

APPENDIX M

HYDROCAD ANALYSES

February 11, 2011
File No. 01210155.00

MEMORANDUM

TO: Joe Miller
Ambrose McCready

FROM: Alex Tuveson

SUBJECT: Hydrologic Analysis for Drainage Design
Sonoma County Central Disposal Site, Sonoma County, California

SCS Engineers was authorized to perform a hydrologic analysis to route storm water drainage from the Sonoma County Central Disposal Site (CDS) to existing sedimentation ponds present at the facility. The hydrologic analysis for the drainage design at the CDS has been completed and conducted according to the anticipated and existing conditions that have been specified. The waste disposal areas Landfill 1 (LF-1) and Landfill 2 (LF-2) extend over approximately 172.8 acres. Areas outside the LF-1 and LF-2 footprint, but within the CDS property boundary, were also included in the hydrologic analysis. A table of all drainage areas and their parameters (subcatchments) present within the CDS property boundary is attached. Figures showing drainage areas, reach locations, and general drainage features are attached. The design specifications require drainage ditches, culverts, down chutes, sedimentation ponds, and general drainage control features to be sized according to a 100-year, 24-hour peak storm event. This type of storm will generate runoff that will account for the maximum flow through the drainage system.

HydroCAD, a stormwater modeling program, was used to determine the peak runoff and to size the drainage ditches and culverts for the improvement areas at the site. This model employs the use of the United States Department of Agriculture, Soil Conservation Service (USDA SCS) TR-20 runoff method. The TR-20 method utilizes hydrologic soil-cover complexes to determine runoff volumes and unit hydrographs to determine peak rates of discharge. Factors included in the method are 24-hour rainfall amount, a given rainfall distribution, runoff curve numbers, time of concentration, travel time, and drainage area. It is very useful for large drainage basins, especially when there are a series of structures or several tributaries to be studied. The program has the capability of routing storm volumes through drainage ditches, road culverts and storm detention basins.

The input storm data was derived from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2 website which provides storm data given the latitude and longitude of the site. The design storm event is 5.77 inches of rain.

Prepared by: ALT
Checked by: JJM

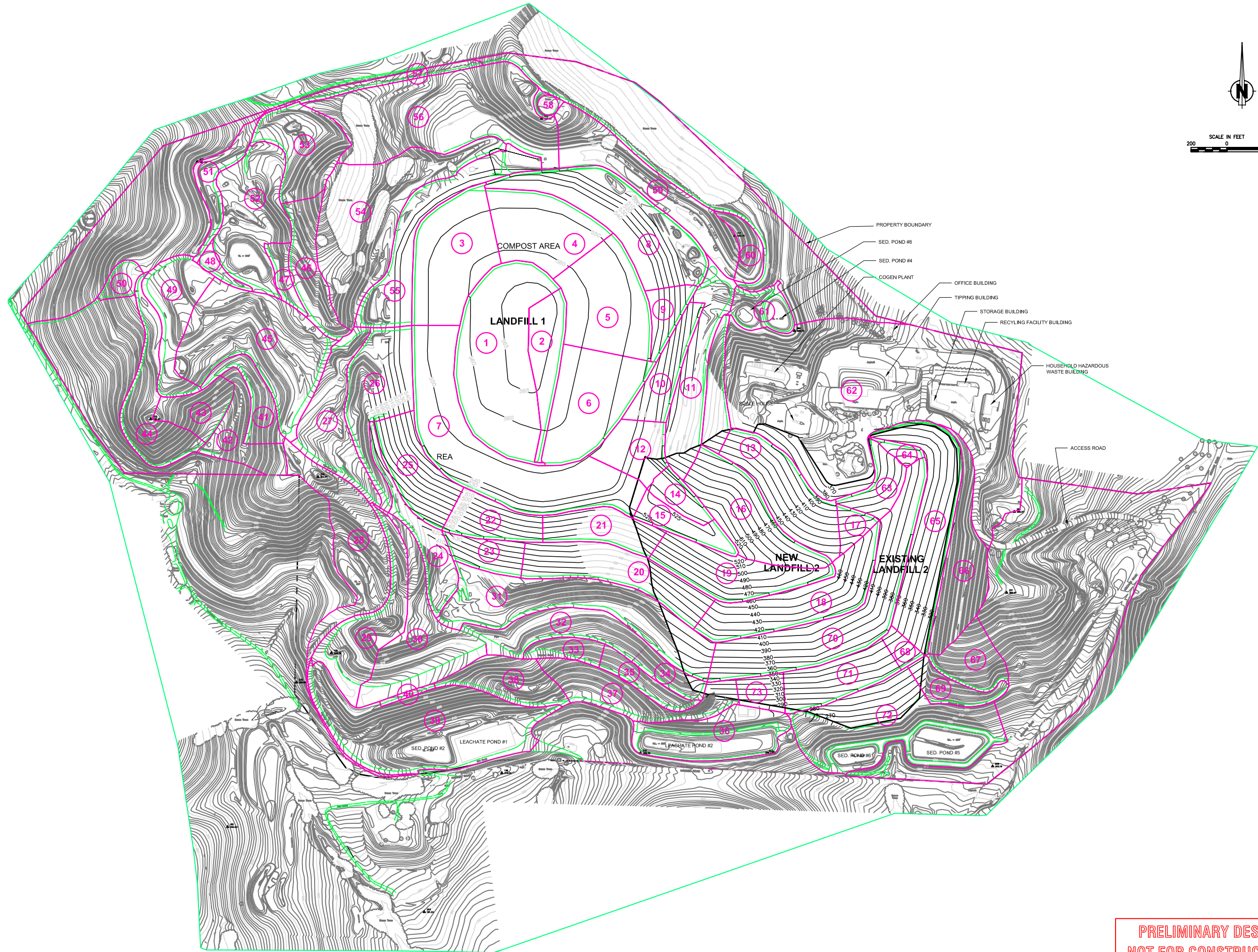
Using the TR-20 method of the HydroCAD storm water modeling program, a detailed report has been generated which has determined the amount of runoff through the drainage system and the appropriate ditch and culvert sizing to account for that runoff. The model has determined peak flows in cubic feet per second (cfs) based on the 100-yr, 24-hr storm criteria. A list of the maximum peak flows for each type of drainage feature is listed below:

- Maximum flow rate in v-ditch – 95.36 cfs
- Maximum flow rate in down chute – 89.89 cfs
- Maximum flow rate into sedimentation pond – 91.87 cfs

As stated above, all drainage features have been designed to properly manage and convey maximum peak flow rates. Drainage features have been designed not to exceed 80 percent of available capacity during the peak flows.

