Recology
Yuba - Sutter
WASTE ZERO

October 30, 2013

Mr. Todd Del Frate
California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

Re: Compost Area Work Plan, Recology Yuba Sutter, Yuba County, California

Dear Mr. Del Frate:

Recology Yuba Sutter is transmitting the attached Compost Area Work Plan (CAWP) as required by order 5 of Cleanup and Abatement Order R5-2013-0704. The CAWP was prepared by Golder Associates Inc., on behalf of Recology Yuba-Sutter.

The CAWP presents the following requested elements:

1. A description of how the composting activities will be separated from the closure cover of LF-1 including:
   a. An evaluation of different low permeability pad materials
   b. A justification for the use of low permeability aggregate as a pad material
   c. Design specifications for the compost pad

2. A description of how the compost pad will be graded to drain all liquids to central collection points for reuse in the composting process or for disposal.

3. A description of "Thickness Control Monuments" incorporated into the compost pad.

4. A proposed schedule for construction

5. A proposed monitoring plan

6. A proposed Operations and Maintenance Manual describing:
   a. How operations will prevent ponding to the maximum extent possible, maintain board approved thickness, and prevent compost operations from extending beyond the compost pad.
   b. The type and frequency of inspections
   c. The type and frequency of maintenance actions
   d. Documentation that will be submitted to the board

As required by the Standard Provisions, "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

If you have any questions or require additional information, please contact me at (530) 743-6321.

Sincerely,

Phil Graham
Feather River Organics

Attachment: Compost Area Work Plan
Operations and Maintenance Manual

cc: Paul Donoho, Yuba County Environmental Health
Dave Vaughn, Recology Yuba-Sutter

WORK PLAN

COMPOST AREA WORK PLAN

Feather River Organics

Recology Yuba-Sutter Facility

Submitted To: Recology Yuba-Sutter
3001 North Levee Road
Marysville, CA 95901

Submitted By: Golder Associates Inc.
1000 Enterprise Way, Suite 190
Roseville, CA 95678 USA

October 2013

Project No. 1301525

A world of capabilities delivered locally

Golder Associates

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1.0 INTRODUCTION

The Recology Yuba-Sutter (RYS) facility located in Marysville, California is comprised of existing closed landfill units, a Material Recycling Facility, an administration office, equipment maintenance area, and the Feather River Organics (FRO) composting facility. The FRO compost facility is located on Landfill 1 (LF-1), which was closed in the 1980's in accordance with the appropriate regulations at the time. Prior to composting, FRO constructed a compost pad consisting of a 0.5 foot minimum low-permeability aggregate layer over LF-1 so that composting would not be conducted directly on the landfill cover.

The Central Valley Regional Water Quality Control Board (CVRWQCB) issued Cleanup and Abatement Order (CAO) R5-2013-0704 requiring Recology to implement a number of improvements at the RYS. One of the CAO requirements is to submit a Compost Area Work Plan (Work Plan) which describes how the composting activities are to be designed, constructed, operated, and maintained to protect the existing final cover over LF-1. Golder has prepared this Work Plan to assist RYS in complying with the CAO.

This Work Plan has been structured to address specific items required in Section 5 of the CAO. This Work Plan includes:

- An evaluation of the existing and alternative low-permeability barriers for the compost pad operations
- Engineering recommendations for the selected low-permeability barrier
- Monitoring criteria and Inspection plan
- Construction schedule
- Operation and Maintenance Manual

1.1 Previous Compost Pad Investigations

In May 2001, Golder submitted a report that summarized the subsurface conditions beneath the compost area (Golder, 2001). At that time, the active compost operations were conducted on an aggregate base compost pad comprised of a low-permeability aggregate base located at the eastern end of LF-1. Golder provided material and compaction recommendations for achieving a low-permeability aggregate material based on our evaluation at that time. Following the 2001 report, FRO extended the compost operations to the west and south over LF–1 using material meeting Golder's 2001 recommendations.

In February 2013, Golder prepared an updated investigation of the existing composting operations pad and underlying LF-1 final cover (Golder, 2013). Golder observed that the older portion of the compost pad had worn thin in some areas over the past ten years and Golder recommended adding additional low-permeability aggregate material to the existing compost pad to increase the thickness to a minimum of 0.5 feet to ensure compost operations do not disturb the final cover soil.

1.2 Site Description and Operations

The current FRO permitted composting facility measures approximately 15.8 acres and is permitted by Yuba County to accept a maximum of 400 tons per day of green waste for processing with a capacity of 40,000 tons of materials on-site at any one time. Materials are processed through a screening system and placed in windrows where composting occurs. These windrows are turned in place using a loader to ensure that outer most material is subject to the inner environment of the pile. Compost piles are not pushed across the pad. Composting operations are currently contained within the existing 7.7-acre area underlain by a low-permeability aggregate layer and a 3.7-acre area to the south where FRO stockpiles wood stock and green waste.

2.0 LOW-PERMEABILITY COMPOST PAD ALTERNATIVES EVALUATION

As required by Section 5.a (pg. 11) of the CAO, Golder completed an engineering evaluation of low-permeability barrier alternatives for the compost pad operations. Our analysis includes a comparison alternative barrier layer infiltration rates, capital construction costs, and an evaluation of long-term performance of each barrier layer alternative.

Golder evaluated compost pad alternatives comprised of the following:

- an asphaltic-concrete (AC) pavement
- a reinforced concrete (RC) pavement
- a low-permeability aggregate layer

All three of these alternatives have low permeability surfaces which will reduce infiltration into the underlying soils and landfill when compared to a standard aggregate surface. In addition, each of these alternatives can be designed, operated, and maintained to protect the cover of LF-1. These three alternatives are described in more detail below:

- AC Pavement: A 5-inch thick asphaltic-concrete pavement constructed over a 12-inch thick, Class 2 aggregate base
- RC Pavement: An 8-inch thick reinforced concrete pavement constructed over a 12-inch thick, Class 2 aggregate base
- Low-Permeability Aggregate: A minimum 6-inch thick, low-permeability aggregate. This aggregate was evaluated as part of the 2001 Golder composting pad study. Based on laboratory analysis, an aggregate material with a minimum of 15 percent fines and compacted to 90 percent relative compaction per ASTM D1557 will achieve a permeability of 1×10^{-6} cm/sec or less. FRO has mixed recycled concrete aggregate with clay to produce this material in the past.

2.1 Infiltration Modeling

Golder simulated the water balance for the compost pad alternatives in order to compare the relative quantity of liquids that may infiltrate into the underlying waste using the Hydrologic Evaluation of Landfill Performance (HELP) model (v 3.07) developed by the United States Army Corps of Engineers (USACE). The HELP model is a quasi-two-dimensional hydrological model for conducting water balance analysis to estimate liquid infiltration estimates. In the western U.S., it is Golder's experience that the HELP model over predicts infiltration through a cover. However, the HELP model is still a useful tool in comparing the relative infiltration performance of various operating pad alternatives.

Although this program is designed to model infiltration through various types of soil and geosynthetic layers, it is limited in that it was not designed to model a barrier layer at the ground surface (i.e. a bare compost pad surface). Therefore, the HELP model was used to compare the infiltration in areas that contain compost piles on top of the compost pad.

The precipitation data for the past five years (2008 to 2012) for Marysville, California was used in the HELP model. During this period of time, the maximum daily precipitation was approximately 1.94 inches, which has been only exceeded 8 times since 1982 (0.4 percent of the days with measured precipitation). The evapotranspiration and temperature data were synthetically generated within the model from weather data for Sacramento, California.

Both concrete and asphalt are subject to cracking after construction and therefore, Golder modeled a range of pavement permeabilities which represent the "as-constructed" intact surfaces and more realistic pavement permeabilities to account for the increase in infiltration due to cracking. This is particularly significant for the FRO compost operations due to continued settlement of the underlying refuse and traffic loading on the rigid pavements, which will crack with time. Although sealants can be applied to pavement cracks to reduce pavement permeabilities and mitigate cracking, it is not realistic to assume that cracks can be sealed readily for a composting operation because pavement cracking will be at least partially concealed by compost piles and compost debris that accumulates on the pad surface. An effective crack sealing program would require periodic sweeping/cleaning of the pad surface, which can only be conducted infrequently. Therefore, it is Golder's opinion that a realistic long-term permeability for AC and RC pavements should be one to two orders of magnitude higher than the initial "as-constructed" permeability prior to cracking.

Based on a study of the long-term performance of concrete (Rice, 2007), the cracking in concrete can increase the permeability from approximately 1×10^{-8} cm/sec up to 1×10^{-5} cm/sec. Therefore, our model evaluated the infiltration for a permeability range from 1×10^{-7} to 1×10^{-5} cm/sec to determine the sensitivity of the infiltration to the estimated permeability. For concrete, the lowest permeability value was limited to 1×10^{-7} cm/sec to account for cracking that occurs during the drying of all concrete pavements.

Several studies on the performance of hydraulic AC pavement determined that asphaltic-concrete can have a measured permeability of 1×10^{-8} cm/sec immediately following the initial construction (Anthony, 1993, Bowders, 2000). These pavements require AC mixes with low air voids and high fines content. Although AC is more flexible than RC, it is still subject to cracking due to the differential waste settlement and traffic loading. Therefore, we assumed that the AC would exhibit a long-term permeability of 1×10^{-7} cm/sec which is one order of magnitude greater than the initial intact permeability.

For the purposes of evaluating the relative infiltration performance of the various compost pad alternatives, Golder modeled a typical 10-foot high compost pile as a 9-foot thick vertical infiltration layer with the bottom 1 foot as a horizontal drainage layer. Our model was set up in this manner to more accurately model how liquids migrate through a compost pile.

The modeling profiles for each alternative consist of the following:

Profile 1: Asphaltic Concrete Pavement

- A 9-foot thick vertical percolation layer of compost modeled with a permeability of 1 cm/sec
- A 12-inch thick horizontal compost drainage layer with a permeability of 1 cm/sec
- A 5-inch thick AC pavement with a permeability of 1×10^{-7} cm/sec
- A 12-inch thick layer of granular base layer with a permeability of 5×10^{-4} cm/sec

6 - 10 x less perm.

Profile 2: Reinforced Concrete Pavement

- A 9-foot thick vertical percolation layer of compost modeled with a permeability of 1 cm/sec
- A 12-inch thick horizontal compost drainage layer with a permeability of 1 cm/sec
- A 8-inch thick RC pavement with a permeability ranging from 1×10^{-5} cm/sec to 1×10^{-7} cm/sec
- A 12-inch thick granular base layer with a permeability of 5×10^{-4} cm/sec

Profile 3: Aggregate Pad

- A 9-foot thick vertical percolation layer of compost modeled with a permeability of 1 cm/sec
- A 12-inch thick horizontal compost drainage layer with a permeability of 1 cm/sec
- A 6-inch thick low-permeability aggregate soil with a permeability of 1×10^{-6} cm/sec. Golder's 2001 study found that the existing low-permeability aggregate exhibited measured permeabilities of approximately 7×10^{-7} cm/sec.

The results from the HELP modeling indicate that the potential for water infiltration into the underlying landfill is generally proportional to the permeability of the compost pad surface, see Table 1 below. The HELP model predicts that a typical concrete pad without crack sealing with a permeability of 1×10^{-5} cm/sec has 9 times the infiltration of the low permeability aggregate base alternative when comparing daily maximums and 3.5 times the infiltration when comparing average annual totals. Similarly, the HELP model predicts that a compost pad paved with AC and that is highly maintained (i.e. crack sealing) with a permeability of 1×10^{-7} cm/sec has 10 to 6 times less infiltration in comparison to the low permeability aggregate base alternative when comparing daily maximums and average annual totals, respectively.

Table 1: HELP Model Infiltration Summary

Compost Pad Material	Modeled Hydraulic Conductivity (cm/sec)	Infiltration for a 1.94 in., 24-hr storm (in.)	Average Annual Infiltration[1] (in.)
Asphaltic-Concrete	1×10^{-7} (2)	0.006	0.13
Reinforced Concrete	1×10^{-7}	0.005	0.13
	1×10^{-6}	0.047	0.81
	1×10^{-5}	0.442	2.90
Low-permeability aggregate	1×10^{-6}	0.051	0.82

Notes:
1. Average annual precipitation for the period analyzed = 19.12 inches of precipitation.
2. A Hydraulic Conductivity of 1×10^{-7} represents a rigorously maintained AC surface

As discussed previously, the HELP model is useful in comparing relative performance. It is Golder's experience that it over-predicts actual infiltration volumes in relatively dry climates in the western U.S., such as that for the Marysville area.

2.2 Cost Analysis

Golder prepared estimates of the capital costs associated with the construction and annual maintenance for the three alternative compost pad surfaces described previously. The costs to perform the initial grading to establish a minimum positive drainage grade of three percent was not included in the estimate as this step would be required for each alternative and therefore the costs would be identical.

The following key assumptions were made in completing the cost comparison:

- The site will be graded to a minimum of three percent to promote positive drainage prior to the installation of the selected compost pad surface
- Costs for construction including materials and labor for the AC alternative were obtained from the recent California Department of Transportation (Caltrans) price index (Caltrans, 2013)
- Costs for low-permeability aggregate and RC were developed using equipment rates provided by Caltrans and labor rates provided by California Department of Industrial Relations (DIR)

Table 2 summarizes our capital cost and annual maintenance estimates. A detailed cost estimate is included in Appendix B.

Table 2: Compost Pad Alternatives Cost Summary

Description	Compost Pad Alternatives		
	Asphaltic-Concrete Pavement	Reinforced Concrete Pavement	Low-Permeability Aggregate Base
Capital Construction Costs	$ 2,260,000	$ 4,170,000	$ 210,000
Annual Maintenance Costs	$ 452,000	$ 834,000	$ 42,000

The annual maintenance costs were assumed to be 20 percent of the estimated initial construction capital costs. Our key assumptions for the annual maintenance costs include:

- Both AC and RC will likely require extensive crack repair due to the continual settling of refuse in LF-1. Crack repairs may include localized removal and repaving areas where crack-sealing will not provide the level of protection needed to for LF-1.
- The low-permeability aggregate surface will likely require filling and grading due to LF-1 settlement as well. This may require some soil and aggregate import as well as mobilization of equipment to perform the earthfill.

3.0 LOW-PERMEABILITY COMPOST PAD ALTERNATIVES COMPARISON

Golder evaluated the potential advantages and disadvantages for each compost pad alternative. The evaluation criteria consisted of the following:

- Infiltration Performance
- Protection of the LF-1 Cap
- Maintenance
- Capital Costs

Each of these criteria is discussed below with respect to the various compost pad alternatives.

