



Additional Graphical Materials to the Edwards Aquifer (San Antonio Region) Groundwater Flow Model (Lindgren et al., 2004)

Compiled by:

**Ned Troshanov, P.G., Modeler/Data Analyst
Mark Hamilton, P.G., Senior Hydrogeologist**

Content:

1. MODPATH particle trace (flowpath) simulation using a MODFLOW numerical solution for September 1956.
2. Steady-state and transient water level residuals for the MODFLOW Edwards Aquifer groundwater flow model.
3. Comparison between water-level root mean square error (RMSE) distributions for target wells used in the MODFLOW and GWSIM models.

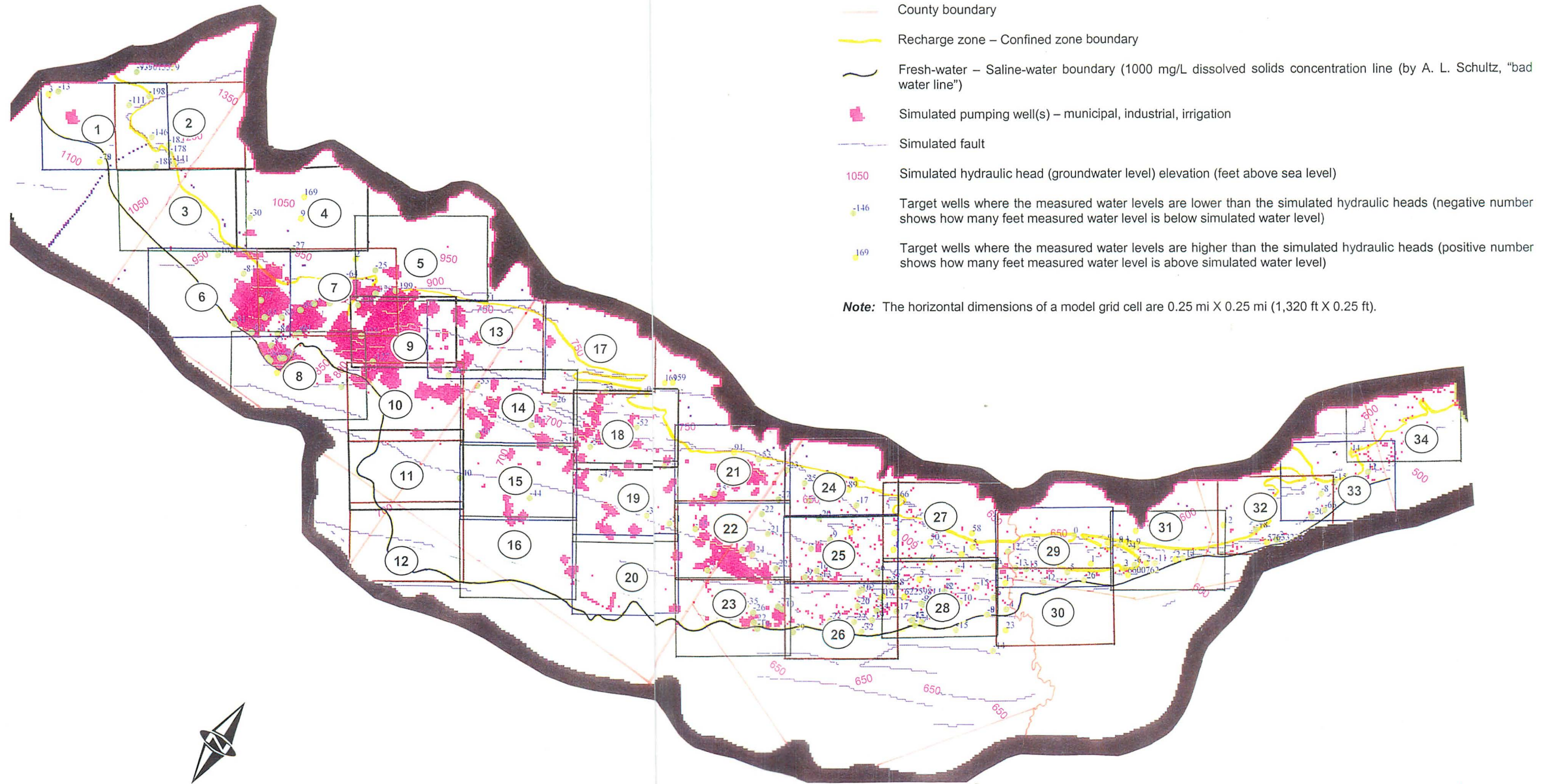
March 2005

1615 N. St. Mary's St.
San Antonio, Texas 78215

<http://www.edwardsaquifer.org>

INDEX

of the maps showing MODPATH particle traces/flowpaths superimposed on the simulated model solution for September 1956 of the MODFLOW Edwards Aquifer model (Lindgren et al., 2004)



Note: The horizontal dimensions of a model grid cell are 0.25 mi X 0.25 mi (1,320 ft X 0.25 ft).

Ned V. Troshanov, P.G.
Modeler/Data Analyst

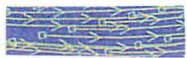


Explanation

to the MODPATH particle trace (flowpath) simulation maps



Index number of a map;



Flowpaths and directions of simulated groundwater flow;

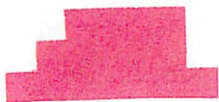


1171 300000

Hydraulic conductivity (ft/day); conduit cells are shown with a smaller font of the numbers;



Inactive model cells;



Simulated pumping well(s) – municipal, industrial, irrigation;



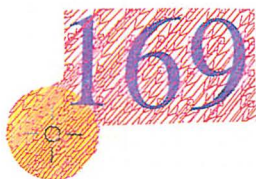
Simulated fault;



Simulated hydraulic head (groundwater level) elevation (feet above sea level);



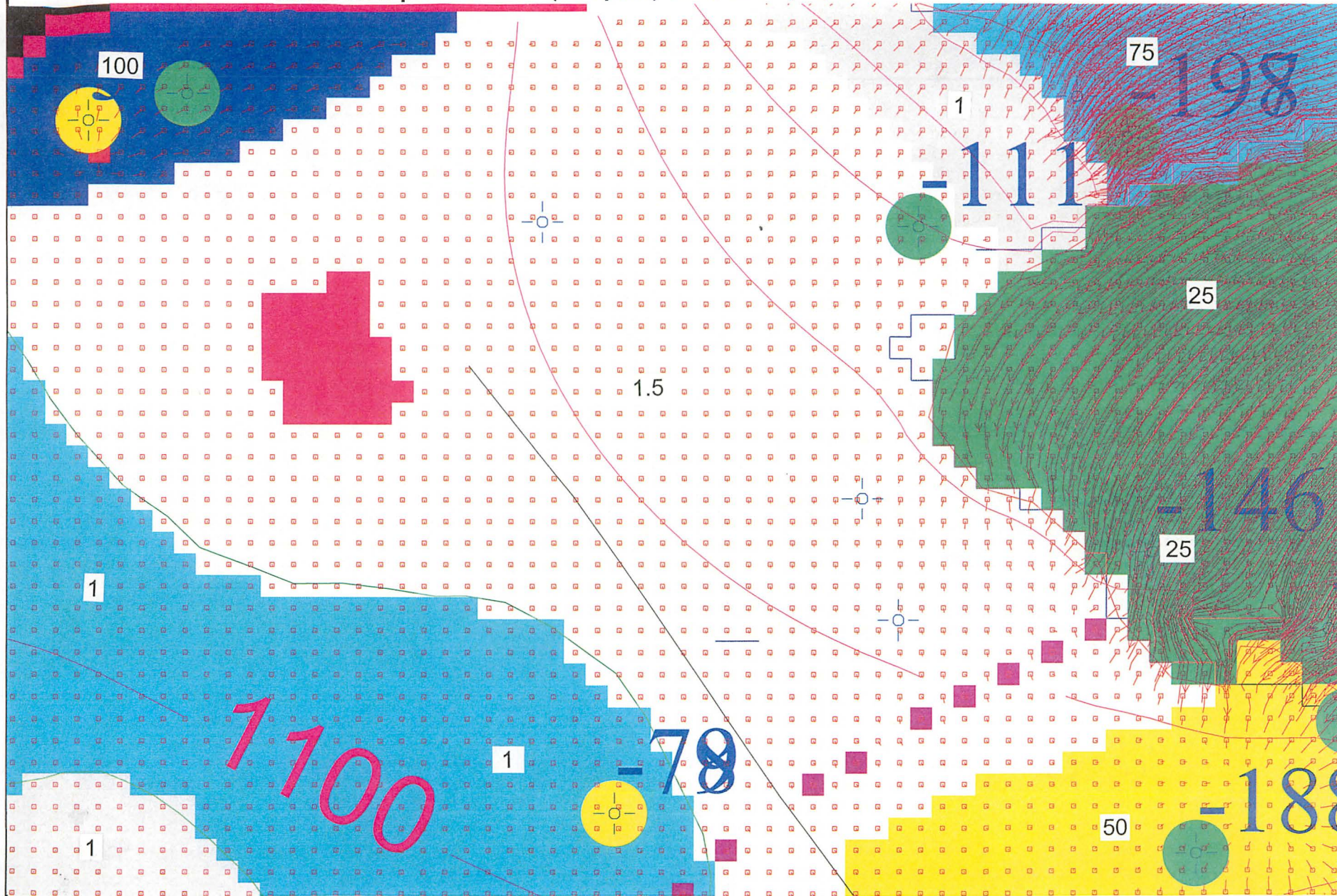
Target well where the measured water level is lower than the simulated water level (negative number shows how many feet measured water level is below simulated water level);



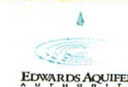
Target well where the measured water level is higher than the simulated water level (positive number shows how many feet measured water level is above simulated water level).

Notes: 1) Different colored areas indicate zones with certain range of values of hydraulic conductivity; 2) The horizontal dimensions of a model grid cell are 0.25 mi X 0.25 mi (1,320 ft X 1,320 ft).

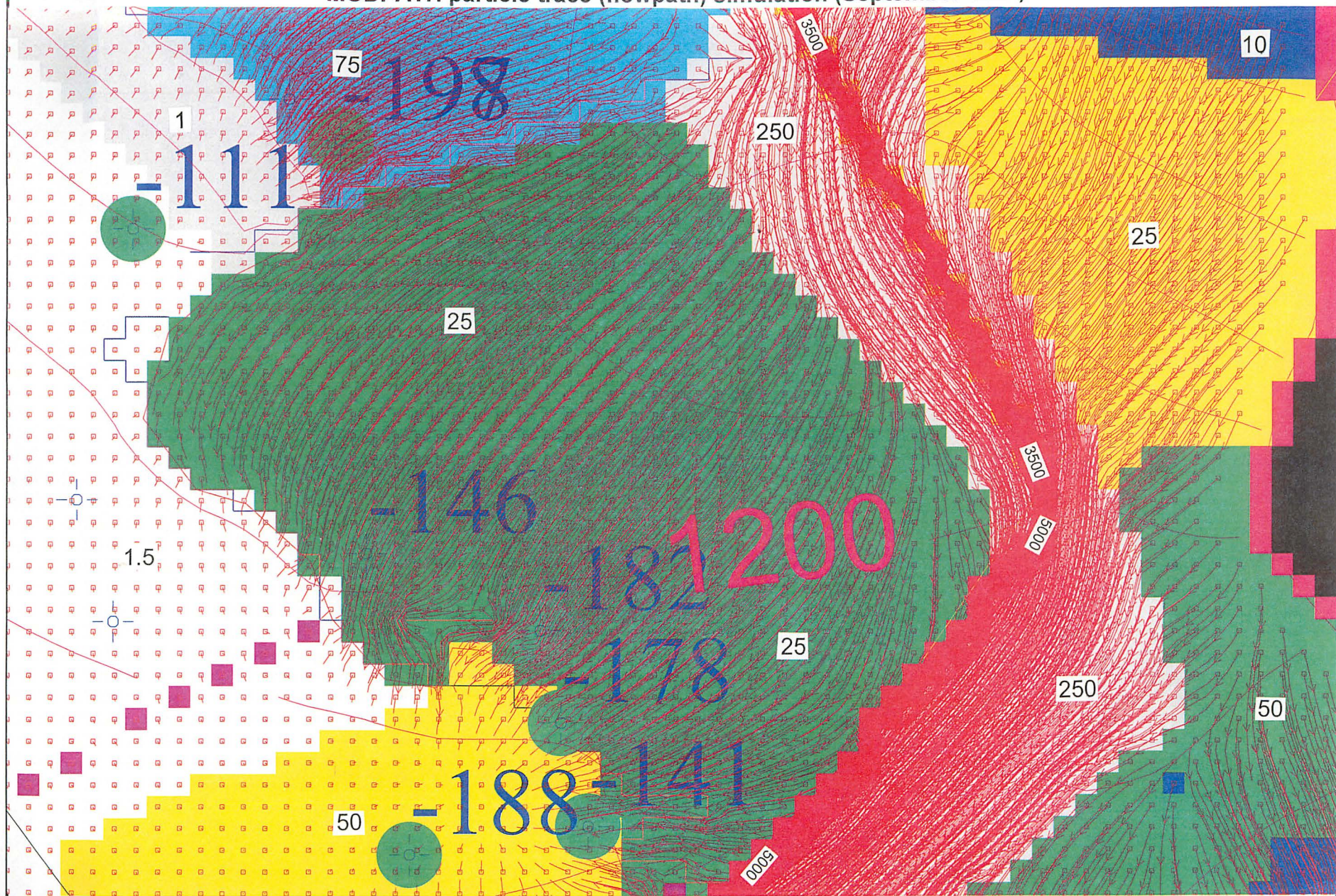
MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004



