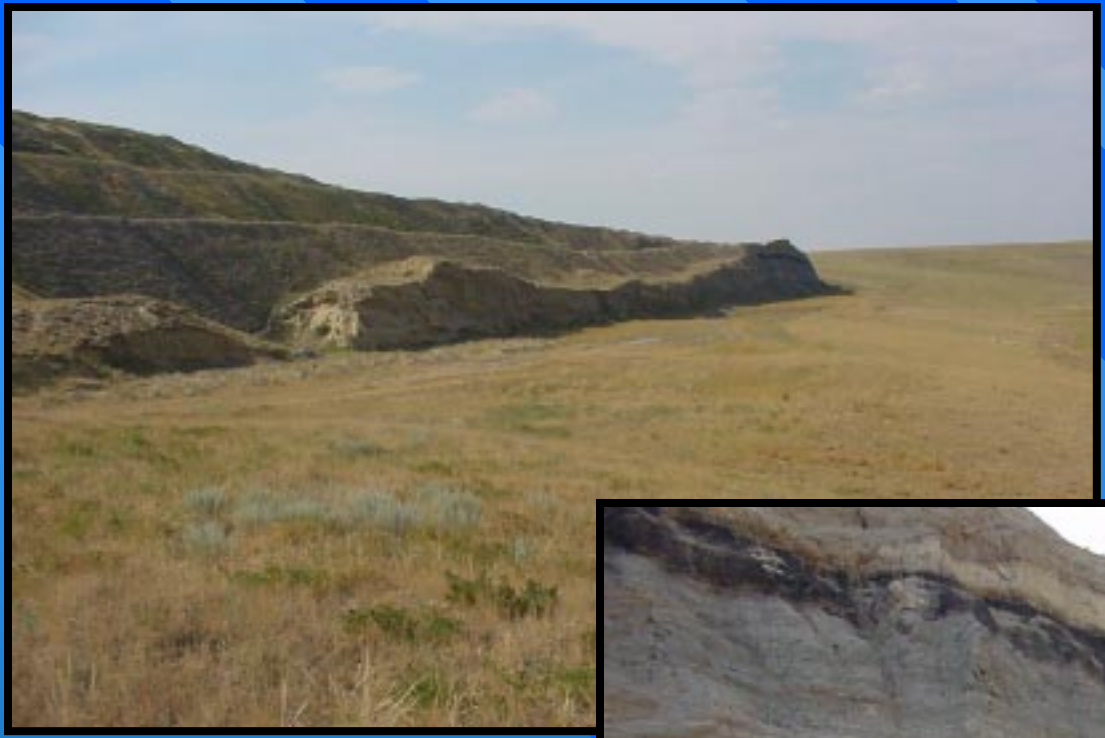
Permitted Bluff

Proposed Bluff

Proposed Bluff 2

Proposed PMT

Proposed PMT



Highwalls

Reclaimed AVF

Reclaimed AVF

AVF Settlement 1

AVF Settlement 2

CBM NPDES Discharge Point

CBM NPDES Discharge Point 2

AVF Exclosure 1

AVF Exclosure 2

AVF Exclosure 3

Cotton Wood Tree

Golden Willow

Golden Willow Browsing

Little Draw AVF Weeds

Little Draw Brush Pile 2

Little Draw Brush Pile 1

Brush

Vegetation Diversity

Winter Fat

Big Sage Drill Holes

Big Sage

Marijuana

USDA Ag Experimental Station Sagebrush Test Plots

Big Sage Test Plots

Electric Fence

Electric Fence

MAGNUM

Regulatory Obstacles Of Reclaiming Wildlife Habitat in Wyoming

By

Scott Benson
Triton Coal Company

Presented at the
OSM Bond Release Forum
August 2001

Promulgation of Environmental "Laws"

- **Federal Level** (e.g., Surface Mining Control and Reclamation Act [SMCRA], National Environmental Policy Act [NEPA], Clean Air Act, and Clean Water Act, etc.)
  - **Surface Mining Control and Reclamation Act of 1977 [SMCRA]**
    - » Department of Interior - Office of Surface Mining Reclamation and Enforcement (OSM)
  - **OSM Regulations (30 CFR 700-899)**

Promulgation of Environmental "Laws"

- **State Primacy**
  - **Wyoming Environmental Quality Act** (WEQA) (W.S. 35-11)
    - » Wyoming Department of Environmental Quality [WDEQ] – LQD, WQD, AQD, SHWD
  - **Coal Rules and Regulations**
  - **"Guidelines", "SOP's", "Instruction Memoranda", "Coal Permitting Handbook",** and written or unwritten statements of **"Administrator policy"** regarding reclamation

Reclamation of Wildlife Habitat

WEQA - Definitions

- Reclamation
- Fish and Wildlife Habitat
- Grazingland

WEQA - Definitions

- **Reclamation**
  - W.S. 35-11-103(e)(i) **"Reclamation" means the process of reclaiming an area of land affected by mining to use for grazing, agricultural, recreational, wildlife purposes, or any other purpose of equal or greater value. ….**
- **Fish and Wildlife Habitat**
- **Grazingland**

WEQA - Definitions

- Reclamation
- Fish and Wildlife Habitat
  - W.S. 35-11-103(e)(xxvi) "Fish and wildlife habitat" means land dedicated wholly or partially to the production, protection or management of species of fish or wildlife;
- Grazingland

WEQA - Definitions

- Reclamation
- Fish and Wildlife Habitat
- Grazingland
  - S. 35 11 103(e)(xxvii) "Grazingland" includes rangelands and forestlands where the indigenous native vegetation is actively managed for grazing, browsing, occasional hay production, and occasional use by wildlife;

WEQA Reclamation Standards

- W.S. 35-11-402. Establishment of standards.
  - "The highest previous use of the affected lands…"

Coal Rules and Regulations Definitions

- **Land Use**
  - **Cropland**
  - **Pastureland**
  - **Grazingland**
  - **Forestry**
  - **Residential**
  - **Industrial Commercial**
  - **Recreational**
  - **Fish and Wildlife Habitat**
  - **Developed Water Resources**
  - **Undeveloped Land**
  - **Treated Grazingland**

Coal Rules and Regulations Definitions

- **Land Use**
  - Chapter 1: (bc) "Land use" means for surface coal mining operations, specific uses or management-related activities, rather than the vegetation or cover of the land. Land uses may be identified in combination when joint or seasonal uses occur…..

Coal Rules and Regulations Definitions

- **Grazingland**
  - Chapter 1: (bc)(iii) Grazingland includes rangelands and forest lands where the indigenous native vegetation is actively managed for grazing, browsing, and occasional hay production, and occasional use by wildlife.

Coal Rules and Regulations Definitions

- **Fish and Wildlife Habitat**
  - Chapter 1: (bc)(viii) Fish and wildlife habitat means land dedicated wholly or partially to the production, protection or management of species of fish or wildlife.

Coal Rules and Regulations Definitions

- **Critical Habitat**
  - Chapter 1: (v) "Critical habitat" means those areas essential to the survival and recovery of species listed by the Secretary of the Interior as threatened or endangered under the authority of 50 CFR, Part 17.

Coal Rules and Regulations Definitions

- **Crucial Habitat**
  - Chapter 1: (w) "Crucial habitat" means those areas, designated as such by the Wyoming Game and Fish Department, which determine a populations's ability to maintain and reproduce itself at a certain level over the long term.

Coal Rules and Regulations Definitions

- **Important Habitat**
  - Chapter 1: (ax) "Important habitat" means that habitat which, in limited availability, supports or encourages a maximum diversity of wildlife species or fulfills one or more living requirements of a wildlife species. Examples of important habitat include, but are not limited to, wetlands, riparian areas, rimrocks, areas offering special shelter or protection, reproduction and nursery areas, and wintering areas.

Coal Rules and Regulations Definitions

- **Steep Slope**
  - Chapter 1: (cm) "Steep slope" means any slope of more than 20 degrees or such lesser slope as may be designated by the Administrator after consideration of soil, climate, and other characteristics of the area.

Coal Rules and Regulations Definitions

- **Best Technology Currently Available**
  - Chapter 1: (j) "Best technology currently available" means equipment, devices, systems, methods, or techniques which, as determined by the Administrator, are currently available and practicable, and will:

    (ii) Minimize, to the extent possible, disturbances and adverse impacts on fish, wildlife and related environmental values, and achieve enhancement of those resources where practicable.

Coal Rules and Regulations Definitions

- **Eligible Land**
  - Chapter 1: (ac) "Eligible land" means all land to be affected by a mining operation after August 6, 1996. Cropland, pastureland or treated grazingland approved by the Administrator which is to be affected by a mining operation after August 6, 1996 is not "eligible land".

Coal Rules and Regulations Definitions

- **Good Husbandry Practices**
  - Chapter 1: (ao) "Good husbandry practices" means sound land management techniques which are commonly practiced in the area of the mine considering the postmining land use and, if discontinued after the bond period ends, shall not reduce the probability of permanent vegetation success.

Coal Rules and Regulations Definitions

- **Highest Previous Use**
  - Chapter 1: (ar) "Highest previous use" means a sustainable use of the land which has the greatest economic and social values to the people of the area prior to the commencement of the mining operation.

Coal Rules and Regulations Definitions

- **Highwall**
  - Chapter 1: (as) "Highwall" means the face of exposed overburden or coal in an open cut of a surface mine or entry to an underground mine.

Coal Rules and Regulations
Chapter 2,
Permit Application Requirements

Ch 2, Sec 2. Application Content Requirements for Surface Coal Mining Operations

- (a)(vi) Description of Affected Lands
  - (C) Vegetation Types
  - (G) Fish, Wildlife, and Their Habitats
    - (I) Indigenous Vertebrate Wildlife Species
    - (II) Critical Habitat

Ch 2, Sec 2. Application Content Requirements for Surface Coal Mining Operations (cont'd)

- (a)(vi) Plan to Minimize Impacts
  - (A) Enhanced Resources
  - (B) Monitoring Methods to Protect or Enhance
    - (I) Threatened or Endangered Species
    - (II) Species Identified Through Consultation
    - (III) Important Habitats

Coal Rules and Regulations
Chapter 4,
Environmental Performance Standards

Ch 4, Sec 2. General Environmental Protection Performance Standards

- (a) Land Uses
  - (i) Equal or Greater Than “Highest Previous Use”
  - (ii) Restoration of Wildlife Habitat

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (b) Backfilling, Grading and Contouring
  - (ii) Support Approved Postmining Land Use and Minimize Erosion
  - (iii) Approximate Original Contour
  - (iv) Eliminate Highwalls, except
    - (A) To Create and Enhance Wildlife Habitat
    - (B) By Authorization
  - (v) Static Safety Factor of 1.3

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (b) Backfilling, Grading and Contouring
  - (v) Soft Rock Surface Mining
    - (A) Reclaimed Slopes Shall Approximate Premining Slopes and Drainages Shall Be Preserved
    - (C) The Reclamation Shall Blend with Surrounding Topography
    - (D) Highwall Retention May Be Considered For Enhanced Wildlife Habitat

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (c) Topsoil, Subsoil, Overburden, and Refuse
  - (v) Topsoil, Subsoil, and/or Approved Topsoil Substitute Shall Be Redistributed in a Manner That:
    - (A) Achieves An Approximate Uniform, Stable Thickness Consistent With the Approved Permit and the Postmining Land Uses

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (c) Topsoil, Subsoil, Overburden, and Refuse
  - (vi) All Rills and Gullies Which Either Preclude Achievement of the Approved Postmining Land Use……..Shall be Regraded or Otherwise Stabilized

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (c) Topsoil, Subsoil, Overburden, and Refuse
  - (xi) Overburden, Spoil and Refuse
    - (K) No Water Impoundments or Large Depressions. Soil Conservation Techniques May be Approved

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (d) Revegetation
  - (i) …Shall Establish a Diverse, Permanent Vegetative Cover
  - (ii) Rills and Gullies Precluding Successful Revegetation Will Be Corrected. Approved Seeding Techniques Will Be Used

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (d) Revegetation
  - (ix) The Bond For Revegetation Will Be Retained No Less Than Ten Years
  - (x) Revegetation is Complete When:
    - (1) Self Renewing, & Ground Cover >= Premine
    - (2) Productivity >= Premining
    - (3) Species Diversity and Composition Suitable for Approved Postmining Land Use

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (d) Revegetation
  - (x) The Entire Bond Cannot Be Released Until:
    - (E) Shrub Density, Composition, Distribution
    - (F) Trees, 80 % For At Least Eight Years

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (e) Diversion Systems and Drainage Control
  - (i) Diversion of Streams
    - (E) When Stream Channels Are Restored
      - (I) Restore Riparian Vegetation
      - (II) Restore Stream Characteristics and Aquatic Habitats

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (g) Permanent and Temporary Water Impoundments
  - (i) Permanent Water Impoundments are Prohibited *unless* Authorized on the Basis:
    - (A) Postmining Land Use is Equal to or Greater Than the Previous Use

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (r) Fish and Wildlife Performance Standards
  - (i) Minimize Impacts on Fish, Wildlife and Related Environmental Values:
    - (A) Avoid Electrocution of Raptors
    - (B) Limit Accesses to Avoid Damage to Wildlife
    - (C) Restore and Enhance Where Practicable, Important Habitats

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (r) Fish and Wildlife Performance Standards
  - (i) Minimize Impacts on Fish, Wildlife and Related Environmental Values:
    - (D) Select Plant Species to Best Enhance Habitat
    - (E) Report Threatened or Endangered Species
    - (F) Restore Habitat to Break up Monocultures

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (r) Fish and Wildlife Performance Standards
  - (ii) Stream Buffer Zone
    - (A) No Land Within 100 Feet of a Perennial or Intermittent Stream Shall be Affected Unless Authorized

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (r) Fish and Wildlife Performance Standards
  - (iii) No Surface Mining Activity Shall be Conducted Which is Likely to Jeopardize Endangered or Threatened Species
  - (iv) The Operator Shall Perform Periodic Surveys

Ch 4, Sec 2. General Environmental Protection Performance Standards (cont'd)

- (r) Fish and Wildlife Performance Standards
  - (iii) No Surface Mining Activity Shall be Conducted Which is Likely to Jeopardize Endangered or Threatened Species
  - (iv) The Operator Shall Perform Periodic Surveys

Coal Rules and Regulation – Appendix A, Vegetation Sampling Methods and Reclamation Success Standard for Surface Coal Mining Operations

I. General Inventory Procedures

A. Mapping of Plant Communities

B. Sampling of Plant Communities

C. Establishing and Sampling Control or Reference Areas

D. Describing the Plant Communities

E. Compiling a Plant Species List

F. Sample Adequacy

II. Detailed Qualitative and Quantitative Sampling Procedures

A. Choice of Sample Locations
B. Choosing Sampling Methods
C. Suggested Sampling Procedures for Specific Vegetation Parameters
D. Recording of Sample Methodology

III. Establishing Revegetation Success Goals

A. Quantitative and Qualitative Vegetation Standards

B. Quantitative and Qualitative Vegetation Standards

IV. Estimating Adequate Sample Size

A. General Considerations
B. Procedures
C. Determining d and z values
D. Determining Minimum and Maximum Sample Sizes

V. Suggested Timetable for Components of the Vegetative Inventory

VI. General Format for Appendix D-8

VII. Developing a Revegetation Plan

A. General Considerations
B. Seed Mixtures
C. Seeding Practices
D. Husbandry Practices
E. Postmining Grazing Practices
F. Restoration of Shrubs, Subshrubs and Trees
G. Literature

VIII. Testing Adequacy of Reclamation

A. Reclamation Success Standards
B. Land Units for Evaluating Revegetation Success
C. Evaluation of Species Diversity and Species Composition
D. Evaluation of Restored Cropland or Pastureland
E. Evaluation of Shrub Density
    A. Option I
    B. Option II
    C. Option III
    D. Option IV
F. Summary

Coal Rules and Regulation – Appendix B, Wildlife Monitoring Requirements for Surface Coal Mining Operations

A. Big Game Seasonal Habitat Use

- Seasonal Distribution and Habitat Affinity
- Climatological Information
- Range Conversions
- Mortalities and Concentration Buildups

B. Upland Gamebird Brood Counts and Lek Attendance Surveys

- Lek Searches
- Lek Attendance Surveys
- Brood Habitat Surveys
- Measures of Disturbance

C. Raptor Production

- Nest Status and Production Success
- Measures of Disturbance
- Prey Abundance Indices
- Permit Term Mitigation Plan

D. Migratory Birds of High Federal Interest

E. Federally Listed Threatened and Endangered Species

- Bald Eagles
- Black-Footed Ferrets

Guidelines, SOP's, Policies

- **LQD Guideline No. 2** – Vegetation
- **LQD Guideline No. 5** – Wildlife
- **LQD Guideline No. 14** – Permanent Reclamation Vegetation Monitoring
- **LQD Guideline No. 17** – Permanent Postmine Impoundments
- **LQD *Draft* Guideline No. ?** – Alternative Success Standards and Evaluations
- LQD Draft Bond Release Guideline

Guidelines, SOP's, Policies (cont'd)

- **Coal S.O.P. 3.1** – Postmining Topography Assessments
- **LQD Guideline No. 14** – Permanent Reclamation Vegetation Monitoring
- **Instruction Memorandum No. 41** – Procedures for Full and Partial Bond Release
- Written "Administrator policy" – Bond Release Terminology, April 12, 2001
- Memorandum of Understanding Between the Wyoming Game and Fish Department and Department of Environmental Quality, Land Quality Division

LQD Guideline No. 5 - Wildlife

- Information Needed in a Wildlife Inventory

  (3) Habitat Description Including Both Vegetative and Physical Habitat Types Including:

  - Ponds
  - Playas
  - Rough Breaks
  - Outcrops
  - Rimrocks

LQD Guideline No. 5 - Wildlife

- (D) Mitigation Plan
  - Acceptable Mitigation Includes Wildlife-Oriented Reclamation and Habitat Improvement Projects…[with] New and Innovative Techniques.

