

### **Attachment 3 – Effect of Fully Penetrating Wells**

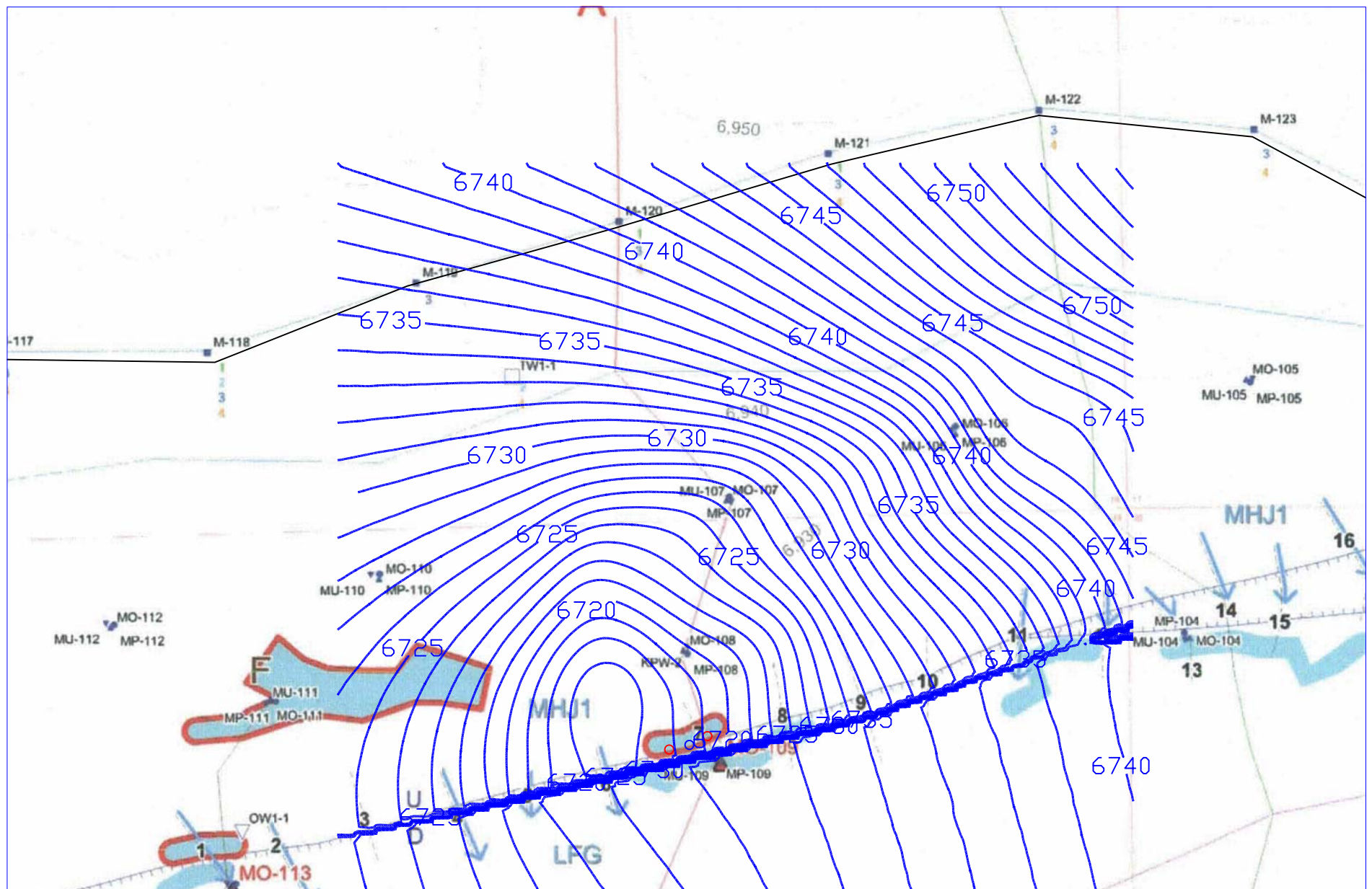
Lost Creek has made commitments to evaluate abandoned boreholes as potential conduits for lixiviant migration; however, staff is unaware of Lost Creek's plan for, or the extent of, all existing wells within the perimeter ring of MU1. Most wells appear to be screened in a single horizon. On the other hand, staff knows of at least four wells that are screened over multiple zones within the HJ horizon. Those wells are the pumping wells used to the regional and MU1 pumping tests (LC16M, LC19M, PW-101 and PW-102).