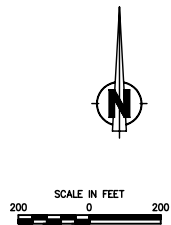
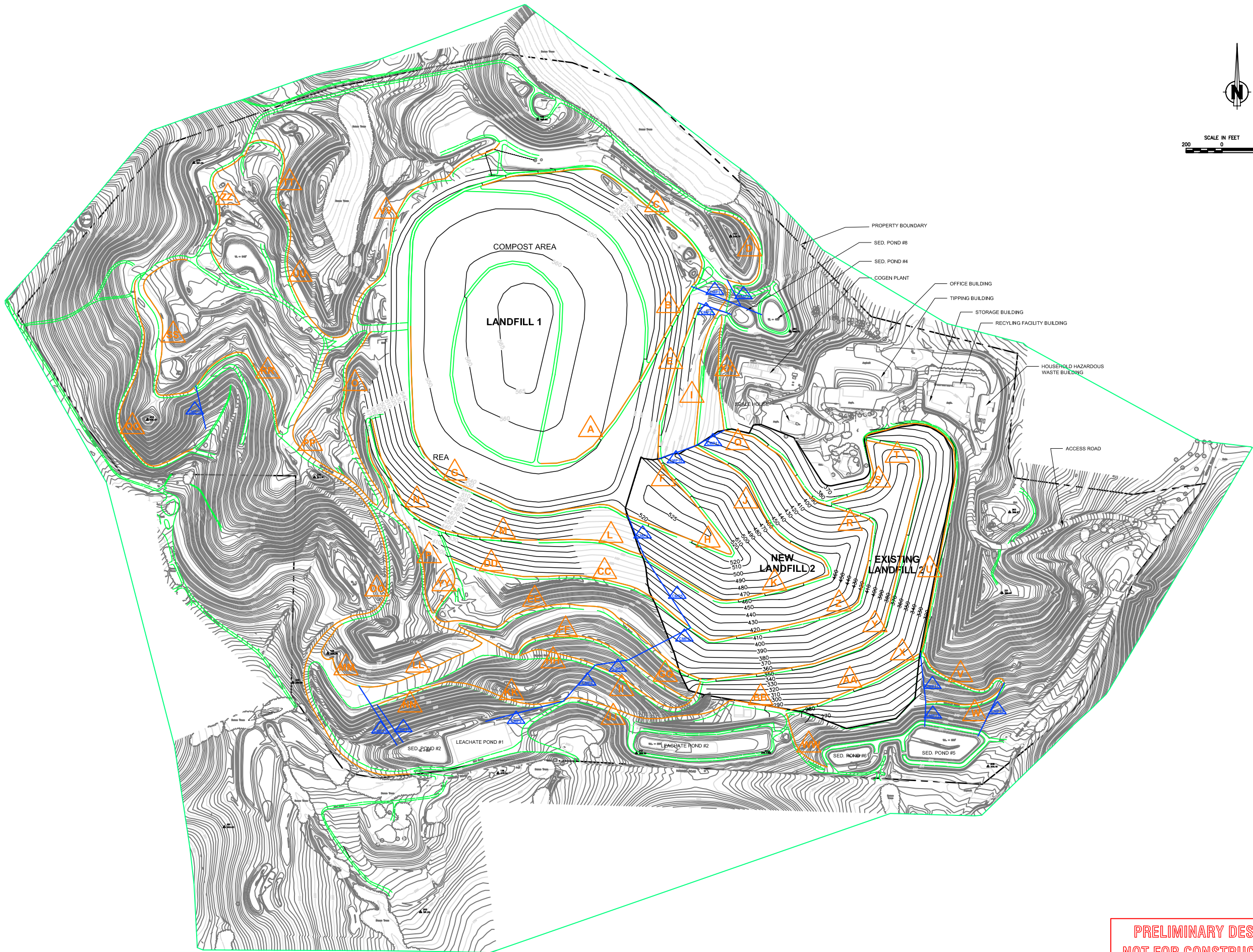
Reduction of the potential for erosion and gulying was achieved by conveying v-ditches to a drop inlet to a down chute pipe. Drop inlets will bring the flow from each v-ditch into the pipe and into a corresponding sedimentation basin. A table listing all v-ditches (reaches) and down chutes, and their parameters present within the CDS property boundary is attached. Figures showing their locations are also attached. A visual display of the HydroCAD model run drainage system and drainage features is also attached.

FIGURES



PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

| SCS ENGINEERS | | SHEET TITLE | | NO. | | REVISION | | DATE | |
|--|--|--|--|-----|--|----------|--|------|--|
| ENVIRONMENTAL CONSULTANTS | | HYDROCAD DRAINAGE AREAS | | 1 | | | | | |
| 6601 KOLL CENTER PKWY, SUITE 140 | | PROJECT TITLE | | 1 | | | | | |
| PLEASANTON, CA 94566 | | RJTD & PFCP SONOMA COUNTY CENTRAL DISPOSAL SITE | | 1 | | | | | |
| PH. (925) 426-0080 FAX. (925) 426-0707 | | SONOMA COUNTY, CALIFORNIA | | 1 | | | | | |
| PROJ. NO. 07204201.01 | | COUNTY OF SONOMA DEPT. TRANSPORTATION AND PUBLIC WORKS | | 1 | | | | | |
| DSN. BY: ATV | | PETALUMA, CALIFORNIA | | 1 | | | | | |
| APP. BY: J. MILLER | | | | 1 | | | | | |
| DATE: 2/11/11 | | | | 1 | | | | | |
| SCALE: AS SHOWN | | | | 1 | | | | | |
| DRAWING NO. | | | | 1 | | | | | |
| | | | | 1 | | | | | |



PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

| SHEET TITLE | | HYDROCAD DRAINAGE FEATURES | | NO. | | REVISION | DATE |
|--|--|--|--|-------------|--|----------|------|
| COUNTY OF SONOMA DEPT. TRANSPORTATION AND PUBLIC WORKS PETALUMA, CALIFORNIA | | PROJECT TITLE | | | | | |
| | | RJTD & PFCP SONOMA COUNTY CENTRAL DISPOSAL SITE SONOMA COUNTY, CALIFORNIA | | | | | |
| SCS ENGINEERS | | ENVIRONMENTAL CONSULTANTS | | DATE: | | 2/11/11 | |
| 6601 KOLL CENTER PKWY, SUITE 140 PLEASANTON, CA 94566 PH. (925) 426-0080 FAX. (925) 426-0707 | | PROJECT NO. 07204201.01 | | SCALE: | | AS SHOWN | |
| DRAWN BY: ALT | | CHECKED BY: AAM | | DRAWING NO. | | 2 | |
| ACAD FILE: SHT-X | | APP. BY: J. MILLER | | | | | |

