RECLAMATION

Managing Water in the West

Footsteps into Modeling

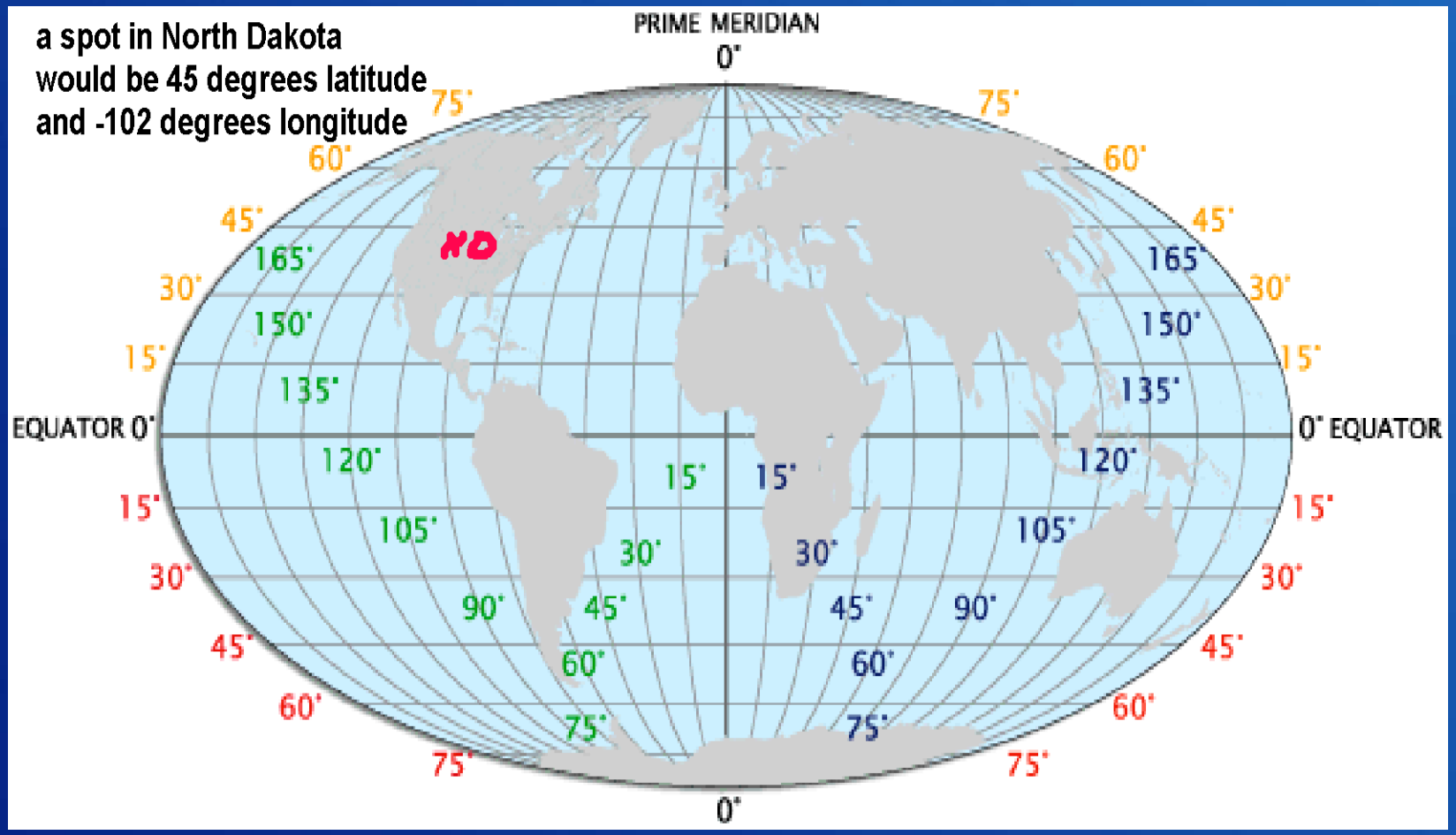
GPS data, DEM's, DLG's, Topos, Ortho Rectification, Contours, Grids, Tins

U.S. Department of the Interior
Bureau of Reclamation

GIS - geographic information system

Maps that are tied to real world coordinates

Every pixel in the map has a northing and an easting



GIS is ‘world’ not just ‘USA’

RECLAMATION

OLD DATA

GPS waypoints Text Files

- Points are often in several formats
- Data is missing from columns
- Sometimes the data is typed in wrong – the point just doesn’t exist in North America!

RECLAMATION

messy old tab-delimited file

```
owndate Owner   Wellnum Landnet Lat     Long    Station use     Depth   Aquifer qualdate        Parcode templab temp
xxxxx   "THOMPSON, LAWRENCE"    106N71w17DBAAR  NENWSES17T106NR71w      43.984717       -99.370833      435903099221701 Domestic        850     x       "sept16,
10s     40s     20s     20s     6s      7s      15s     8s      8n      7s      10s     5s              8n
        "KETCHEN, JOHN" 109N77w2BCABR   NESWNWS2T109NR77W       441645  1000435 441646100043301 -               211DKOT 6/11/1969       95      EC uSiemens
        "KETCHEN, JOHN" 109N77W2BCABR   NESWNWS2T109NR77W       441645  1000435 441646100043301 -               211DKOT 6/11/1969       900     Hardness mg/L
        "KETCHEN, JOHN" 109N77W2BCABR   NESWNWS2T109NR77W       441645  1000435 441646100043301 -               211DKOT 6/11/1969       940     Cl(mg/L)
10/1/1969       USGS    109N76W6BCBCR   NWSWNWS6T109NR76W       441635  1000120 441637100012001 Unused
3/23/1971       USPHS   109N77W1ACR     SWNES1T109NR77W 441640  1000150 441635100014501 Unused
10-Jun-69       USCE    107N72W26CDCBR  SWSESWS26T107NR72W      44.037500       -99.440278      440213099262701 Public Supply   9999    111ALVM "june10,69"
00-00-1964      "THOMPSON, BILL"        109N77W2ADDDR   SESENES2T109NR77W       441630  1000237 441630100023701 Stock   35      111ALVM 6/12/1969       95
00-00-1964      "THOMPSON, BILL"        109N77W2ADDDR   SESENES2T109NR77W       441630  1000237 441630100023701 Stock   35      111ALVM 6/12/1969       900
00-00-1964      "THOMPSON, BILL"        109N77W2ADDDR   SESENES2T109NR77W       441630  1000237 441630100023701 Stock   35      111ALVM 6/12/1969       940
10/1/1969       USGS    109N77W1BDCCR   SWSENWS1T109NR77W       441630  1000215 441630100021601 Unused
9/4/1968        USGS    109N76W11CAABR  NENESWS11T109NR76W      441535  995605  441534099560501 Unused
10-Jun-69       "SCHAEFER, LEROY"       107N74W8CAAAR   NENESWS8T107NR74W       44.086111       -99.736111      440510099441001 Domestic        65      111ALVM
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W10DBDAR  SENWSES10T109NR76W      441530  995655  441529099565501 Unused          6/18/1956       95
1/1/1969        "CLARK, C"      109N76W13BBBB2R NWNWNWS13T109NR76W      441510  995520  441510099552202 -       80
00-00-1953      "WHITE, LILLIAN"        107N74W5ABCBR   SWNWNES5T107NR74W       44.105556       -99.734722      440620099440301 Domestic        9999    111ALVM
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13BBBBR  NWNWNWS13T109NR76W      441510  995522  441510099552201 Stock   80      111ALVM 6/11/1969       95
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13BBBBR  NWNWNWS13T109NR76W      441510  995522  441510099552201 Stock   80      111ALVM 6/11/1969       900
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13BBBBR  NWNWNWS13T109NR76W      441510  995522  441510099552201 Stock   80      111ALVM 6/11/1969       940
9/4/1968        USGS    109N76W14BAACR  NENENWS14T109NR76W      441505  995605  441505099560501 Unused
9/4/1968        USGS    109N76W15AADCR  SENENES15T109NR76W      441500  995640  441459099564101 Unused
00-00-1967      "DORMAN, KEITH" 107N75W30CBBD2R NWNWSWS30T107NR75W      44.043056       -99.884722      440235099530502 Stock   1470    211DKOT "june18,69"
06-00-1956      "CLARK, C"      109N76W14AACCR  SWNENES14T109NR76W      441500  995540  441459099553901 -       1000            06-00-1956      95      EC uSiem
9/5/1968        USGS    109N76W15BCBAR  NWSWNWS15T109NR76W      441455  995745  441453099574501 Unused
00-00-1945      "LARSON, WALTER"        106N72W31BBBBR  NWNWNWS31T106NR72W      43.948611       -99.525000      435659099313601 Domestic        1300    211DKOT
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W16ACDBR  SESWNES16T109NR76W      441450  995810  441449099581001 Unused  1000    211DKOT
9/4/1968        USGS    109N76W13ACBBR  NWSWNES13T109NR76W      441455  995445  441455099542501 Unused
00-00-1964      "THOMPSON, J"   108N73W10BBBBR  NWNWNWS10T108NR73W      44.180000       -99.584444      441048099350401 Domestic        47      111ALVM "june18,
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W16ACDB2R SESWNES16T109NR76W      441448  995812  441448099581201 Stock   1000    211GRNR
00-00-1945      "ALLEN, GUS"    107N75W7ADDBR   SESENES7T107NR75W       44.087500       -99.866667      440516099520201 Unused  1400    211DKOT "june11,69"
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13ACCCR  SWSWNES13T109NR76W      441445  995445  441446099544401 Unused  80      110ALVM 6/11/1969       95
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13ACCCR  SWSWNES13T109NR76W      441445  995445  441446099544401 Unused  80      110ALVM 6/11/1969       400
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13ACCCR  SWSWNES13T109NR76W      441445  995445  441446099544401 Unused  80      110ALVM 6/11/1969       900
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W13ACCCR  SWSWNES13T109NR76W      441445  995445  441446099544401 Unused  80      110ALVM 6/11/1969       940
00-00-1961      "THOMPSON, W"   109N77W14CDDDR   SESESWS14T109NR77W      441420  1000315 441420100031501 Stock   1400    211DKOT
9/4/1968        USGS    109N76W14DDDDR  SESESES14T109NR76W      441420  995525  441420099552501 Unused
9/4/1968        USGS    109N76W13CDCCR  SWSESWS13T109NR76W      441420  995500  441420099550201 Unused
6/12/1969       SCHOOL  109N76W23AAAAR  NENENES23T109NR76W      441415  995525  441417099552401 Unused          6/12/1969       95      EC uSiemens
6/12/1969       SCHOOL  109N76W23AAAAR  NENENES23T109NR76W      441415  995525  441417099552401 Unused          6/12/1969       900     Hardness mg/L
6/12/1969       SCHOOL  109N76W23AAAAR  NENENES23T109NR76W      441415  995525  441417099552401 Unused          6/12/1969       940     Cl(mg/L)
11-Jun-69       "CLARK, C"      109N76W13BBBBR  NWNWNWS13T109NR76W      44.252777       -99.922778      441510099552201 Stock   80      111ALVM "june11,69"
6/12/1969       "DURKIN, SALLY" 109N76W24BADR   SENENWS24T109NR76W      441410  995450  441409099545001 Unused  80      111ALVM 6/12/1969       95      EC uSiem
6/12/1969       "DURKIN, SALLY" 109N76W24BADR   SENENWS24T109NR76W      441410  995450  441409099545001 Unused  80      111ALVM 6/12/1969       900     Hardness
6/12/1969       "DURKIN, SALLY" 109N76W24BADR   SENENWS24T109NR76W      441410  995450  441409099545001 Unused  80      111ALVM 6/12/1969       940     Cl(mg/L)
00-00-1962      "CLARK, C"      109N76W26ABACR  NENWNES26T109NR76W      441355  995545  441357099554701 Stock   70      111ALVM 6/11/1969       95      EC uSiem
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ABACR  NENWNES26T109NR76W      441355  995545  441357099554701 Stock   70      111ALVM 6/11/1969       400
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ABACR  NENWNES26T109NR76W      441355  995545  441357099554701 Stock   70      111ALVM 6/11/1969       900
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ABACR  NENWNES26T109NR76W      441355  995545  441357099554701 Stock   70      111ALVM 6/11/1969       940
9/4/1968        USGS    109N76W23ACDBR  SESWNES23T109NR76W      441456  995547  441356099554701 Unused
00-00-1964      "THOMPSON, BILL"        109N77W2ADDDR   SESENES2T109NR77W       44.163000       -100.043611     441630100023701 Stock   35      111ALVM "june12,
00-00-1959      "DURKIN, BETTY" 109N76W14CCCR   SWSWSWS14T109NR76W      441330  995645  441329100012101 Stock   1090    211DKOT 6/12/1969       95      EC uSiem
00-00-1959      "DURKIN, BETTY" 109N76W14CCCR   SWSWSWS14T109NR76W      441330  995645  441329100012101 Stock   1090    211DKOT 6/12/1969       900     Hardness
00-00-1959      "DURKIN, BETTY" 109N76W14CCCR   SWSWSWS14T109NR76W      441330  995645  441329100012101 Stock   1090    211DKOT 6/12/1969       940     Cl(mg/L)
9/3/1968        USGS    109N76W26BBDDR  SENWNWS26T109NR76W      441315  995620  441316099562001 Unused
9/4/1968        USGS    109N76W26ABDDR  SENWNES26T109NR76W      441315  995545  441315099554601 Unused
23-Jun-64       USCE    107N74W3CBCBR   SWNWSWS3T107NR74W       44.098611       -99.704167      440555099421701 Public Supply   22      111ALVM "june9,69"
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26BDBDR  NWSENWS26T109NR76W      441310  995610  441308099561101 Stock   1000    211DKOT 6/11/1969       95
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26BDBDR  NWSENWS26T109NR76W      441310  995610  441308099561101 Stock   1000    211DKOT 6/11/1969       900
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26BDBDR  NWSENWS26T109NR76W      441310  995610  441308099561101 Stock   1000    211DKOT 6/11/1969       940
11-Jun-69       "CLARK, C"      109N76W13ACCCR  SWSWNES13T109NR76W      44.245833       -99.912500      441446099544401 Unused  80      110ALVM "june11,69"
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ACCBR  SWSWNES26T109NR76W      441305  995555  441305099555701 Unused  900     211GRNR 6/11/1969       95
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ACCBR  SWSWNES26T109NR76W      441305  995555  441305099555701 Unused  900     211GRNR 6/11/1969       900
00-00-1975      "LOWERBRULE, SIOUXTR"   109N76W26ACCBR  SWSWNES26T109NR76W      441305  995555  441305099555701 Unused  900     211GRNR 6/11/1969       940
10/24/1967      USGS    108N73W5BAABR   NENENWS5T108NR73W       441140  993625  441140099362601 Unused
3/16/1971       "GRASSROPE, MATTHEW"    108N73W6BBR     NWNWS6T108NR73W 441140  993830  441135099383401 Unused          110ALVM
5/25/1967       BR      108N73W5BCBC2R  NWSWNWS5T108NR73W       441125  993730  441123099373002 Unused
5/25/1967       BR      108N73W5BCBCR   NWSWNWS5T108NR73W       441125  993730  441123099373001 Unused
00-00-1962      "LANGDEAU, LLOYD"       108N76W9BBABR   NENWNWS9T108NR76W       441050  995740  441048099574201 Stock
12-Jun-69       "DURKIN, SALLY" 109N76W24BADR   SENENWS24T109NR76W      44.236111       -99.913889      441409099545001 Unused  80      111ALVM "june12,69"
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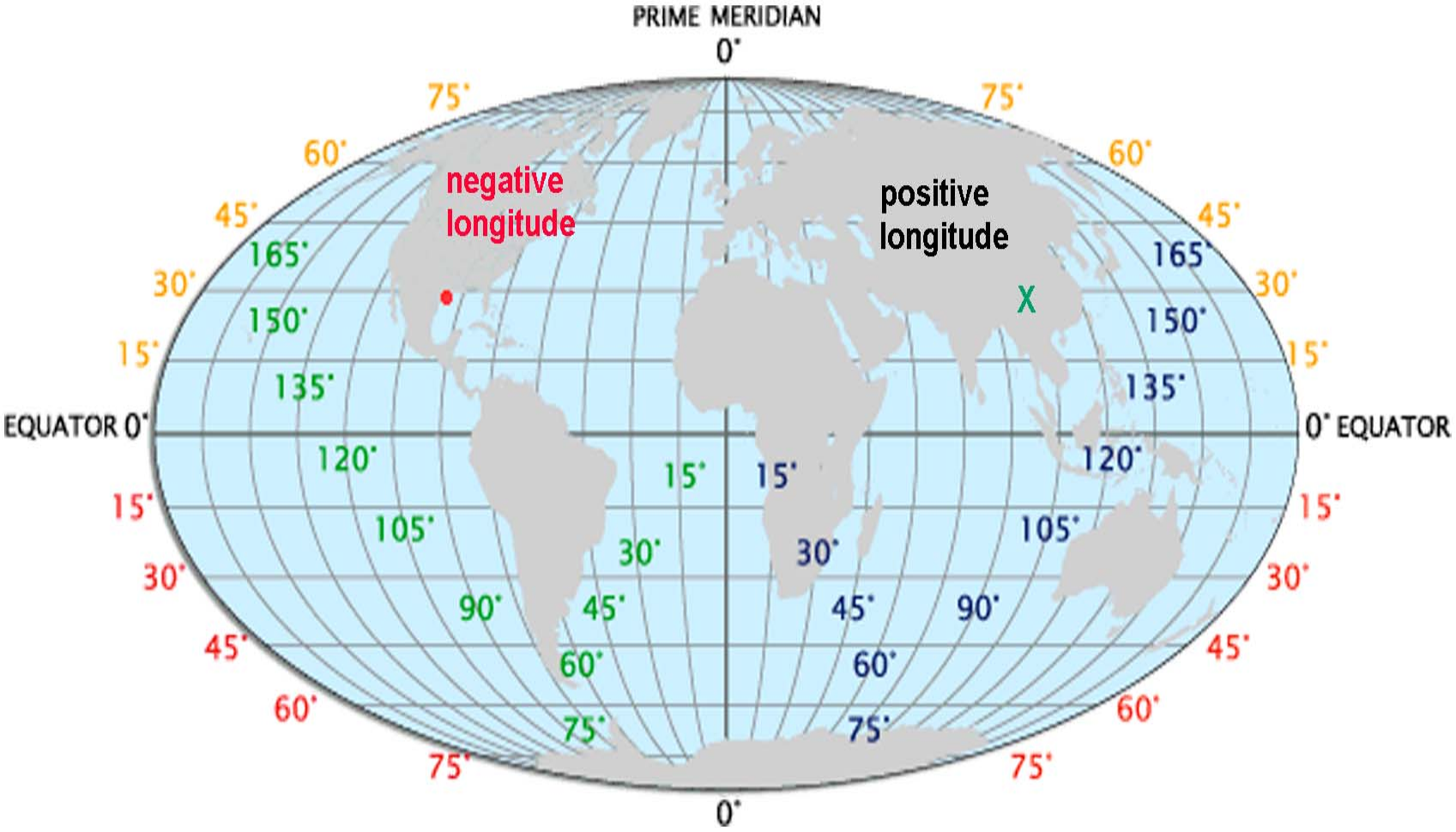
Since time and distance measurements for sailing began in

England

areas west of the Prime Meridian have a negative longitude



RECLAMATION

Change the file type from text to EXCEL

Get the columns straightened out.

Change numbers to the same format –

- **Pay attention to number of decimals**
- **Pay attention to negative and positive Longitudes**

DON’T USE FORMULAS!

RECLAMATION

	Name Box	A	B	C	D	E	F	G	H	I	J	K	L
1	Owner		Wellnum	Landnet	Lat	Long	Station	use	Depth	Aquifer	qualdate	Parcode	Celcius
2	THOMPSON	LAWRENCE	106N71W17DBAAR	NENWSES17T106NR71W	43.984717	-99.370833	435903099221701	Domestic	850	2x	sept16 92	10	7.0
3	USCE		107N72W26CDCBR	SWSESWS26T107NR72W	44.037500	-99.440278	440213099262701	Public Supply	9999	111ALVM	june10 69	10	8.9
4	SCHAEFER	LEROY	107N74W8CAAAR	NENESWS8T107NR74W	44.086111	-99.736111	440510099441001	Domestic	65	111ALVM	june10 69	10	9.4
5	WHITE	LILLIAN	107N74W5ABCBR	SWNWNES5T107NR74W	44.105556	-99.734722	440620099440301	Domestic	9999	111ALVM	june10 69	10	10.0
6	DORMAN	KEITH	107N75W30CBBD2R	NWNWSWS30T107NR75W	44.043056	-99.884722	440235099530502	Stock	1470	211DKOT	june18 69	10	10.0
7	LARSON	WALTER	106N72W31BBBBR	NWNWNWS31T106NR72W	43.948611	-99.525000	435659099313601	Domestic	1300	211DKOT	aug10 61	10	10.0
8	THOMPSON	J	108N73W10BBBBR	NWNWNWS10T108NR73W	44.180000	-99.584444	441048099350401	Domestic	47	111ALVM	june18 69	10	10.6
9	ALLEN	GUS	107N75W7ADDBR	SESENES7T107NR75W	44.087500	-99.866667	440516099520201	Unused	1400	211DKOT	june11 69	10	10.6
10	CLARK	C	109N76W13BBBBR	NWNWNWS13T109NR76W	44.252777	-99.922778	441510099552201	Stock	80	111ALVM	june11 69	10	11.5
11	THOMPSON	BILL	109N77W2ADDDR	SESENES2T109NR77W	44.163000	-100.043611	441630100023701	Stock	35	111ALVM	june12 69	10	11.7
12	USCE		107N74W3CBCBR	SWNWSWS3T107NR74W	44.098611	-99.704167	440555099421701	Public Supply	22	111ALVM	june9 69	10	11.7
13	CLARK	C	109N76W13ACCCR	SWSWNES13T109NR76W	44.245833	-99.912500	441446099544401	Unused	80	110ALVM	june11 69	10	12.0
14	DURKIN	SALLY	109N76W24BADR	SENENWS24T109NR76W	44.236111	-99.913889	441409099545001	Unused	80	111ALVM	june12 69	10	12.0
15	ESTES	ANDREW	107N74W11AACBR	SWNENES11T107NR74W	44.091666	-99.668056	440529099400701	Unused	120	211PIRR	june11 69	10	12.8
16	GIFFORD	DALLAS	107N77W13DAABR(2)	NENESES13T107NR77W	44.071667	-100.006389	440418100002301	nolist	1300	2x	june18 69	10	12.8
17	MELLGARD		107N75W11CAAR	NENESWS11T107NR75W	44.086111	-99.795833	440509099474601	Domestic	1400	211DKOT	june12 69	10	13.3
18	DORMAN	B	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	13.9
19	LANGDEAU	LLOYD	108N76W8AABCR	SWNWNES8T108NR76W	44.179167	-99.969444	441045099580901	Domestic	1550	211DKOT	july17 92	10	14.5
20	LANGDEAU	LESLIEN	108N77W35DBADR	NENWSES35T108NR77W	44.113889	-100.031944	440730099350901	Unused	9999	2x	june23 70	10	14.5
21	JANDREAU	FAY	107N75W11CAAR	NENESWS11T107NR75W	44.086111	-99.795833	440509099474601	Domestic	1400	211DKOT	july16 69	10	14.6
22	SMITH SMITH	WAYNE	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	14.8
23	SMITH	W[illegible]NE	107N75W29CCDBR	NWSESWS29T107NR75W	44.037500	-99.866667	440215099520001	Domestic	9999	211DKOT	july20 92	10	15.0
24	BUNKER	[illegible]	106N72W21CADCR	SENESWS21T106NR72W	43.9706[illegible]	-99.479167	435815099284501	Domestic	9999	211DKOT	aug10 92	10	15.5
25	BRULE CA[illegible]	[illegible]	106N71W30BBCDR	SWNWNWS30T106NR71W	43.[illegible]597	-99.401389	435735099240501	Unused	973	211DKOT	aug15 61	10	16.0
26	HUSTON	[illegible]	107N76W26CCCCR	SWSWSWS26T107NR76W	[illegible]036[illegible]	-99.925000	440209099552901	Stock	1440	211DKOT	june01 69	10	16.1
27	FARR	AR[illegible]	10[illegible]W1AAAAR	NENENES1T107NR75W	[illegible]069	-99.765278	440626099455701	Stock	1000	211GRNR	aug01 69	10	16.2
28	CHRISTEN[illegible]	EA[illegible]	[illegible]BCA[illegible]AR	NENESWS8T1[illegible]	[illegible]086[illegible]	-99.736111	440510099441001	Domestic	65	111ALVM	aug6 92	10	16.5
29	WILMOT	[illegible]	[illegible]5B[illegible]	S[illegible]WNWS26[illegible]	[illegible]569	-99.444444	445724099264001	Stock	1360	211DKOT	aug10 92	10	16.5
30	BOLMAN	[illegible]ODO	7[illegible]C	N[illegible]SWS30T[illegible]R71	[illegible]559	-99.398611	435719099235601	Domestic	946	211DKOT	aug13 92	10	16.5
31	TAYLOR	[illegible]	7[illegible]B	S[illegible]WNWS3T[illegible]R77W	[illegible]0180	-100.061111	440105100033901	Stock	1470	211DKOT	june18 69	10	16.6
32	THOMPSO[illegible]	[illegible]DY	72[illegible]A	S[illegible]NES25T[illegible]R72W	[illegible]861	-99.406944	435738099242501	nolist	9999	211DKOT	may31 56	10	16.7
33	BUNKER	[illegible]	72W33A	S[illegible]06NR72W	[illegible]427	-99.477778	435634099284001	Domestic	1280	211DKOT	aug11 92	10	17.0
34	KARLEN	[illegible]LL	73W8AA	S[illegible]NES8T1[illegible]W	[illegible]0930	-99.609722	440533099363701	Stock	1220	211DKOT	aug17 61	10	17.2
35	GOURNEA	[illegible]YD	73W23C[illegible]R	S[illegible]SWS22T[illegible]R73	[illegible]0513	-99.581944	440307099345501	Domestic	9999	2x	july24 92	10	17.5
36	KELLER	N[illegible]	75[illegible]B[illegible]R	S[illegible]NWS36T[illegible]R75	[illegible]168	-99.779167	440700099464401	Stock	9999	2x	june23 70	10	17.6
37	THOMPSO[illegible]	[illegible]FW	72[illegible]A[illegible]R	N[illegible]NES25T[illegible]R72W	[illegible]569	-99.408333	435723099243201	nolist	9999	2x	may31 56	10	17.9
38	LANGDEA[illegible]	[illegible]	7[illegible]D	S[illegible]T108[illegible]W	[illegible]527	-99.947222	440911099565201	Unused	980	211GRNR	aug25 61	10	18.2
39	BRAKKE	[illegible]REV	[illegible]2C	N[illegible]WS22T[illegible]R77	[illegible]319	-100.019444	440823100033201	Stock	9999	2x	june19 69	10	18.3
40	NESS	BA[illegible]	1[illegible]25DABBR	NWNESES25T[illegible]R77W	[illegible]	-100.009722	440746100003501	Domestic	1300	211DKOT	july8 92	10	18.3
41	THOMPSO[illegible]		108N73W9AAAA3R	NENENES9T108NR73W	[illegible]	-99.587500	441047099350903	nolist	800	211GRRS	aug15 61	10	18.9
42	BLUM	BA[illegible]	105N71W5CBACR	NENWSWS5T105NR71W	[illegible]	-99.381944	435532099225601	Unused	9999	2x	may01 69	10	18.9
43	BUNKER	[illegible]	106N72W28BDDD2R	SENWS28T106NR72W	43.9[illegible]	-99.468056	435725099280701	Domestic	1440	211DKOT	aug10 92	10	19.0
44	GANDT	V[illegible]	108N76W21DCADR	NESWSES21T108NR76W	44.138[illegible]	-99.951389	440821099570501	Domestic	1000	211DKOT	july2 92	10	19.5
45	LANGDEA[illegible]	CHARLES	108N76W21CCCDR	SWSWSWS21T108NR76W	44.138889	-99.965278	440818099575401	Domestic	1200	211DKOT	july8 92	10	20.0
46	BLUM	BART	105N71W5CCBAR	NWSWSWS5T105NR71W	43.922222	-99.383333	435522099230101	nolist	9999	2x	aug01 61	10	20.0
47	CLARK	CORNELIUS	109N76W10DBDAR	SENWSES10T109NR76W	44.258333	-99.948611	441529099565501	Unused	9999	2x	june18 56	10	21.0
48	CLARK	C	109N76W26BDBDR	NWSENWS26T109NR76W	44.219444	-99.936111	441308099561101	Stock	1000	211DKOT	june11 69	10	21.0
49	CLARK	C	109N76W26ACCBR	SWSWNES26T109NR76W	44.218056	-99.931944	441305099555701	Unused	900	211GRNR	june11 69	10	21.0
50	MIDDLETENT	PAULINE	108N76W30ABADR	SENENWS30T108NR76W	44.135000	-99.991667	440806099593001	Domestic	9999	2x	aug24 92	10	21.0
51	THOMPSON		108N74W1CABBR	NWNESWS1T108NR74W	44.187500	-99.659722	441114099393501	nolist	965	211DKOT	june01 69	10	21.1
52	THOMPSON		108N74W1CABBR	NWNESWS1T108NR74W	44.187500	-99.659722	441114099393501	nolist	965	211DKOT	aug15 61	10	21.1
53	CHRISTIAN		107N75W4ADCAR	SWSENES4T107NR75W	44.102778	-99.827778	440608099494101	Domestic	1330	211DKOT	aug21 61	10	21.1
54	CHRISTIAN		107N75W4ADCAR	SWSENES4T107NR75W	44.102778	-99.827778	440608099494101	Domestic	1330	211DKOT	july17 92	10	21.1
55	THOMPSON	J	108N73W17ADBCR	NWSENES17T108NR73W	44.161111	-99.611111	440939099363501	Stock	980	211DKOT	june 01 69	10	21.6

EXCELLENT

Clean the data

- Watch column format – 8 letter headers
- Put numbers or text into missing labels:

  use 9999 for any missing number,

  for any missing text use 2x

- One Complete Row in Excel will be attached to

  "one point" in the map

RECLAMATION

Data Attached to Points

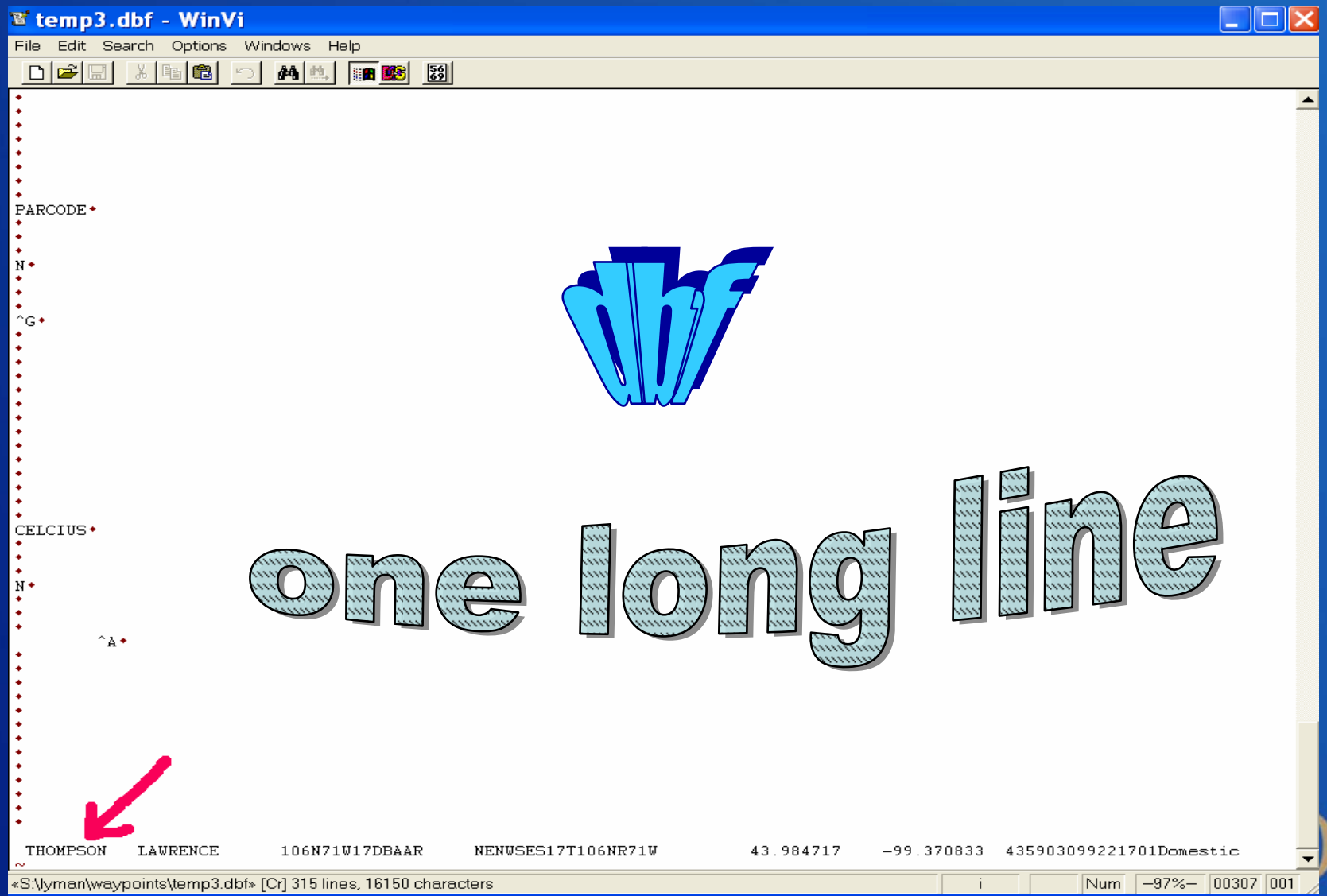
- There can be **NO** empty cells in EXCEL, if you are going to convert to a ‘dbf’ file
- The ‘dbf’ – database file format – will look like gooble-d-gook in windows
- All 1000 rows in the Excel file become **ONE** long, streaming data line in dbf
- The line is read in partitions - a missing cell will make every label ‘off’ after it.