Infiltration Performance

The HELP modeling indicates that the infiltration potential of the compost pad surface is generally proportional to the permeability. Lower material permeabilities will result in lower infiltration rates.

Rigid pavements initially have relatively lower permeabilities than the low-permeability aggregate. However, subsequent cracking of the pavements will inevitably increase the permeability of the rigid pavements. This cracking will be exacerbated by continued settlement of underlying refuse in LF-1. In particular, the inclusion of expansion joints and the cracking that occurs following drying will substantially increase the effective permeability of an RC pavement. In our opinion, the effective permeability of a well-maintained RC pavement with periodic pad cleaning is likely to be the same or greater than that of a low-permeability aggregate, which is expected to be 1×10^{-6} cm/sec or less. AC pavement is more flexible and will not incur cracking due to shrinkage. However, some cracking is inevitable due to equipment loading during operations and it is Golder's opinion that the permeability of a well maintained AC pavement with periodic pad cleaning and crack sealing will be at least comparable to the low-permeability aggregate and likely up to an order of magnitude lower. In the absence of a crack sealing program, rigid pavements may exhibit permeabilities greater than that of a low-permeability aggregate.

The key issue in selecting a minimum permeability for the compost pad is to determine how much infiltration is occurring and whether it is excessive. Golder's 2001 compost pad investigation concluded that the infiltration performance of the a low-permeability aggregate layer with a permeability on the order of 1×10^{-6} cm/sec or less was better than the original, prescriptive vegetated soil cover (i.e. it allows less infiltration). Comparison of the infiltration rates estimated in the attached HELP analysis for the low-permeability aggregate (Appendix A) are also lower than that estimated in 2001 for the prescriptive vegetated soil cover. Field observations of the apparently dry compost pad material at depth in 2001 near the end of the rainy season, and comparison of moisture content profiles of the soil cover below the compost pad and below the vegetated soil cover are consistent with this finding. Therefore, it is Golder's opinion that a compost pad with a permeability of $1x10^{-6}$ cm/sec will exhibit adequate infiltration performance.

Protection of the LF-1 Cap

Operation of the composting facility results in wear on the pad surface that has the potential to reduce the thickness of the compost pad layer over the LF-1 final cover. In the absence of diligent inspection and maintenance, an AC or RC pavement surface provides a high level of protection and can be readily inspected to verify that the compost pad layer is intact.

A low-permeability aggregate surface is subject to a higher level of wearing, or thinning, of the compost pad due to operations. After 10 years of operation, Golder's 2013 investigation indicated that a substantial portion of the original 0.5-foot thick pad had been worn away over a 10-year operating period. To adequately protect the LF-1 cover, a low-permeability aggregate cover needs to be conservatively designed and then diligently inspected and maintained to provide the same level of protection provided by rigid pavements. Conservative design includes "over-building" the pad thickness to account for wear. In addition, a conservative design approach includes the installation of monitoring devices that will allow detection of the thinning of the pad surface prior to reaching the minimum design thickness so that it can be promptly amended with additional low-permeability aggregate material.

Maintenance

The most significant issue with rigid pavements is that they cannot be designed to withstand differential settlement which will occur within LF-1. As differential settlement occurs and creates ponding, portions of the pavement will need to be removed, the aggregate regraded and then the pavement reconstructed locally. Based on the minimum 3 percent grades of LF-1 in the compost pad area, pavement reconstruction will likely involve between 10 to 20 percent of the pavement area on an average annual basis.

AC RC

A low-permeability aggregate layer is subject to the same differential settlement as the rigid pavements. However, it is more flexible and will not crack as the differential settlement initially occurs. As settlement continues and the potential for ponding occurs, additional material can be added to the pad surface to re-establish positive drainage.

Capital Costs

Both AC and RC pavements are substantially more expensive to construct than the low-permeability aggregate. The AC and RC pavements are estimated to be 6 times to 10 times more expensive than a low-permeability aggregate to construct. Annual maintenance costs are also expected to be comparably higher for the rigid pavements.

Summary

The previous studies and additional analyses completed by Golder indicate that the compost pad should be designed so that it has an effective long-term permeability of less than 1 $x10^{-6}$ cm/sec. Due to continued settlement that is likely to occur beneath LF-1, the most flexible compost pad materials will tend to more readily accommodate settlement without cracking. A low-permeability aggregate layer is more flexible than the AC and RC pavements and can be designed to exhibit a permeability of less than 1 $x10^{-6}$ cm/sec based on the results of Golder's 2001 study. In addition, it is relatively easier to maintain and repair areas of differential settlement than rigid pavements. Rigid pavements are considerably less flexible and subject to more cracking and are more expensive to maintain and repair.

The low-permeability aggregate is considerably more vulnerable to wear from composting operations, which will reduce the pad thickness over time. Therefore, construction of a composting pad using this material and conducting composting operations on the pad requires a relatively conservative design and diligent inspection and maintenance to ensure an adequate thickness is achieved through the life of the operations.

4.0 COMPOST PAD DESIGN RECOMMENDATIONS

While the RC and AC pavements offer durable surfaces which typically exhibit lower-permeabilities than the low-permeability aggregate, Golder believes that a properly designed, constructed, and maintained low-permeability aggregate compost pad surface can be comparable to a rigid surface such as RC and AC. A low-permeability aggregate surface will require frequent inspections and will likely require minor maintenance annually to maintain the design thickness and grade. To help facilitate inspections, Golder recommends that FRO install markers to help delineate the boundary of the compost pad. In areas where physical entities (i.e. LFG header adjacent to the existing pad) border the compost pad, these entities will be used to identify the compost pad boundary (see Figure 3).

The design of the compost pad should include the following criteria:

- Place fill within the compost operations area to obtain a minimum three percent grade to promote positive drainage.
- Initially over-build the compost operations area to a minimum of nine inches to allow for wearing of the pad thickness over time
- The low-permeability aggregate should be a minimum of 0.5 feet thick through the operating life of the compost facility 6"
- The low-permeability aggregate should consist of an aggregate comparable to a Caltrans Class 2 or Class 3 aggregate base with a minimum of 15 percent fines. In addition, this material should be compacted to a minimum density of a minimum of 90 percent relative compaction per ASTM D 1557
- Thickness markers need to be installed and monitored to verify that the minimum thickness is maintained.

Golder also recommends construction quality assurance (CQA) testing and observation during the construction of the compost pad improvements. Table 3 below summarizes the minimum testing that should be completed for the compost pad improvement construction.

Table 3: Construction Testing Frequency

Construction Material	Test Designation	Test Frequency
Low-Permeability Aggregate	Grain-Size Distribution ASTM D422	One per 1,000 cy
	Moisture-Density ASTM D1557	One per 5,000 cy
	Nuclear Moisture-Density ASTM D6938	One per 500 cy

In addition to the specified testing, an as-built survey should be prepared that demonstrates that the minimum compost pad thickness has been constructed. This survey should be performed by a third-party surveyor.

4.1 Thickness Control Monuments

Metal thickness markers are to be installed as shown in Figure 3. Thickness markers will be installed in rows approximately 200 feet apart with 65 feet between each marker. The location of the rows will be indicated using markers on each side of the pad. A total of at least 24 settlement markers will be installed throughout the compost pad.

The thickness markers will be installed with an upper steel plate located 0.6 feet above the base of the compost pad layer to assist with inspection of the compost pad thickness over time. The final compost pad will be constructed with a minimum thickness of 9-inches (0.75 feet), to provide material initially 0.15 feet above the plate surface and 0.25 feet above the minimum allowable thickness of 0.5 feet.

Periodic inspections will be conducted by performing a field check of the pad surface along the marker rows using a metal detector. If the metal plate is detected and the plate is not visible, then pad thickness at that location will exceed 0.6 feet. At the point that the marker plate surface is visible, then the pad thickness at that location is 0.6 feet. At this point, RYS will coordinate and add more compacted low-permeability aggregate during the first occurring dry season.

4.2 Surface Water Control

Golder evaluated surface water controls for a 100-year, 24-hour storm event. Our long-term conceptual stormwater design conveys water from the compost pad to the northwest though a series of 6-inch culverts that allows water to pass through the existing screening berm. These culverts were approximately spaced every 100 feet along the screening berm alignment. Future improvements may connect these culverts to an approximate 12 inch diameter pipe which would be routed inside the existing drainage ditch. Flows are currently conveyed and would continue to be conveyed to the northeast towards the "Hog Farm" area as shown on Figure 2. Once the piped run-off reaches the Hog Farm, the water will be collected and either used for compost make-up water or disposed of at a municipal water treatment facility. Details of the specific surface water controls will be presented in the Compost Area Leachate Collection Work Plan to be submitted to the CVRWQCB by February 1, 2014 per Section 9 of the CAO.

5.0 COMPOST PAD IMPROVEMENT SCHEDULE

RYS is currently importing low-permeability aggregate material and is improving the low-permeability aggregate pad along the northern portion of the compost pad to prepare for the 2013-2014 winter. This work is being performed as space on the compost pad is available and as weather allows. The proposed compost pad improvement schedule is as follows:

- Complete Surface Water/Leachate Control Improvement Design: February 1, 2014
- Complete Grading and Additional Compost Pad Material Placement: September 15, 2014
- Install Thickness Control Monuments: October 1, 2014
- Install Surface Water/Leachate Control Improvements: October 1, 2014

6.0 INSPECTION AND MONITORING PLAN

As required by Section 5.e (pg. 11) of the CAO, Golder proposes the following inspection and monitoring plan for the compost facility. Golder proposes that RYS conduct annual soil sampling and inspection of the compost pad to determine if constituents from the compost facility are infiltrating into the closure cap. RYS staff or their representatives will conduct the compost pad inspections and soil sampling as described below.

6.1 Inspections

The compost facility is to be inspected to verify that:

- Operations are conducted within the compost pad
- Compost pad maintains minimum 6-inches of low-permeability aggregate as determined by thickness markers
- Compost pad is free of significant cracks
- Compost pad maintains positive drainage

Inspection and monitoring frequencies are summarized on Table 4 below. Detailed inspection and monitoring procedures are discussed in the Operations and Maintenance (O&M) Plan (Appendix C).

Table 4: Inspection Schedule Summary

Inspection Type	Proposed Frequency
Operations Containment	Weekly
Compost Pad Surface Thickness Field Verification	Quarterly
Compost Pad Topographic Survey	Every 5 years
Compost Pad Drainage Controls	Weekly between October 15th and April 15th and during inclement weather

6.2 Soil Sampling

The installation of suction lysimeters below the compost pad is not practical since compost operations would likely destroy the surface access to a below-grade lysimeter. As an alternative to lysimeters, soil samples from the LF-1 cover soil below the compost pad will be collected and submitted to a laboratory for soil pore fluid extraction. The extracted soil pore fluid will then be analyzed for the compost parameters listed in Table 5.

(E.)

Soil samples will be obtained from the LF-1 cover below the compost pad to establish background concentrations of the monitoring parameters that would be indicative of compost impact.

Background material

Soil sampling shall take place annually, in the late spring to increase the potential for soil-moisture capture. Soil samples will be obtained from the LF-1 soil cover at depths of 6 inches and 12 inches below the compost pad layer at a frequency of one location per acre of compost pad (approximately 11 locations, see Figure 4 for proposed soil sample locations). Soil samples will be analyzed for percent moisture and if sufficient moisture is present, the soil pore liquid will be extracted and analyzed for the monitoring parameters.

Table 5: Soil Sampling Constituents

Compost Monitoring Parameters	Units
Total Kjeldahl Nitrogen	mg/L
Ammonia N	mg/L
Nitrate/nitrite as N	mg/L
pH	units
Phosphorus (P_2O_5)	mg/L
AgIndex (Nutrient salts (Ca & Mg) / Na & Cl salts)	ratio
Potassium	mg/L
Moisture	%

Water
EC
TDS
pH

6.2.1 *Background Values, Data Analysis, and Reporting*

Background values for each of the naturally-occurring monitoring parameters will be calculated by pooling the initial soils sample analytical results. The pooled data will be used to calculate tolerance limits for each constituent.

This evaluation will occur during the monitoring period in which the post-composting samples are obtained. If a measured concentration higher than the background limit is determined, the CVRWQCB should be notified within 72 hours of the determination, followed by written notification within seven days. Results of the monitoring program will be reported in the semi-annual/annual monitoring reports for the landfill.

6.2.2 *Sampling Procedures*

At each sample location, the compost pad will be removed using a backhoe or excavator to expose the top of the landfill cover soil. Grab soil samples will be taken from depths of 6 inches and 12 inches below the top of the landfill cover soil. Samples will be placed in sealed plastic bags to preserve the sample for laboratory analysis. After samples are sealed and labeled, they are placed in an ice-cooled container to await shipment to the laboratory. The landfill cover soil sample holes will be backfilled with sodium bentonite chips and the compost pad will be backfilled with aggregate base that meets the material specification discussed in Section 3. All sampling equipment will be washed prior to use between samples to minimize the potential for cross-contamination.

Sample identification and chain-of-custody procedures ensure sample integrity, and document sample possession from the time of collection to the final analysis. Each sample submitted for analysis is labeled to identify the job number, date, time of sample collection, a sample number unique to the sample, and the name of the sampling personnel. All sample containers are labeled immediately following collection. At the time of sampling, each sample is logged on a chain-of-custody record, which accompanies the sample to the laboratory.

7.0 OPERATIONS AND MAINTENANCE MANUAL

As required by Section 5.f (pg. 12) of the CAO, Golder has prepared an Operations and Maintenance (O&M) Manual for the compost facility. This manual is included in Appendix C. This manual describes how composting activities and inspections shall be performed to help protect the LF-1 cover.

8.0 CLOSING

Golder appreciates the opportunity to work with Recology on the Recology Yuba-Sutter Feather River Organics project. Please call if you have any questions or require additional information.

Sincerely,

GOLDER ASSOCIATES INC.

Joel Kelsey
Project Engineer

Ken Haskell, P.E.
Principal

REGISTERED PROFESSIONAL ENGINEER
KENNETH G. HASKELL
No. C053290
Exp. 6/30/15
CIVIL
STATE OF CALIFORNIA

9.0 REFERENCES

Anthony, John et al. (1993) " Performance Evaluation of a Hydraulic Asphalt Concrete Pavement Capping a Hazardous Waste Site, Third International Conference on Case Histories in Geotechnical Engineering, St. Louis, Missouri, June 1-4, 1993, Paper No. 11.01.