To verify the expected impact, staff used the AEM Model discussed in Attachment 2. A contour map of the model-predicted potentiometric surface in Zone 2 under normal long-term operations in Zones 3 and 4 is shown on Attachment Figure 3-1. The contour map shows that the potentiometric head is depressed in part from the operations in Zones 3 and 4; however, a west-southwestern gradient is maintained in Zone 2.

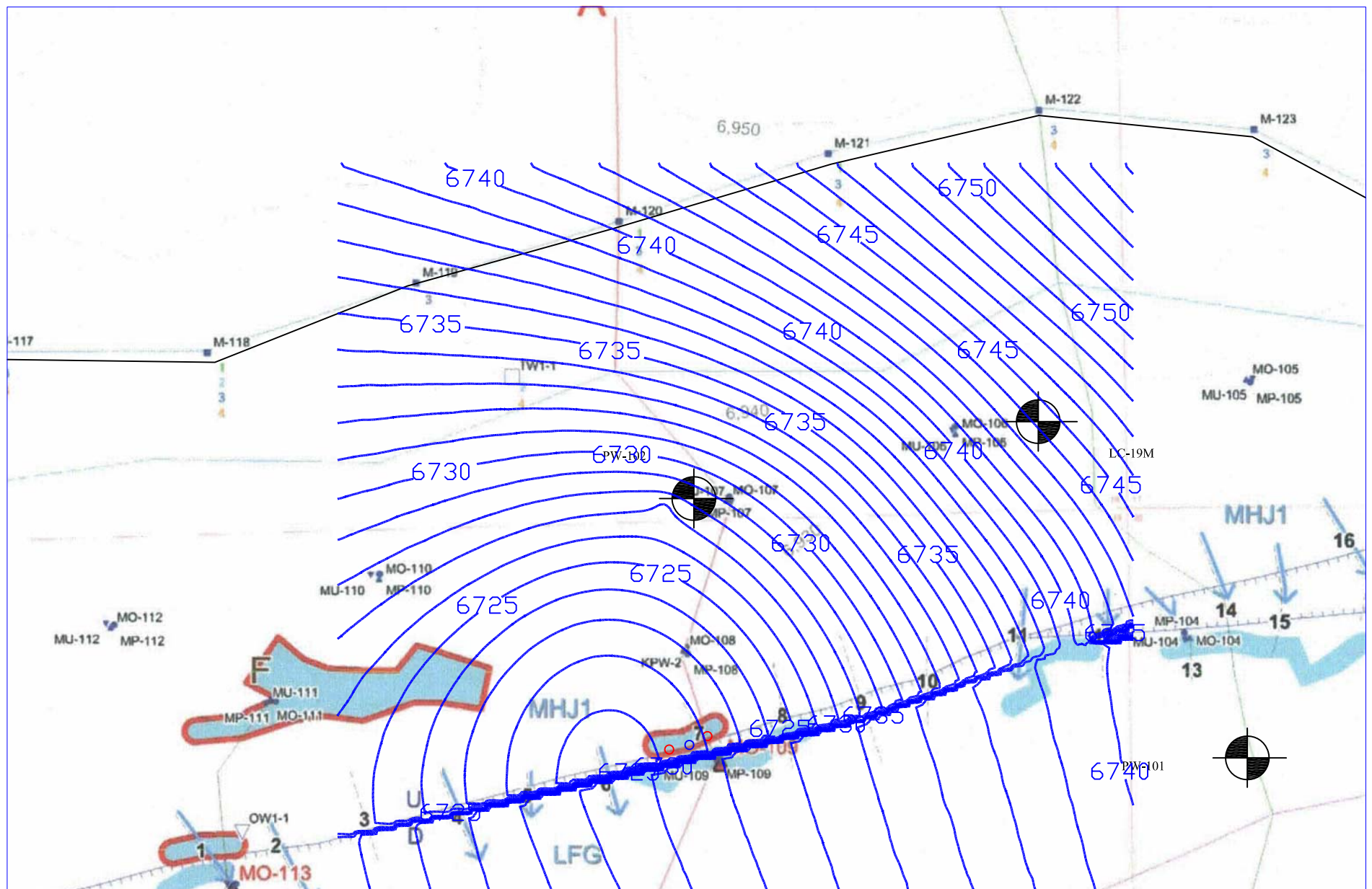
Non-operating wells were added to simulate wells PW-102 and LC19M (for the revised model input, see Appendix 3-A). A contour map of the model predicted potentiometric surface in Zone 2 under long-term operations in Zone 3 and 4 with the non-operating wells is shown on Attachment Figure 3-2.