TABLES

Subcatchments

| Number | Area (sq ft) | CN | Hydraulic Length (ft) | Avg. Slope |
|--------|--------------|----|-----------------------|------------|
| 1 | 446,520 | 40 | 2,076 | 0.055 |
| 2 | 120,116 | 40 | 1,225 | 0.055 |
| 3 | 285,032 | 40 | 1,276 | 0.055 |
| 4 | 228,447 | 40 | 1,191 | 0.055 |
| 5 | 269,433 | 40 | 1,185 | 0.055 |
| 6 | 263,414 | 40 | 1,016 | 0.055 |
| 7 | 486,414 | 40 | 2,287 | 0.111 |
| 8 | 325,978 | 40 | 1,637 | 0.190 |
| 9 | 64,718 | 40 | 500 | 0.280 |
| 10 | 108,613 | 40 | 953 | 0.280 |
| 11 | 195,911 | 40 | 1,013 | 0.250 |
| 12 | 107,914 | 40 | 445 | 0.250 |
| 13 | 215,083 | 40 | 896 | 0.333 |
| 14 | 55,009 | 40 | 454 | 0.150 |
| 15 | 76,937 | 40 | 903 | 0.120 |
| 16 | 229,035 | 40 | 1,570 | 0.310 |
| 17 | 36,850 | 40 | 537 | 0.310 |
| 18 | 245,491 | 40 | 1,806 | 0.310 |
| 19 | 196,287 | 40 | 1,729 | 0.310 |
| 20 | 219,522 | 40 | 1,257 | 0.333 |
| 21 | 121,770 | 40 | 763 | 0.333 |
| 22 | 108,872 | 40 | 712 | 0.333 |
| 23 | 76,355 | 40 | 442 | 0.333 |
| 24 | 115,471 | 40 | 1,195 | 0.075 |
| 25 | 163,169 | 40 | 971 | 0.333 |
| 26 | 219,437 | 40 | 1,197 | 0.180 |
| 27 | 195,082 | 40 | 1,041 | 0.060 |
| 28 | 263,068 | 40 | 2,742 | 0.105 |
| 29 | 202,572 | 40 | 1,369 | 0.118 |
| 30 | 252,809 | 40 | 1,453 | 0.118 |
| 31 | 367,297 | 40 | 1,947 | 0.300 |
| 32 | 163,211 | 40 | 962 | 0.333 |
| 33 | 51,322 | 40 | 460 | 0.300 |
| 34 | 54,944 | 40 | 523 | 0.300 |
| 35 | 62,820 | 40 | 624 | 0.300 |
| 36 | 204,583 | 40 | 157 | 0.200 |
| 37 | 176,074 | 40 | 1,154 | 0.200 |
| 38 | 129,561 | 40 | 802 | 0.300 |
| 39 | 485,701 | 40 | 915 | 0.333 |
| 40 | 10,342 | 40 | 340 | 0.040 |
| 41 | 83,208 | 40 | 743 | 0.278 |
| 42 | 115,397 | 40 | 465 | 0.260 |
| 43 | 90,752 | 40 | 461 | 0.300 |
| 44 | 179,315 | 40 | 1,540 | 0.300 |
| 45 | 405,526 | 40 | 1,701 | 0.200 |
| 46 | 134,239 | 40 | 1,163 | 0.150 |
| 47 | 39,314 | 40 | 244 | 0.150 |
| 48 | 23,482 | 40 | 335 | 0.045 |
| 49 | 160,316 | 40 | 1,183 | 0.087 |
| 50 | 35,123 | 40 | 375 | 0.250 |
| 51 | 76,102 | 40 | 1,068 | 0.140 |

Subcatchments

| Number | Area (sq ft) | CN | Hydraulic Length (ft) | Avg. Slope |
|--------|--------------|----|-----------------------|------------|
| 52 | 263,237 | 40 | 530 | 0.075 |
| 53 | 183,544 | 40 | 719 | 0.206 |
| 54 | 418,685 | 40 | 1,556 | 0.300 |
| 55 | 227,863 | 40 | 1,948 | 0.200 |
| 56 | 523,338 | 40 | 1,394 | 0.245 |
| 57 | 48,448 | 40 | 1,284 | 0.180 |
| 58 | 18,266 | 40 | 168 | 0.050 |
| 59 | 251,938 | 40 | 1,426 | 0.100 |
| 60 | 52,799 | 40 | 912 | 0.300 |
| 61 | 74,239 | 40 | 70 | 0.100 |
| 62 | 1,253,082 | 70 | 1,586 | 0.150 |
| 63 | 78,590 | 40 | 495 | 0.300 |
| 64 | 22,059 | 40 | 414 | 0.300 |
| 65 | 290,795 | 40 | 1,727 | 0.333 |
| 66 | 191,196 | 40 | 1,264 | 0.333 |
| 67 | 105,529 | 40 | 929 | 0.300 |
| 68 | 28,011 | 40 | 351 | 0.333 |
| 69 | 69,057 | 40 | 519 | 0.300 |
| 70 | 376,436 | 40 | 2,531 | 0.333 |
| 71 | 142,773 | 40 | 890 | 0.300 |
| 72 | 437,488 | 40 | 343 | 0.280 |
| 73 | 49,202 | 40 | 385 | 0.333 |
| 74 | 79,091 | 40 | 671 | 0.300 |

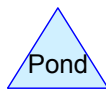
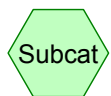
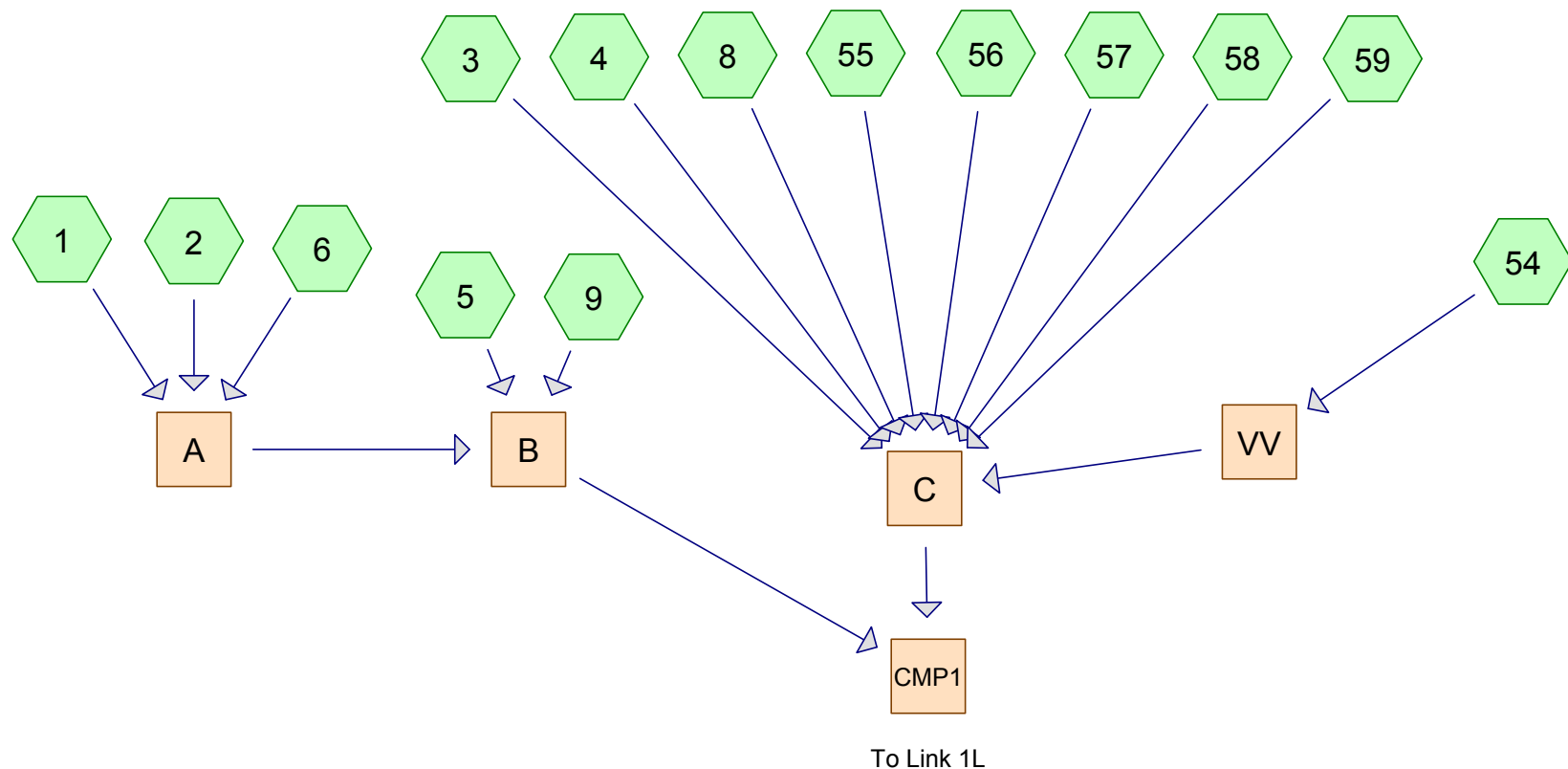
Reaches