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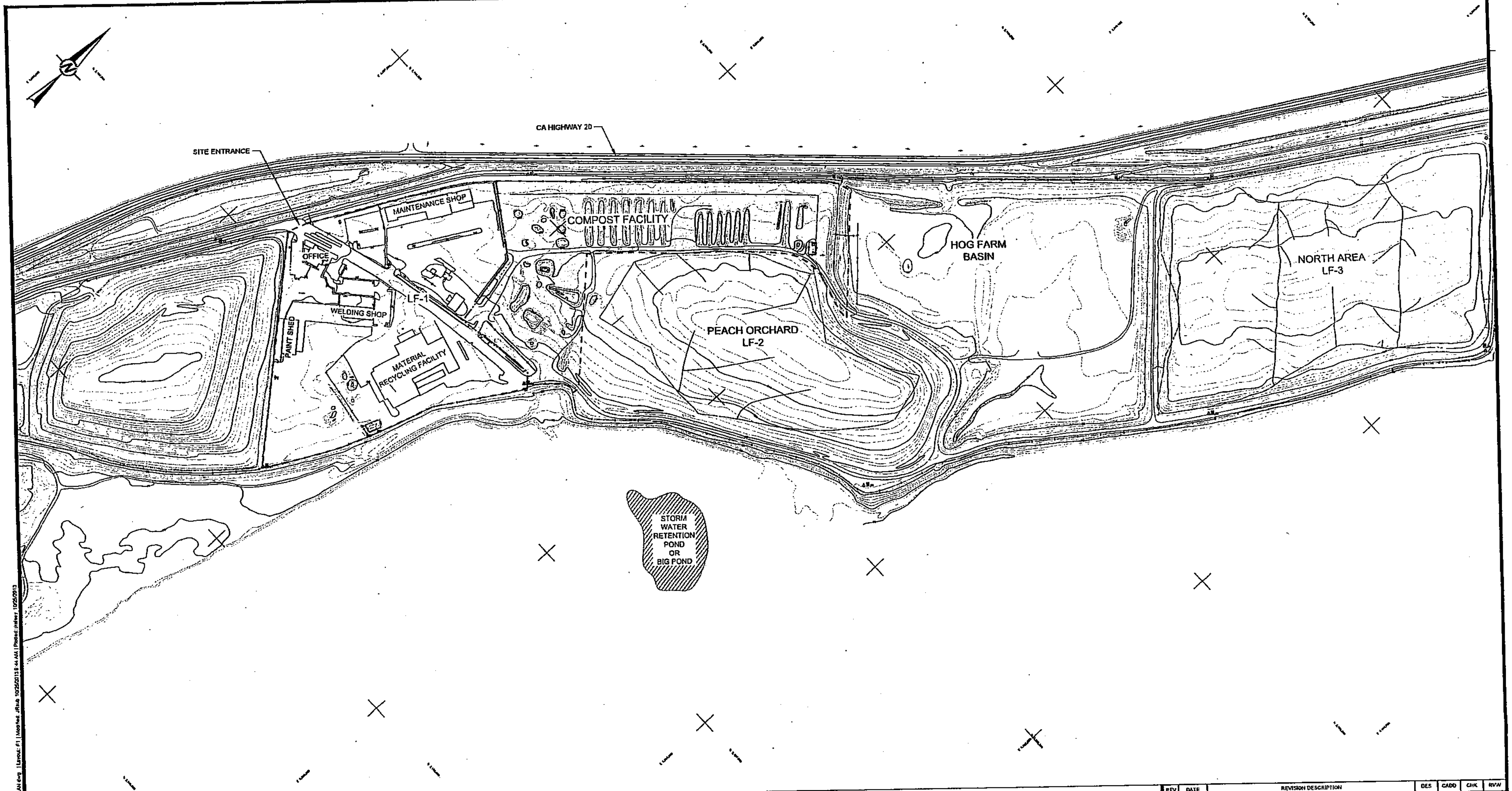
Golder Associates, (Golder) (2001), "Results of Field and Engineering Study Proposed YSDI Compost Area, Marysville, California", May 18.

Golder Associates, (Golder) (2013), "Subsurface Characterization of the Compost Pad at the Recology Yuba-Sutter Facility, Marysville, California", February 15.

Rice, John, D. (2007), "A study on the Long-Term Performance of Seepage Barriers in Dams", Virginia Polytechnic Institute and State University, Civil and Environmental Engineering, December 7.

FIGURES



NOTES

1. TOPOGRAPHIC INFORMATION PREPARED USING PHOTOGRAMMETRIC METHODS BY AERIAL DATA INC. DATE OF TOPOGRAPHY: APRIL 4, 2012.

LEGEND

[dotted box] COMPOST FACILITY

- - - - - - - APPROXIMATE BOUNDARY OF LF-1

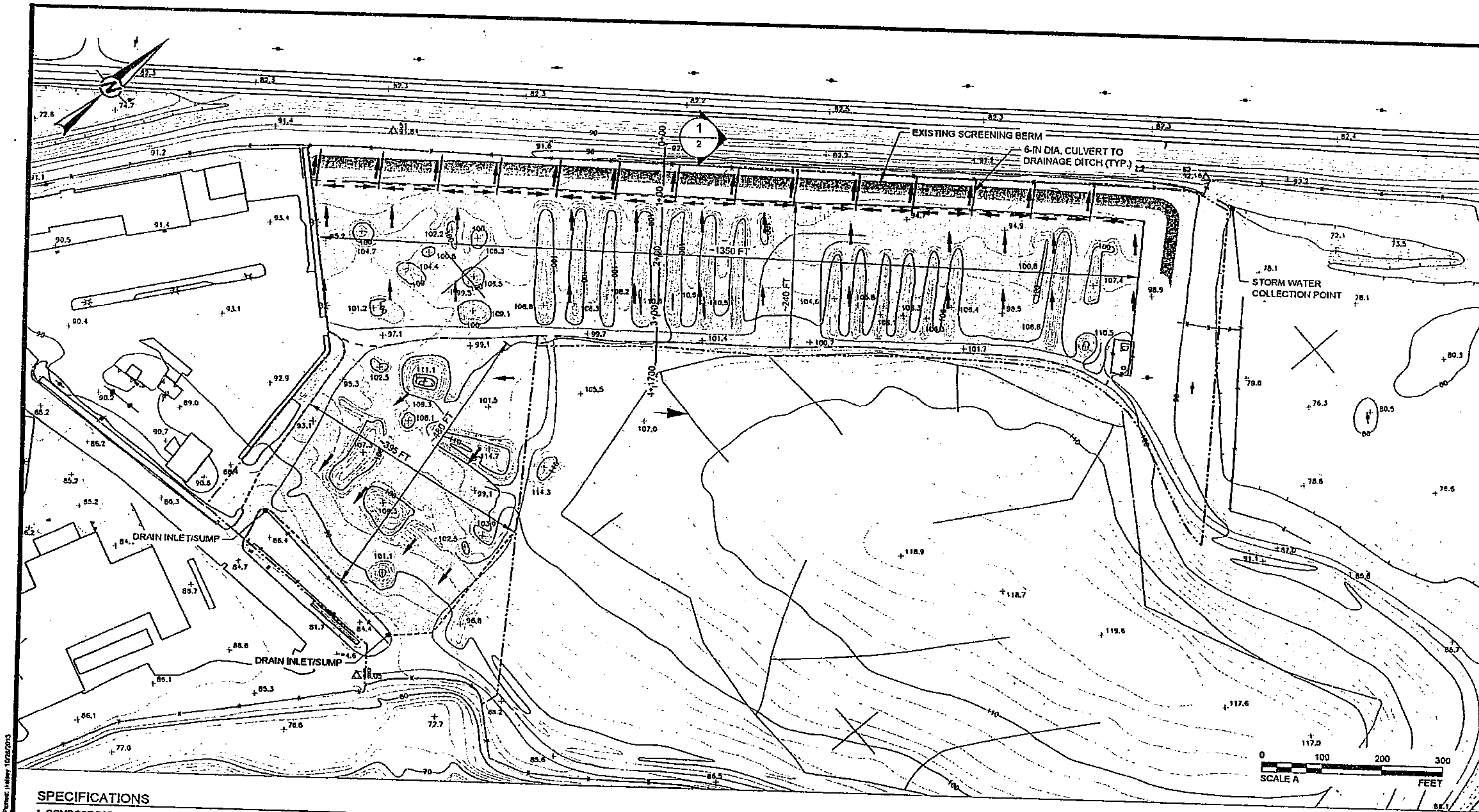
REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT
RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE
SITE PLAN

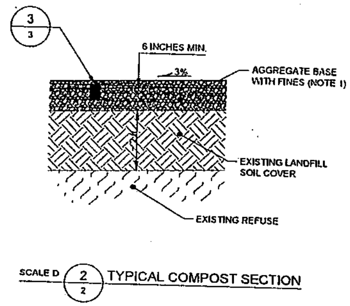
Golder Associates

PROJECT No.		130-1525	FILE No. CAD COMPOST SITE PLAN	
DESIGN	JTK	10/6/13	SCALE	AS SHOWN
CADD	JCS	10/14/13	FIGURE	
CHECK	JTK	10/15/13		1
REVIEW	KGH	10/17/13		



LEGEND

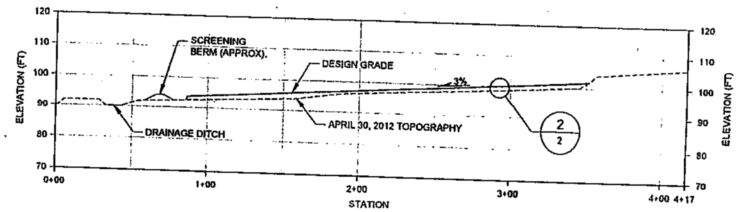
- COMPOST FACILITY
- PERMITTED BOUNDARY OF COMPOST FACILITY
- APPROXIMATE CURRENT EXTENT OF COMPOST PAD
- APPROXIMATE AREA TO BE UNDERLAIN BY LOW PERMEABILITY AGGREGATE COMPOST PAD
- GROUNDWATER FLOW DIRECTION



SCALE D (2/2) TYPICAL COMPOST SECTION

SPECIFICATIONS

1. COMPOST PAD SHALL CONSIST OF A 1.5-INCH MINUS CLASS 2 OR CLASS 3 AGGREGATE BASE WITH A MINIMUM OF 15 PERCENT FINES CONTENT IN ACCORDANCE WITH CALTRANS STANDARD SPECIFICATIONS.
2. THE AGGREGATE BASE SHALL BE COMPACTED TO A MINIMUM 90 PERCENT RELATIVE COMPACTION AT A MOISTURE CONTENT 1 TO 4 PERCENT ABOVE OPTIMUM WATER CONTENT (ASTM D 1557).



HORI. SCALE B / VERT. SCALE C (1/2) SECTION A

SCALE B 0 40 80 120 FEET
SCALE C 0 20 40 60 FEET
SCALE D 0 2 4 6 FEET

NOTES

1. TOPOGRAPHIC INFORMATION PREPARED USING PHOTOGRAMMETRIC METHODS BY AERIAL DATA INC. DATE OF TOPOGRAPHY: APRIL 4, 2012.

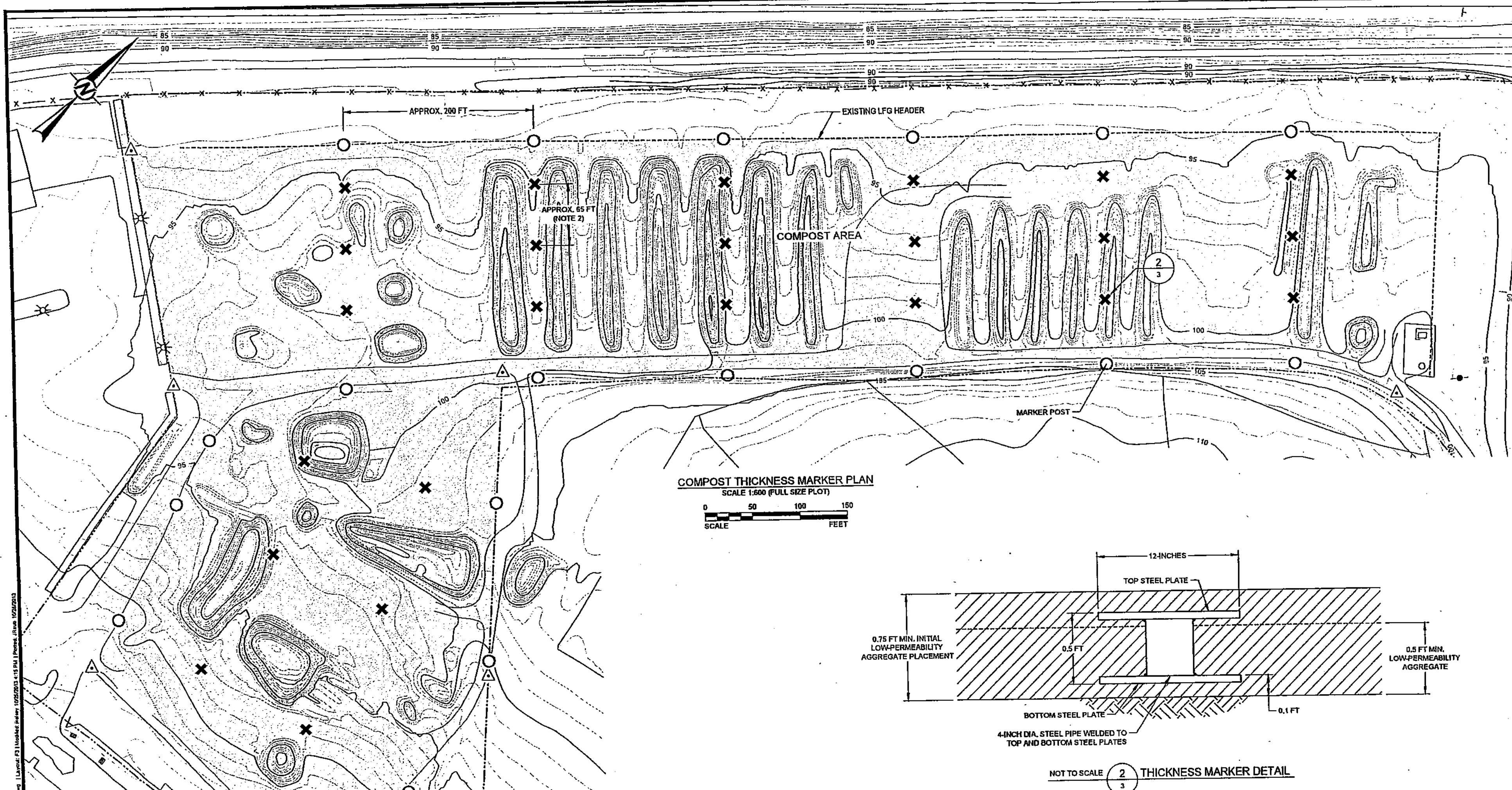
REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT
RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE
COMPOST PAD
CONCEPTUAL GRADING PLAN

Golder Associates

PROJECT No.		130-1525	FILE No. ...COMPOST GRADING_Final
DESIGN	JTK	10/8/13	SCALE AS SHOWN
CADD	JCS	10/14/13	FIGURE
CHECK	JTK	10/15/13	
REVIEW	KGH	10/17/13	2



LEGEND

Symbol	Description
—··—··—	PERMITTED BOUNDARY OF COMPOST FACILITY
-----	LANDFILL GAS (LFG) HEADER
(stippled)	APPROXIMATE AREA OF COMPOST PAD
○	RECOMMENDED LOCATION FOR MARKER POST
△	APPROXIMATE LOCATION OF CORNER MARKER
✖	THICKNESS MARKER (2/3)

NOTES

1. TOPOGRAPHY PROVIDED BY AERIAL DATA, INC. DATE OF TOPOGRAPHY: APRIL 30, 2012.
2. LOCATION OF THICKNESS MARKERS TO BE SURVEYED AFTER THEY ARE INSTALLED.