A comparison between Attachment figures 3-1 and 3-2 show area of minor depression in the vicinity of non-operating well PW-102. The minor depression indicates increased communication with Zone 3 through well PW-102. If well PW-102 was located closer to an injection well, the connection may result in the migration of lixiviant from Zone 3 to Zone 2.

Lost Creek does not propose monitoring, does not specify corrective actions should such a scenario develop nor provide details on well abandonment.



Attachment 3 Figure 3-1 NRC model-predicted potentiometric surface in Zone 2 with long-term operations at Selected Modules in Zone 3 and Zone 4



Attachment 3 Figure 3-2 NRC model-predicted potentiometric surface in Zone 2 with long-term operations at Selected Modules in Zone 3 and Zone 4 and fully penetrating wells LC19M and PW-102

## Attachment 3 Appendix 3-A

```

1  from TimML import *
2  from mlpylabutil import *
3  import csv
4
5  # steady state
6  # Coordinates based on NAD83 traslantion from (2208300,593600) to (0,0)
7
8
9
10 z = [6540,6535,6530,6525,6520,6515,6510,6505,6500,6495,6490,6485,6480,6475,
    ,6420]
11 kh1 = [1.07, 1.07, 1.07, 1.07,0.008, 1.07, 1.07, 1.07, 1.07, 1.07,0.008,(
    07, 1.07, 1.07, 1.07, 1.07)]
12 kz = [0.02,0.02,0.02,0.02, 0.7, 0.02,0.02,0.02,0.02,0.02,0.02, 0.7, 0.7,0.02,(
    .02)]
13
14
15
16 ml=Model3D(z,kh1,kz)
17 rf= Constant(ml,0,10000,6780,[1])
18 uf=Uflow(ml,0.009,220)
19 #
20 # now for the hfb
21 LineDoubletImp(ml,3498.,1923.,4686.,2027.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
22 LineDoubletImp(ml,4686.,2027.,5443.,2199.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
23 LineDoubletImp(ml,7822.,3284.,6174.,2756.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
24 LineDoubletImp(ml,6174.,2756.,5189.,2435.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
25 LineDoubletImp(ml,5189.,2435.,4428.,2240.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
26 LineDoubletImp(ml,4428.,2240.,3868.,2049.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
27 LineDoubletImp(ml,3868.,2049.,3498.,1928.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
28 LineDoubletImp(ml,3498.,1928.,2981.,1745.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
29 LineDoubletImp(ml,2981.,1745.,2132.,1549.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
30 LineDoubletImp(ml,2132.,1549.,946.,1299.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
31 LineDoubletImp(ml,946.,1299.,805.,1272.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
32 LineDoubletImp(ml,805.,1272.,457.,1234.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
33 LineDoubletImp(ml,457.,1234.,-200.,989.,order=3,layers=
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
34
35 # for the wells
36 w7 = Well(ml ,2657,2401,-1620,0.25, [14,15,16])
37 w8 = Well(ml ,2623,2322,-3240,0.25, [14,15,16])
38 w9 = Well(ml ,2691,2275,-6480,0.25, [14,15,16])
39 w10 = Well(ml ,2757,2378,-4860,0.25, [14,15,16])