| Letter | Length (ft) | Inlet Elev. (ft) | Outlet Elev. (ft) | Manning # |
|--------|-------------|------------------|-------------------|-----------|
| A | 901 | 552.40 | 535.60 | 0.028 |
| B | 489 | 535.60 | 483.73 | 0.028 |
| C | 1,615 | 540.00 | 483.73 | 0.028 |
| D | 718 | 524.13 | 492.19 | 0.028 |
| E | 711 | 513.00 | 472.36 | 0.028 |
| F | 448 | 523.42 | 488.54 | 0.028 |
| G | 2,028 | 545.09 | 509.65 | 0.028 |
| H | 845 | 523.42 | 509.65 | 0.028 |
| I | 951 | 488.39 | 443.66 | 0.028 |
| J | 1,026 | 468.22 | 443.66 | 0.028 |
| K | 1,185 | 468.22 | 452.62 | 0.028 |
| L | 625 | 468.59 | 452.62 | 0.028 |
| M | 573 | 468.59 | 428.80 | 0.028 |
| N | 747 | 473.12 | 428.80 | 0.028 |
| O | 1,110 | 531.09 | 454.35 | 0.028 |
| P | 1,163 | 454.35 | 389.00 | 0.028 |
| Q | 768 | 405.23 | 394.11 | 0.028 |
| R | 249 | 416.30 | 394.11 | 0.028 |
| S | 507 | 394.11 | 359.79 | 0.028 |
| T | 323 | 385.33 | 359.79 | 0.028 |
| U | 1,754 | 359.79 | 311.82 | 0.028 |
| V | 585 | 317.82 | 265.82 | 0.028 |
| W | 481 | 265.82 | 253.09 | 0.028 |
| X | 153 | 317.82 | 311.82 | 0.028 |
| Y | 2,076 | 385.33 | 338.18 | 0.028 |
| Z | 1,465 | 416.30 | 403.64 | 0.028 |
| AA | 674 | 317.82 | 287.03 | 0.028 |
| BB | 291 | 299.82 | 287.03 | 0.028 |
| CC | 1,068 | 419.58 | 403.64 | 0.028 |
| DD | 389 | 419.58 | 398.66 | 0.028 |
| EE | 1,727 | 388.18 | 338.18 | 0.028 |
| FF | 1,110 | 378.38 | 317.17 | 0.028 |
| GG | 525 | 338.18 | 317.17 | 0.028 |
| HH | 448 | 337.97 | 295.17 | 0.028 |
| II | 624 | 320.00 | 295.17 | 0.028 |
| JJ | 1,018 | 299.79 | 248.16 | 0.028 |
| KK | 786 | 340.59 | 248.16 | 0.028 |
| LL | 1,112 | 389.00 | 331.37 | 0.028 |
| MM | 492 | 352.11 | 331.37 | 0.028 |
| NN | 325 | 340.59 | 328.00 | 0.028 |
| OO | 1,091 | 332.81 | 240.23 | 0.028 |
| PP | 1,405 | 553.93 | 454.35 | 0.028 |
| QQ | 1,443 | 523.97 | 412.18 | 0.028 |
| RR | 886 | 513.89 | 482.00 | 0.028 |
| SS | 1,201 | 549.90 | 482.00 | 0.028 |
| TT | 520 | 605.93 | 576.00 | 0.028 |
| UU | 906 | 605.93 | 533.93 | 0.028 |
| VV | 1,445 | 547.58 | 511.00 | 0.028 |
| WW | 462 | 287.03 | 210.00 | 0.028 |
| XX | 664 | 464.84 | 405.23 | 0.028 |
| YY | 359 | 398.66 | 389.00 | 0.028 |
| ZZ | 839 | 576.00 | 548.00 | 0.028 |

Down Chutes

| | Length (ft) | Inlet Elev. (ft) | Outlet Elev. (ft) | Manning # | Diameter (in) |
|-------|-------------|------------------|-------------------|-----------|---------------|
| CMP1 | 420 | 483.73 | 465.00 | 0.025 | 18 |
| CMP2 | 192 | 472.36 | 465.00 | 0.025 | 12 |
| CMP3 | 153 | 492.19 | 465.00 | 0.025 | 12 |
| CMP4 | 248 | 509.65 | 452.62 | 0.025 | 12 |
| CMP5 | 476 | 452.62 | 403.64 | 0.025 | 12 |
| CMP6 | 394 | 403.64 | 317.17 | 0.025 | 12 |
| CMP7 | 194 | 317.17 | 295.17 | 0.025 | 12 |
| CMP8 | 275 | 295.17 | 248.16 | 0.025 | 12 |
| CMP9 | 447 | 248.16 | 232.00 | 0.025 | 18 |
| CMP10 | 214 | 488.54 | 443.66 | 0.025 | 12 |
| CMP11 | 192 | 443.66 | 405.23 | 0.025 | 12 |
| CMP12 | 335 | 265.82 | 210.00 | 0.025 | 12 |
| CMP13 | 137 | 253.07 | 210.00 | 0.025 | 36 |
| CMP14 | 414 | 331.37 | 232.00 | 0.025 | 12 |
| CMP15 | 260 | 328.00 | 232.00 | 0.025 | 12 |
| CMP16 | 256 | 482.00 | 414.00 | 0.025 | 12 |
| CMP17 | 280 | 311.82 | 253.07 | 0.025 | 36 |

