FINAL INTERIM REMEDIAL ACTION WORK PLAN FOR THE PASCO ZONE B RCRA CAP

Pasco, Washington

May 12, 2010

Submitted to:

Washington Department of Ecology
Eastern Regional Office
4601 N. Monroe Street
Spokane, WA 99205-1295

Submitted on behalf of:

Bayer CropScience
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Submitted by:

AMEC Earth & Environmental, Inc.
7376 SW Durham Road
Portland, OR 97224

4-61M-107051/Phase 1

May 12, 2010

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Mr. Chuck Gruenenfelder, LG/LHG
Washington Department of Ecology
Eastern Regional Office
4601 N. Monroe Street
Spokane, Washington 99205-1295

Dear Mr. Gruenenfelder:

Re: Final Interim Remedial Action Work Plan for the Pasco Zone B RCRA Cap
Pasco Landfill Zone B
Pasco, Washington

On behalf of Bayer CropScience (BCS), AMEC Earth & Environmental, Inc. (AMEC) is submitting this Final Interim Remedial Action Work Plan for the Pasco Zone B RCRA Cap (Final Zone B RCRA Cap Work Plan) to the Washington Department of Ecology (Ecology) for review and approval. This remedial action is being conducted under Enforcement Order No. DE 00TCPER-1325 for the Pasco Landfill (Ecology, 2000). Three copies of this document also will be submitted by mail.

The original work plan, titled "Draft Interim Remedial Action Work Plan and Preliminary Design", was submitted to Ecology on November 1, 2006 (AMEC, 2006a). Based on a meeting with Ecology on November 7, 2006, BCS submitted to Ecology the "Addendum 1 to Draft Interim Remedial Action Work Plan" on November 28, 2006 (AMEC, 2006b), which addressed post-excavation soil sampling. On December 5, 2006, BCS received Ecology comments to the original work plan and the addendum (Ecology, 2006). BCS' responses to Ecology's December 5, 2006, comments were included in the Draft Final Interim Remedial Action Work Plan submitted to Ecology on December 24, 2009 (AMEC, 2009a). On March 16, 2010, BCS received Ecology comments to the draft final work plan (Ecology, 2010). BCS' responses to Ecology's March 16, 2010, comments were included in this cover letter.

The following appendices are included in the Final Zone B RCRA Cap Work Plan for review by Ecology:

- Appendix A-1 - Design Drawings
- Appendix A-2 - Interim Remedial Action Technical Specifications
- Appendix B - Cap Inspection and Maintenance Plan
- Appendix C - Construction Quality Assurance Plan
- Appendix D - Engineering Calculations

Not included with this package to Ecology is the project-specific Health and Safety Plan for BCS, AMEC, Ecology, and other visitors to the site during construction. The Health and Safety

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Plan will be submitted to Ecology for their records prior to award of the construction contract. The construction contractor will be required to provide a project-specific Health and Safety Plan for itself and all of its subcontractors prior to mobilization to the site.

Ecology's comments from March 16, 2010, to the Draft Final Interim Remedial Action Work Plan and Preliminary Design dated December 24, 2009 (AMEC, 2009a) are presented below in italics, along with BCS' responses. BCS acknowledges that in the March 16, 2010 letter, Ecology commented on items in the draft final work plan (AMEC, 2009a) that it did not comment on from the original November 2006 work plan and addendum (Ecology, 2006; AMEC, 2006a and 2006b). BCS is working diligently to complete the Pasco Zone B Cap prior to the end of fall 2010, and unless Ecology has comments on the revised content in this Final Zone B RCRA Cap Work Plan (as described below), BCS respectfully requests that Ecology withhold from commenting on work plan contents it previously reviewed.

Ecology Comment 1:

1. *Work Plan, Page 3, Part 2.0:*
   The first sentence of this section indicates that "this proposed RA is to enhance the existing interim Zone B cover ...." The remedial objective is more than just to enhance the temporary cover which currently is in place; rather, installation of a RCRA Subtitle C Landfill Capping System is intended to serve as an interim remedial action pending the determination of a final site remedy for Zone B and the rest of the Pasco landfill Site. Please modify the language in this sentence.

BCS Response:

BCS has modified the text accordingly.

Ecology Comment 2:

2. *Work Plan, Page 3, Part 2.0, Number 3:*
   Please modify this sentence to read "Provide engineering and institutional controls to limit access to Zone B."

BCS Response:

BCS has modified the text accordingly.

Ecology Comment 3:

3. *Work Plan, Page 4, Part 3.0, Sixth Bullet:*
   Please define "easily obtainable materials" within the text.