- This is the labeling format for images

RECLAMATION

	Name Box A	B	C	D	E	F	G	H	I	J	K	L
1	Owner	Wellnum	Landnet	Lat	Long	Station	use	Depth	Aquifer	qualdate	Parcode	Celcius
2	THOMPSON LAWRENCE	106N71W17DBAAR	NENWSES17T106NR71W	43.984717	-99.370833	435903099221701	Domestic	850	2x	sept16 92	10	7.0
3	USCE	107N72W26CDCBR	SWSESWS26T107NR72W	44.037500	-99.440278	440213099262701	Public Supply	9999	111ALVM	june10 69	10	8.9
4	SCHAEFER LEROY	107N74W8CAAAR	NENESWS8T107NR74W	44.086111	-99.736111	440510099441001	Domestic	65	111ALVM	june10 69	10	9.4
5	WHITE LILLIAN	107N74W5ABCBR	SWNWNES5T107NR74W	44.105556	-99.734722	440620099440301	Domestic	9999	111ALVM	june10 69	10	10.0
6	DORMAN KEITH	107N75W30CBBD2R	NWNWSWS30T107NR75W	44.043056	-99.884722	440235099530502	Stock	1470	211DKOT	june18 69	10	10.0
7	LARSON WALTER	106N72W31BBBBR	NWNWNWS31T106NR72W	43.948611	-99.525000	435659099313601	Domestic	1300	211DKOT	aug10 61	10	10.0
8	THOMPSON J	108N73W10BBBBR	NWNWNWS10T108NR73W	44.180000	-99.584444	441048099350401	Domestic	47	111ALVM	june18 69	10	10.6
9	ALLEN GUS	107N75W7ADDBR	SESENES7T107NR75W	44.087500	-99.866667	440516099520201	Unused	1400	211DKOT	june11 69	10	10.6
10	CLARK C	109N76W13BBBBR	NWNWNWS13T109NR76W	44.252777	-99.922778	441510099552201	Stock	80	111ALVM	june11 69	10	11.5
11	THOMPSON BILL	109N77W2ADDDR	SESENES2T109NR77W	44.163000	-100.043611	441630100023701	Stock	35	111ALVM	june12 69	10	11.7
12	USCE	107N74W3CBCBR	SWNWSWS3T107NR74W	44.098611	-99.704167	440555099421701	Public Supply	22	111ALVM	june9 69	10	11.7
13	CLARK C	109N76W13ACCCR	SWSWNES13T109NR76W	44.245833	-99.912500	441446099544401	Unused	80	110ALVM	june11 69	10	12.0
14	DURKIN SALLY	109N76W24BADR	SENENWS24T109NR76W	44.236111	-99.913889	441409099545001	Unused	80	111ALVM	june12 69	10	12.0
15	ESTES ANDREW	107N74W11AACBR	SWNENES11T107NR74W	44.091666	-99.668056	440529099400701	Unused	120	211PIRR	june11 69	10	12.8
16	GIFFORD DALLAS	107N77W13DAABR(2)	NENESES13T107NR77W	44.071667	-100.006389	440418100002301	nolist	1300	2x	june18 69	10	12.8
17	MELLGARD	107N75W11CAAR	NENESWS11T107NR75W	44.086111	-99.795833	440509099474601	Domestic	1400	211DKOT	june12 69	10	13.3
18	DORMAN B	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	13.9
19	LANGDEAU LLOYD	108N76W8AABCR	SWNWNES8T108NR76W	44.179167	-99.969444	441045099580901	Domestic	1550	211DKOT	july17 92	10	14.5
20	LANGDEAU LESLIEN	108N77W35DBADR	NENWSES35T108NR77W	44.113889	-100.031944	440730099350901	Unused	9999	2x	june23 70	10	14.5
21	JANDREAU FAY	107N75W11CAAR	NENESWS11T107NR75W	44.086111	-99.795833	440509099474601	Domestic	1400	211DKOT	july16 69	10	14.6
22	SMITH SMITH WAYNE	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	14.8
23	SMITH WAYNE	107N75W29CCDBR	NWSESWS29T107NR75W	44.037500	-99.866667	440215099520001	Domestic	9999	211DKOT	july20 92	10	15.0
24	BUNKER DARYL	106N72W21CADCR	SENESWS21T106NR72W	43.970833	-99.479167	435815099284501	Domestic	9999	211DKOT	aug10 92	10	15.5
25	BRULE CATTL ECO	71W30BBCDR	SWNWNWS30T106NR7	43.959722	-99.401389	435735099240501	Unused	973	211DKOT	aug15 61	10	16.0
26	HUSTON R	W26CCCCR	SWSWSWS26T R7	44.036111	-99.925000	440209099552901	Stock	1440	211DKOT	june01 69	10	16.1
27	FARR ARCHIE		NENENE 6W	44.106944	-99.765278	440626099455701	Stock	1000	211GRNR	aug01 69	10	16.2
28	CHRISTENCE EARL	07	NESW 4W	44.086111	-99.736111	440510099441001	Domestic	65	111ALVM	aug6 92	10	16.5
29	WILMOT TOM	06	SWN 26 R7	43.956944	-99.444444	445724099264001	Stock	1360	211DKOT	aug10 92	10	16.5
30	BOLMAN THEODORE		NESW R7	43.955556	-99.398611	435719099235601	Domestic	946	211DKOT	aug13 92	10	16.5
31	TAYLOR CF	BDD	NWN 77	44.018056	-100.061111	440105100033901	Stock	1470	211DKOT	june18 69	10	16.6
32	THOMPSON FLOYD	06	NENE 5T 72	43.961111	-99.406944	435738099242501	nolist	9999	211DKOT	may31 56	10	16.7
33	BUNKER JOHN	06	06 72	43.942778	-99.477778	435634099284001	Domestic	1280	211DKOT	aug11 92	10	17.0
34	KARLEN MERRILL	07	SWNENE T1	44.093056	-99.609722	440533099363701	Stock	1220	211DKOT	aug17 61	10	17.2
35	GOURNEAU BOYD	7	22CCACR	SWNESWS22	44.051389	-99.581944	440307099345501	Domestic	9999	2x	july24 92	10	17.5
36	KELLER M	75W36BDCAR	SWSENWS36T108N	44.116666	-99.779167	440700099464401	Stock	9999	2x	june23 70	10	17.6
37	THOMPSON FW	06N72W25ADCDR	NESENES25T106NR72W	43.956944	-99.408333	435723099243201	nolist	9999	2x	may31 56	10	17.9
38	LANGDEAU L	108N76W16DDR	SESES16T108NR76W	44.152778	-99.947222	440911099565201	Unused	980	211GRNR	aug25 61	10	18.2
39	BRAKKE ANDREW	108N77W22CDBAR	NWSESWS22T108NR77W	44.131944	-100.019444	440823100033201	Stock	9999	2x	june19 69	10	18.3
40	NESS BAUNITA	108N77W25DABBR	NWNESES25T108NR77W	44.129167	-100.009722	440746100003501	Domestic	1300	211DKOT	july8 92	10	18.3
41	THOMPSON SW	108N73W9AAAA3R	NENENES9T108NR73W	44.179167	-99.587500	441047099350903	nolist	800	211GRRS	aug15 61	10	18.9
42	BLUM BART	105N71W5CBACR	NENWSWS5T105NR71W	43.925000	-99.381944	435532099225601	Unused	9999	2x	may01 69	10	18.9
43	BUNKER JOHN	106N72W28BDDD2R	SENWS28T106NR72W	43.956944	-99.468056	435725099280701	Domestic	1440	211DKOT	aug10 92	10	19.0
44	GANDT VERA	108N76W21DCADR	NESWSES21T108NR76W	44.138889	-99.951389	440821099570501	Domestic	1000	211DKOT	july2 92	10	19.5
45	LANGDEAU CHARLES	108N76W21CCCDR	SWSWSWS21T108NR76W	44.138889	-99.965278	440818099575401	Domestic	1200	211DKOT	july8 92	10	20.0
46	BLUM BART	105N71W5CCBAR	NWSWSWS5T105NR71W	43.922222	-99.383333	435522099230101	nolist	9999	2x	aug01 61	10	20.0
47	CLARK CORNELIUS	109N76W10DBDAR	SENWSES10T109NR76W	44.258333	-99.948611	441529099565501	Unused	9999	2x	june18 56	10	21.0
48	CLARK C	109N76W26BDBDR	NWSENWS26T109NR76W	44.219444	-99.936111	441308099561101	Stock	1000	211DKOT	june11 69	10	21.0
49	CLARK C	109N76W26ACCBR	SWSWNES26T109NR76W	44.218056	-99.931944	441305099555701	Unused	900	211GRNR	june11 69	10	21.0
50	MIDDLETENT PAULINE	108N76W30ABADR	SENENWS30T108NR76W	44.135000	-99.991667	440806099593001	Domestic	9999	2x	aug24 92	10	21.0
51	THOMPSON	108N74W1CABBR	NWNESWS1T108NR74W	44.187500	-99.659722	441114099393501	nolist	965	211DKOT	june01 69	10	21.1
52	THOMPSON	108N74W1CABBR	NWNESWS1T108NR74W	44.187500	-99.659722	441114099393501	nolist	965	211DKOT	aug15 61	10	21.1
53	CHRISTIAN	107N75W4ADCAR	SWSENES4T107NR75W	44.102778	-99.827778	440608099494101	Domestic	1330	211DKOT	aug21 61	10	21.1
54	CHRISTIAN	107N75W4ADCAR	SWSENES4T107NR75W	44.102778	-99.827778	440608099494101	Domestic	1330	211DKOT	july17 92	10	21.1
55	THOMPSON J	108N73W17ADBCR	NWSENES17T108NR73W	44.161111	-99.611111	440939099363501	Stock	980	211DKOT	june 01 69	10	21.6

EXCELFILE

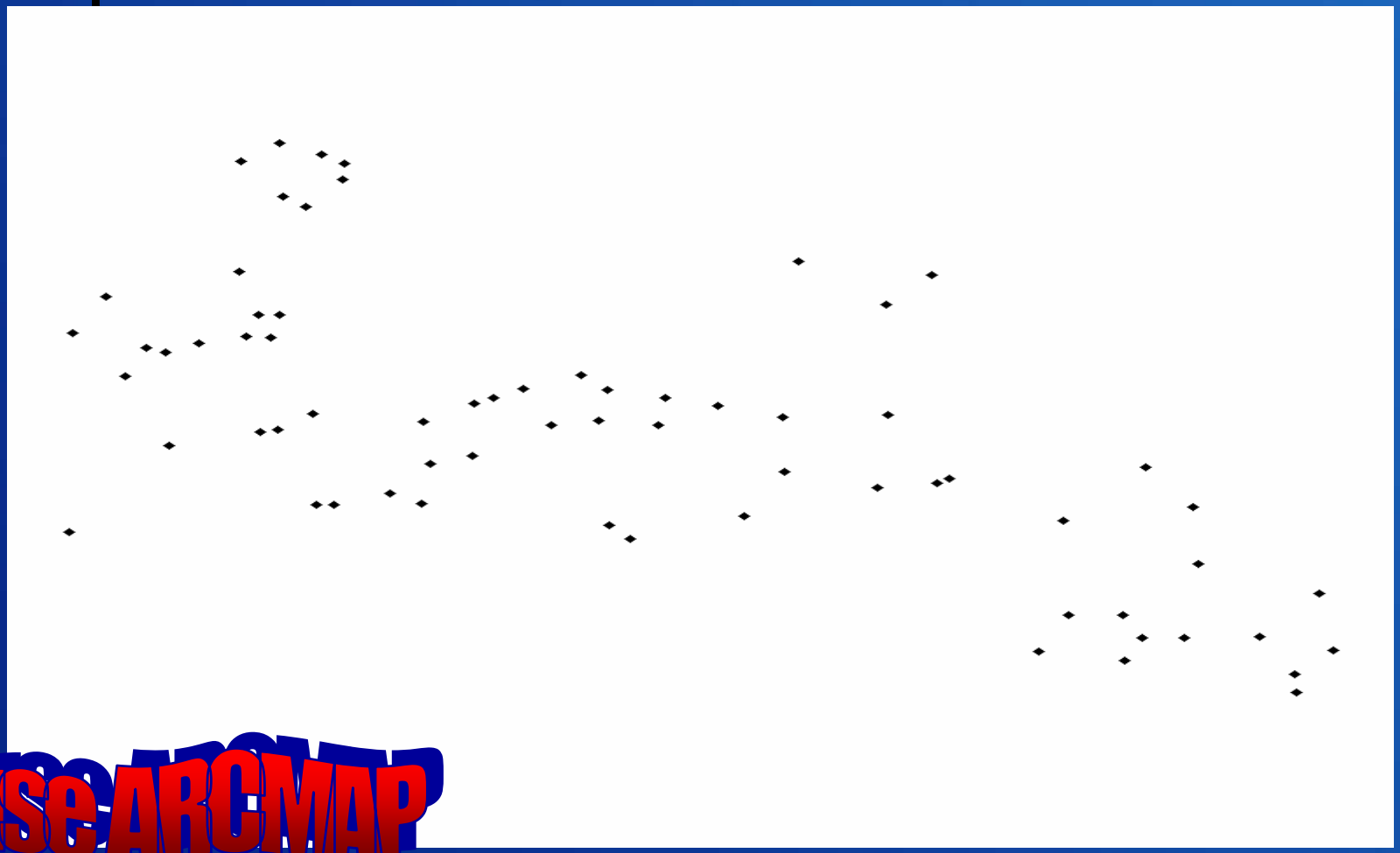
Convert to a dbf format - this has all the data on one long line



Convert the ‘dbf’ to a Shapefile . . . . .

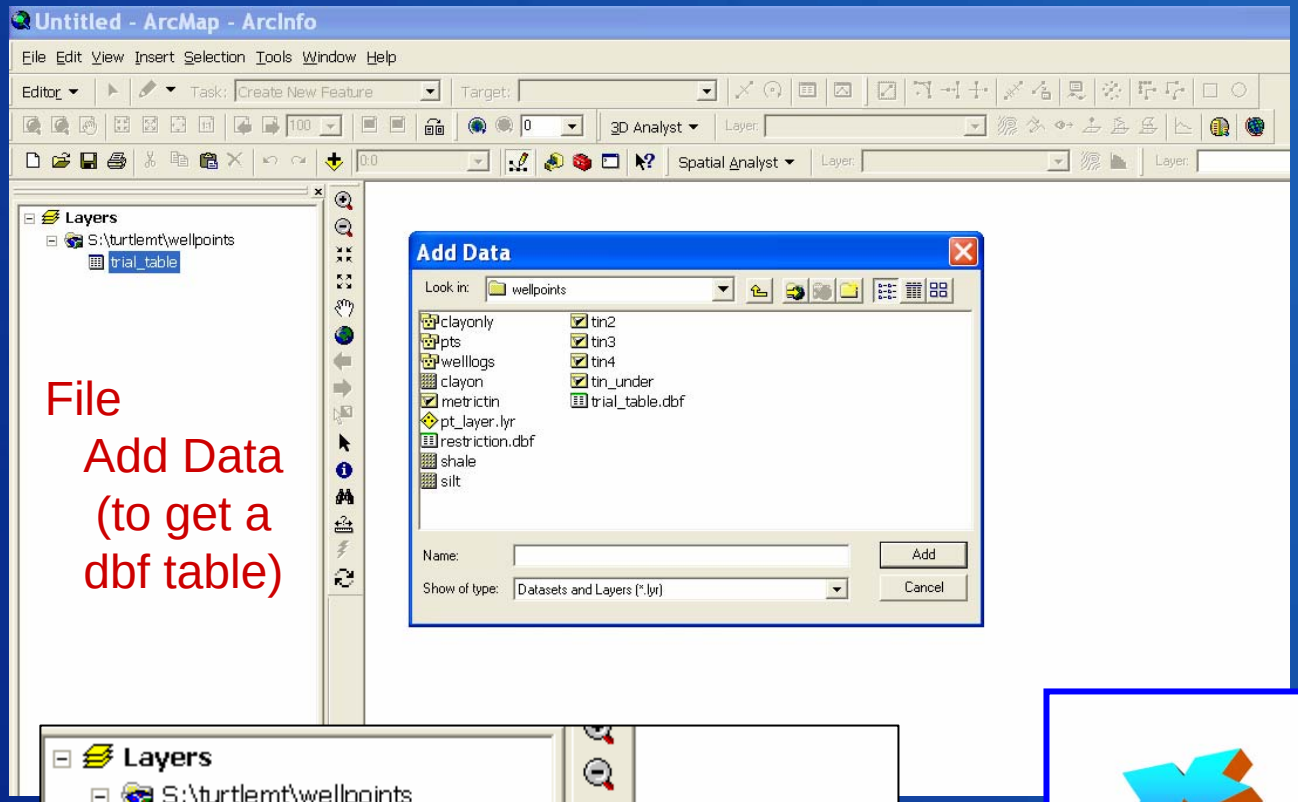
Now each point has world coordinates and

a complete EXCEL row attached to it



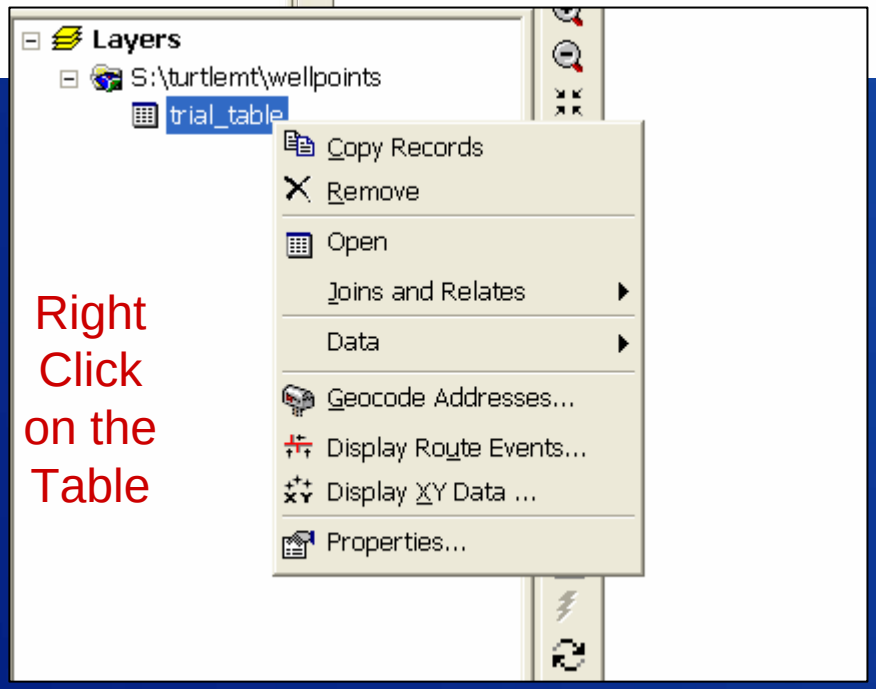
USE ARCMAP

RECLAMATION

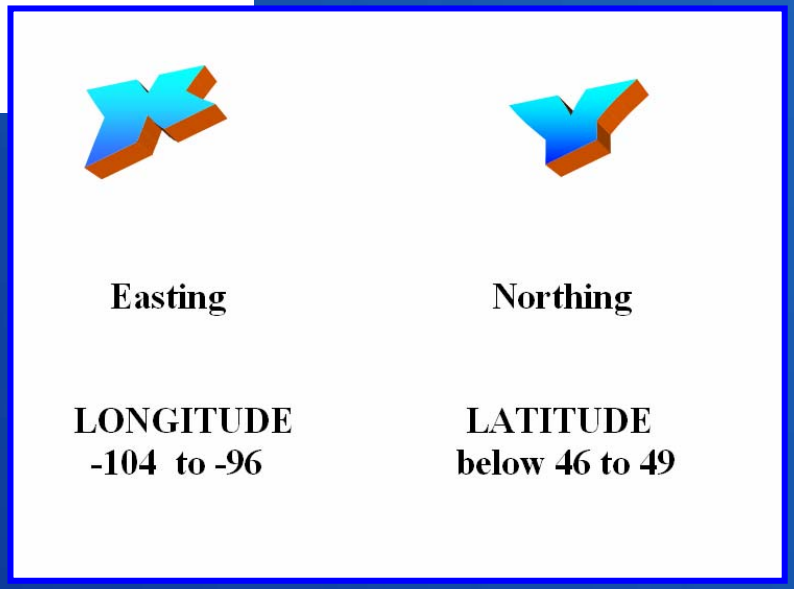


File
Add Data
(to get a
dbf table)

'Display XY' creates an **EVENT** file that can be saved as a **layer** file. Then use Arctools for 'feature to shapefile' or 'feature to cover'. You can set the projection during the display XY.