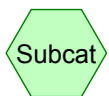
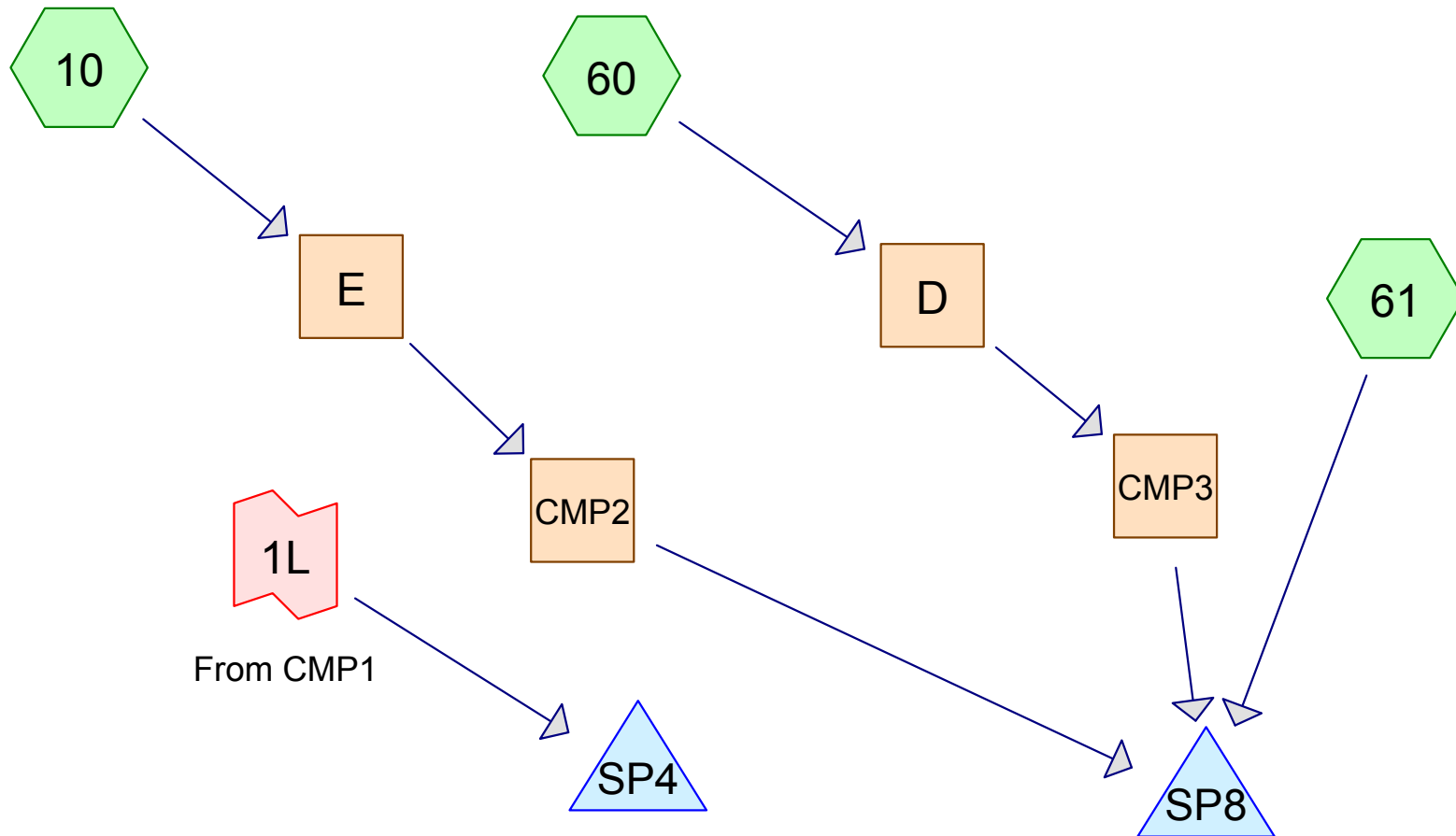
HYDROCAD DIAGRAMS



Drainage Diagram for Sonoma County Landfill 1

Prepared by SCS Engineers 2/11/2011

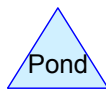
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Subcat



Reach



Pond

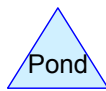
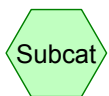
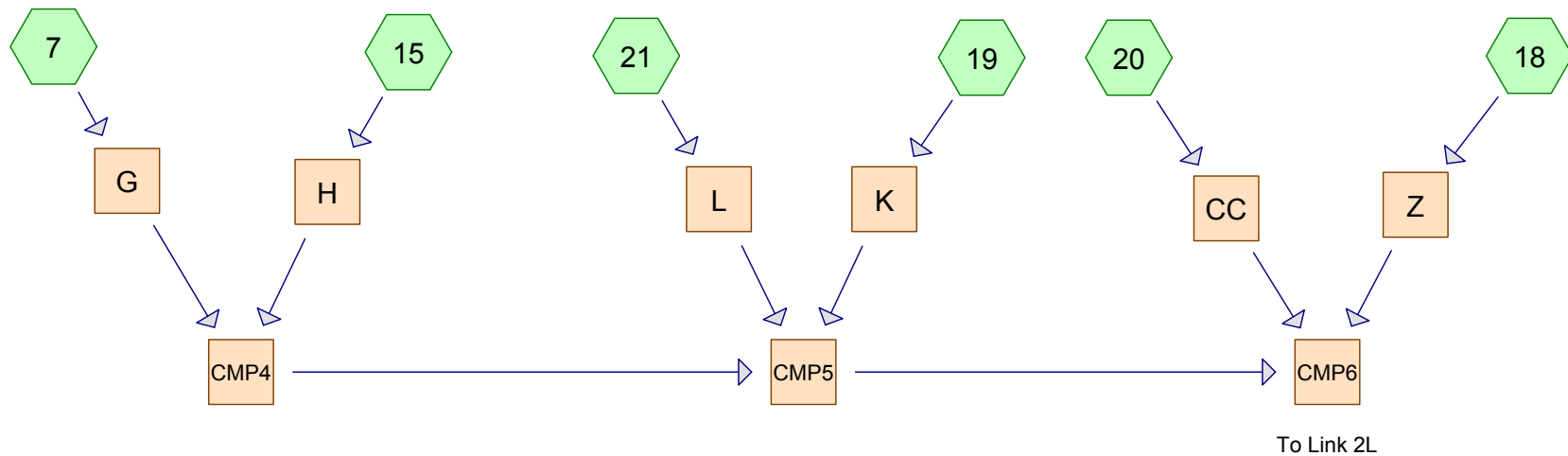


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Drainage Diagram for Sonoma County Landfill 2

Prepared by SCS Engineers 2/11/2011

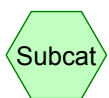
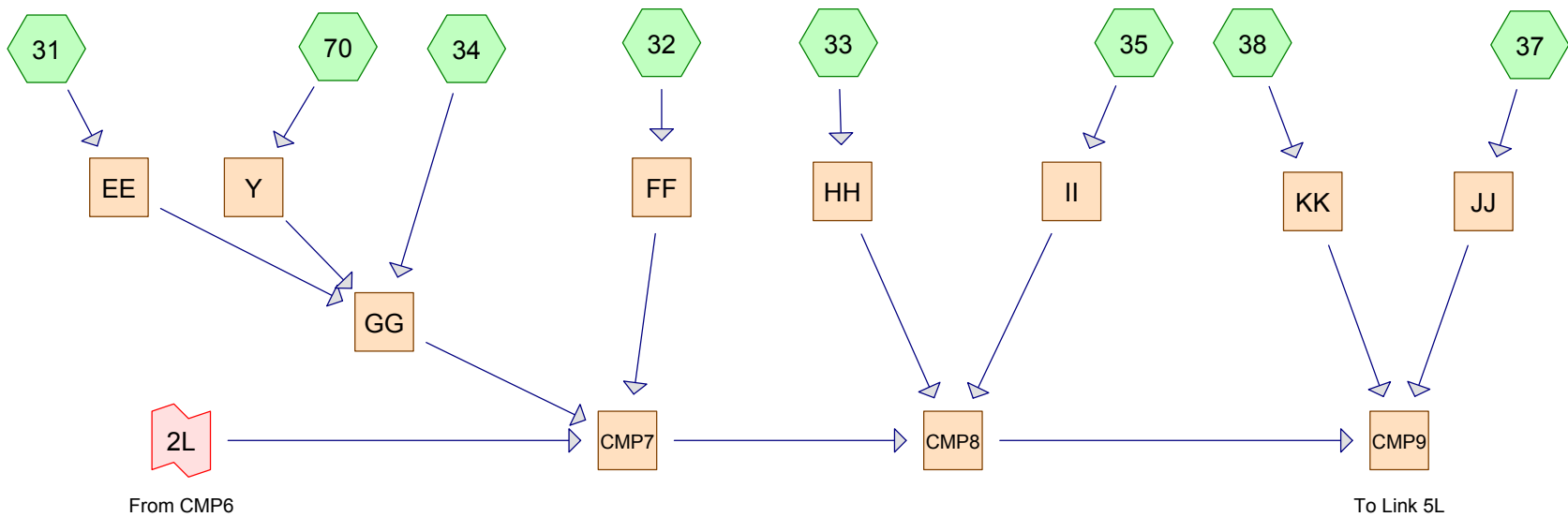
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Drainage Diagram for Sonoma County Landfill 3