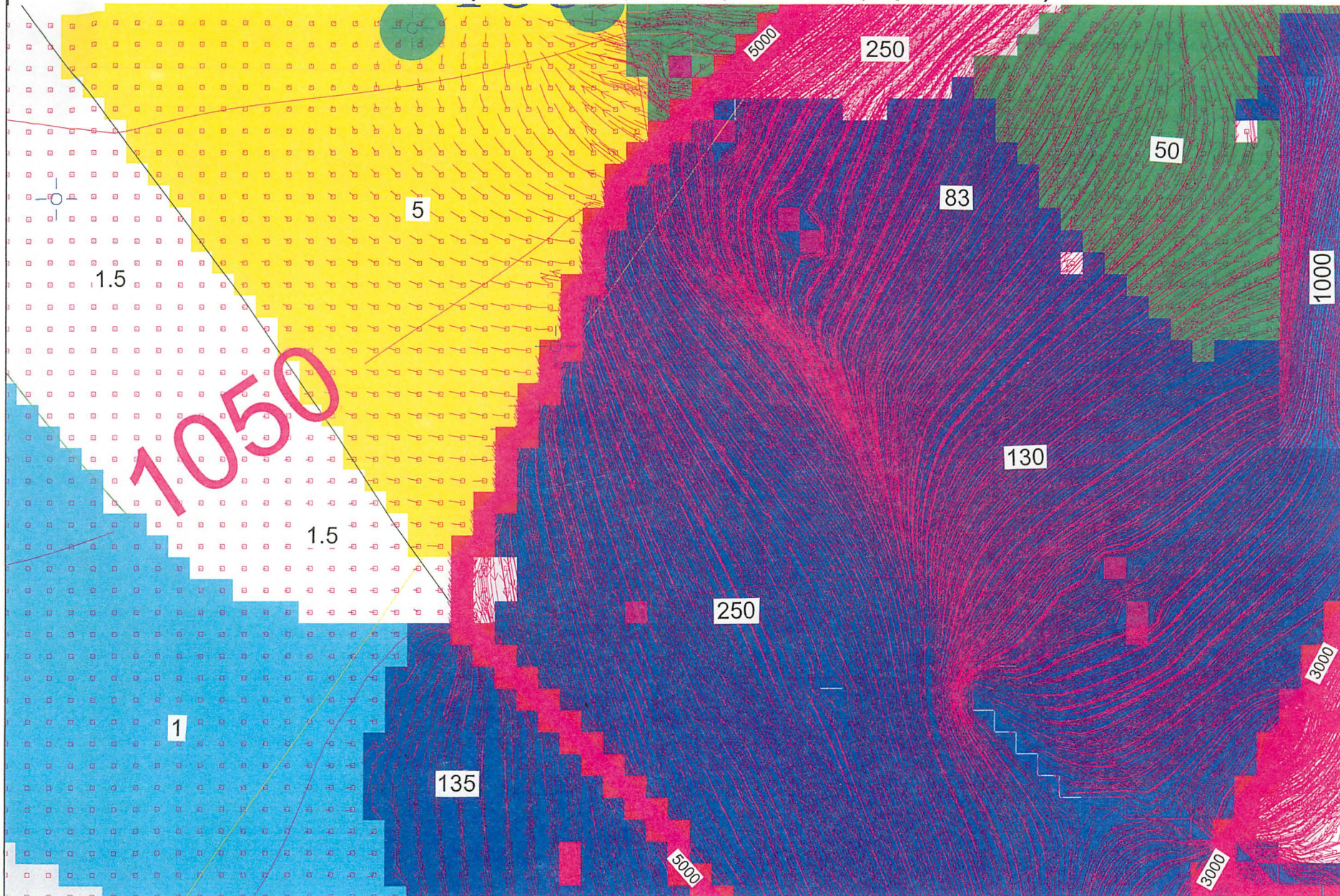
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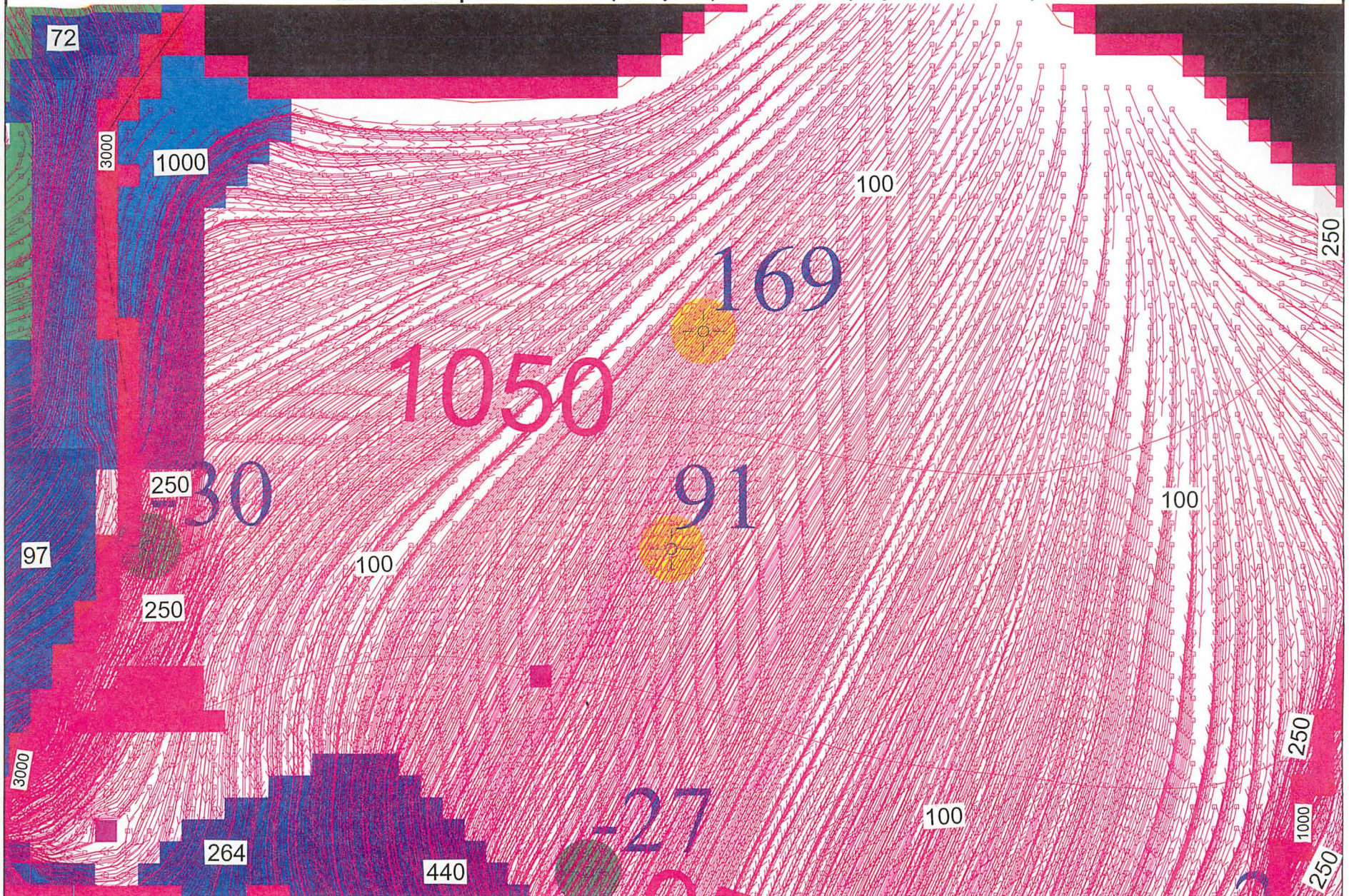
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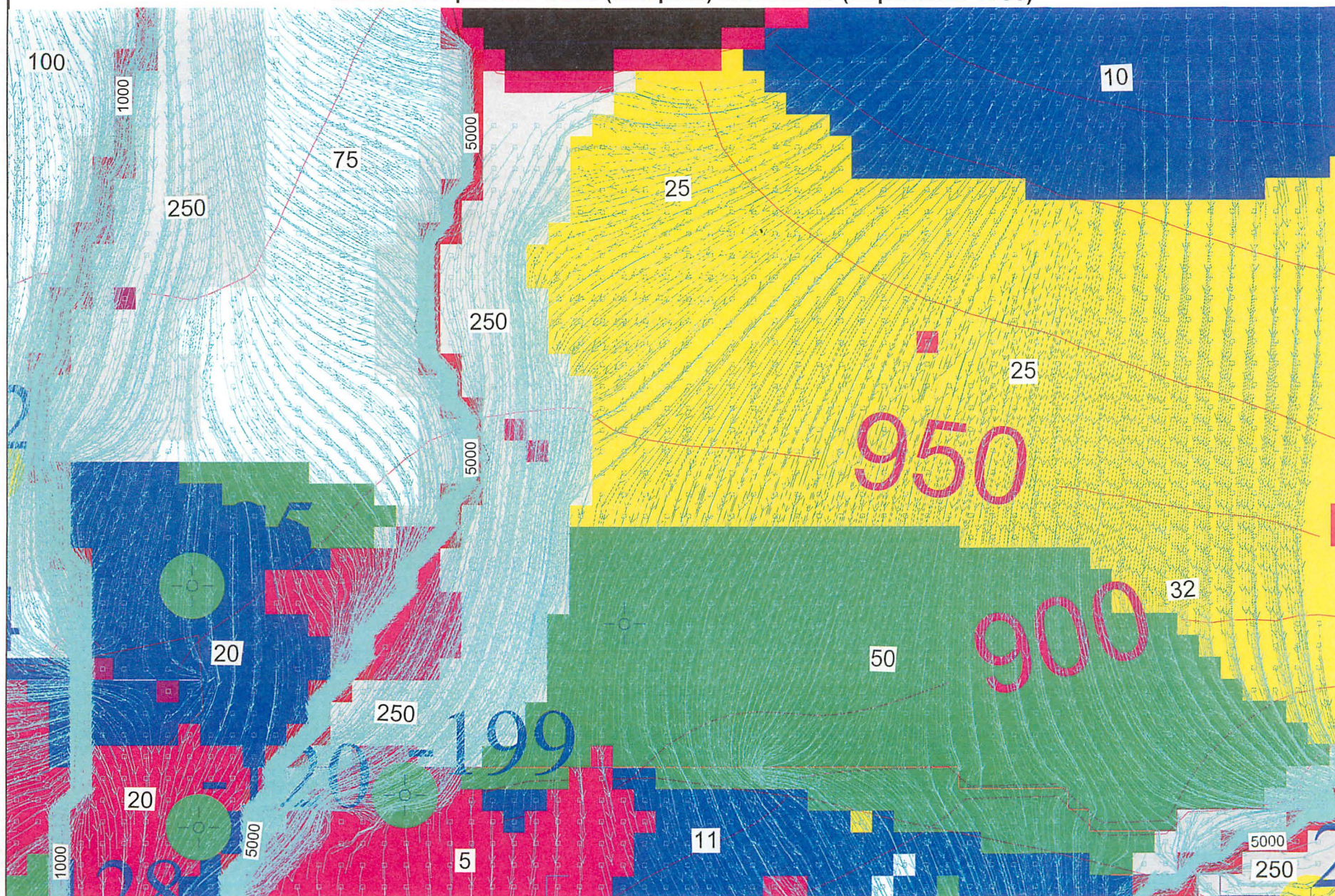
MODPATH particle trace (flowpath) simulation (September 1956)



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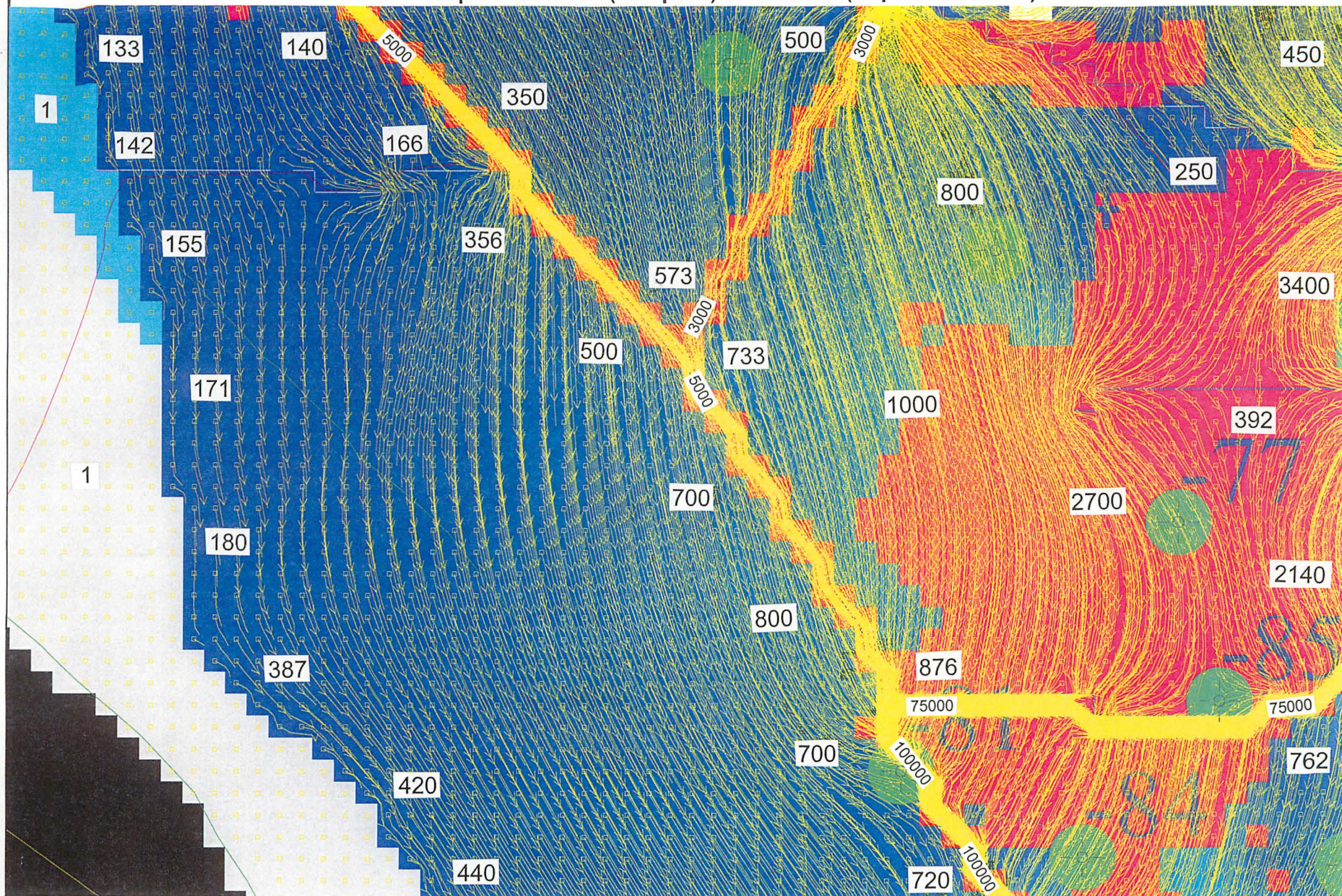
MODPATH particle trace (flowpath) simulation (September 1956)



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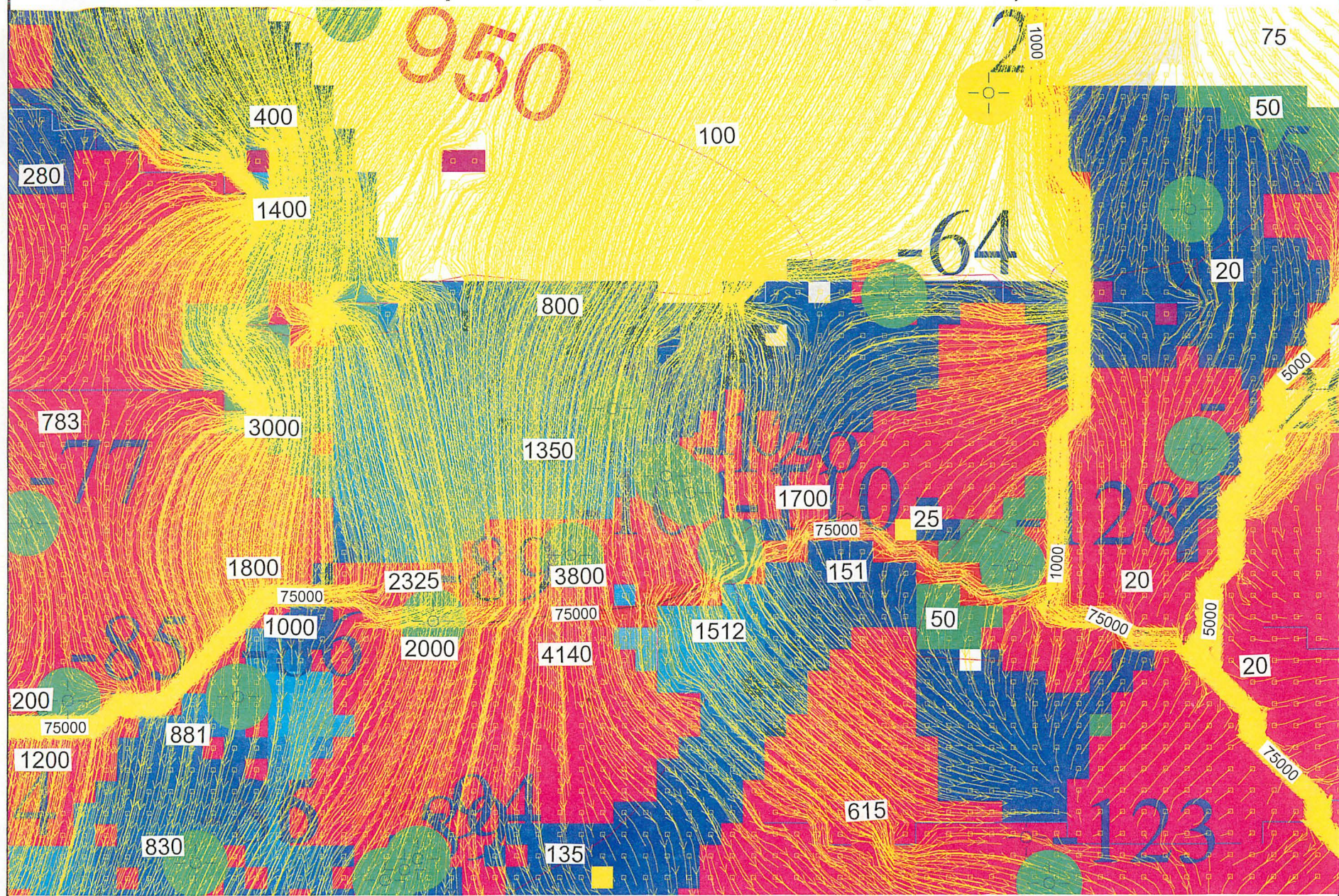
MODPATH particle trace (flowpath) simulation (September 1956)