Right
Click
on the
Table



RECLAMATION

Converting text or dbf tables

- I have points with real world projections
- Labels & data are attached to every point
- ARCMAP produces a data table

The data can be edited in ARCMap – it looks a lot like EXCEL

notice the depth & (Celcius) temp columns

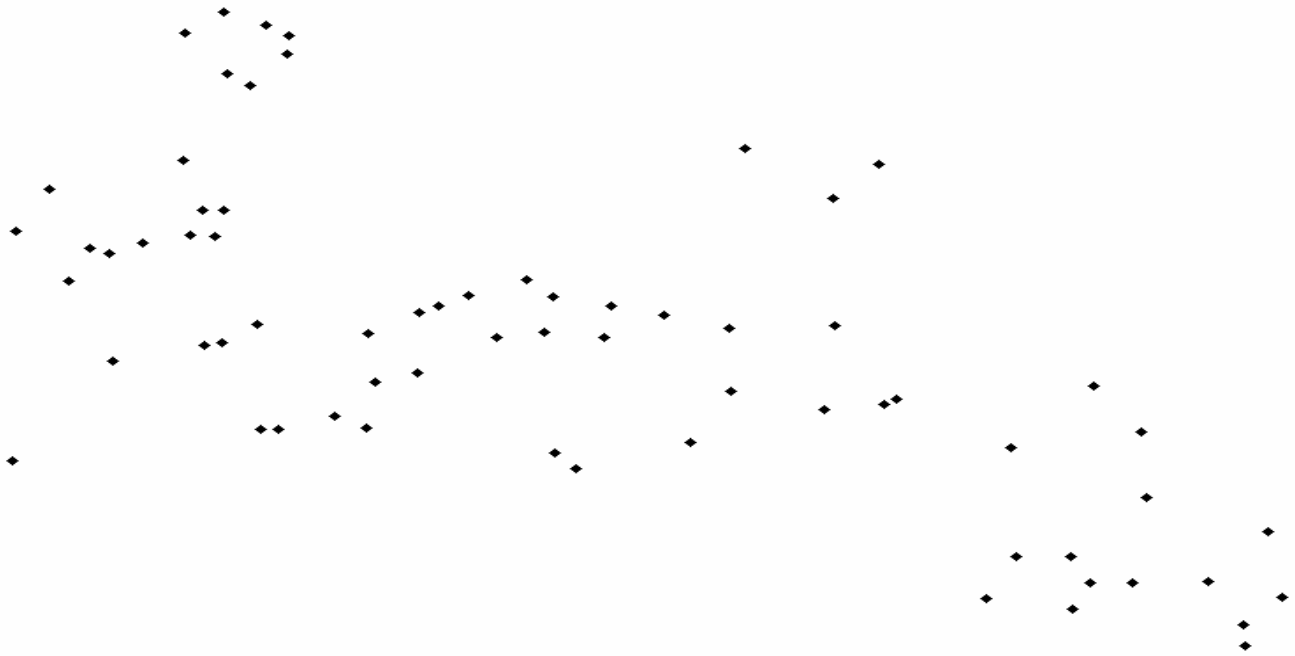
OWNER	WELLNUM	LANDNET	LAT	LONG	STATION	USE	DEPTH	AQUIFER	QUALDATE	PARCODE	CELCIUS
BLUM BART	105N71W5CBACR	NENWSWS5T105NR71W	43.925	-99.381944	435532099225601	Unused	9999	2x	may01 69	10	18.9
BLUM BART	105N71W5CCBAR	NWSWSWS5T105NR71W	43.922222	-99.383333	435522099230101	nolist	9999	2x	aug01 61	10	20
MENZIE RICHARD	106N71W32CCCDR	SESWSWS32T106NR71W	43.934722	-99.383333	435607099230001	Domestic	840	211DKOT	sept11 92	10	60
BUNKER JOHN	106N72W33ADBCR	S33T106NR72W	43.942778	-99.477778	435634099284001	Domestic	1280	211DKOT	aug11 92	10	17
LARSON WALTER	106N72W31BBBBR	NWNWNWS31T106NR72W	43.948611	-99.525	435659099313601	Domestic	1300	211DKOT	aug10 61	10	10
BRULE CATTLE CO	106N71W28CCDBR	SESWSWS28T106NR71W	43.95	-99.3625	435659099214401	Stock	829	211DKOT	may25 24	10	21.6
BUNKER JOHN	106N72W28BDDD2R	SENWS28T106NR72W	43.956944	-99.468056	435725099280701	Domestic	1440	211DKOT	aug10 92	10	19
WILMOT TOM	106N72W26BCCAR	SWSWNWS26T106NR72W	43.956944	-99.444444	445724099264001	Stock	1360	211DKOT	aug10 92	10	16.5
FORELL OK	106N72W26BCCAR	SWSWNWS26T106NR72W	43.956944	-99.444444	445724099264001	Stock	1360	211DKOT	aug29 69	10	58
BRULE CATTL ECO	106N71W30BBCDR	SWNWNWS30T106NR71W	43.959722	-99.401389	435735099240501	Unused	973	211DKOT	aug15 61	10	16
BOLMAN THEODORE	106N71W30CABAR	NWNESWS30T106NR71W	43.955556	-99.398611	435719099235601	Domestic	946	211DKOT	aug13 92	10	16.5
THOMPSON FLOYD	106N72W25AADR	SENENES25T106NR72W	43.961111	-99.406944	435738099242501	nolist	9999	211DKOT	may31 56	10	16.7
THOMPSON FW	106N72W25ADCDR	NESENES25T106NR72W	43.956944	-99.408333	435723099243201	nolist	9999	2x	may31 56	10	17.9
THOMPSON FW	106N71W30CABAR	NWNESWS30T106NR71W	43.955556	-99.398611	435719099235601	Domestic	946	211DKOT	june4 69	10	22.7
BUNKER WILFRED	106N72W19DAADR	NENESES19T106NR72W	43.970833	-99.508333	435813099302901	Unused	1280	211DKOT	june16 69	10	23.9
BUNKER DARYL	106N72W21CADCR	SENESWS21T106NR72W	43.970833	-99.479167	435815099284501	Domestic	9999	211DKOT	aug10 92	10	15.5
THOMPSON LAWRENCE	106N71W17DBAAR	NENWSES17T106NR71W	43.984717	-99.370833	435903099221701	Domestic	850	2x	sept16 92	10	7
THOMPSON CLARENCE	106N71W17DBAAR	NENWSES17T106NR71W	43.984722	-99.370833	435903099221701	Domestic	850	2x	june3 69	10	22
THOMPSON C	106N72W11BDAAR	NESENWS11T106NR72W	44.002778	-99.4375	440008099261301	Unused	1020	211DKOT	may25 24	10	24.3
IRELAND J	106N74W6ACADR	NESWNES6T106NR74W	44.016667	-99.751389	440058099450301	Stock	1100	211DKOT	june01 69	10	22.8
TAYLOR CF	106N77W3BBDDR	SENWNWS3T106NR77W	44.018056	-100.061111	440105100033901	Stock	1470	211DKOT	june18 69	10	16.6
IRELAND J	107N74W31CBDCR	SENWSWS31T107NR74W	44.025	-99.7625	440131099454401	Stock	1100	211DKOT	june01 69	10	22.2
USCE	107N72W31ACDR	SESWNES31T107NR72W	44.029167	-99.5125	440146099304501	Public Supply	36	111ALVM	june01 69	10	56
JANDREAU BROTHERS	107N74W34ADR	SENES34T107NR74W	44.030556	-99.688889	440149099411601	nolist	1080	211GRNR	aug01 61	10	25
HUSTON R	107N76W26CCCCR	SWSWSWS26T107NR76W	44.036111	-99.925	440209099552901	Stock	1440	211DKOT	june01 69	10	16.1
DORMAN B	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	13.9
SMITH SMITH WAYNE	107N75W29CCCCR	SWSWSWS29T107NR75W	44.036111	-99.913889	440210099515401	Unused	1470	211DKOT	june17 69	10	14.8
HUSTON BROS.	107N76W26CDCD2R	SWSESWS26T107NR76W	44.036111	-99.918056	440210099550701	Domestic	1600	211DKOT	june28 73	10	26.7
SMITH WAYNE	107N75W29CCDBR	NWSESWS29T107NR75W	44.0375	-99.866667	440215099520001	Domestic	9999	211DKOT	july20 92	10	15
USCE	107N72W26CDCBR	SWSESWS26T107NR72W	44.0375	-99.440278	440213099262701	Public Supply	9999	111ALVM	june10 69	10	8.9
DORMAN KEITH	107N75W30CBBD2R	NWNWSWS30T107NR75W	44.043056	-99.884722	440235099530502	Stock	1470	211DKOT	june18 69	10	10
ZEIGLER A	107N73W29ABBCR	NWNWNES29T107NR73W	44.048611	-99.615278	440255099365301	Unused	1240	211DKOT	aug01 61	10	21.6
GOURNEAU BOYD	107N73W22CCACR	SWNESWS22T107NR73W	44.051389	-99.581944	440307099345501	Domestic	9999	2x	july24 92	10	17.5
LANGDEAUX ORVILLE	107N73W22DBCCR	SWNWSES22T107NR73W	44.054167	-99.575	440315099342801	Domestic	1030	211DKOT	july23 92	10	29.5
SVOBODA B	107N74W23ADDBR	SESENES23T107NR74W	44.058333	-99.666667	440332099400201	Stock	1270	211DKOT	june01 69	10	23.3
SCHAEFER JIM	107N75W20BBBCR	SWNENES20T107NR75W	44.0625	-99.859722	440343099513501	Domestic	1260	211GRNR	july20 92	10	22.5
SCHAEFER JIM	107N75W20BCBR	NWSWNWS20T107NR75W	44.061111	-99.863889	440336099514901	Domestic	1600	217INKR	oct27 79	10	30
WYNIA HUGH	107N74W24AADCR	SENENES24T107NR74W	44.061944	-99.466666	440343099384801	Stock	1200	211DKOT	june01 69	10	70
IRELAND JERRY	107N75W16CDCAR	SWSESWS16T107NR75W	44.066667	-99.838889	440358099501901	nolist	1500	217INKR	aug24 61	10	26.6
GIFFORD DALLAS	107N77W13DAABR(2)	NENESES13T107NR77W	44.071667	-100.006389	440418100002301	nolist	1300	2x	june18 69	10	12.8
JANDREAU MIKE	107N76W9CDACR	NESESWS9T107NR76W	44.080556	-99.956944	440452099572701	Domestic	1370	211DKOT	aug23 61	10	28.2
JANDREAU MIKE	107N76W9DDAB2R	NESESES9T107NR76W	44.081944	-99.947222	440457099564701	Domestic	1340	211DKOT	july15 92	10	28.3
MELLGARD	107N75W11CAAR	NENESWS11T107NR75W	44.086111	-99.795833	440509099474601	Domestic	1400	211DKOT	june12 69	10	13.3

Depth

Temp.

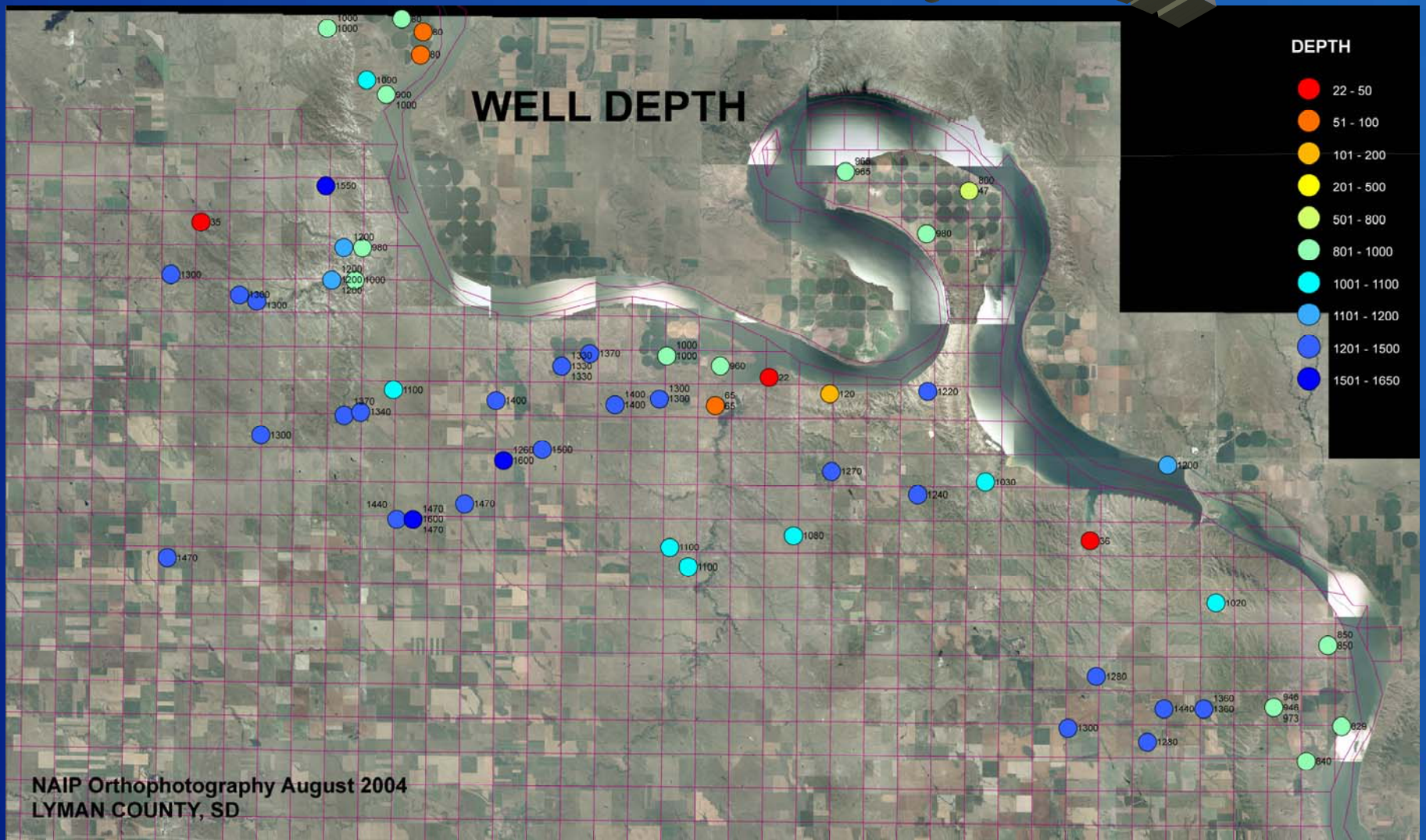
RECLAMATION

What can we do with a bunch of boring black points ?

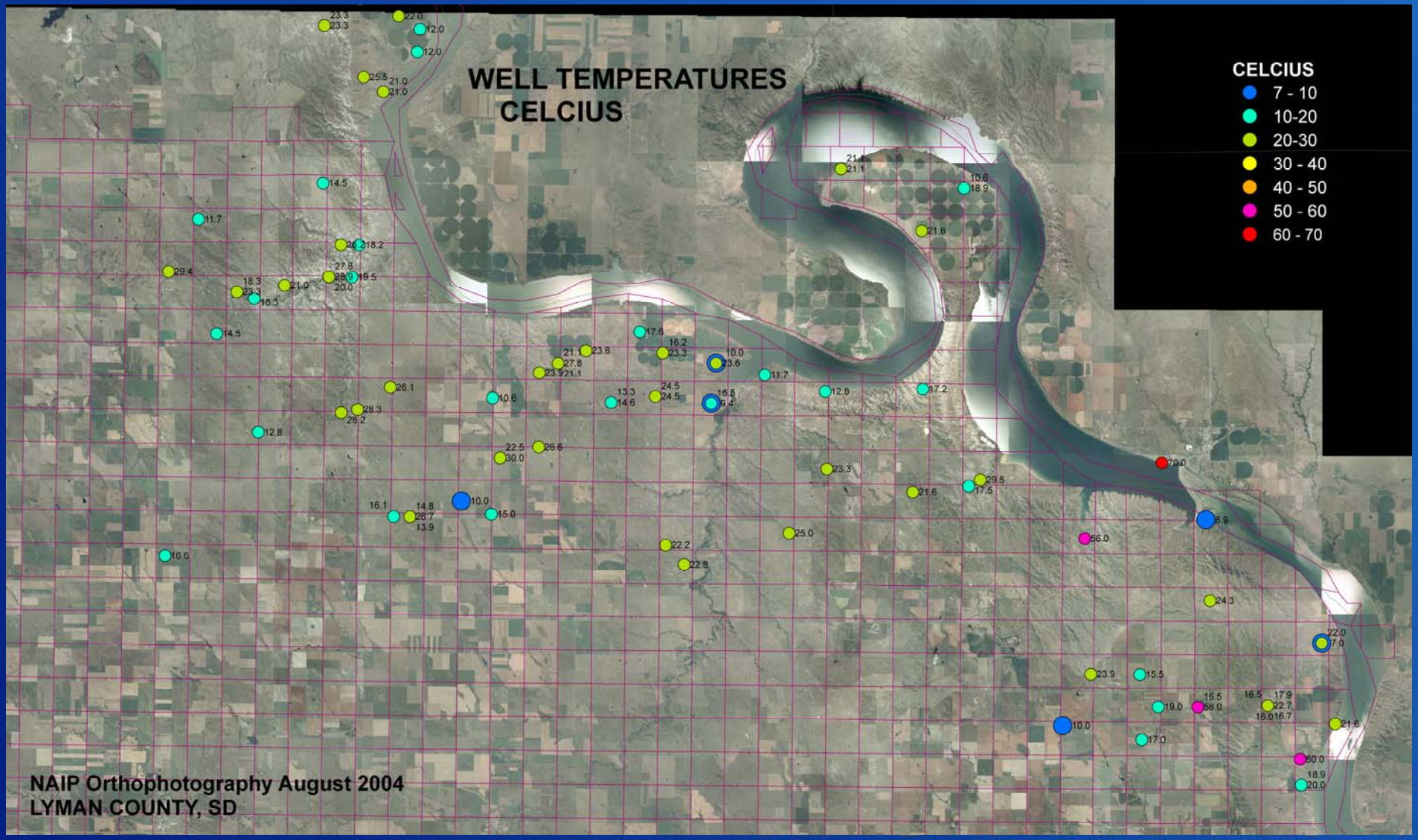


RECLAMATION

We can place the points on top of an aerial (ortho) photo and sort them by depth

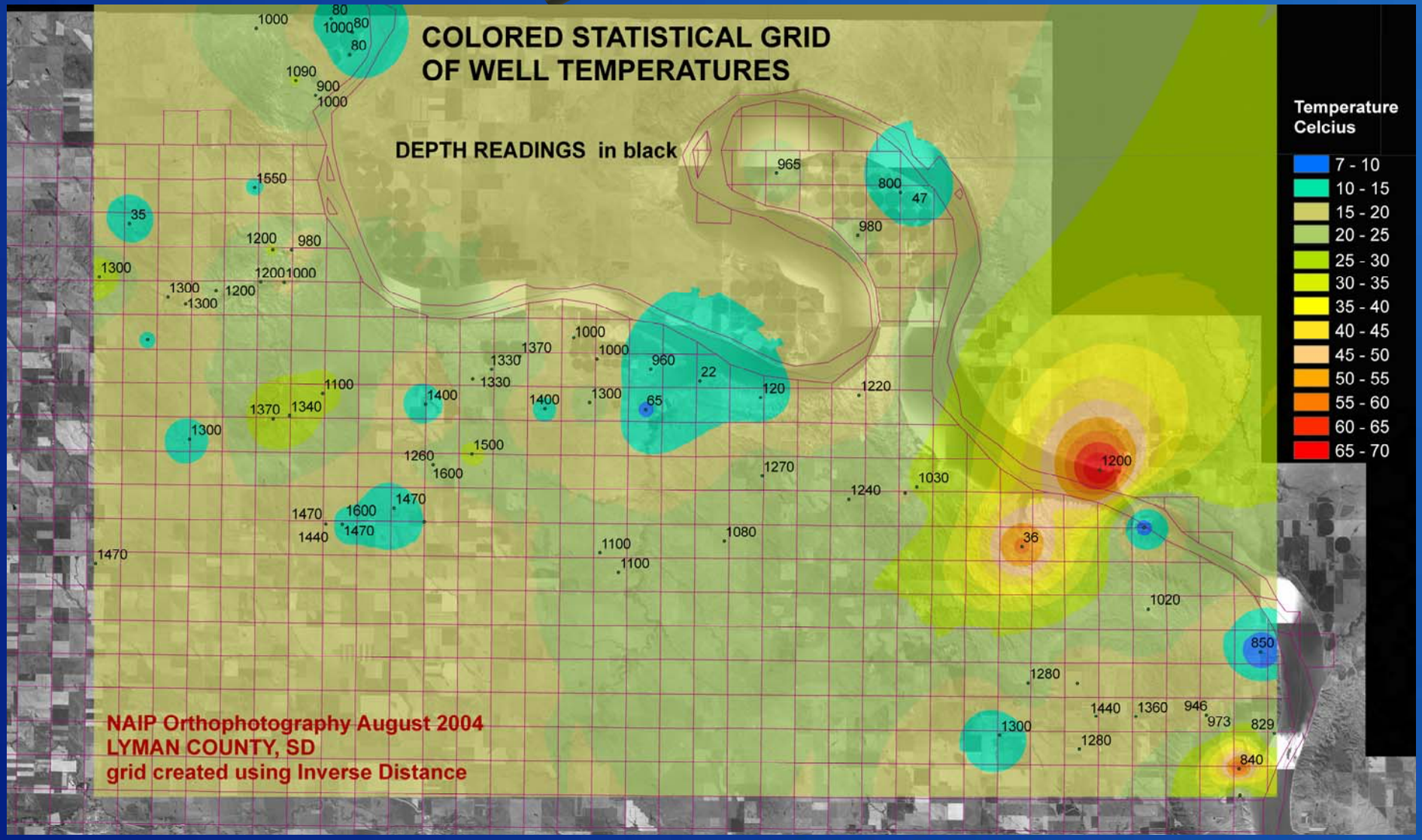


We can sort them by temperature

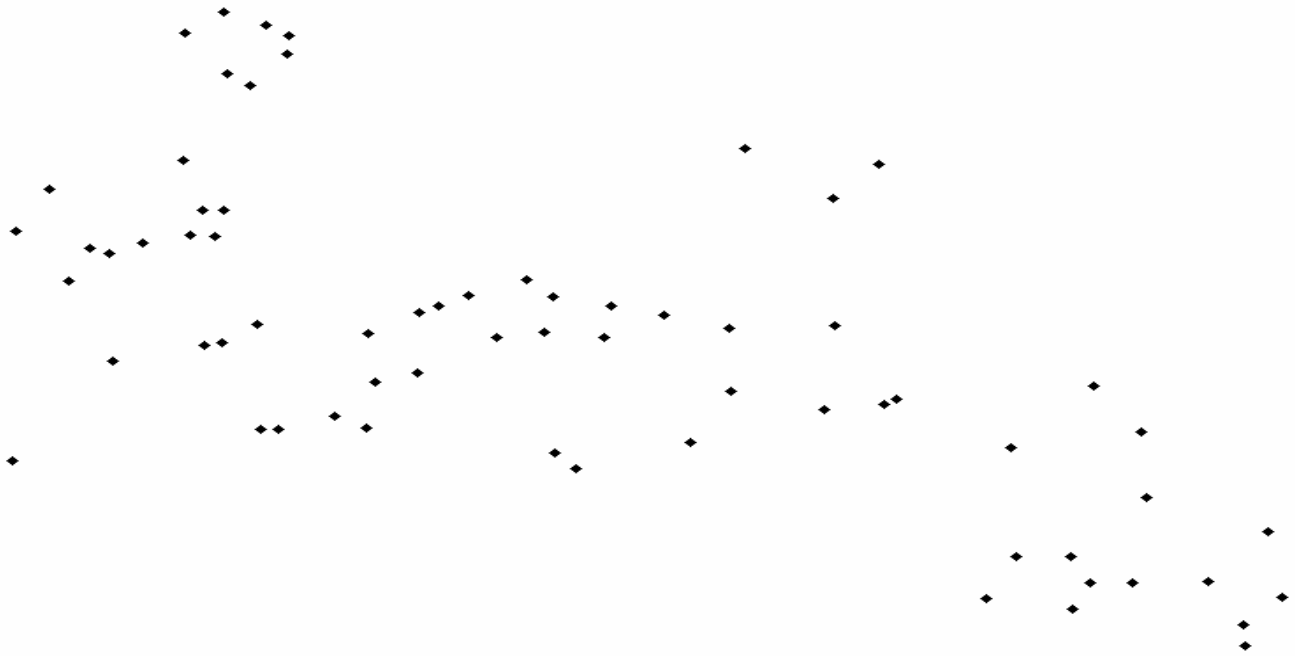


areas of influence

We can run statistics and calculate

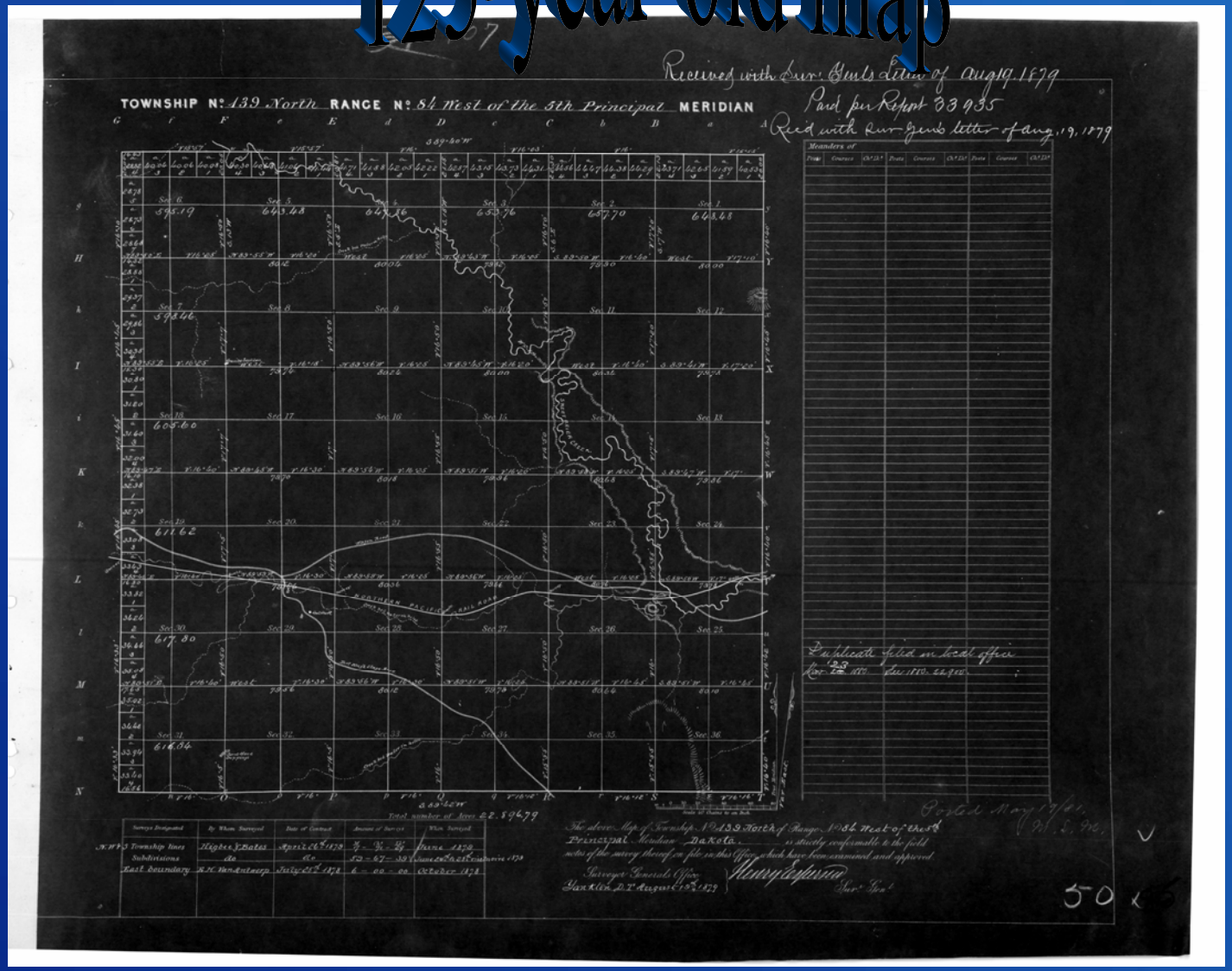


That is a lot better than a bunch of boring black points



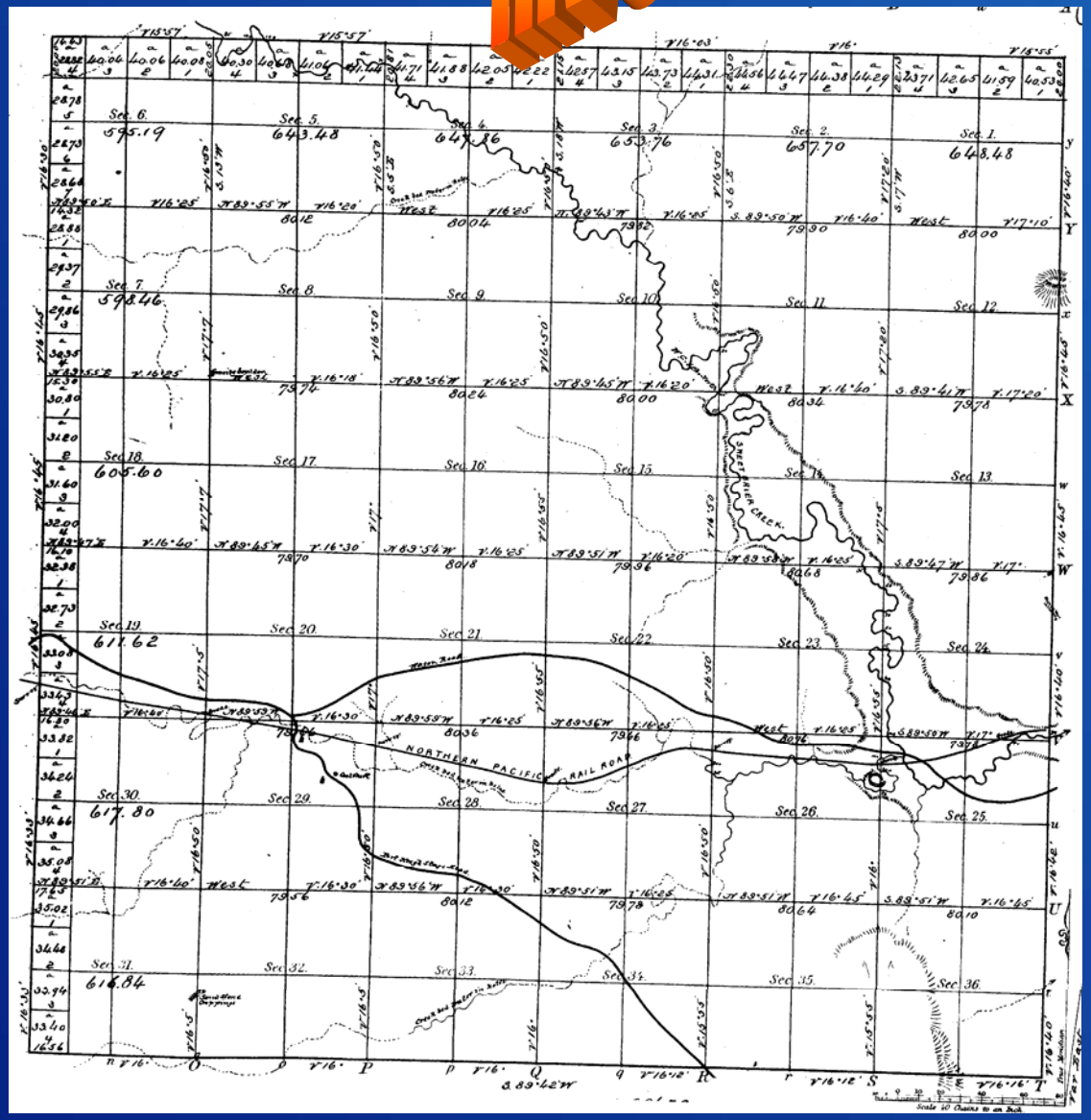
RECLAMATION

We can take a 125-year-old map



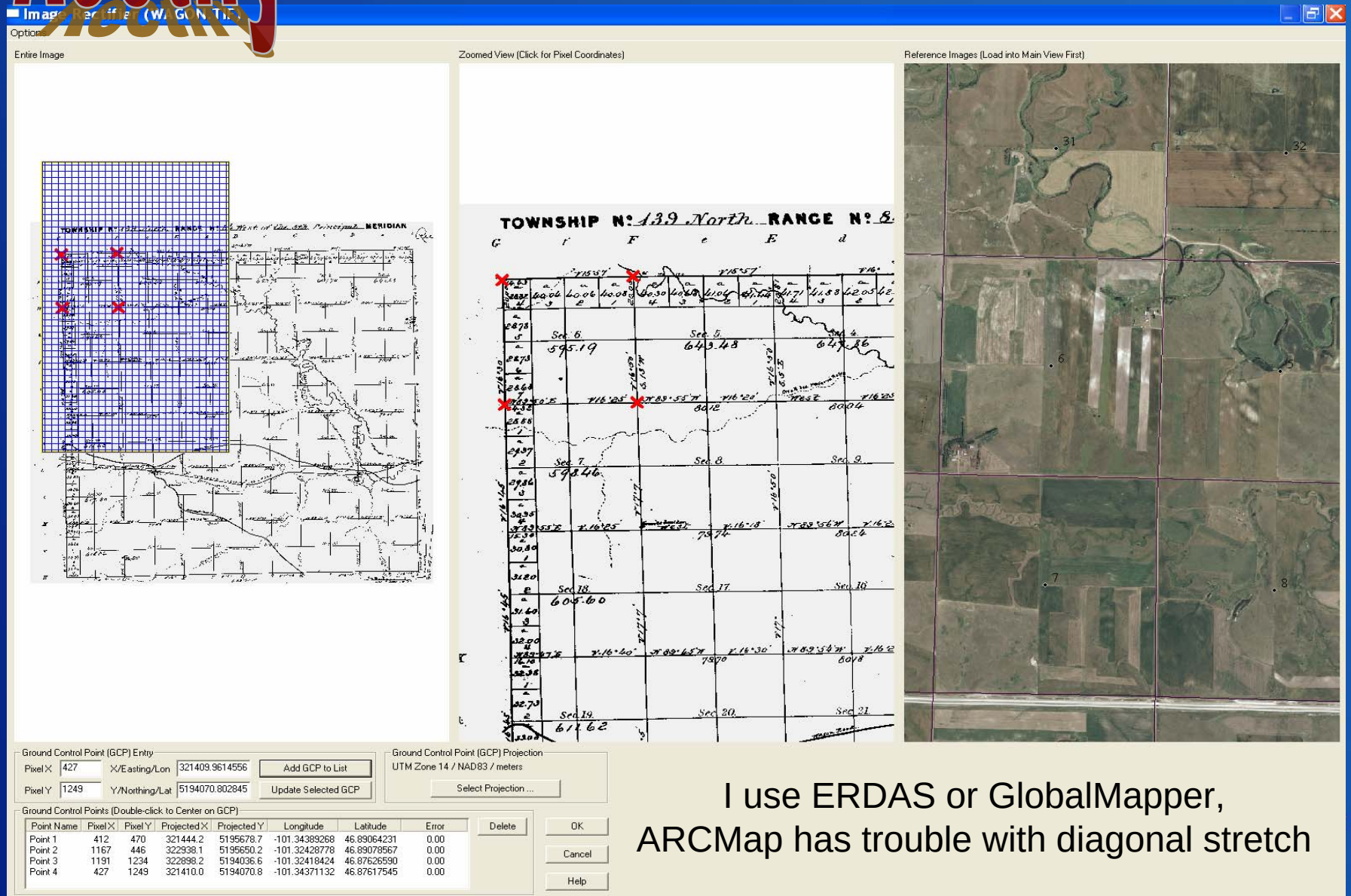
RECLAMATION

Scan and invert the black to white



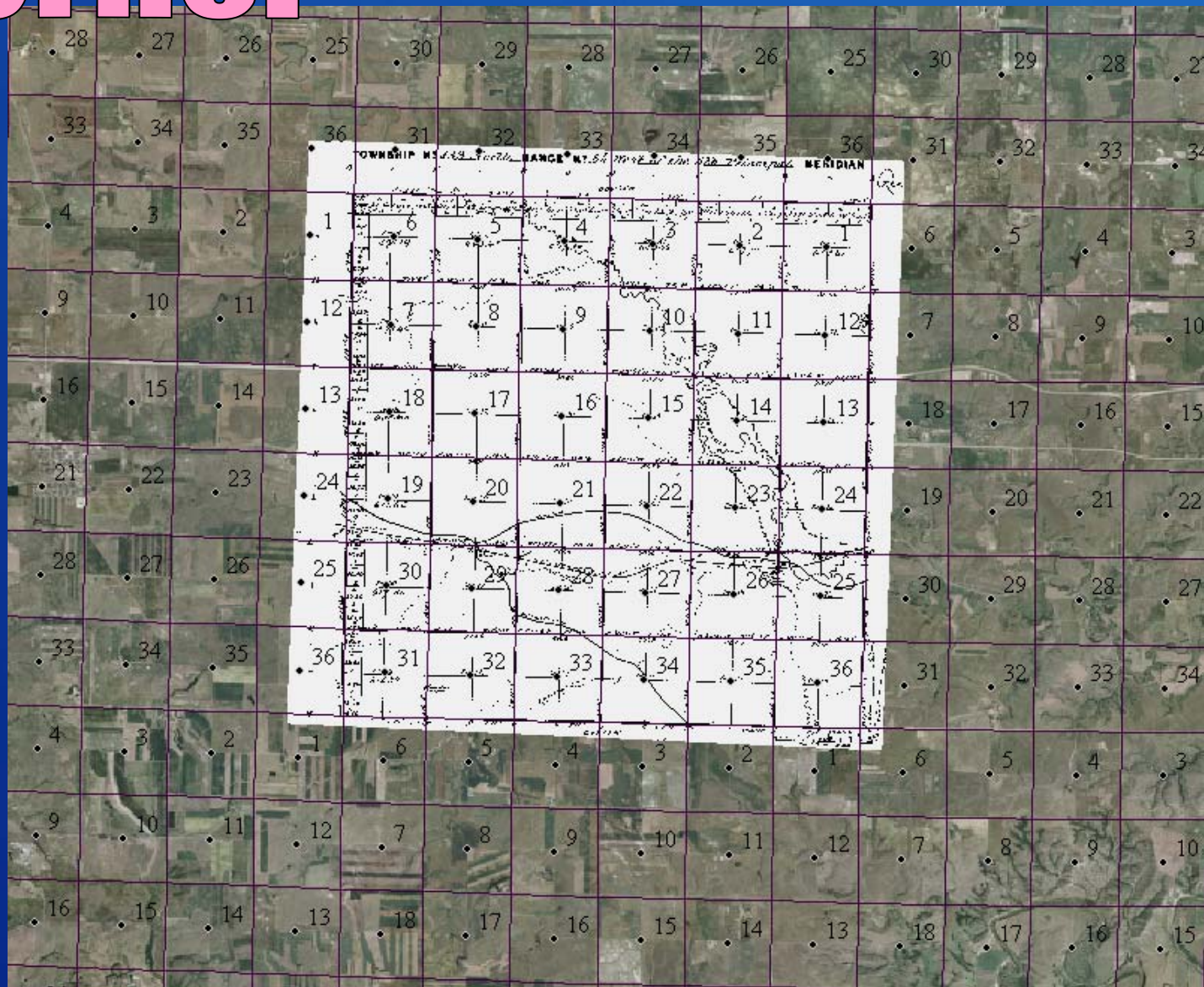
RECLAMATION

Rectify the scan using the section edges and an orthophoto



I use ERDAS or GlobalMapper, ARCMap has trouble with diagonal stretch

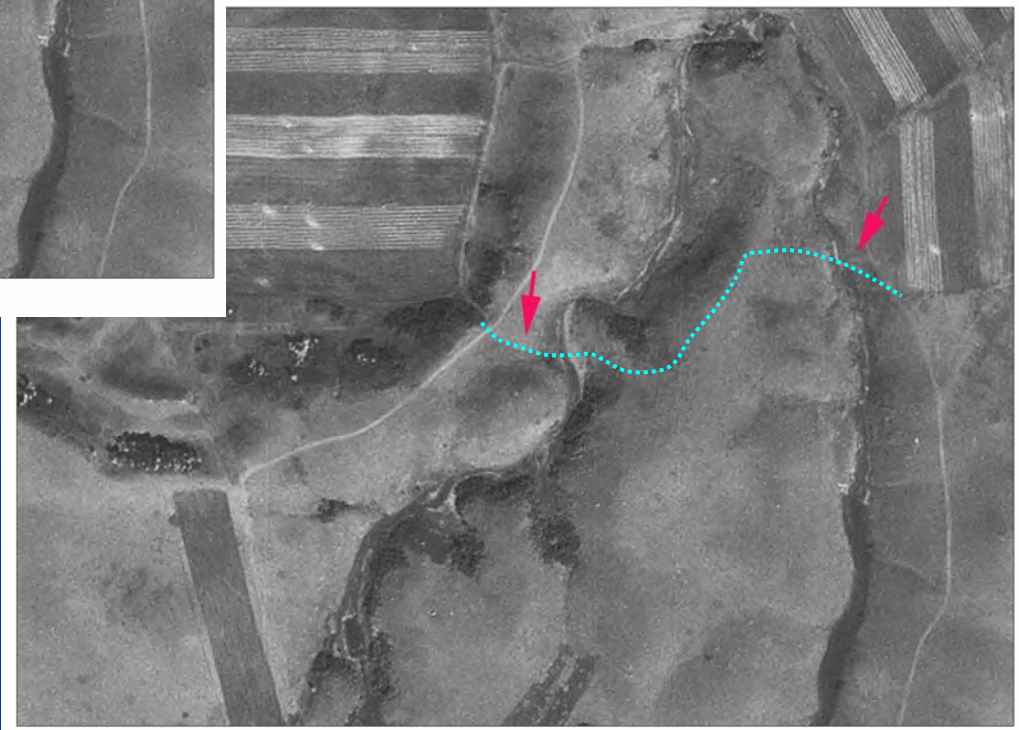
The rectified image produces world coordinates for each corner, so it matches the ortho



The old wagon trail still shows (*if the area has not been cropped*)

I made the linework blue and the back-ground invisible. Remember . . . a thick pencil line is 70 feet wide on a topo sheet.