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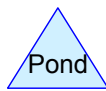
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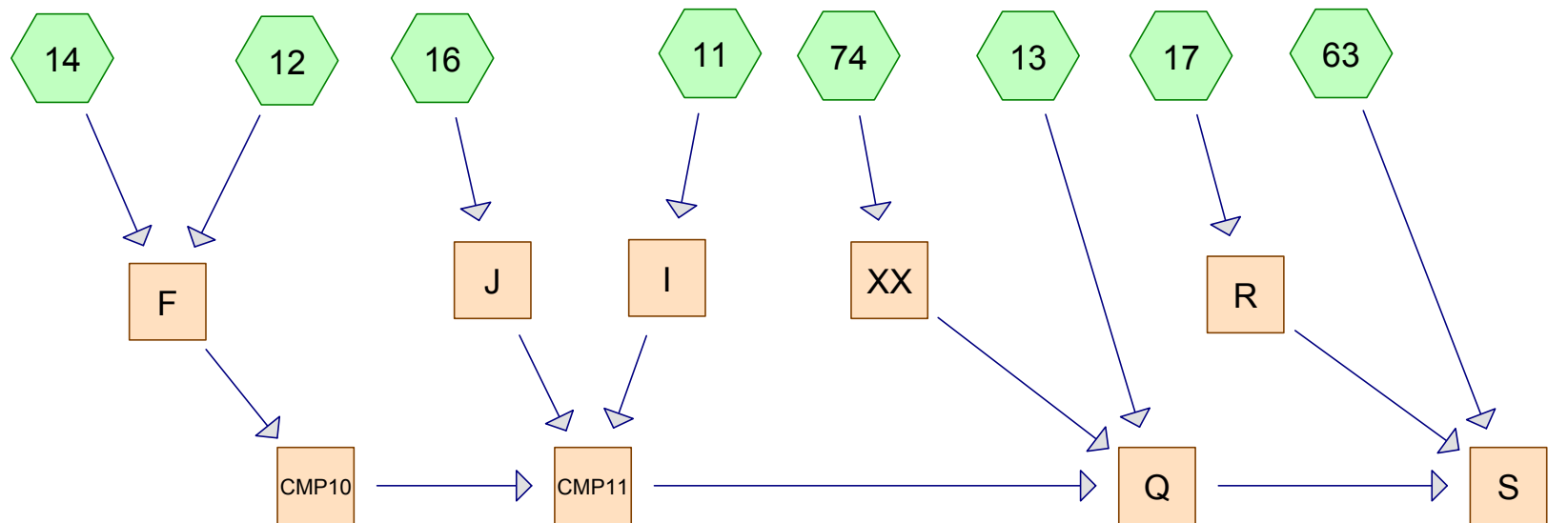


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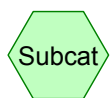
Drainage Diagram for Sonoma County Landfill 4

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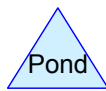
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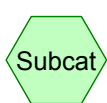
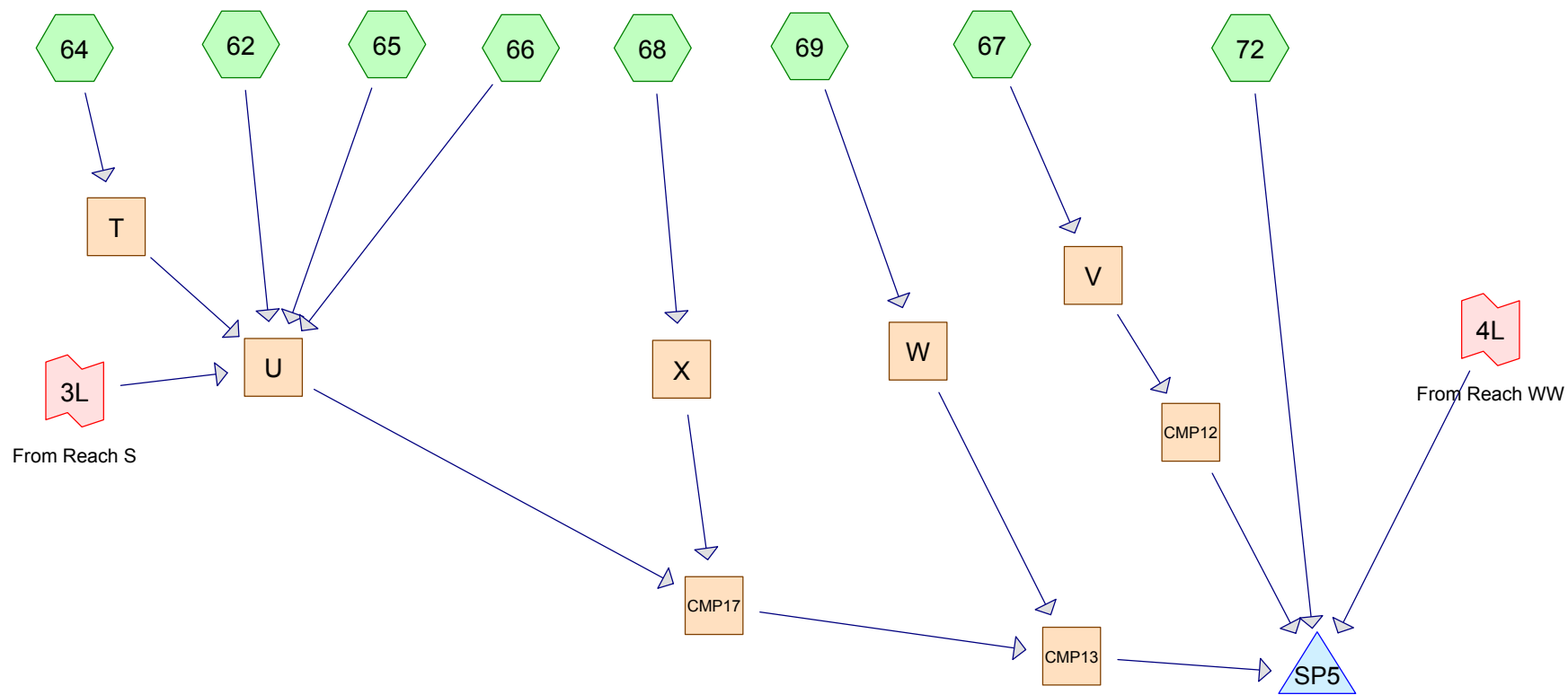


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Drainage Diagram for Sonoma County Landfill 5

