NURSERY PRODUCTS
HAWES COMPOSTING FACILITY

Design Plan, Construction Quality Assurance Plan & Technical Specifications

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1. INTRODUCTION

1.1 Introduction

This report presents the Design Plan, Construction Quality Assurance (CQA) Plan and Technical Specifications for the two surface impoundments and the waste pile at the Nursery Products Hawes Composting Facility in San Bernardino County (County).

This document was prepared for Nursery Products to support the Report of Waste Discharge (ROWD) for the Nursery Products Hawes Composting Facility. This report satisfies the requirement for a Design Plan and CQA Plan in the Waste Discharge Requirements (WDR) prepared by the California Regional Water Quality Control Board (RWQCB) – Lahontan Region. Nursery Products proposes to construct two surface impoundments and one waste pile in accordance with California Code of Regulations (CCR) Title 27. The construction of the surface impoundments and waste pile will be carried out in accordance with a CQA Plan that is in accordance with requirements of Title 27, Section 20324. The CQA plan can be found in section 4 of this report.

1.2 Reference Documents

The following reference documents provide background information and support the CQA Plan for construction:

American Society for Testing and Materials (ASTM) Annual Book of ASTM Standards. Section 4 Construction, Volume 04.02 Concrete and Aggregates.

Annual Book of ASTM Standards. Section 4 Construction, Volume 04.08 Soil and Rock(I), and Volume 04.09 Soil and Rock (II); Geosynthetics.

Annual Book of ASTM Standards. Section 8 Plastics, Volumes 08.01 Plastics (I), 08.02 Plastics (II), and 08.03 Plastics (III).

2. FACILITY OVERVIEW

2.1 Project Description

The facility is a biosolids and green material composting facility located on approximately 80 acres of a 160-acre parcel located within an unincorporated area of the County. The facility will compost biosolids and green material to produce agricultural grade compost in compliance with U.S. Environmental Protection Agency (EPA) Code of Federal Regulations (CFR), Title 40, Chapter 1, Part 503 and CCR Title 14.

The composting process will occur on the waste pile that is an engineered pad consisting of prepared, compacted subgrade of no less than 12 inches of native material. The engineered pad will be sloped to prevent ponding such that all storm water will flow to two surface impoundments located on the northern end of the facility. Design drawings illustrating the project components are presented in Appendix A of this report.

3. FACILITY DESIGN PLAN

The perimeter berms, composting pad, surface impoundments and perimeter drainage structures, are the primary engineered structures at the facility. These structures were designed to have a foundation capable of providing support for the structures, and capable of withstanding hydraulic pressure gradients to prevent failure due to settlement, compression, uplift, and effects of earthquake-induced ground motions.

3.1 Waste Pile Design

The grading design was prepared by AEI CASC Consulting (Appendix A). The grading was designed to minimize the amount of earthwork required to construct the site while meeting the engineering objectives of storm water run-on, runoff control, erosion protection, and minimizing storm water infiltration. Varying sizes of berms with side slopes of 2:1 (horizontal:vertical) are located around the perimeter of the facility to prevent storm water run on and run off to and from the facility, respectively. All storm water falling within the facility will be contained and directed to the surface impoundments. The facility will contain the volume of water from a 1,000-year, 24-hour storm event (Appendix B).

The waste pile liner consists of a minimum of 12 inches of engineered fill consisting of native subgrade compacted to 90 percent relative compaction using American Society of Testing and Materials (ASTM) D1557 as the compaction standard.

3.2 Surface Impoundment Design

The two surface impoundments are artificial ponds designed to capture storm water from the 100-year, 24-hour storm event over the entire facility and the 1,000-year, 24-hour storm event that falls directly on the surface impoundments. There is a 1,000-year berm with multiple inlets around the perimeter of both retention basins so that storm water can be stopped from entering the basins if necessary, to maintain a freeboard of 2 feet.

As presented in the ROWD, The engineered alternative approved by the RWQCB for the surface impoundments is a single composite liner. This liner system includes (from bottom to top, in order of construction):

- 6 inches of prepared compacted native subgrade which is moisture conditioned and compacted to 90 percent of the maximum dry density per ASTM Standard D1557;
- Leak detection monitoring sump under the lower-most part of each surface impoundment that consists of a composite liner of geosynthetic clay (GCL) and 60-mil High Density Polyethylene (HDPE) surrounding a gravel drainage layer;
- A GCL and 60-mil HDPE liner;

The engineered alternative consists of a geosynthetic HDPE Flexible Membrane Liner (FML) as the primary liner for the storm water retention basins. To provide additional resistance to downward migration of water, and to provide a smooth surface on which to install the FML, a GCL is included in the liner system beneath the FML. A GCL consists of powdered, dry, bentonite clay sewn in between two layers of synthetic fabric. Consequently, this engineered alternative liner provides a hydraulic conductivity two orders of magnitude lower than the prescriptive liner requirements outlined in CCR Title 27. This design helps protect the vadose zone if a leak were to occur in the FML because the

GCL would hydrate to "self-repair" a leak in the FML, mitigating the downward migration of water from the impoundments.

Static and seismic slope stability analyses of the surface impoundment side slopes was presented in Appendix G of the ROWD.

3.3 Leak Detection Monitoring Sumps

The storm water retention basin engineered alternative liner design includes lined sumps below the lowest portions of the storm water retention basins. Details regarding these leak detection sumps are included in the ROWD. The leak detection sumps allow detection of the vertical migration and removal of a water sample for testing.

Leak detection monitoring sumps will be installed at the site below the lowest point of each lined storm water retention basin. Details of the unsaturated zone monitoring sumps are presented in Appendix A.

4. CONSTRUCTION QUALITY ASSURANCE PLAN

4.1 Introduction and Purpose

The purpose of the CQA Plan is to address the quality assurance procedures and monitoring requirements for construction of the project. The CQA Plan is intended to: (i) define the responsibilities of parties involved with the construction; (ii) provide guidance for the proper construction of the major components of the project; (iii) establish testing protocols; (iv) establish guidelines for construction documentation; and (v) provide the means for assuring that the project is constructed in conformance to technical specifications, applicable regulatory requirements, and the construction drawings.

This CQA Plan addresses the soil, geosynthetic, and appurtenant components of the project including, but not limited to LDMS sumps, earthwork, GCL, and FML. Care and documentation are required in the placement and compaction of soils and in the production and installation of all liner materials placed during construction. The CQA Plan delineates the procedures to be followed for monitoring the construction of these materials.

The CQA consultanting activities during the evaluation, moisture treatment, placement, and compaction of soils for earthworks and the leak detection are included in the scope of this plan. The CQA protocols applicable to manufacturing, shipping, handling, and installing all liner materials are also included.

4.2 Parties Involved with Construction Quality Assurance

4.2.1 Owner and Construction Manager

During the construction, the Owner, Nursery Products will serve as the construction manager and will serve as a single point of contact for the Contractor and CQA consultant during construction.

4.2.2 Design Engineer

The design engineer for the grading design and the storm water controls is Mr. Ceazar Aguilar, P.E. of AEI CASC Consulting. The design engineer reviews and approves any proposed changes in design during construction.

4.2.3 CQA Consultant

The CQA consultant is an independent party not affiliated with the contractor, subcontractors, suppliers, or manufacturers. The CQA consultant may be the design engineer. The CQA consultant has the overall responsibility for managing, coordinating, and implementing the CQA activities and confirming that the contractor's construction quality control (CQC) activities are performed in accordance with the CQA Plan, construction drawings and technical specifications. Critical activities related to the construction, manufacture, and installation of the earthwork, geosynthetics, civil improvements, and other project components will be monitored and documented by the CQA consultant. The CQA consultant will be responsible for issuing a Final Certification Report containing CQA documentation sufficient to satisfy regulatory requirements and the requirements of this CQA Plan.

4.2.4 Contractor

The contractor is responsible for the timely construction the project, as delineated in the design drawings and material technical specifications and in accordance with this CQA Plan. The contractor is also responsible for CQC. In particular, the contractor shall ensure that: (i) only materials meeting the requirements set forth in the design drawings and technical specifications are used; and (ii) the materials are installed in full conformance with the design drawings and technical specifications.

4.2.5 Resin Supplier

The resin supplier produces and delivers the resin to the geosynthetics manufacturer. Qualifications of the resin supplier are specific to the manufacturer's requirements.

4.2.6 Geosynthetics Manufacturer

The geosynthetics manufacturer is responsible for the production of finished material from appropriate raw materials. The geomembrane manufacturer reports to the geosynthetics installer.

4.2.7 Geosynthetics Installer

The geosynthetic installer is the contractor. The geosynthetic installer is responsible for field handling, storage, placement, seaming, loading, or anchoring against wind uplift, and other aspects of the geosynthetic material installation. The geosynthetic installer will be trained and qualified to install the geosynthetic materials of the type specified for this project.

4.2.8 Soils Testing Laboratory

In the performance of CQA activities, the CQA consultant may engage a soils testing laboratory independent from the contractor, subcontractors, or any material supplier or manufacturer. The testing laboratory will conduct tests on representative soil samples to evaluate their properties and compliance with the construction drawings and technical specifications.

4.3 CQA Consultant

Prior to Construction

- Reviews the final design and construction drawings
- Administers the CQA program
- Reviews the geosynthetic installers personal qualifications

During Construction the CQA consultant will supervise monitoring of activities, including:

- Site grading;
- Excavation, processing, placement, and compaction of native soils as engineered fill;
- Installation of sumps; and
- Installation of GCL & FML, and other liner components
- Conducts site visits
- Prepares daily field reports
- Verifies the calibration and condition of on-site CQA equipment
- Oversees the collection and shipping of all laboratory test samples
- Reviews results of laboratory testing
- Reviews all installation and monitoring activities of the geosynthetic materials
- Prepares the final certification report.

4.4 Project Control Meetings

To ensure a high degree of quality during construction, clear, open channels of communication are essential. To this end, meetings of key project personnel are necessary.