LQD Guideline No. 5 - Wildlife

- (E) Reclamation Plan
  - Topographic and Plant Diversity is Essential to Replace Wildlife Habitat, Including:
    - Varying Slopes
    - Rock Piles
    - Brush Piles
    - Riparian Zones
    - Highwalls to Simulate Rimrocks

Section 404 CWA – Jurisdictional Wetlands Mitigation – C.O.E.

Caballo Mine

Wildlife Habitat Enhancements

Presented by Steve Storie
OSM Bond Release Forum
August 2001

Machine Guidance in Mining Activities

Presented by Tim Kerr

OSM Bond Release Forum

August 2001

MADE TO MEASURE

Leica Dozer 2000 - Machine Guidance System

This presentation describes Leica Dozer 2000 - Machine Guidance System and how it significantly increases productivity by changing work flow, empowering machine operators, and eliminating re-work.

This presentation compares traditional construction procedures with new procedures, describes how Leica Dozer 2000 works, provides examples of some ideal applications and outlines the enormous productivity benefits that are gained by using Leica Dozer 2000 system.

Imagine a Better Way of Working with Machines

- Machines are used in mining and construction to move large amounts of dirt to create surfaces designed by engineers - ranging from a simple bench level to more complex shapes and forms such as curved and embanked roads with drainage ditches.
- The earthmoving machinery is guided by operators who rely on surveyors' grade stakes to guide them in their work.

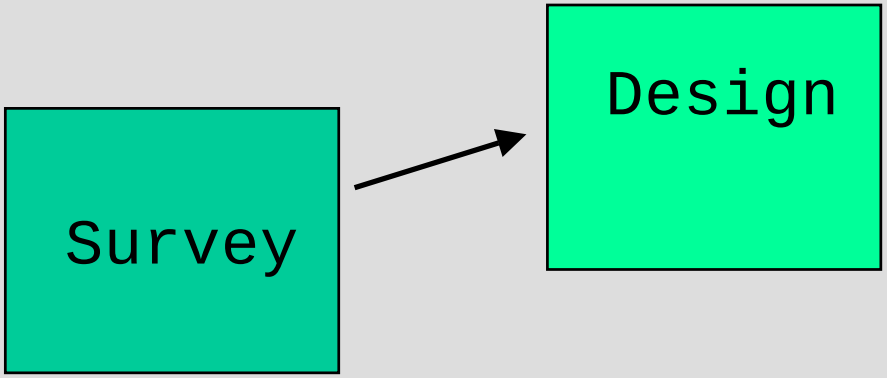
- Now, there is a much better way of working. Lets look at the current work practices used in construction and mining.

Traditional Procedure

Survey

<u>Stage One</u>:
The surveyor measures the topography of the construction or mining site to provide the design engineer with an understanding of the current shape of the land.

Traditional Procedure



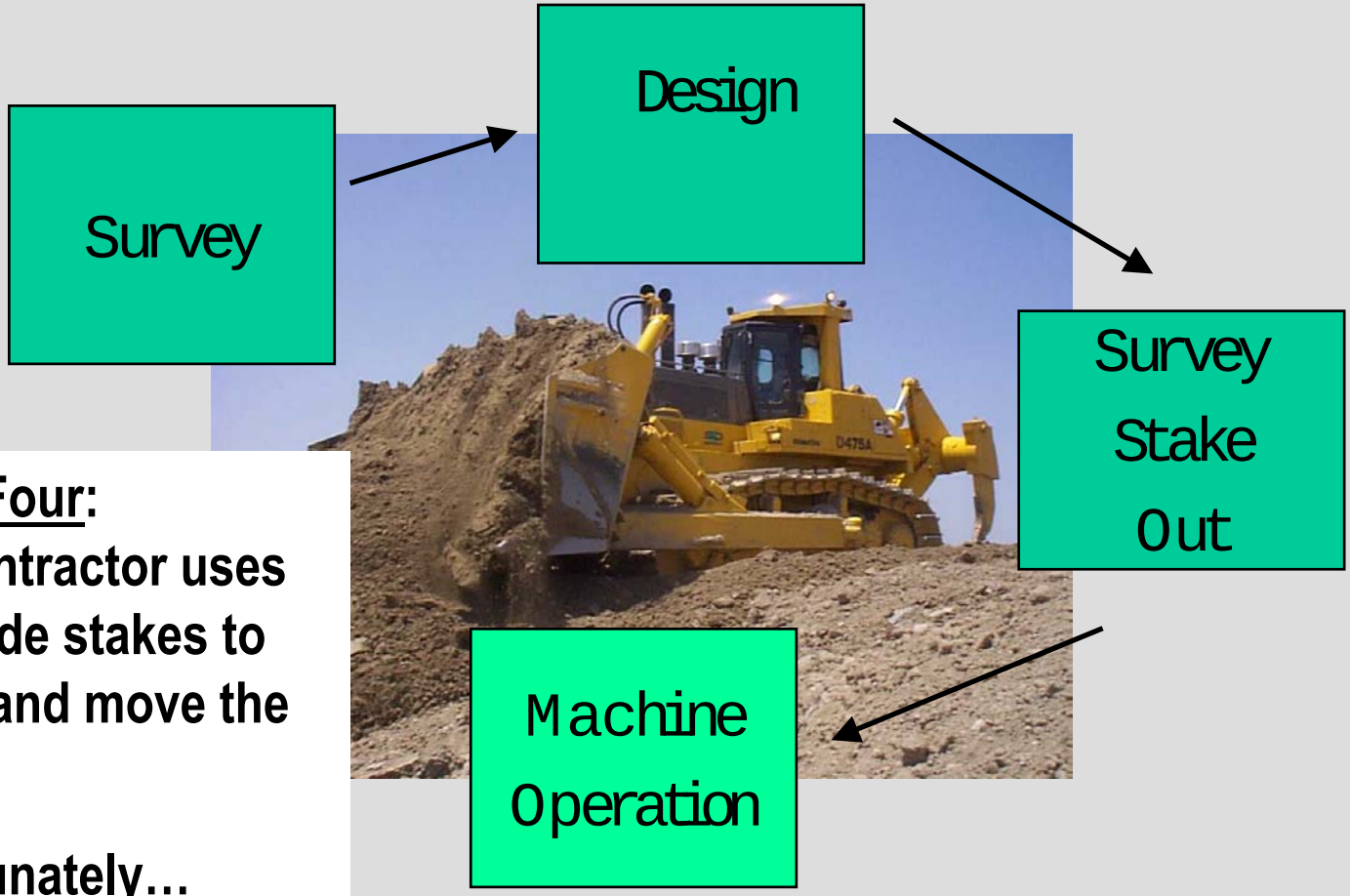
<u>Stage Two</u>:
The engineer designs the desired final surface for the road, mine or construction site. This surface can be stored as a Digital Terrain Model (DTM).

Traditional Procedure

Survey → Design → Survey Stake Out

<u>Stage Three</u>: Surveyors place grade stakes in the field based on the engineering design.

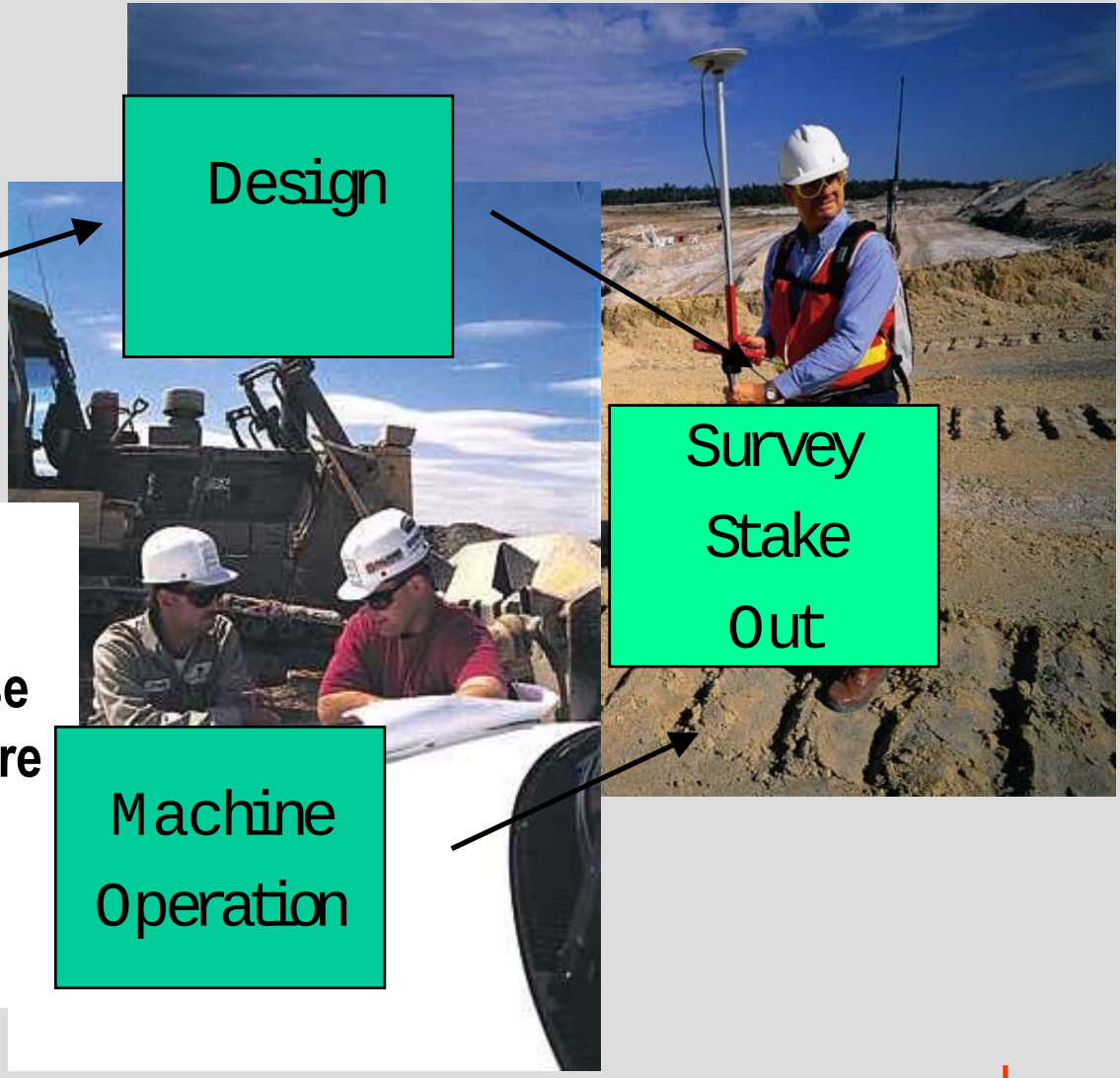
Traditional Procedure



<u>Stage Four</u>:
The contractor uses the grade stakes to shape and move the earth.

Unfortunately…

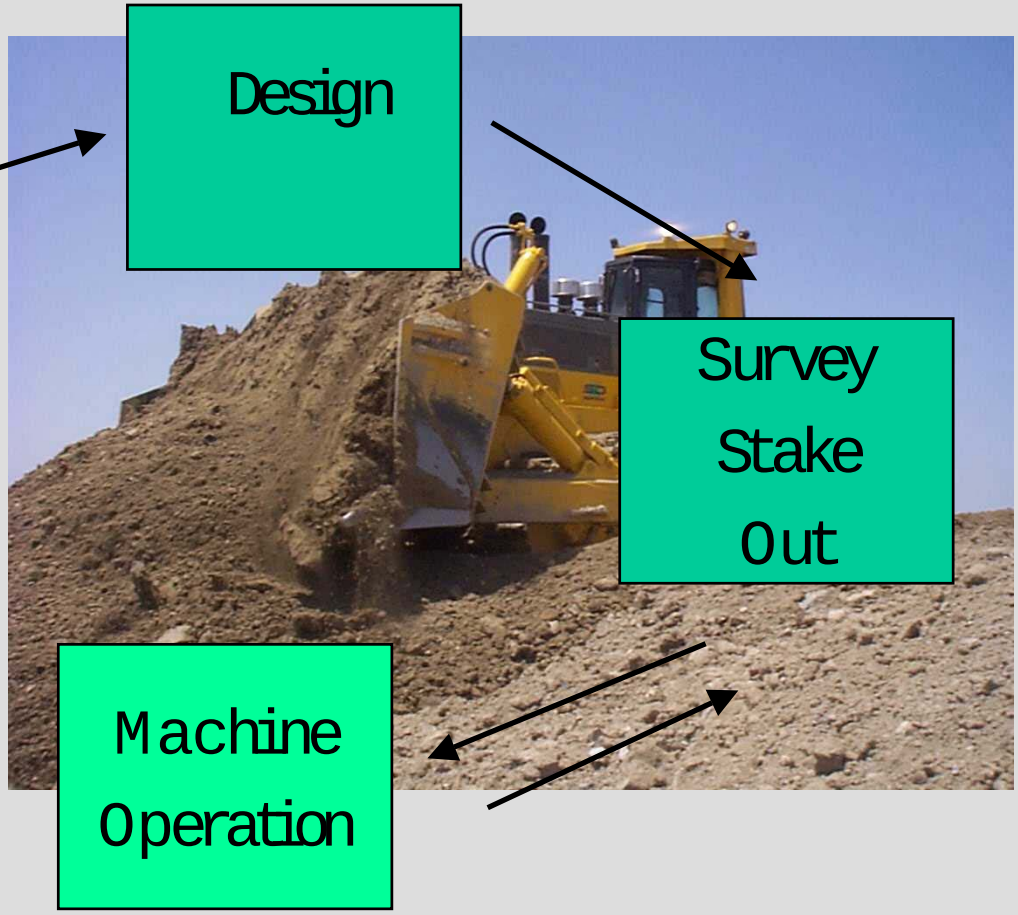
Traditional Procedure



…the contractor knocks the existing grade stakes out of the ground, during the course of work, and the surveyors are required to replace them.

Ready for the Contractor…

Traditional Procedure



…to continue to move the earth. Unfortunately, the contractor knocks out the grade stakes and the surveyor is called back on the job. These iterations continue until…

Traditional Procedure

Survey → Design → Survey Stake → Machine Operation → As Built Survey

...the contractor's work is completed and the surveyor carries out a final "As Built" survey to ensure the final surface meets design specifications.

Limitations of the Traditional Procedure

There is a complex data flow from one stage to the next. The design is in digital format, the surveyors use paper plans for staking out and represent the design surface to the operator with grade stakes.

The accuracy of the final design surface relies on operator experience.

Many aspects of this current work practice are inefficient.

Surveyors are required back on site to execute an “as built” survey at the completion of the project.

The surveyor must re-stake the site many times during the earth moving process. The contractor risks expensive re-work if they operate without grade stakes.

Using a combination of recently released technology, this picture can be dramatically changed.

Leica Dozer 2000 - What is it?

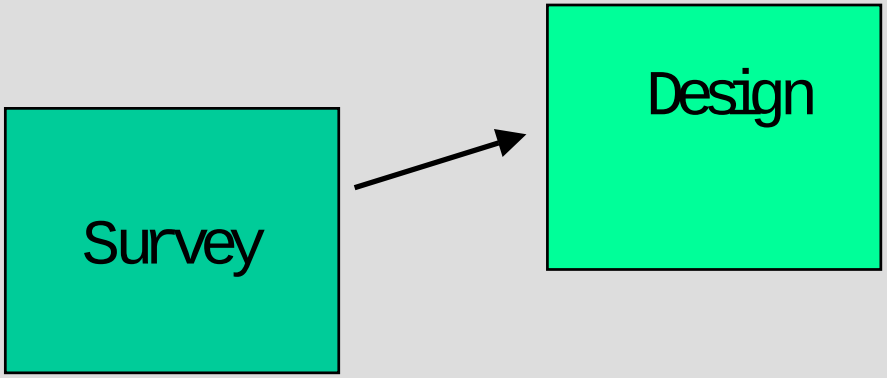
- Leica Dozer 2000 has revolutionized earth moving.
- Leica Dozer 2000 transfers the engineering design from the office directly into the operator cab. The operator easily sees what he has to do without requiring grade stakes placed by surveyors.
- This changes the entire procedure!