BCS Response:

BCS has modified the text to read the following:

Development of a design that utilizes standardized specifications and easily obtainable (i.e., local, "off-the-shelf") materials; and

Ecology Comment 4:

4. *Work Plan, Page 4, Part 5.1:*
   As noted in Ecology Comment 5 (December 5, 2006 comment letter to BCS), soils adjacent to the Zone B cell contain K-listed wastes (K043 waste designation). K043 waste is subject to federal land ban restrictions and to specific requirements related to handling and disposal. Contaminated soils adjacent to the Zone B cell are covered under the Area of Contamination concept which allows for consolidation beneath the proposed interim RCRA compliant cover system. Please modify the first sentence of this section to say "BCS will excavate and relocate approximately 1,000 CY of contaminated shallow soil located immediate adjacent to the Zone B cell, consistent with Area of Contamination allowances."

BCS Response:

BCS has modified the text accordingly.

Ecology Comment 5:

5. *Work Plan, Page 5, Part 5.1, Second Paragraph:*
   Please add discussion relating to the staging and backfill borrow area, i.e. how much material will be borrowed, how will the borrow area be graded in a final condition, will hydroseeding occur, etc.

BCS Response:

BCS will use certified-clean imported fill material for all fill needs. BCS has added a statement immediately following Section 5.1, Paragraph 2, which states the following:

All excavations will be backfilled to approximate original grades using certified-clean, imported fill. Fill outside of the landfill footprint will be compacted to 85% maximum dry density; fill inside the landfill footprint will be compacted to 90% maximum dry density, as determined by ASTM D698. Following earthwork activities, all areas shall be immediately hydroseeded with native grasses to prevent soil losses by wind and precipitation.

Ecology Comment 6:

6. *Work Plan, Page 5, Part 5.2, First Bullet:*
   This bullet states that the topsoil, sand, and geosynthetic cover system acts as an infiltration barrier. The geomembrane and GCL act as the primary low permeable layers, consistent with the descriptions provided in Sections 4.3 and 4.4 of the Construction Quality Assurance Plan (Appendix C). Please revise this bullet statement accordingly.

BCS Response:

BCS has modified the text accordingly.

Ecology Comment 7:

7. *Work Plan, Page 6, Part 5.2.1,"Drainage collection system":*
   The last sentence of this paragraph indicates that "The outlet flow will be distributed on erosion protection rock and will dissipate through infiltration and evaporation consistent with current and surrounding stormwater runoff patterns." Please provide an engineering design for the downstream "infiltration area" or a more detailed justification (with detailed calculations) as to why this would not be necessary. Ecology is concerned that the current design of piping and releasing the stormwater just beyond the edge of the cover system could potentially cause downslope erosion during larger storm events. The drainage outlets currently are positioned directly above an area where the uppermost topsoil layer will be removed. There also is concern over possible contaminant mobilization implications caused by localized ponding or infiltration immediately adjacent to the south end of the capped cell.

BCS Response:

Using the Stormwater Management Manual for Eastern Washington (SMMEW) as guidance, specifically Chapter 4.5, AMEC calculated the run-off volume for a 2-year, 24-hour and a 25-year, 24-hour storm event. The estimated initial abstraction volume of the Pasco Zone B Cap is approximately 48,300 gallons. In the event of a 2-year, 24-hour storm event or a 25-year, 24-hour storm event, the estimated runoff volumes are 8,017 gallons and 4,875 gallons, respectively. The calculations are provided in Appendix D.

Based on these calculations, BCS is confident that any water which may infiltrate through the landfill cap, above the impervious layers, and discharge through the discharge pipes, would be minimal and of insufficient velocity to create any erosional issues.

Also, please note that BCS will backfill the adjacent excavation area and immediately re-vegetate by hydroseeding to further avoid any direct precipitation causing erosion.

Ecology Comment 8:

8. *Work Plan, Page 6, Part 5.2.1, "Vegetative Layer":*
   Please indicate the borrow location for the "2-foot thick layer of imported topsoil."

BCS Response:

As stated, the topsoil shall be imported, not borrowed from on-site. A statement in specification Section 02801 – DRAINAGE AND VEGATATIVE LAYERS contains a statement indicating that all imported material will be required to be demonstrated clean by the Contractor.

Ecology Comment 9:

9. Work Plan, Page 9, Part 6.4.5:
Please indicate what the specification will be for soil compaction for the excavated soils placed on the existing 12-mil cover.

BCS Response:

BCS has added a statement indicating that excavated soil placed on the landfill shall be compacted to 90% maximum dry density as determined by ASTM D698. Specification Section 02200 – EARTHWORK will state all compaction requirements.

Ecology Comment 10:

10. Work Plan, Page 10, Part 6.4.6:
Please delete the second sentence of the second paragraph and clearly indicate what the specification will be for soil compaction for the subgrade below the GCL and Geomembrane (see comment 9).