4.4.1 Preconstruction Meeting

The preconstruction meeting will include the CQA consultant, construction manager, and the contractor. The purpose of this meeting is to review the construction drawings, coordinate construction tasks, anticipate any installation problems which might cause difficulties or delays in construction, and review the CQA Plan with all of the parties involved. It is very important that the criteria regarding testing, repair, etc., be known and accepted by all parties prior to construction.

The CQA consultant will record the discussions and decisions of the meeting. The record of the meeting will be documented in the form of meeting minutes which will be subsequently distributed to all attendees.

4.4.2 Progress Meetings

Progress meetings will be held between the CQA consultant, the construction manager, and the contractor. The progress meeting will be used to discuss current progress, planned activities, or revisions to the work. Minutes of the progress meeting will be documented by the CQA consultant and distributed to all appropriate parties.

4.4.3 Problem or Work Deficiency Meeting

A special meeting will be held when and if a problem or deficiency is present or likely to occur. The meeting will be attended by the construction manager, CQA consultant, and other parties as appropriate. If the problem requires a design modification, the design engineer should either be present at, or consulted prior to this meeting. The purpose of the work deficiency meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions;
- Select a suitable solution agreeable to all parties; and
- Implement an action plan to resolve the problem or deficiency.

Minutes of the work deficiency meeting shall be documented by the CQA consultant and distributed to all appropriate parties, including the RWQCB.

4.5 Documentation

4.5.1 General

An effective CQA plan recognizes all construction activities that should be monitored and assigns responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA consultant will document that all quality assurance requirements have been satisfied. The CQA consultant will also maintain at the job site a complete file of construction drawings, technical specifications, CQA Plan, test procedures, daily logs, and other pertinent documents.

4.5.2 Daily Recordkeeping

Standard reporting procedures will include preparation of daily CQA documentation which, at a minimum, will consist of: (i) field notes, including memoranda of meetings and/or discussions with the design engineer or construction manager; (ii) CQA consulting logs and testing data sheets; and (iii) construction problems and solution summary sheets. This information will be reviewed by the CQA consultant, signed, and transmitted to the construction manager on a daily basis.

Monitoring logs and testing data sheets will be prepared daily. At a minimum, these logs and data sheets will include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- A site plan showing work areas and locations selected for random CQA testing;
- Descriptions and locations of ongoing construction;
- Equipment and personnel in each work area;
- Location where in-site CQA tests and samples were taken;
- A summary of test results;
- Calibration of test equipment;
- Decisions made regarding acceptance of units of work and/or corrective actions to be taken;
- Signature of CQA consultant representative.

4.5.3 Construction Problems

The construction manager will be informed by the CQA consultant about any significant recurring nonconformance with the construction drawings, technical specifications, or CQA plan. The cause of the nonconformance will be determined and appropriate changes in procedures or specifications may be recommended. These changes will be submitted to the design engineer for approval. When changes are made, they will become part of the construction documents.

4.5.4 Photographic Documentation

Photographs will be taken by the CQA consultant and documented in order to serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints and they will be identified with the date, time, and location of the photograph.

4.5.5 Design and/or Specification Changes

Design and/or specification changes may be required during construction. In such cases, the CQA consultant will notify the design engineer and Construction Manager.

4.5.6 Final Certification Report

At the completion of the work, the CQA consultant will submit to the construction manager a signed and sealed final certification report. This report will document that: (i) work has been performed in compliance with the construction documents; (ii) physical sampling and testing has been conducted at the appropriate frequencies specified in the CQA plan; and (iii) the required CQA documentation has been completed. At a minimum, this report will include:

- GCL & FML manufacturers quality control documentation;
- A summary describing the CQA activities and indicating compliance with the drawings and technical specifications;
- A summary of CQA/CQC testing, including failures, corrective measures, and retest results;
- Documentation that the geomembrane trial seams were performed according to the CQA plan and technical specifications;
- Documentation that field seams were non-destructively tested using a method in general accordance with the applicable test standards;
- Geosynthetic panel layout record drawing with destructive test locations;
- Documentation that nondestructive testing was monitored by the CQA consultant, that the CQA consultant informed the contractor of any required repairs, and that the CQA consultant inspected the seaming and patching operations for uniformity and completeness;
- Records of sample and resample locations, the name of the individual conducting the tests, and the results of the tests;
- Photo logs;
- Soil laboratory and field compaction test results; and
- Daily inspection reports.

4.6 Earthwork

This section describes CQA procedures for earthwork operations. The scope of earthwork and related

construction quality assurance includes the following elements:

- Clearing, Grubbing, and Stripping
- Stockpiling and Soil Management
- Excavation
- Engineered Fill

The contractor shall provide adequate notice to the CQA consultant for inspections and testing. Observation and testing will be periodic to full time, to monitor per the requirements of this plan.

4.6.1 Earthwork Construction Test Standards

The following test standards apply as called out in this manual or the technical specifications:

- ASTM D422 Standard Test Method for Particle Size Analysis of Soils
- ASTM D1140 Standard Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve
- ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
- ASTM D2216 Standard Test Method of Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

4.6.2 Earthwork Test Frequencies

The CQA consultant conducts all earthwork testing necessary to verify that the waste pile (engineered pad) is an area of prepared subgrade of no less than 12 inches of engineered native material. The CQA consultant will verify that the engineered pad will be moisture conditioned and compacted to a minimum relative compaction of 90 percent per ASTM D1557. Extra testing must be conducted whenever work or materials are suspect, marginal, or of poor quality. Extra testing may also be performed to provide additional data for engineering evaluation. Any re-tests performed as a result of a failing test do not contribute to the total number of tests performed in satisfying the minimum test frequency.

4.6.3 Earthwork Soil Sample Numbering

The CQA consultant maintains soil sample numbers in a master log maintained at the site. Sample numbers begin with (01) and proceed upward. Information contained in the master log of test samples includes:

- Sample number
- Date sampled
- Location sampled
- Location of Laboratory testing

- Date sample sent off site
- Date test results received
- Test results and remarks

4.6.4 Field Density Tests

4.6.4.1 Test Numbering

The CQA consultant is responsible for maintaining test numbers and results for field density tests performed by the nuclear moisture density gauge. The CQA consultant will maintain field books that identify soil segments, date tested, personnel performing the test, and sequential test number. No test number can be repeated and re-tests of failing tests must be given a new number and a retest notation. Test data and results must be filled out on the field density test form.

4.6.4.2 Test Locations

The intention of the CQA program is to provide confidence that the earthwork materials and work conform to the technical specifications. To meet this intent, the CQA consultant will perform density tests of soil fills and compacted soil liner during construction. Density tests must be located at various elevations and uniformly dispersed throughout the entire plan dimensions of the fill. Density test locations must be chosen without bias; however, additional testing can be performed in any areas that are suspect, marginal, or appear to be of poor quality. During the progress of the work, density test locations will be plotted on a drawing by the CQA consultant to document that no significant areas are untested. The drawing becomes part of the Final CQA Report.

4.6.5 Monitoring and Testing Requirements

Earthwork components of the construction are summarized in this section. Each component has specific construction requirements that must be monitored. The following sections list monitoring requirements for each type of earthwork.

4.6.5.1 Clearing, Grubbing, and Stripping

- Document that erosion and sediment control measures are securely in place prior to initiating clearing, grubbing, and stripping operations in any area.
- Document that clearing and stripping in areas required for site access and execution of the work is complete.
- Document that vegetation, roots, and highly organic soil are removed in areas to receive fill or liner materials.

4.6.5.2 Excavations

- Document that construction staking is performed before work and that survey bench marks with elevations are secured outside the work area.
- Document that the contractor has notified the Underground Service Alert to identify and locate underground utilities.
- Coordinate with the contractor to perform excavation verification surveys upon completion of excavating operations.

4.6.5.3 Engineered Fill

- Monitor that construction staking is performed before work and that survey bench marks with elevations are secured outside the work area.
- Perform visual and manual soil classifications to verify that material source is suitable for earth fills.
- Verify that the material is free of organic and oversized materials and perform visual classifications during excavation of borrow materials.
- Perform moisture-density relationship testing to determine the maximum dry density and optimum moisture content for earth fill materials.
- Perform nuclear density-moisture tests to document that each lift is compacted in accordance with project specifications.
- Monitor that soil materials are above the optimum moisture content.
- Monitor that desiccated earth fills are properly repaired or removed before placing subsequent lifts.
- Monitor that final earth fill surfaces are free of ruts, gouges, and other features that might contribute to erosion and sediment run-off.
- Coordinate with the contractor and Surveyor to perform verification surveys at the completion of earth fill operations. Verify corrective action measures (i.e. for over- or under- builds) as determined by verification surveys.

4.6.6 LDMS Drainage Material

- Review the contractor's proposed methods to place the LDMS drainage aggregate over geosynthetics for compliance with the drawings and specifications.
- Review contractor provided gradation report to verify that granular drainage materials comply with material gradation requirements of the technical specifications.
- Monitor placement operations to verify that underlying geosynthetics installations are not damaged and wrinkles are minimized during placement operations.

4.6.7 Non-Conforming Work

If a defect is identified in any soil layer, the CQA consultant shall determine the extent and the nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA consultant deems appropriate. If the soil layer has been subject to adverse weather conditions during construction, the CQA consultant shall re-examine the layer for possible damage in overly wet, desiccated or windblown areas.

4.6.7.1 Notification

After determining the extent and nature of the defect, the CQA consultant shall promptly notify the contractor and the construction manager. If necessary, a work deficiency meeting may be held as needed between the contractor, CQA consultant, design engineer, construction manager and other necessary parties to assess the problem, review alternative solutions, and implement an action plan.

4.6.7.2 Repairs and Retesting

The contractor shall correct all deficiencies to meet the project specifications. If project specification criteria cannot be met, or unusual weather conditions hinder work, the CQA consultant shall develop and present to the construction manager suggested solutions for his approval. The CQA consultant shall schedule appropriate re-tests when the work defect has been corrected. All re-tests by the CQA consultant must verify that the defect has been corrected before additional work is performed by the Contractor in the area of the deficiency. The CQA consultant shall observe any repair and report any noncompliance with the above requirements in writing to the construction manager.