40 w11 = Well(ml ,2546,2244,-4860,0.25, [14,15,16])
41 w12 = Well(ml ,2656,2193,-4860,0.25, [14,15,16])
42 w13 = Well(ml ,2654,2144,-1620,0.25, [14,15,16])
43 w14 = Well(ml ,2529,2146,-3240,0.25, [14,15,16])

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44 w15 = Well(ml ,2433,2154,-4860,0.25, [14,15,16])
45 w16 = Well(ml ,2418,2228,-3240,0.25, [14,15,16])
46 w17 = Well(ml ,2314,2218,-1620,0.25, [14,15,16])
47 w18 = Well(ml ,2308,2158,-3240,0.25, [14,15,16])
48 w19 = Well(ml ,2324,2074,-3240,0.25, [14,15,16])
49 w20 = Well(ml ,2425,2084,-3240,0.25, [14,15,16])
50 w21 = Well(ml ,2443,1996,-4860,0.25, [14,15,16])
51 w22 = Well(ml ,2319,1996,-3240,0.25, [14,15,16])
52 w23 = Well(ml ,2333,1908,-3240,0.25, [14,15,16])
53 w24 = Well(ml ,2416,1897,-6480,0.25, [14,15,16])
54 w25 = Well(ml ,2519,1871,-4860,0.25, [14,15,16])
55 w26 = Well(ml ,2542,1929,-1620,0.25, [14,15,16])
56 w27 = Well(ml ,2404,1789,-3240,0.25, [14,15,16])
57 w28 = Well(ml ,2326,1786,-3240,0.25, [14,15,16])
58 w29 = Well(ml ,2310,1678,-1620,0.25, [14,15,16])
59 w30 = Well(ml ,2418,1683,-1620,0.25, [14,15,16])
60 w31 = Well(ml ,2506,1782,-3240,0.25, [14,15,16])
61 w32 = Well(ml ,2616,1766,-3240,0.25, [14,15,16])
62 w33 = Well(ml ,2726,1777,-1620,0.25, [14,15,16])
63 w34 = Well(ml ,2618,1862,-4860,0.25, [14,15,16])
64 w35 = Well(ml ,2724,1860,-4860,0.25, [14,15,16])
65 w36 = Well(ml ,2715,1954,-3240,0.25, [14,15,16])
66 w37 = Well(ml ,2614,1938,-1620,0.25, [14,15,16])
67 w38 = Well(ml ,2759,1975,-3240,0.25, [14,15,16])
68 w39 = Well(ml ,2837,1899,-3240,0.25, [14,15,16])
69 w40 = Well(ml ,2890,1968,-1620,0.25, [14,15,16])
70 w41 = Well(ml ,2821,2028,-1620,0.25, [14,15,16])
71 w42 = Well(ml ,2771,2166,-1620,0.25, [14,15,16])
72 w43 = Well(ml ,2784,2244,-3240,0.25, [14,15,16])
73 w44 = Well(ml ,2825,2286,-4860,0.25, [14,15,16])
74 w45 = Well(ml ,2888,2330,-6480,0.25, [14,15,16])
75 w46 = Well(ml ,2843,2407,-3240,0.25, [14,15,16])
76 w47 = Well(ml ,2960,2442,-3240,0.25, [14,15,16])
77 w48 = Well(ml ,2976,2366,-6480,0.25, [14,15,16])
78 w49 = Well(ml ,3009,2273,-3240,0.25, [14,15,16])
79 w50 = Well(ml ,2949,2226,-4860,0.25, [14,15,16])
80 w51 = Well(ml ,2859,2198,-3240,0.25, [14,15,16])
81 w52 = Well(ml ,2944,2103,-3240,0.25, [14,15,16])
82 w53 = Well(ml ,2983,2197,-4860,0.25, [14,15,16])
83 w54 = Well(ml ,3060,2174,-1620,0.25, [14,15,16])
84 w55 = Well(ml ,3004,2066,-1620,0.25, [14,15,16])
85 w56 = Well(ml ,3072,2276,-3240,0.25, [14,15,16])
86 w57 = Well(ml ,3089,2384,-6480,0.25, [14,15,16])
87 w58 = Well(ml ,3062,2476,-3240,0.25, [14,15,16])
88 w59 = Well(ml ,3164,2267,-3240,0.25, [14,15,16])
89 w60 = Well(ml ,3156,2382,-6480,0.25, [14,15,16])
90 w61 = Well(ml ,3165,2501,-4860,0.25, [14,15,16])
91 w62 = Well(ml ,3221,2623,-3240,0.25, [14,15,16])
92 w63 = Well(ml ,3233,2507,-6480,0.25, [14,15,16])
93 w64 = Well(ml ,3247,2381,-4860,0.25, [14,15,16])
94 w65 = Well(ml ,3264,2301,-1620,0.25, [14,15,16])
95 w66 = Well(ml ,3298,2382,-3240,0.25, [14,15,16])