PROJECT

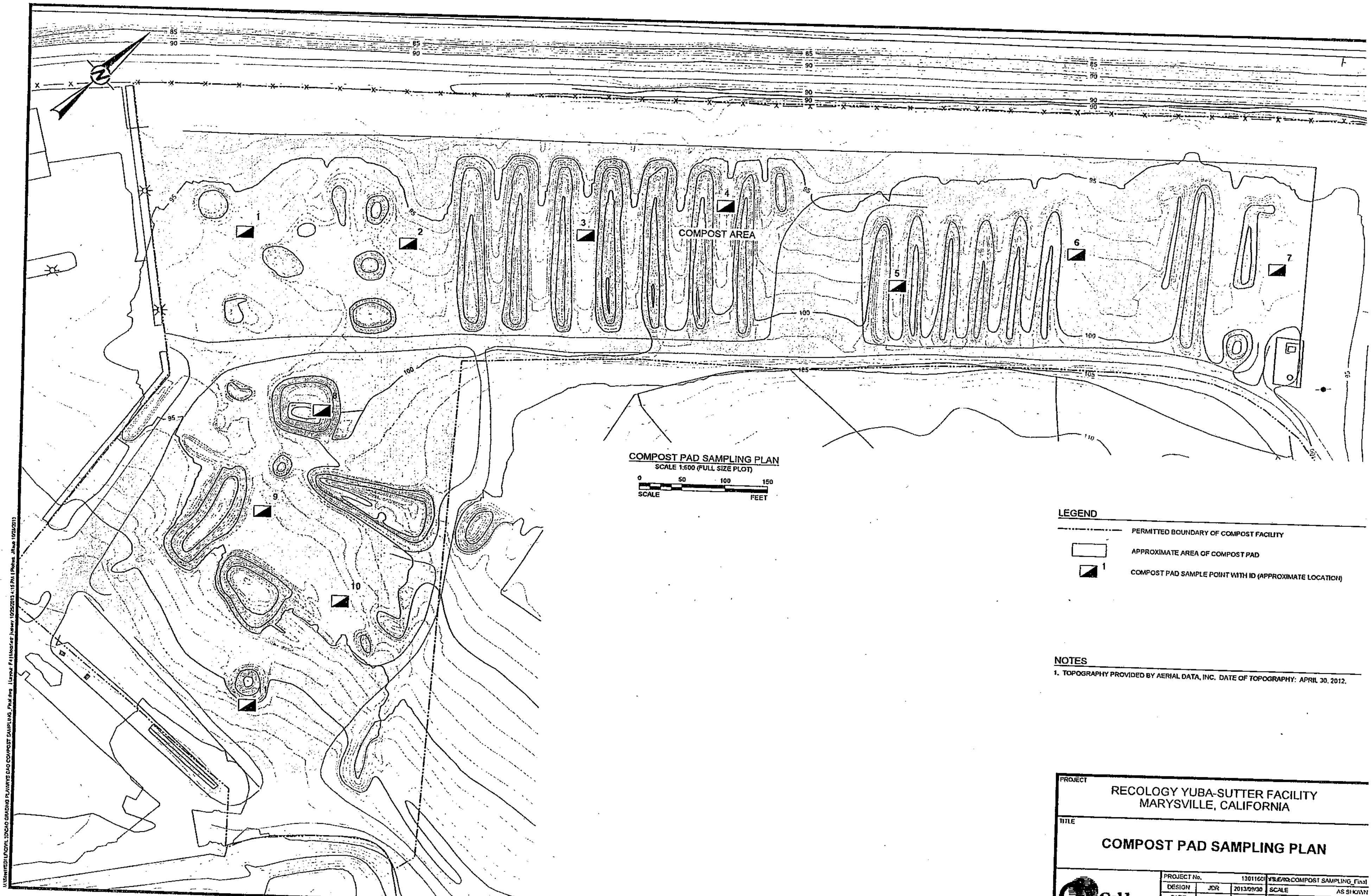
RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE

THICKNESS MARKER PLAN AND DETAIL

Golder Associates

PROJECT No.		1301150	RYUE030 COMPOST MARKER_Final
DESIGN	JDR	2013/09/30	SCALE AS SHOWN
CADD	JDR	2013/09/30	FIGURE
CHECK	KGH	2013/09/30	3
REVIEW	KGH	2013/09/30	



LEGEND

— · · —	PERMITTED BOUNDARY OF COMPOST FACILITY
▭	APPROXIMATE AREA OF COMPOST PAD
◩ 1	COMPOST PAD SAMPLE POINT WITH ID (APPROXIMATE LOCATION)

NOTES

1. TOPOGRAPHY PROVIDED BY AERIAL DATA, INC. DATE OF TOPOGRAPHY: APRIL 30, 2012.

PROJECT

RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE

COMPOST PAD SAMPLING PLAN

Golder Associates

PROJECT No.		13011601	FILE No. COMPOST SAMPLING_Final
DESIGN	JDR	2013/09/30	SCALE AS SHOWN
CADD	JDR	2013/09/30	FIGURE
CHECK	KGH	2013/09/30	4
REVIEW	KGH	2013/09/30	

APPENDIX A
HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE (HELP) MODEL RESULTS

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**             HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**              DEVELOPED BY ENVIRONMENTAL LABORATORY                       **
**                 USAE WATERWAYS EXPERIMENT STATION                        **
**          FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                          **
**                                                                          **
******************************************************************************
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PRECIPITATION DATA FILE:      C:\RYS\data4.D4
TEMPERATURE DATA FILE:        C:\rys\data7.D7
SOLAR RADIATION DATA FILE:    C:\rys\data13.D13
EVAPOTRANSPIRATION DATA:      C:\rys\data11.D11
SOIL AND DESIGN DATA FILE:    C:\rys\data15.D10
OUTPUT DATA FILE:             C:\rys\wen15.OUT


TIME:  16:40      DATE:  10/21/2013


******************************************************************************

    TITLE:  Recology Yuba Sutter Asphalt Compost Pad 1x10-7

******************************************************************************


    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
             WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   0
         THICKNESS                  =    108.00    INCHES
         POROSITY                   =      0.6710 VOL/VOL
         FIELD CAPACITY             =      0.2920 VOL/VOL
         WILTING POINT              =      0.0770 VOL/VOL
         INITIAL SOIL WATER CONTENT =      0.0800 VOL/VOL
         EFFECTIVE SAT. HYD. COND.  =    1.00000000000      CM/SEC


                               LAYER  2
                               --------

                  TYPE 2 - LATERAL DRAINAGE LAYER
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MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	5.00	INCHES
POROSITY	=	0.0300	VOL/VOL
FIELD CAPACITY	=	0.0210	VOL/VOL
WILTING POINT	=	0.0100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH AN EXCELLENT STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 25. FEET.

SCS RUNOFF CURVE NUMBER	=	58.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.104	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.848	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	9.390	INCHES
TOTAL INITIAL WATER	=	9.390	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Marysville CALIFORNIA

STATION LATITUDE	=	38.40 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	73
END OF GROWING SEASON (JULIAN DATE)	=	319
EVAPORATIVE ZONE DEPTH	=	24.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	55.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	73.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SAN FRANCISCO CALIFORNIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.65	3.23	2.64	1.53	0.32	0.11
0.03	0.05	0.19	1.06	2.35	3.55

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.30	50.30	53.20	58.20	64.90	71.20
75.60	74.70	71.70	63.90	53.00	45.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA
AND STATION LATITUDE = 38.40 DEGREES

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ANNUAL TOTALS FOR YEAR 2008

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.26	55393.805	100.00
RUNOFF	0.000	0.000	0.00

EVAPOTRANSPIRATION	7.018	25474.654	45.99
DRAINAGE COLLECTED FROM LAYER 2	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 3	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0000		
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	8.242	29919.150	54.01
SOIL WATER AT START OF YEAR	9.390	34085.641	
SOIL WATER AT END OF YEAR	17.632	64004.789	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.46	59749.824	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	9.166	33273.531	55.69
DRAINAGE COLLECTED FROM LAYER 2	0.1452	527.017	0.88
PERC./LEAKAGE THROUGH LAYER 3	0.007586	27.538	0.05
AVG. HEAD ON TOP OF LAYER 3	0.0008		
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	7.149	25949.244	43.43
SOIL WATER AT START OF YEAR	17.632	64004.789	
SOIL WATER AT END OF YEAR	24.781	89954.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.034	0.00

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.70	82401.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.600	45738.863	55.51
DRAINAGE COLLECTED FROM LAYER 2	6.3764	23146.244	28.09
PERC./LEAKAGE THROUGH LAYER 3	0.266020	965.653	1.17
AVG. HEAD ON TOP OF LAYER 3	0.0305		
PERC./LEAKAGE THROUGH LAYER 4	0.066955	243.046	0.29
CHANGE IN WATER STORAGE	3.656	13272.846	16.11
SOIL WATER AT START OF YEAR	24.781	89954.031	
SOIL WATER AT END OF YEAR	28.437	103226.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.032	0.00

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	18.68	67808.406	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.570	45627.676	67.29
DRAINAGE COLLECTED FROM LAYER 2	6.7543	24518.148	36.16
PERC./LEAKAGE THROUGH LAYER 3	0.211548	767.917	1.13
AVG. HEAD ON TOP OF LAYER 3	0.0332		
PERC./LEAKAGE THROUGH LAYER 4	0.319326	1159.155	1.71
CHANGE IN WATER STORAGE	-0.963	-3496.574	-5.16
SOIL WATER AT START OF YEAR	28.437	103226.875	

SOIL WATER AT END OF YEAR	27.474	99730.305	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.002	0.00

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.52	81747.617	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	11.043	40087.254	49.04
DRAINAGE COLLECTED FROM LAYER 2	11.0424	40084.027	49.03
PERC./LEAKAGE THROUGH LAYER 3	0.180682	655.874	0.80
AVG. HEAD ON TOP OF LAYER 3	0.0534		
PERC./LEAKAGE THROUGH LAYER 4	0.110395	400.735	0.49
CHANGE IN WATER STORAGE	0.324	1175.571	1.44
SOIL WATER AT START OF YEAR	27.474	99730.305	
SOIL WATER AT END OF YEAR	27.798	100905.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.028	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2008 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.87	2.80	2.71	1.39	1.10	0.37
	0.00	0.00	0.06	1.35	2.74	2.74

STD. DEVIATIONS	2.59	1.63	2.43	1.57	1.03	0.54
	0.00	0.00	0.11	0.85	1.84	1.91

RUNOFF

TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION

TOTALS	1.109	1.400	1.773	1.567	1.087	0.378
	0.010	0.000	0.057	0.707	1.359	1.030
STD. DEVIATIONS	0.425	0.527	0.723	1.590	1.021	0.520
	0.023	0.000	0.114	0.569	0.484	0.488

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.8945	0.6245	0.8914	0.1606	0.0081	0.0012
	0.0004	0.0000	0.0009	0.0371	0.9920	1.2531
STD. DEVIATIONS	1.2595	0.9491	1.7403	0.2733	0.0115	0.0028
	0.0008	0.0000	0.0020	0.0794	1.8421	1.7935

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0188	0.0193	0.0246	0.0138	0.0039	0.0009
	0.0003	0.0000	0.0005	0.0030	0.0206	0.0274
STD. DEVIATIONS	0.0187	0.0190	0.0370	0.0140	0.0056	0.0021
	0.0007	0.0000	0.0011	0.0041	0.0281	0.0406

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0097	0.0067	0.0088	0.0190	0.0135	0.0097
	0.0076	0.0062	0.0049	0.0041	0.0039	0.0053
STD. DEVIATIONS	0.0180	0.0094	0.0128	0.0334	0.0185	0.0111
	0.0083	0.0066	0.0049	0.0041	0.0042	0.0069

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0509	0.0391	0.0508	0.0095	0.0005	0.0001
	0.0000	0.0000	0.0001	0.0021	0.0584	0.0714
STD. DEVIATIONS	0.0717	0.0599	0.0991	0.0161	0.0007	0.0002
	0.0000	0.0000	0.0001	0.0045	0.1084	0.1021

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2008 THROUGH 2012

	INCHES		CU. FEET	PERCENT
PRECIPITATION	19.12	(3.411)	69420.1	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	10.479	(2.3923)	38040.39	54.797
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.86366	(4.74234)	17655.088	25.43223
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.13317	(0.12202)	483.396	0.69633
AVERAGE HEAD ON TOP OF LAYER 3	0.024	(0.023)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.09934	(0.13163)	360.587	0.51943
CHANGE IN WATER STORAGE	3.682	(4.0518)	13364.05	19.251

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PEAK DAILY VALUES FOR YEARS 2008 THROUGH 2012

	(INCHES)	(CU. FT.)
PRECIPITATION	1.94	7042.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	1.76157	6394.48633
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.005517	20.02781
AVERAGE HEAD ON TOP OF LAYER 3	3.110	
MAXIMUM HEAD ON TOP OF LAYER 3	5.476	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	35.7 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.005041	18.30063
SNOW WATER	2.31	8380.2168
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2361	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0777	

*** Maximum heads are computed using McEnroe's equations. ***

WEN15.OUT

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(INCHES)	(VOL/VOL)
1	26.7346	0.2475
2	0.3840	0.0320
3	0.1500	0.0300
4	0.5292	0.0441
SNOW WATER	0.000	

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**            FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\RYS\data4.D4
TEMPERATURE DATA FILE:        C:\rys\data7.D7
SOLAR RADIATION DATA FILE:    C:\rys\data13.D13
EVAPOTRANSPIRATION DATA:      C:\rys\data11.D11
SOIL AND DESIGN DATA FILE:    C:\rys\data17.D10
OUTPUT DATA FILE:             C:\rys\wen17.OUT


TIME:  16:39     DATE:  10/21/2013


******************************************************************************

    TITLE:  Recology Yuba Sutter Concrete Compost Pad 1x10-7

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    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
             WERE SPECIFIED BY THE USER.