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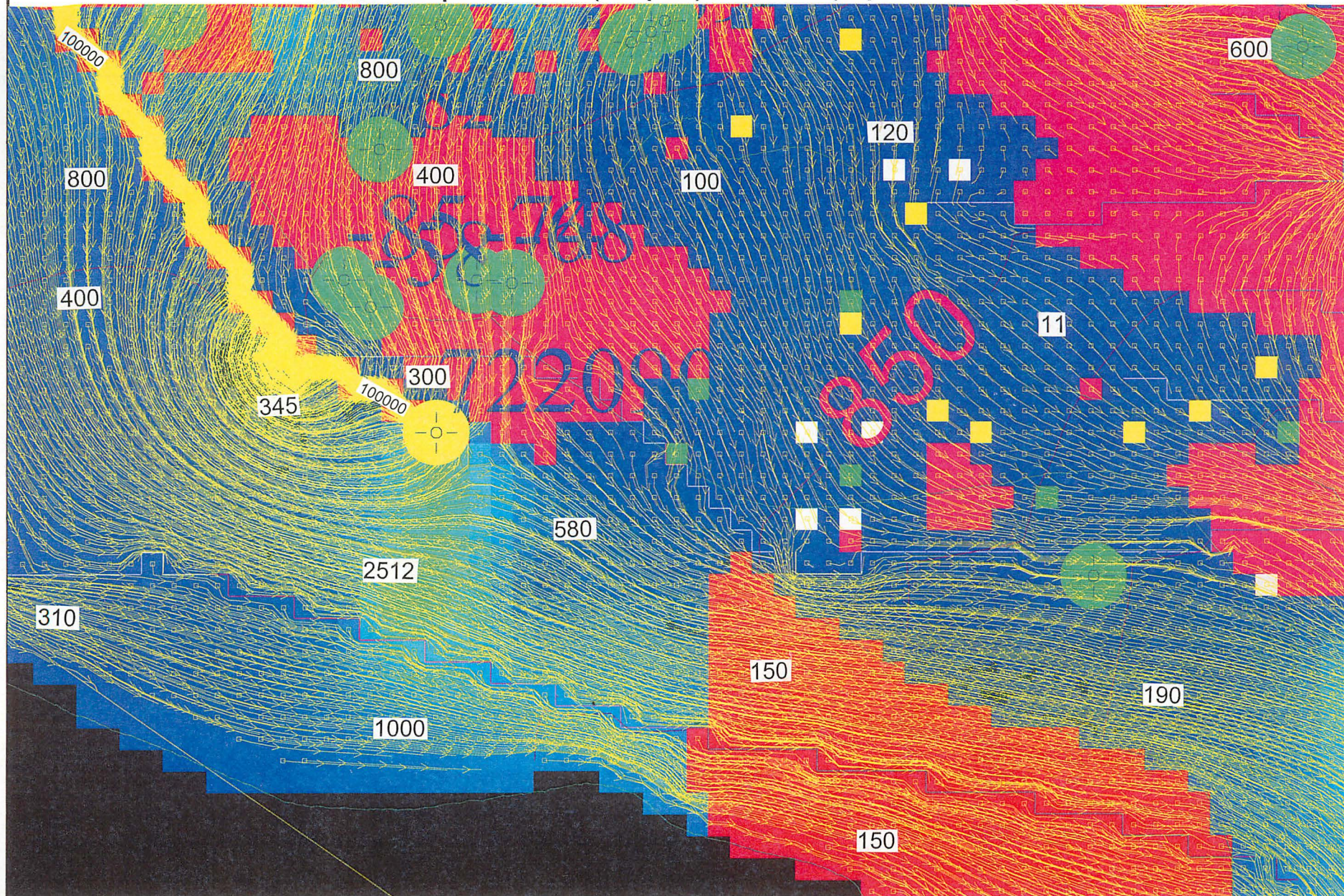
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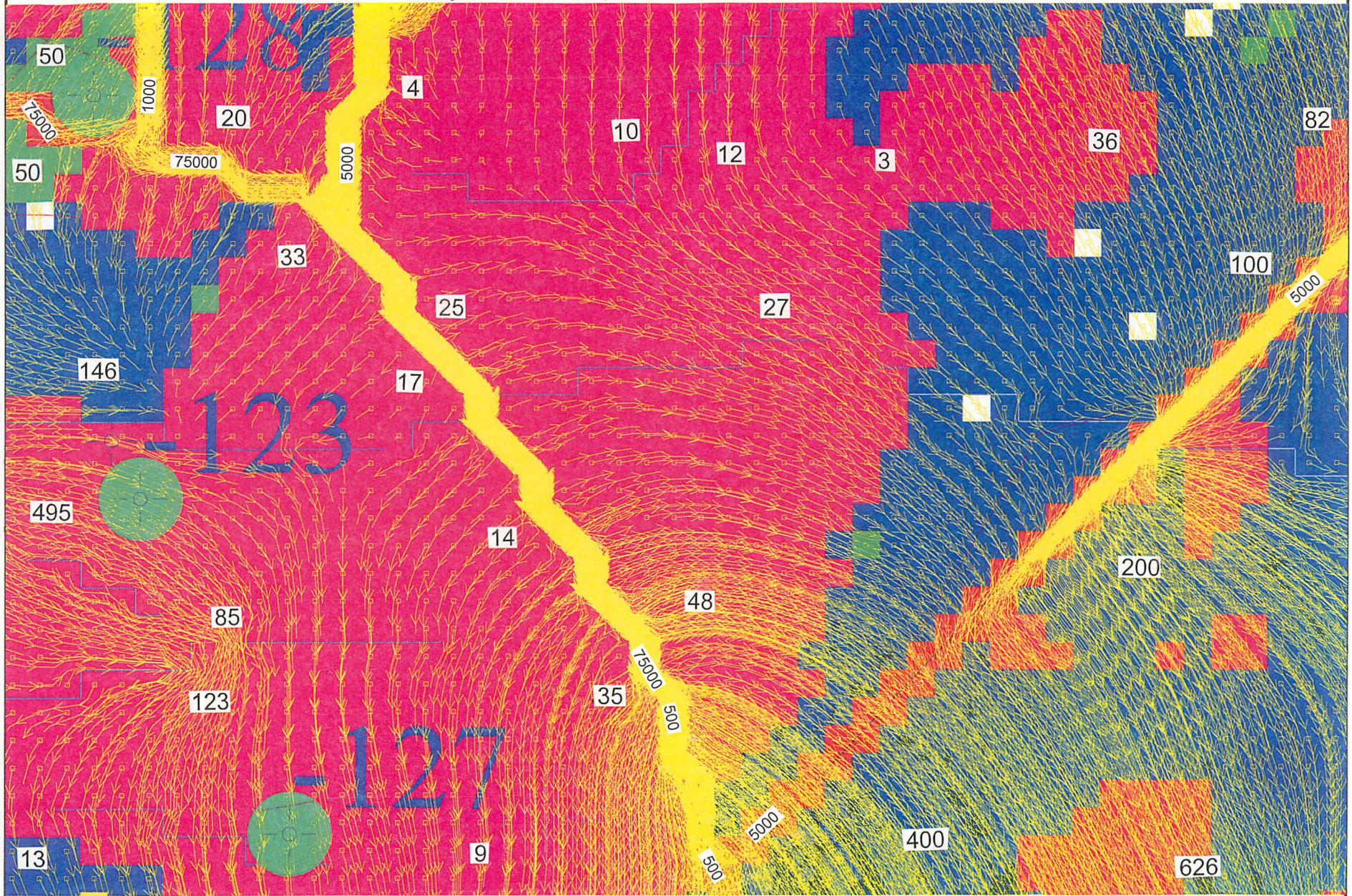
MODPATH particle trace (flowpath) simulation (September 1956)



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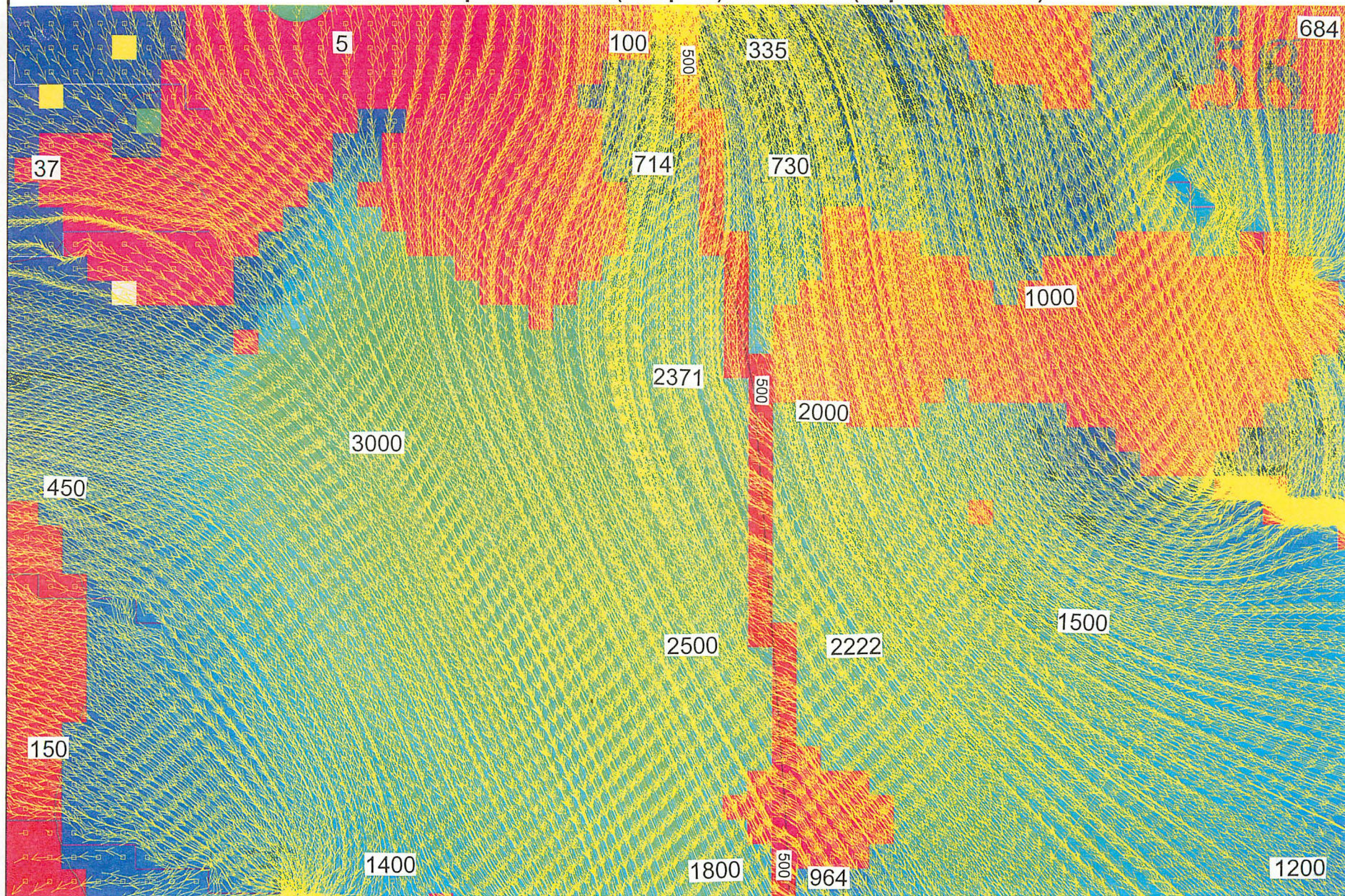
MODPATH particle trace (flowpath) simulation (September 1956)



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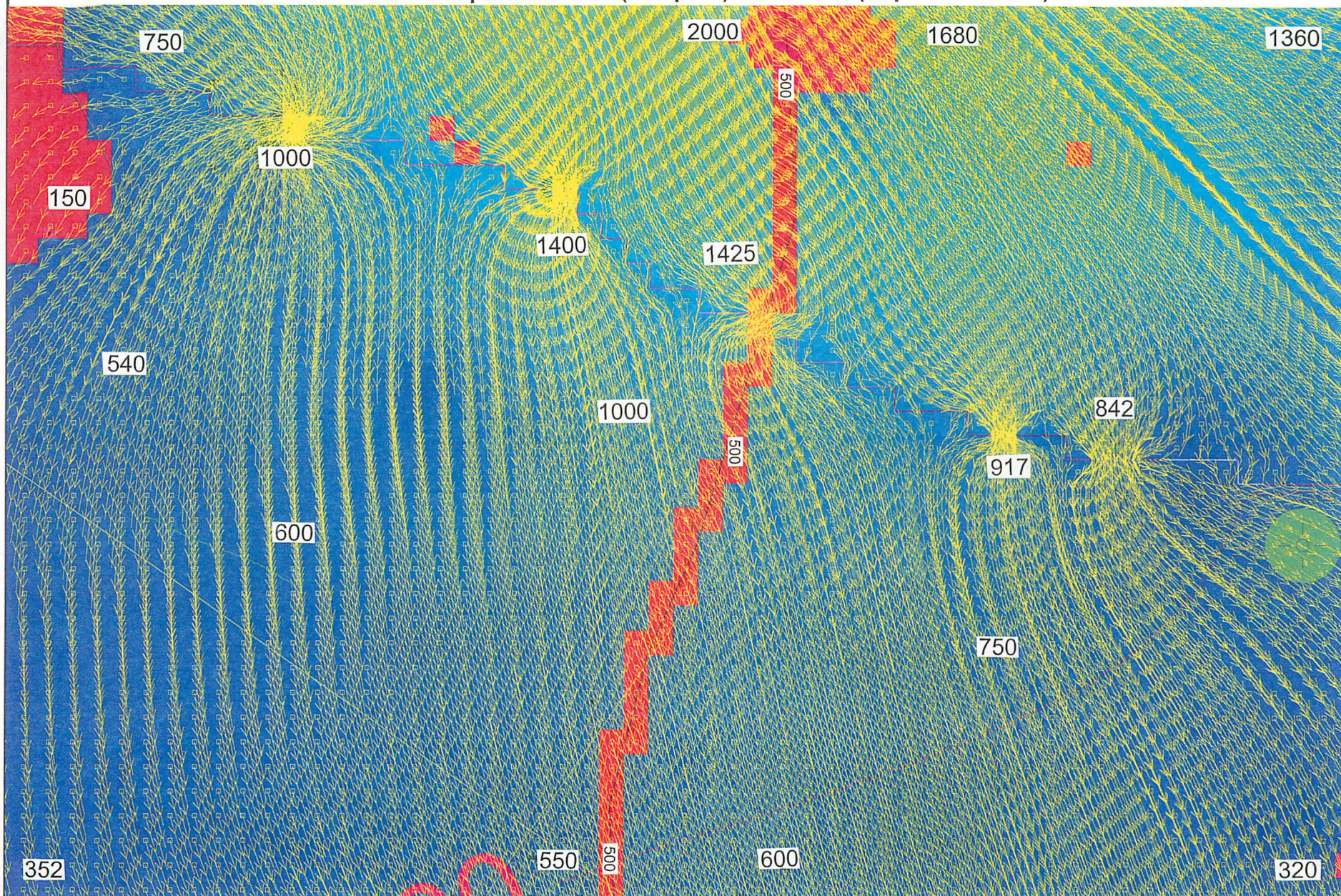
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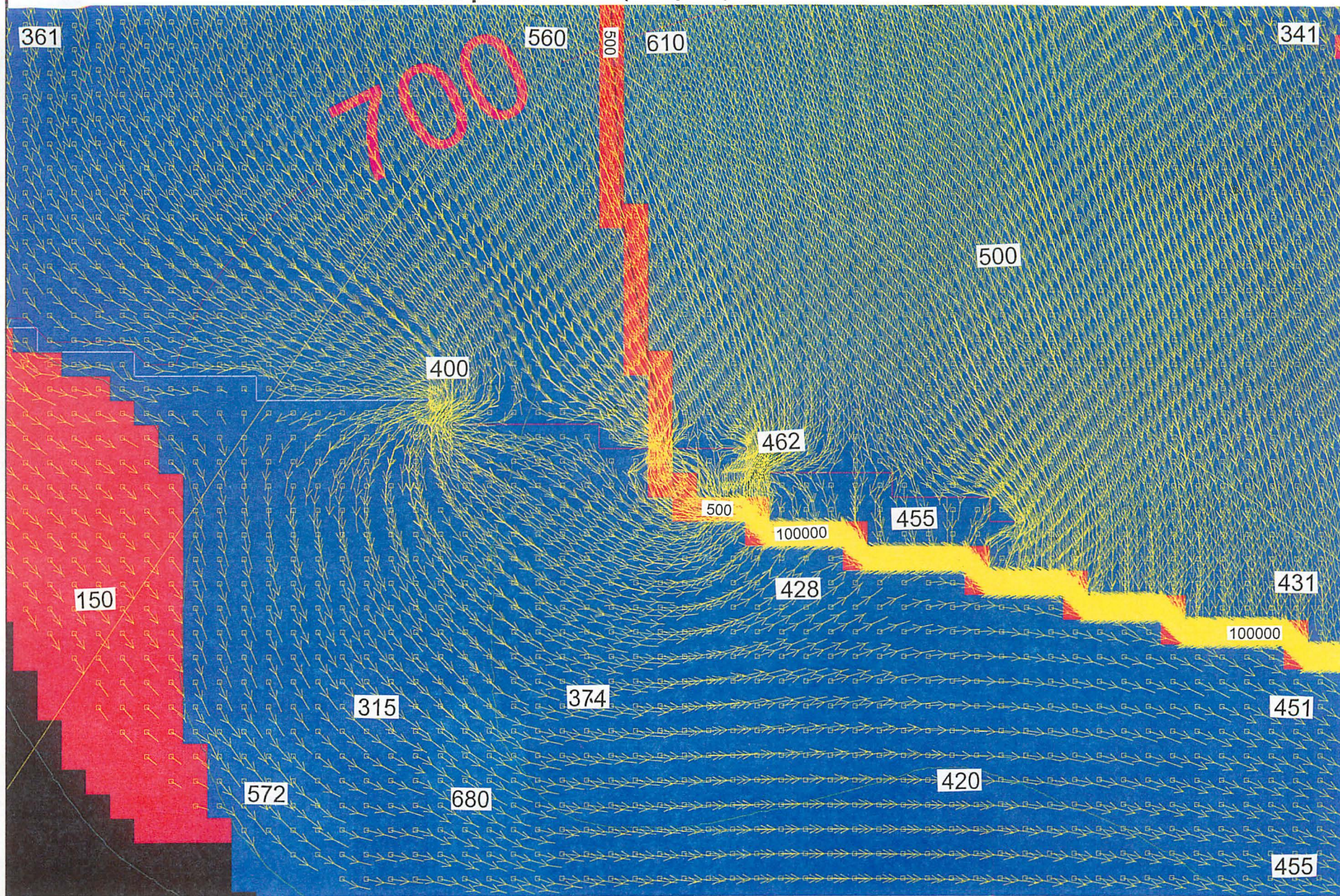
MODPATH particle trace (flowpath) simulation (September 1956)



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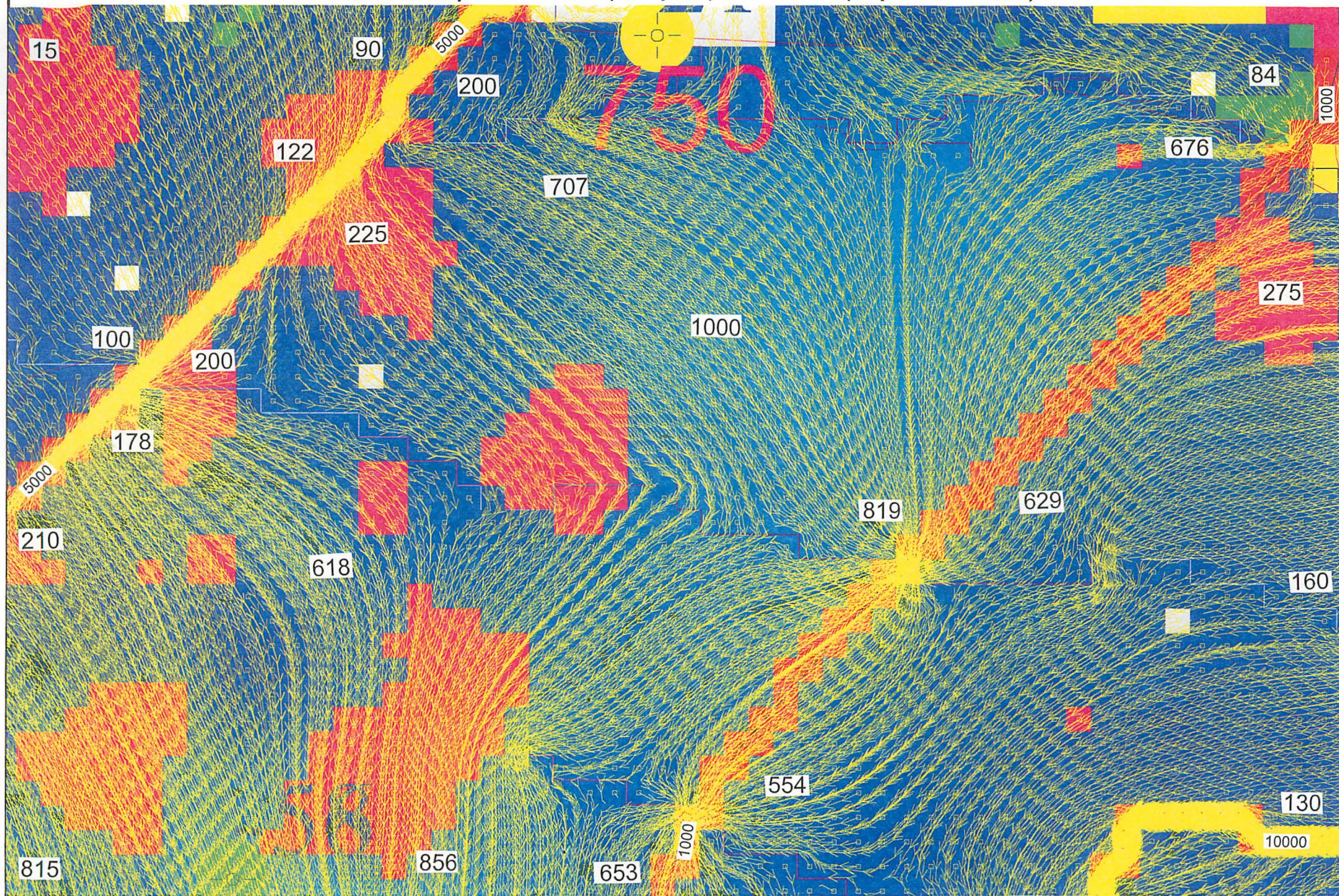
MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004