BCS Response:

Please refer to BCS' response to Comment 9. The second sentence of the second paragraph has been modified to state the following:

Soil will be compacted to 90% maximum dry density as determined by ASTM D698.

Ecology Comment 11:

11. Work Plan, Page 10, Part 6.4.6:
Within the last paragraph of this section, please indicate what the specification will be for soil compaction for the vegetative layer.

BCS Response:

Please refer to BCS' response to Comment 5. BCS has added the following as the last sentence of this section:

The vegetative layer will be compacted to 90% maximum dry density as determined by ASTM D698.

Ecology Comment 12:

12. Work Plan, Page 10, Part 6.4.7:
The first sentence indicates that "isopluvial rainfall intensity maps published by the National Oceanic and Atmospheric Administration and the rational method were used to calculate design stormwater runoff volumes." According to the design in Appendix D, the source of the rainfall intensity value was the Stormwater Management Manual for Eastern Washington and not isopluvial maps from NOAA. Please modify accordingly.

BCS Response:

BCS has revised this section to reflect the method and calculations presented in BCS' response to Comment 7.

Ecology Comment 13:

13. Work Plan, Page 11, Part 6.4.7:
The third sentence implies that runoff observations were made during a 50-year storm event at or near the site. Is this truly the case? If not, please remove the sentence.

BCS Response:

BCS has revised this section to reflect the method and calculations presented in BCS' response to Comment 7.

Ecology Comment 14:

14. Work Plan, Page 14, Part 8.2, "Project Schedule":
Within the last sentence of this section, please define "significant delays or changes."

BCS Response:

BCS has added the following sentence to the end of the paragraph:

> *"Significant delays" are defined by delays to the project schedule that result in a change in the Contract Completion date.*

Ecology Comment 15:

15. Work Plan, Page 15, Part 9.0:
The second sentence of the third paragraph indicates "Defects in the cap that are noted during inspections will be reported to management for repair coordination." Please indicate within this sentence specifically who management is. In addition, please modify the text to indicate that Ecology will be notified in advance of completing any major cover system repair actions which are indicated in response to routine inspections.

BCS Response:

BCS has replaced "management" with "the Owner and/or Engineer", as well as included the aforementioned Ecology notification.

Ecology Comment 16:

16. Work Plan, Page 16, Part 10.1:
Within this section, please indicate which specific constituents or air quality parameters will be monitored.

BCS Response:

BCS has modified the third sentence as follows:

> *The air monitoring plan will specify the parameters to be monitored, the monitoring methods, the frequency of readings, and the equipment used for monitoring. BCS plans to monitor dust particulates in the air during cap implementation, as well as air temperature and estimated wind velocity. Periodic watering will be used to control dust emissions as needed.*

Ecology Comment 17:

17. Work Plan, Page 16, Part 11.0
Please modify the anticipated implementation dates in accordance with the current schedule.

BCS Response:

BCS has modified the schedule accordingly.

Ecology Comment 18:

18. Work Plan, Page 16, Part 12.0:
Please change the WAC reference in the second sentence from 173-340-400 (7) to 173-340-400.

BCS Response:

BCS has modified the text accordingly.

Ecology Comment 19:

19. Work Plan, Appendix A-l, Sheet 2 of 5:
Please elaborate on the well regulations and the specific method that will be executed to decommission the monitoring well (EE4) near the center of Cell B. This comment also applies to Appendix A-2, Section 02600, Part 3.0. See also comment no. 4 regarding waste management considerations associated with K043 wastes.

BCS Response:

BCS has modified the text on Appendix A-1, Sheet 2 of 5, and in Part 3.0 of Appendix A-2, Section 02600 to indicate that well EE-4 will be decommissioned per WAC 173-160-460 (20) (a) by filing the casing from the bottom of the well to the land surface with neat cement grout. WAC 173-160-460 (20) (a) will be followed because well EE-4 was constructed with a 2-inch-diameter inside casing. This method of decommissioning will also be the most appropriate in light of the placement of excavated soils associated with K043 wastes on the existing temporary cap.

Ecology Comment 20:

20. Work Plan, Appendix A-I, Sheet 3 of 5:
The "control point table" appears to have erroneous elevations for points C, D, and E. Please correct the table with the proper elevations.

BCS Response:

BCS has corrected the control point table; specifically, points C, D, and E have been corrected.

Ecology Comment 21:

21. Work Plan, Appendix A-I, Sheet 3 of 5:
The dashed blue lines representing the 6" perforated drainage pipe indicate that they change flow direction at the "top of cap side slope" on the East and West sides of the cap. Is this true, or will the perforated pipe angle at this location to maintain grade out to the edge of the cover? Please modify accordingly.