How Does it Happen with Leica Dozer 2000?

Survey

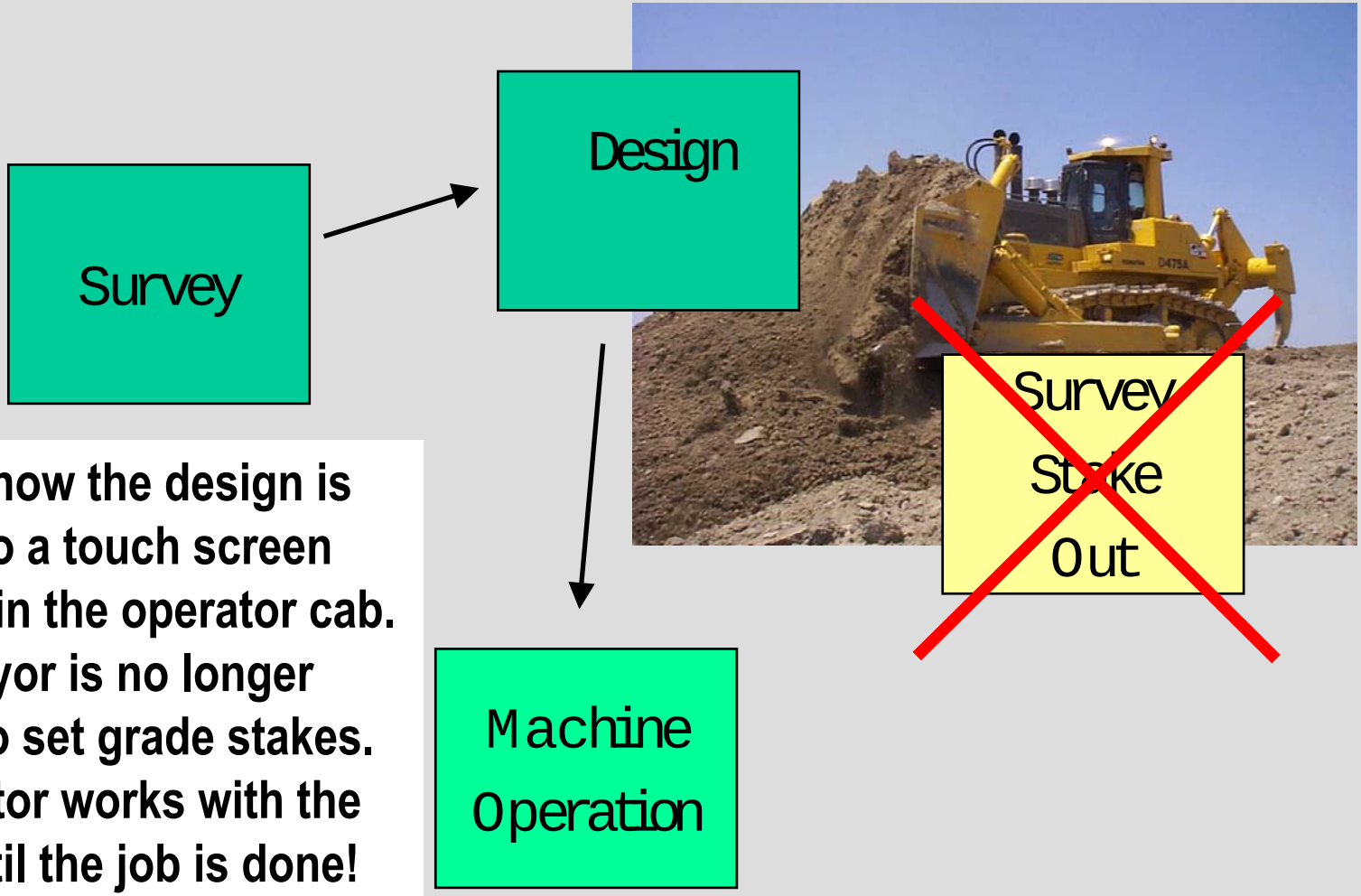
The first stage is the same. The surveyor measures the topography of the construction or mining site to provide the design engineer with an understanding of the current shape of the land.

How Does it Happen with Leica Dozer 2000?



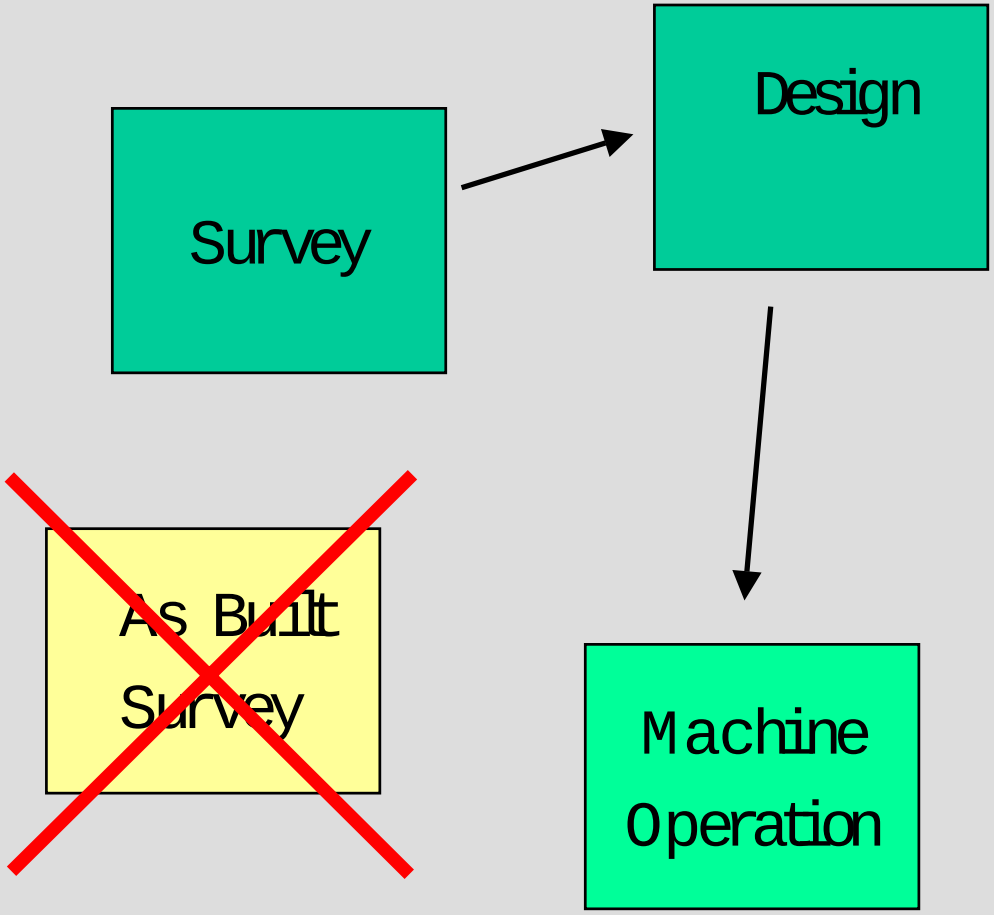
As before, the engineer designs the road, mine or construction site to create the desired final surface. This surface can be stored as a Digital Terrain Model (DTM).

How Does it Happen with Leica Dozer 2000?



However, now the design is loaded into a touch screen computer in the operator cab. The surveyor is no longer required to set grade stakes. The operator works with the design until the job is done!

How Does it Happen with Leica Dozer 2000?



In addition, Leica Dozer 2000 logs data in the field as the machine operates. This data can be post-processed and provides the site manager with a final “as built” survey. This can be calculated on a daily basis!

Advantages of Leica Dozer 2000

The data flow is simplified. The digital design format is transferred directly into the operator cab, eliminating the need for paper plans and grade stakes.

Leica Dozer 2000 enables even the most inexperienced operators to grade efficiently and accurately.

With Leica Dozer 2000 the work practice is much more efficient.

The "as built" survey is completed automatically as data can be logged in the field during equipment operation.

The surveyor does not need to set grade stakes. Surveyors can manage the system, create design files, install the systems in the cabs and process the collected data.

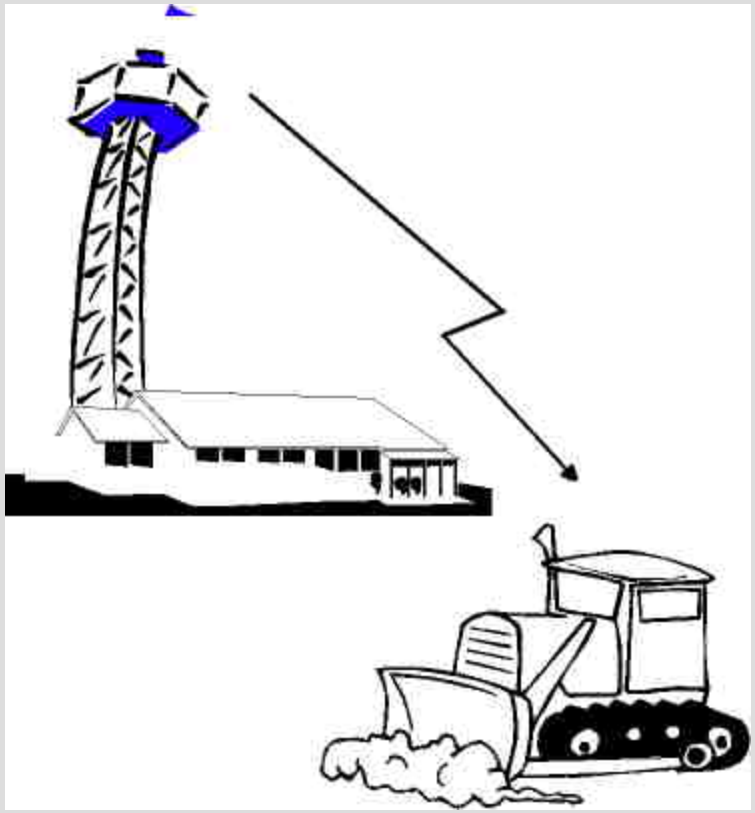
Leica Dozer 2000 creates enormous efficiencies on site which lead to significant savings.

How Does Leica Dozer 2000 Work?

- It is based on Global Positioning Systems (GPS) satellite technology.
- Provides high accuracy positions world wide, 24 hours a day.

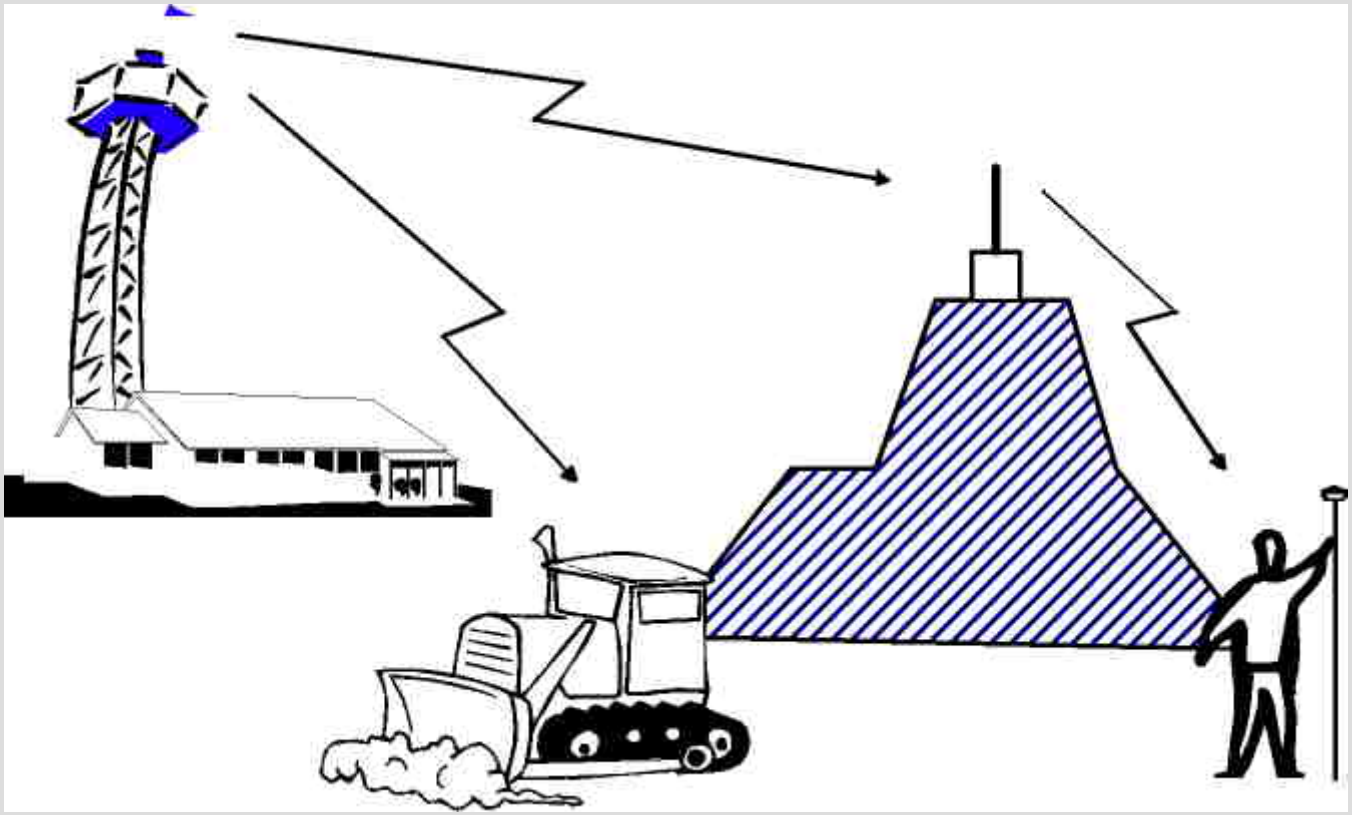
- GPS base station is established at the office site.
- GPS Rover receiver is installed on the vehicle.

How Does Leica Dozer 2000 Work?



Data from the Base Station is transmitted via radio around the site using Spread Spectrum or UHF Radios

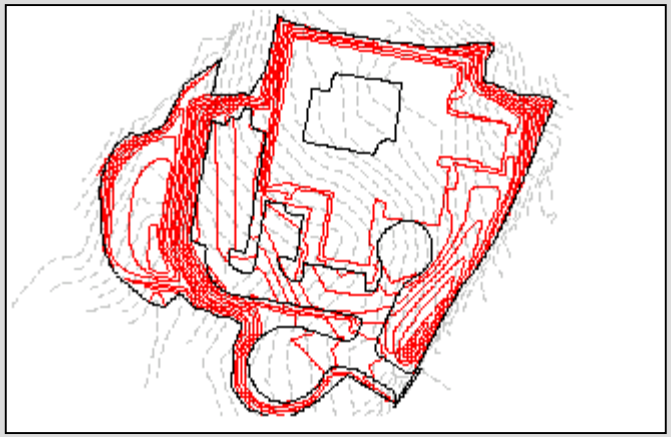
How Does Leica Dozer 2000 Work?



Repeaters allow the signal to be further propagated over the site as needed.

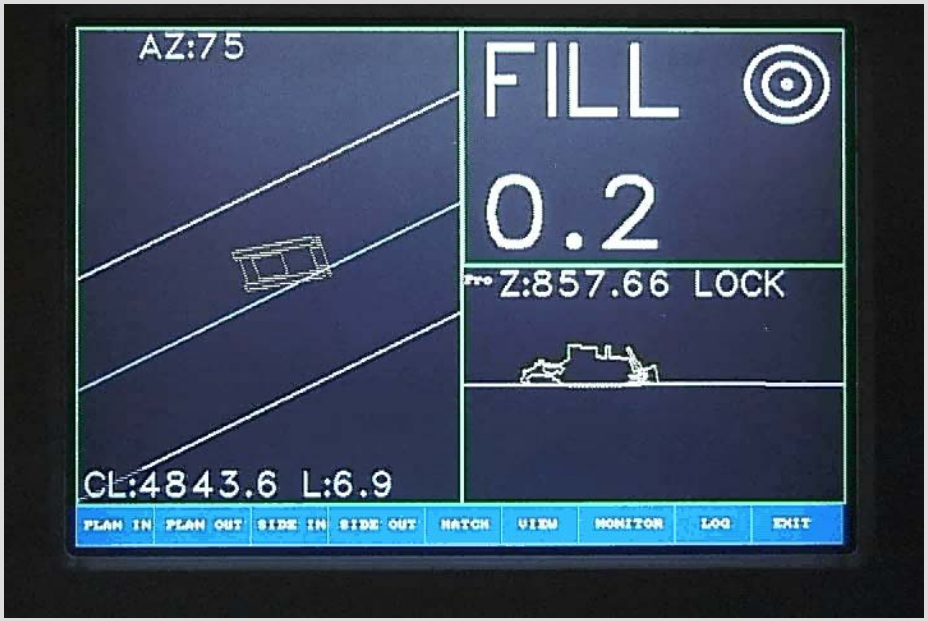
How Does Leica Dozer 2000 Work?