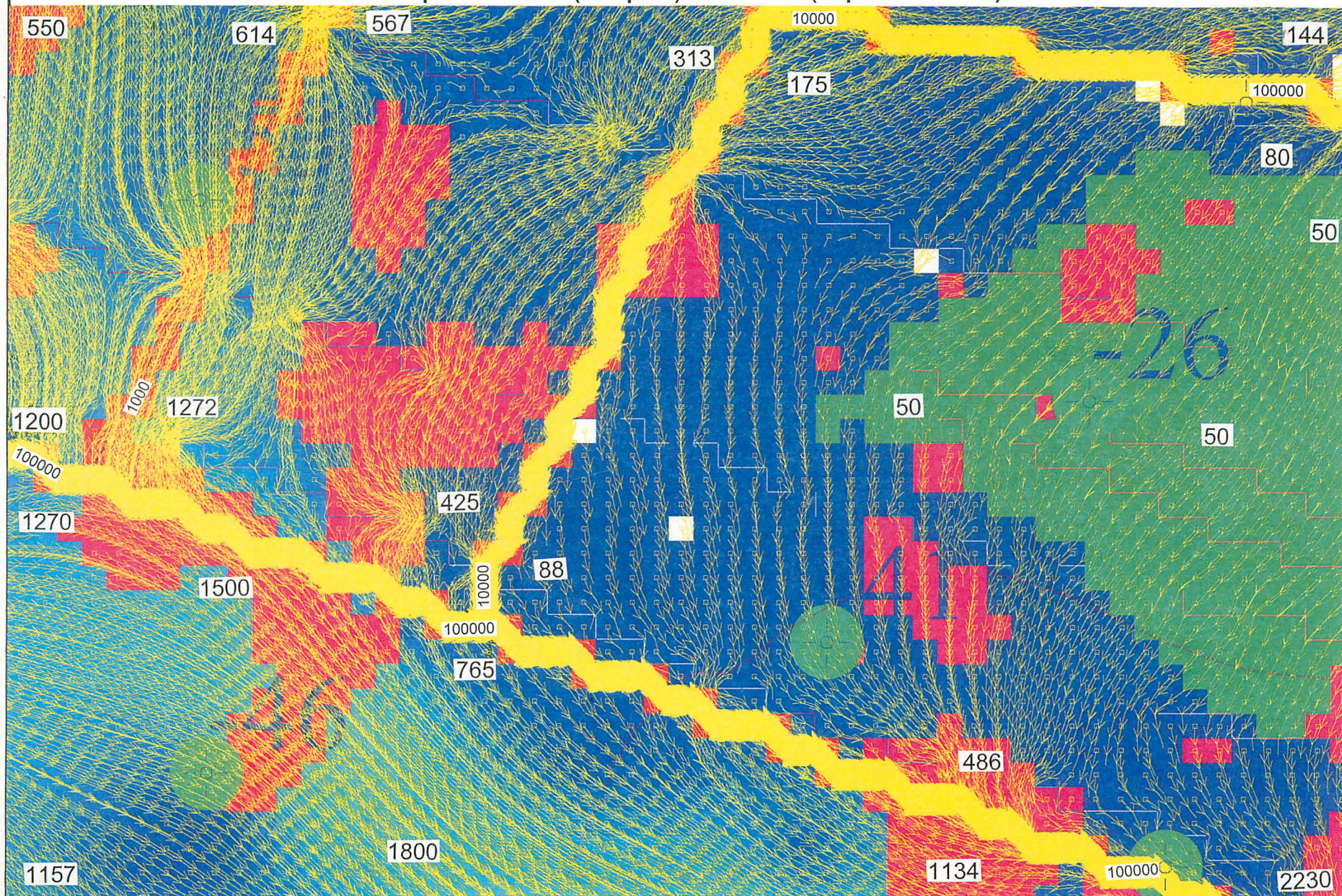
MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004

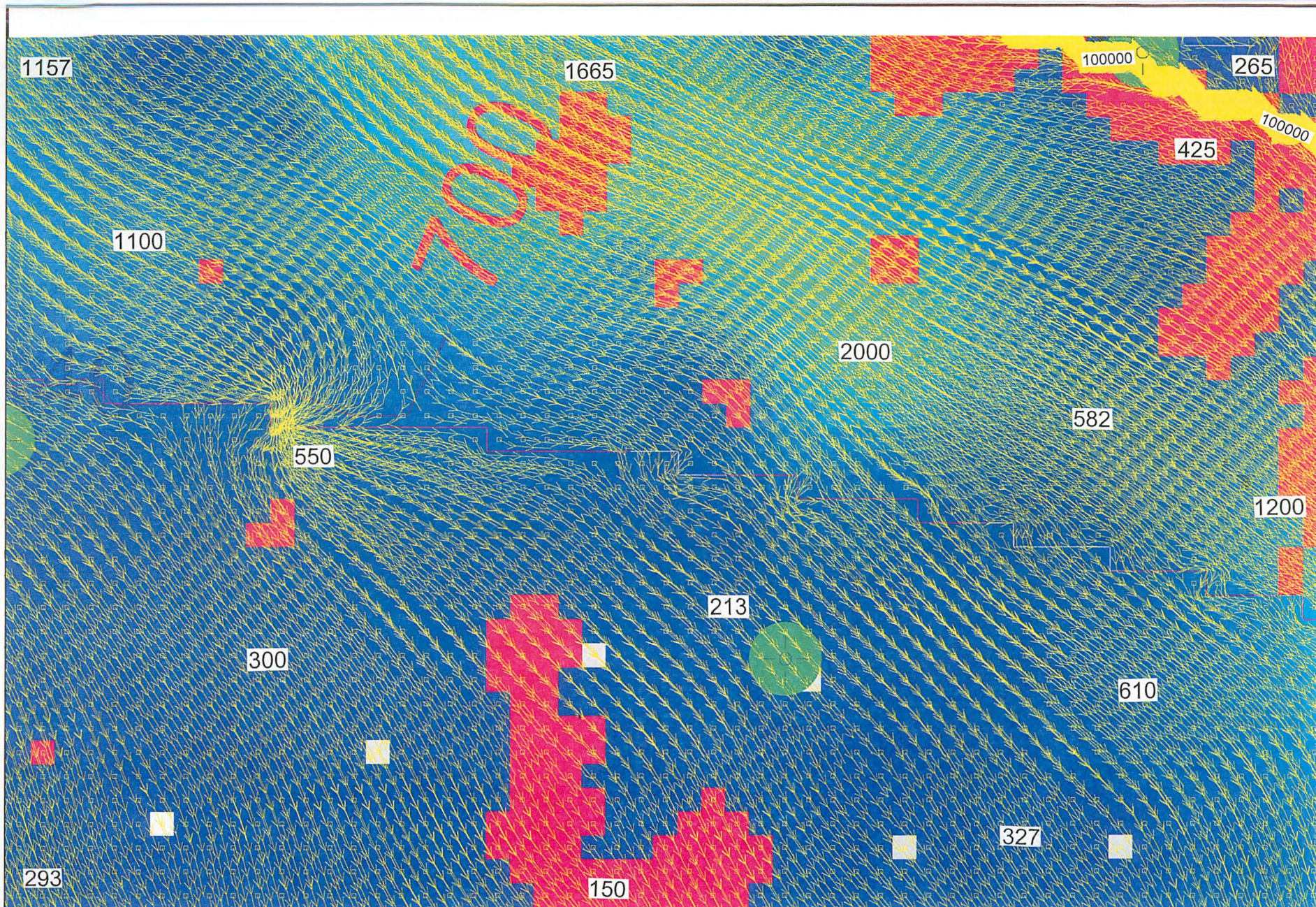


MODPATH particle trace (flowpath) simulation (September 1956)



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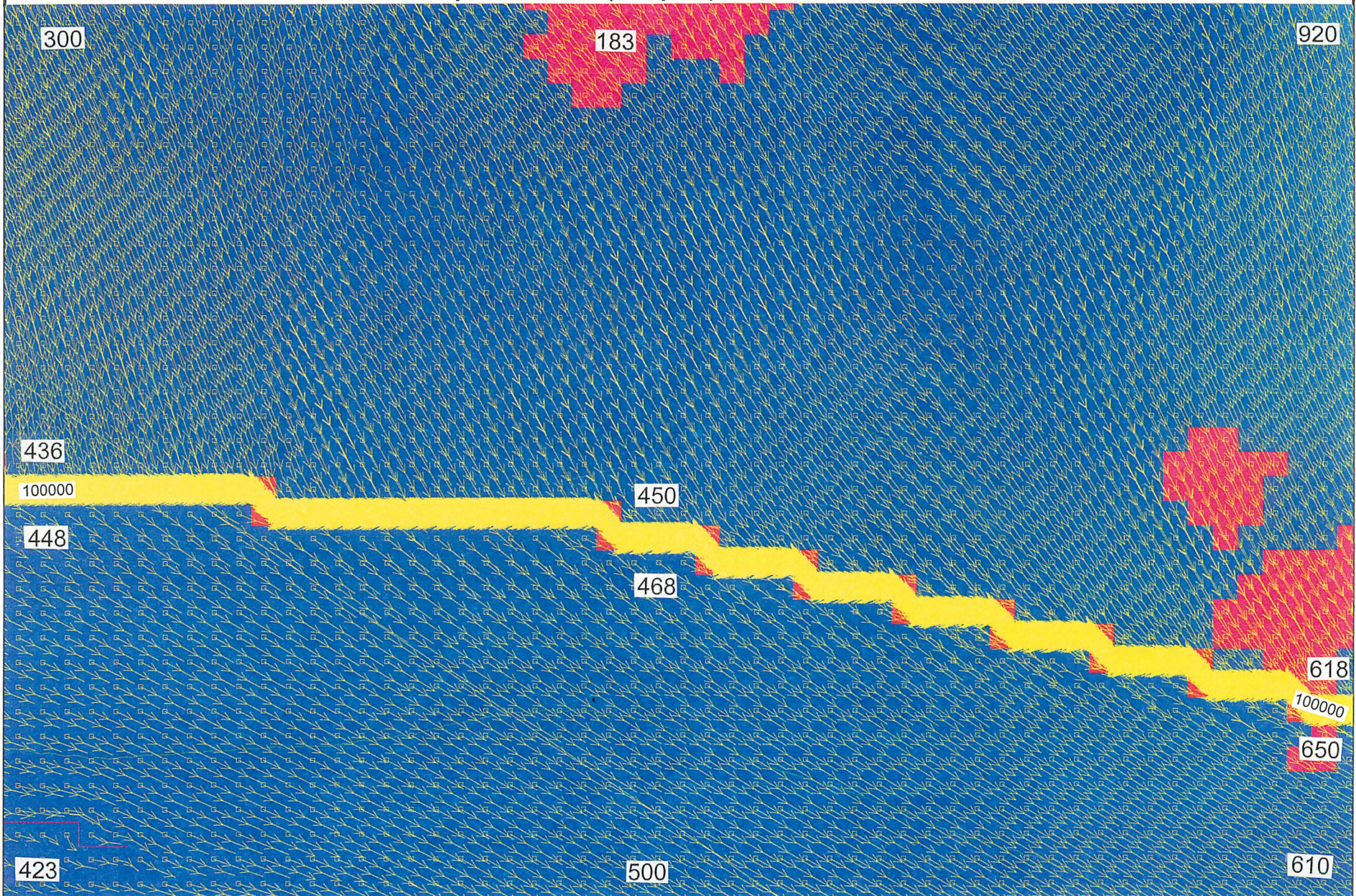




Source of Primary Data: Lindgren et al., 2004



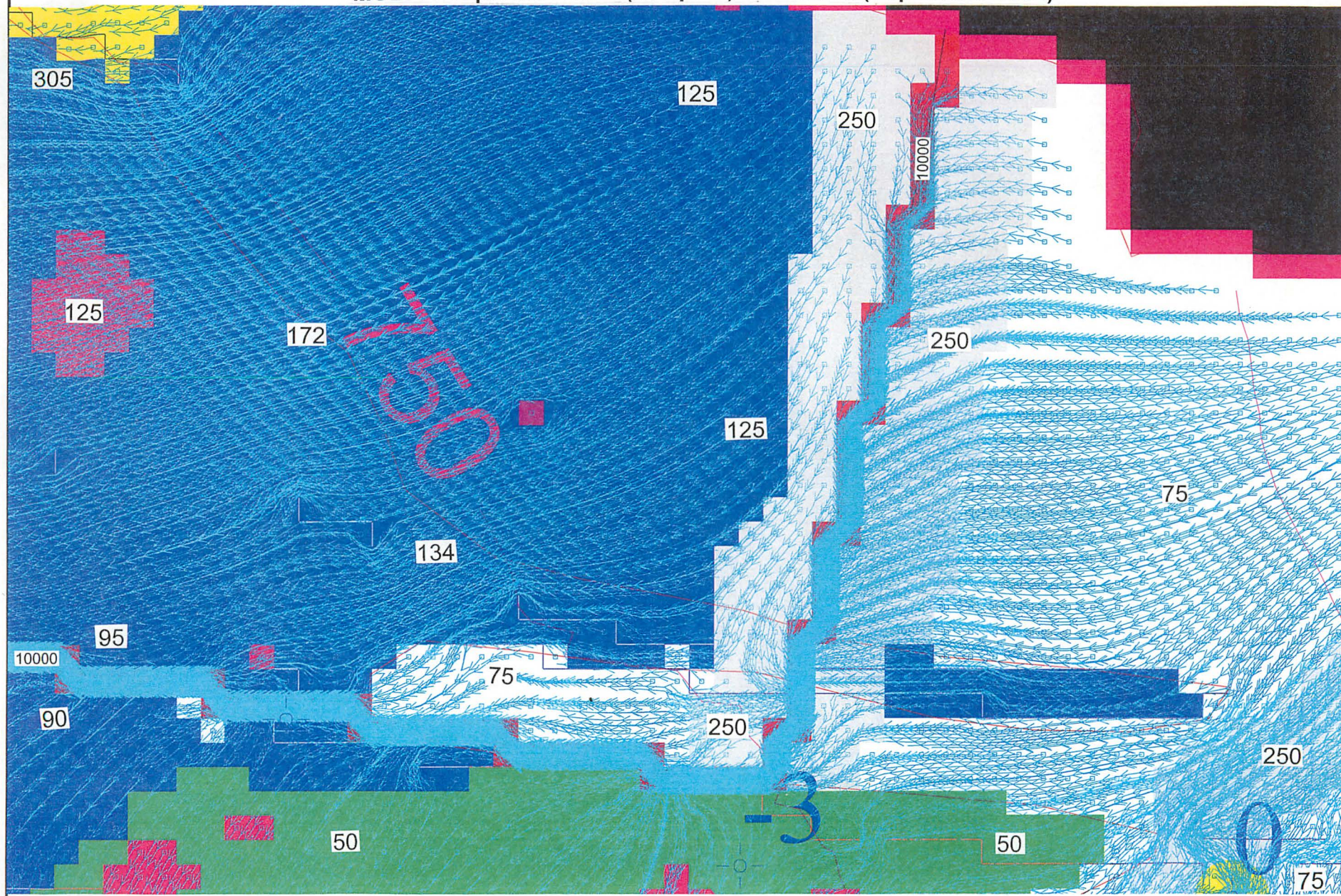
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MODPATH particle trace (flowpath) simulation (September 1956)