                                 LAYER  1
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =     108.00   INCHES
          POROSITY                   =       0.6710 VOL/VOL
          FIELD CAPACITY             =       0.2920 VOL/VOL
          WILTING POINT              =       0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT =       0.0800 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =    1.00000000000      CM/SEC


                                 LAYER  2
                                 --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
```

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	8.00	INCHES
POROSITY	=	0.0300	VOL/VOL
FIELD CAPACITY	=	0.0210	VOL/VOL
WILTING POINT	=	0.0100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH AN EXCELLENT STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 25. FEET.

SCS RUNOFF CURVE NUMBER	=	58.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.104	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.848	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	12.720	INCHES
TOTAL INITIAL WATER	=	12.720	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Marysville CALIFORNIA

STATION LATITUDE	= 38.40 DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00
START OF GROWING SEASON (JULIAN DATE)	= 73
END OF GROWING SEASON (JULIAN DATE)	= 319
EVAPORATIVE ZONE DEPTH	= 24.0 INCHES
AVERAGE ANNUAL WIND SPEED	= 8.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 77.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 60.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	= 55.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	= 73.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SAN FRANCISCO CALIFORNIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.65	3.23	2.64	1.53	0.32	0.11
0.03	0.05	0.19	1.06	2.35	3.55

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.30	50.30	53.20	58.20	64.90	71.20
75.60	74.70	71.70	63.90	53.00	45.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA
AND STATION LATITUDE = 38.40 DEGREES

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ANNUAL TOTALS FOR YEAR 2008

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.26	55393.805	100.00
RUNOFF	0.000	0.000	0.00

EVAPOTRANSPIRATION	7.018	25474.654	45.99
DRAINAGE COLLECTED FROM LAYER 2	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 3	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0000		
PERC./LEAKAGE THROUGH LAYER 4	3.216000	11674.080	21.07
CHANGE IN WATER STORAGE	5.026	18245.068	32.94
SOIL WATER AT START OF YEAR	12.720	46173.543	
SOIL WATER AT END OF YEAR	17.746	64418.609	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.46	59749.824	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	9.166	33273.531	55.69
DRAINAGE COLLECTED FROM LAYER 2	0.1452	527.242	0.88
PERC./LEAKAGE THROUGH LAYER 3	0.007524	27.313	0.05
AVG. HEAD ON TOP OF LAYER 3	0.0008		
PERC./LEAKAGE THROUGH LAYER 4	0.007524	27.313	0.05
CHANGE IN WATER STORAGE	7.141	25921.709	43.38
SOIL WATER AT START OF YEAR	17.746	64418.609	
SOIL WATER AT END OF YEAR	24.887	90340.320	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.031	0.00

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.70	82401.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.600	45738.863	55.51
DRAINAGE COLLECTED FROM LAYER 2	6.3785	23153.986	28.10
PERC./LEAKAGE THROUGH LAYER 3	0.263866	957.832	1.16
AVG. HEAD ON TOP OF LAYER 3	0.0305		
PERC./LEAKAGE THROUGH LAYER 4	0.078968	286.653	0.35
CHANGE IN WATER STORAGE	3.642	13221.485	16.05
SOIL WATER AT START OF YEAR	24.887	90340.320	
SOIL WATER AT END OF YEAR	28.529	103561.805	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	18.68	67808.406	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.570	45627.676	67.29
DRAINAGE COLLECTED FROM LAYER 2	6.7590	24535.273	36.18
PERC./LEAKAGE THROUGH LAYER 3	0.206853	750.877	1.11
AVG. HEAD ON TOP OF LAYER 3	0.0333		
PERC./LEAKAGE THROUGH LAYER 4	0.316939	1150.488	1.70
CHANGE IN WATER STORAGE	-0.966	-3505.021	-5.17
SOIL WATER AT START OF YEAR	28.529	103561.805	

SOIL WATER AT END OF YEAR	27.564	100056.781	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.52	81747.617	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	11.043	40087.254	49.04
DRAINAGE COLLECTED FROM LAYER 2	11.0474	40101.953	49.06
PERC./LEAKAGE THROUGH LAYER 3	0.175742	637.943	0.78
AVG. HEAD ON TOP OF LAYER 3	0.0534		
PERC./LEAKAGE THROUGH LAYER 4	0.107856	391.518	0.48
CHANGE IN WATER STORAGE	0.321	1166.854	1.43
SOIL WATER AT START OF YEAR	27.564	100056.781	
SOIL WATER AT END OF YEAR	27.885	101223.641	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.037	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2008 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.87	2.80	2.71	1.39	1.10	0.37
	0.00	0.00	0.06	1.35	2.74	2.74

STD. DEVIATIONS	2.59 0.00	1.63 0.00	2.43 0.11	1.57 0.85	1.03 1.84	0.54 1.91

RUNOFF

TOTALS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

EVAPOTRANSPIRATION

TOTALS	1.109 0.010	1.400 0.000	1.773 0.057	1.567 0.707	1.087 1.359	0.378 1.030
STD. DEVIATIONS	0.425 0.023	0.527 0.000	0.723 0.114	1.590 0.569	1.021 0.484	0.520 0.488

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.8950 0.0004	0.6248 0.0000	0.8919 0.0009	0.1607 0.0371	0.0081 0.9923	0.0012 1.2536
STD. DEVIATIONS	1.2600 0.0008	0.9495 0.0000	1.7415 0.0020	0.2735 0.0794	0.0115 1.8429	0.0028 1.7943

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.0182 0.0003	0.0190 0.0000	0.0240 0.0005	0.0137 0.0030	0.0039 0.0203	0.0009 0.0268
STD. DEVIATIONS	0.0183 0.0007	0.0187 0.0000	0.0359 0.0011	0.0139 0.0041	0.0056 0.0275	0.0021 0.0398

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.6530 0.0081	0.0069 0.0064	0.0093 0.0050	0.0193 0.0042	0.0141 0.0039	0.0103 0.0051
STD. DEVIATIONS	1.4329 0.0082	0.0093 0.0067	0.0121 0.0050	0.0322 0.0041	0.0179 0.0041	0.0108 0.0067

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0510 0.0000	0.0392 0.0000	0.0508 0.0001	0.0095 0.0021	0.0005 0.0584	0.0001 0.0714
STD. DEVIATIONS	0.0718 0.0000	0.0599 0.0000	0.0992 0.0001	0.0161 0.0045	0.0007 0.1085	0.0002 0.1022

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2008 THROUGH 2012

	INCHES		CU. FEET	PERCENT
PRECIPITATION	19.12	(3.411)	69420.1	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	10.479	(2.3923)	38040.39	54.797
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.86603	(4.74458)	17663.691	25.44462
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.13080	(0.12022)	474.793	0.68394
AVERAGE HEAD ON TOP OF LAYER 3	0.024	(0.023)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.74546	(1.38587)	2706.010	3.89802
CHANGE IN WATER STORAGE	3.033	(3.3377)	11010.02	15.860

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PEAK DAILY VALUES FOR YEARS 2008 THROUGH 2012

	(INCHES)	(CU. FT.)
PRECIPITATION	1.94	7042.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	1.76223	6396.90820
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.004724	17.14952
AVERAGE HEAD ON TOP OF LAYER 3	3.111	
MAXIMUM HEAD ON TOP OF LAYER 3	5.478	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	35.7 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	3.216000	11674.08010
SNOW WATER	2.31	8380.2168
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2361	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0777	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(INCHES)	(VOL/VOL)
1	26.7346	0.2475
2	0.3840	0.0320
3	0.2400	0.0300
4	0.5267	0.0439
SNOW WATER	0.000	

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**             HELP MODEL VERSION 3.07   (1 NOVEMBER 1997)                  **
**              DEVELOPED BY ENVIRONMENTAL LABORATORY                       **
**                 USAE WATERWAYS EXPERIMENT STATION                        **
**           FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\RYS\data4.D4
TEMPERATURE DATA FILE:        C:\rys\data7.D7
SOLAR RADIATION DATA FILE:    C:\rys\data13.D13
EVAPOTRANSPIRATION DATA:      C:\rys\data11.D11
SOIL AND DESIGN DATA FILE:    C:\rys\data16.D10
OUTPUT DATA FILE:             C:\rys\wen16.OUT


TIME:  16:40      DATE:  10/21/2013


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    TITLE:  Recology Yuba Sutter Concrete Compost Pad 1x10-6

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    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
             WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER   0
        THICKNESS                  =   108.00    INCHES
        POROSITY                   =     0.6710 VOL/VOL
        FIELD CAPACITY             =     0.2920 VOL/VOL
        WILTING POINT              =     0.0770 VOL/VOL
        INITIAL SOIL WATER CONTENT =     0.0800 VOL/VOL
        EFFECTIVE SAT. HYD. COND.  =  1.00000000000     CM/SEC


                               LAYER  2
                               --------

                   TYPE 2 - LATERAL DRAINAGE LAYER
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MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	8.00	INCHES
POROSITY	=	0.0300	VOL/VOL
FIELD CAPACITY	=	0.0210	VOL/VOL
WILTING POINT	=	0.0100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999997000E-06	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH AN EXCELLENT STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 25. FEET.

SCS RUNOFF CURVE NUMBER	=	58.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.104	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.848	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	12.720	INCHES
TOTAL INITIAL WATER	=	12.720	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Marysville CALIFORNIA

STATION LATITUDE	=	38.40 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	73
END OF GROWING SEASON (JULIAN DATE)	=	319
EVAPORATIVE ZONE DEPTH	=	24.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	55.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	73.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SAN FRANCISCO CALIFORNIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.65	3.23	2.64	1.53	0.32	0.11
0.03	0.05	0.19	1.06	2.35	3.55

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.30	50.30	53.20	58.20	64.90	71.20
75.60	74.70	71.70	63.90	53.00	45.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA
AND STATION LATITUDE = 38.40 DEGREES

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ANNUAL TOTALS FOR YEAR 2008

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.26	55393.805	100.00
RUNOFF	0.000	0.000	0.00

EVAPOTRANSPIRATION	7.018	25474.654	45.99
DRAINAGE COLLECTED FROM LAYER 2	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 3	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0000		
PERC./LEAKAGE THROUGH LAYER 4	3.216000	11674.080	21.07
CHANGE IN WATER STORAGE	5.026	18245.068	32.94
SOIL WATER AT START OF YEAR	12.720	46173.543	
SOIL WATER AT END OF YEAR	17.746	64418.609	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.46	59749.824	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	9.166	33273.531	55.69
DRAINAGE COLLECTED FROM LAYER 2	0.1158	420.458	0.70
PERC./LEAKAGE THROUGH LAYER 3	0.036942	134.098	0.22
AVG. HEAD ON TOP OF LAYER 3	0.0006		
PERC./LEAKAGE THROUGH LAYER 4	0.026188	95.063	0.16
CHANGE IN WATER STORAGE	7.152	25960.736	43.45
SOIL WATER AT START OF YEAR	17.746	64418.609	
SOIL WATER AT END OF YEAR	24.898	90379.352	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.037	0.00

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.70	82401.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.600	45738.863	55.51
DRAINAGE COLLECTED FROM LAYER 2	5.0440	18309.771	22.22
PERC./LEAKAGE THROUGH LAYER 3	1.618251	5874.250	7.13
AVG. HEAD ON TOP OF LAYER 3	0.0242		
PERC./LEAKAGE THROUGH LAYER 4	1.141293	4142.895	5.03
CHANGE IN WATER STORAGE	3.914	14209.466	17.24
SOIL WATER AT START OF YEAR	24.898	90379.352	
SOIL WATER AT END OF YEAR	28.812	104588.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.035	0.00

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	18.68	67808.406	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.570	45627.676	67.29
DRAINAGE COLLECTED FROM LAYER 2	5.7655	20928.867	30.86
PERC./LEAKAGE THROUGH LAYER 3	1.180459	4285.067	6.32
AVG. HEAD ON TOP OF LAYER 3	0.0285		
PERC./LEAKAGE THROUGH LAYER 4	1.582986	5746.240	8.47
CHANGE IN WATER STORAGE	-1.238	-4494.386	-6.63
SOIL WATER AT START OF YEAR	28.812	104588.812	

SOIL WATER AT END OF YEAR	27.574	100094.430	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.011	0.00

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.52	81747.617	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	11.043	40087.254	49.04
DRAINAGE COLLECTED FROM LAYER 2	10.0022	36307.957	44.41
PERC./LEAKAGE THROUGH LAYER 3	1.220921	4431.943	5.42
AVG. HEAD ON TOP OF LAYER 3	0.0484		
PERC./LEAKAGE THROUGH LAYER 4	1.053191	3823.085	4.68
CHANGE IN WATER STORAGE	0.421	1529.295	1.87
SOIL WATER AT START OF YEAR	27.574	100094.430	
SOIL WATER AT END OF YEAR	27.996	101623.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2008 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.87	2.80	2.71	1.39	1.10	0.37
	0.00	0.00	0.06	1.35	2.74	2.74

STD. DEVIATIONS	2.59	1.63	2.43	1.57	1.03	0.54
	0.00	0.00	0.11	0.85	1.84	1.91

RUNOFF

TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION

TOTALS	1.109	1.400	1.773	1.567	1.087	0.378
	0.010	0.000	0.057	0.707	1.359	1.030
STD. DEVIATIONS	0.425	0.527	0.723	1.590	1.021	0.520
	0.023	0.000	0.114	0.569	0.484	0.488

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.7831	0.5430	0.7514	0.1186	0.0027	0.0003
	0.0001	0.0000	0.0002	0.0314	0.8799	1.0749
STD. DEVIATIONS	1.2173	0.8692	1.5114	0.2216	0.0041	0.0007
	0.0002	0.0000	0.0004	0.0696	1.6725	1.5287

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.1315	0.0997	0.1642	0.0520	0.0093	0.0019
	0.0006	0.0000	0.0016	0.0119	0.1326	0.2060
STD. DEVIATIONS	0.1437	0.1115	0.2570	0.0593	0.0130	0.0042
	0.0013	0.0000	0.0037	0.0214	0.1966	0.3088

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.7291	0.0759	0.1717	0.0883	0.0403	0.0223
	0.0148	0.0106	0.0078	0.0066	0.0642	0.1722
STD. DEVIATIONS	1.4012	0.0891	0.2773	0.0926	0.0365	0.0195
	0.0125	0.0088	0.0062	0.0053	0.1300	0.2353

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0447	0.0341	0.0429	0.0071	0.0002	0.0000
	0.0000	0.0000	0.0000	0.0018	0.0519	0.0613
STD. DEVIATIONS	0.0693	0.0549	0.0862	0.0131	0.0004	0.0001
	0.0000	0.0000	0.0000	0.0040	0.0985	0.0872

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2008 THROUGH 2012

	INCHES		CU. FEET	PERCENT
PRECIPITATION	19.12	(3.411)	69420.1	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	10.479	(2.3923)	38040.39	54.797
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.18551	(4.21747)	15193.410	21.88617
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.81131	(0.74382)	2945.072	4.24239
AVERAGE HEAD ON TOP OF LAYER 3	0.020	(0.020)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.40393	(1.16252)	5096.272	7.34120
CHANGE IN WATER STORAGE	3.055	(3.4196)	11090.04	15.975

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PEAK DAILY VALUES FOR YEARS 2008 THROUGH 2012

	(INCHES)	(CU. FT.)
PRECIPITATION	1.94	7042.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	1.72418	6258.77832
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.046958	170.45827
AVERAGE HEAD ON TOP OF LAYER 3	3.044	
MAXIMUM HEAD ON TOP OF LAYER 3	5.369	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	35.2 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	3.216000	11674.08010
SNOW WATER	2.31	8380.2168
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2361	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0777	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(INCHES)	(VOL/VOL)
1	26.7346	0.2475
2	0.3840	0.0320
3	0.2400	0.0300
4	0.6369	0.0531
SNOW WATER	0.000	

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
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PRECIPITATION DATA FILE:      C:\RYS\data4.D4
TEMPERATURE DATA FILE:        C:\rys\data7.D7
SOLAR RADIATION DATA FILE:    C:\rys\data13.D13
EVAPOTRANSPIRATION DATA:      C:\rys\data11.D11
SOIL AND DESIGN DATA FILE:    C:\rys\data14.D10
OUTPUT DATA FILE:             C:\rys\wen14.OUT


TIME:  16:40      DATE:  10/21/2013


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    TITLE:  Recology Yuba Sutter Concrete Compost Pad

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    NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
             WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =    108.00    INCHES
          POROSITY                   =      0.6710 VOL/VOL
          FIELD CAPACITY             =      0.2920 VOL/VOL
          WILTING POINT              =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.0800 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =   1.00000000000     CM/SEC


                                  LAYER  2
                                  --------

                       TYPE 2 - LATERAL DRAINAGE LAYER
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MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	8.00	INCHES
POROSITY	=	0.0300	VOL/VOL
FIELD CAPACITY	=	0.0210	VOL/VOL
WILTING POINT	=	0.0100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH AN EXCELLENT STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 25. FEET.

SCS RUNOFF CURVE NUMBER	=	58.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.104	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.848	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	12.720	INCHES
TOTAL INITIAL WATER	=	12.720	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Marysville CALIFORNIA

STATION LATITUDE	=	38.40 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	73
END OF GROWING SEASON (JULIAN DATE)	=	319
EVAPORATIVE ZONE DEPTH	=	24.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	55.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	73.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SAN FRANCISCO CALIFORNIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.65	3.23	2.64	1.53	0.32	0.11
0.03	0.05	0.19	1.06	2.35	3.55

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.30	50.30	53.20	58.20	64.90	71.20
75.60	74.70	71.70	63.90	53.00	45.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA
AND STATION LATITUDE = 38.40 DEGREES

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ANNUAL TOTALS FOR YEAR 2008

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.26	55393.805	100.00
RUNOFF	0.000	0.000	0.00

EVAPOTRANSPIRATION	7.018	25474.654	45.99
DRAINAGE COLLECTED FROM LAYER 2	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 3	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0000		
PERC./LEAKAGE THROUGH LAYER 4	3.216000	11674.080	21.07
CHANGE IN WATER STORAGE	5.026	18245.068	32.94
SOIL WATER AT START OF YEAR	12.720	46173.543	
SOIL WATER AT END OF YEAR	17.746	64418.609	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.46	59749.824	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	9.166	33273.531	55.69
DRAINAGE COLLECTED FROM LAYER 2	0.0593	215.403	0.36
PERC./LEAKAGE THROUGH LAYER 3	0.093430	339.152	0.57
AVG. HEAD ON TOP OF LAYER 3	0.0003		
PERC./LEAKAGE THROUGH LAYER 4	0.060161	218.386	0.37
CHANGE IN WATER STORAGE	7.174	26042.471	43.59
SOIL WATER AT START OF YEAR	17.746	64418.609	
SOIL WATER AT END OF YEAR	24.920	90461.078	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.035	0.00

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.70	82401.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.600	45738.863	55.51
DRAINAGE COLLECTED FROM LAYER 2	1.8144	6586.197	7.99
PERC./LEAKAGE THROUGH LAYER 3	4.851943	17612.555	21.37
AVG. HEAD ON TOP OF LAYER 3	0.0102		
PERC./LEAKAGE THROUGH LAYER 4	4.323895	15695.737	19.05
CHANGE IN WATER STORAGE	3.961	14380.204	17.45
SOIL WATER AT START OF YEAR	24.920	90461.078	
SOIL WATER AT END OF YEAR	28.882	104841.289	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	18.68	67808.406	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.570	45627.676	67.29
DRAINAGE COLLECTED FROM LAYER 2	2.5255	9167.481	13.52
PERC./LEAKAGE THROUGH LAYER 3	4.416452	16031.721	23.64
AVG. HEAD ON TOP OF LAYER 3	0.0138		
PERC./LEAKAGE THROUGH LAYER 4	4.890235	17751.555	26.18
CHANGE IN WATER STORAGE	-1.305	-4738.307	-6.99
SOIL WATER AT START OF YEAR	28.882	104841.289	

SOIL WATER AT END OF YEAR	27.577	100102.977	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.52	81747.617	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	11.043	40087.254	49.04
DRAINAGE COLLECTED FROM LAYER 2	6.0405	21927.137	26.82
PERC./LEAKAGE THROUGH LAYER 3	5.182580	18812.764	23.01
AVG. HEAD ON TOP OF LAYER 3	0.0302		
PERC./LEAKAGE THROUGH LAYER 4	5.005707	18170.715	22.23
CHANGE IN WATER STORAGE	0.430	1562.487	1.91
SOIL WATER AT START OF YEAR	27.577	100102.977	
SOIL WATER AT END OF YEAR	28.007	101665.469	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2008 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.87	2.80	2.71	1.39	1.10	0.37
	0.00	0.00	0.06	1.35	2.74	2.74

STD. DEVIATIONS	2.59	1.63	2.43	1.57	1.03	0.54
	0.00	0.00	0.11	0.85	1.84	1.91

RUNOFF

TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION

TOTALS	1.109	1.400	1.773	1.567	1.087	0.378
	0.010	0.000	0.057	0.707	1.359	1.030
STD. DEVIATIONS	0.425	0.527	0.723	1.590	1.021	0.520
	0.023	0.000	0.114	0.569	0.484	0.488

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.4602	0.2863	0.2992	0.0461	0.0004	0.0000
	0.0000	0.0000	0.0000	0.0112	0.5280	0.4564
STD. DEVIATIONS	0.9196	0.4424	0.6381	0.0944	0.0006	0.0001
	0.0000	0.0000	0.0000	0.0250	1.0534	0.6413

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.4529	0.3578	0.6156	0.1244	0.0116	0.0021
	0.0007	0.0000	0.0018	0.0355	0.4797	0.8266
STD. DEVIATIONS	0.4888	0.5361	1.1273	0.1835	0.0165	0.0048
	0.0015	0.0000	0.0040	0.0733	0.8059	1.1999

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	1.0074	0.3626	0.6332	0.1631	0.0504	0.0261
	0.0166	0.0118	0.0086	0.0073	0.4019	0.8102
STD. DEVIATIONS	1.2628	0.4262	1.1723	0.1759	0.0441	0.0214
	0.0130	0.0088	0.0061	0.0052	0.8008	1.1589

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0276	0.0191	0.0189	0.0037	0.0002	0.0000
	0.0000	0.0000	0.0000	0.0008	0.0325	0.0280
STD. DEVIATIONS	0.0520	0.0291	0.0389	0.0062	0.0004	0.0001
	0.0000	0.0000	0.0000	0.0017	0.0636	0.0395

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2008 THROUGH 2012

	INCHES		CU. FEET	PERCENT
PRECIPITATION	19.12	(3.411)	69420.1	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	10.479	(2.3923)	38040.39	54.797
LATERAL DRAINAGE COLLECTED FROM LAYER 2	2.08795	(2.46799)	7579.244	10.91793
PERCOLATION/LEAKAGE THROUGH LAYER 3	2.90888	(2.62709)	10559.238	15.21063
AVERAGE HEAD ON TOP OF LAYER 3	0.011	(0.012)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	3.49920	(2.04889)	12702.095	18.29742
CHANGE IN WATER STORAGE	3.057	(3.4488)	11098.38	15.987

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PEAK DAILY VALUES FOR YEARS 2008 THROUGH 2012

	(INCHES)	(CU. FT.)
PRECIPITATION	1.94	7042.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	1.36216	4944.63232
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.442406	1605.93298
AVERAGE HEAD ON TOP OF LAYER 3	2.405	
MAXIMUM HEAD ON TOP OF LAYER 3	4.319	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	30.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	3.216000	11674.08010
SNOW WATER	2.31	8380.2168
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2361	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0777	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(INCHES)	(VOL/VOL)
1	26.7346	0.2475
2	0.3840	0.0320
3	0.2400	0.0300
4	0.6484	0.0540
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\RYS\data4.D4
TEMPERATURE DATA FILE:        C:\rys\data7.D7
SOLAR RADIATION DATA FILE:    C:\rys\data13.D13
EVAPOTRANSPIRATION DATA:      C:\rys\data11.D11
SOIL AND DESIGN DATA FILE:    C:\rys\data12.D10
OUTPUT DATA FILE:             C:\rys\wen12.OUT


TIME:  16:40      DATE:  10/21/2013


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     TITLE:  Recology Yuba Sutter Aggregate Base Compost Pad

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =    108.00    INCHES
           POROSITY                     =      0.6710 VOL/VOL
           FIELD CAPACITY               =      0.2920 VOL/VOL
           WILTING POINT                =      0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.0800 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =   1.00000000000      CM/SEC


                                  LAYER  2
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                         TYPE 2 - LATERAL DRAINAGE LAYER
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MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4510	VOL/VOL
FIELD CAPACITY	=	0.4190	VOL/VOL
WILTING POINT	=	0.3320	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4510	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999997000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH AN EXCELLENT STAND OF GRASS, A SURFACE SLOPE OF 30.% AND A SLOPE LENGTH OF 25. FEET.

SCS RUNOFF CURVE NUMBER	=	58.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.920	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.104	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.848	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	11.586	INCHES
TOTAL INITIAL WATER	=	11.586	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM Marysville CALIFORNIA

STATION LATITUDE	=	38.40	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	73	
END OF GROWING SEASON (JULIAN DATE)	=	319	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES

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AVERAGE ANNUAL WIND SPEED                    =   8.10 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY        =  77.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY        =  60.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY        =  55.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY        =  73.00 %
```