RECLAMATION



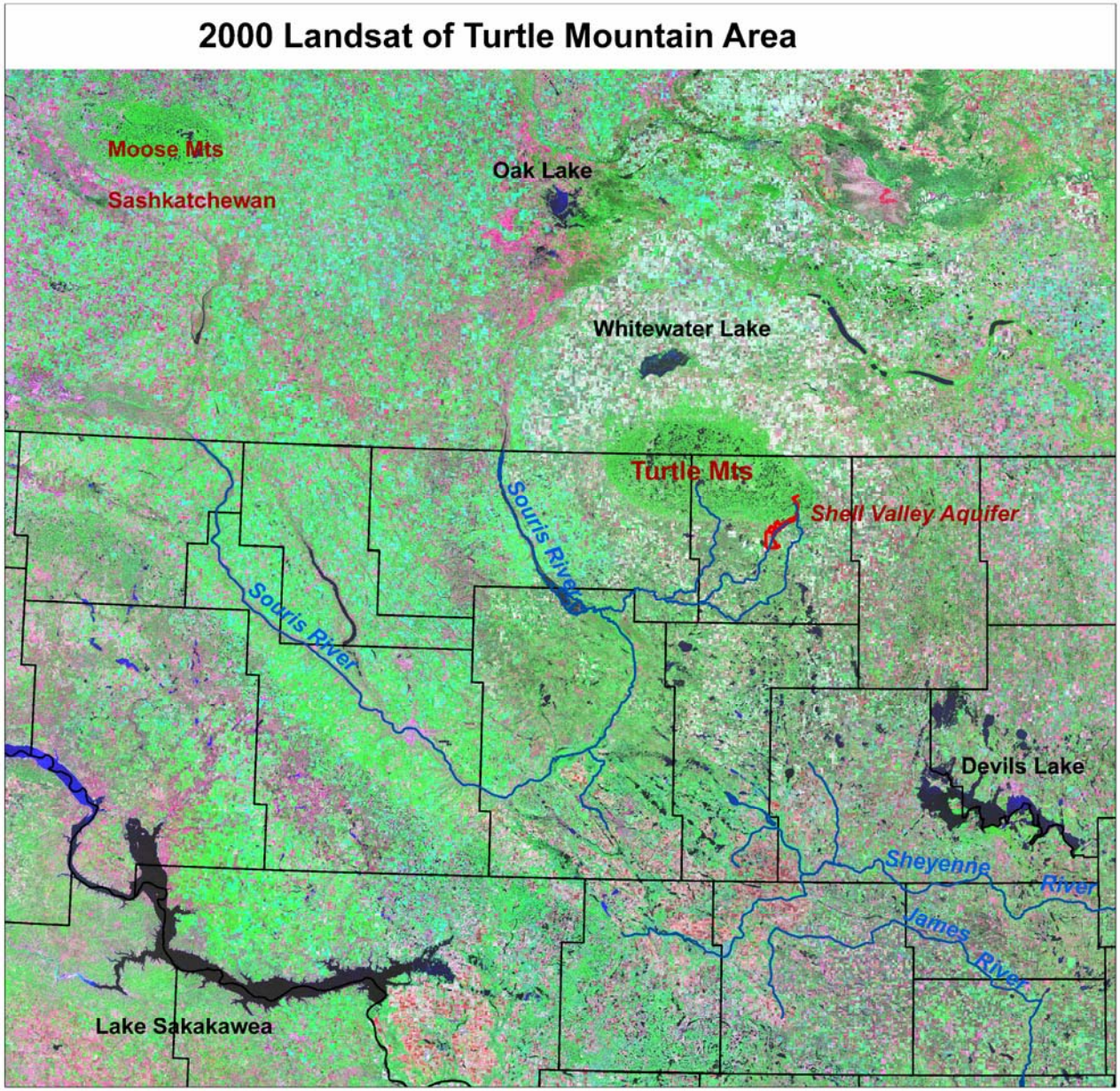
RECLAMATION

GIS

- These programs allow you to take old data (either tables or maps with point locations) and place them on new photography with real world coordinates.

- These rectified points can be put into a palm pilot and taken out to the field. A field comparison can be made between old data and new.

RECLAMATION



- Two glaciers collide . .
- They leave a ‘comma’ shaped wedge of land in between
- Turtle Mts. may be a wedge of land that was broken loose and shoved on top
- There is a sister mountain in Canada

LANDSAT Image color infrared orthorectified

RECLAMATION

What is a DEM?

Digital Elevation Model - a raster grid of regularly spaced elevation points (derived from paper topos)

ASCII characters in fixed block format

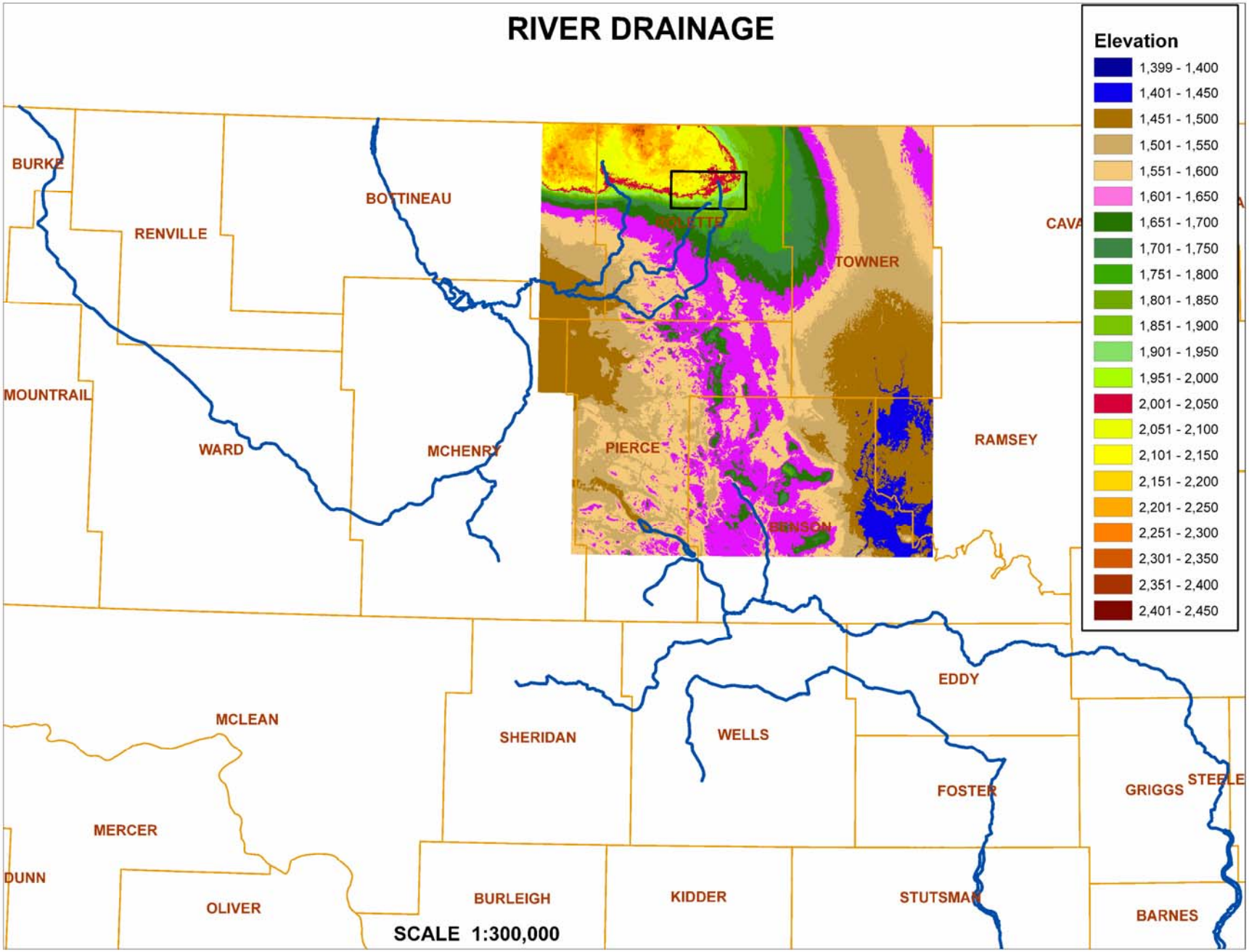
The 30 meter grid has a point every 30 meters on the ground

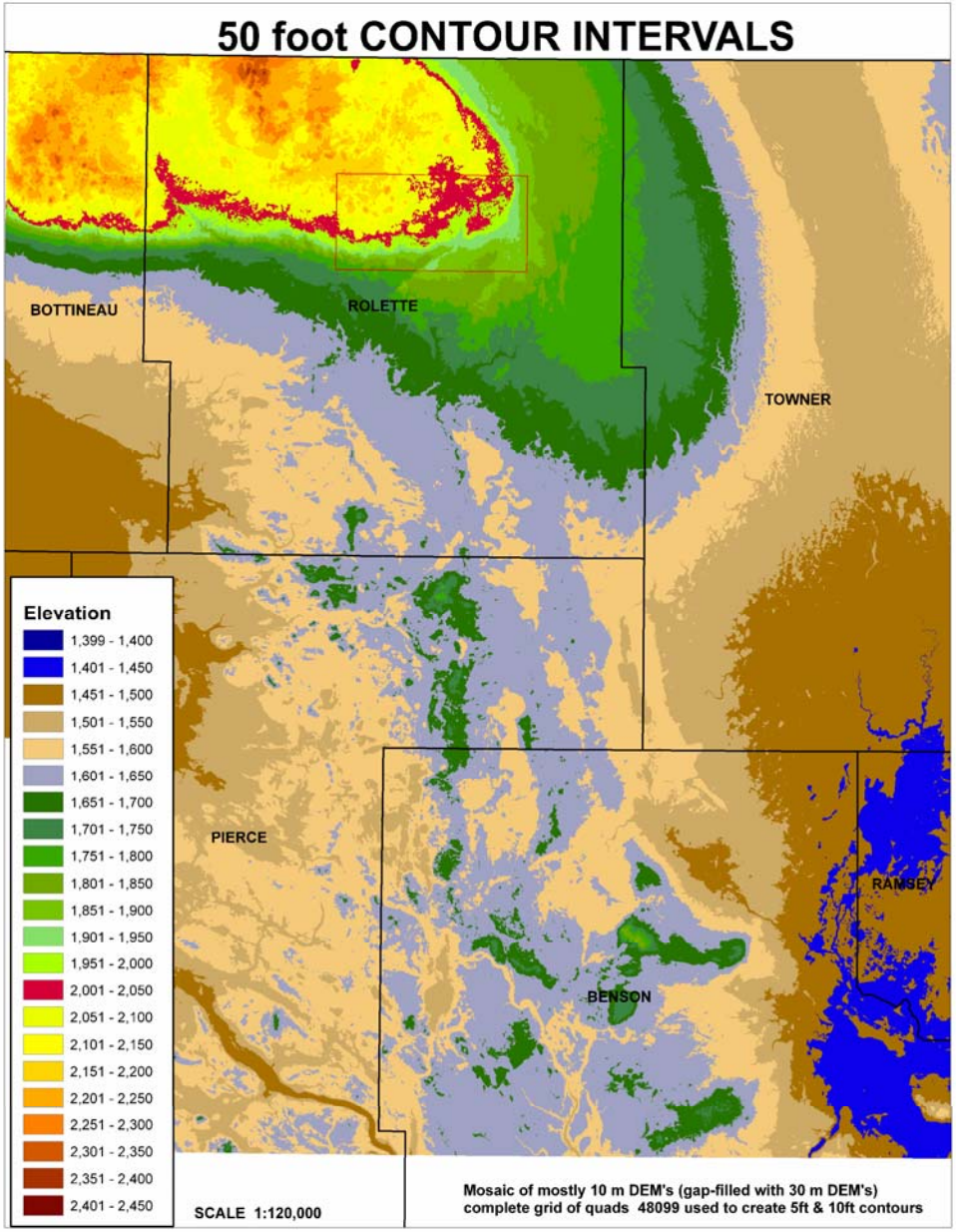
A 10 meter grid has a point every 10 meters on the ground

Contours are created by connecting like points (2-D map)

Elevation readings can be used in ARCScene for 3-D maps

RECLAMATION


RIVER DRAINAGE
Elevation
1,399 - 1,400
1,401 - 1,450
1,451 - 1,500
1,501 - 1,550
1,551 - 1,600
1,601 - 1,650
1,651 - 1,700
1,701 - 1,750
1,751 - 1,800
1,801 - 1,850
1,851 - 1,900
1,901 - 1,950
1,951 - 2,000
2,001 - 2,050
2,051 - 2,100
2,101 - 2,150
2,151 - 2,200
2,201 - 2,250
2,251 - 2,300
2,301 - 2,350
2,351 - 2,400
2,401 - 2,450
BURKE
RENVILLE
BOTTINEAU
TOWNER
MOUNTRAIL
WARD
MCHENRY
PIERCE
RAMSEY
EDDY
MCLEAN
SHERIDAN
WELLS
FOSTER
GRIGGS
MERCER
DUNN
OLIVER
BURLEIGH
KIDDER
BARNES
SCALE 1:300,000



- Purple color is the ridge between the two glaciers
- Yellow & orange are the high areas
- Brown & blue are the lowlands

flat DEM

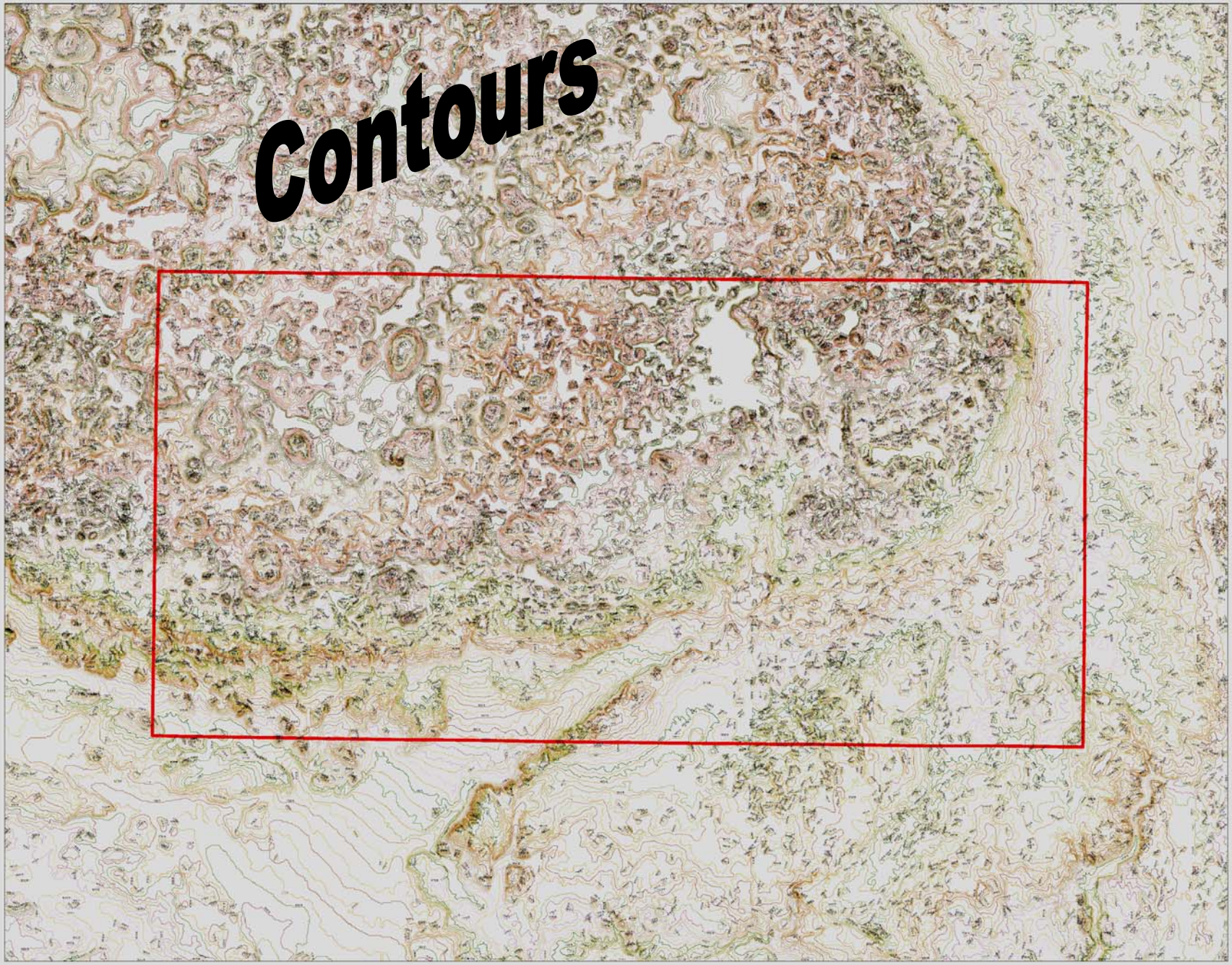
50 foot contour lines with areas between the contours shaded in.