96 w67 = Well(ml ,3358,2383,-3240,0.25, [14,15,16])
97 w68 = Well(ml ,3374,2490,-6480,0.25, [14,15,16])
98 w69 = Well(ml ,3301,2509,-6480,0.25, [14,15,16])
99 w70 = Well(ml ,3320,2615,-3240,0.25, [14,15,16])
100 w71 = Well(ml ,3392,2612,-3240,0.25, [14,15,16])
101 w72 = Well(ml ,3485,2567,-3240,0.25, [14,15,16])
102 w73 = Well(ml ,3453,2483,-6480,0.25, [14,15,16])
103 w74 = Well(ml ,3466,2391,-3240,0.25, [14,15,16])
104 w75 = Well(ml ,3569,2396,-3240,0.25, [14,15,16])
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105 w76 = Well(ml ,3579,2466,-6480,0.25, [14,15,16])
106 w77 = Well(ml ,3577,2537,-3240,0.25, [14,15,16])
107 w78 = Well(ml ,3681,2561,-3240,0.25, [14,15,16])
108 w79 = Well(ml ,3696,2461,-6480,0.25, [14,15,16])
109 w80 = Well(ml ,3683,2384,-3240,0.25, [14,15,16])
110 w81 = Well(ml ,3787,2471,-6480,0.25, [14,15,16])
111 w82 = Well(ml ,3813,2373,-3240,0.25, [14,15,16])
112 w83 = Well(ml ,3773,2569,-3240,0.25, [14,15,16])
113 w84 = Well(ml ,3893,2532,-3240,0.25, [14,15,16])
114 w85 = Well(ml ,3885,2495,-4860,0.25, [14,15,16])
115 w86 = Well(ml ,3870,2378,-3240,0.25, [14,15,16])
116 w87 = Well(ml ,3967,2476,-1620,0.25, [14,15,16])
117 w88 = Well(ml ,3955,2375,-1620,0.25, [14,15,16])
118 w89 = Well(ml ,3828,2520,6687.5,0.25, [14,15,16])
119 w90 = Well(ml ,3920,2430,6687.5,0.25, [14,15,16])
120 w91 = Well(ml ,3840,2439,6687.5,0.25, [14,15,16])
121 w92 = Well(ml ,3745,2421,6687.5,0.25, [14,15,16])
122 w93 = Well(ml ,3734,2513,6687.5,0.25, [14,15,16])
123 w94 = Well(ml ,3637,2505,6687.5,0.25, [14,15,16])
124 w95 = Well(ml ,3631,2423,6687.5,0.25, [14,15,16])
125 w96 = Well(ml ,3517,2433,6687.5,0.25, [14,15,16])
126 w97 = Well(ml ,3519,2506,6687.5,0.25, [14,15,16])
127 w98 = Well(ml ,3420,2550,6687.5,0.25, [14,15,16])
128 w99 = Well(ml ,3409,2431,6687.5,0.25, [14,15,16])
129 w100 = Well(ml ,3332,2441,6687.5,0.25, [14,15,16])
130 w101 = Well(ml ,3351,2559,6687.5,0.25, [14,15,16])
131 w102 = Well(ml ,3269,2567,6687.5,0.25, [14,15,16])
132 w103 = Well(ml ,3209,2549,6687.5,0.25, [14,15,16])
133 w104 = Well(ml ,3200,2442,6687.5,0.25, [14,15,16])
134 w105 = Well(ml ,3203,2326,6687.5,0.25, [14,15,16])
135 w106 = Well(ml ,3125,2319,6687.5,0.25, [14,15,16])
136 w107 = Well(ml ,3121,2443,6687.5,0.25, [14,15,16])
137 w108 = Well(ml ,3028,2415,6687.5,0.25, [14,15,16])
138 w109 = Well(ml ,3043,2330,6687.5,0.25, [14,15,16])
139 w110 = Well(ml ,2955,2301,6687.5,0.25, [14,15,16])
140 w111 = Well(ml ,2917,2393,6687.5,0.25, [14,15,16])
141 w112 = Well(ml ,2823,2351,6687.5,0.25, [14,15,16])
142 w113 = Well(ml ,2887,2253,6687.5,0.25, [14,15,16])
143 w114 = Well(ml ,2755,2305,6687.5,0.25, [14,15,16])
144 w115 = Well(ml ,2726,2217,6687.5,0.25, [14,15,16])
145 w116 = Well(ml ,2687,2344,6687.5,0.25, [14,15,16])
146 w117 = Well(ml ,2624,2256,6687.5,0.25, [14,15,16])
147 w118 = Well(ml ,2587,2185,6687.5,0.25, [14,15,16])
148 w119 = Well(ml ,2484,2201,6687.5,0.25, [14,15,16])
149 w120 = Well(ml ,2371,2189,6687.5,0.25, [14,15,16])