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SAN FRANCISCO CALIFORNIA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.65	3.23	2.64	1.53	0.32	0.11
0.03	0.05	0.19	1.06	2.35	3.55

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
45.30	50.30	53.20	58.20	64.90	71.20
75.60	74.70	71.70	63.90	53.00	45.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SACRAMENTO CALIFORNIA
AND STATION LATITUDE = 38.40 DEGREES

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ANNUAL TOTALS FOR YEAR 2008

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.26	55393.805	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	7.018	25474.654	45.99
DRAINAGE COLLECTED FROM LAYER 2	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 3	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 3	0.0000		
CHANGE IN WATER STORAGE	8.242	29919.145	54.01
SOIL WATER AT START OF YEAR	11.586	42057.121	
SOIL WATER AT END OF YEAR	19.828	71976.266	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.46	59749.824	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	9.166	33273.531	55.69
DRAINAGE COLLECTED FROM LAYER 2	0.1156	419.732	0.70
PERC./LEAKAGE THROUGH LAYER 3	0.037141	134.823	0.23
AVG. HEAD ON TOP OF LAYER 3	0.0006		
CHANGE IN WATER STORAGE	7.141	25921.709	43.38
SOIL WATER AT START OF YEAR	19.828	71976.266	
SOIL WATER AT END OF YEAR	26.969	97897.977	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.031	0.00

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.70	82401.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.600	45738.863	55.51
DRAINAGE COLLECTED FROM LAYER 2	5.0366	18282.875	22.19
PERC./LEAKAGE THROUGH LAYER 3	1.625724	5901.377	7.16
AVG. HEAD ON TOP OF LAYER 3	0.0241		

CHANGE IN WATER STORAGE	3.437	12477.876	15.14
SOIL WATER AT START OF YEAR	26.969	97897.977	
SOIL WATER AT END OF YEAR	30.407	110375.852	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.038	0.00

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	18.68	67808.406	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.570	45627.676	67.29
DRAINAGE COLLECTED FROM LAYER 2	5.7519	20879.445	30.79
PERC./LEAKAGE THROUGH LAYER 3	1.194010	4334.255	6.39
AVG. HEAD ON TOP OF LAYER 3	0.0285		
CHANGE IN WATER STORAGE	-0.836	-3032.978	-4.47
SOIL WATER AT START OF YEAR	30.407	110375.852	
SOIL WATER AT END OF YEAR	29.571	107342.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.009	0.00

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	22.52	81747.617	100.00
RUNOFF	0.000	0.000	0.00

EVAPOTRANSPIRATION	11.043	40087.254	49.04
DRAINAGE COLLECTED FROM LAYER 2	9.9706	36193.430	44.27
PERC./LEAKAGE THROUGH LAYER 3	1.252470	4546.464	5.56
AVG. HEAD ON TOP OF LAYER 3	0.0482		
CHANGE IN WATER STORAGE	0.254	920.433	1.13
SOIL WATER AT START OF YEAR	29.571	107342.875	
SOIL WATER AT END OF YEAR	29.825	108263.305	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2008 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.87	2.80	2.71	1.39	1.10	0.37
	0.00	0.00	0.06	1.35	2.74	2.74
STD. DEVIATIONS	2.59	1.63	2.43	1.57	1.03	0.54
	0.00	0.00	0.11	0.85	1.84	1.91
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.109	1.400	1.773	1.567	1.087	0.378
	0.010	0.000	0.057	0.707	1.359	1.030
STD. DEVIATIONS	0.425	0.527	0.723	1.590	1.021	0.520
	0.023	0.000	0.114	0.569	0.484	0.488
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.7812	0.5417	0.7496	0.1168	0.0027	0.0003
	0.0001	0.0000	0.0002	0.0313	0.8770	1.0739

STD. DEVIATIONS	1.2144	0.8672	1.5077	0.2198	0.0041	0.0007
	0.0002	0.0000	0.0004	0.0695	1.6668	1.5280

PERCOLATION/LEAKAGE THROUGH LAYER 3

TOTALS	0.1333	0.1009	0.1660	0.0539	0.0093	0.0019
	0.0006	0.0000	0.0016	0.0120	0.1354	0.2069
STD. DEVIATIONS	0.1446	0.1134	0.2605	0.0614	0.0130	0.0042
	0.0013	0.0000	0.0037	0.0215	0.2018	0.3091

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0446	0.0341	0.0428	0.0070	0.0002	0.0000
	0.0000	0.0000	0.0000	0.0018	0.0517	0.0613
STD. DEVIATIONS	0.0692	0.0548	0.0860	0.0130	0.0004	0.0001
	0.0000	0.0000	0.0000	0.0040	0.0981	0.0872

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2008 THROUGH 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	19.12 (3.411)	69420.1	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	10.479 (2.3923)	38040.39	54.797
LATERAL DRAINAGE COLLECTED FROM LAYER 2	4.17496 (4.20499)	15155.099	21.83098
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.82187 (0.75189)	2983.384	4.29758
AVERAGE HEAD ON TOP OF LAYER 3	0.020 (0.020)		
CHANGE IN WATER STORAGE	3.648 (4.0304)	13241.24	19.074

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PEAK DAILY VALUES FOR YEARS 2008 THROUGH 2012

	(INCHES)	(CU. FT.)