RECLAMATION

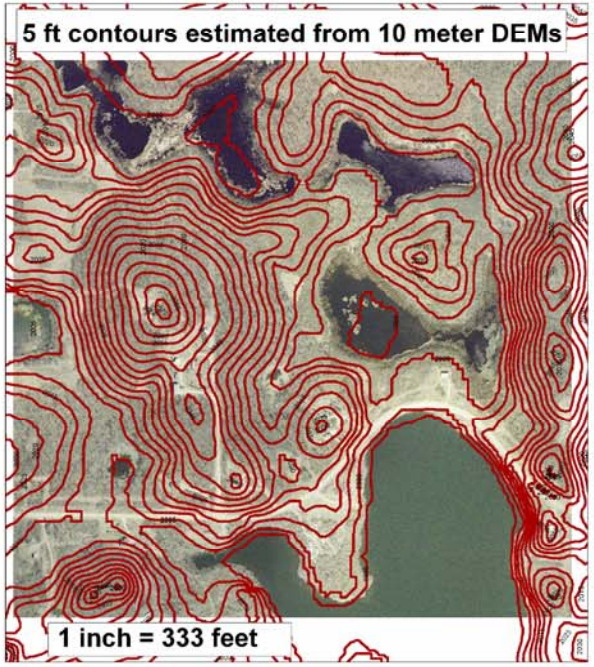
CONTOURS

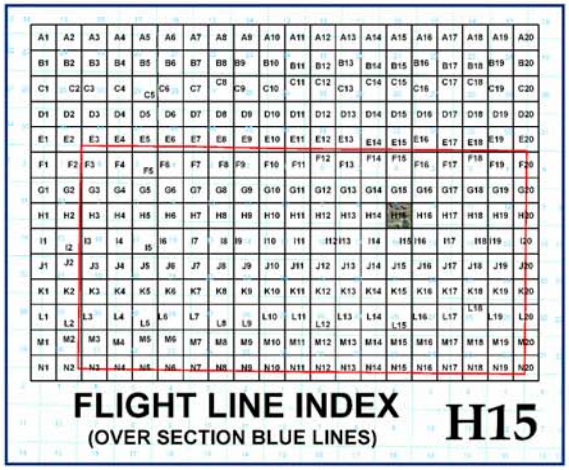
RECLAMATION

Contours



6 inch Resolution Aerial Photography 5/2002 SCALE 1 inch = 167 feet





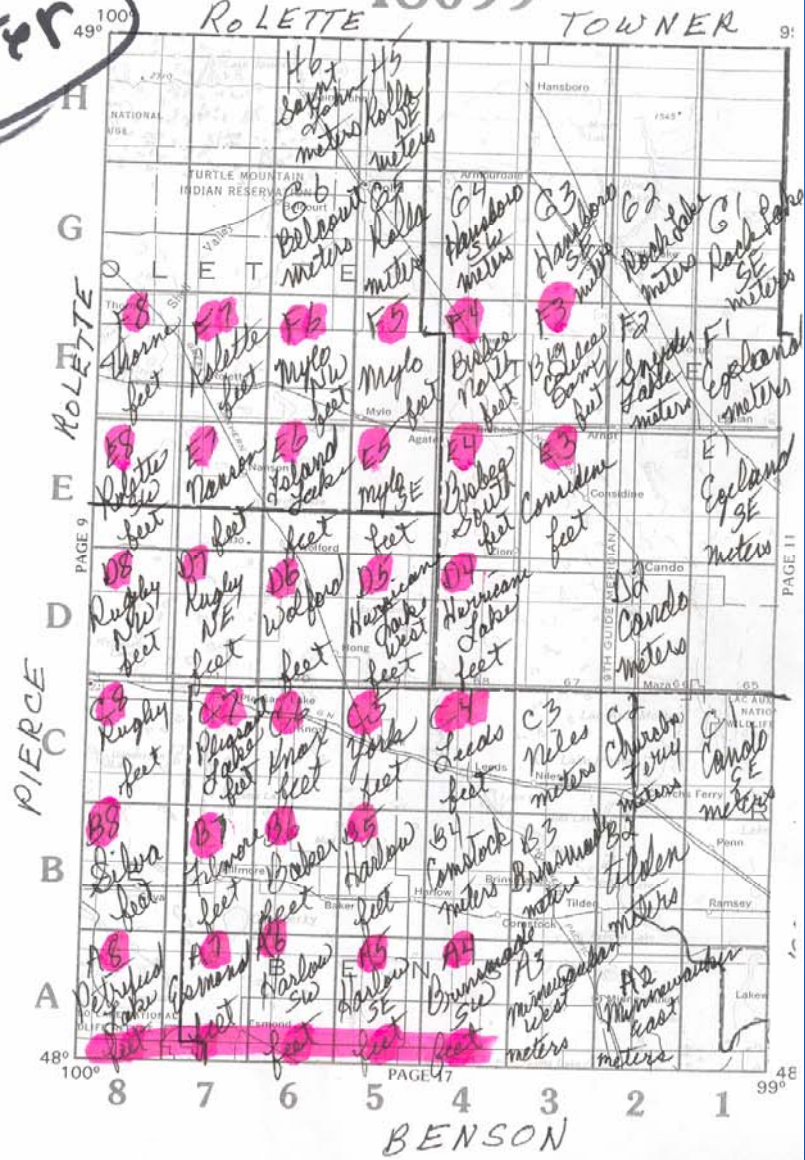
DEM 10 10 Meter

(CANADA)

48099

7.5 MINUTE QUADRANGLE NAMES

A1	Grahams Island	E1	Egeland SE
A2	Minnewauken East	E2	Egeland SW
A3	Minnewaukan West	E3	Considine
A4	Brinsmade SW	E4	Bisbee South
A5	Harlow SE	E5	Mylo SE
A6	Harlow SW	E6	Island Lake
A7	Esmond	E7	Nanson
A8	Petrified Lake	E8	Rolette SW
B1	Penn	F1	Egeland
B2	Tilden	F2	Snyder Lake
B3	Brinsmade	F3	Big Coulee Dam
B4	Comstock	F4	Bisbee North
B5	Harlow	F5	Mylo
B6	Baker	F6	Mylo NW
B7	Fillmore	F7	Rolette
B8	Silva	F8	Thorne
C1	Cando SE	G1	Rock Lake SE
C2	Churchs Ferry	G2	Rock Lake
C3	Niles	G3	Hansboro SE
C4	Leeds	G4	Hansboro SW
C5	York	G5	Rolla
C6	Knox	G6	Belcourt
C7	Pleasant Lake	G7	Lake Upsilon SE
C8	Rugby	G8	Lake Upsilon SW
D1	Cando NE	H1	Rock Lake NE
D2	Cando	H2	Rock Lake NW
D3	Leeds NE	H3	Hansboro NE
D4	Hurricane Lake East	H4	Hansboro
D5	Hurricane Lake West	H5	Rolla NE
D6	Wolford	H6	Saint John
D7	Rugby NE	H7	Lake Upsilon
D8	Rugby NW	H8	Carpenter Lake



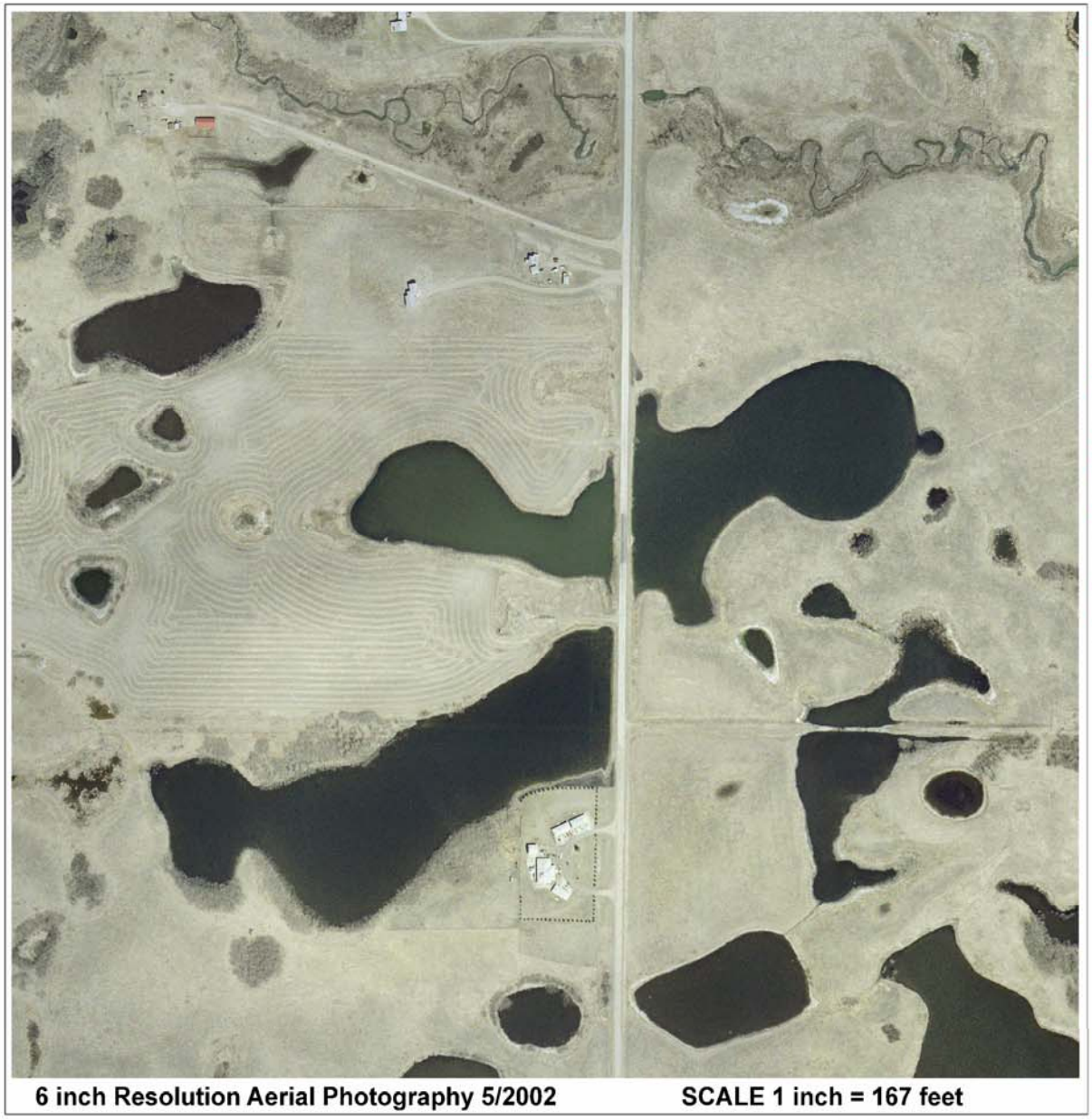
North Dakota is completely covered by 7.5-minute maps

Certain areas may be covered by 7.5 × 15- or 15-minute maps

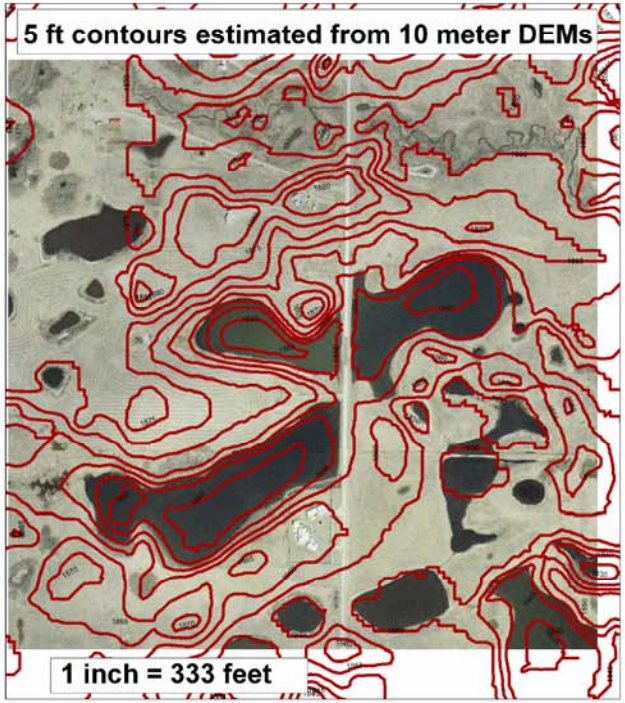
See CATALOG OF PUBLISHED MAPS for *available* maps, dates, scales, prices, and Map Order Forms

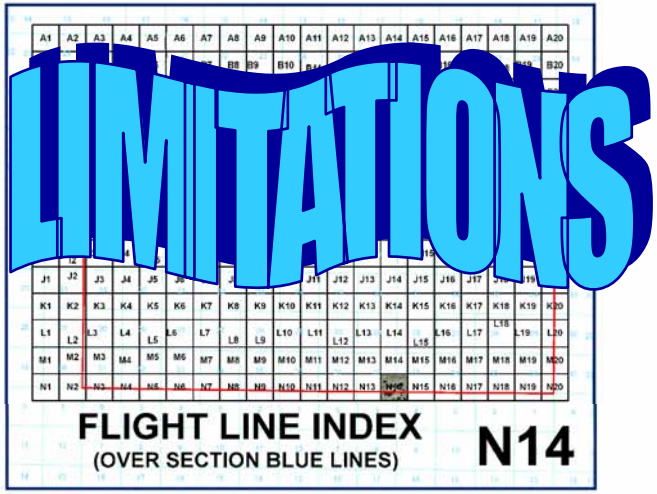
48099

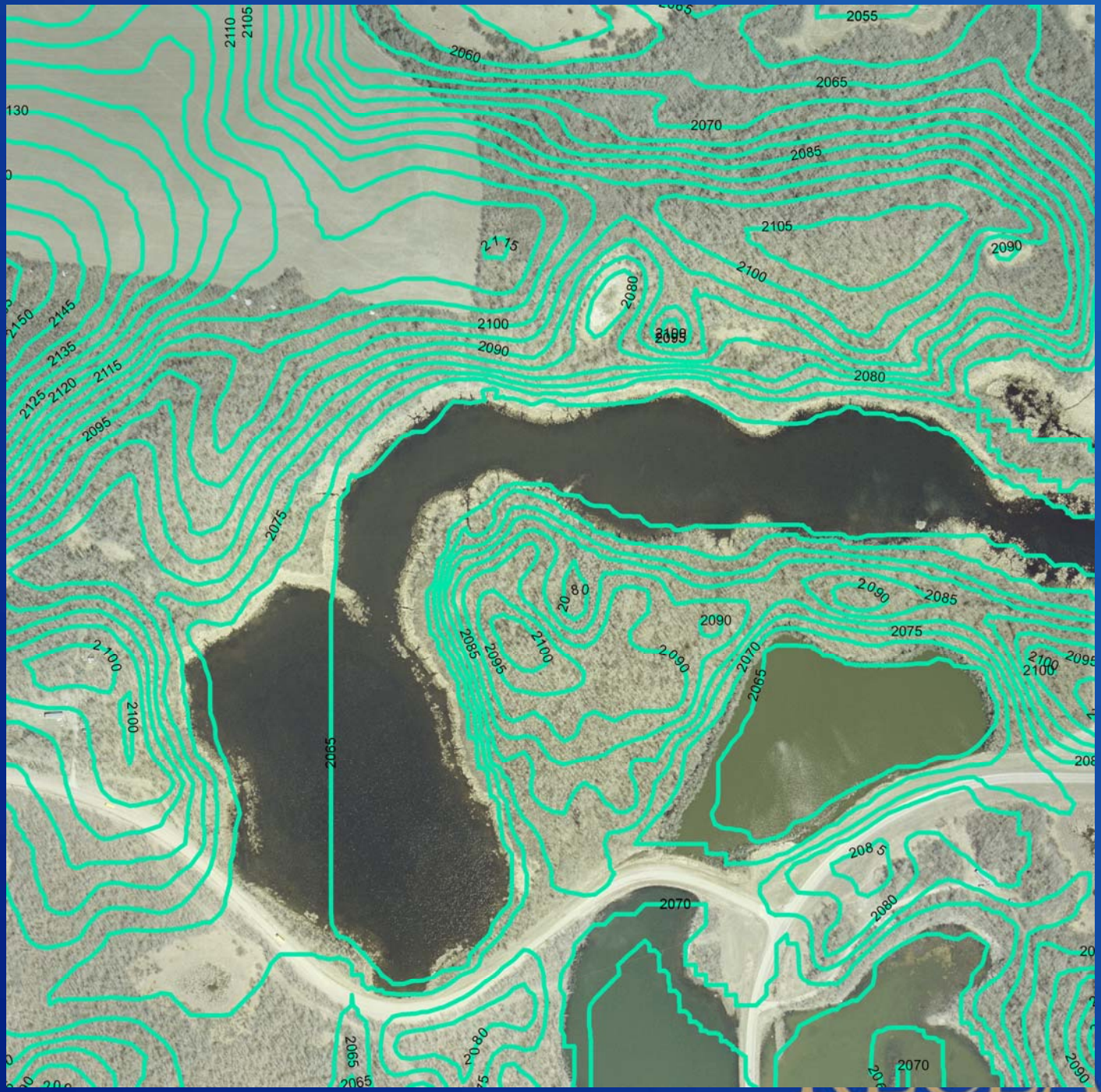
RECLAMATION



6 inch Resolution Aerial Photography 5/2002 SCALE 1 inch = 167 feet







Digital Contours:

The computer will locate the nearest point with the same value, this is not always the right point.

RECLAMATION

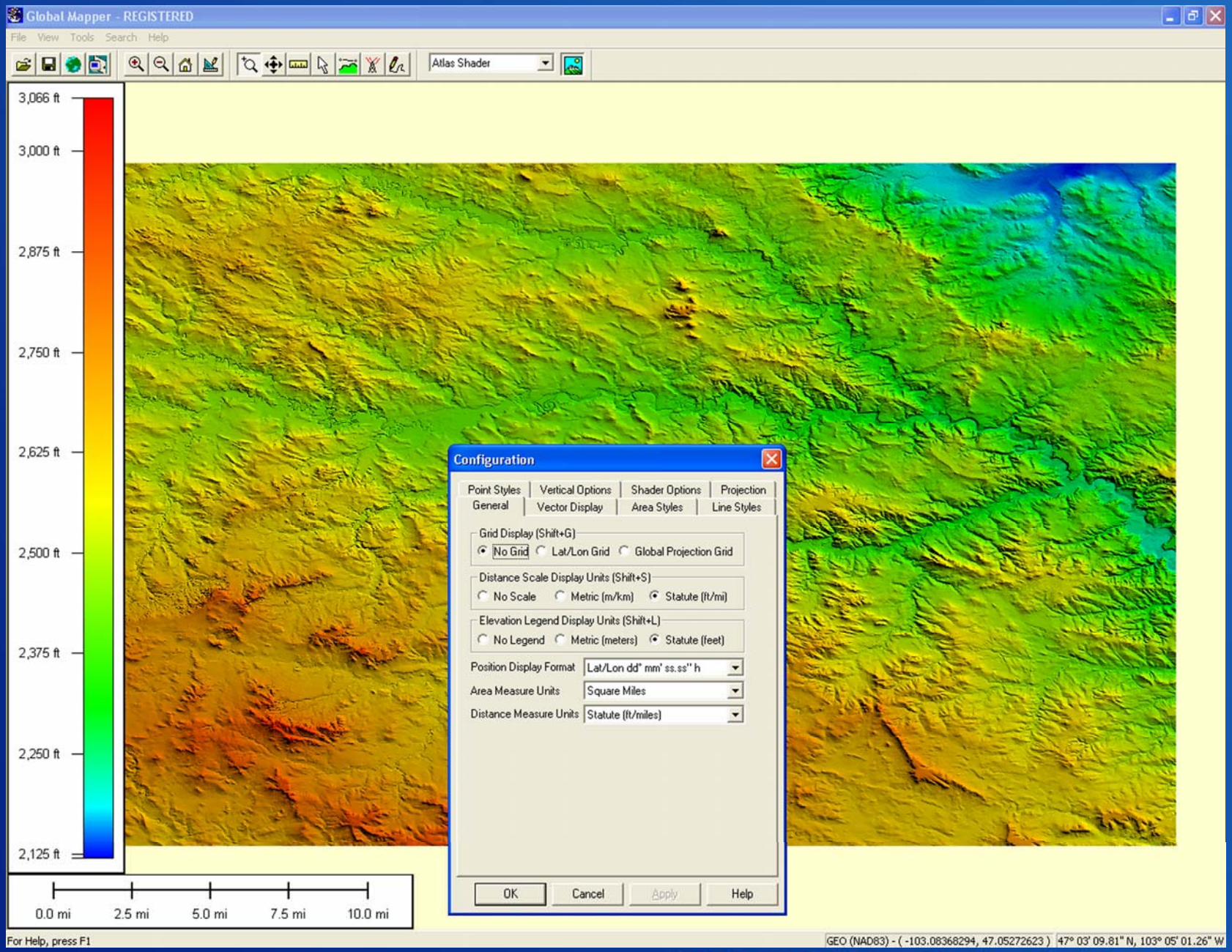
CREATING CONTOURS USING:

GLOBAL MAPPER

or

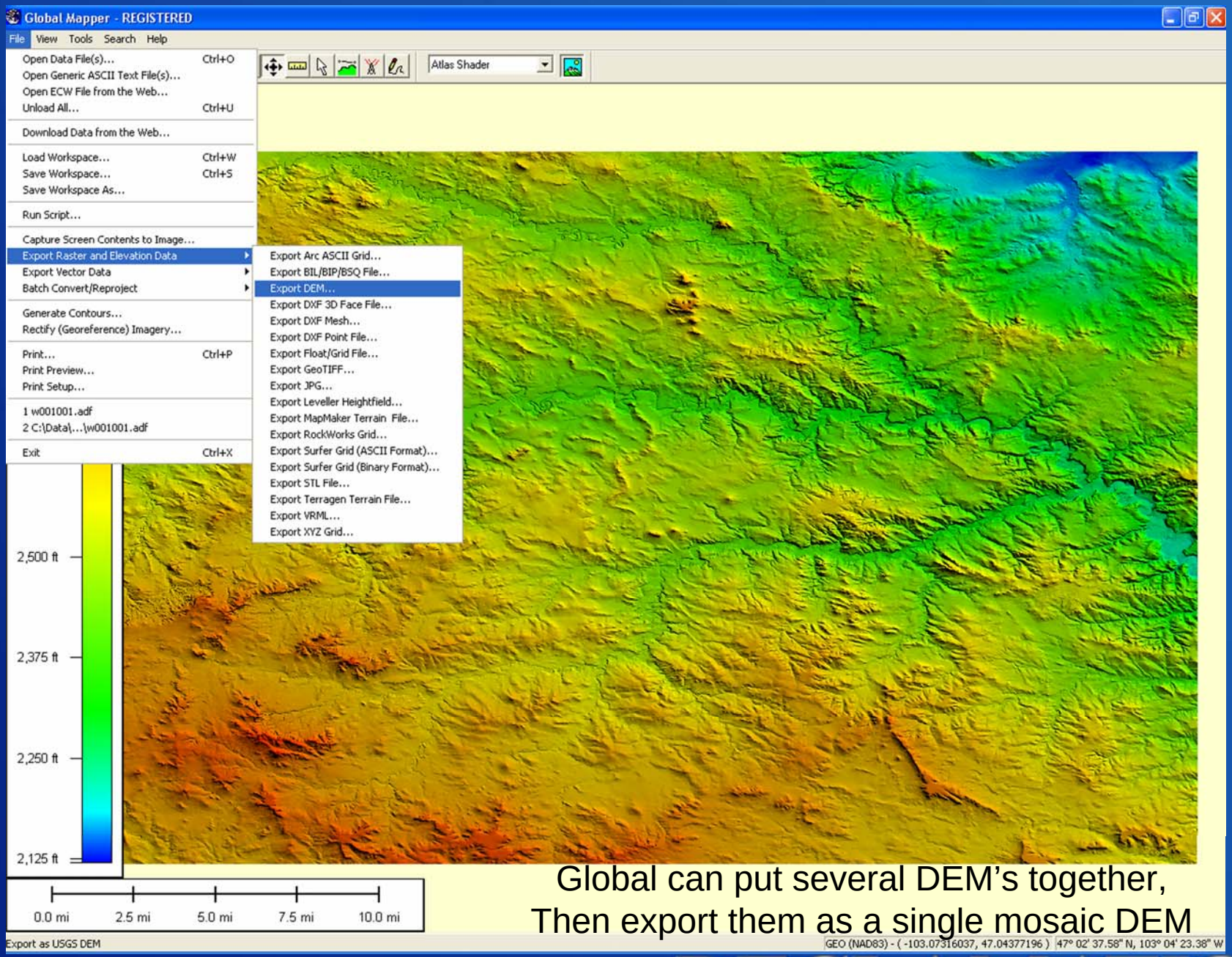
ARCGIS ?