- The on-site engineer / surveyor creates a plan view file and a Digital Terrain Model (DTM) on any existing engineering design software.
- These files are converted to the Leica Dozer 2000 AutoCAD format using the Leica Site Manager software that is provided with Leica Dozer 2000.
- These files are transferred to the rover computer via a serial cable or a PCMCIA card.



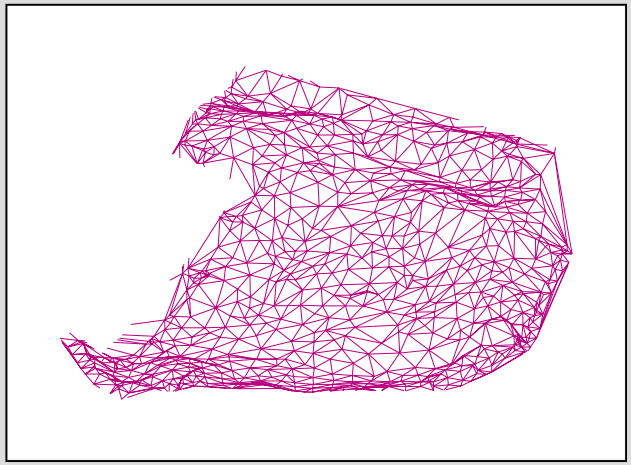
How Does Leica Dozer 2000 Work?

- The engineering design files are loaded on the ruggedized touch screen computer that has been mounted in the machine cab.
- The operator controls the computer by touching the large option icons displayed on screen.
- This video clip displays some of the operator's screen selections.



How Does Leica Dozer 2000 Work?

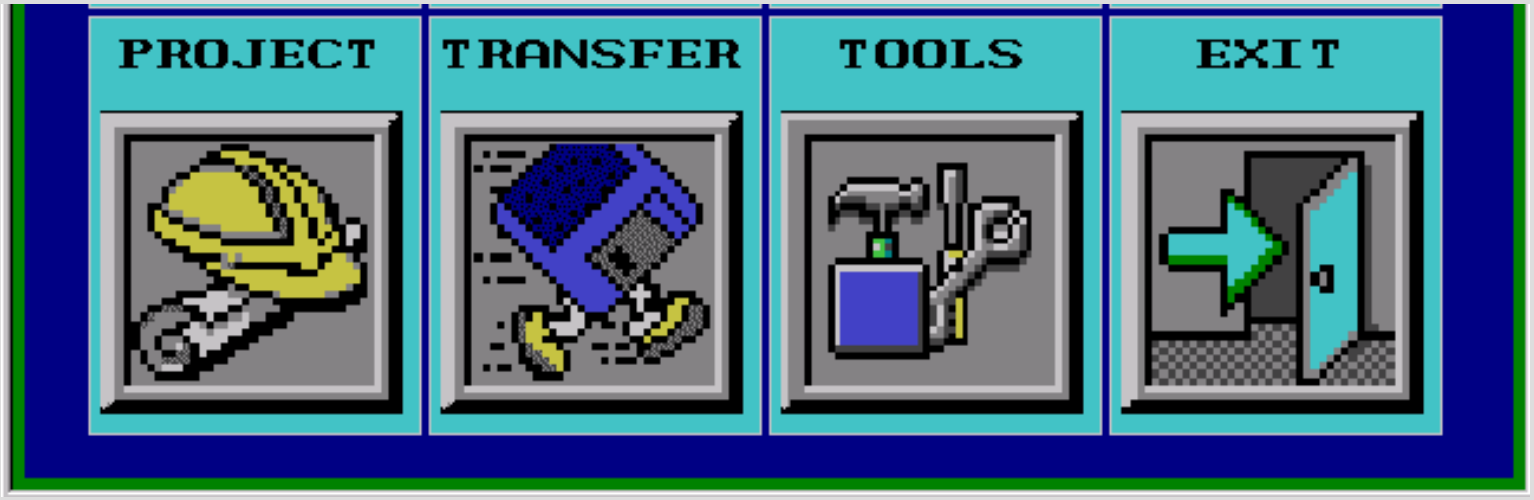
- Leica Dozer 2000 can be configured to log data in the field while the equipment is working.
- The data can be easily transferred back into the original engineering design package.
- The DTM of the site is continuously updated during operation and volumes can be calculated on a daily basis. This enables better control, monitoring, and planning of the project.



Leica Dozer 2000 - Features

Display Grade Position	Navigate to a Point	Design a Ramp	Display local coordinates and satellite positions

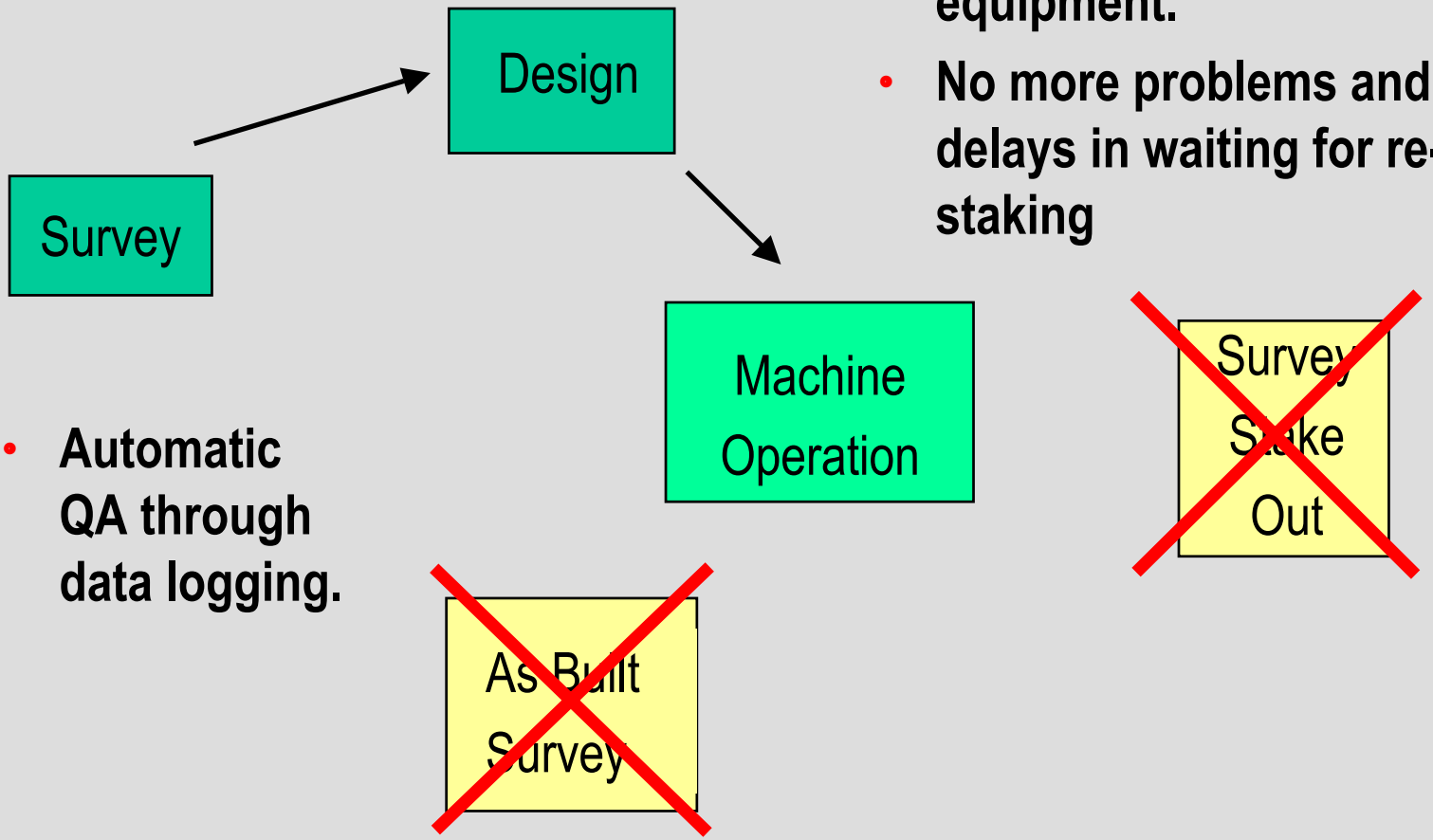
Leica Dozer 2000 - Configuration



Project Parameters	Data Transfer	System Set-Up Parameters	Exit Program

Leica Dozer 2000 - Benefits

Streamlines work procedures



- Grade stakes are no longer required to guide equipment.
- No more problems and delays in waiting for re-staking

- Automatic QA through data logging.

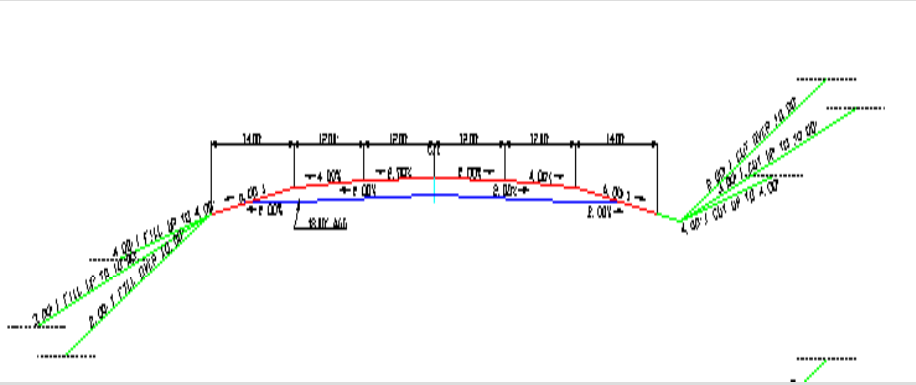
Leica Dozer 2000 - Benefits

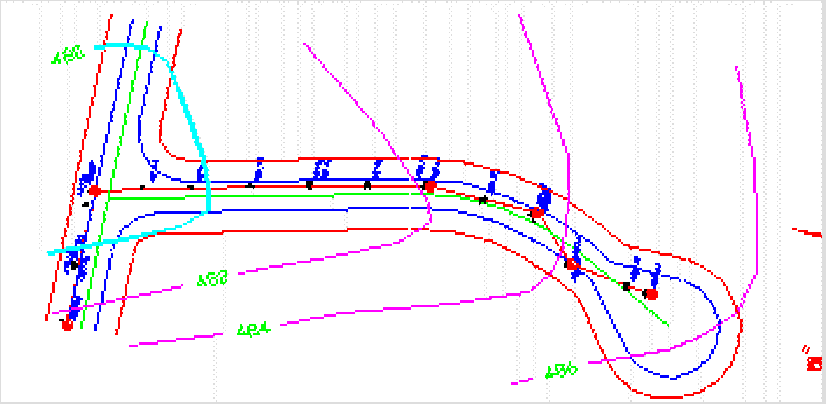
- Works 24 hours each day, 365 days per year in any weather condition.

- Accuracy is to within 2 - 5 cm.
- Ideal for large earth moving applications and sub grading.

Leica Dozer 2000 - Benefits

- Creating design files is easy
  - Based on Carlson Software developed for Mining, Engineering and Surveying applications
  - Easy to design complex surfaces - roads, drainage ditches, slopes
- Uses AutoCAD - the most popular engineering design package
- Earth moved can be calculated on a daily basis which is ideal for project control and monitoring.



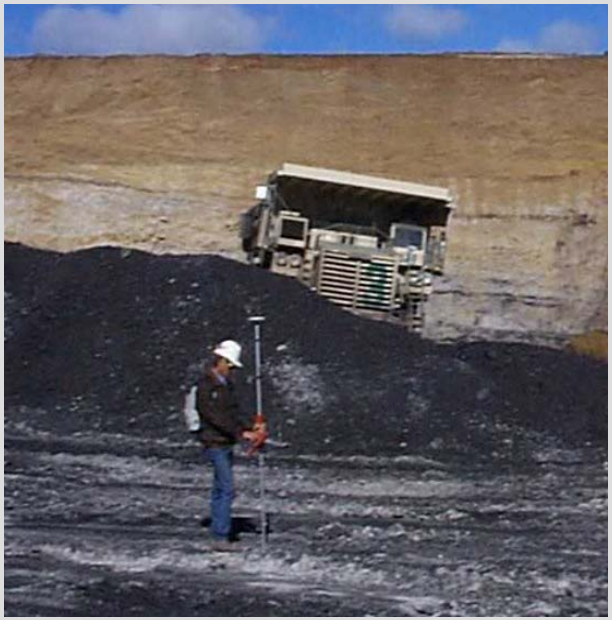


Leica Dozer 2000 - Benefits

- Modular Design
  - Fits any make or model of Bulldozer
  - Easy to install in other Earthmoving equipment or inspection vehicle

Leica Dozer 2000 - Benefits

- Easy to use
  - Operators can see exactly where they are in the field.
  - Short Training Time



- Compatible
- Base Station can support existing, high-accuracy GPS Survey Receivers.
  - Lower infrastructure costs.
  - Lower training costs.
- Works in local coordinate system.

Leica Dozer 2000 - Results in Productivity

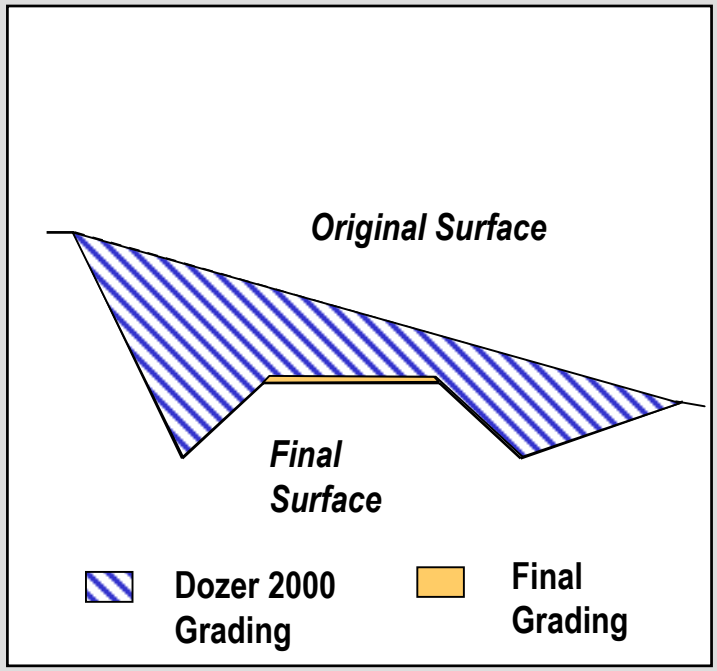
- Mining Customers have reported productivity improvements of 20%- 30%
- Depending on the application, Leica Dozer 2000 can pay for itself in less than 6 months
- Work is done quickly and more efficiently

Leica Dozer 2000 - Mining Applications

- Reduces the need for Survey Staking and Support
  - Dozers can move dirt, clear land, build dams and ponds without grade staking.
- Ideal for Road and Drainage Construction
  - Roads and associated drainage can be constructed in entirety.
- Saves re-work for reclamation applications
  - Saves re-handling of spoil piles - results in significant savings.
- Dragline Bench Control
  - Leica Dozer 2000 enables controlling of the bench height for draglines - results in improved operation efficiency.

Leica Dozer 2000 - Construction Applications

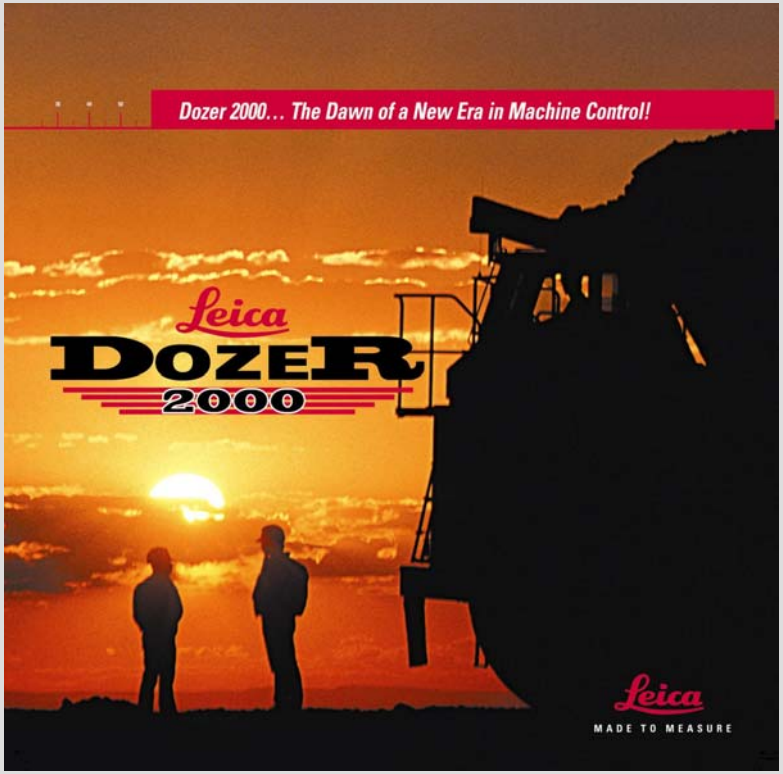
- Leica Dozer 2000 can be used in a range of construction applications - civil engineering, road works, and many more.
- Leica Dozer 2000 is used for the major earthworks on the project - moving all the earth until the final graded surface (mm accuracy required)
- Road design files can be entered into Leica Dozer 2000 to provide Station and Offset information.