4.7 Leak Detection Monitoring Sump Construction

Sumps are proposed at the site below the lowest point of each surface impoundment. The CQA consultant will monitor that the sumps are constructed in accordance with construction drawings presented in Appendix A and the technical specifications.

4.8 GCL & FML Liner Construction

This section discusses and outlines the CQA activities to be performed for the GCL and FML installation. The CQA consultant will review the drawings and the technical specifications regarding the installation.

4.8.1 Material Conformance

The CQA consultant will document that the GCL and FML delivered to the site meets the requirements of the technical specifications prior to installation. The CQA consultant will:

- Review the manufacturer's submittals for compliance with technical specifications;
- Document the delivery and proper storage of GCL & FML; and

4.8.2 Review of Construction Quality Control

The contractor will provide the construction manager and the CQA consultant with the following:

- A properties sheet including all specified properties;
- The sampling procedure and results of testing; and
- A certification that property values given in the properties sheet are guaranteed by the manufacturer.

The CQA consultant will document that:

- The property values certified by the manufacturer meet all of the technical specifications; and
- The measurements of properties by the manufacturer are properly documented and that the test methods used are acceptable.

The contractor will provide the construction manager and the CQA consultant with a product certification and quality control certificate for every roll of GCL and FML provided. The quality control certificate will be signed by a responsible party employed at the GCL & FML manufacturer.

The quality control certificate will include roll numbers and identification and results of quality control tests.

The CQA consultant will evaluate that the quality control certificates have been provided at the specified frequency, and that the certificate identifies the rolls related to the roll represented by the test results. The CQA consultant will also review the quality control certificates and evaluate that the certified roll properties meet the specifications.

4.8.3 Delivery

The CQA consultant will visually inspect and document that the transportation and handling did not damage to the FML & GCL. Upon delivery at the site, the Contractor and the CQA consultant will conduct a surface observation of the rolls for defects and damage. This inspection will be conducted without unrolling unless defects or damages are found or suspected. The CQA consultant will notify the construction manager should any rolls be rejected.

4.8.4 Storage

The contractor will be responsible for the storage of the GCL and FML on site. The contractor will provide storage space in a location (or several locations) such that on-site transportation and handling are optimized. The CQA consultant will document that storage of the GCL & FML provides adequate protection against sources of damage.

4.9 GCL & FML Installation

The CQA consultant will document that the GCL & FML are installed in accordance with drawings, technical specifications and manufacturer's recommendations.

4.9.1 Subgrade Preparation

The CQA consultant will document that the lines and grades for the supporting prepared subgrade meet the technical specifications, and that placement of the overlying materials does not damage, create large wrinkles, or induce excessive tensile stress in the underlying materials.

The contractor will certify in writing that the surface on which the GCL and FML will be installed is acceptable. The certificate of acceptance will be given by the contractor to the construction manager and CQA consultant prior to commencement of GCL & FML installation in the area under consideration.

After the supporting subgrade has been accepted by the construction manager, it will be the contractors responsibility to indicate to the construction manager any change in the supporting soil condition that may require repair work. If the CQA consultant concurs with the contractor, then the construction manager will document that the supporting soil is repaired. At any time before and during the installation, the CQA consultant will indicate to the construction manager locations that may not provide adequate support to the liner.

The CQA consultant will document that the geosynthetic terminations have been constructed in general accordance with the drawings. Backfilling above the terminations will be conducted in general accordance with the technical specifications.

4.9.2 GCL & FML Placement

A field panel is the unit area of FML which is to be seamed in the field. It will be the responsibility of the Geosynthetics Installer to document that each field panel is given an "identification code". This field panel identification code will be as simple and logical as possible. Roll numbers established in the manufacturing plant must be traceable to the field panel identification code.

The CQA consultant will establish documentation showing correspondence between roll numbers, and field panel identification codes. The field panel identification code will be used for all quality assurance records.

4.9.3 Field Panel Placement & Installation

A drawing illustrating the field panel layout will be submitted by the Geosynthetics Installer to the construction manager and CQA consultant for approval prior to construction. The CQA consultant will document that field panels are installed at the location indicated in the panel layout.

Field panels will be placed one at a time and each field panel is seamed after its placement. During field panel placement, it is usually beneficial to begin at the high point area and proceed toward the low point with the "shingle" overlaps to facilitate drainage in the event of precipitation. It is also usually beneficial to proceed in the direction of prevailing winds. Accordingly, an early decision regarding installation scheduling should be made if and only if weather conditions can be predicted with reasonable certainty. Otherwise, scheduling decisions must be made during installation, in general accordance with varying conditions. In any event, the contractor is fully responsible for the decision made regarding placement procedures.

The CQA consultant will evaluate every change in the schedule proposed by the contractor and advise the construction manager on the acceptability of that change. The CQA consultant will document that the condition of the supporting soil has not changed detrimentally during installation.

The CQA consultant will record the identification code, location, and date of installation of each field panel.

GCL & FML placement will not proceed unless otherwise authorized:

- When the ambient temperature is below 40 degrees F or above 105 degrees F;
- When geomembrane sheet temperature is below 40 degrees F or above 105 degrees F; or

GCL & FML placement will not be performed during any precipitation, in the presence of excessive moisture, in an area of ponded water, or in the presence of excessive winds.

The CQA consultant will document that the above conditions are fulfilled. Additionally, the CQA consultant will document that the supporting soil has not been damaged by weather conditions. The contractor will inform the construction manager if the above conditions are not fulfilled.

The CQA consultant will document the following:

- Equipment used does not damage the GCL & FML by handling, trafficking, excessive heat, leakage of hydrocarbons or other means;

- The surface underlying the GCL & FML hasn't deteriorated since previous acceptance, and is still acceptable immediately prior to GCL & FML placement;
- Elements underlying the GCL & FML are clean and free of debris;
- Personnel working on the GCL & FML do not smoke, wear damaging shoes, or engage in other activities which could damage the liner;
- The method used to unroll the panels does not cause scratches or crimps in the GCL & FML and does not damage the supporting soil;
- The method used to place the panels minimizes wrinkles; and
- Adequate temporary loading and/or anchoring is not likely to damage the liner and has been placed to prevent uplift by wind.

The CQA consultant will inform the construction manager if the above conditions are not fulfilled. Damaged panels or portions of damaged panels that have been rejected will be marked and their removal from the work area recorded by the CQA consultant.

The contractor will provide the construction manager and the CQA consultant with an as-built seam layout drawing. The CQA consultant will review the seam layout drawing and evaluate that it is consistent with the preliminary panel layout. No panels may be seamed in the field with the CQA consultant's approval. In addition, panels not specifically show on the seam layout drawing may not be used without the CQA consultant's prior approval.

Seams should be oriented parallel to the line of maximum slope. In corners and odd-shaped locations, the number of seams should be minimized. No horizontal seam should be less than 5 feet from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized.

A seam numbering system compatible with the panel numbering system will be agreed upon at the pre-construction meeting.

The contractor will provide the construction manager and the CQA consultant with a list of proposed seaming personnel and their experience records.

The CQA consultant will log ambient temperature, seaming apparatus number, and geomembrane surface temperatures as well as seaming apparatus pressures.

The CQA consultant will also document that:

- The contractor maintains the appropriate on-site the number of spare operable seaming apparatus';
- Equipment used for seaming is not likely to damage the liner;
- For cross-seams, the edge of the cross-seam is ground to a smooth incline (top and bottom) prior to welding;
- The electric generator is placed on a smooth base such that no damage occurs to the liner;
- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage;
- The liner is protected from damage in heavily trafficked areas;
- A movable protective layer may be used directly below each overlap of liner that is to be seamed to prevent build up of moisture between sheets;
- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris, and foreign material; and
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths."

If the contractor wishes to use methods that may allow seaming at ambient temperatures below 40 degrees F or above 104 degrees F, the contractor will demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced within acceptable temperature and wind requirements, and that the overall quality of the liner is not adversely affected.

The CQA consultant will document that these seaming conditions are fulfilled and will advise the construction manager if they are not. The construction manager will then decide if the installation will be stopped or postponed.

The CQA consultant will document that:

- The panels of FML have finished overlap of a minimum of 3 inches for fusion welding; and
- The procedure used to temporarily bond adjacent panels together does not damage the liner.

Trial seams will be made on fragment pieces of liner to verify that seaming conditions are adequate. The CQA consultant will observe trial seam procedures. Trial seam samples will be assigned a number. The CQA consultant will log the date, time, machine temperature, number of the seaming unit, name of the seamer, and pass or fail description for each trial seam sample tested.

Unless otherwise specified, the general seaming procedure used by the Contractor will be as follows:

- Fishmouths or wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles will be seamed and any portion where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.
- If seaming operations are carried out at night, adequate illumination will be provided at the Contractors expense.
- Seaming will extend to the outside edge of panels to be place in the liner anchorage.

The CQA consultant will document that the above seaming procedures are followed, and will inform the construction manager if they are not.

The contractor will non-destructively test field seams over their length using an air pressure test (for double fusion seams only) or other approved method. The purpose of nondestructive tests is to check the continuity of seams. It does not provide information on seam strength. Continuity testing will be carried out as the seaming work progresses, not at the completion of field seaming.

The CQA consultant will:

- Observe continuity testing;
- Record location, date, test unit number, name of person conducting the test, and the results of tests; and
- Inform the contractor and construction manager of required repairs.

The contractor will complete any required repairs.

The CQA consultant will:

- Observe the repair and re-testing of the repair;
- Mark on the liner that the repair has been made; and
- Document the results.

The following procedures will apply to locations where seams cannot be non-destructively tested:

- All such seams will be cap-stripped with the same geomembrane.
- If the seam is accessible to testing equipment prior to final installation, the seam will be non-destructively tested prior to final installation.
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations will be observed by the CQA consultant and contractor for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation will be recorded by the CQA consultant.