RECLAMATION



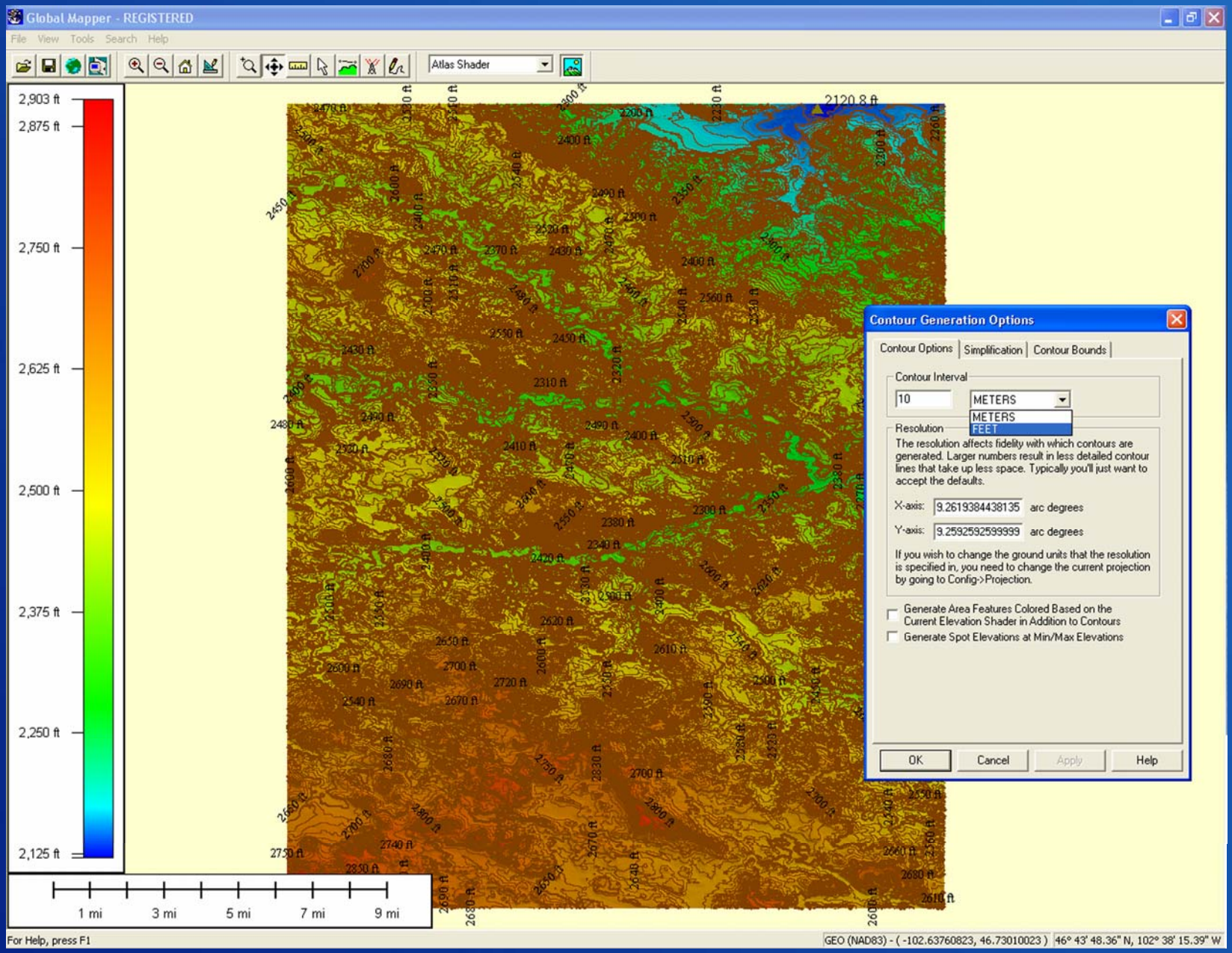
Global Mapper – you can set the scale doesn't matter what is pulled in

RECLAMATION



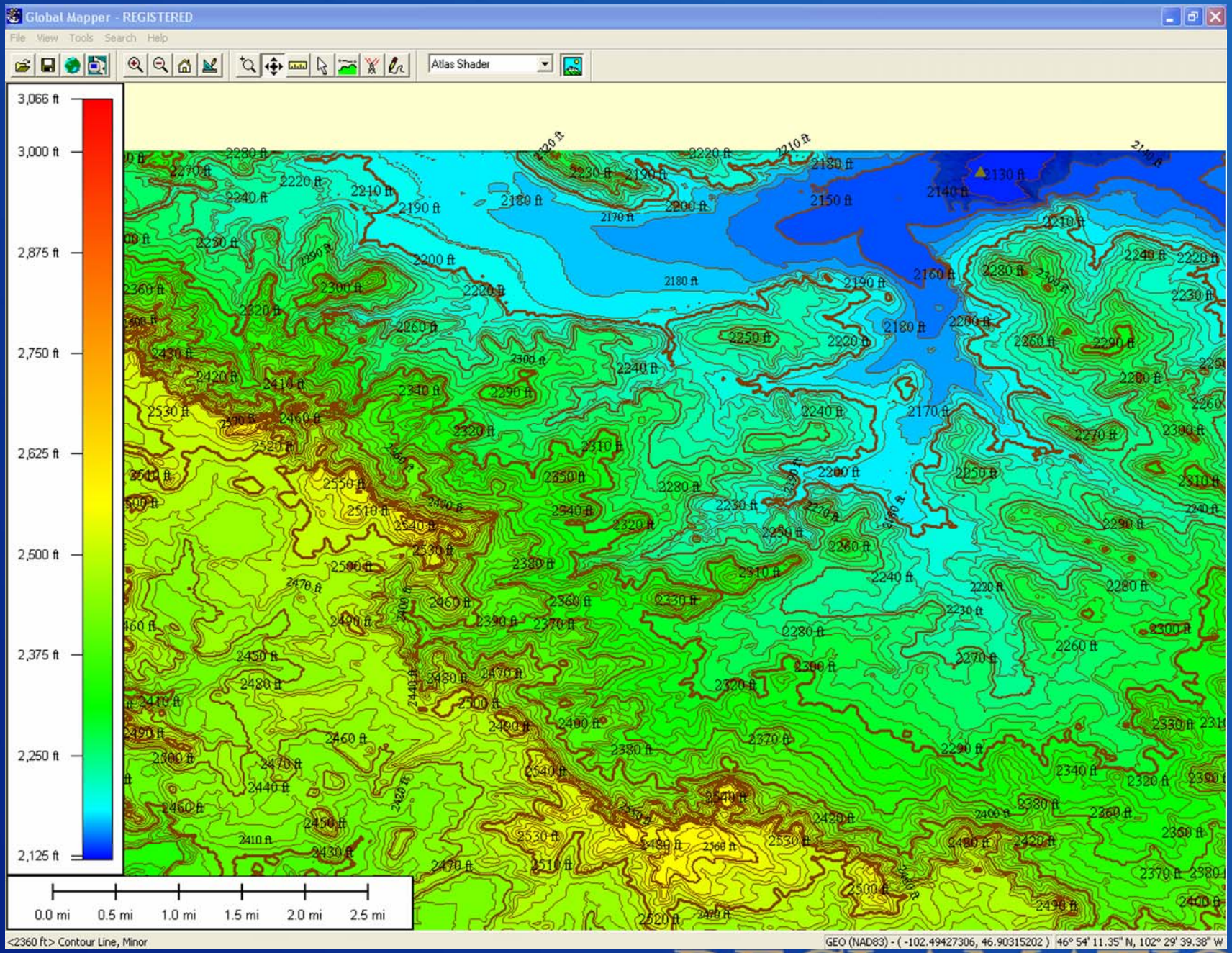
Global can put several DEM's together,
Then export them as a single mosaic DEM

RECLAMATION

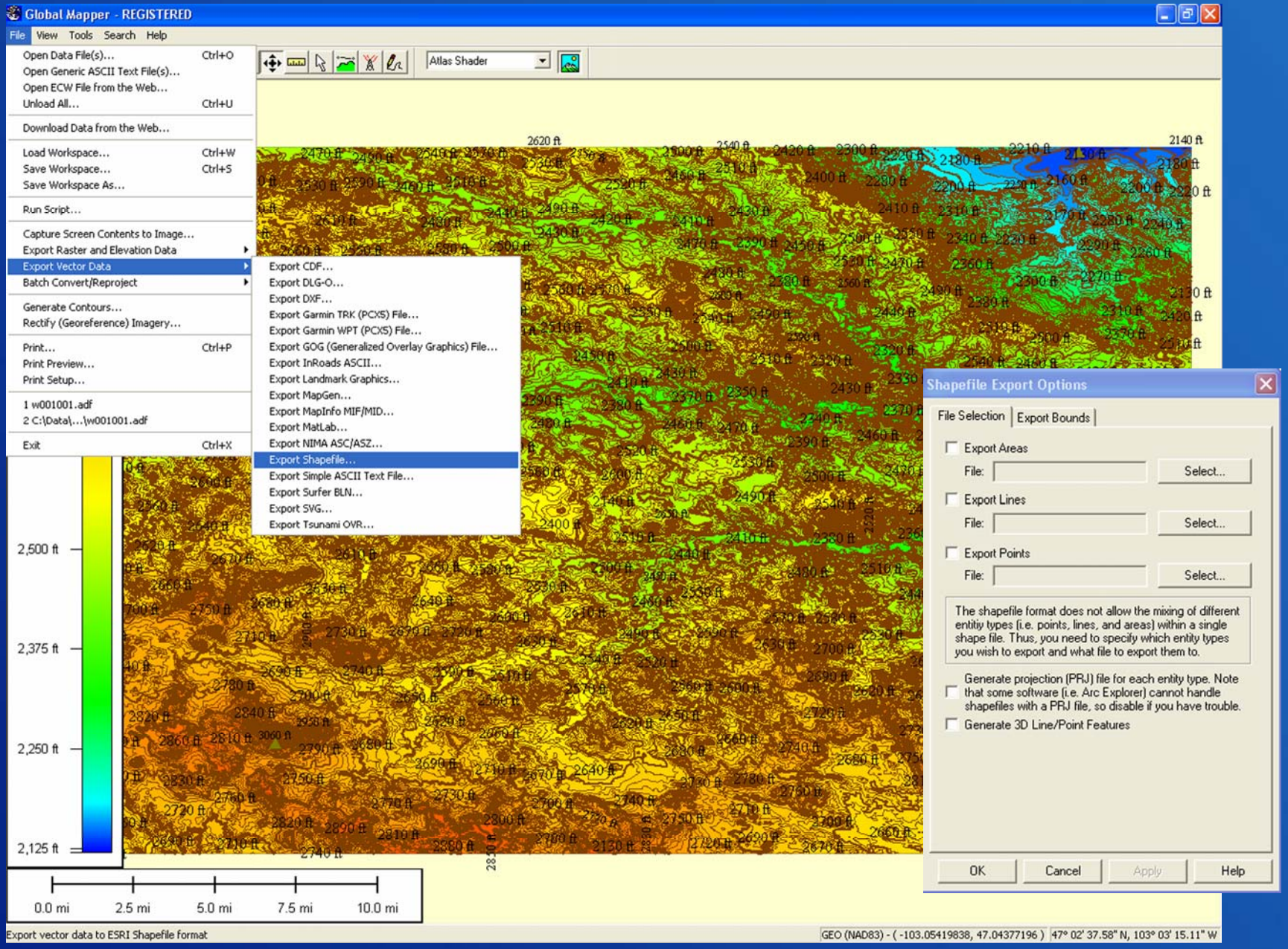


Global easily sets the contour interval to feet, and you can create area or point features

RECLAMATION

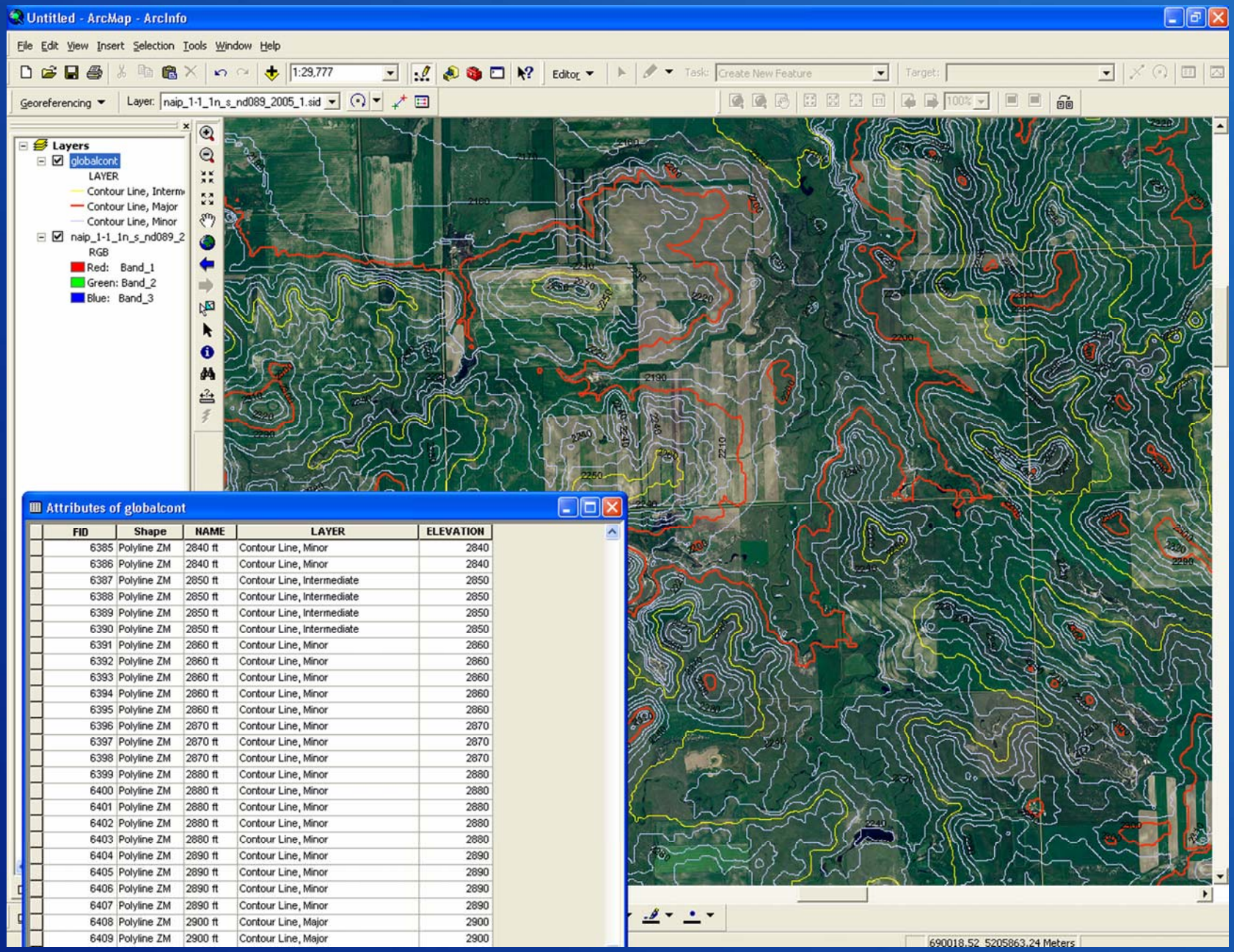


RECLAMATION



Even if I bring in more than one DEM, I can create the contours and export as a shapefile

RECLAMATION

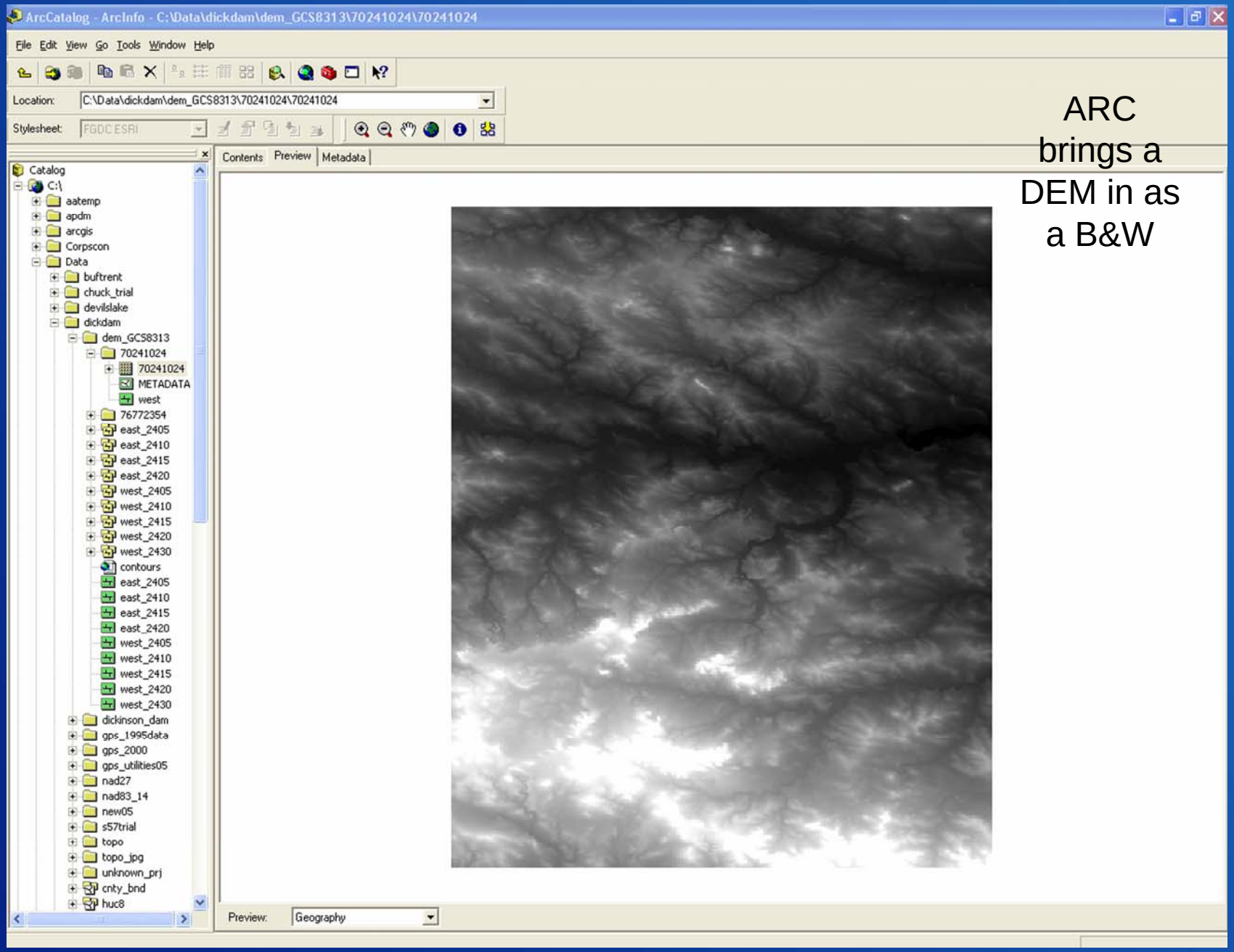


Attributes of globalcont

FID	Shape	NAME	LAYER	ELEVATION
6385	Polyline ZM	2840 ft	Contour Line, Minor	2840
6386	Polyline ZM	2840 ft	Contour Line, Minor	2840
6387	Polyline ZM	2850 ft	Contour Line, Intermediate	2850
6388	Polyline ZM	2850 ft	Contour Line, Intermediate	2850
6389	Polyline ZM	2850 ft	Contour Line, Intermediate	2850
6390	Polyline ZM	2850 ft	Contour Line, Intermediate	2850
6391	Polyline ZM	2860 ft	Contour Line, Minor	2860
6392	Polyline ZM	2860 ft	Contour Line, Minor	2860
6393	Polyline ZM	2860 ft	Contour Line, Minor	2860
6394	Polyline ZM	2860 ft	Contour Line, Minor	2860
6395	Polyline ZM	2860 ft	Contour Line, Minor	2860
6396	Polyline ZM	2870 ft	Contour Line, Minor	2870
6397	Polyline ZM	2870 ft	Contour Line, Minor	2870
6398	Polyline ZM	2870 ft	Contour Line, Minor	2870
6399	Polyline ZM	2880 ft	Contour Line, Minor	2880
6400	Polyline ZM	2880 ft	Contour Line, Minor	2880
6401	Polyline ZM	2880 ft	Contour Line, Minor	2880
6402	Polyline ZM	2880 ft	Contour Line, Minor	2880
6403	Polyline ZM	2880 ft	Contour Line, Minor	2880
6404	Polyline ZM	2890 ft	Contour Line, Minor	2890
6405	Polyline ZM	2890 ft	Contour Line, Minor	2890
6406	Polyline ZM	2890 ft	Contour Line, Minor	2890
6407	Polyline ZM	2890 ft	Contour Line, Minor	2890
6408	Polyline ZM	2900 ft	Contour Line, Major	2900
6409	Polyline ZM	2900 ft	Contour Line, Major	2900

When I bring the Global shapefile into ARC, it contains contour layers and elevation data

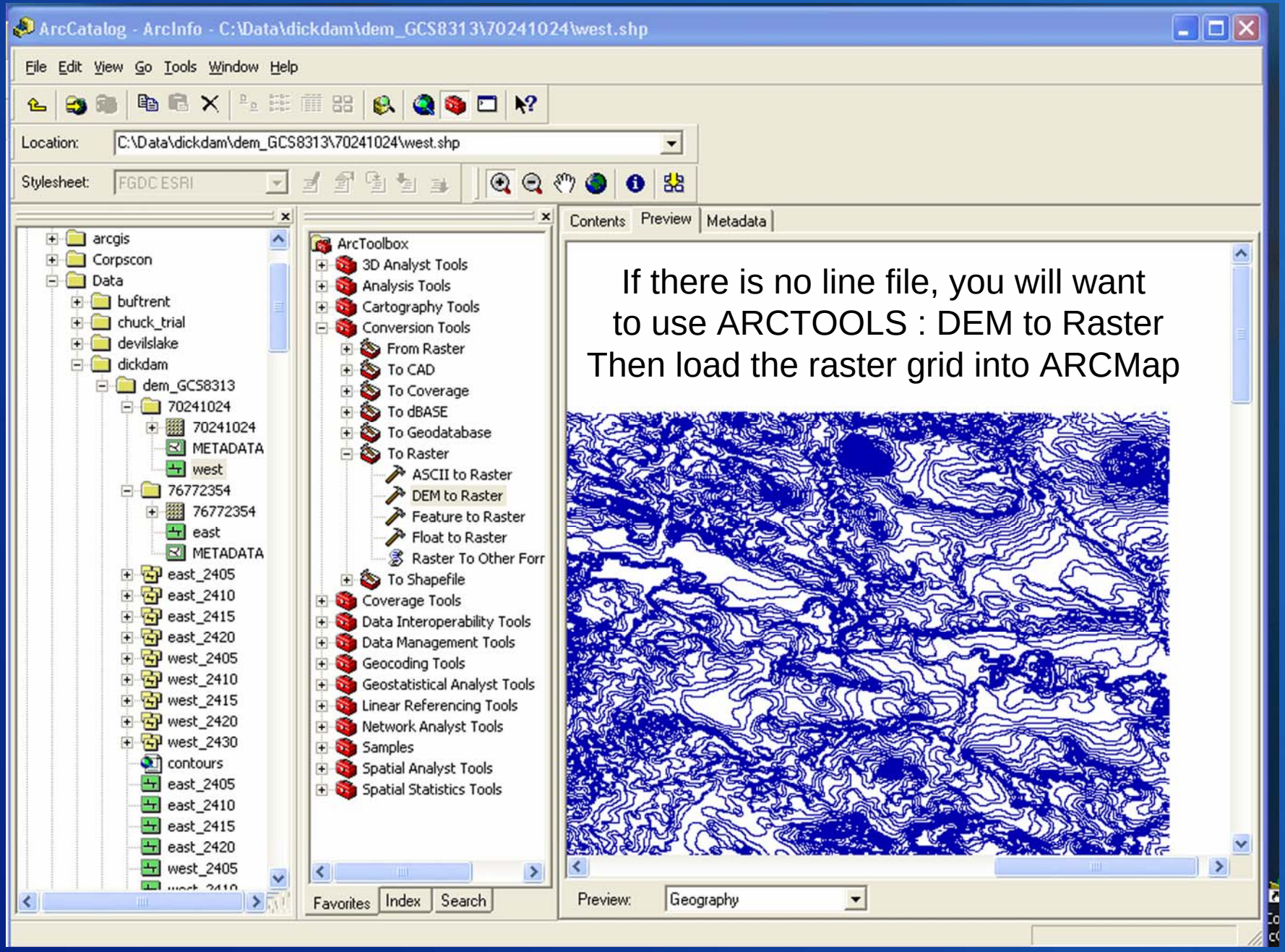
RECLAMATION



ARC brings a DEM in as a B&W

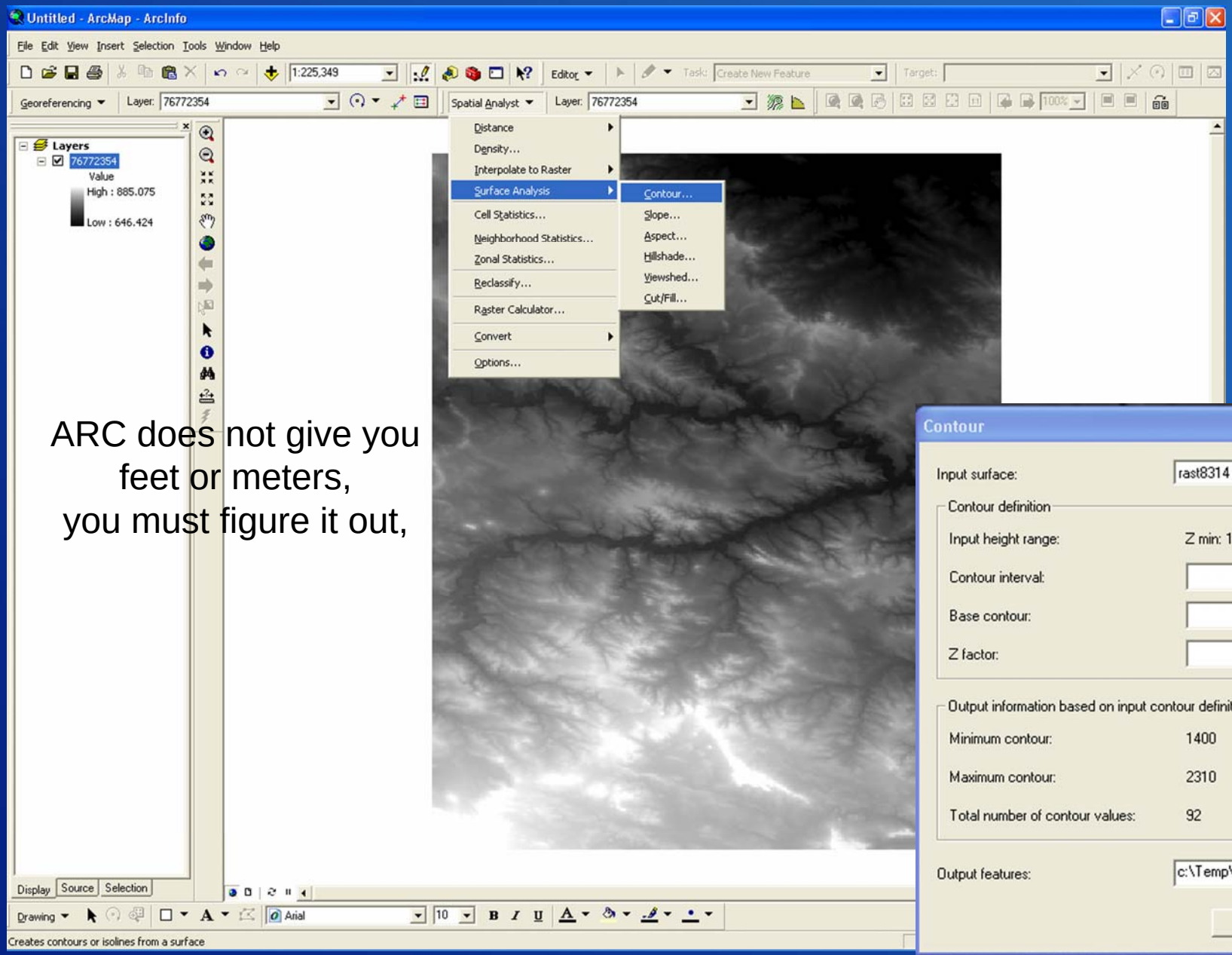
Newer DEM's from EROS have a line file, some older versions of DEM's will not open

RECLAMATION



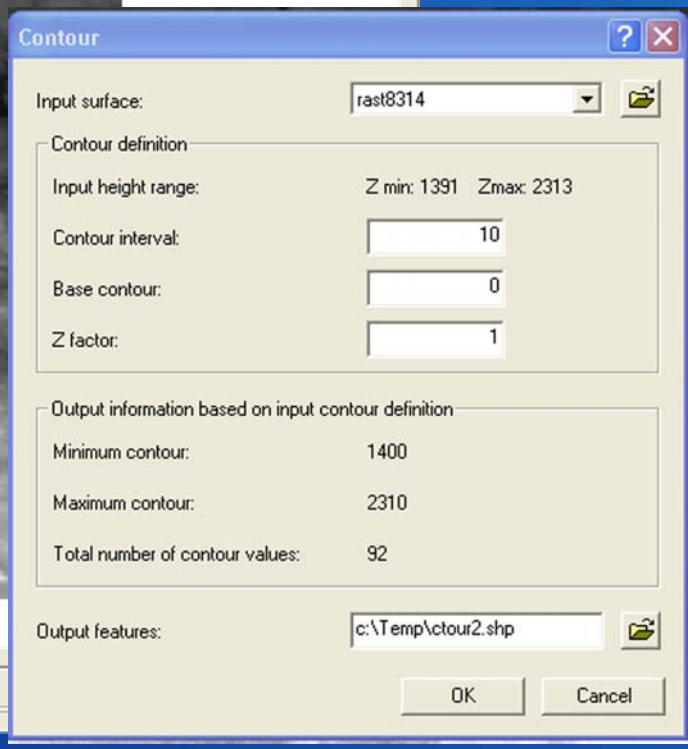
No line differentiation

RECLAMATION



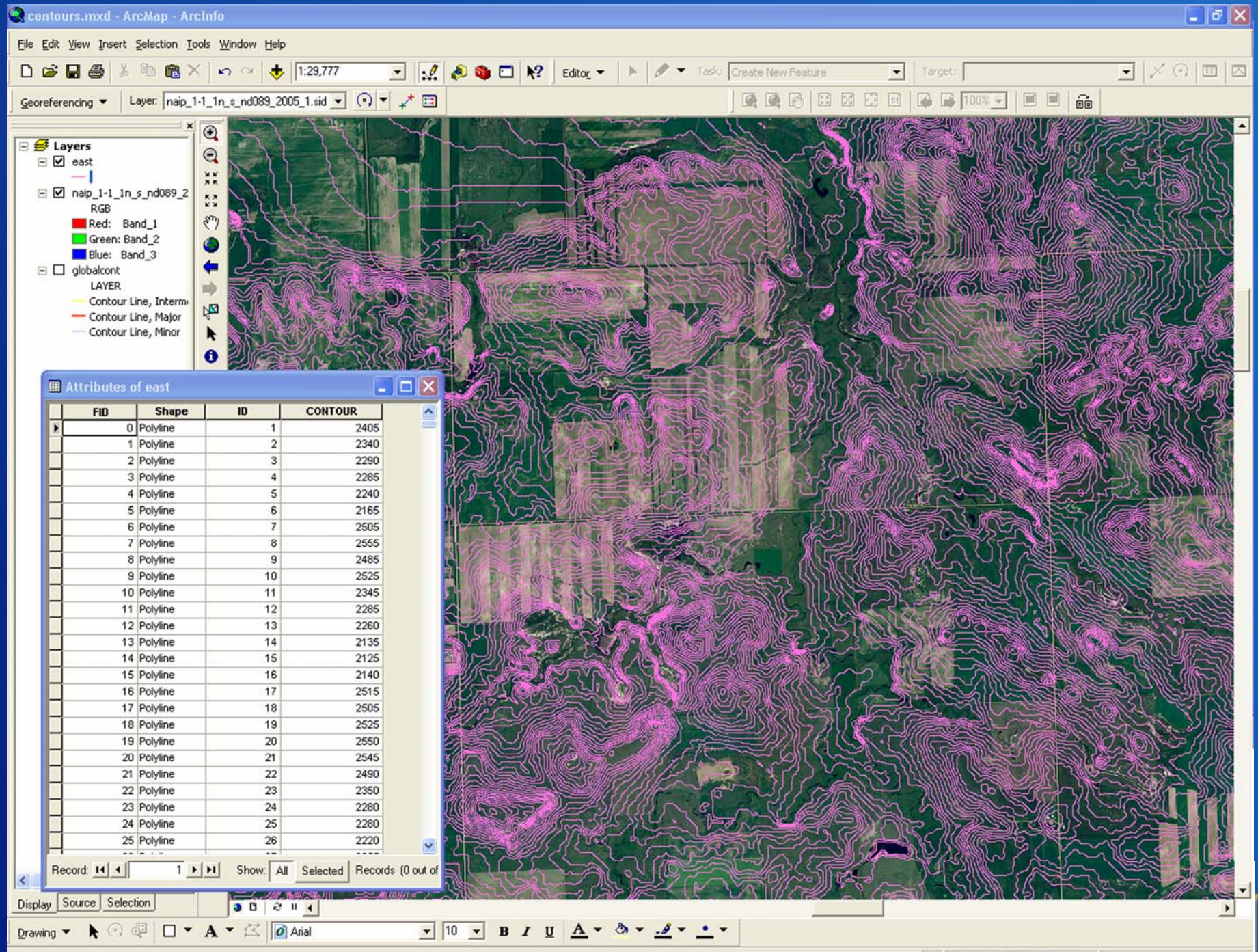
ARC only creates a line file

ARC does not give you feet or meters, you must figure it out,



The base contour starts at zero and creates contours all the way up, crashing your program.

RECLAMATION



FID	Shape	ID	CONTOUR
0	Polyline	1	2405
1	Polyline	2	2340
2	Polyline	3	2290
3	Polyline	4	2285
4	Polyline	5	2240
5	Polyline	6	2165
6	Polyline	7	2505
7	Polyline	8	2555
8	Polyline	9	2485
9	Polyline	10	2525
10	Polyline	11	2345
11	Polyline	12	2285
12	Polyline	13	2260
13	Polyline	14	2135
14	Polyline	15	2125
15	Polyline	16	2140
16	Polyline	17	2515
17	Polyline	18	2505
18	Polyline	19	2525
19	Polyline	20	2550
20	Polyline	21	2545
21	Polyline	22	2490
22	Polyline	23	2350
23	Polyline	24	2280
24	Polyline	25	2280
25	Polyline	26	2220

TOPOS

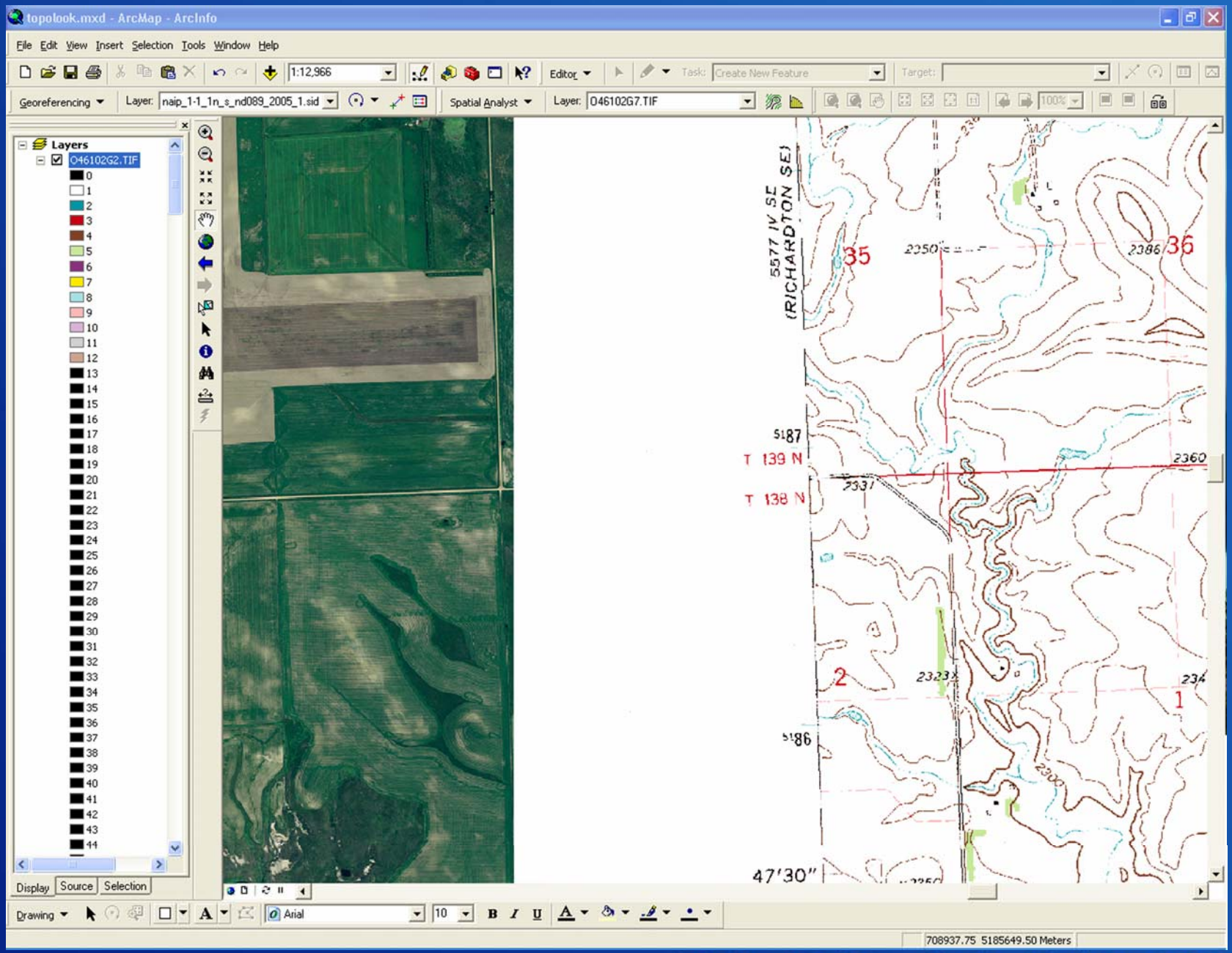
OR

DLG's ?