150 w121 = Well(ml ,2371,2115,6687.5,0.25, [14,15,16])
151 w122 = Well(ml ,2372,2035,6687.5,0.25, [14,15,16])
152 w123 = Well(ml ,2379,1949,6687.5,0.25, [14,15,16])
153 w124 = Well(ml ,2473,1924,6687.5,0.25, [14,15,16])
154 w125 = Well(ml ,2366,1842,6687.5,0.25, [14,15,16])
155 w126 = Well(ml ,2448,1835,6687.5,0.25, [14,15,16])
156 w127 = Well(ml ,2569,1820,6687.5,0.25, [14,15,16])
157 w128 = Well(ml ,2675,1820,6687.5,0.25, [14,15,16])
158 w129 = Well(ml ,2680,1906,6687.5,0.25, [14,15,16])
159 w130 = Well(ml ,2764,1921,6687.5,0.25, [14,15,16])
160 w131 = Well(ml ,2827,1967,6687.5,0.25, [14,15,16])
161 w132 = Well(ml ,2361,1731,6687.5,0.25, [14,15,16])
162 w133 = Well(ml ,3002,2138,6687.5,0.25, [14,15,16])
163 w134 = Well(ml ,2915,2185,6687.5,0.25, [14,15,16])
164 w135 = Well(ml ,2583,1684,-1620,0.25, [21,22,23])
165 w136 = Well(ml ,2684,1699,-1620,0.25, [21,22,23])
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166 w137 = Well(ml ,2680,1785,-3240,0.25, [21,22,23])
167 w138 = Well(ml ,2577,1784,-4860,0.25, [21,22,23])
168 w139 = Well(ml ,2498,1790,-1620,0.25, [21,22,23])
169 w140 = Well(ml ,2502,1898,-1620,0.25, [21,22,23])
170 w141 = Well(ml ,2592,1895,-4860,0.25, [21,22,23])
171 w142 = Well(ml ,2690,1886,-3240,0.25, [21,22,23])
172 w143 = Well(ml ,2694,1992,-1620,0.25, [21,22,23])
173 w144 = Well(ml ,2593,1976,-1620,0.25, [21,22,23])
174 w145 = Well(ml ,2895,2074,-1620,0.25, [21,22,23])
175 w146 = Well(ml ,2908,2169,-4860,0.25, [21,22,23])
176 w147 = Well(ml ,3000,2167,-3240,0.25, [21,22,23])
177 w148 = Well(ml ,3016,2103,-3240,0.25, [21,22,23])
178 w149 = Well(ml ,3026,2241,-4860,0.25, [21,22,23])
179 w150 = Well(ml ,2941,2291,-3240,0.25, [21,22,23])
180 w151 = Well(ml ,2878,2233,-1620,0.25, [21,22,23])
181 w152 = Well(ml ,2968,2365,-1620,0.25, [21,22,23])
182 w153 = Well(ml ,3073,2343,-3240,0.25, [21,22,23])
183 w154 = Well(ml ,3145,2292,-4860,0.25, [21,22,23])
184 w155 = Well(ml ,3130,2241,-3240,0.25, [21,22,23])
185 w156 = Well(ml ,3238,2195,-1620,0.25, [21,22,23])
186 w157 = Well(ml ,3257,2278,-3240,0.25, [21,22,23])
187 w158 = Well(ml ,3244,2382,-3240,0.25, [21,22,23])
188 w159 = Well(ml ,3169,2387,-3240,0.25, [21,22,23])
189 w160 = Well(ml ,3264,2481,-3240,0.25, [21,22,23])
190 w161 = Well(ml ,3279,2415,-3240,0.25, [21,22,23])
191 w162 = Well(ml ,3340,2388,-3240,0.25, [21,22,23])
192 w163 = Well(ml ,3406,2343,-1620,0.25, [21,22,23])
193 w164 = Well(ml ,3472,2407,-3240,0.25, [21,22,23])
194 w165 = Well(ml ,3392,2490,-4860,0.25, [21,22,23])
195 w166 = Well(ml ,3462,2542,-1620,0.25, [21,22,23])
196 w167 = Well(ml ,3526,2468,-1620,0.25, [21,22,23])
197 w168 = Well(ml ,3156,2099,-1620,0.25, [21,22,23])
198 w169 = Well(ml ,3269,2090,-1620,0.25, [21,22,23])
199 w170 = Well(ml ,3390,2095,-1620,0.25, [21,22,23])
200 w171 = Well(ml ,2804,2163,-1620,0.25, [21,22,23])
201 w172 = Well(ml ,2736,2137,-1620,0.25, [21,22,23])
202 w173 = Well(ml ,2540,1848,5818.5,0.25, [21,22,23])