The CQA consultant will select locations where seam samples will be cut out for laboratory testing. Those locations will be established as follows:

- The frequency of seam testing is a minimum of one destructive sample per 1000 feet of weld. The minimum frequency is to be evaluated as an average taken throughout each surface impoundment.
- Test locations will be evaluated during seaming at CQA consultant's direction.

The contractor will not be informed in advance of the locations where the seam samples will be taken.

Samples will be cut by the contractor as the seaming progresses in order to have test results before the liner is covered by another material.

The CQA consultant will:

- Observe sample cutting;
- Assign a number to each sample, and mark it accordingly;
- Record sample location on layout drawing; and
- Record reason for taking the sample at this location.

Holes in the liner resulting from destructive seam sampling will be immediately repaired and the continuity of the new seams in the repaired area will be tested.

Field testing will be performed by the contractor using a gauged tensiometer. Prior to field testing the contractor shall submit a calibration certificate for the gauge tensiometer to the CQA consultant. Calibration must have been performed within one year of use on the current project. Two 1-inch wide strips will be taken for peel and shear. The specimens shall not fail in the seam and shall meet the specified strength requirements. If any field test specimen fails, then the appropriate procedures will be followed.

The CQA consultant will witness field tests and mark samples and portions with their number. The CQA consultant will also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description.

At the option of the construction manager, destructive test samples may be packaged, under the responsibility of the contractor in a manner that will not damage the test sample. The construction manager will document that packaging and shipping conditions are acceptable. The construction manager will be responsible for storing archive samples. Samples will be tested by the CQA laboratory. The CQA laboratory will be selected by the contractor with the concurrence of the construction manager and CQA consultant.

Testing will include "bonded seam strength" and "Peel Adhesion." At least five specimens will be tested for each test method. Specimens will be selected alternatively by test from the samples. A passing test will meet the minimum required values in at least four out of five specimens.

The CQA laboratory should provide test results no more than 24 hours after they receive the samples. The CQA consultant will review laboratory test results as soon as they become available, and make appropriate recommendations to the construction manager.

The following procedures will apply whenever a sample fails a destructive test, whether that test was conducted by the CQA laboratory, the contractor laboratory, or by the gauged tensiometer in the field. The contractor has two options;

- The contractor can reconstruct the seam between two passed test locations.
- The contractor can trace the welding path to an intermediate location at 10 feet minimum from the point of the failed test in each direction and take a small sample for an additional field test at each location. If these additional samples pass the test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

Acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken.

4.9.4 Defects and Repairs

This section prescribes CQA activities to document that defects, tears, rips, punctures, damage, or failing seams shall be repaired.

Seams and non-seam areas of the liner will be examined by the CQA consultant for identification of defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. Because light reflected by the liner helps to detect defects, the surface of the liner will be clean at the time of examination.

Portions of the geomembrane exhibiting a flaw, or failing a test, will be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure will be at the discretion of the CQA consultant. The procedures available include:

- Patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter;
- Spot welding or seaming, used to repair small tears, pinholes, or other minor localized flaws;
- Capping, used to repair large lengths of failed seams;
- Removing bad seam and replacing with a strip of new material welded into place.

In addition, the following provisions will be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than 20 minutes prior to the repair;
- Surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance by the CQA consultant;
- Patches or caps will extend at least 6 inches beyond the edge of the defect, and all corners of patches will be rounded with a radius of at least 3 inches; and
- The geomembrane below large caps should be appropriately cut to avoid water collection between the layers.

Each repair will be numbered and logged, and be tested as appropriate. Repairs that pass the test will be taken as an indication of an adequate repair. Failed tests indicate that the repair will be redone and re-tested until a passing test results. The CQA consultant will observe all testing of repairs and will record the number of each repair, date, and test outcome.

4.9.5 Lining System Acceptance

The contractor and the manufacturer will retain all responsibility for the liner materials in the liner system until acceptance by the construction manager.

The liner system will be accepted by the construction manager when:

- The installation is finished;
- Verification of the adequacy of all seams and repairs, including associated testing, is complete;
- All documentation of installation is completed including the CQA consultants final construction quality assurance report; and
- CQA report sealed by a California-registered professional engineer has been received by the construction manager, documenting installation has been completed accordance with this CQA Plan, the design drawings, and the technical specifications.

4.10 PVC Piping

This section describes CQA procedures for PVC pipe installations. Perforated and solid Schedule 40 PVC pipe will be used to construct the LDMS sump riser. CQA for the PVC pipe installations will be performed to verify that PVC pipe systems are installed in accordance with the design. Construction must be conducted in accordance with the project construction drawings and specifications. Pipe must comply with applicable ASTM standards.

Upon delivery of the PVC pipe, the CQA consultant will observe pipe for damage during shipping and handling and identify damaged materials and document that damaged materials are set aside. Damaged pipe may be rejected. If rejected, document that pipe is removed from the site or stored at a location, separate from accepted pipe.

No conformance testing is required for PVC pipe.

During pipe installation and welding, the CQA Monitor will:

- Monitor that chains, end hooks, cable slings, or any other devices that may scar the pipe are not used to handle pipe.
- Monitor that the pipe is not damaged during handling operations.
- Monitor that inside and outside of pipe ends are cleaned to remove dirt, water, grease, and other foreign material.
- Monitor that perforations are made per the design plans.

5. TECHNICAL SPECIFICATIONS

5.1 GCL – Geotextile Component

The geotextile component of the GCL shall be manufactured of non-woven/woven, continuous or staple filament, needle-punched, polypropylene or polyester, UV-stabilized yarn oriented into a stable network that maintains its structure during handling, placement, and long-term service.

The geotextile shall be chemical resistant and cannot be heat burnished or contain recycled materials. The geotextile shall have minimum average roll values shown in the table below.

5.2 GCL

The GCL shall consist of a layer of granular sodium bentonite clay needle punched between two geotextiles and shall comply with all of the criteria listed in this Section.

Bentonite shall be a high-swelling sodium bentonite, with a minimum swell index of 24 mL/2g and a maximum fluid loss of 18 mL.

Bentonite shall have a granular consistency (1 percent max. passing a No. 200 sieve [75 μm]), to ensure uniform distribution throughout the GCL and minimal edge loss during handling and installation.

The moisture content of the bentonite in the finished GCL shall be between 20 and 40 percent, to ensure uniform bentonite distribution, consistent needle punch density.

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY $ft^2(m^2)$	REQUIRED VALUES
Bentonite Swell Index[1]	ASTM D 5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss[1]	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Mass/Area[2]	ASTM D 5993	40,000 ft^2 (4,000 m^2)	0.50 lb/ft^2 (2.4 kg/m^2) min
GCL Tensile Strength[3]	ASTM D 6768	200,000 ft^2 (20,000 m^2)	30 lbs/in (53 N/cm) MARV
GCL Peel Strength[3]	ASTM D 6496	40,000 ft^2 (4,000 m^2)	3.5 lbs/in (6.1 N/cm) min

GCL Index Flux[4]	ASTM D 5887	Weekly	1 x 10^{-8} m^3/m^2/sec max
GCL Hydraulic Conductivity[4]	ASTM D 5887	Weekly	5 x 10^{-9} cm/sec max
GCL Hydrated Internal Shear Strength[5]	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf

The GCL manufacturer shall provide the Contractor with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:

- Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the swell index and fluid loss values shown in the Physical Properties table.
- Manufacturer's test data for the finished GCL product demonstrating compliance with the values shown in the Physical Properties table.

5.3 HDPE – Smooth Geomembrane

All resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane and shall meet the guidelines of GRI-GM13.

Property	**Test Method**	**HDPE Resin**
Density, g/cm3	ASTM D1505	0.932
OIT. minutes	ASTM D3895 (1 atm,200" C)	100
Melt Flow Index, g/10min	ASTM D1238 (190/2.16)	Less than or equal to 1

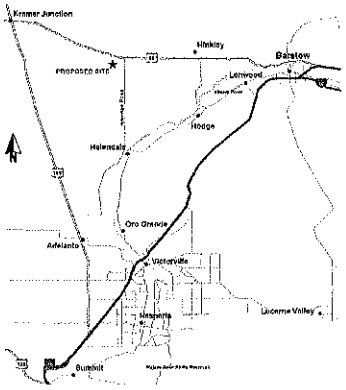
Geomembrane shall meet the following additional requirements:

Property	Test Method	Minimum Specification
Thickness. mil	ASTM D5994	
Minimum Average		60
Lowest Individual Reading		54
Density	ASTM D1505	0.94
Carbon Black Content, %	ASTM 1603, modified	2.0
Tensile Properties: (each Direction)	ASTM D6693	
Strength at Yield, lb/in		126
Strength at Break, lb/in		228
Elongation at Yield	(1.3" gauge length)	12
Elongation at Break	(2.0" gauge length)	700
Tear Resistance, lb	ASTM D1004	42
Puncture Resistance, lb	ASTM D4833	108

6. CERTIFICATION

I certify under penalty of perjury that I have personally examined and am familiar with the information submitted in this Design and Construction Quality Assurance Plan for the Nursery Products Hawes Composting Facility and all attachments and, based on my inquiry of those individuals immediately responsible for obtaining the information; I believe the information is true, accurate, and complete. My seal as a registered professional engineer licensed in the State of California is affixed below.