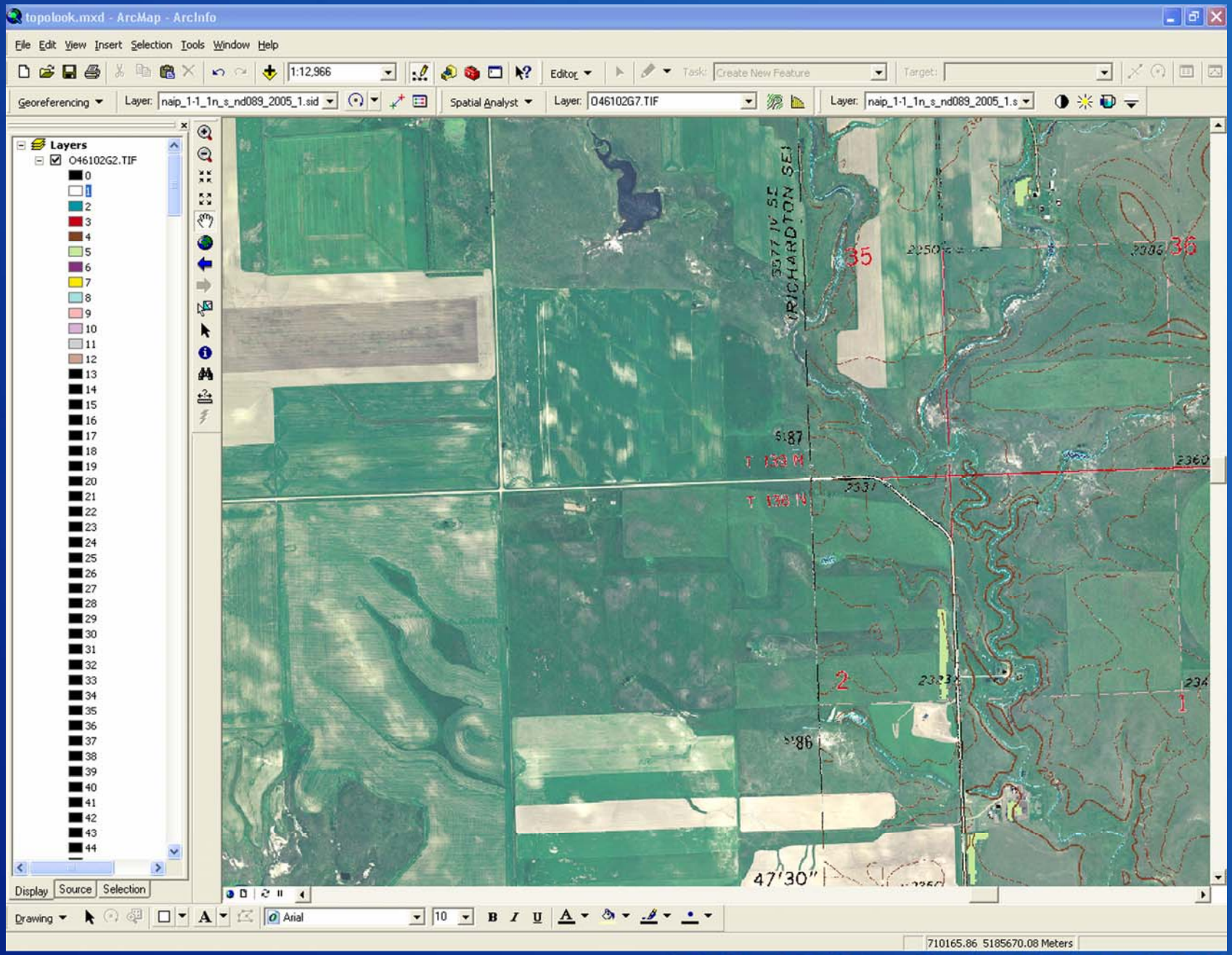
hypsography

http://gis1.state.nd.us/100k/hypsography/arc_export/

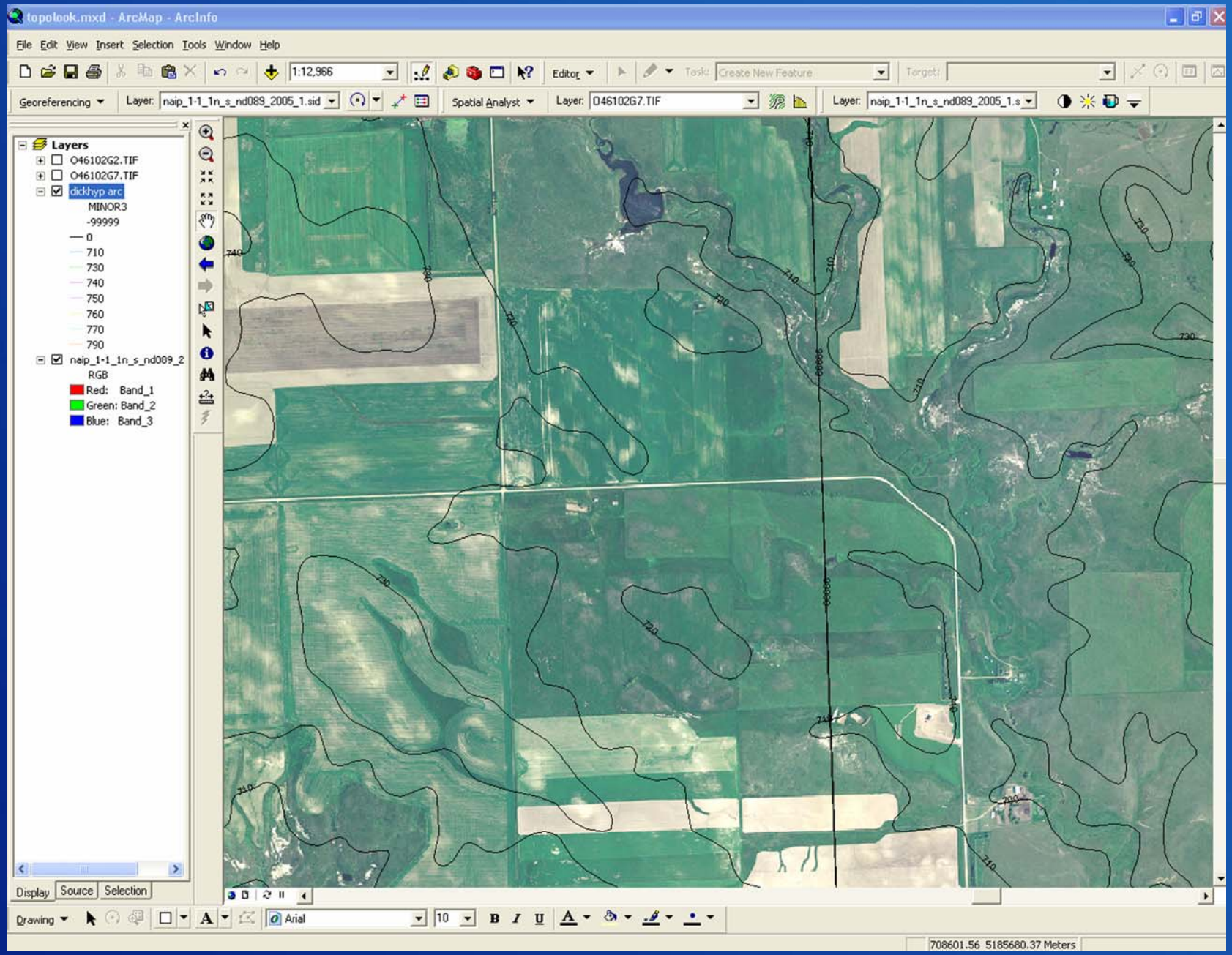
RECLAMATION



RECLAMATION



RECLAMATION

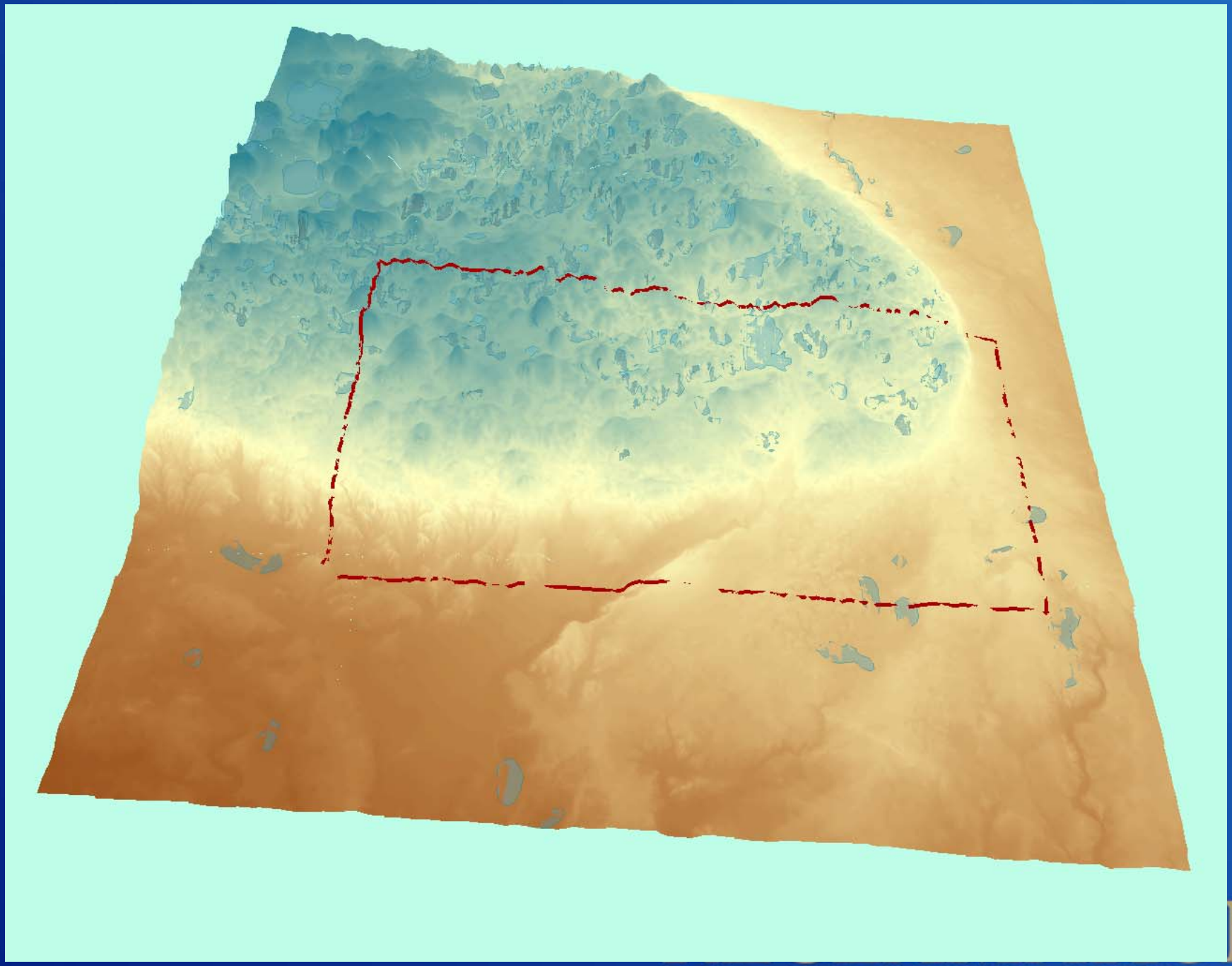


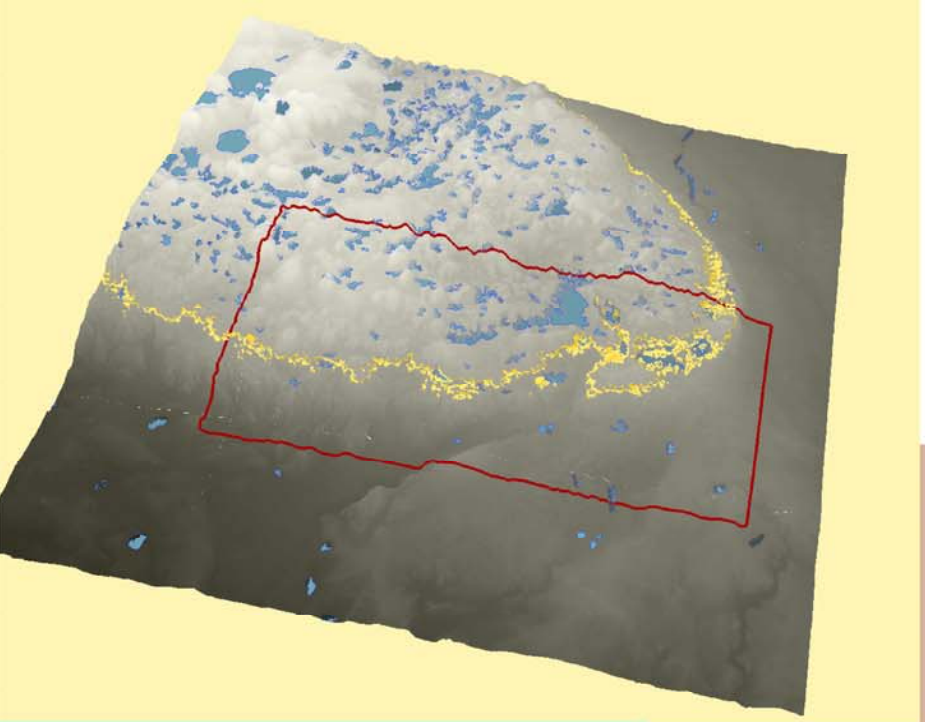
RECLAMATION

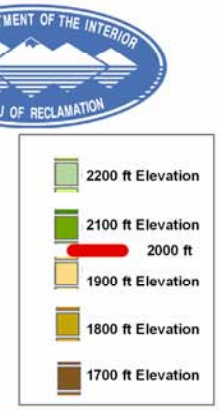
3 D

Three Dimensional Images need an elevation unit – called the Z unit

RECLAMATION





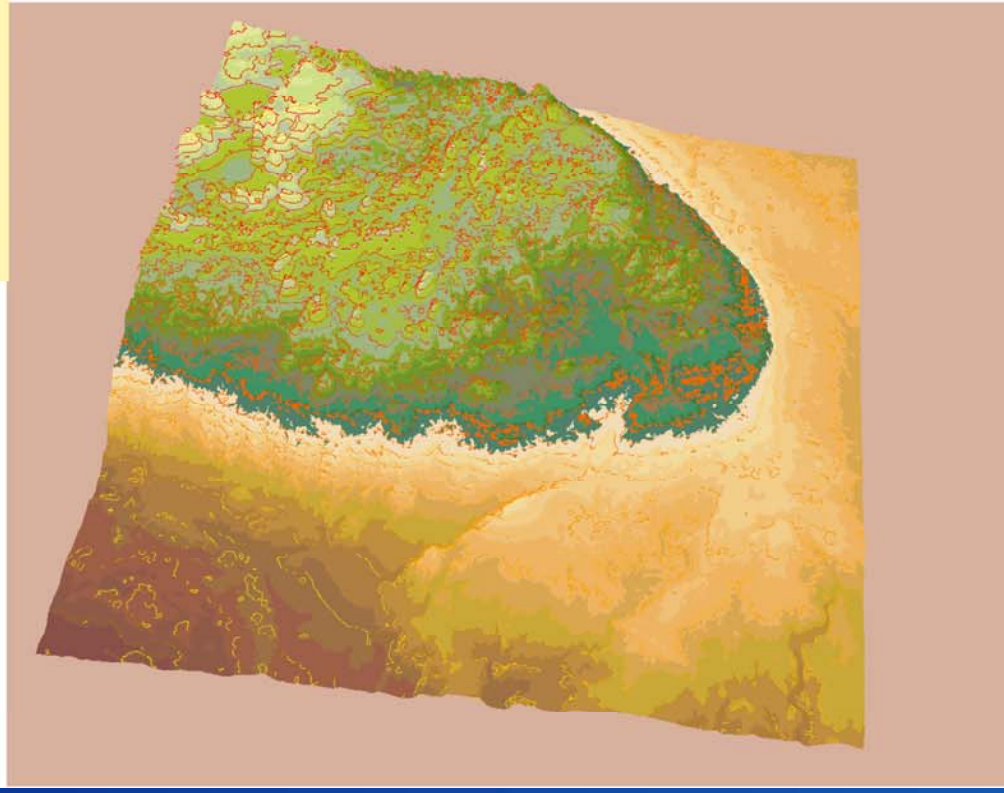


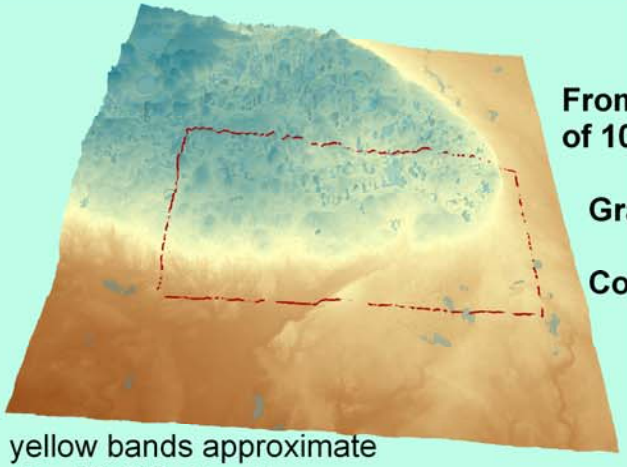
Right Image:

Color Gradient Map now in 3D created from contour lines (contour lines were generated from the DEM's)

elevation in this block grades from 1635 ft to 2275 ft

red band is approximately the 2000 ft elevation





yellow bands approximate the 2000 ft elevation

Two Left Images:

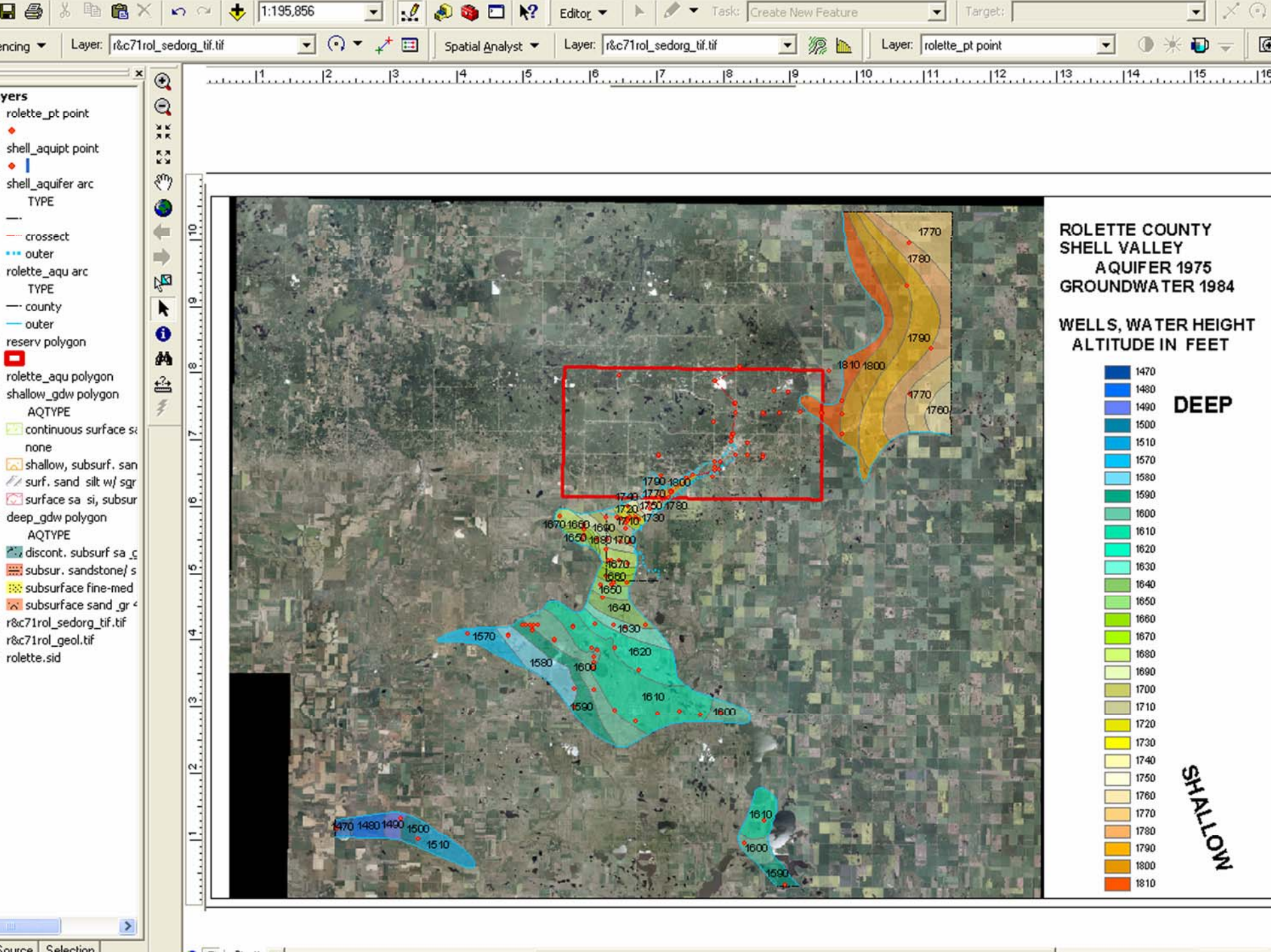
From the mosaic of 10-meter DEM's:

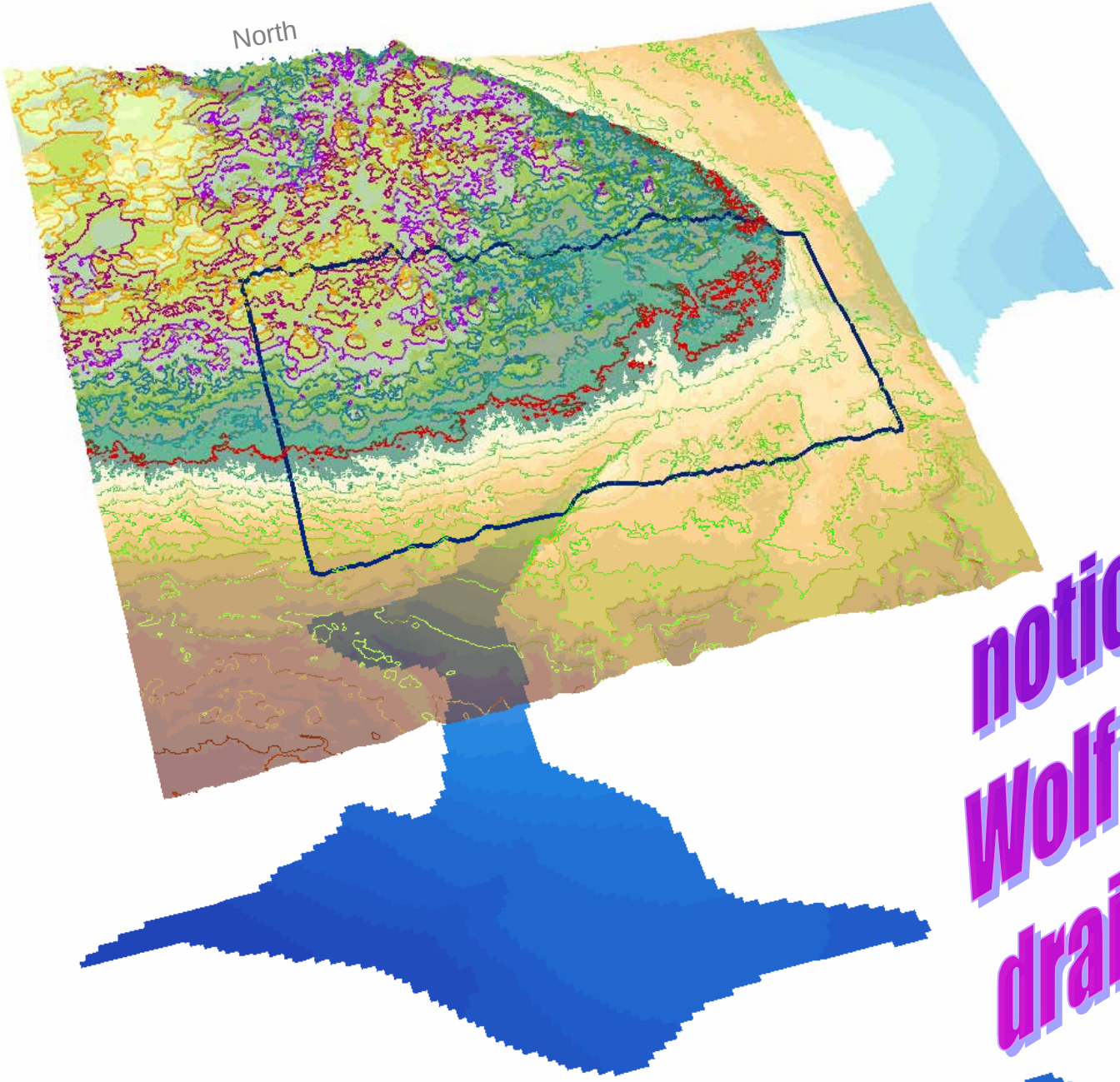
Grayscale (above)

Color Gradient (left)

MAP 2: 3 VIEWS

RECLAMATION


ROLETTE COUNTY
SHELL VALLEY
AQUIFER 1975
GROUNDWATER 1984
WELLS, WATER HEIGHT
ALTITUDE IN FEET
DEEP
SHALLOW
1470
1480
1490
1500
1510
1570
1580
1590
1600
1610
1620
1630
1640
1650
1660
1670
1680
1690
1700
1710
1720
1730
1740
1750
1760
1770
1780
1790
1800
1810
Layer: r&c71rol_sedorg_tif.tif
Layer: rolette_pt point
Spatial Analyst
Editor
Task: Create New Feature
Target:
1:195,856
rolette_pt point
shell_aquipt point
shell_aquifer arc
TYPE
crossect
outer
rolette_aqu arc
TYPE
county
outer
reserv polygon
rolette_aqu polygon
shallow_gdw polygon
AQTYPE
continuous surface sa
none
shallow, subsurf. san
surf. sand silt w/ sgr
surface sa si, subsur
deep_gdw polygon
AQTYPE
discont. subsurf sa
subsur. sandstone/ s
subsurface fine-med
subsurface sand gr
r&c71rol_sedorg_tif.tif
r&c71rol_geol.tif
rolette.sid

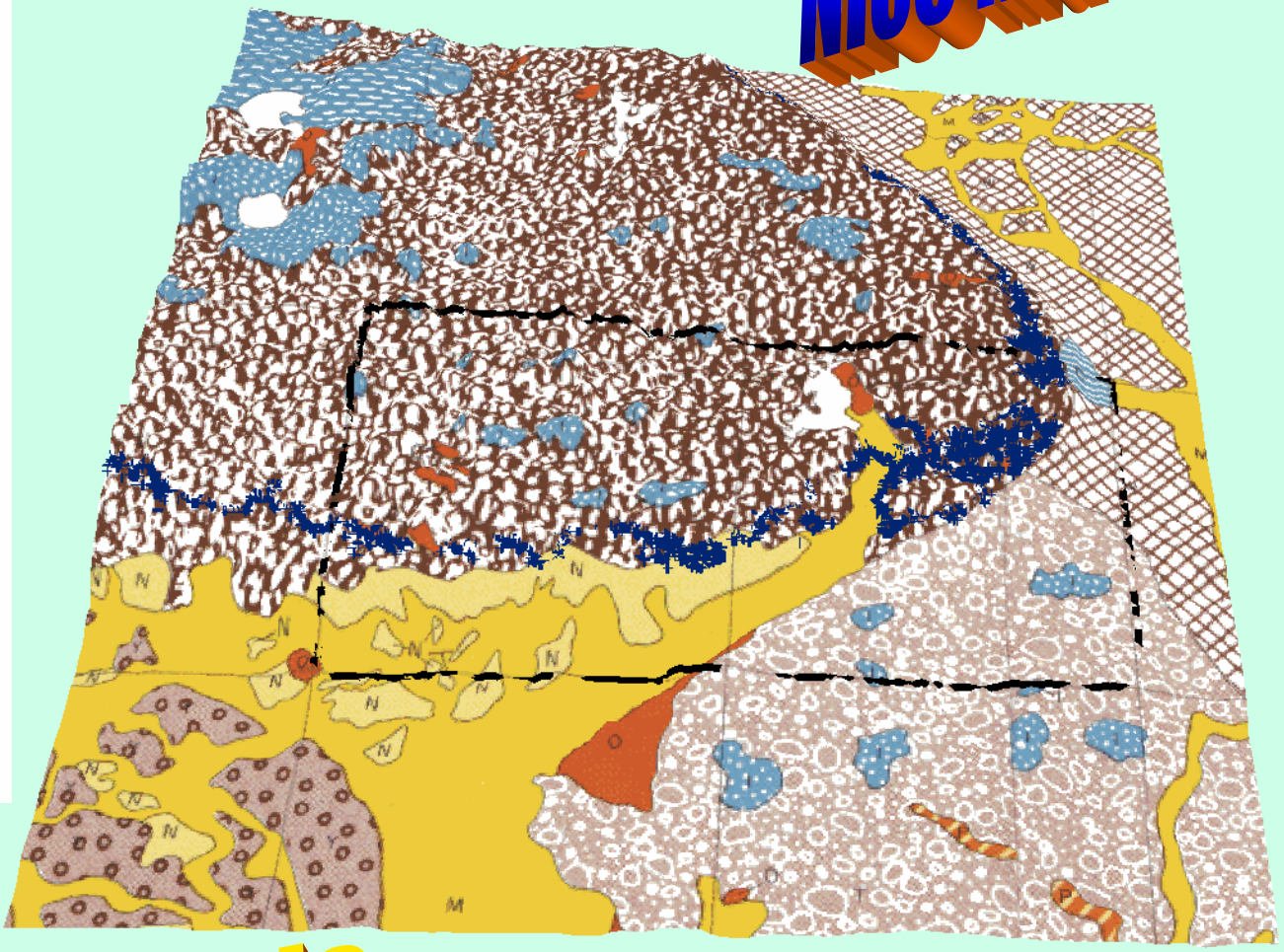


notice the Wolf Creek drainage

Nice Match!