PRECIPITATION	1.94	7042.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	1.72056	6245.61963
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.051236	185.98758
AVERAGE HEAD ON TOP OF LAYER 3	3.038	
MAXIMUM HEAD ON TOP OF LAYER 3	5.359	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	35.1 FEET	
SNOW WATER	2.31	8380.2168

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2361
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0777

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(INCHES)	(VOL/VOL)
1	26.7346	0.2475
2	0.3840	0.0320
3	2.7060	0.4510
SNOW WATER	0.000	

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APPENDIX B
COMPOST PAD ALTERNATIVES COST DETAIL

TABLE 1
RECOLOGY YUBA-SUTTER
COMPOST PAD OPTION COST ESTIMATES

DESCRIPTION	Asphaltic-Concrete Pavement[1]	Reinforced Concrete Pavement	Low-Permeability Aggregate Base
Capital Construction Costs[2]	$ 2,260,000	$ 4,170,000	$ 210,000
Annual Maintenance Costs[3]	$ 452,000	$ 834,000	$ 42,000

Notes:

1. Cost based on California Department of Transportation, "Price Index for Selected Highway Construction Items, 2nd Quarter Ending June 30, 2013" Prepared by Division of Engineering Services - Office Engineer

2. Costs associated with preparing the site for the compost pad including leveling fill and grading would be the same for all three alternatives and therefore not included in this cost comparison.

3. Annual maintenance costs were assumed to cost 20 percent of the capital costs

Golder Associates

SUBJECT - Recology/RYS FRO Compost Facilities Engineer's Cost Estimate- Conceptual Design		
Job. 1301525	Made by: JTK Checked: LMD Reviewed: KGH	Date: 10/28

OBJECTIVE: Calculate construction quantities for an Engineer's Cost Estimate.

METHODOLOGY: Use AutoCAD software and the Conceptual Grading Plan for the Feather River Organics (FRO) Compost Facility to estimate areas associated with the Compost Facility. Plan areas for the Compost Pad cover are calculated using the area measuring feature in AutoCAD and adjusted for slope factors as needed. Volumes of the aggregate base, asphalt, and concrete components are calculated based on the areas and design thickness.

GIVEN:

Area ID	Description of Area	Plan Area (sf)	Slope	Slope Factor	Corrected Area (sf)
A1	Compost Area	333,612	3%	1.000	333,612
A2	Southern Compost Facility	161,995	3%	1.000	161,995

Asphaltic-Concrete Pavement	**Total =**	**$ 2,256,791**	**=>**	**2,260,000**

Aggregate Base (A/B) for asphalt subbase

Compost Area		333,612	sf
Southern Compost Facility		161,995	sf
Aggregate Base thickness		1	ft
	Total A/B Volume =	495,607	cf
Assumed A/B Density		130	pcf
	Total A/B Required =	32,214	tons
A/B Cost per Ton		$ 24.91	(2013 Caltrans Price Index[1])
	Total Cost =	$ 802,462	

Asphalt Pad (5-inch thick)

Compost Area		333,612	sf
Southern Compost Facility		161,995	sf
Asphalt Thickness		5	in.
	Total Asphalt Volume =	206,503	cf
Assumed Asphalt Density		145	pcf
	Total Asphalt Required =	14,971	tons
Asphalt Cost per Ton		$ 97.14	(2013 Caltrans Price Index[1])
	Total Cost =	$ 1,454,328	

SUBJECT - Recology/RYS FRO Compost Facilities Engineer's Cost Estimate- Conceptual Design		
Job. 1301525	Made by: JTK Checked: LMD Reviewed: KGH	Date: 10/28

Reinforced Concrete Pavement — Total = $ 4,167,696 => 4,170,000

Aggregate Base (A/B) for concrete subbase

Compost Area		333,612	sf
Southern Compost Facility		161,995	sf
A/B Thickness		1	ft
	Total A/B Volume =	495,607	cf
Assumed A/B Density		130	pcf
	Total A/B Required =	32,214	tons
A/B Cost per Ton		$ 24.91	(2013 Caltrans Price Index[1])
	Total Cost =	$ 802,462	

Concrete Pad (8-inch thick)

Compost Area		333,612	sf
Southern Compost Facility		161,995	sf
Concrete Thickness		8	in.
	Total Concrete Volume =	12,237	cy
Concrete Cost per Cubic Yard		$ 275.00	(Recent cost estimate for Recology)
	Total Cost =	$ 3,365,234	

Low-Permeability Aggregate Base Pad — Total = $ 201,960 => 210,000

Soil Fines Admix

Compost Area		333,612	sf
Southern Compost Facility		161,995	sf
A/B Thickness		9	in
	Total A/B Volume =	13,767	cy
A/B Cost per cy		$ 14.67	(See cost detail back-up)
	Total Cost =	$ 201,960	

APPENDIX C
OPERATIONS AND MAINTENANCE MANUAL

COMPOST PAD OPERATIONS AND MAINTENANCE MANUAL

REVISION 0

October 28, 2013

Submitted To: Feather River Organics
3001 North Levee Road
Marysville, CA 95901

Submitted By: Golder Associates Inc.
1000 Enterprise Way, Suite 190
Roseville, CA 95678 USA

Golder Project No. 1301525

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1.0 INTRODUCTION

Feather River Organics (FRO) operates a composting facility at the Recology Yuba-Sutter (RYS) facility located in Marysville, California. The FRO compost pad is located on top of Landfill 1 (LF-1), which was previously closed in the 1980's in accordance with the regulations at the time.

The FRO compost operations must be conducted in manner that protects and maintains the LF-1 cover, prevents ponding of liquids on the compost operations surface, and contains, segregates, and manages water run-off from the compost pad surface from other surface water run-off at the site. FRO personnel are required to conduct regular inspections and perform and document periodic maintenance to protect and maintain LF-1.

The active compost operations are underlain by a low-permeability aggregate layer placed over the LF-1 final soil cover. The low-permeability aggregate layer must be maintained with a minimum of 6-inch thickness.

The LF-1 landfill is continuing to settle as the waste decomposes although the rate of settlement is expected to progressively decrease with time. Due to variability of the refuse thickness and waste types, the amount of settlement will vary throughout the landfill resulting in differential settlement. Therefore, it is expected that low areas or poorly drained areas may develop within the compost pad surface. When low areas are observed, FRO will need to promptly place and compact appropriate low-permeability aggregate material to re-establish positive drainage.

In addition to maintaining the compost pad thickness and grade, stormwater run-off from the compost operation must be segregated and managed separately from other site surface water run-off. This will require FRO personnel to regularly inspect and ensure the water drainage system is functioning properly.

This Operation and Maintenance Plan (O&M) Plan is organized as follows:

- Section 1 - Introduction
- Section 2 – Compost Operations
- Section 3 - Compost Pad Inspections
- Section 4 - Compost Pad Maintenance Activities
- Section 5 – Documentation and Reporting

2.0 COMPOST OPERATIONS

The composting operations must be conducted in a manner that protects the environment including the existing LF-1 landfill final soil cover. Key aspects of the operations are implemented to comply with the following requirements:

- The active compost operations are contained within the limits of the designated compost pad shown in Figure 1. Active compost operations include the green waste stockpiles and compost windrows. FRO will install marker posts along the perimeter and at the corners of the pad to assist the operators with visual observation of the pad limits.
- Wood feedstock and finished compost product must be stored in the Product Storage Area or on the designated compost pad as shown in Figure 1.
- The compost pad and finished Product Storage Area must have positive drainage (i.e. no ponding of water) to the drain inlet.
- Compost handling and equipment traffic will result in the progressive wearing of the compost pad that will reduce the pad thickness over time. The minimum thickness (6-inches) must be maintained at all times.
- Water run-off from the designated compost pad and Product Storage Area will consist of a combination of surface water and compost leachate. These waters must be segregated and managed separately from other site surface water run-off. This requires FRO personnel to regularly inspect and maintain the surface water collection system, particularly during the rainy season, which typically ranges from October 15th through April 15th, and during other periods of inclement weather.

Compost pad thickness marker plates will be installed in rows across the compost pad as shown in Figure 2. The compost pad layer will be initially constructed with a 9-inch thickness (0.75 feet) and the top steel marker plate set at an elevation that corresponds to a thickness of 7-inches (approximately 0.6 feet). When the top of the marker is visibly exposed, FRO personnel will place additional low-permeability aggregate material as described in Section 3.6.

When low areas or poorly draining areas are observed, FRO will place and compact appropriate low-permeability aggregate material as described in Section 3.6 to ensure positive drainage.

3.0 COMPOST PAD INSPECTIONS AND MAINTENANCE ACTIONS

The following inspection activities will be conducted for the FRO composting operations. Prior to conducting these inspections, FRO will prepare inspection and monitoring field forms to be used for these purposes. Table 1 summarizes the minimum inspection types and frequencies, which are discussed in more detail in the subsequent sections.

Table 1: Inspection Schedule Summary

Inspection Type	Proposed Frequency
Compost Operations Limits	Monthly
Compost Pad Thickness Field Verification	Quarterly
Compost Pad Grading	Monthly
Compost Pad Topographic Survey	Every 5 years
Compost Pad Drainage Controls	Weekly between Oct 15th and April 15th and during other periods of inclement weather

In addition to performing the above inspections, annual soil sampling will be completed to confirm that compost constituents are not migrating into the underlying soil cover. This soil sampling is described in the Compost Work Plan prepared by Golder dated October 2013.

3.1 Compost Operations Limits

At a minimum of a monthly basis, FRO personnel shall document whether the compost operations are contained within the physical limits of the respective areas. Where physical entities (i.e. landfill gas (LFG) header pipe) do not exist to help delineate the limits of the compost pad, FRO will establish perimeter marker posts along the limits to assist in the visual survey. FRO personnel will document that the active windrows, stockpiles of self-haul green waste, and finished product are contained within the compost pad. In the event that operations do not comply with this requirement, the area of non-compliance will be documented and the FRO manager contacted immediately. If portions of the FRO operations are not in compliance, they must be corrected and brought into compliance within 48 hours (i.e. fully moved to within the proper facility limits).

3.2 Compost Pad Thickness Inspection

Thickness markers will be installed in rows as shown in Figure 2. The location of the rows will be indicated using markers on each side of the pad. The markers will be initially buried by approximately 0.15 feet of low-permeability aggregate base surface. Each marker will be surveyed and given a unique identification number. Golder recommends labeling each row numerically and each marker within a given row alphabetically (i.e. 1A, 1B, 1C, 2A, 2B....etc.).

Accordingly, the compost pad thickness will be surveyed using the following procedures:

- On a quarterly basis, the rows of markers shall be identified by the end post markers and then determined whether they are covered by compost windrows or stockpiles. It is anticipated that some thickness markers will be covered by windrows or stockpiles during each inspection. It is the intent of the quarterly inspection to ensure each marker is inspected at least once annually. FRO will ensure that each settlement marker is surveyed once annually.
- On a quarterly basis, FRO personnel shall use a metal detector and walk from one end post to the other. As each steel marker plate is detected, the personnel conducting the inspection shall note the detection and then also determine whether the steel plate is visible.

In the event that a marker plate is visible, the FRO manager shall be contacted immediately and maintenance completed during the next 6 months to amend the compost pad thickness. This maintenance shall be completed in accordance with Section 3.6.

3.3 Compost Pad Grading

The compost pad is required to maintain a minimum grade of three (3) percent and positive drainage (i.e. no ponding). Compost pad inspections shall be conducted monthly to visually identify areas of inadequate drainage. In addition to these visual observations, topographic surveys shall be completed periodically to help quantify and identify areas of inadequate drainage as discussed in Section 3.4.

In the event that poorly drained areas are identified, the FRO manager shall be contacted immediately and maintenance completed during the first available dry weather period to amend the compost pad thickness. This maintenance shall be completed in accordance with Section 3.6.

3.4 Compost Pad Topographic Survey

At a minimum of every five years, a topographic survey shall be completed for the compost pad . The survey shall delineate areas where the surface grades are less than three (3) percent. In the event that the survey identifies areas within grades less than 3 percent, the FRO manager shall be contacted immediately and maintenance completed as soon as practical, but not to exceed 6 months. Areas that create ponding must be repaired during the first available dry period. This maintenance shall be completed in accordance with Section 3.6.