APPENDIX A



VICINITY MAP
NO SCALE

PLANS FOR:

NURSERY PRODUCTS HAWES COMPOSTING FACILITY

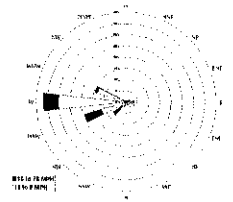
APRIL 2010

SAN BERNARDINO COUNTY CALIFORNIA

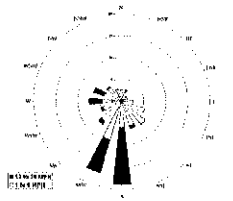
PREPARED BY:
URS CORPORATION
1615 MURRAY CANYON ROAD
SUITE 1000
SAN DIEGO, CALIFORNIA 92108
(619) 294-9400

PREPARED FOR:
NURSERY PRODUCTS

12277 APPLE VALLEY ROAD, SUITE 131
APPLE VALLEY, CALIFORNIA 92308
(760) 272-1224



BARSTOW WIND ROSE (MDAQMD, 2007)



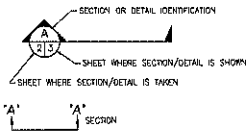
VICTORVILLE WIND ROSE (MDAQMD, 2007)

LEGEND

GENERAL LINES:

- GRADING CONTOUR
- EXISTING MAJOR ELEVATION CONTOUR
- EXISTING MINOR ELEVATION CONTOUR
- PROPERTY BOUNDARY
- SITE BOUNDARY
- BASIN BOTTOM ANCHORAGE

KEY FOR DETAIL SYMBOLS:



FILL PATTERNS

- CONCRETE
- SUBGRADE
- NON-WOVEN GEOTEXTILE
- GRAVEL
- FML
- GCL

MISCELLANEOUS:

- OPERATIONS SUPPLY WELL
- LEAK DETENTION MONITORING SUMP
- 0.5% DIRECTION OF DRAINAGE AND SLOPE
- [M] GROUNDWATER MONITORING LOCATION
- [V] VADOSE ZONE MONITORING LOCATION

INDEX OF SHEETS:

ABBREVIATIONS:

DIA	DIAMETER
FML	FLEXIBLE MEMBRANE LINER
GCL	GEOSYNTHETIC CLAY LINER
HDPE	HIGH DENSITY POLYETHYLENE
IN	INCH
MDAQMD	MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT
MIN	MINIMUM
MIL	1/1000TH OF AN INCH
OC	ON CENTER
PCC	PORTLAND CEMENT CONCRETE
SCH	SCHEDULE
TYP	TYPICAL

REV	DESCRIPTION OF REVISION	BY	DATE
1	ISSUED FOR CONSTRUCTION	JLN	04-01-10

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

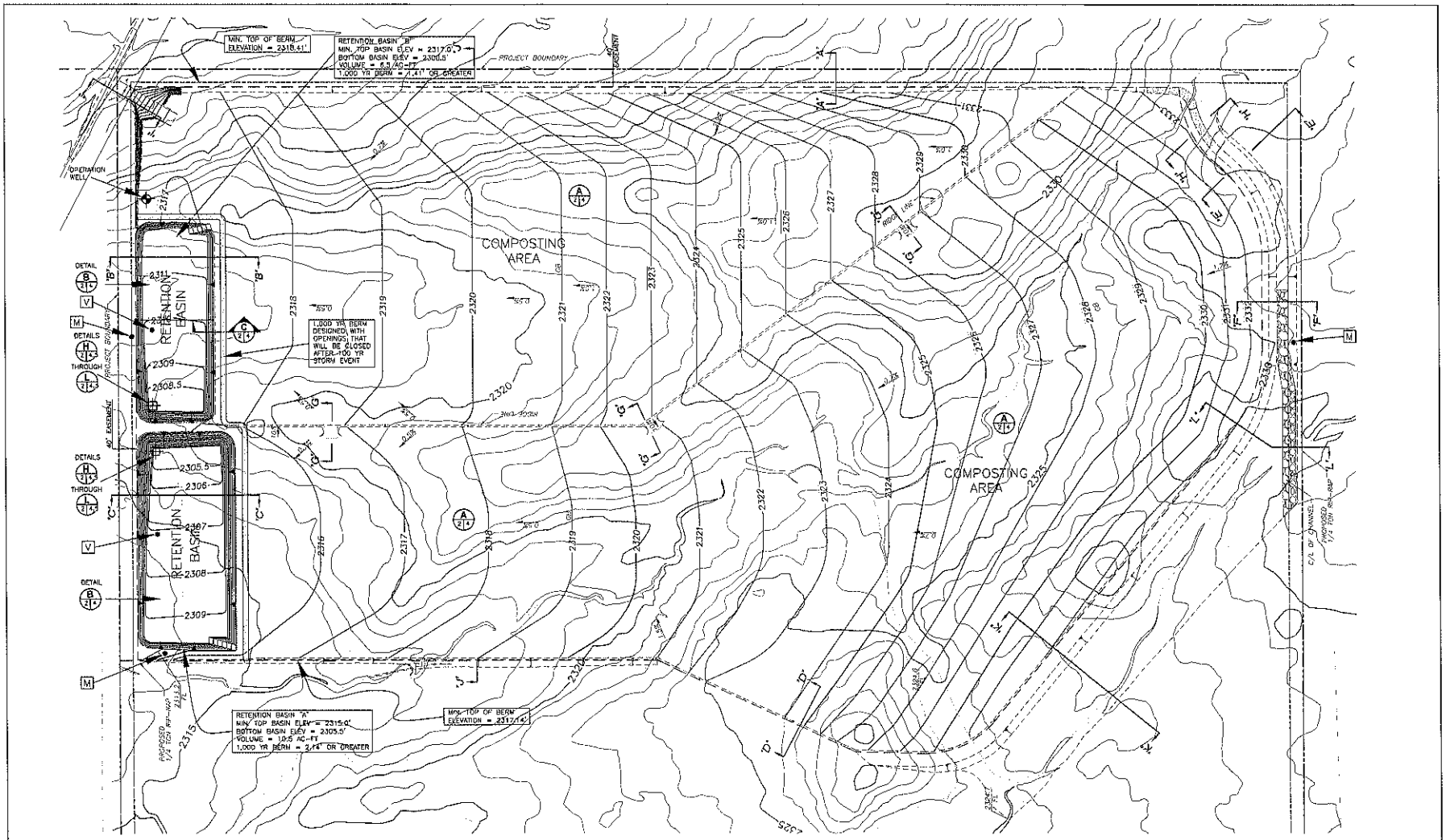
PROJECT	27657037.00100
DESIGNED	JLN
CHECKED	LDW
PROJECT MANAGER	DEM
DATE	04-01-10

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

TITLE SHEET

REVISION 1

SHEET NO. 1 of 6



REV	DESCRIPTION OF REVISION	BY	DATE
1			
2			
3			
4			
5			
A	ISSUED FOR CONSTRUCTION	JLH	04-01-10

GRAPHIC SCALE
100 50 0 50 100
1 inch = 100 feet

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

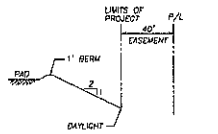
PROJECT	27857037.00100
DESIGNED	JLH
CHECKED	LDH
PROJECT MANAGER	DEM
DATE	04-01-10

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

GRADING PLAN

REVISION 1

SHEET NO. 2 of 6



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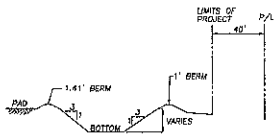

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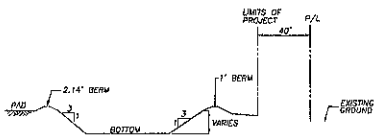

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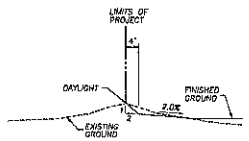

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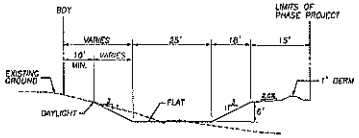

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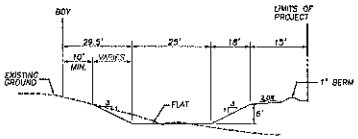

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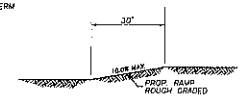

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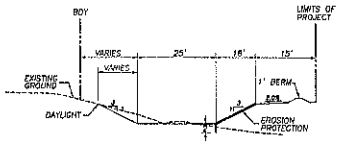

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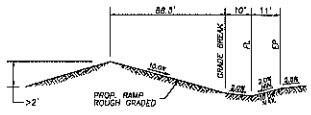

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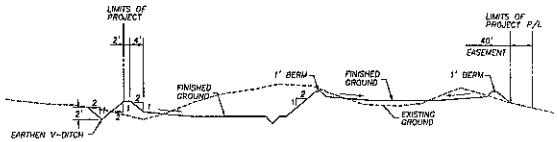

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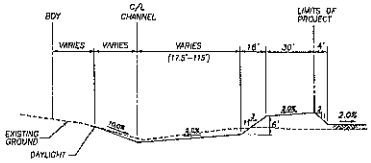

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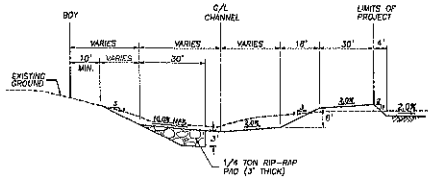

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1	ISSUED FOR CONSTRUCTION	JLN	04-01-10

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

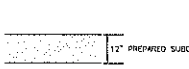
PROJECT	27657037.00100
DESIGNED	JLN
CHECKED	LDH
PROJECT MANAGER	DEN
DATE	

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

AEI CASC GRADING CROSS SECTIONS

REVISION 1

SHEET NO. 3 of 3



COMPOSTING AREA LINING SYSTEM
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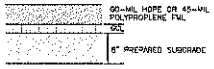

STORMWATER RETENTION BASIN LINING SYSTEM
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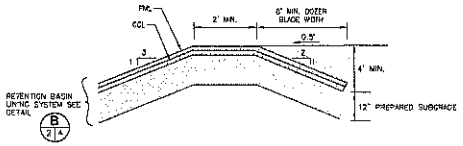

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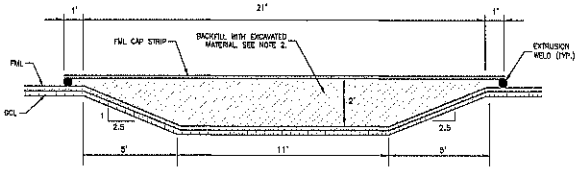