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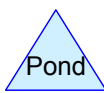
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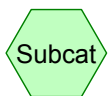
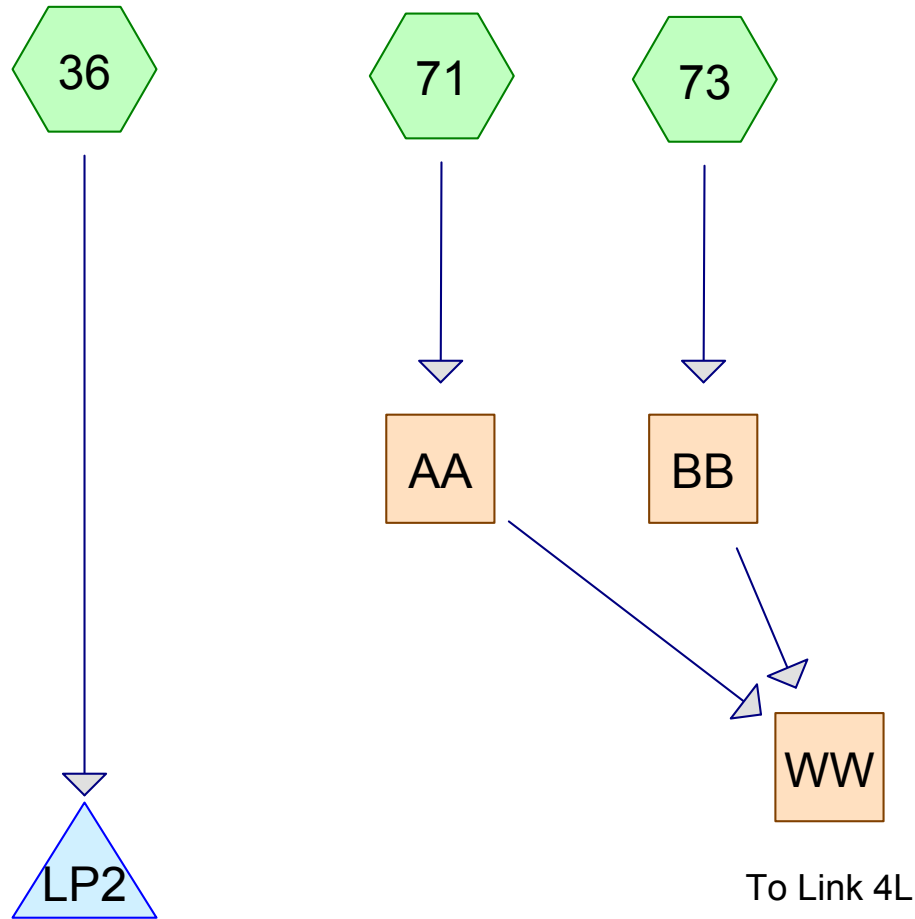


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Drainage Diagram for Sonoma County Landfill 6

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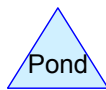
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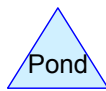
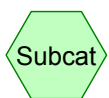
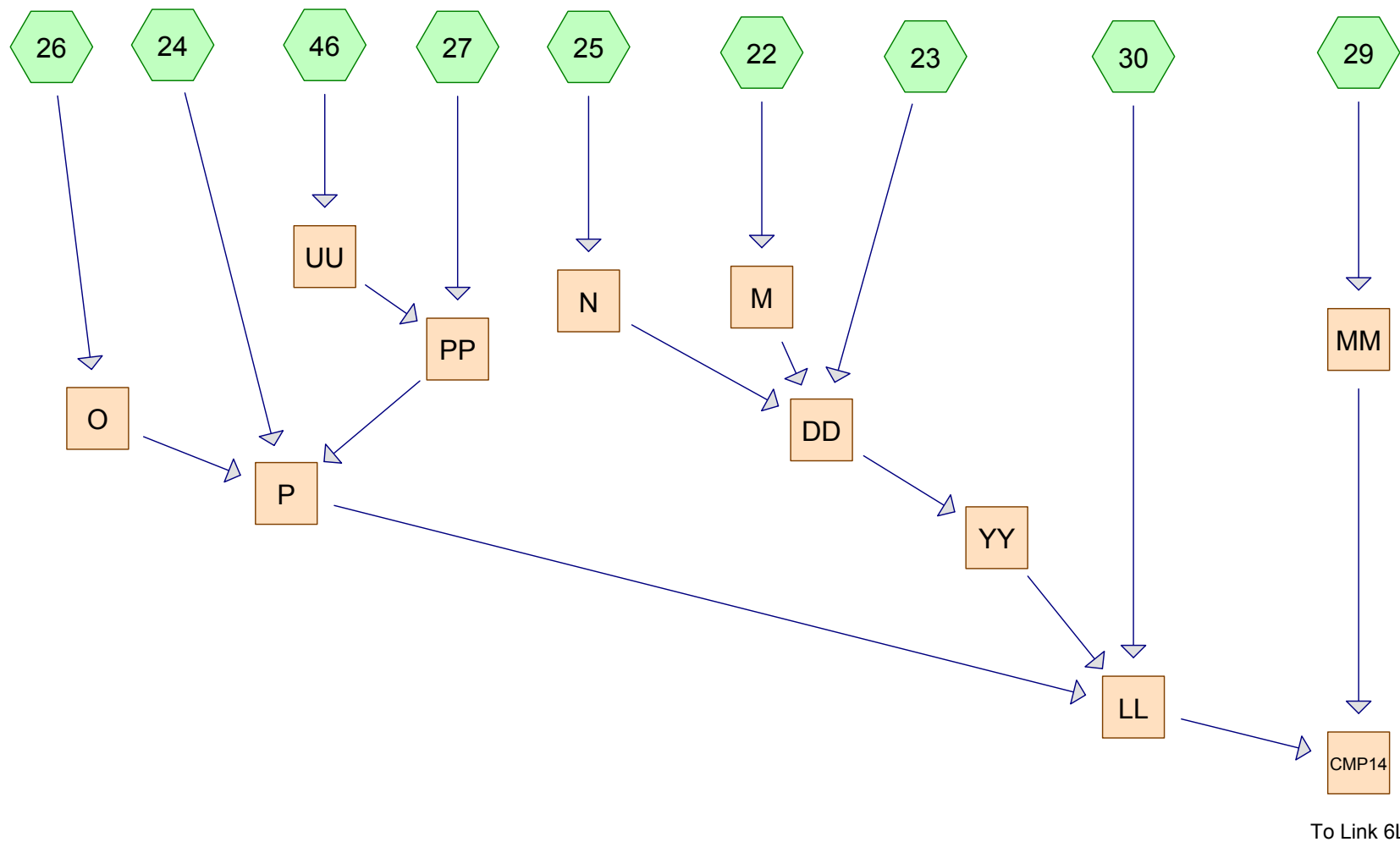


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Drainage Diagram for Sonoma County Landfill 7