Leica Dozer 2000 - Inspection Applications

- Leica Dozer 2000 is an ideal tool for Site Inspection.
- Leica Dozer 2000 equipment can be easily installed in the site inspection vehicle and the desired DTM loaded.
- The site inspector can check the grades in real time.
- In addition, data can be logged and a “comparison” file generated showing the variation between design surface and actual surface.

Leica Dozer 2000 - Try it Yourself!



- Demonstration versions of both Leica Dozer 2000 and the Leica Site Manager software are contained on this CD.
- Please select the appropriate icons from the main menu in order to load and run these programs.
- Each of the programs have a small “readme” file that explains the main features of the software.

Contact Leica for More Information

For more information about Leica Dozer 2000 system please contact your local Leica representative.

WILDLIFE PROGRAMS at TRANSALTA CENTRALIA MINING, LLC.

Presented by
Tim LeDuc and Phil Berry
TransAlta Centralia Mining, LLC

OSM Bond Release Forum
August 2001

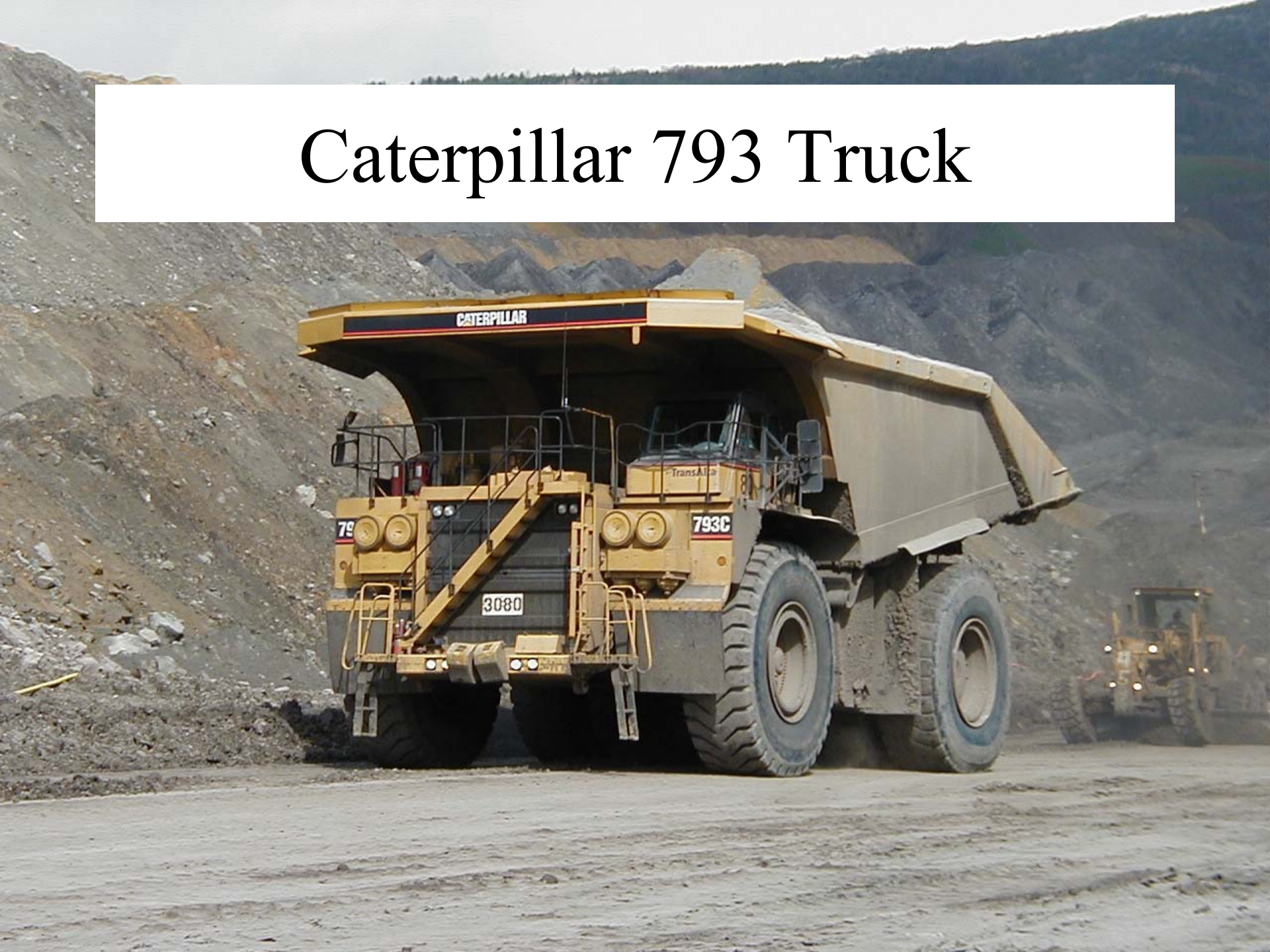
CANADA
San Juan Is.
Bellingham
North Cascades Nat'l. Pk.
CASCADE RANGE
Columbia
IDAHO
Port Angeles
Cape Flattery
Everett
Puget Sound
Lake Chelan
Spokane
Grand Coulee Dam
Seattle
Bellevue
Spokane
Olympic Nat'l. Pk.
Tacoma
WASHINGTON
OLYMPIA
Mt. Rainier
Pullman
Mt. Rainier Nat'l. Pk.
Yakima
Snake
TransAlta
Yakima
Longview
Mt. St. Helens
Kennewick
Walla Walla
CASCADE RANGE
Columbia
North Pacific Ocean
Vancouver
OREGON

Mining Operations

- Operations commenced in 1971
- Permit Area: 14,450 acres
- Annual production of 4.0 – 5.0 million tons
- Total of 131 million tons produced
- Multiple seam mining
- Seams range from 2 to 35 feet thick
- 562 full time employees

P & H 4100 Shovel

Caterpillar 793 Truck



Dragline Operation

Mine Environment

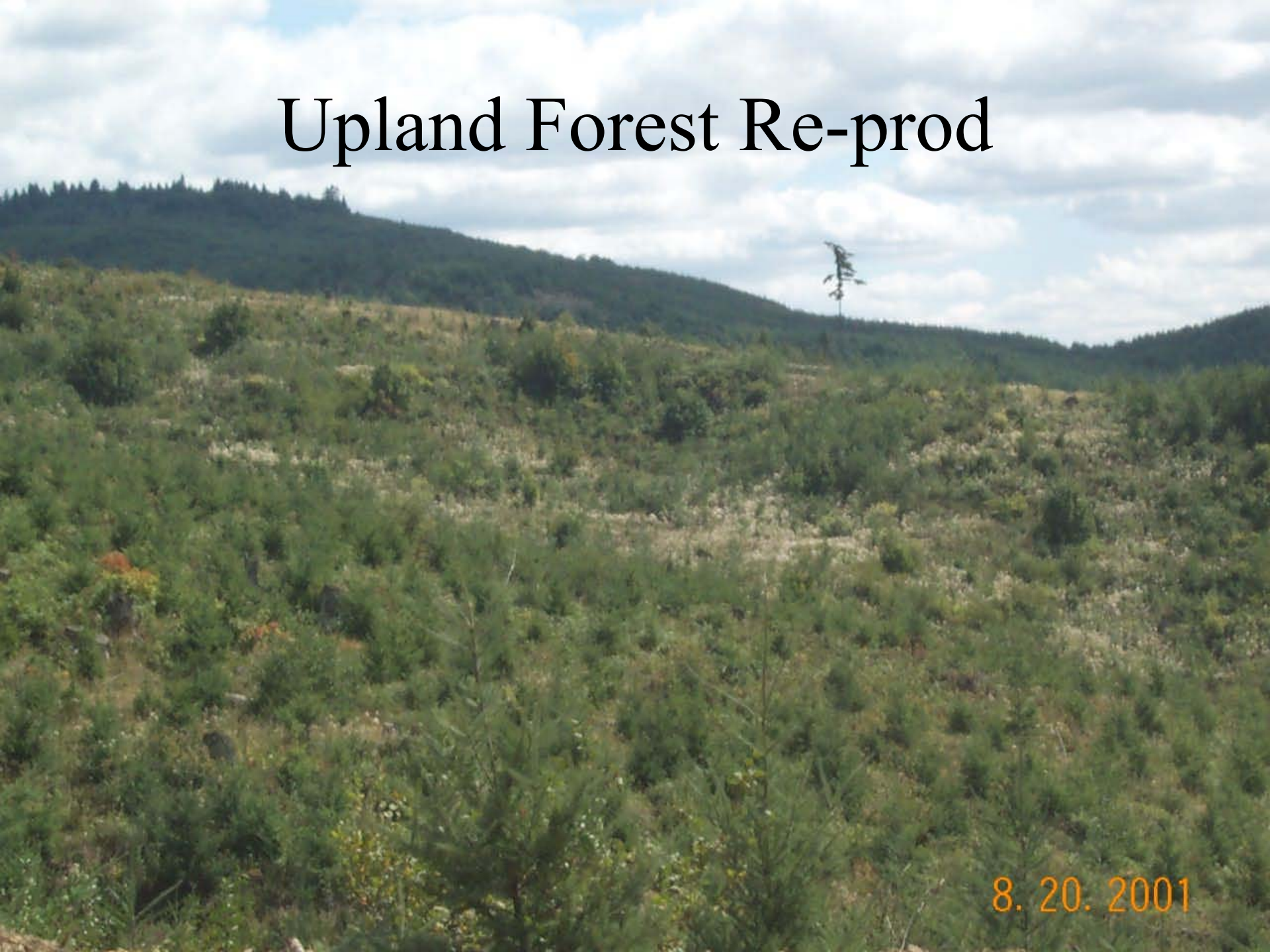
- Climate – mild marine climate with average temperatures ranging from 20°F to 90°F
- Rainfall – average rainfall exceeds 48” annually
- Soils – generally clay to silty clay, highly variable

Existing Habitats & PMLU

- Upland forest
  - Dominated by Douglas fir and Red Alder
  - Commercial Timber
- Lowland Forest
  - Wetlands
- Agricultural Production

Upland Forest

Upland Forest Re-prod



Channelized Creek

Undisturbed Creek

Natural Wetland

Agricultural Production

Wildlife Resources

- Large Mammals
  - Elk
  - Black-tailed Deer
  - Black Bear
  - Cougar
  - Coyote
- Small Mammals
  - Rabbits
  - Beavers

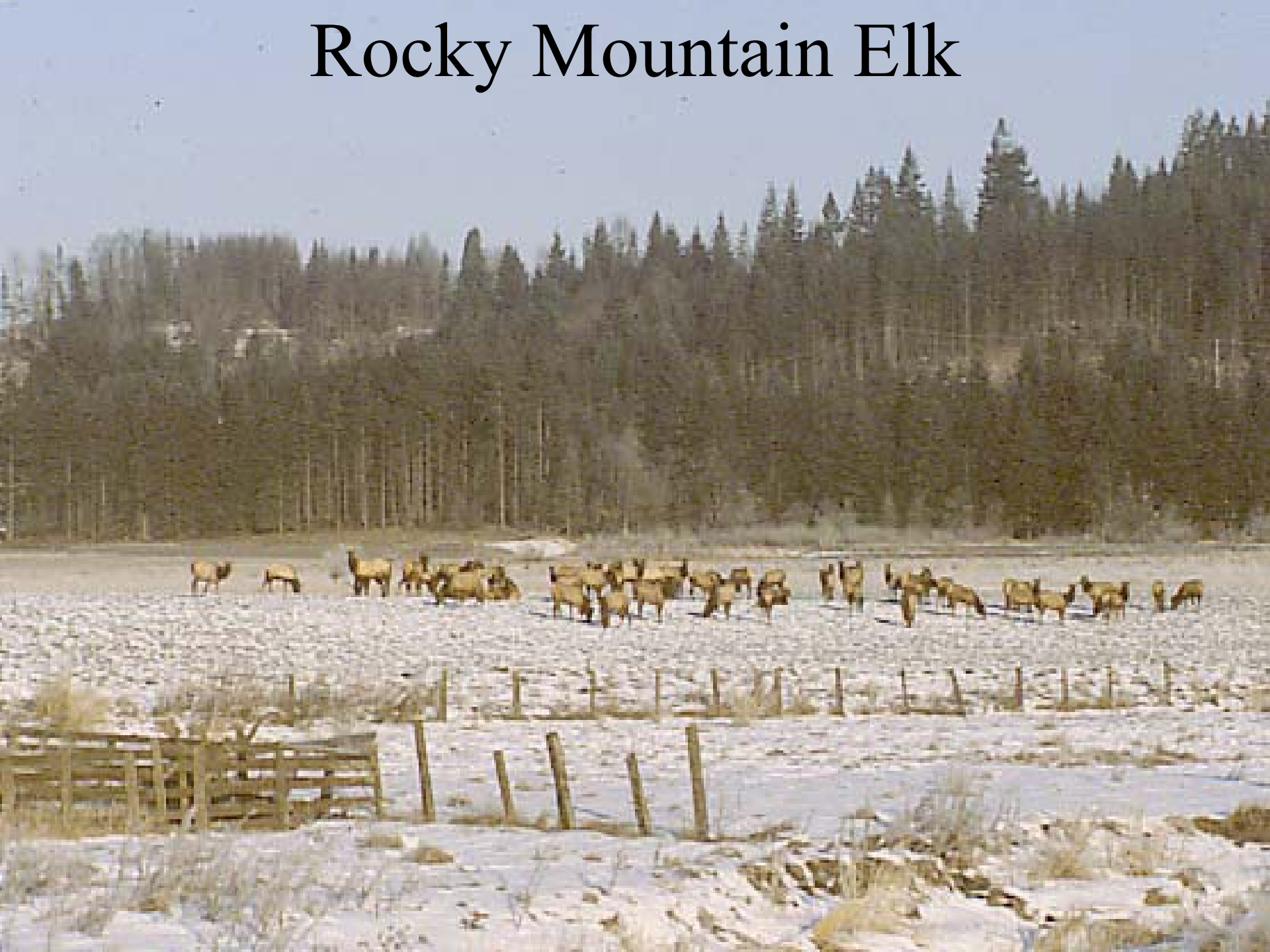
Wildlife Resources

- Avian Species
  - Canadian Geese
  - Ducks
  - Raptors
- Aquatic Species
  - Salmon
  - Trout
  - Bass
  - Invertebrates