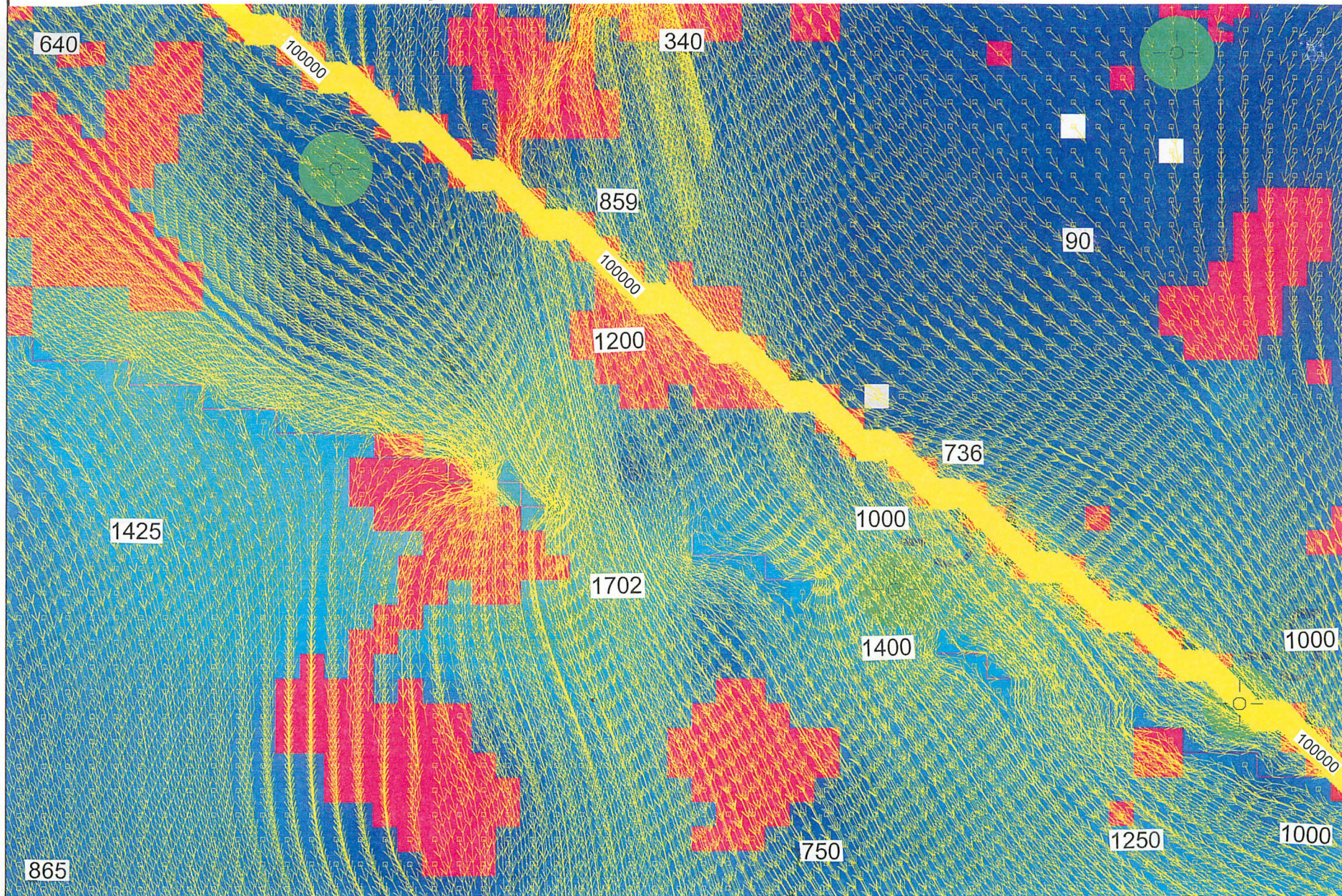
Source of Primary Data: Lindgren et al., 2004



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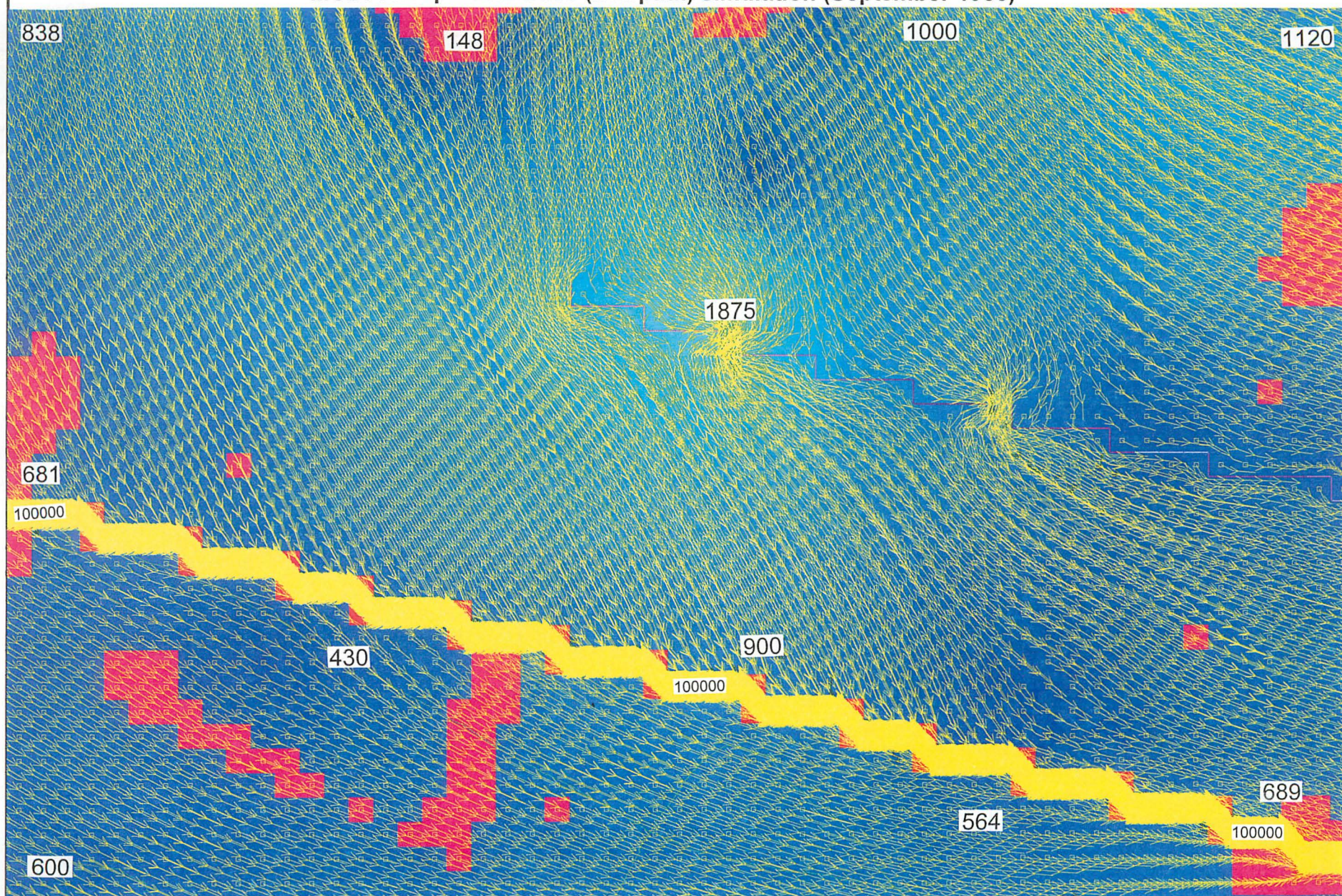
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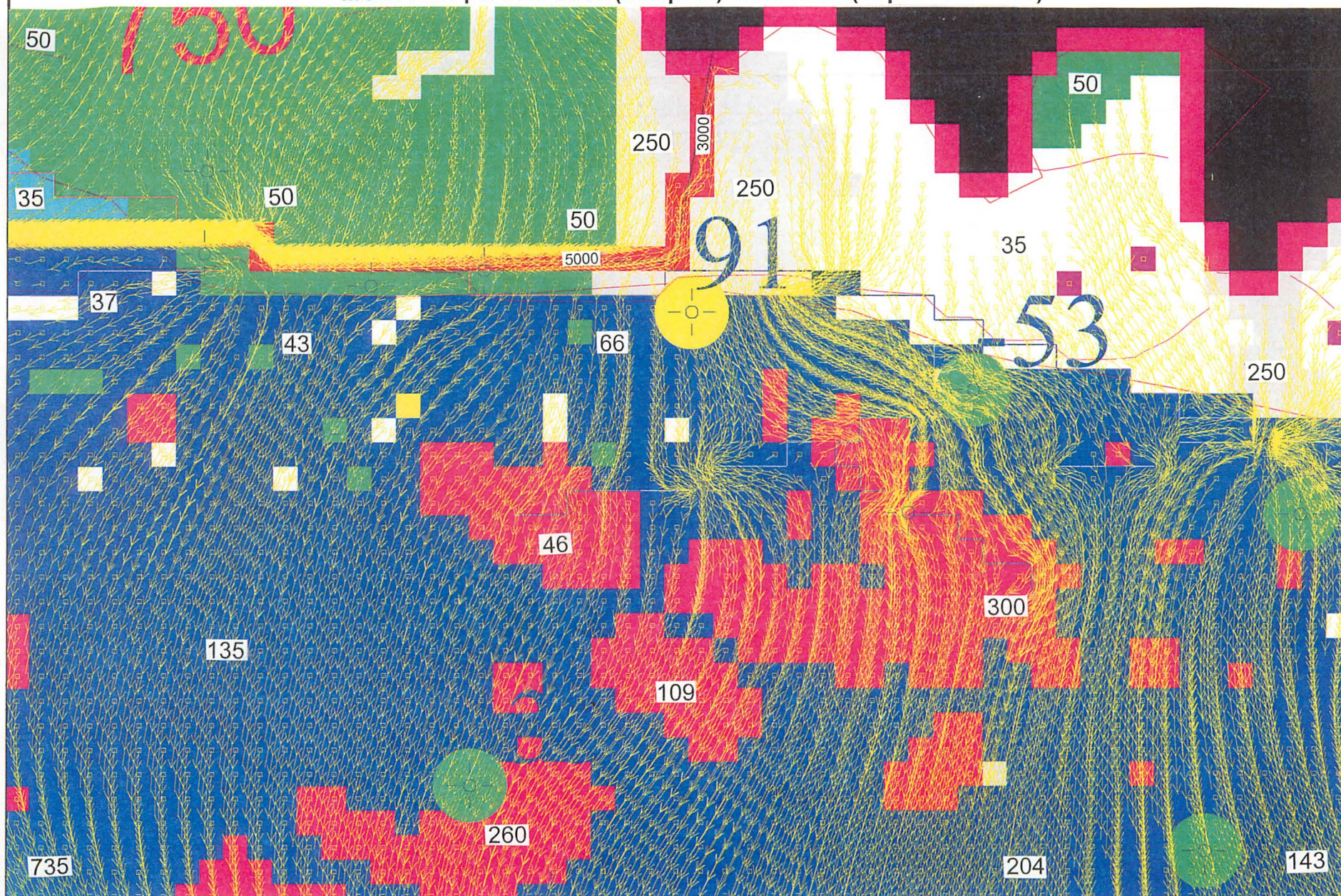
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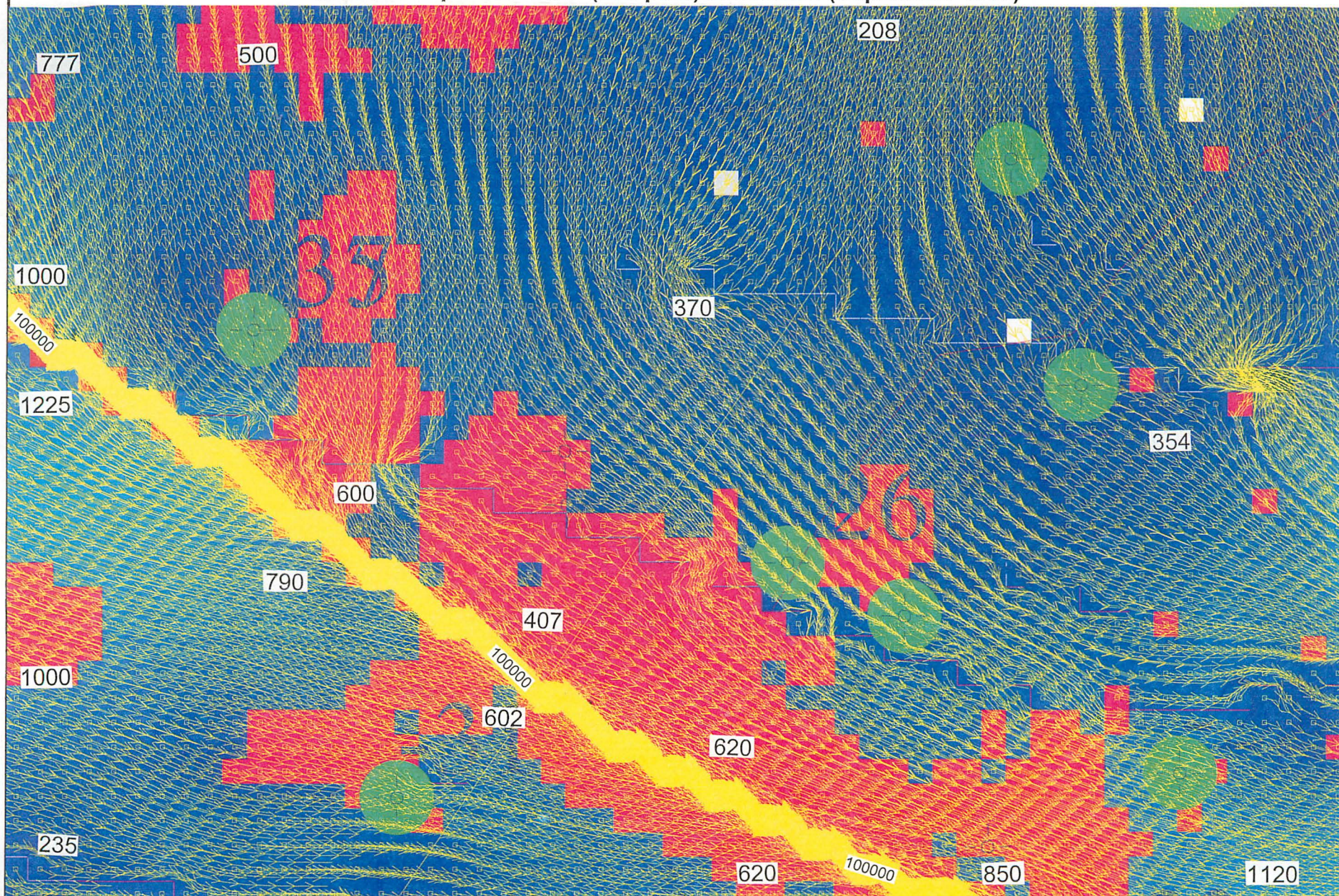
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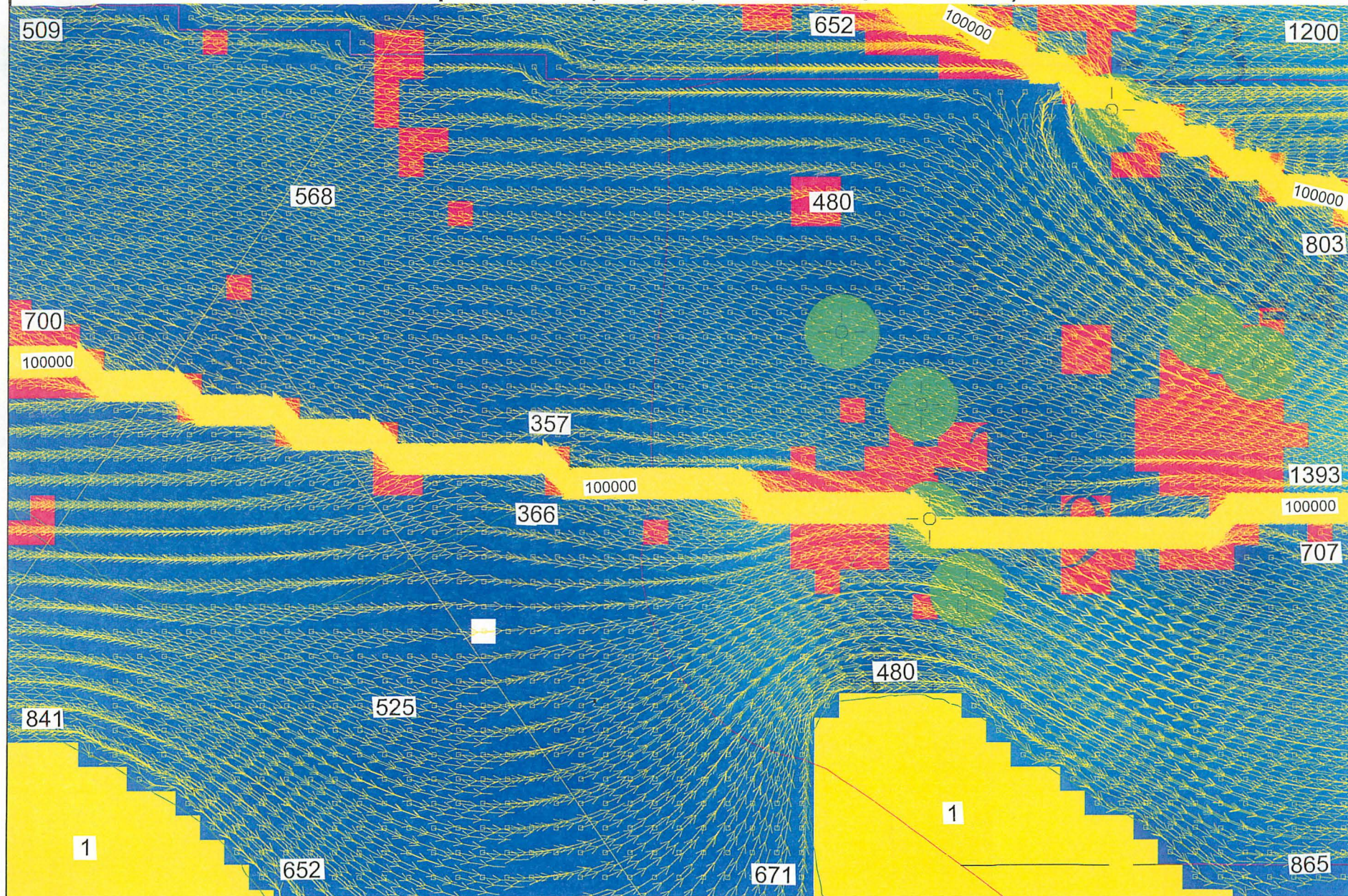
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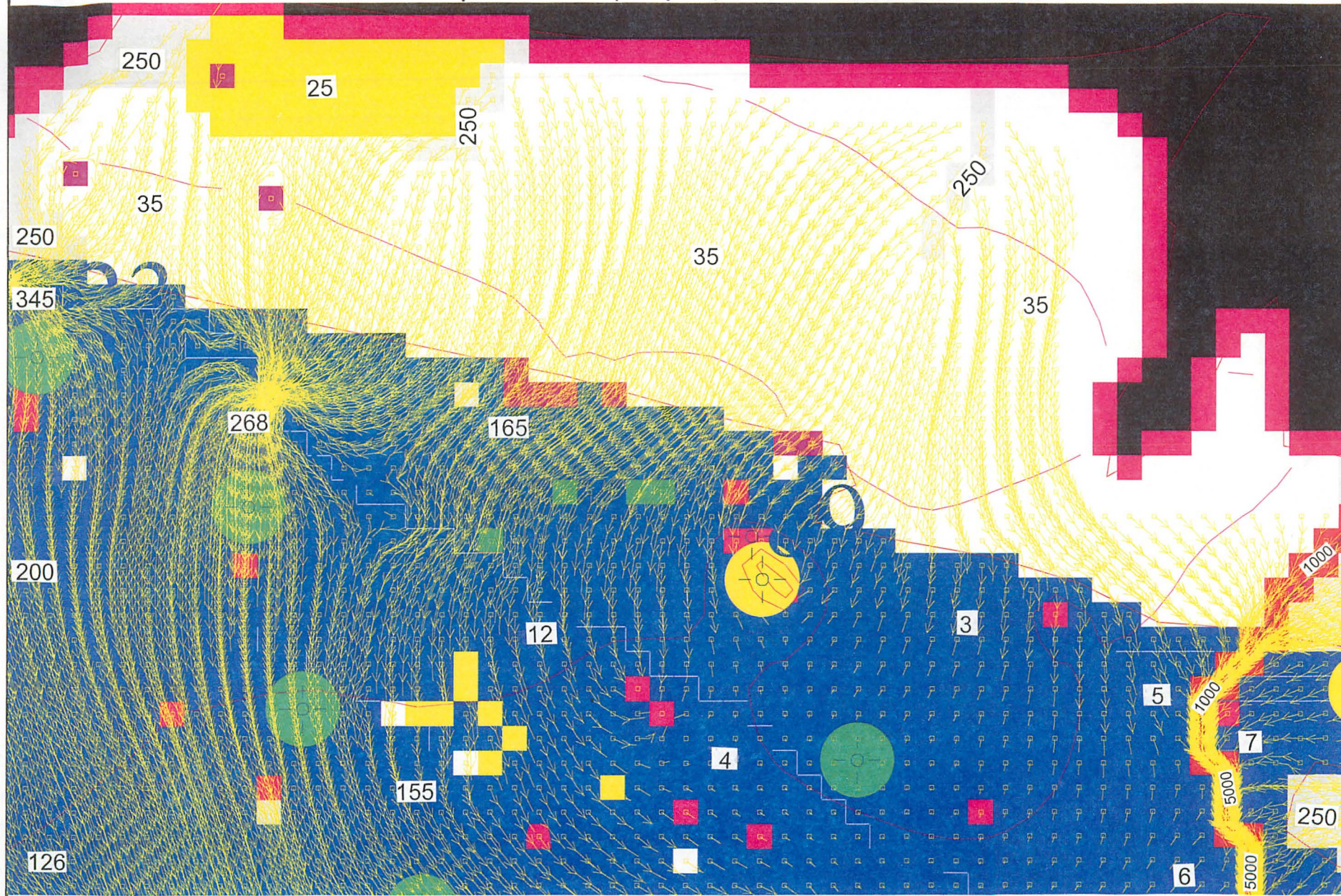
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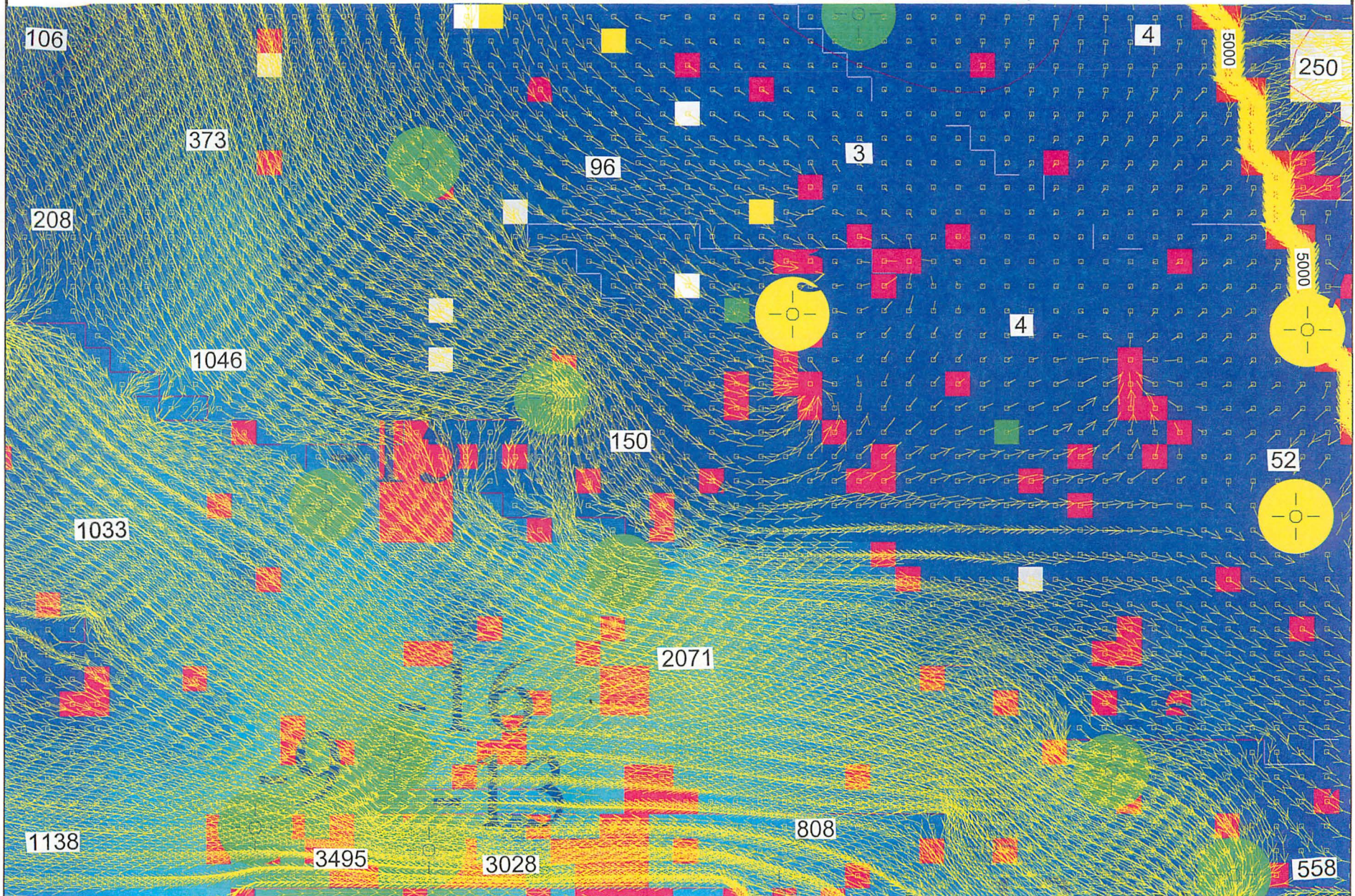
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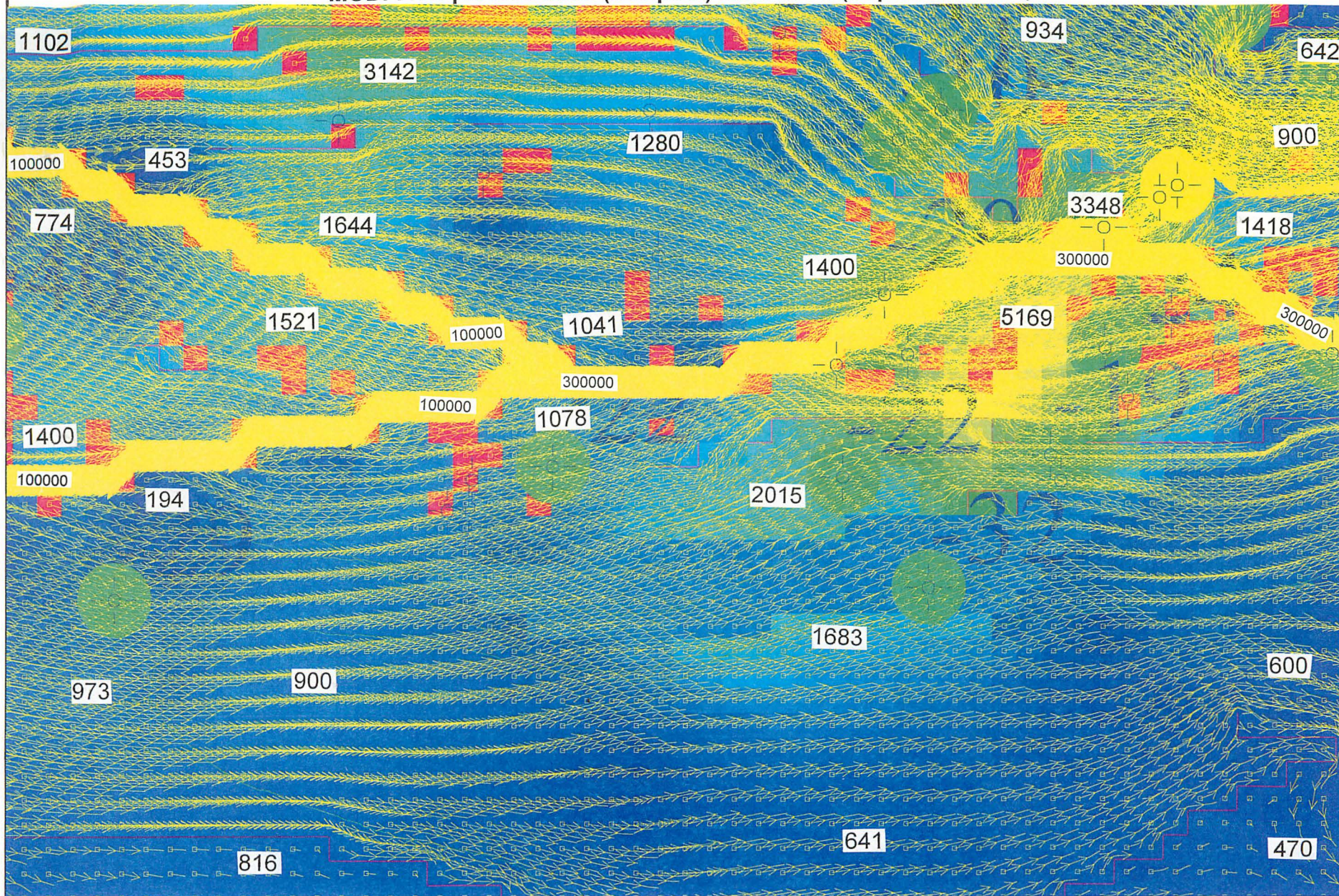
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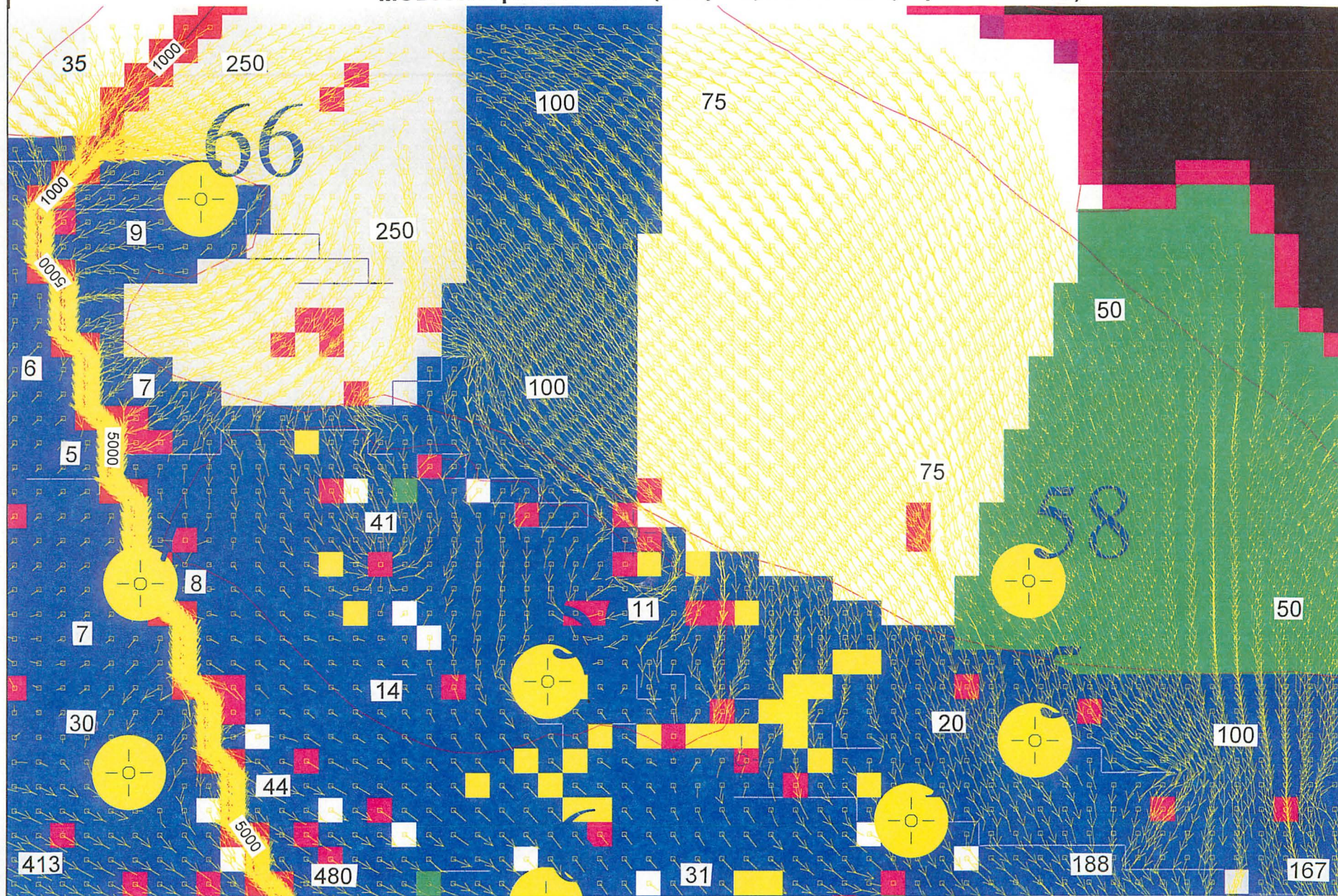
MODPATH particle trace (flowpath) simulation (September 1956)