3.5 Compost Operations Drainage Controls

Operations and maintenance of the drainage controls is a key component to ensuring that the compost pad is limiting infiltration into the landfill and not comingling with other site storm water. The plans for the final storm water controls have not been finalized and are due to the Regional Water Quality Control Board (RWQCB) on February 1, 2014. However, key drainage concepts have been prepared and preliminary inspection items identified as discussed below. This portion of the O&M plan will be updated as necessary following the submittal of final storm water and compost leachate management system on February 1, 2014.

Key inspection items that will be documented on at least a weekly basis between October 15th and April 15th and during periods of inclement weather (i.e. rain) include:

- Surface water diversion berms are intact and not eroded
- Drainage flow paths are clear of debris, and convey water without ponding
- Drain pipe inlets remain clear of debris
- No ponding of water occurs on the compost pad
- Water collection pipes do not have sags and appear to be conveying drainage
- Storm water and compost leachate storage tanks (or ponds) maintain adequate freeboard and can accommodate future storm events. Excess water shall be hauled to the local municipal water treatment plant as necessary.

In the event that ponding areas are identified, the FRO manager shall be contacted immediately and maintenance completed during the first available dry weather period to amend the compost pad grades. This maintenance shall be completed in accordance with Section 3.6.

3.6 Compost Pad Maintenance Procedures

Areas within the compost pad that require additional fill due to low spots or grades flatter than 3 percent shall be corrected using procedures outlined in this section. Construction Quality Assurance (CQA) testing and observation will be required to verify that the compost pad has been repaired to re-establish design grades and thicknesses. CQA testing frequencies for fill materials required to repair the compost pad are summarized on Table 2 below.

Table 2: Construction Testing Frequency

Construction Material	Test Designation	Test Frequency
Low-Permeability Aggregate	Grain-Size Distribution ASTM D422	One per 1,000 cy
	Moisture-Density ASTM D1557	One per 5,000 cy
	Nuclear Moisture-Density ASTM D6938	One per 500 cy

Procedures for repairing the compost pad and documenting the repair include the following:

- The limits of the area requiring fill shall be delineated. For areas measuring 100 feet by 100 feet or less, a grade-setter may provide grade control. For areas larger than 100 feet by 100 feet, a California registered surveyor shall provide survey control and prepare an as-built topographic survey of the completed repairs.

- Remove the top layer of compost debris from the area requiring fill and extend the cleaning limits outside of the fill limits as necessary so that compost is not intermixed with the low-permeability aggregate base material during placement.
- Areas that require fill will need to be filled in a manner that still provides positive drainage to the established drainage controls and maintain a minimum three (3) percent grade.
- Procure aggregate material which consists of an aggregate comparable to a Caltrans Class 2 or Class 3 aggregate base with minimum 15 percent fines content (Per ASTM D422). Admixing of additional clay material to meet the fines content requirement may be necessary. Perform material testing per the specified frequency in Table 2.
- Place fill as needed within the area limits to obtain a minimum three (3) percent grade to promote positive drainage. Fills should be placed in thin lifts not to exceed 6-inches and should be compacted to a minimum density of 90 percent relative compaction per ASTM D 1557. Perform construction testing per the specified frequency listing in Table 2.
- The CQA firm prepares a summary letter describing the compost pad repairs and compiles the results of the CQA testing.

4.0 DOCUMENTATION AND REPORTING

The following list summarizes the required minimum documentation and reporting for the inspection and maintenance activities:

- Compost Operations Limits Field Inspection
- Compost Pad Surface Thickness Field Inspection
- Compost Operations Drainage Controls Field Inspection
- Compost Pad Grading Field Inspection
- Compost Pad Topographic Survey

All of the above inspections are reported on the "Compost Pad Field Inspections Form" after each inspection. A copy of this form in included in Appendix A.

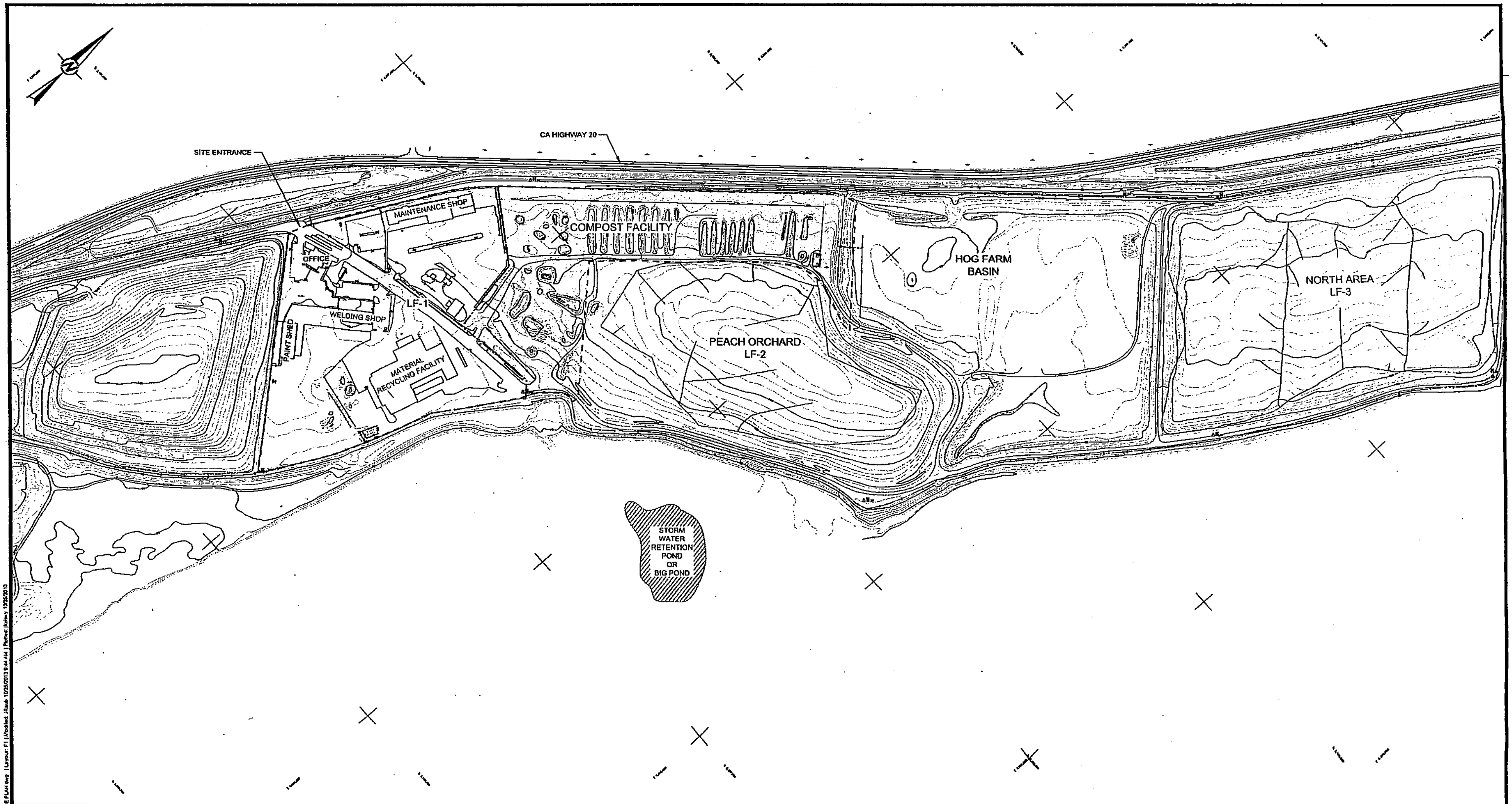
The completed inspection forms and surveys shall be maintained on site and will be available for review by the regulatory agencies. The topographic survey will consist of topographic map of the compost facility with areas denoted that have less than a three (3) percent drainage grade.

An annual report will be compiled that summarizes and documents the followings:

- Areas of non-compliance and corrective actions that were implemented
- Compost maintenance activities completed to correct drainage grades or compost pad thickness and the quality assurance testing and results that were completed to support the maintenance activities

The annual report will be submitted to the RWQCB prior to January 31st of the following year.

FIGURES



NOTES

1. TOPOGRAPHIC INFORMATION PREPARED USING PHOTOGRAMMETRIC METHODS BY AERIAL DATA INC. DATE OF TOPOGRAPHY: APRIL 4, 2012.

LEGEND

COMPOST FACILITY

APPROXIMATE BOUNDARY OF LF-1

SCALE 0 200 400 600 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT

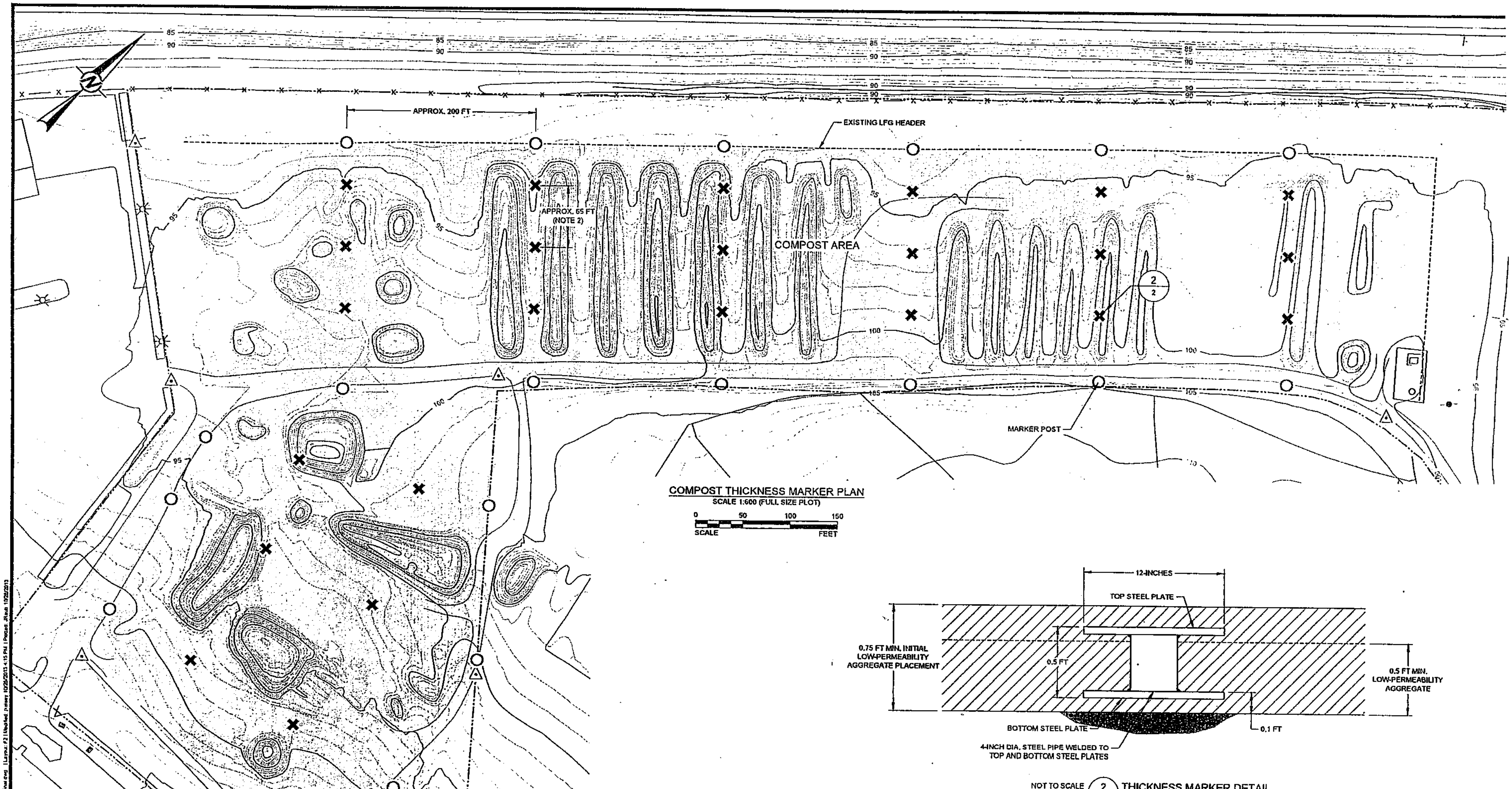
RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE

SITE PLAN

Golder Associates

PROJECT No.		130-1525	FILE No.	CAD COMPOST SITE PLAN
DESIGN	JTK	10/6/13	SCALE	AS SHOWN
CADD	JCS	10/14/13	FIGURE	
CHECK	JTK	10/15/13		1
REVIEW	KGH	10/17/13		



COMPOST THICKNESS MARKER PLAN
SCALE 1:600 (FULL SIZE PLOT)
0 50 100 150 SCALE FEET

NOT TO SCALE (2/2) THICKNESS MARKER DETAIL

LEGEND

- PERMITTED BOUNDARY OF COMPOST FACILITY
- LANDFILL GAS (LFG) HEADER
- APPROXIMATE AREA OF COMPOST PAD
- RECOMMENDED LOCATION FOR MARKER POST
- APPROXIMATE LOCATION OF CORNER MARKER
- THICKNESS MARKER (2/2)

NOTES

1. TOPOGRAPHY PROVIDED BY AERIAL DATA, INC. DATE OF TOPOGRAPHY: APRIL 30, 2012.
2. LOCATION OF THICKNESS MARKERS TO BE SURVEYED AFTER THEY ARE INSTALLED.

PROJECT
RECOLOGY YUBA-SUTTER FACILITY
MARYSVILLE, CALIFORNIA

TITLE
THICKNESS MARKER
PLAN AND DETAIL

Golder Associates

PROJECT No.		1301160	RKS\CAD COMPOST MARKER_Final
DESIGN	JDR	2013/09/30	SCALE AS SHOWN
CADD	JDR	2013/09/30	FIGURE
CHECK	KGH	2013/09/30	2
REVIEW	KGH	2013/09/30	

APPENDIX A
COMPOST PAD FIELD INSPECTIONS FORM

Feather River Organics

Compost Operations Limit, Pad Grading and Drainage Control Form

Month: ________________

Week of:						
(Yes/ No) (explain No answers unless noted)	**WEEKLY**					**COMMENTS**
Surface water diversion berms are intact and not eroded						
Drainage flow paths are clear of debris, and convey water without ponding						
Drain pipe inlets remain clear of debris						
No ponding of water occurs on the compost pad						
Water collection pipes do not have sags and appear to be conveying drainage						
Storm water and compost leachate storage tanks (or ponds) maintain adequate freeboard and can accommodate future storm events.						
	MONTHLY					
Operations are conducted w/in the compost pad						
Compost pad is free of significant cracks						
Compost pad maintains positive drainage						

EXPLANATIONS:

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Inspector: ________________________

Revised 10/24/2013