Prepared by SCS Engineers 2/11/2011

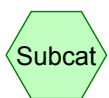
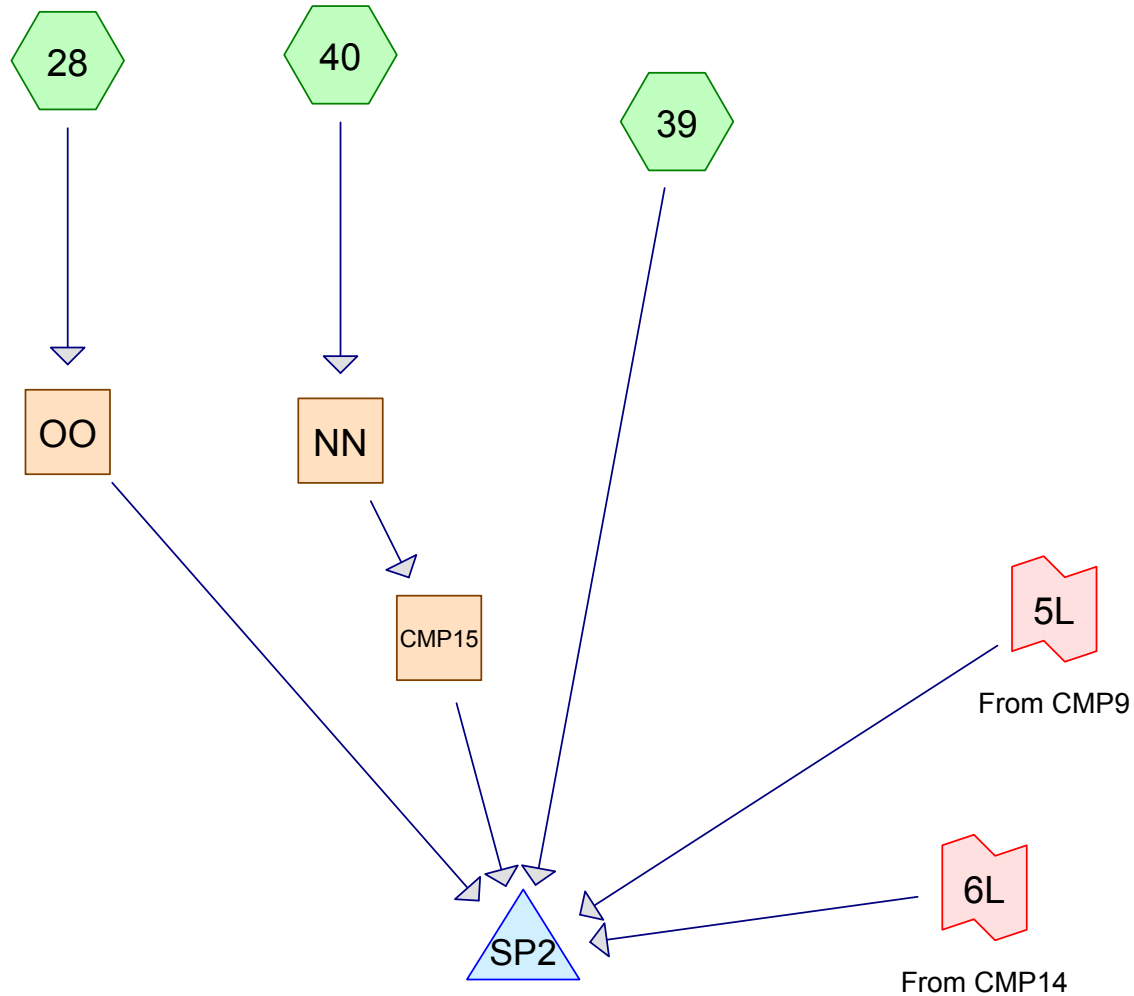
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Drainage Diagram for Sonoma County Landfill 8

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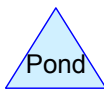
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Subcat



Reach



Pond

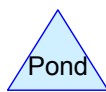
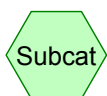
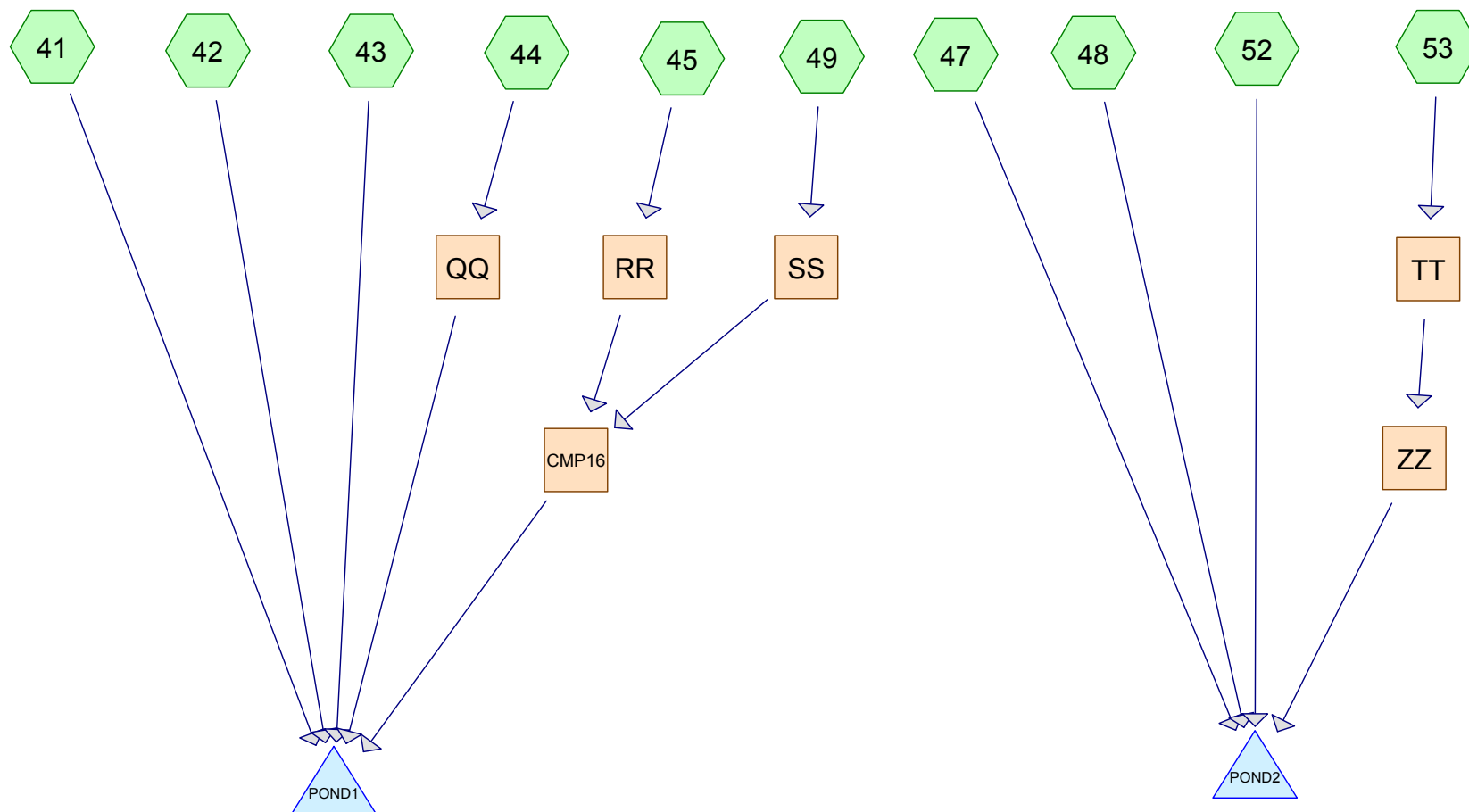


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Drainage Diagram for Sonoma County Landfill 9

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Drainage Diagram for Sonoma County Landfill 10

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