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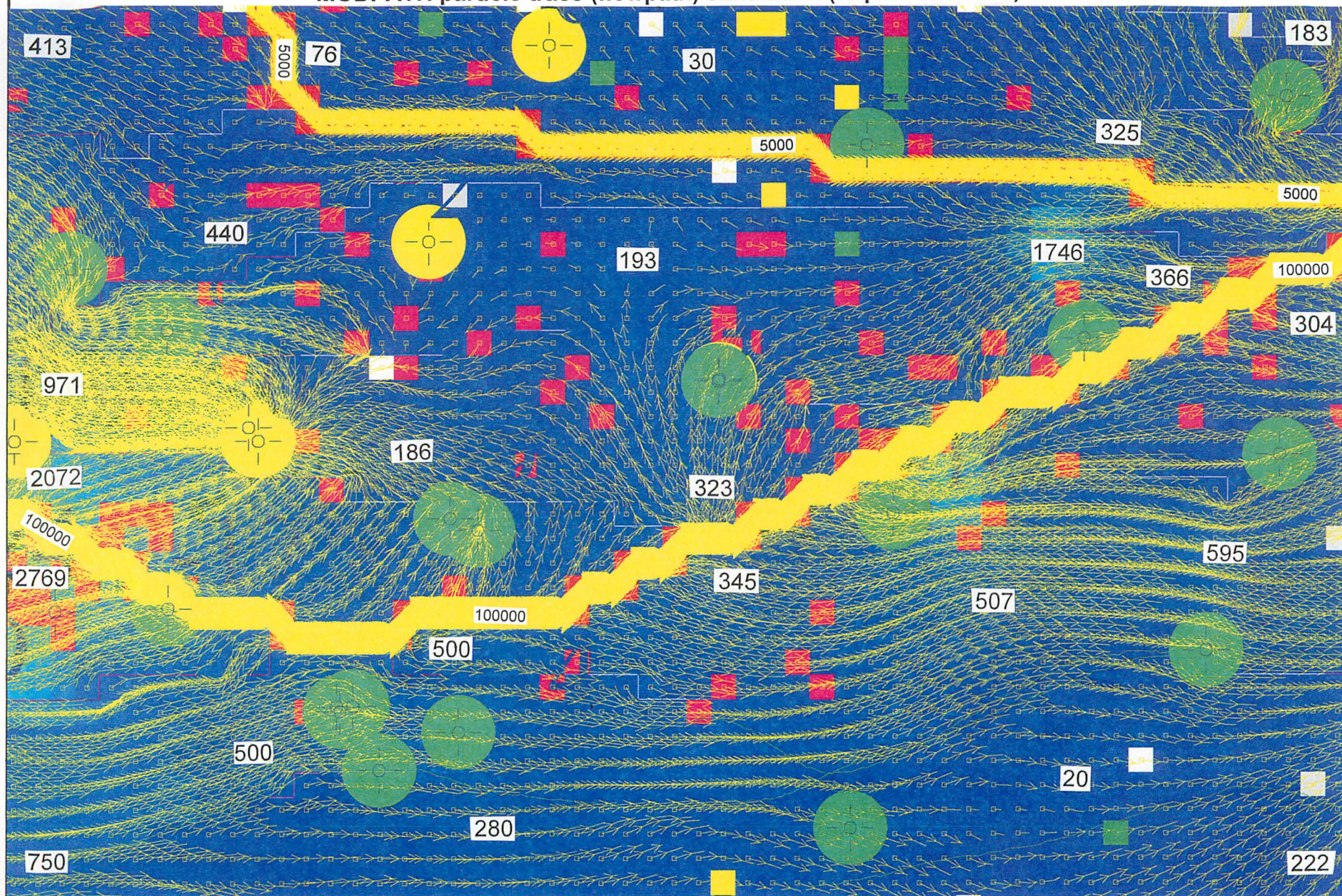


MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004

MODPATH particle trace (flowpath) simulation (September 1956)

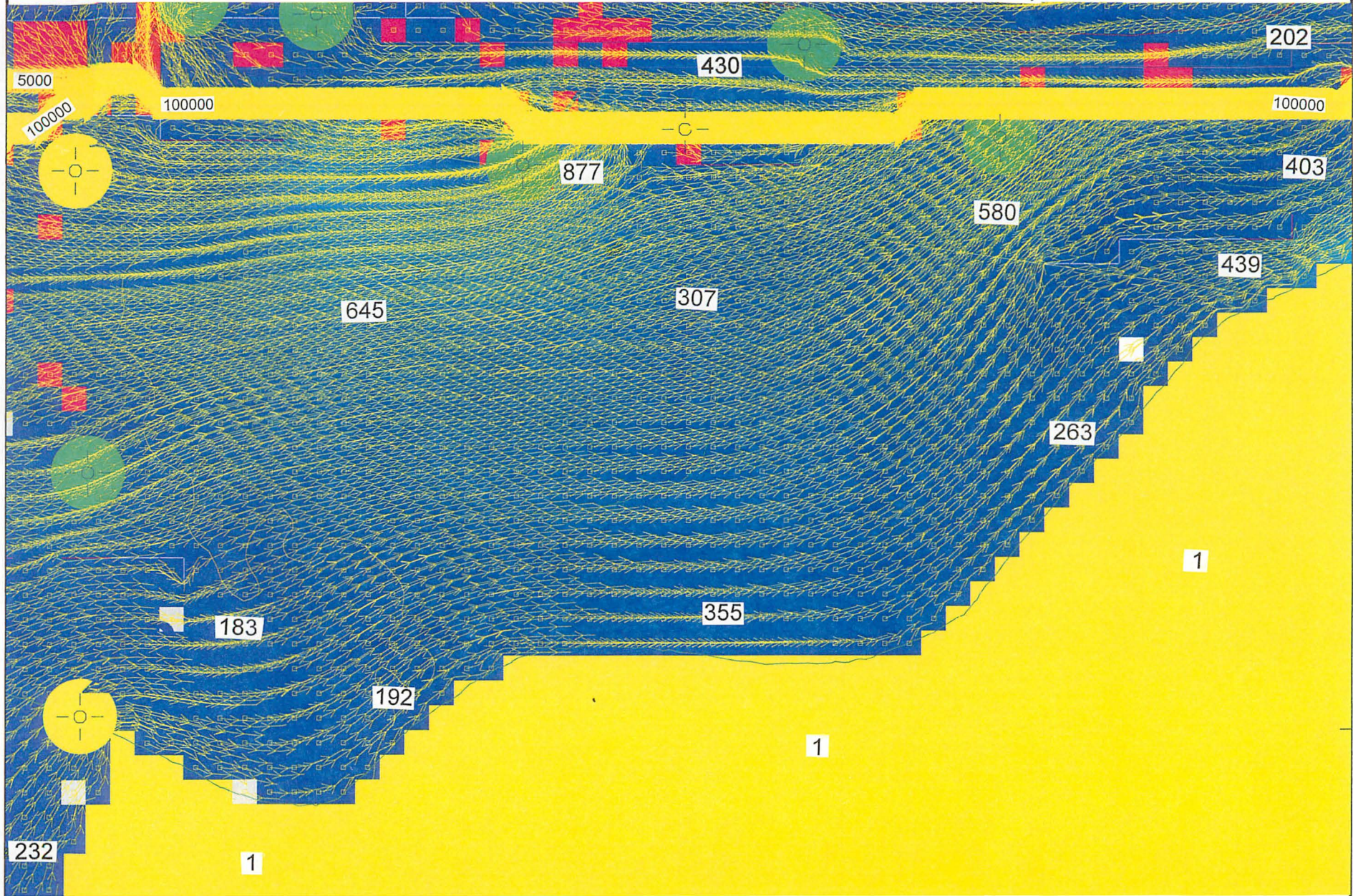


Source of Primary Data: Lindgren et al., 2004

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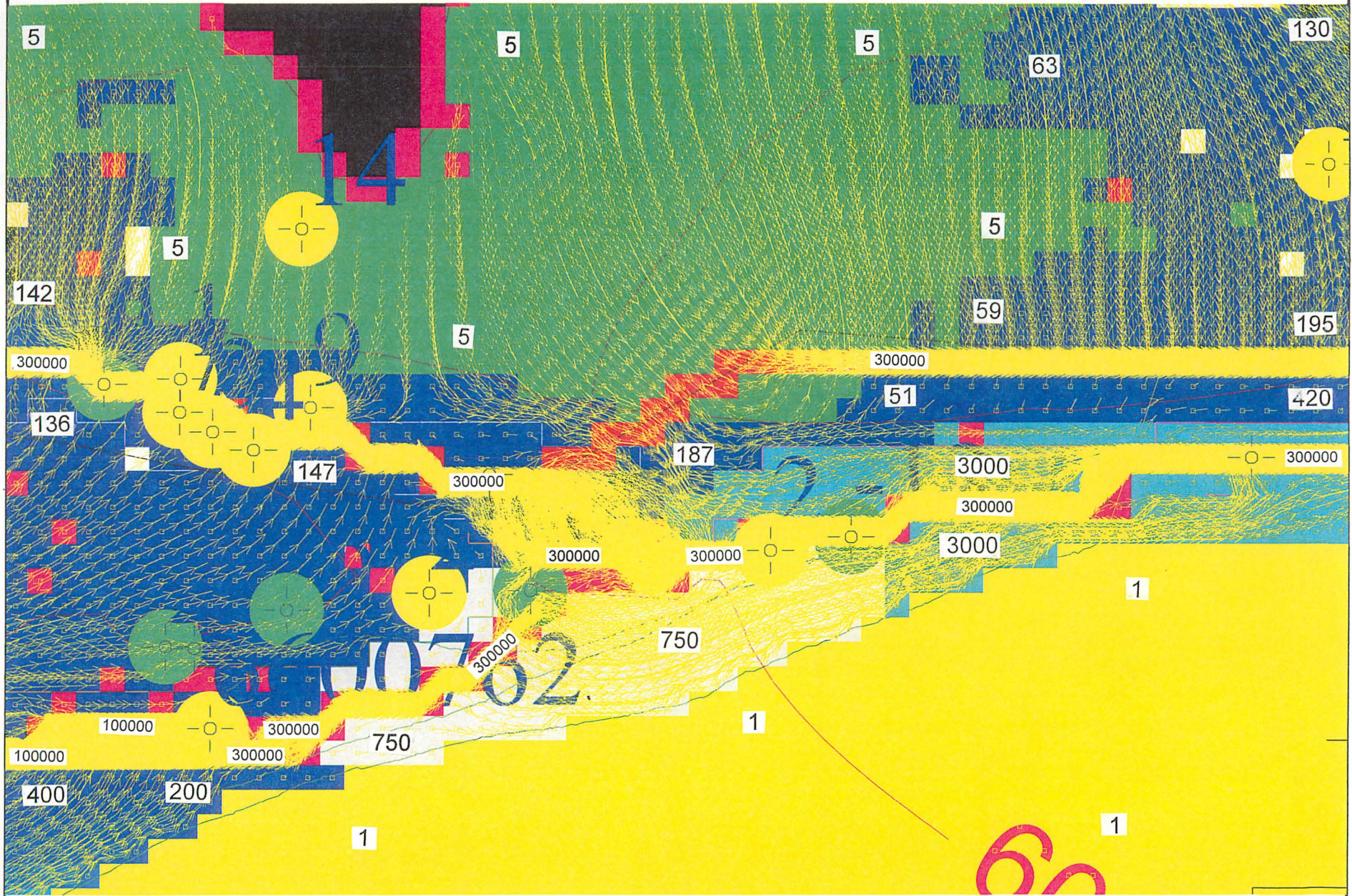
MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004

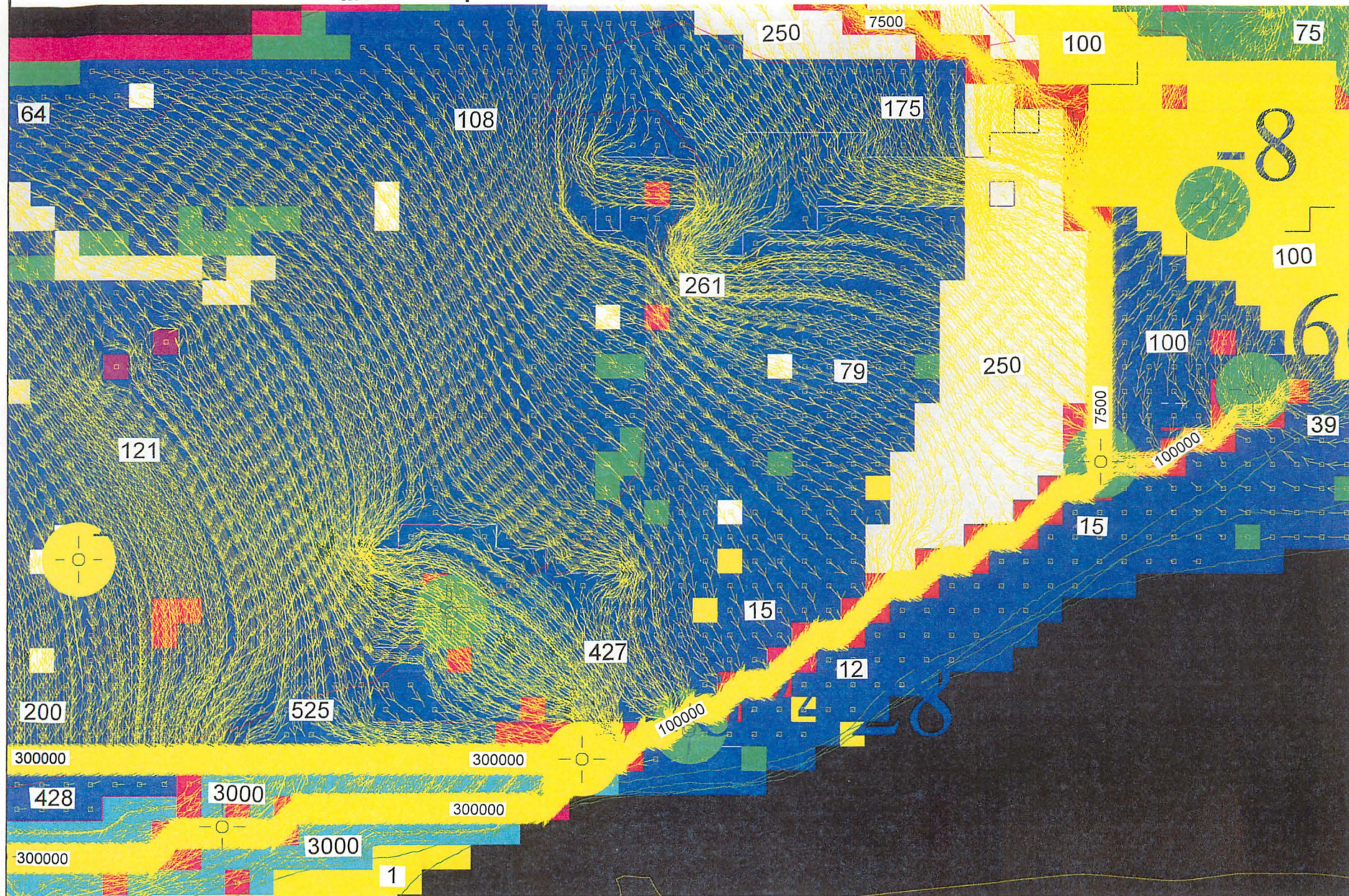


MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004

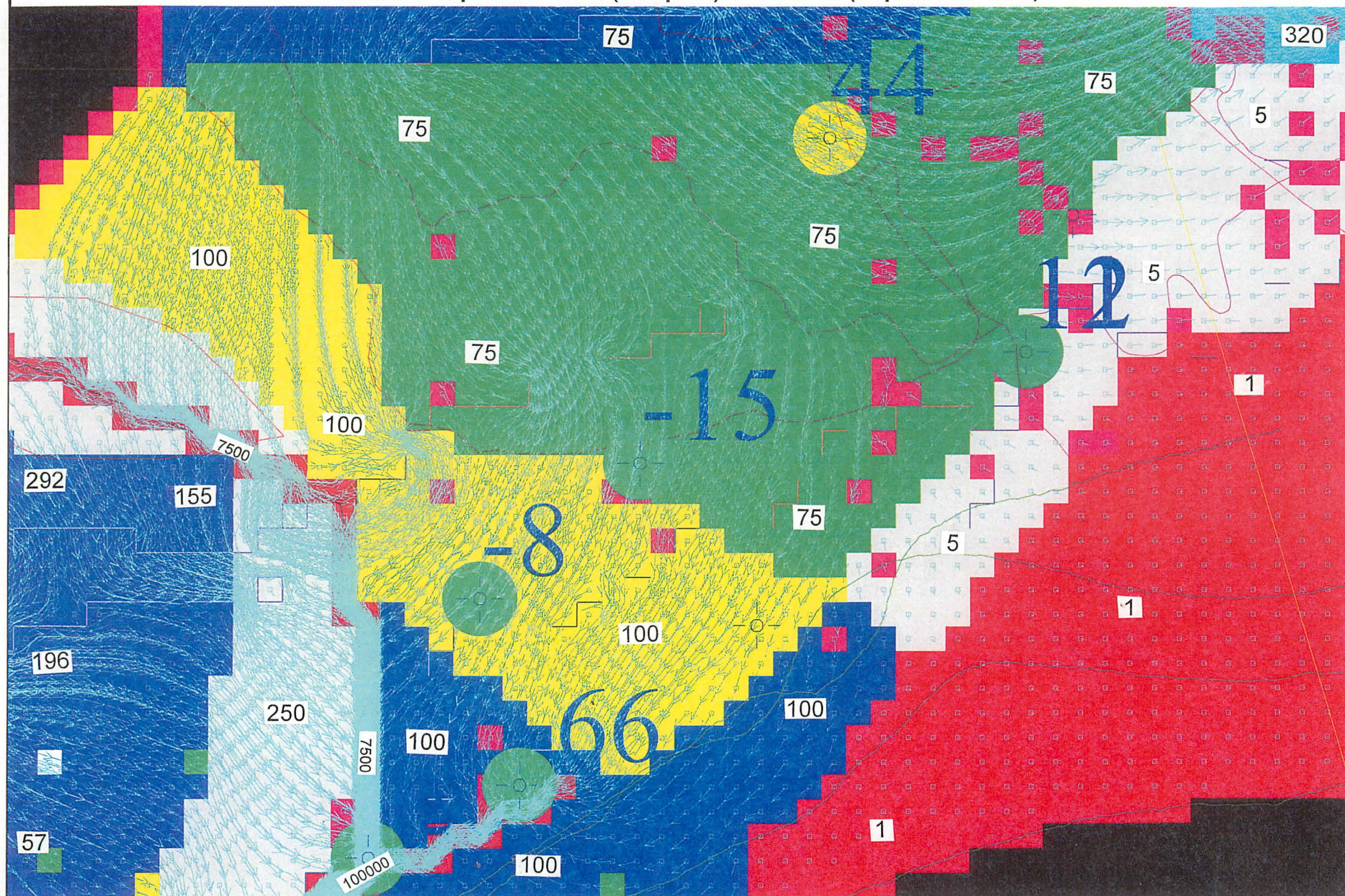
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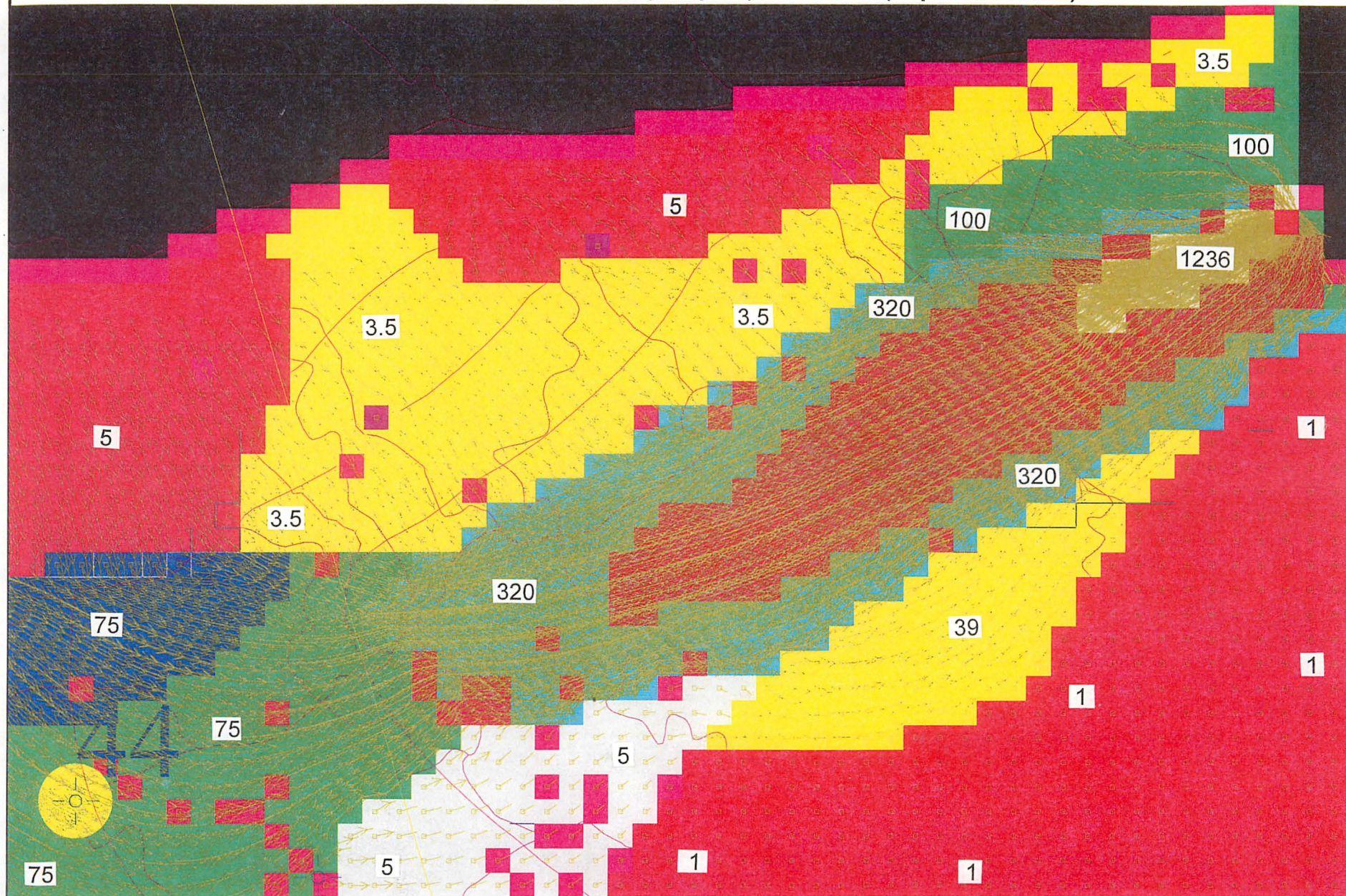


MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004

MODPATH particle trace (flowpath) simulation (September 1956)



Source of Primary Data: Lindgren et al., 2004



Explanation

Artesian Zone Boundary



Recharge Zone



County Boundaries



Water Level Residual

Simulated Above/Below Measured Values

-31



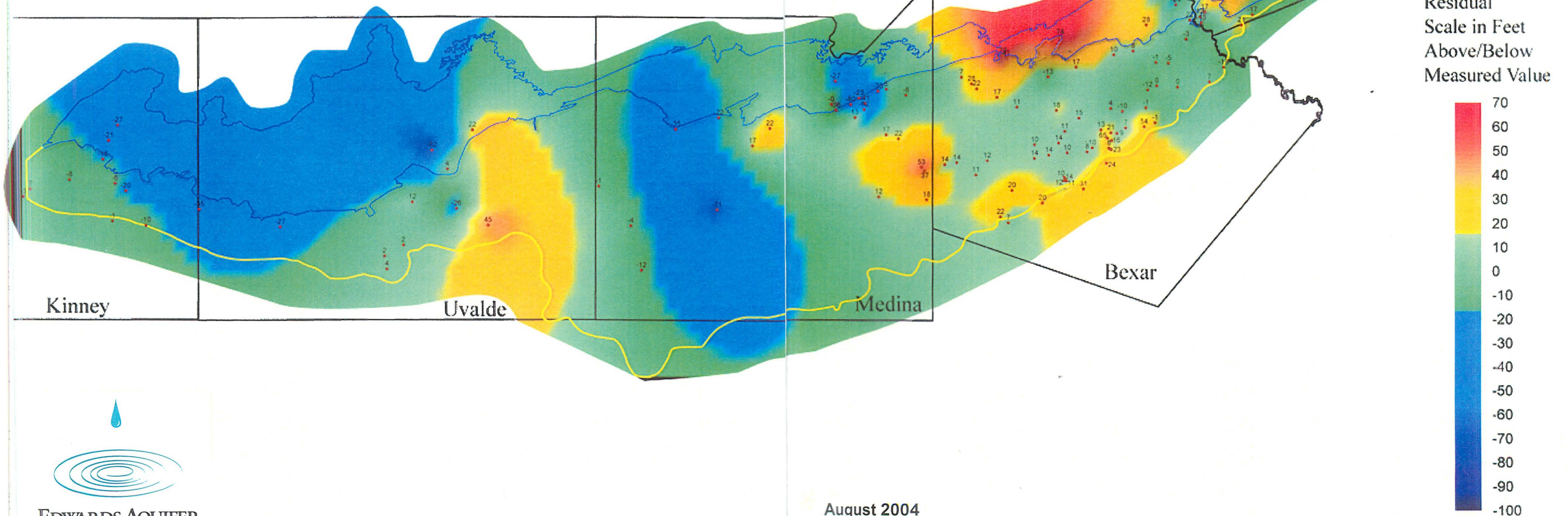
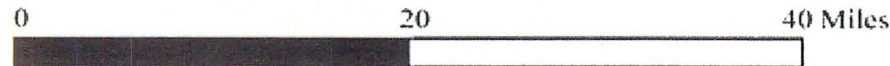
Data source: USGS 2004



Steady-state Water Level Residuals for the MODFLOW Edwards Aquifer Model (as of 5/4/04)

Mark Hamilton, P.G.
Ned Troshanov, P.G.

Approximate Scale



August 2004

Explanation

Artesian Zone Boundary



Recharge Zone



County Boundaries



Water Level Residual

Simulated Above/Below Measured Values

-31



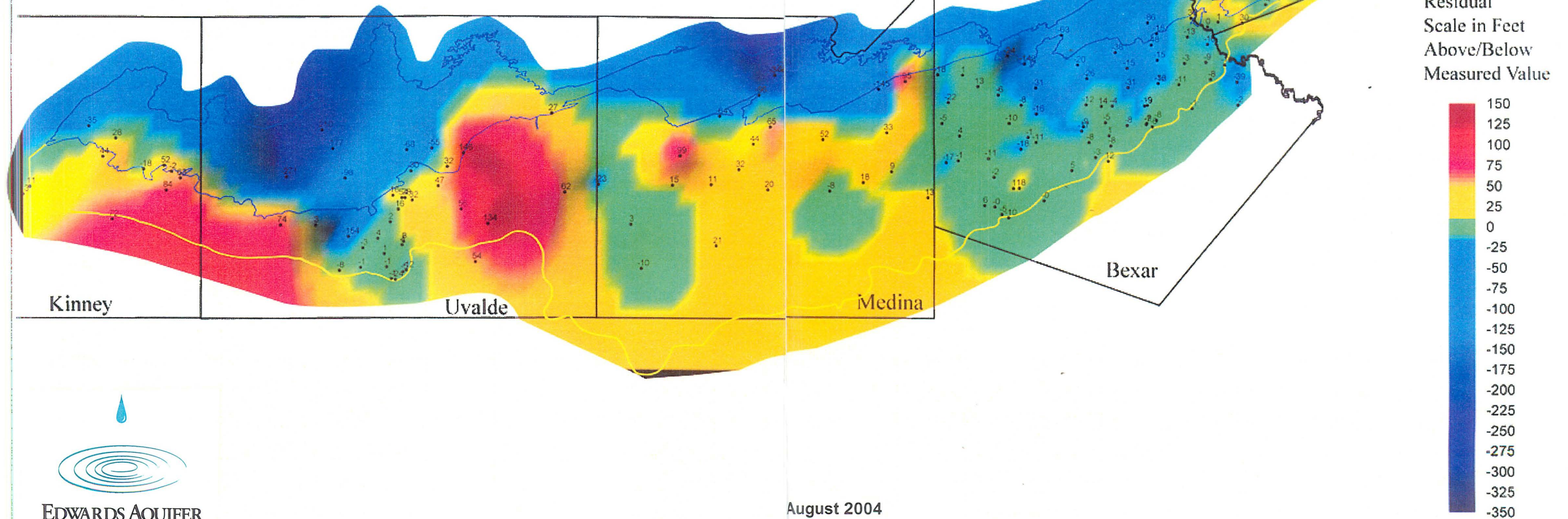
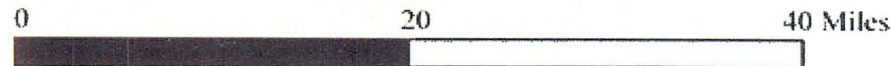
Data source: USGS 2004



Transient Simulation Water-level Residuals for Drought Conditions for the MODFLOW Edwards Aquifer Model (as of 5/4/04)

Mark Hamilton, P.G.
Ned Troshanov, P.G.

Approximate Scale



August 2004

Explanation

Artesian Zone Boundary



Recharge Zone



County Boundaries



Water Level Residual

Simulated Above/Below Measured Values

-31



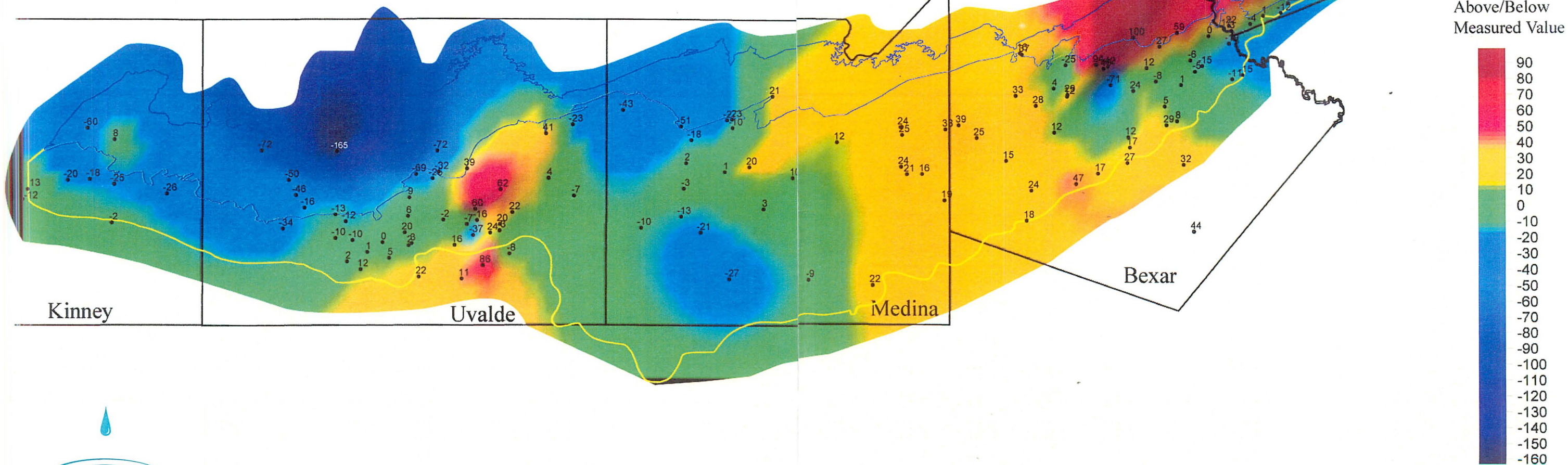
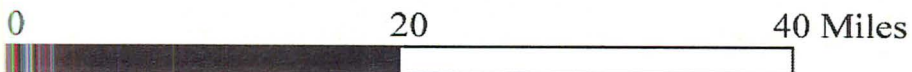
Data source: USGS 2004



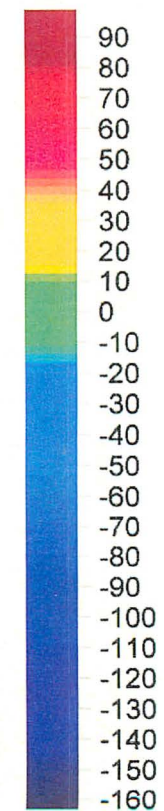
Transient Simulation Water-level Residuals
for Above Normal Precipitation and Recharge
Conditions for the
MODFLOW Edwards Aquifer Model
(as of 5/4/04)

Mark Hamilton, P.G.
Ned Troshanov, P.G.

Approximate Scale



Residual
Scale in Feet
Above/Below
Measured Value



EDWARDS AQUIFER
AUTHORITY

August 2004

Explanation

Artesian Zone Boundary



Recharge Zone



County Boundaries



Model RMSE (in Feet)

-31



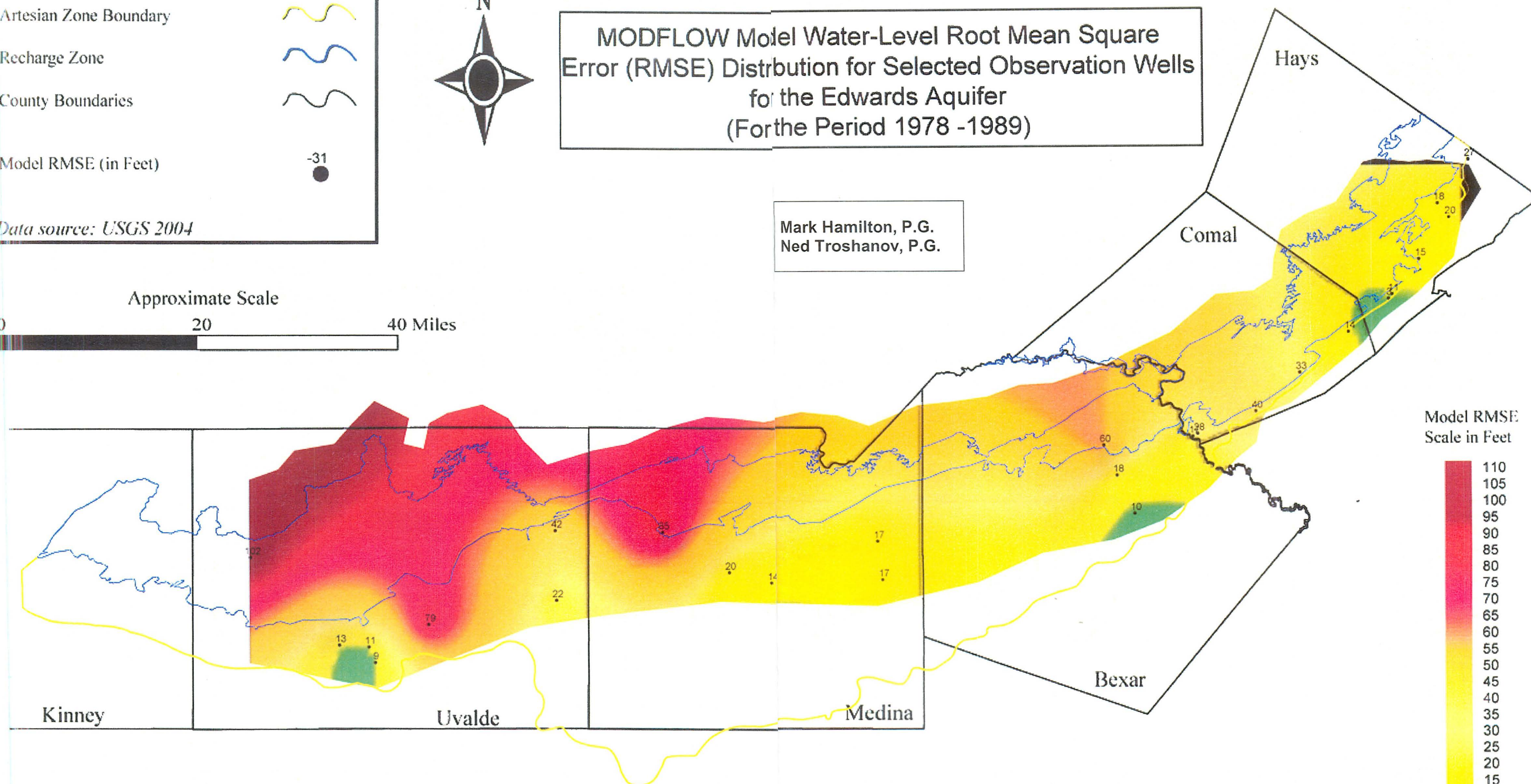
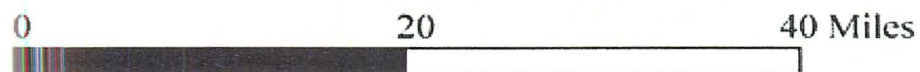
Data source: USGS 2004



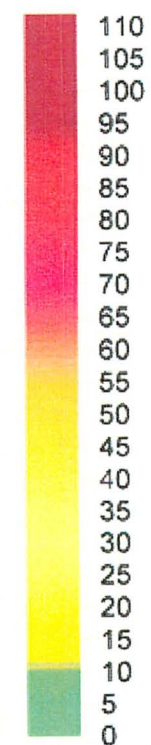
MODFLOW Model Water-Level Root Mean Square Error (RMSE) Distribution for Selected Observation Wells for the Edwards Aquifer (For the Period 1978 -1989)

Mark Hamilton, P.G.
Ned Troshanov, P.G.

Approximate Scale



Model RMSE
Scale in Feet



EDWARDS AQUIFER
AUTHORITY

August 2004

Explanation

Artesian Zone Boundary

Recharge Zone

County Boundaries

Model RMSE (in Feet)

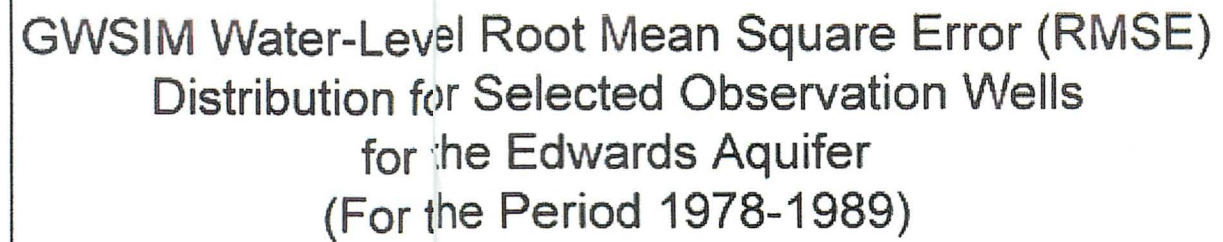
-31

Data source: USGS 2004



-31

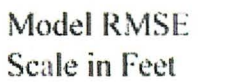
Data source: USGS 2004



Mark Hamilton, P.G.
Ned Troshanov, P.G.

Approximate Scale

0 20 40 Miles



August 2004

REFERENCES

Lindgren, R.J., Dutton, A.R., Hovorka, S.D., Worthington, S.R.H., Painter, S., 2004, Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas, Scientific Investigation Report 2004-5277, p.143 w/ illustr.

USGS (Lindgren, R.J., Dutton, A.R., Hovorka, S.D.), 2004, Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas, Second Draft Report, p. 215.