Black-tailed Deer

Bald Eagle

Rocky Mountain Elk



Swans

Otters

Management Programs

- Hunting
- Community Programs
- Habitat Improvements
- Wildlife Problems

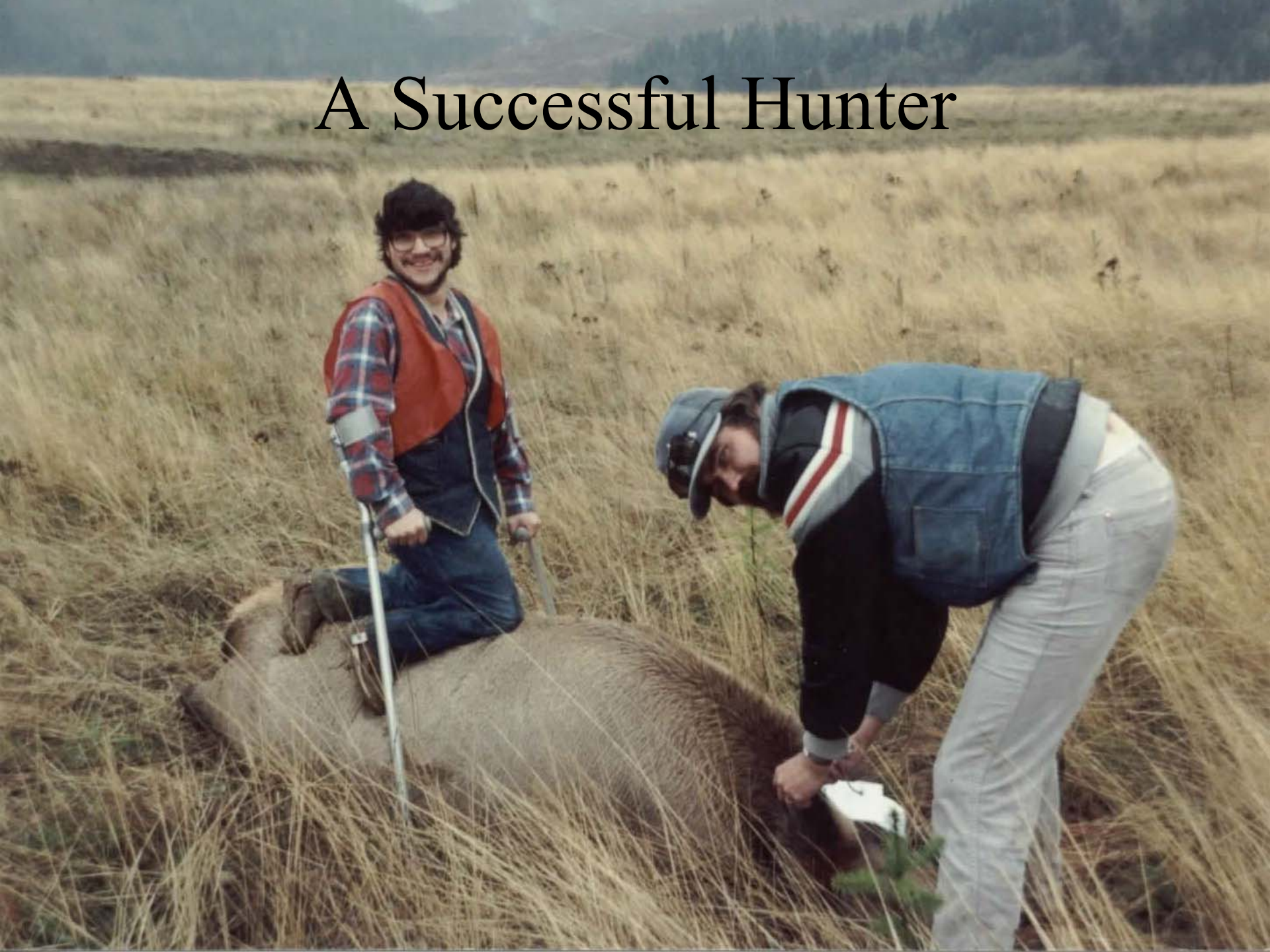
Hunting Programs

- Elk
  - Open to qualified disabled persons
  - Drawing with up to 200 applicants for 8 tags
  - Conjunction with the State of Washington Dept. of Fish and Wildlife

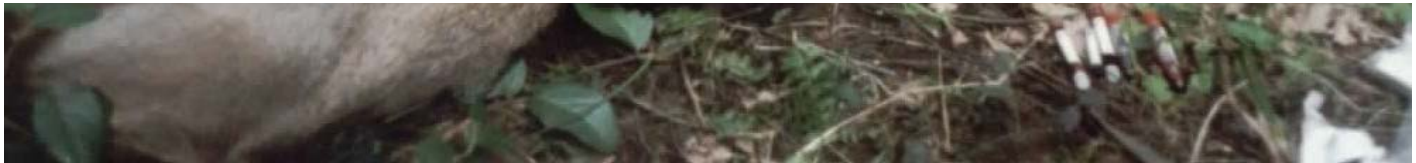
- Waterfowl: Open to general public on a sign-up basis on regulated days in specific areas

- Upland Bird: Open to general public in specific areas

A Successful Hunter



Tagging and Collaring Elk



More Successful Hunters`

Bird Hunter and Best Friend

Community Programs

- Ducks Unlimited
  - Surveys
  - Resource Conservation
- Boy Scouts
  - Bird Box Construction
  - Maintenance

Duck Box Installation

Volunteers with Nesting Material

Lunch Crew

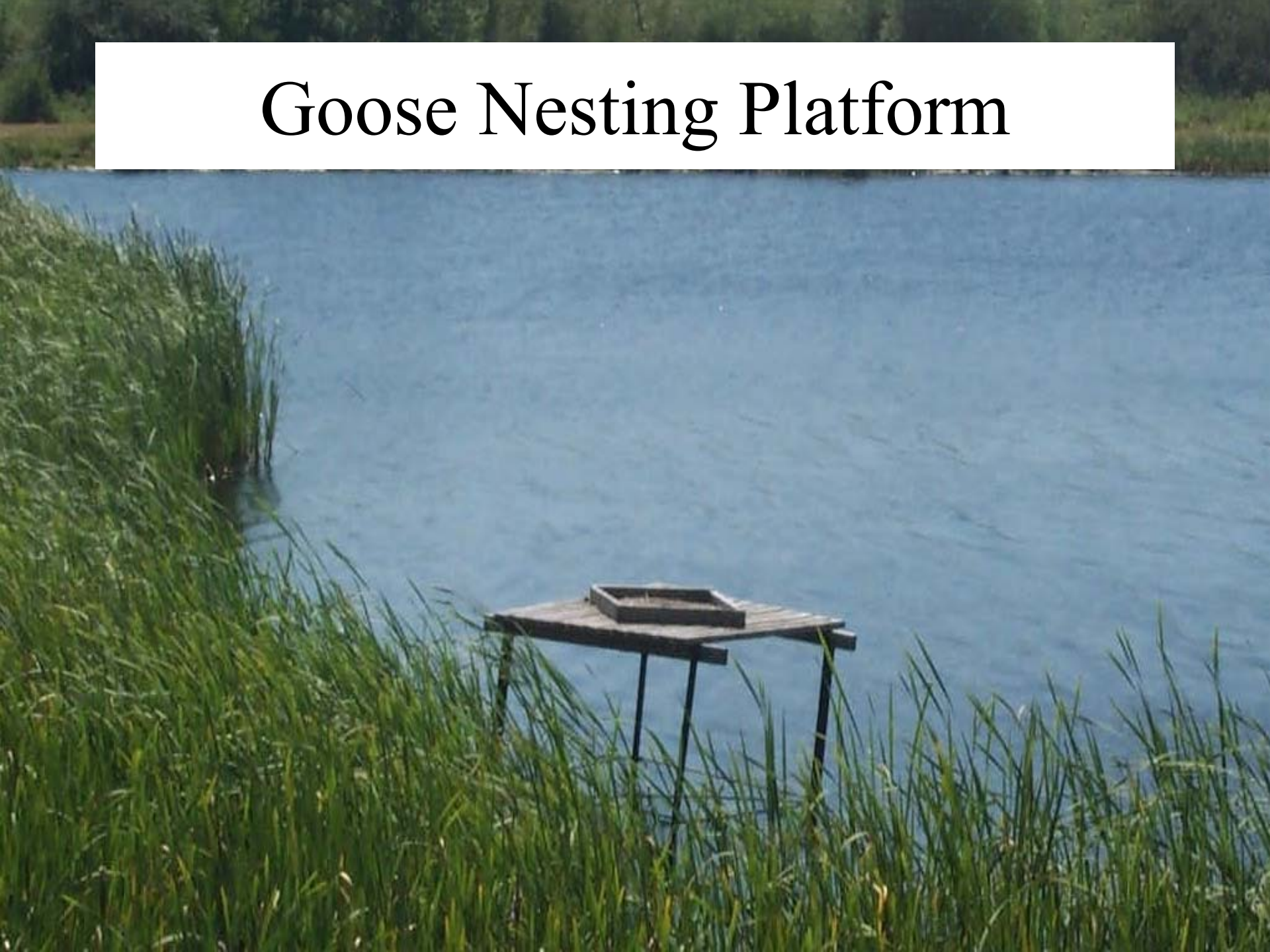
Ducks Unlimited at Local Fair

Habitat Improvement

- Waterfowl
  - Duck Boxes
  - Goose Nesting Platforms
- Aquatics
  - Stream Fencing
  - Stream Restoration
  - Sediment Pond Conversion

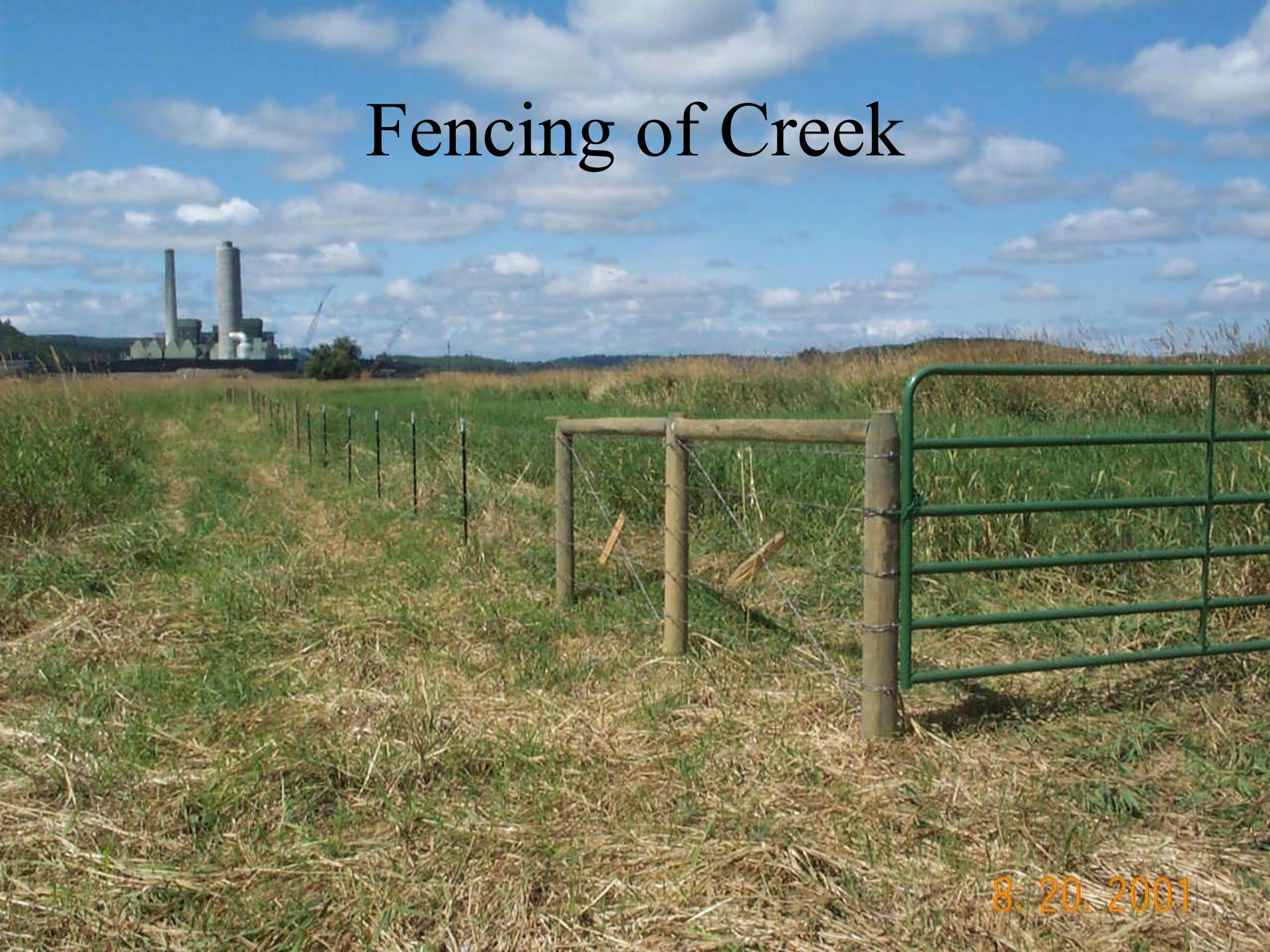
Wood Duck Nesting Box

Goose Nesting Platform



Kestrel Nesting Box

Fencing of Creek



Sediment Pond

Reclaimed Pond

Wildlife Problems

- Voles
  - Sludge program
  - Tree impacts
- Deer/Elk/Bear
  - Herbivore

Sludge Area

Tree Girdle
8.20.2001

Tree Browse

Small Out of Pit Spoil Pile!!!

WELCOME
TO…

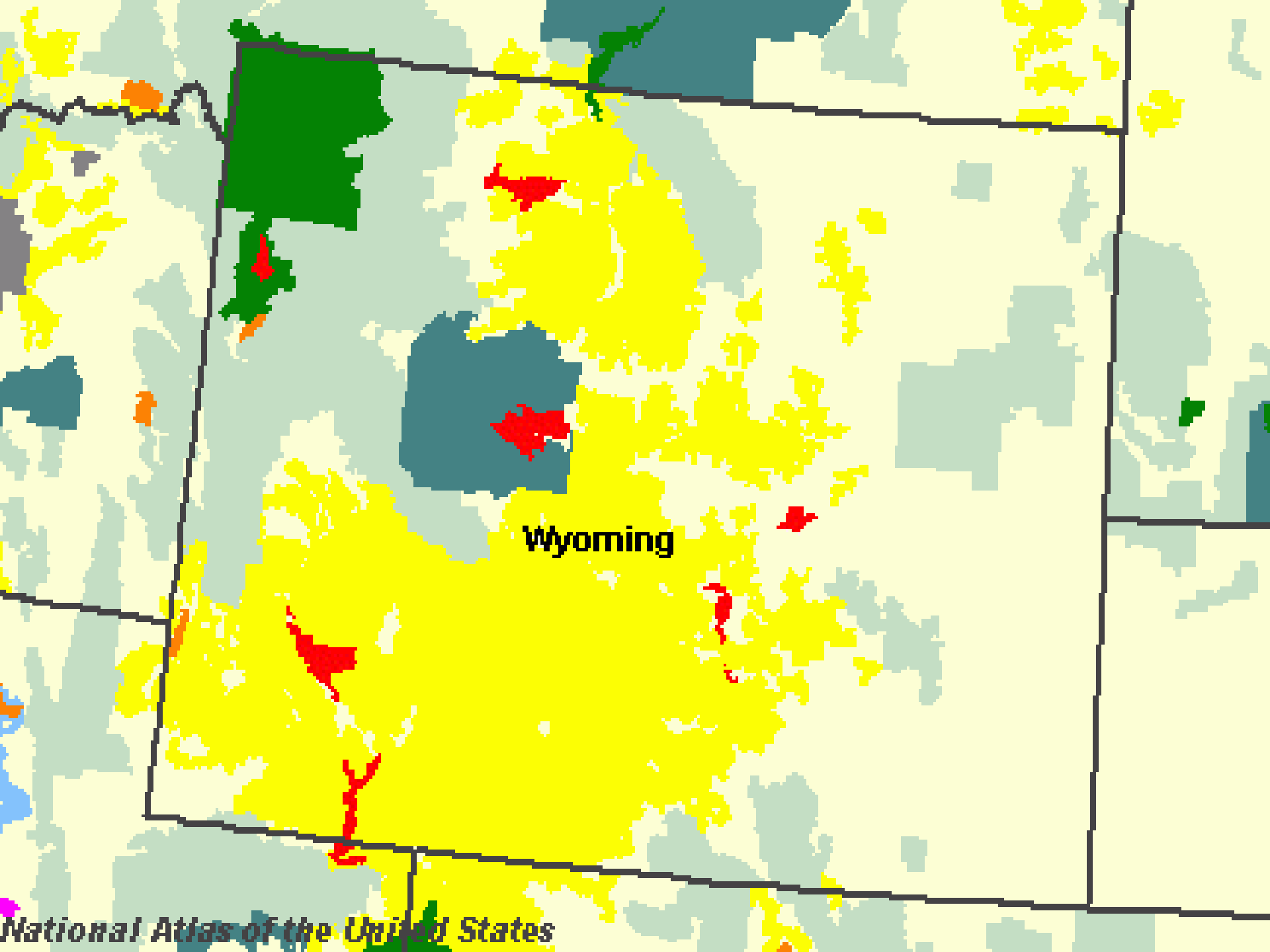
Good morning. Welcome to Gillette, WY, Campbell county, the S. PRB, the energy capital of the world, the Saudi Arabia of coal… Some of these areas can be easily pin-pointed on a map. Others are merely broad descriptions that could be applied anywhere across the northeastern WY Landscape**.**

Many of us, whether mine operator, regulator, federal land manager or member of the general public use maps to communicate about the business of surface coal mining and reclamation. Maps establish borders, boundaries, barriers. Maps delineate roads, routes and resources. Maps define ownership, relationship and even stewardship.