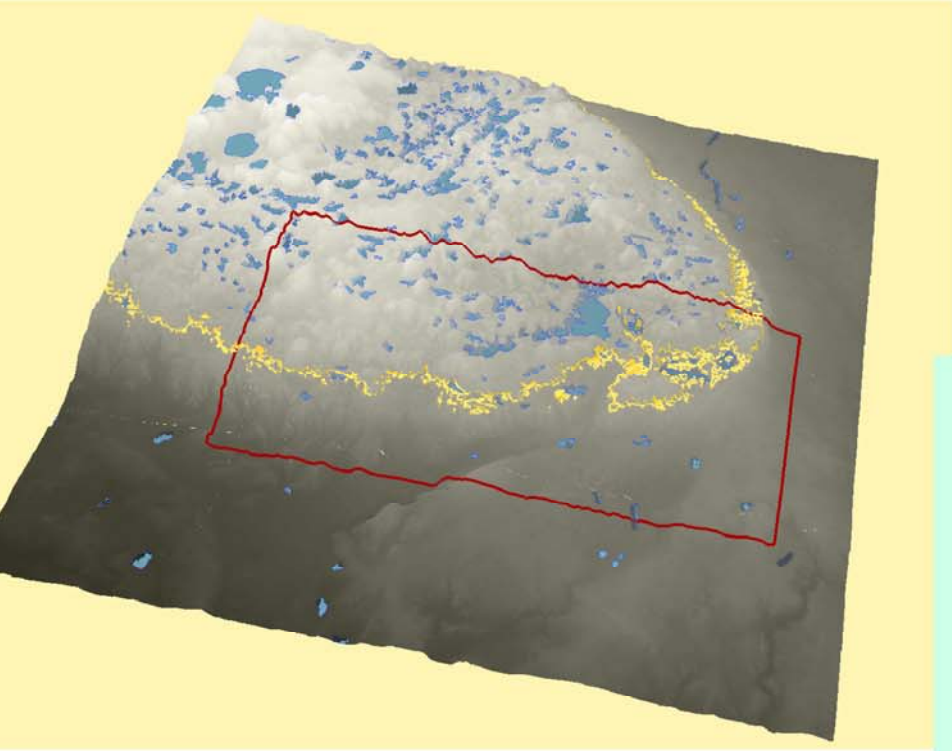
Sediment Origin

- Slow to Pond Sediment
- Lake Sediment
- Ice-Marginal Lake Sediment
  ice-walled lake plains
- Stagnant Glacial Ice Lake Sediment
- Stream Sediment from the Last Deglaciation
  sheet of sand, gravel & silt
- Stream Sediment deposited early in the Last Deglaciation
  higher than "M" layer & on steeper slopes
- Stream Sediment deposited on Glacial Ice
  gravel & sandy gravel
- Ice Contact Sand & Gravel
- Low Relief Shale-Rich Till, east of the Turtle Mountains
  end moraine, gets thicker as landscape gets hillier
  this Late Wisconsin till blankets older till units
- High Relief Dead Ice Moraine
  Shale-Rich Till in the Turtle Mountains
  gets thicker as landscape gets hillier
  blankets older Pleistocene till units
- Moderate Relief Till in the Turtle Mountains
  a topographic low in the last glaciation
- Complex Relief, Shale-Rich Till
  east of the Turtle Mountains
  varying surface exposes older till units
- Low to Moderate Relief, Shale & Sandstone-Rich Till
  thin eroded blanket of sediment



Underground Sediments

RECLAMATION



Left Image:

elevation in this block grades from 1635 ft to 2275 ft

Grayscale of the mosaic of 10-meter DEM's

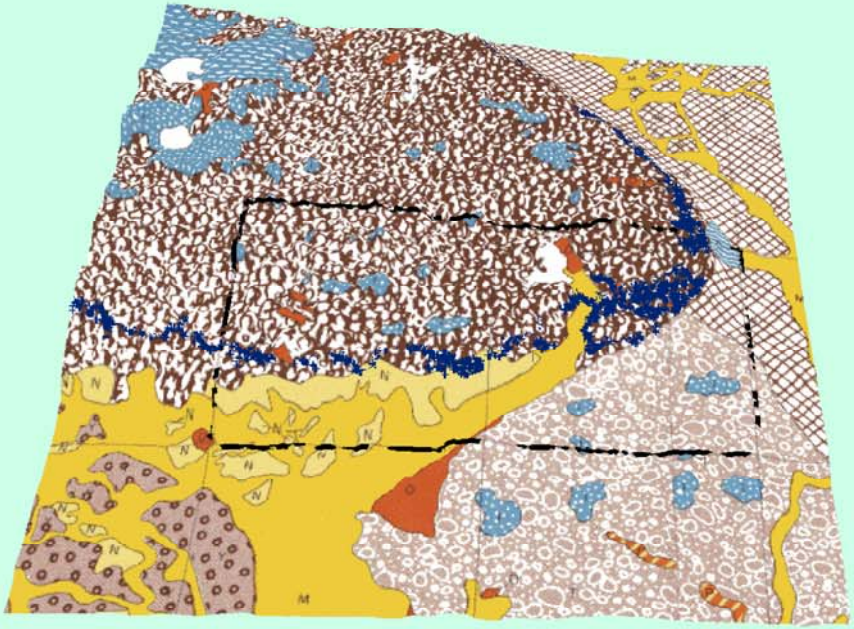
yellow band is approximately the 2000 ft elevation

Right Image:

Sediment Origin Map of Rolette County 1971 Bulletin 58, USGS

dark blue band is the approx. 2000 ft elevation

note the outwash materials & the thin eroded till in the SW corner

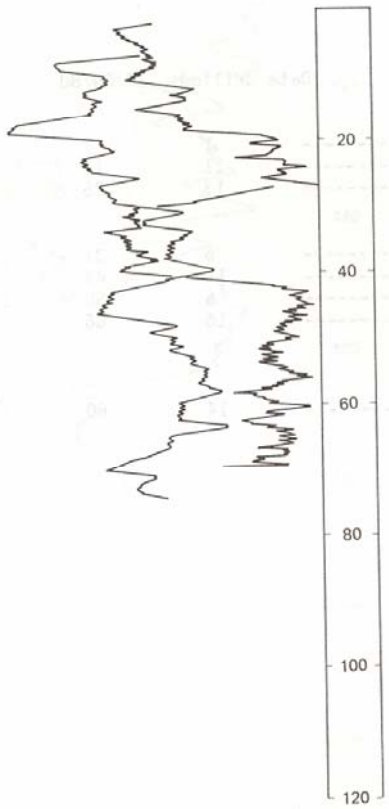


U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MAP 4: SEDIMENTOLOGY

RECLAMATION

Well Logs



DESCRIPTION OF DEPOSITS

GLACIAL DRIFT

0-1	Soil.
1-17	Sand, very fine to very coarse, gravelly, well-rounded; predominately quartz, carbonate, igneous, and detrital shale grains.
17-30	Sand, fine, silty; some detrital lignite.
30-42	Sand, medium to coarse, well-rounded; predominately detrital shale, carbonate, and quartz grains

FOX HILLS SANDSTONE

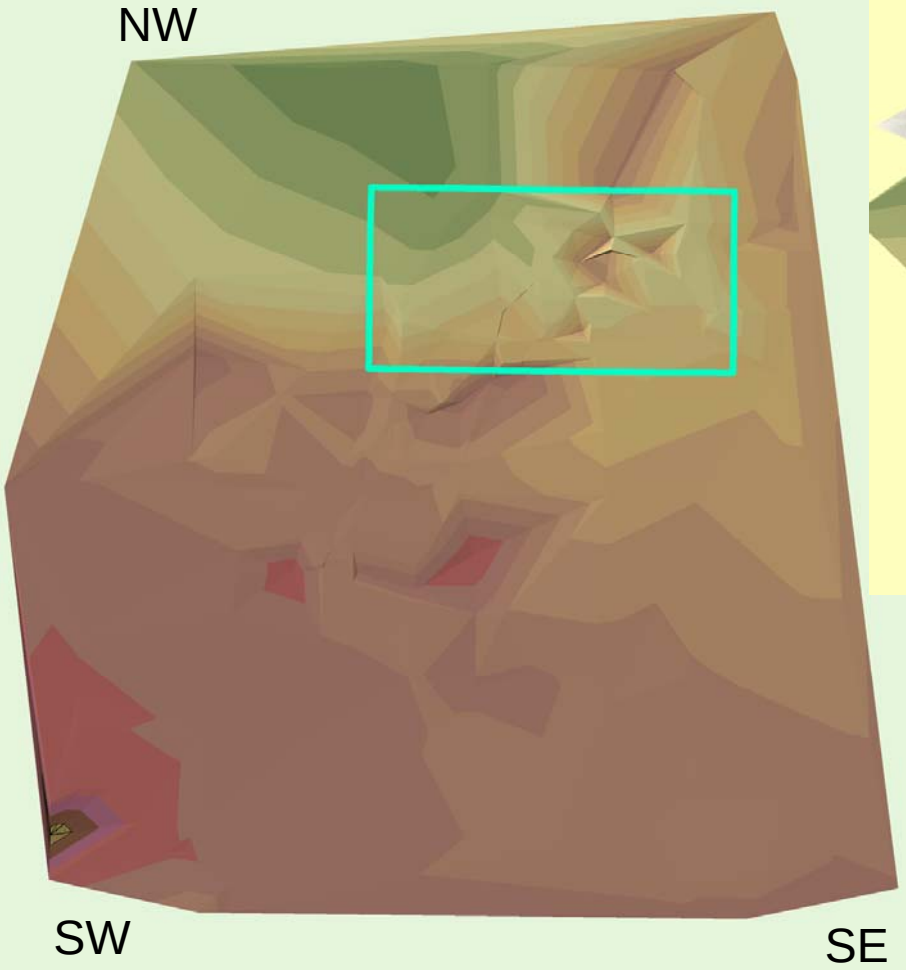
42-77	Siltstone, argillaceous, quartzose, poorly indurated, greenish-gray.

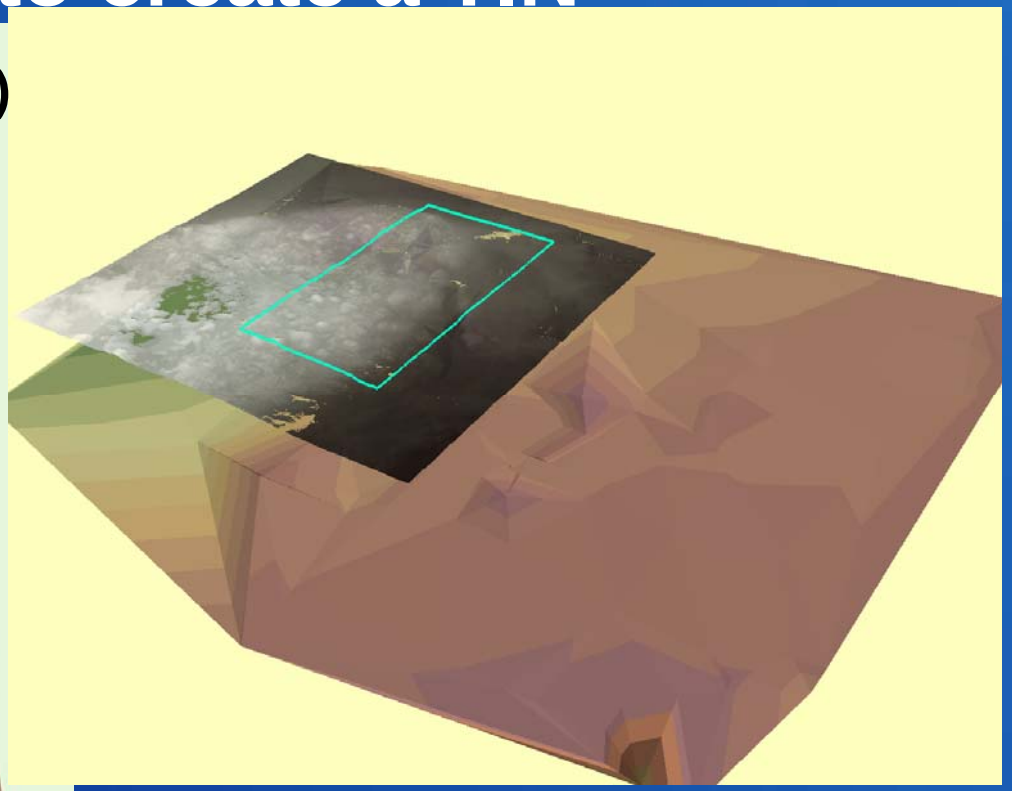
- **Look for a "restrictive" layer**
- **In this case, the siltstone at a 42 foot depth**

RECLAMATION

Used 376 well logs to create a TIN

(triangulated irregular network)





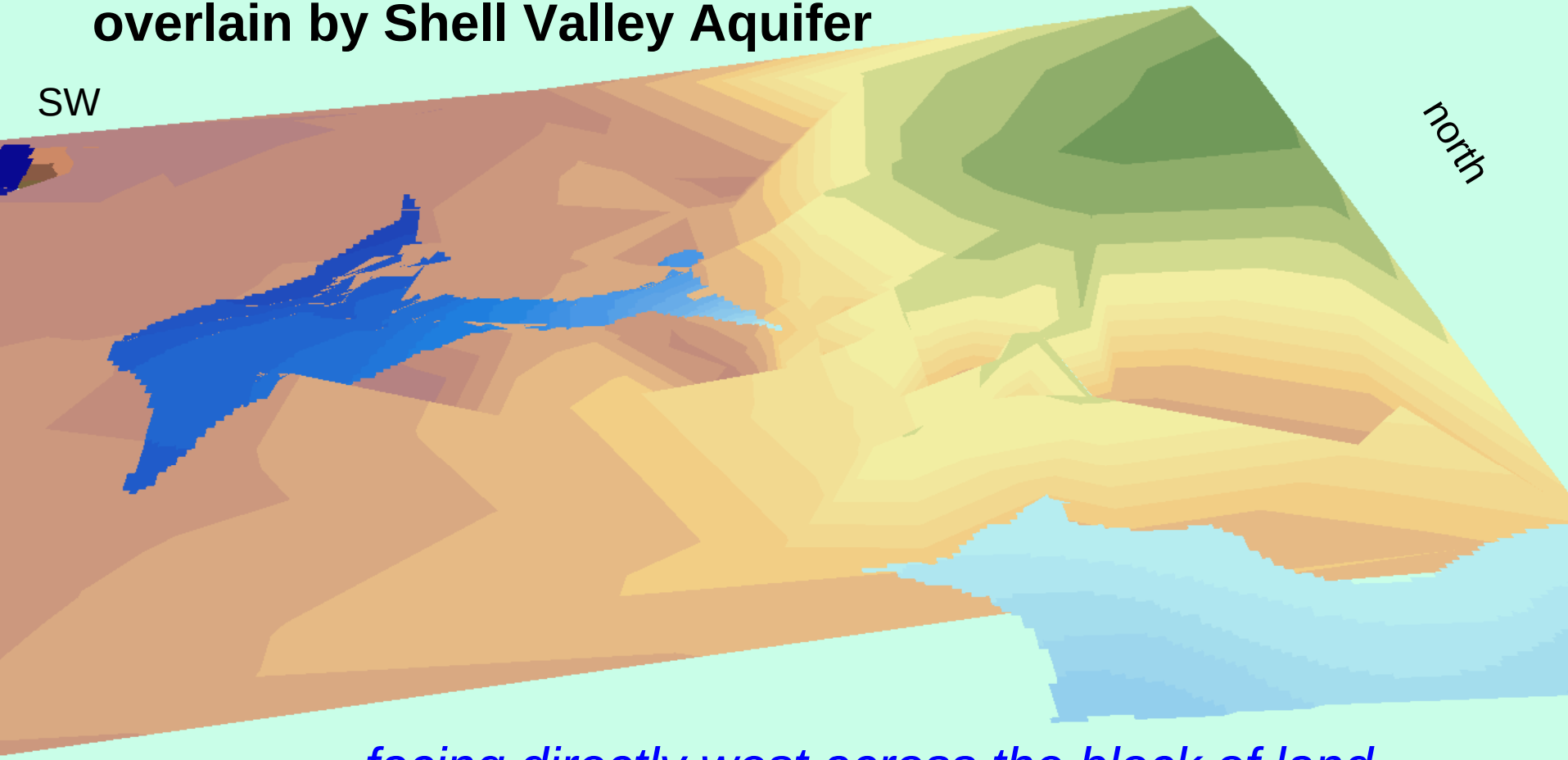
Subsurface Restrictive Layers

Dark Green 2230 ft elev.

Dark Rust 1260 ft elev.

RECLAMATION

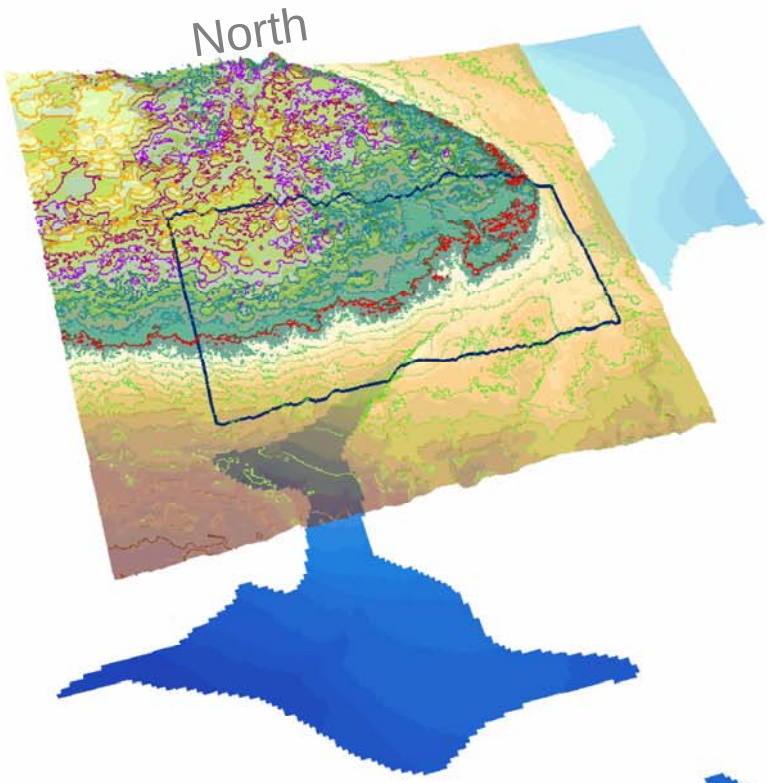
Subsurface Restrictive Layers overlain by Shell Valley Aquifer



facing directly west across the block of land

LIGHT BLUE 1800 ft
DARK BLUE 1470 ft

from 1635 ft to 2275 ft



Contour Surface Features underlain by Aquifers (in blue gradient) 3D Map

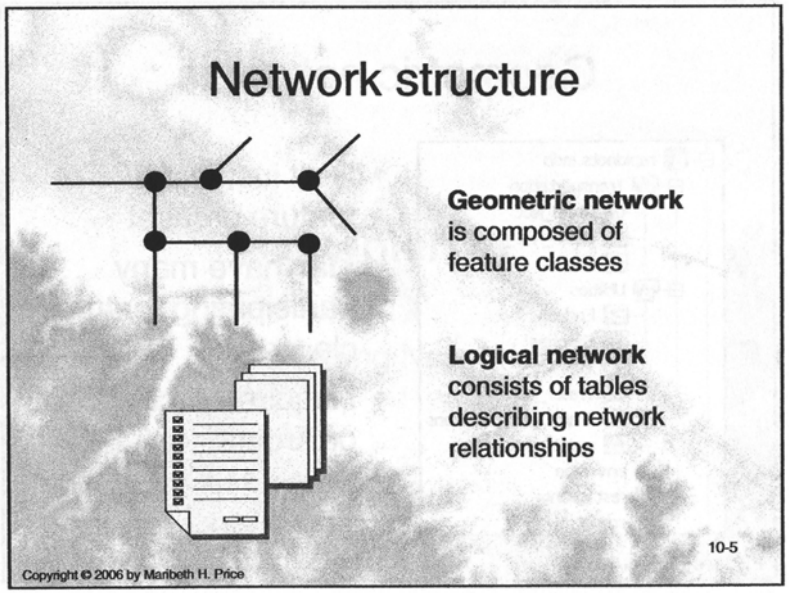
LAND SURFACE:

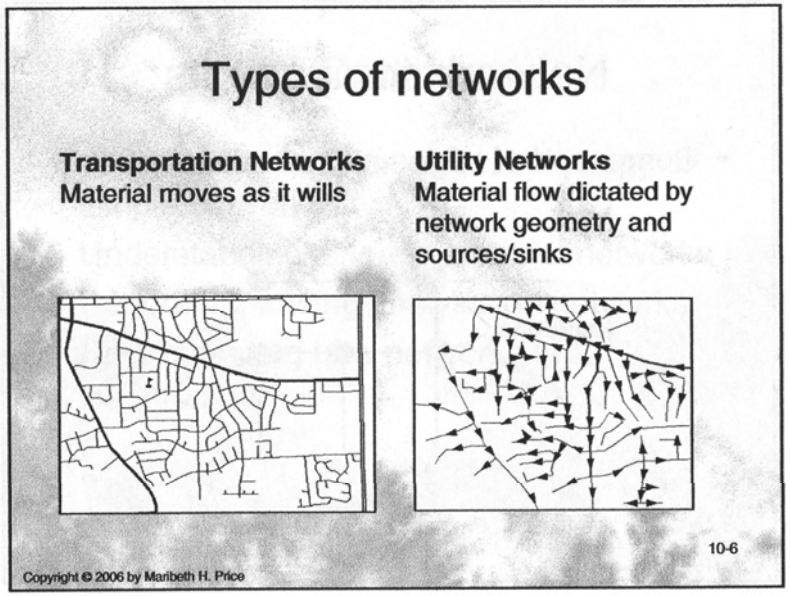
the elevation of the land surface along the west edge of the block climbs from 1635 feet in the SW corner to 2275 feet in the NW corner

AQUIFER SURFACE:

the elevation of the aquifers vary from 1800 feet at the Rolette Aquifer (light blue) to 1470 feet at the south end of the Shell Valley Aquifer (dark blue)

MAP 7: SOUTH to NORTH LINE

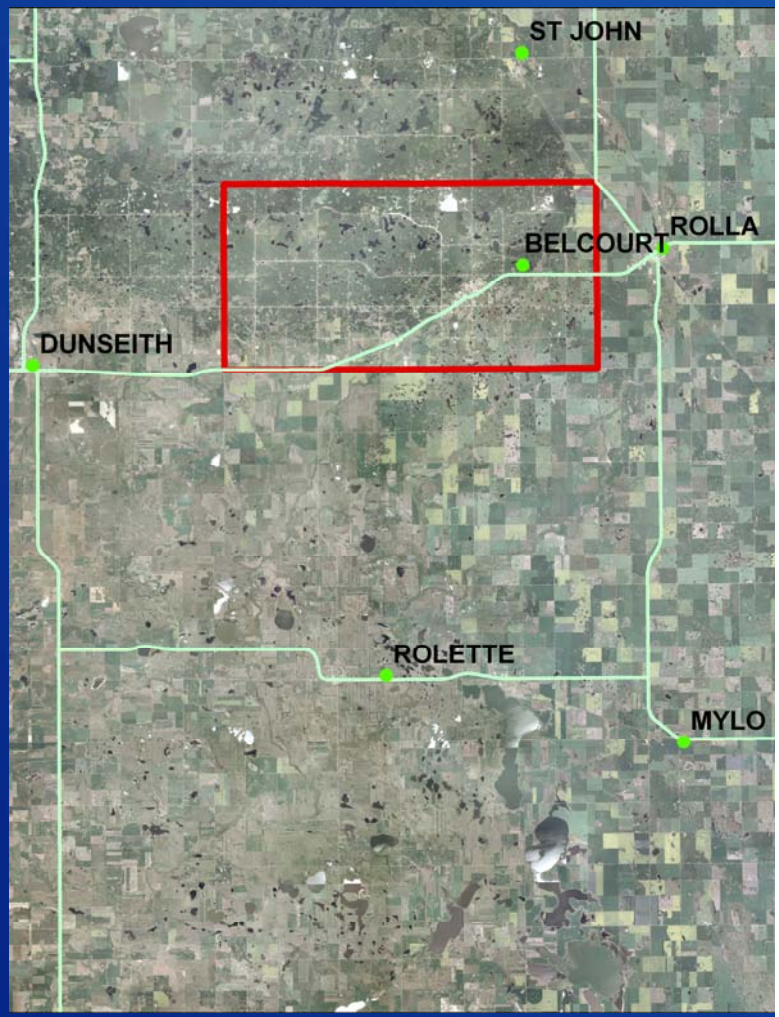


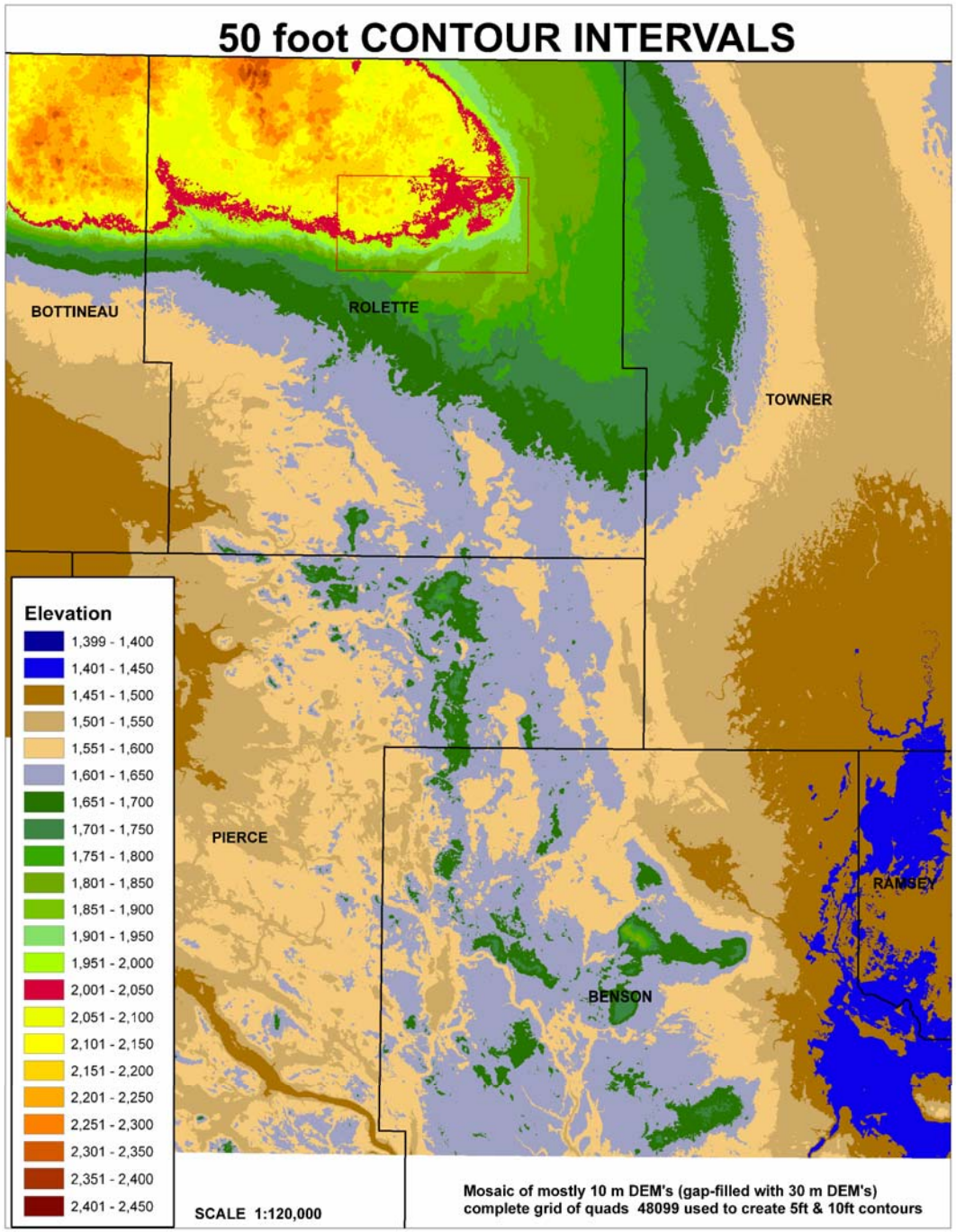


Networks need
junctions & edges.

A flow network:
can track speed
can show direction

RECLAMATION





Which tells you more . .

1. **True color photo**
2. **Color emphasized elevation lines**