BASIN BOTTOM ANCHOR TRENCH
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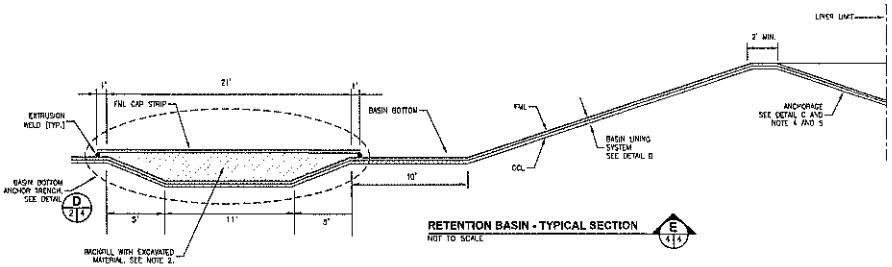

RETENTION BASIN - TYPICAL SECTION
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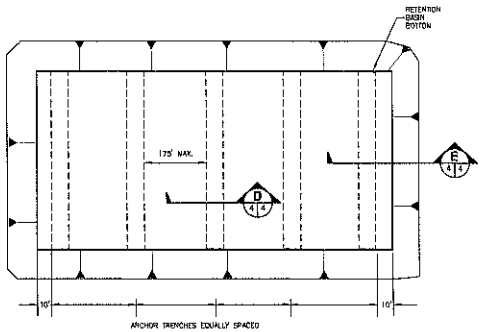

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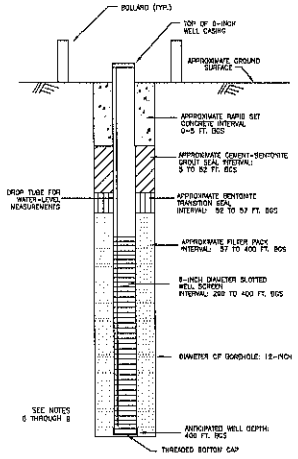


GROUNDWATER MONITORING WELL
NOT TO SCALE

NOTES:

1. EXISTING GROUND SURFACE IS BASED ON A SURVEY PREVIOUSLY PERFORMED BY OTHERS.
2. USE THE EXCAVATED MATERIAL TO CONSTRUCT THE BERMS AND AS BACKFILL ABOVE THE LINER ANCHORAGE. REMOVE MATERIALS THAT ARE GREATER THAN 3-INCHES OR THAT MAY DAMAGE THE GEOSYNTHETICS.
3. TOP OF BERM SHALL BE GRADED FLAT IN THE LONGITUDINAL AND 1% IN THE LATERAL DIRECTION, AWAY FROM THE INSIDE OF THE POND.
4. ANCHOR ALIGNMENT AND EDGES SHALL BE STRAIGHT AND SMOOTH.
5. EXTEND GEOMEMBRANE SEAM WELDS THROUGH THE ANCHOR TRENCH.
6. THIS WELL CONSTRUCTION DIAGRAM IS SCHEMATIC AND IS NOT TO SCALE.
7. WELL MAY BE DEEPER AND SCREEN LENGTHENED BASED ON GEOLOGY.
8. WELL GROUNDWATER MONITORING DESIGN IS BASED ON ENCOUNTERING GROUNDWATER AT AN APPROXIMATE DEPTH OF 300 FEET.
9. A WELL CONSTRUCTION WORKPLAN WILL BE SUBMITTED TO THE RWQCB PRIOR TO CONSTRUCTION FOR REVIEW AND APPROVAL.

REV	DESCRIPTION OF REVISION	BY	DATE
1	ISSUED FOR CONSTRUCTION	JLN	04-01-10

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

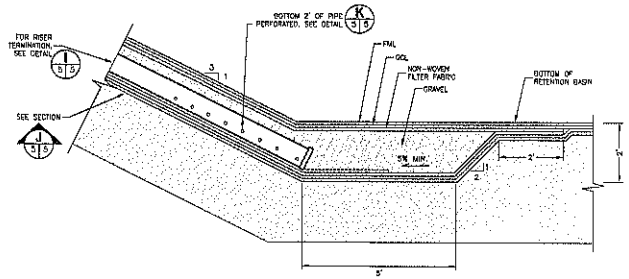
PROJECT	27537037.00100
DESIGNED	JLN
CHECKED	LDH
PROJECT MANAGER	DEM
DATE	04-01-10

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

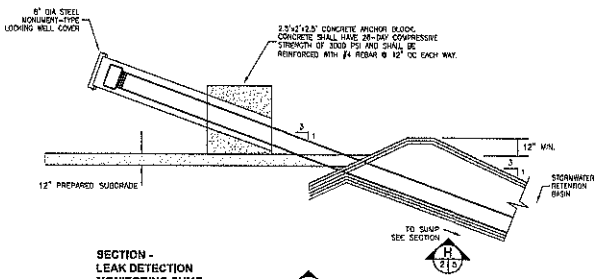
DETAILS AND SECTIONS

REVISION 1

SHEET NO. 4 of 6



SECTION - LEAK DETECTION MONITORING SUMP
NOT TO SCALE



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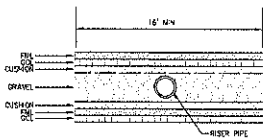
NOT TO SCALE



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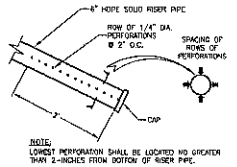

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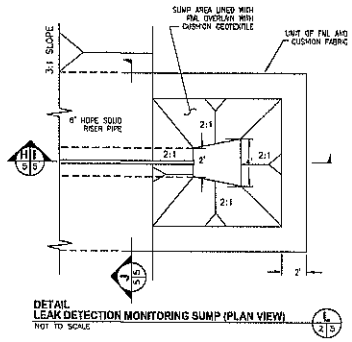


DETAIL LEAK DETECTION MONITORING SUMP (PLAN VIEW)
NOT TO SCALE

REV	DESCRIPTION OF REVISION	BY	DATE
2	ISSUED FOR CONSTRUCTION	JLN	04-01-10

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

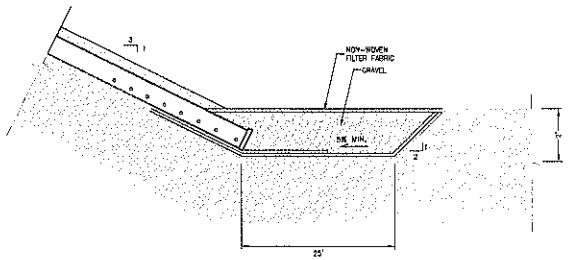
PROJECT	27657037.00100
DESIGNED	JLN
CHECKED	LDH
PROJECT MANAGER	DEN
DATE	04-01-10

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

DETAILS AND SECTIONS

REVISION 2

SHEET NO. 5 of 6



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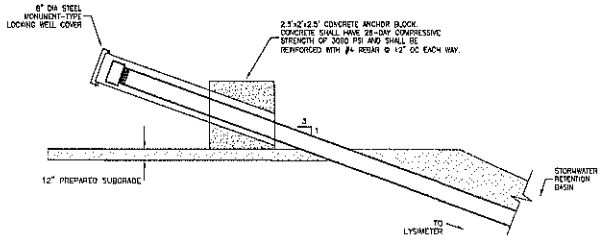

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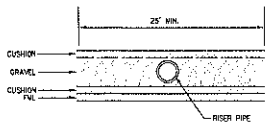

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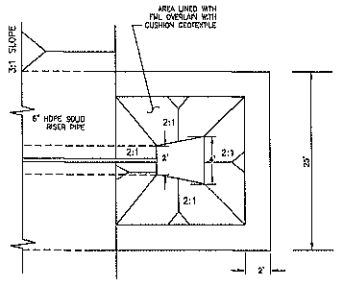

DETAIL LYSIMETER (PLAN VIEW)
NOT TO SCALE

REV	DESCRIPTION OF REVISION	BY	DATE
1	ISSUED FOR CONSTRUCTION	JLM	04-01-10

URS
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108

PROJECT	27657037.00100
DESIGNED	JLM
CHECKED	LDH
PROJECT MANAGER	DEM
DATE	04-01-10

HAWES COMPOSTING FACILITY
SAN BERNARDINO COUNTY, CA

DETAILS AND SECTIONS

REVISION 1

SHEET NO. 6 of 6

APPENDIX B

HYDROLOGY STUDY FOR THE 1,000-YEAR FLOOD EVENT

HAWES COMPOST FACILITY

SOUTHEAST ¼ OF SECTION 36, TOWNSHIP 10 NORTH AND RANGE 4 WEST
SAN BERNARDINO COUNTY, CALIFORNIA

PREPARED FOR:

NURSERY PRODUCTS
12277 APPLE VALLEY ROAD, SUITE 131
APPLE VALLEY, CA 92308

PREPARED BY:

AEI CASC CONSULTING

937 SOUTH VIA LATA, SUITE 500
COLTON, CA 92324
(909) 783-0101 • FAX (909) 783-0108

APRIL 8, 2010

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APPENDICES

EXHIBITS

I. PURPOSE AND SCOPE

The purpose of this study is to determine the 1,000-year/24-hour flood volume emanating from the on-site composting area for the Hawes Compost Facility in order to determine the required berm sizing around the composting area and retention ponds. The composting area is the area outside of the proposed retention basins and must contain the maximum flood volume of the 1,000-year, 24-hour storm event minus the 100-year, 24-hour storm event emanating from the facility. This computed maximum flood volume is regarded as the "net" flood volume. The 100-year, 24-hour storm volume will be allowed to discharge into the two retention basins including the 1,000-year/24-hour storm flow and volume that falls directly on the basins.

The scope of the study includes the following:

1. Determination of the 1,000-year/24-hour flood volume based upon the previous hydrology study for the site.
2. Determination of the berm sizing around the compost area and retention basins resulting from the 1,000-year/24-hour flood volume.
3. Preparation of the hydrology report including the hydrology maps.