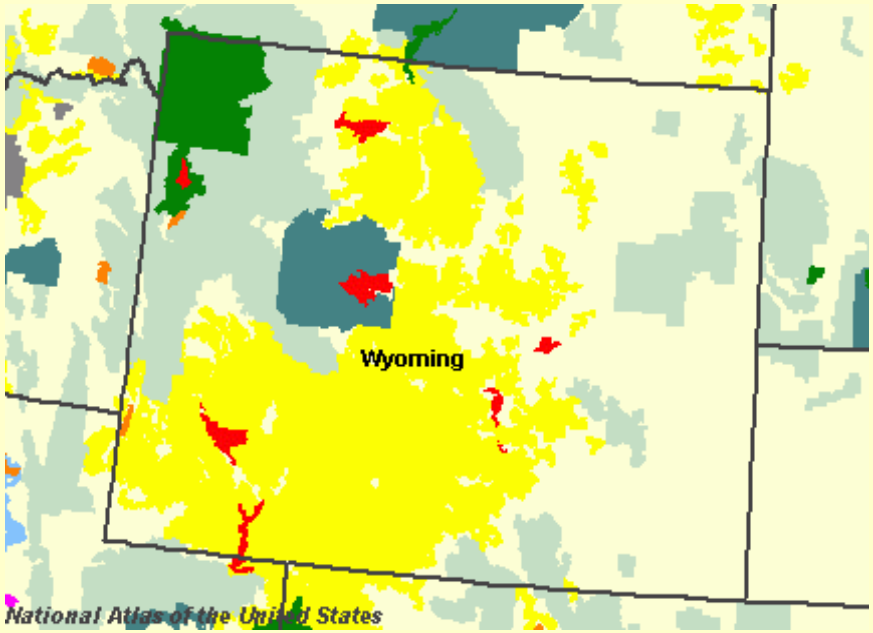
Wildlife is a resource not always easily or adequately defined within boundaries or borders. The surface mining regulations acknowledge limits with respect to wildlife monitoring. Surface coal operators have extensive information about the wildlife resource within the regulated study limits.

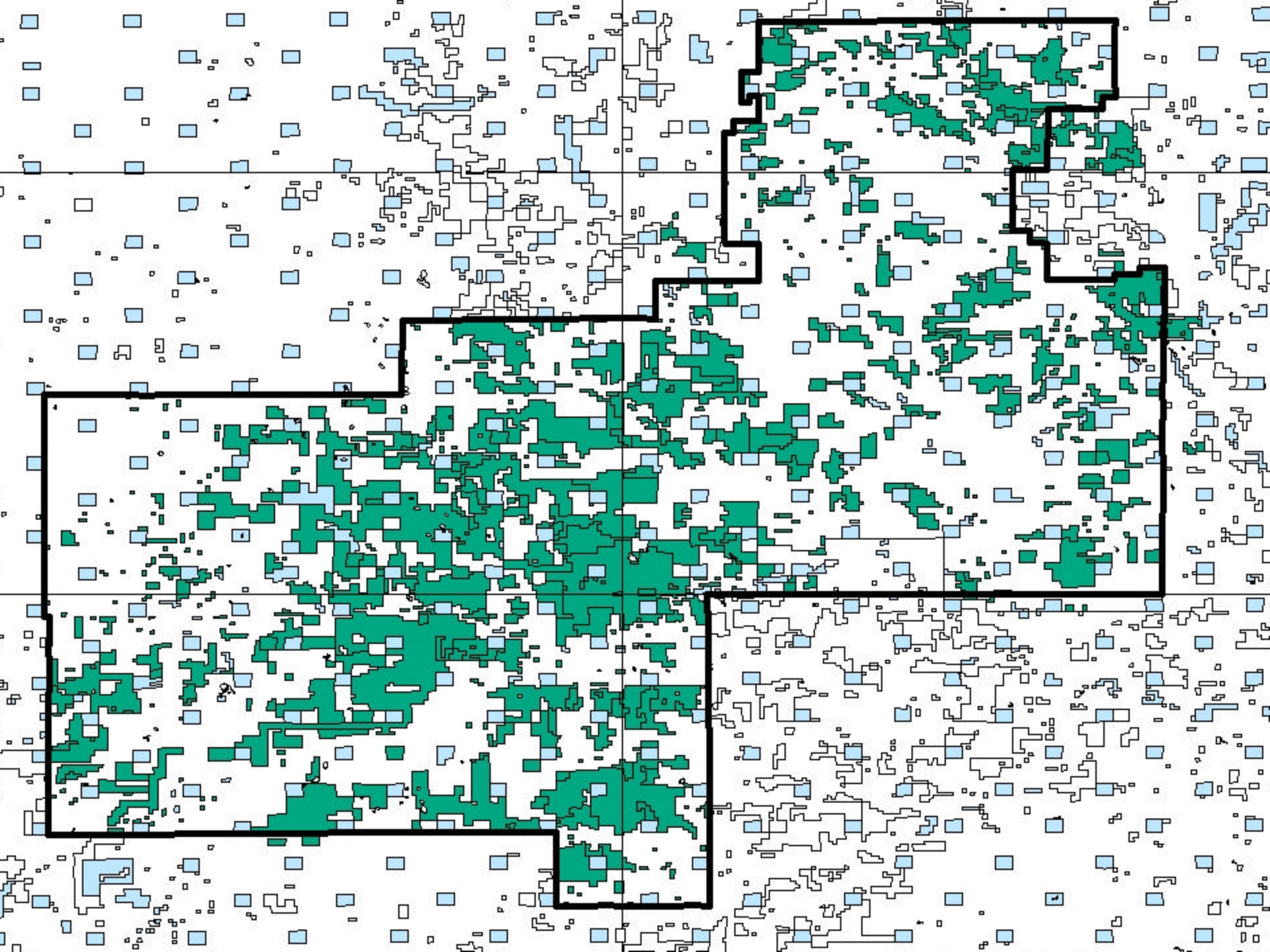
Today, I would like to talk about an innovative opportunity for wildlife management that looks beyond these traditional boundaries.

First, let me orient you on a map.

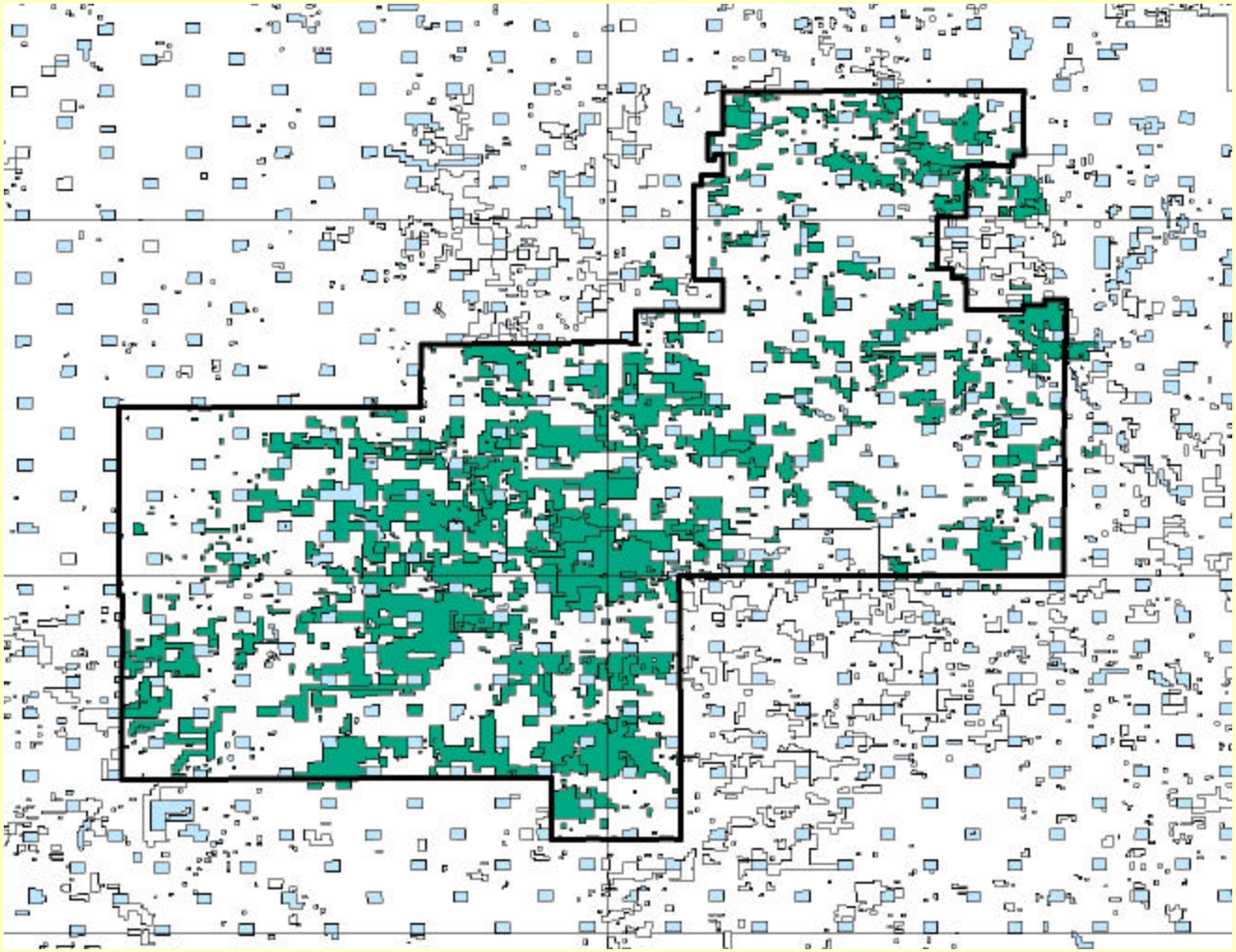

Wyoming
National Atlas of the United States

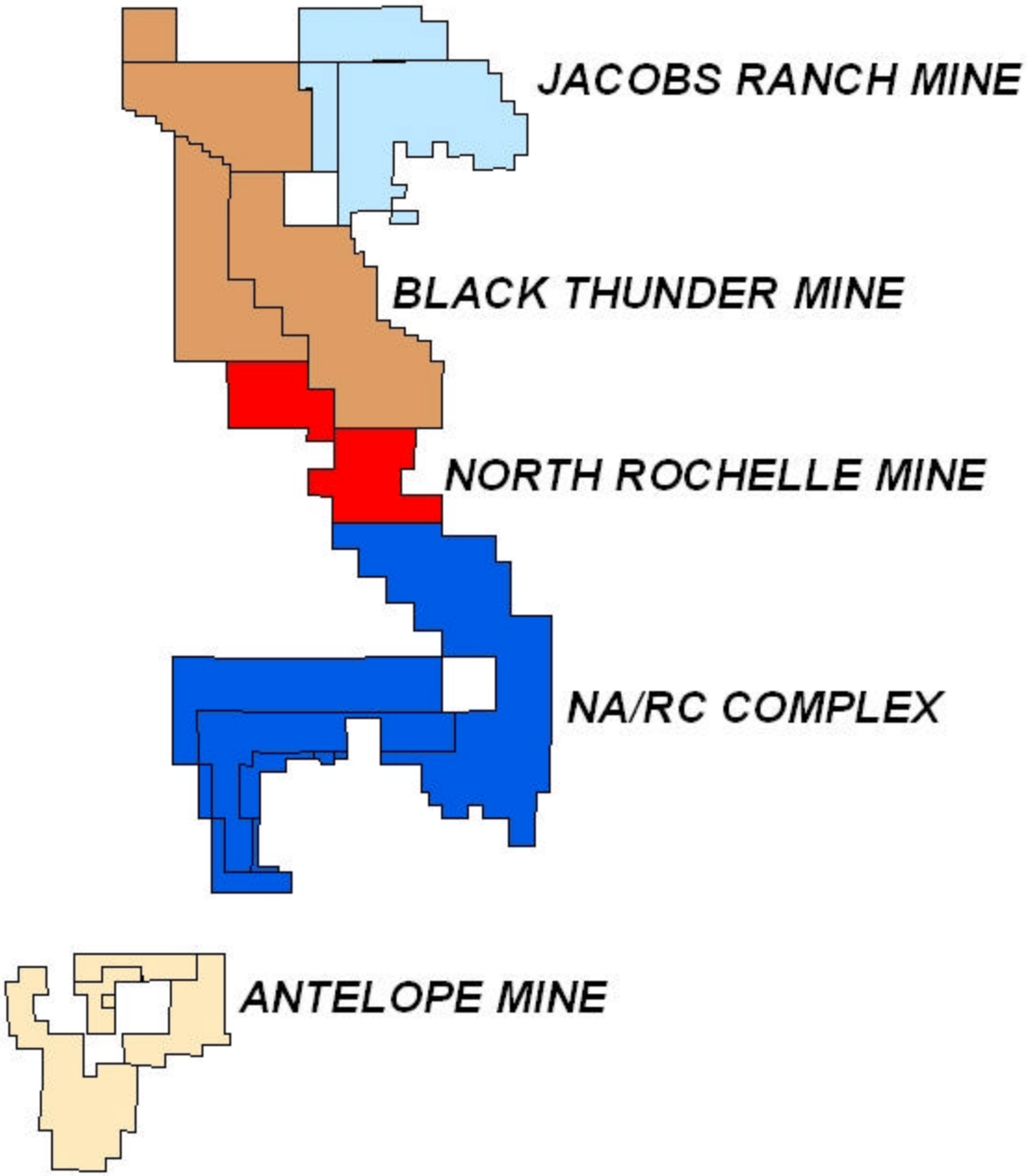
This map of Wyoming highlights the areas of the state under surface ownership by various federal agencies.The particular area we will discuss today is the Thunder Basin National Grassland. As many of you well know, the Powder River Basin begins in southeastern Montana and extends across the northeastern corner of Wyoming. The Thunder Basin is a particular area within the Powder River Basin and is depicted as the light gray area located in the northeastern corner of the state.



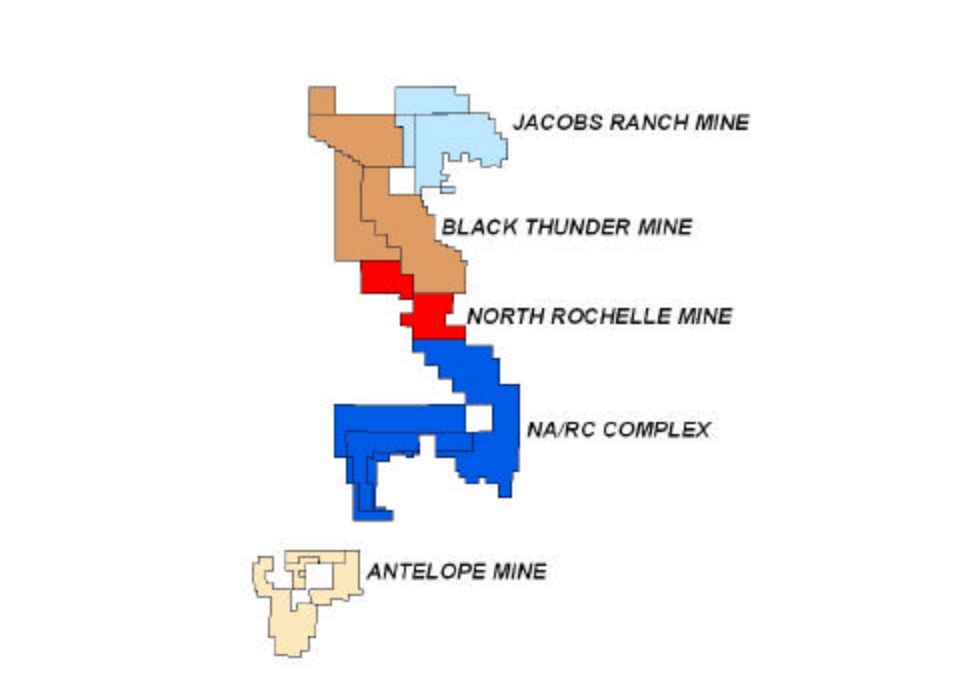


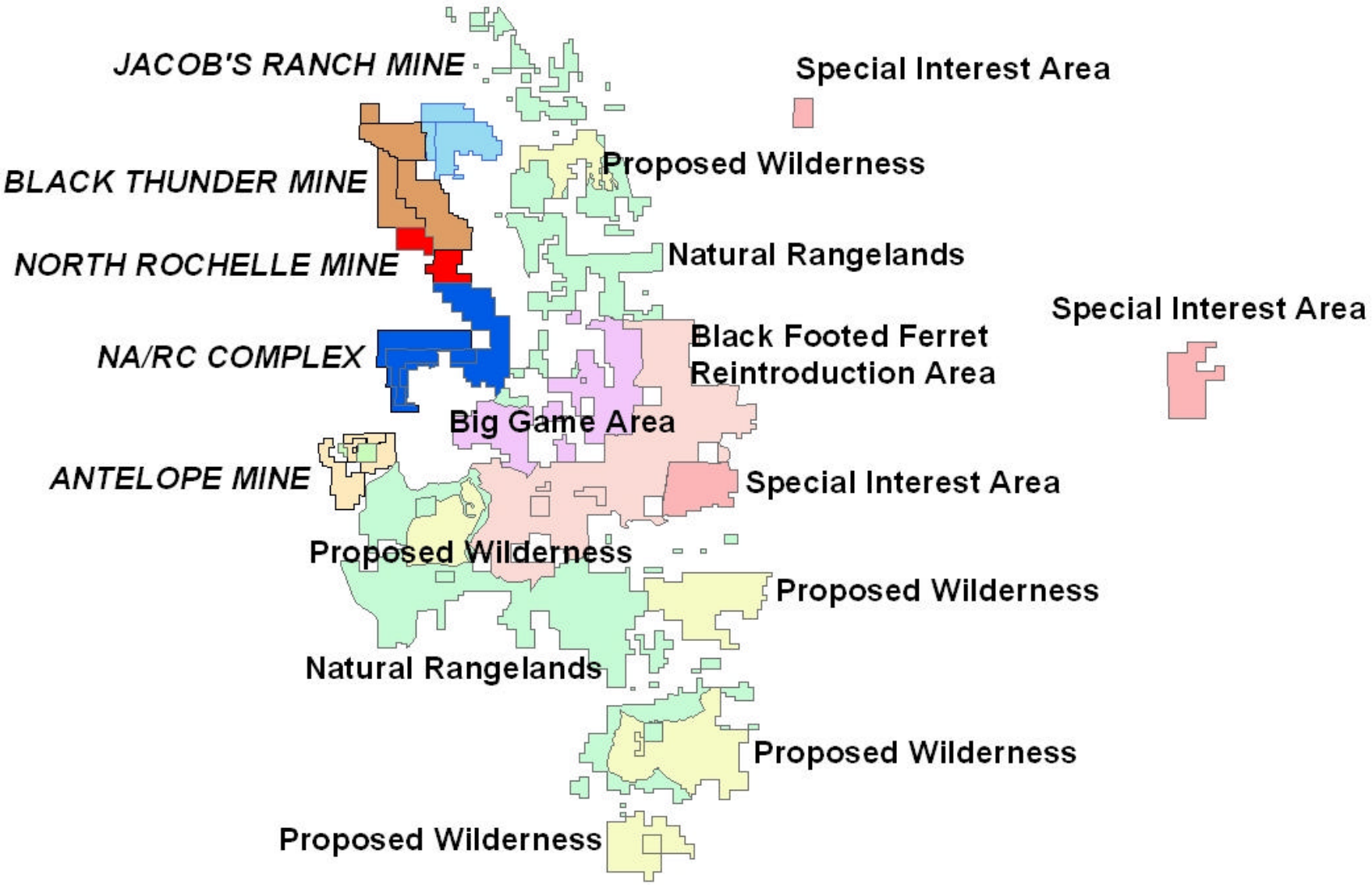
The Thunder Basin is actually a mosaic of state, federal and private lands totaling over 1.8 million acres. The U.S. Forest Service manages 572,000 acres as a national grassland. This map illustrates the ownership pattern within the area designated as the Thunder Basin National Grassland. The blue areas are state-owned, the green – federal, and the white areas represent private ownership. It would appear from this map that a significant portion of the grassland is privately owned. In fact, the ownership mix is approximately 50% private to 50% federal and state.