203 w174 = Well(ml ,2628,1735,5818.5,0.25, [21,22,23])
204 w175 = Well(ml ,2629,1836,5818.5,0.25, [21,22,23])
205 w176 = Well(ml ,2640,1937,5818.5,0.25, [21,22,23])
206 w177 = Well(ml ,2953,2128,5818.5,0.25, [21,22,23])
207 w178 = Well(ml ,2956,2225,5818.5,0.25, [21,22,23])
208 w179 = Well(ml ,3003,2312,5818.5,0.25, [21,22,23])
209 w180 = Well(ml ,3094,2277,5818.5,0.25, [21,22,23])
210 w181 = Well(ml ,3202,2250,5818.5,0.25, [21,22,23])
211 w182 = Well(ml ,3206,2335,5818.5,0.25, [21,22,23])
212 w183 = Well(ml ,3234,2422,5818.5,0.25, [21,22,23])
213 w184 = Well(ml ,3322,2448,5818.5,0.25, [21,22,23])
214 w185 = Well(ml ,3406,2411,5818.5,0.25, [21,22,23])
215 w186 = Well(ml ,3460,2479,5818.5,0.25, [21,22,23])
216 w187 = Well(ml ,3333,2070,5818.5,0.25, [21,22,23])
217 w188 = Well(ml ,3213,2133,5818.5,0.25, [21,22,23])
218 w189 = Well(ml ,3090,2097,5818.5,0.25, [21,22,23])
219 w190 = Well(ml ,2796,2098,5818.5,0.25, [21,22,23])
220
221 lc19M = Well(ml,3363,2359,0,0.25,
[8,9,10,11,12,13,14,15,16,17,18,19,20,21])
222 pw102 = Well(ml,2537,2224,0,0.25,
[1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24])
223
224 ml.solve()

```



```

225
226     timvertcontour(ml,2394,2381,4102,2437,50,6420,6540,50,levels=50,labels=1)
227     show()
228
229
230
231
232     result=open('l8_3a.csv','wb')
233     writer =csv.writer(result,diaclect='excel')
234
235     x1=linspace(1800.0,3600,201)
236     y1=linspace(1200.0,3000,201)
237     ddl  = 50*ones(len(x1))
238
239     writer.writerow(x1)
240     writer.writerow(y1)
241
242     for j in range(len(y1)):
243         print j
244         for i in range(len(x1)):
245             ddl[i]=ml.head3D(x1[i],y1[j],6527)
246             writer.writerow(ddl)
247
248     result.close()
249
250     result=open('l3_3a.csv','wb')
251     writer =csv.writer(result,diaclect='excel')
252
253     x1=linspace(1800.0,3600,201)
254     y1=linspace(1200.0,3000,201)
255     ddl  = 50*ones(len(x1))
256
257     writer.writerow(x1)
258     writer.writerow(y1)
259
260     for j in range(len(y1)):
261         print j
262         for i in range(len(x1)):
263             ddl[i]=ml.head3D(x1[i],y1[j], 6502)
264             writer.writerow(ddl)
265
266
267     result.close()
268
269     result=open('l14_3a.csv','wb')
270     writer =csv.writer(result,diaclect='excel')
271
272     writer.writerow(x1)
273     writer.writerow(y1)
274
275     for j in range(len(y1)):
276         print j
277         for i in range(len(x1)):
278             ddl[i]=ml.head3D(x1[i],y1[j],6472 )
279             writer.writerow(ddl)
280
281
282     result.close()
283
284     result=open('l21_3a.csv','wb')

```

```
285     writer =csv.writer(result,diaclect='excel')
286
287     writer.writerow(x1)
288     writer.writerow(y1)
289
290     for j in range(len(y1)):
291         print j
292         for i in range(len(x1)):
293             ddl[i]=ml.head3D(x1[i],y1[j],6437)
294             writer.writerow(ddl)
295
296     result.close()
```