II. PROJECT SITE AND DRAINAGE AREA OVERVIEW

The proposed Hawes Compost Facility is located in the southeast ¼ of Section 36, Township 10 North and Range 4 West. The project is located within the unincorporated area of San Bernardino County. Currently, the project site consists of desert valley area with sparse desert vegetation, draining in a northerly direction.

The proposed grading and site layout consists of two drainage areas (Composting Areas "A" and "B") and each area drains into a retention basin, Basin "A" and Basin "B". The site slopes gently from south to north (see Exhibit "A").

III. HYDROLOGY

The previous AEI-CASC hydrology report entitled, "Hydrology and On-site Retention Basin Sizing Study" dated April 21, 2008 (Reference 1) and the San Bernardino County Flood Control District (SBCFCD) Hydrology Manual, (Reference 2) were used to develop the hydrological parameters for the 1,000-year storm event. The Unit Hydrograph method was used for the analyses. Computations were performed using the UNSBC computer program developed by Civil Cadd/Civil Design.

The 1,000-year rainfall values used in this study were obtained by multiplying the 100-year rainfall values by 1.35 (Reference 3). The 100-year rainfall values were obtained from the previous report (Reference 1).

IV. FINDINGS

The hydrology analysis evaluated the 1,000-year/24-hour flood volume generated by the on-site areas tributary to composting areas "A" and "B". Table 1 tabulates the 1,000-year/24-hour flood volume and 100-year/24-hour flood volume from these drainage areas. The table also shows the "net" flood volume (i.e. 1,000-year flood volume minus the 100-year flood volume), which will be used to determine the sizing of the berms around the composting area and the retention basins. The proposed retention basins "A" and "B" will be sized to retain and store the tributary on-site 100-year/24-hour flood volumes including the 1,000-year/24-hour flow (and flood volume) that falls directly on the basins with a minimum of 2 feet of freeboard. The berms around the composting area will be sized to contain the "net" flood volume. Based upon the preliminary grading plans, the minimum berm elevation around composting areas "A" and "B" are 2317.14 and 2318.41, respectively (See Exhibit "A").

Table 1 – Hydrology Results

DRAINAGE AREA	1,000-YEAR/24-HOUR FLOOD VOLUME (AF)	100-YEAR/24-HOUR FLOOD VOLUME (AF)	NET FLOOD VOLUME (AF)
ON-SITE COMPOSTING AREA "A"	20.3	10.5	9.8
ON-SITE COMPOSTING AREA "B"	12.5	6.5	6.0

V. REFERENCES

1. "Hydrology and On-site Retention Basin Sizing Study", prepared by AEI-CASC Consulting, April 21, 2008.
2. San Bernardino County Flood Control District Hydrology Manual.
3. San Bernardino County Flood Control District's Detention Basin Design Criteria.

APPENDICES

APPENDIX "A": 1,000-YEAR UNIT HYDROGRAPH ANALYSIS FOR ON-SITE COMPOSTING AREA "A"

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/31/10

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

TRI-8 Builders - S/N 615

NURSERY PRODUCTS
UNIT HYDROGRAPH ANALYSIS FOR BASIN A
1000-YEAR 3-HOUR UNIT HYDROGRAPH ANALYSIS
FN:BASINA31000

Storm Event Year = 1000

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
44.50	1	1.01
Rainfall data for year 2		
44.50	6	0.94
Rainfall data for year 2		
44.50	24	1.35
Rainfall data for year 100		
44.50	1	1.62
Rainfall data for year 100		
44.50	6	2.43
Rainfall data for year 100		
44.50	24	4.05

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
91.0	98.2	44.50	1.000	0.036	0.900	0.032

Area-averaged adjusted loss rate Fm (In/Hr) = 0.032

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
40.05	0.900	91.0	98.2	0.18	0.962
4.45	0.100	98.0	98.0	0.20	0.958

Area-averaged catchment yield fraction, Y = 0.962
Area-averaged low loss fraction, Yb = 0.038
++
Watercourse length = 2437.00(Ft.)
Length from concentration point to centroid = 1222.00(Ft.)
Elevation difference along watercourse = 18.60(Ft.)
Mannings friction factor along watercourse = 0.030
Watershed area = 44.50(Ac.)
Catchment Lag time = 0.152 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 54.6514
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.032(In/Hr)
Average low loss rate fraction (Yb) = 0.038 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 1.057(In)
Computed peak 30-minute rainfall = 1.809(In)
Specified peak 1-hour rainfall = 2.228(In)
Computed peak 3-hour rainfall = 2.837(In)
Specified peak 6-hour rainfall = 3.304(In)
Specified peak 24-hour rainfall = 5.639(In)

Rainfall depth area reduction factors:
Using a total area of 44.50(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 1.055(In)
30-minute factor = 0.998 Adjusted rainfall = 1.806(In)
1-hour factor = 0.998 Adjusted rainfall = 2.223(In)
3-hour factor = 1.000 Adjusted rainfall = 2.836(In)
6-hour factor = 1.000 Adjusted rainfall = 3.304(In)
24-hour factor = 1.000 Adjusted rainfall = 5.639(In)

U n i t H y d r o g r a p h

++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 538.17 (CFS))

1	4.646	25.001
2	35.818	167.761
3	64.402	153.832
4	76.654	65.934
5	83.792	38.418
6	88.603	25.892
7	91.813	17.276
8	94.208	12.888
9	95.966	9.459
10	97.241	6.859
11	98.038	4.289
12	98.642	3.252
13	99.292	3.498
14	99.736	2.391
15	100.000	1.420

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	1.0548	1.0548
2	1.2986	0.2438
3	1.4665	0.1680
4	1.5987	0.1322
5	1.7094	0.1107
6	1.8055	0.0961
7	1.8910	0.0855
8	1.9683	0.0773
9	2.0391	0.0708
10	2.1045	0.0655
11	2.1656	0.0610
12	2.2229	0.0573
13	2.2627	0.0398
14	2.3001	0.0375
15	2.3356	0.0355
16	2.3692	0.0337
17	2.4013	0.0321
18	2.4319	0.0306
19	2.4613	0.0293
20	2.4894	0.0281
21	2.5165	0.0271
22	2.5426	0.0261
23	2.5678	0.0252
24	2.5921	0.0243
25	2.6157	0.0236
26	2.6385	0.0228
27	2.6607	0.0222
28	2.6822	0.0215
29	2.7032	0.0209
30	2.7236	0.0204
31	2.7434	0.0199
32	2.7628	0.0194
33	2.7817	0.0189
34	2.8002	0.0185
35	2.8183	0.0181
36	2.8359	0.0177

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0177	0.0007	0.0170
2	0.0181	0.0007	0.0174
3	0.0189	0.0007	0.0182
4	0.0194	0.0007	0.0186
5	0.0204	0.0008	0.0196
6	0.0209	0.0008	0.0201
7	0.0222	0.0009	0.0213
8	0.0228	0.0009	0.0220
9	0.0243	0.0009	0.0234
10	0.0252	0.0010	0.0242
11	0.0271	0.0010	0.0260
12	0.0281	0.0011	0.0271
13	0.0306	0.0012	0.0294
14	0.0321	0.0012	0.0308
15	0.0355	0.0014	0.0341
16	0.0375	0.0014	0.0360
17	0.0573	0.0022	0.0551
18	0.0610	0.0023	0.0587
19	0.0708	0.0027	0.0681
20	0.0773	0.0027	0.0746
21	0.0961	0.0027	0.0934
22	0.1107	0.0027	0.1080
23	0.1680	0.0027	0.1653
24	0.2438	0.0027	0.2411
25	1.0548	0.0027	1.0521
26	0.1322	0.0027	0.1295
27	0.0855	0.0027	0.0828
28	0.0655	0.0025	0.0630
29	0.0398	0.0015	0.0383
30	0.0337	0.0013	0.0324
31	0.0293	0.0011	0.0282
32	0.0261	0.0010	0.0251
33	0.0236	0.0009	0.0227
34	0.0215	0.0008	0.0207
35	0.0199	0.0008	0.0191
36	0.0185	0.0007	0.0178

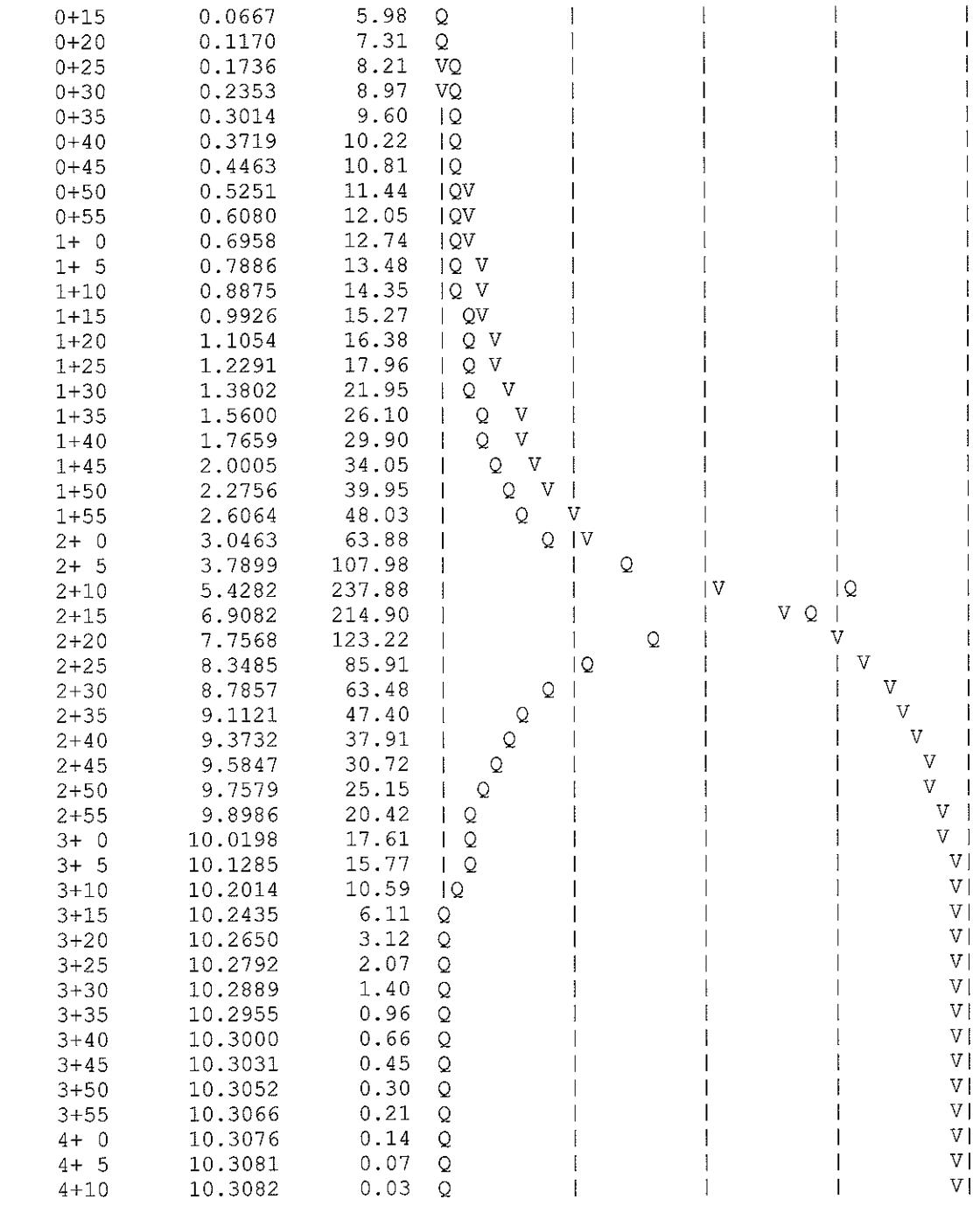
Total soil rain loss = 0.05(In)
Total effective rainfall = 2.78(In)
Peak flow rate in flood hydrograph = 237.88(CFS)