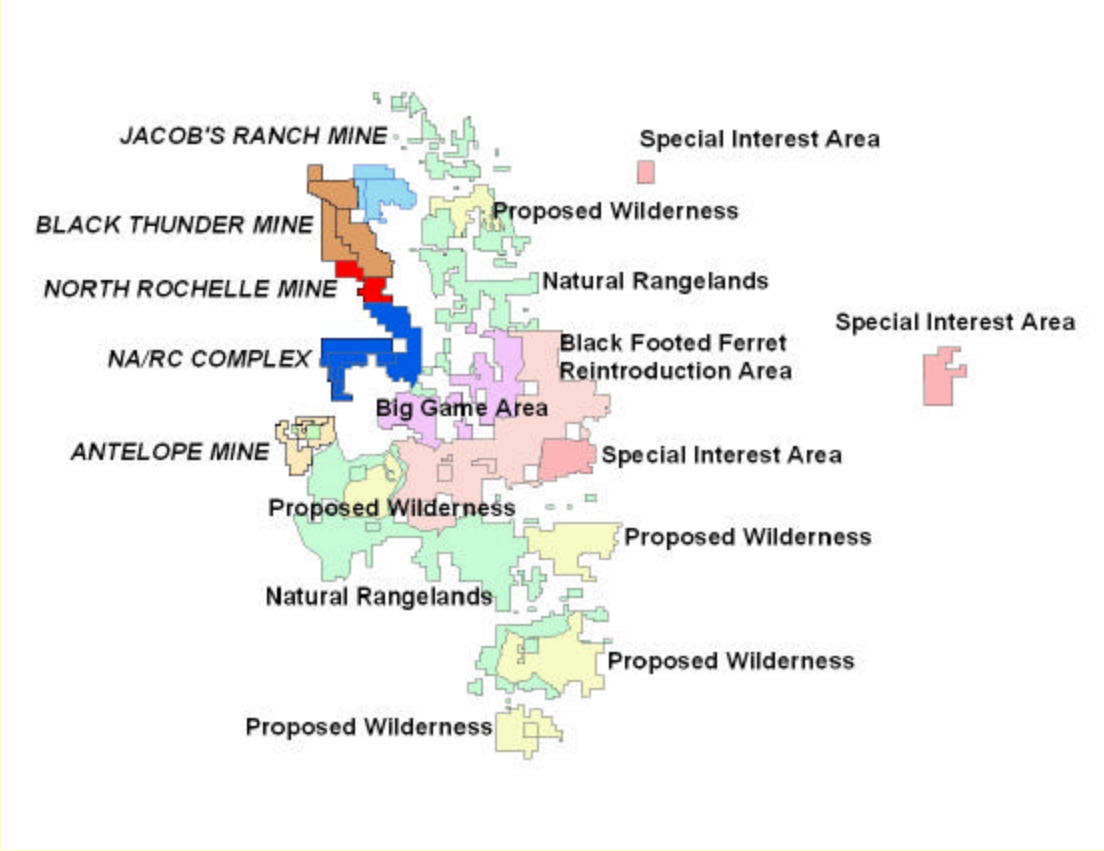

JACOBS RANCH MINE
BLACK THUNDER MINE
NORTH ROCHELLE MINE
NA/RC COMPLEX
ANTELOPE MINE

There are five large surface coal mines located within the TBNG. These five mines produce federally-owned coal with some of the lowest sulfur content of any coal that is mined in the U.S. 322 million tons of coal were mined in the WY PRB in 2000. Approximately 60% (192 million tons) of that production was shipped from these five mines. This equates to approximately 18% of all coal produced in the U.S. in 2000.



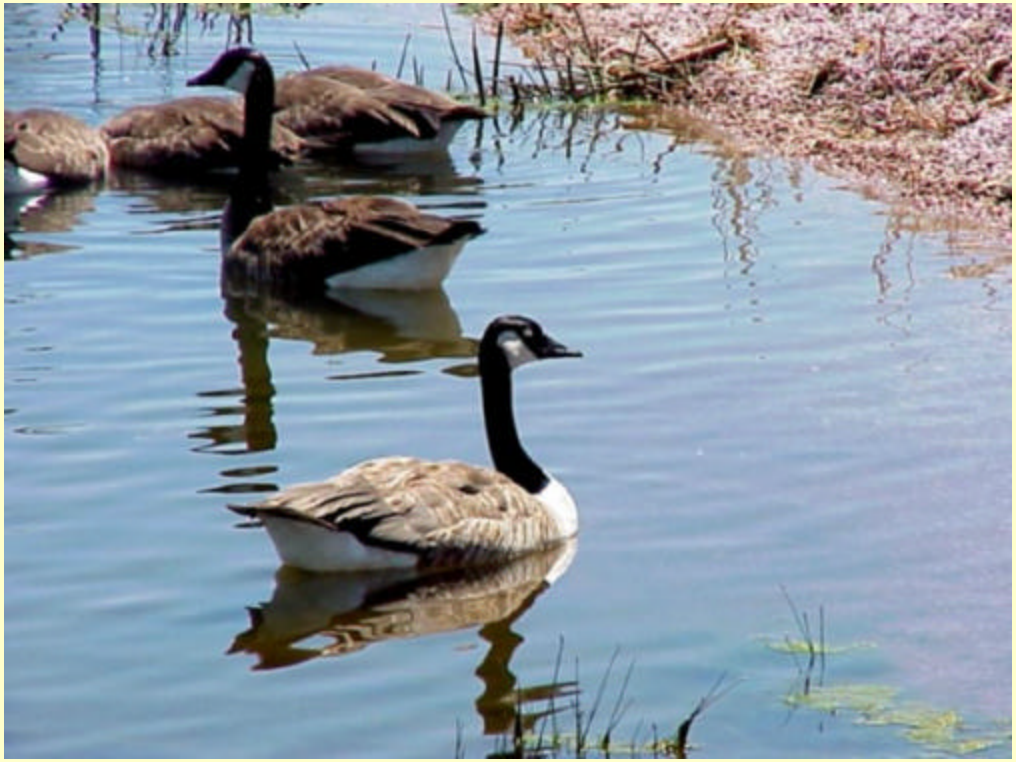

JACOB'S RANCH MINE
Special Interest Area
Proposed Wilderness
BLACK THUNDER MINE
Natural Rangelands
NORTH ROCHELLE MINE
Special Interest Area
Black Footed Ferret
Reintroduction Area
NA/RC COMPLEX
Big Game Area
ANTELOPE MINE
Special Interest Area
Proposed Wilderness
Proposed Wilderness
Natural Rangelands
Proposed Wilderness
Proposed Wilderness

This slide illustrates new or different management strategies proposed by the U.S. Forest Service in a resource management plan for the national grassland. This document has just been published as “final” but is available for public comment until Jan. 27, 2002. Management plans for some of these areas focus specifically on the black-tailed prairie dog. As you can see, a large core area is also proposed for the reintroduction of the black-footed ferret. The Thunder Basin National Grassland (TBNG) is considered to have essential habitat for eight wildlife species of concern including black-tailed prairie dog, black-footed ferret, sage grouse, mountain plover, bald eagle, golden eagle, ferruginous hawk and swift fox.



In 1999, a group of neighbors, private landowners on and adjacent to the TBNG, got together to discuss options as they considered the particular state and federal interest in the black-tailed prairie dog and black-footed ferret. They were concerned about taking specific conservation measures for a single species without a better overall understanding of habitat needs for all wildlife species. With these initial discussions came the understanding that more scientifically credible information was needed about a larger area of land before these landowners could propose to address habitat concerns for all species. It also became apparent that they could address concerns and potentially initiate more effective conservation measures collectively rather than individually. Hence, the Thunder Basin Prairie Ecosystem Association was chartered. This is a WY non-profit corporation with an elected board of directors that meets at least monthly.

Today, the association membership includes over 20 private landowners that control over 200,000 acres. Members are a diverse group of landowners. They are ranchers, coalbed methane gas producers, employees and owners of small businesses, and coal producers. The association retains a managing consultant and legal counsel. It has also assembled an advisory committee with the credentials to assist in this innovative private landowner-lead initiative for conservation and management of natural resources.



The association membership's main focus at this time is to complete an ecosystem management plan. This will be completed in three steps over a 5-year period. Step 1 will be to complete an ecosystem assessment of the private land holdings. This will involve acquiring or developing best available data and state-of-the art knowledge of the landscape. Data will be collected for input into a GIS format. Step 2 will involve the development of an ecosystem management strategy which will integrate ecological, economic and social objectives. The final step will be to develop any appropriate conservation agreements with assurances with the USFWS.

The association is sponsoring a symposium entitled “The History, Ecology and Economy of the Thunder Basin Prairie Ecosystem” on November 1-2 at the parkway plaza in Casper, WY. The purpose for this symposium is to begin building the knowledge base for the ecosystem management plan. The association’s managing consultant is with us today. Ms. Nancy Geehan owner of Nancy 0. Geehan Consulting in Buffalo, WY. Nancy has more information available on the symposium as well as fact sheets about the association. I would certainly encourage you to take the opportunity to talk to her about this exciting and innovative project.

As I close, you may be wondering why coal operators are involved in an association such as the one I have just described.

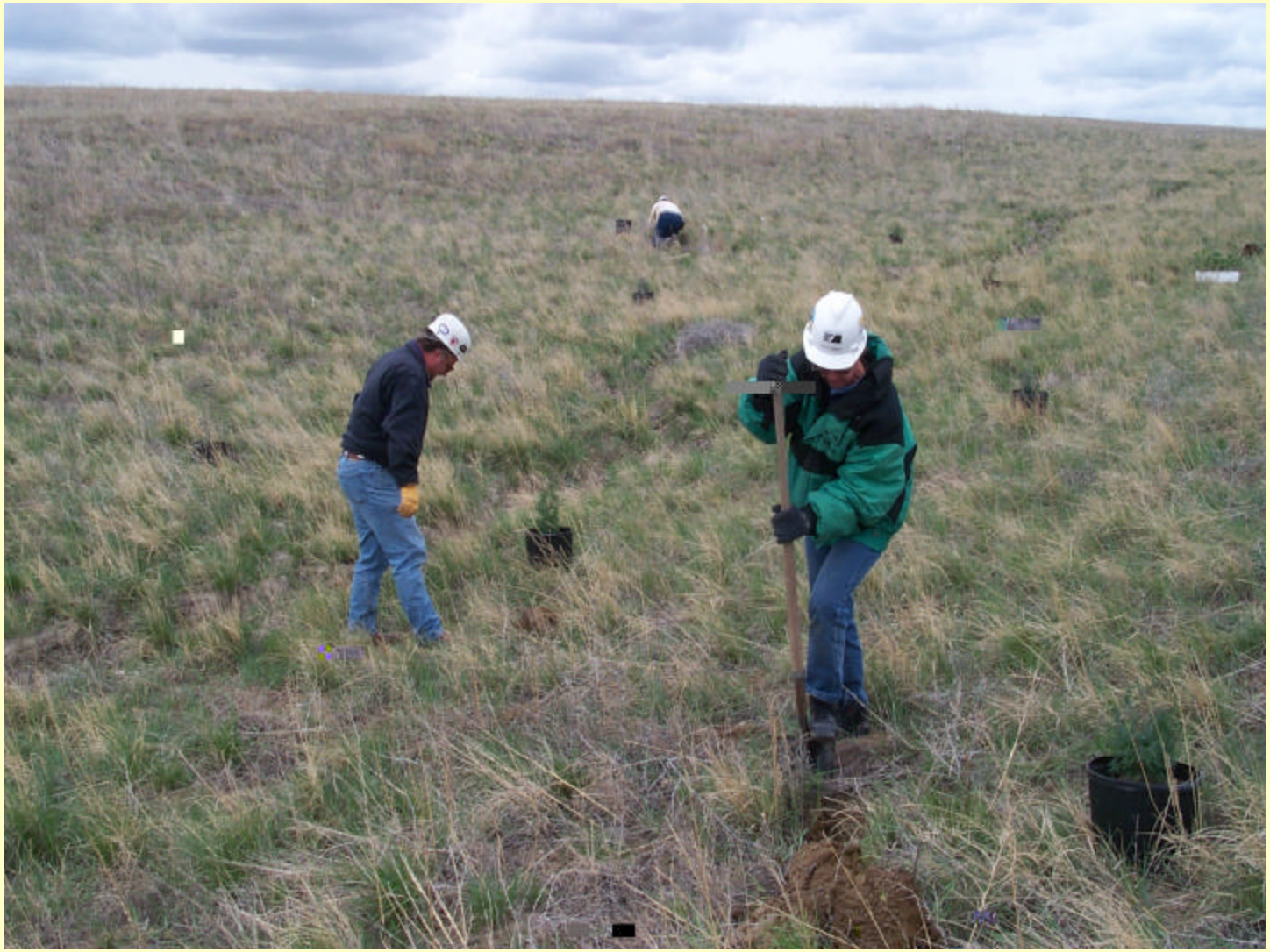
- Surface coal mining certainly is part of the Thunder Basin landscape.

- Also many of the companies are private landowners in their own right.

I can only speak for Powder River Coal Company at this point. These are the opportunities we see.

One goal of the association is to gain knowledge and develop management plans if necessary to avoid listing of species of concern as threatened or endangered. Further, the opportunity may even exist to eventually de-list species. This certainly has value for all resources, wildlife and human alike.

The surface coal mines have an incredible amount of detailed wildlife monitoring data specific to their individual mine sites. I believe there is an opportunity to evaluate additional wildlife management opportunities outside the traditional mine permit boundary as information is shared.



For instance, ..

Mining operations may mitigate on-site impacts during mining by contributing to off-site projects. This possibility could be explored in the context of expanding knowledge and relationships to the broader landscape.

Conversely, mining operations may contribute to mitigation of impacts in the overall landscape through on-site reclamation initiatives such as those you have seen represented in the last few pictures. We have a unique opportunity to incorporate the knowledge gained by this process beyond our borders as we continue to plan, design and build wildlife habitat on reclaimed lands.

We are certainly only limited by our imagination when it comes to opportunities this private landowner project presents.

Now, what does all this mean in the context of “opening remarks”?

Well --- I hope this discussion has started the creative juices flowing. I hope it has opened your eyes to some of the possibilities in your backyard. I hope it has prepared you for four full days of innovation, initiative and an incredible amount of information.

I would like to take this opportunity to recognize and thank Joe Galetovic and Linda Wagner with the OSM regional office in Denver for once again putting together a very informative and enlightening forum. Thank you both for all you do.

And finally — thank you for allowing me to say — welcome!!!