++

3 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	75.0	150.0	225.0	300.0
0+ 5	0.0029	0.42	Q |	|	|	|	|
0+10	0.0255	3.28	Q |	|	|	|	|



U n i t H y d r o g r a p h A n a l y s i s

Study date 03/31/10

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

TRI-8 Builders - S/N 615

NURSERY PRODUCTS
UNIT HYDROGRAPH ANALYSIS FOR BASIN A
1000-YEAR 6-HOUR UNIT HYDROGRAPH ANALYSIS
FN:BASINA61000

Storm Event Year = 1000

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

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Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
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Computed peak 5-minute rainfall = 1.057(In)
Computed peak 30-minute rainfall = 1.809(In)
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Computed peak 3-hour rainfall = 2.837(In)
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1-hour factor = 0.998	Adjusted rainfall = 2.223(In)
3-hour factor = 1.000	Adjusted rainfall = 2.836(In)
6-hour factor = 1.000	Adjusted rainfall = 3.304(In)
24-hour factor = 1.000	Adjusted rainfall = 5.639(In)

U n i t H y d r o g r a p h

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7	1.8910	0.0855
8	1.9683	0.0773
9	2.0391	0.0708
10	2.1045	0.0655
11	2.1656	0.0610
12	2.2229	0.0573
13	2.2627	0.0398
14	2.3001	0.0375
15	2.3356	0.0355
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17	2.4013	0.0321
18	2.4319	0.0306
19	2.4613	0.0293
20	2.4894	0.0281
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23	2.5678	0.0252
24	2.5921	0.0243
25	2.6157	0.0236
26	2.6385	0.0228
27	2.6607	0.0222
28	2.6822	0.0215
29	2.7032	0.0209
30	2.7236	0.0204
31	2.7434	0.0199
32	2.7628	0.0194
33	2.7817	0.0189
34	2.8002	0.0185
35	2.8183	0.0181
36	2.8359	0.0177
37	2.8531	0.0172

38	2.8699	0.0168
39	2.8863	0.0165
40	2.9025	0.0161
41	2.9183	0.0158
42	2.9338	0.0155
43	2.9491	0.0152
44	2.9640	0.0150
45	2.9788	0.0147
46	2.9932	0.0145
47	3.0074	0.0142
48	3.0214	0.0140
49	3.0351	0.0138
50	3.0487	0.0135
51	3.0620	0.0133
52	3.0751	0.0131
53	3.0881	0.0129
54	3.1008	0.0127
55	3.1133	0.0126
56	3.1257	0.0124
57	3.1379	0.0122
58	3.1500	0.0120
59	3.1619	0.0119
60	3.1736	0.0117
61	3.1852	0.0116
62	3.1966	0.0114
63	3.2079	0.0113
64	3.2190	0.0111
65	3.2300	0.0110
66	3.2409	0.0109
67	3.2516	0.0108
68	3.2623	0.0106
69	3.2728	0.0105
70	3.2832	0.0104
71	3.2934	0.0103
72	3.3036	0.0102

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0102	0.0004	0.0098
2	0.0103	0.0004	0.0099
3	0.0105	0.0004	0.0101
4	0.0106	0.0004	0.0102
5	0.0109	0.0004	0.0105
6	0.0110	0.0004	0.0106
7	0.0113	0.0004	0.0109
8	0.0114	0.0004	0.0110
9	0.0117	0.0005	0.0113
10	0.0119	0.0005	0.0114
11	0.0122	0.0005	0.0117
12	0.0124	0.0005	0.0119
13	0.0127	0.0005	0.0122
14	0.0129	0.0005	0.0124
15	0.0133	0.0005	0.0128
16	0.0135	0.0005	0.0130
17	0.0140	0.0005	0.0134

18	0.0142	0.0005	0.0137
19	0.0147	0.0006	0.0141
20	0.0150	0.0006	0.0144
21	0.0155	0.0006	0.0149
22	0.0158	0.0006	0.0152
23	0.0165	0.0006	0.0158
24	0.0168	0.0006	0.0162
25	0.0177	0.0007	0.0170
26	0.0181	0.0007	0.0174
27	0.0189	0.0007	0.0182
28	0.0194	0.0007	0.0186
29	0.0204	0.0008	0.0196
30	0.0209	0.0008	0.0201
31	0.0222	0.0009	0.0213
32	0.0228	0.0009	0.0220
33	0.0243	0.0009	0.0234
34	0.0252	0.0010	0.0242
35	0.0271	0.0010	0.0260
36	0.0281	0.0011	0.0271
37	0.0306	0.0012	0.0294
38	0.0321	0.0012	0.0308
39	0.0355	0.0014	0.0341
40	0.0375	0.0014	0.0360
41	0.0573	0.0022	0.0551
42	0.0610	0.0023	0.0587
43	0.0708	0.0027	0.0681
44	0.0773	0.0027	0.0746
45	0.0961	0.0027	0.0934
46	0.1107	0.0027	0.1080
47	0.1680	0.0027	0.1653
48	0.2438	0.0027	0.2411
49	1.0548	0.0027	1.0521
50	0.1322	0.0027	0.1295
51	0.0855	0.0027	0.0828
52	0.0655	0.0025	0.0630
53	0.0398	0.0015	0.0383
54	0.0337	0.0013	0.0324
55	0.0293	0.0011	0.0282
56	0.0261	0.0010	0.0251
57	0.0236	0.0009	0.0227
58	0.0215	0.0008	0.0207
59	0.0199	0.0008	0.0191
60	0.0185	0.0007	0.0178
61	0.0172	0.0007	0.0165
62	0.0161	0.0006	0.0155
63	0.0152	0.0006	0.0147
64	0.0145	0.0006	0.0139
65	0.0138	0.0005	0.0132
66	0.0131	0.0005	0.0126
67	0.0126	0.0005	0.0121
68	0.0120	0.0005	0.0116
69	0.0116	0.0004	0.0111
70	0.0111	0.0004	0.0107
71	0.0108	0.0004	0.0103
72	0.0104	0.0004	0.0100

Total soil rain loss = 0.07(In)
Total effective rainfall = 3.23(In)
Peak flow rate in flood hydrograph = 237.88(CFS)

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6 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	75.0	150.0	225.0	300.0
0+ 5	0.0017	0.24	Q				
0+10	0.0147	1.89	Q				
0+15	0.0382	3.41	Q				
0+20	0.0665	4.11	Q				
0+25	0.0979	4.56	Q				
0+30	0.1316	4.89	Q				
0+35	0.1670	5.14	Q				
0+40	0.2039	5.36	Q				
0+45	0.2422	5.55	Q				
0+50	0.2816	5.73	Q				
0+55	0.3221	5.88	QV				
1+ 0	0.3636	6.03	QV				
1+ 5	0.4062	6.18	QV				
1+10	0.4498	6.34	QV				
1+15	0.4945	6.48	QV				
1+20	0.5402	6.63	QV				
1+25	0.5868	6.78	QV				
1+30	0.6346	6.94	Q V				
1+35	0.6835	7.10	Q V				
1+40	0.7337	7.28	Q V				
1+45	0.7851	7.47	Q V				
1+50	0.8379	7.67	QV				
1+55	0.8922	7.87	QV				
2+ 0	0.9480	8.10	Q V				
2+ 5	1.0054	8.34	Q V				
2+10	1.0648	8.62	Q V				
2+15	1.1262	8.91	Q V				
2+20	1.1897	9.22	Q V				
2+25	1.2554	9.54	Q V				
2+30	1.3236	9.90	Q V				
2+35	1.3944	10.27	Q V				
2+40	1.4681	10.70	Q V				
2+45	1.5448	11.15	Q V				
2+50	1.6252	11.67	Q V				
2+55	1.7093	12.21	Q V				
3+ 0	1.7978	12.86	Q V				
3+ 5	1.8911	13.54	Q V				
3+10	1.9901	14.37	Q V				
3+15	2.0952	15.27	Q V				
3+20	2.2080	16.38	Q V				
3+25	2.3317	17.96	Q V				
3+30	2.4829	21.95	Q V				
3+35	2.6626	26.10	Q V				
3+40	2.8686	29.90	Q V