BCS Response:

As indicated in Note 1 on Appendix A-I, Sheet 3 of 5, all perforated pipes will slope to the middle collection (non-perforated) pipes, with pipes shown drawn from the edge of the cap to the center. Therefore, no modification is necessary.

Ecology Comment 22:

22. Work Plan, Appendix A-I, Sheet 3 of 5:
Please indicate where hydroseeding will occur on the project. This can be done in a note on the plan sheet or in the specifications (section 02940 of Appendix A-2). Please include any cleared and grubbed areas within the "surface soil excavation area" and the "back fill borrow area" in the area to be hydroseeded.

BCS Response:

Hydoseeding will occur in the soil excavation area and on the vegetative layer of the completed cap. Section 02940 of Appendix A-2 has been modified accordingly. The reference to “borrow area” has been removed from applicable Sheets 1 of 5 and 2 of 5 in Appendix A-I.

Ecology Comment 23:

23. Work Plan, Appendix A-2, Section 02802, Part 3.0, Section 3.1:
Please add to the specification that the subgrade below the GCL will be prepared (at minimum) in accordance with the GCL manufacturer's instructions.

BCS Response:

BCS has modified the specification accordingly.

Ecology Comment 24:

24. Work Plan, Appendix B:
Please provide a discussion of inspection and maintenance requirements for a stormwater infiltration facility, if applicable (see also comment no. 7).

BCS Response:

Please see response to Ecology Comment 7.

Ecology Comment 25:

25. Work Plan, Appendix D:
Please describe how the area (A) input for the rational method was calculated. When scaling Sheet 3 of 5 in Appendix A-1, it appears that the area is closer to 0.57 acres.

BCS Response:

BCS has revised Appendix D calculations to reflect the runoff for a 2-year, 24-hour storm event and a 25-year, 24-hour storm event, as described in the response to Comment 7. A Zone B area of 0.57 acres was used in the calculations.

Ecology Comment 26:

26. Work Plan, Appendix D:
Please describe how the runoff coefficient (C) was determined from table 4.7.1. Please take note that this site would fall in the Rolling (2-10% slopes) column, and that an increase of 20% is required when applying the values in that table to a calculation that determines the 50-year design flow (See section 4.7.1 of the SMMEW, 2004).

BCS Response:

Please see the response to Comment 25.

If you have any questions, please call Roger Gresh at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

Christopher R. Poulsen, P.E.
Associate Engineer

Roger T. Gresh, P.G.
Project Manager

Attachments

CP/lp

c: R. Lockemer, BCS
G. Goodridge, BCS
J. Benedict, CHBH&L
T. Morin, EPI
R. DuBey, IWAG
C.S. Trueblood, Kirkpatrick & Lockhart Preston

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1.0 INTRODUCTION

This document presents the Final Interim Remedial Action Work Plan for the Pasco Zone B Resource Conservation and Recovery Act (RCRA) Cap (Zone B RCRA Cap Work Plan) for the installation of a RCRA Subtitle C Landfill Capping System (Cap) at Zone B the Pasco Landfill in Pasco, Washington (Figure 1). This remedial action (RA) is being conducted under Enforcement Order No. DE 00TCPER-1325 for the Pasco Landfill (Ecology, 2000). The Construction Drawings and Specifications, Cap Inspection and Maintenance Plan, Construction Quality Assurance Plan, and Engineering Calculations are included in Appendices A through D, respectively. On behalf of Bayer CropScience (BCS), AMEC Earth & Environmental, Inc. (AMEC), the Engineer for this RA, is submitting this Zone B RCRA Cap Work Plan to the Washington Department of Ecology (Ecology) for review and approval

The *Superfund/Hazardous Waste Cleanup Memorandum of Agreement* (2000) defines Ecology as the lead agency for the Pasco Landfill Site. Therefore, cleanup actions will be conducted under the authority of the Washington Model Toxics Control Act (MTCA), Chapter 70.105D RCW and accompanying regulations, Chapter 173-340 WAC.

This Zone B RCRA Cap Work Plan and the associated design plans were developed utilizing the *Remedial Design/Remedial Action (RD/RA) Handbook* (EPA, 1995) as a guidance document. Although the handbook was written for Federal-lead sites where the Superfund Trust is utilized to finance the RD/RAs that are prescribed in Records of Decision, the Engineer considered the procedures and terminology substantively applicable to the RA.

1.1 Site Location

The Pasco Landfill Site (Site) encompasses approximately 200 acres and is located approximately 1.5 miles northeast of the city of Pasco in Franklin County, Washington. Along with the surrounding areas, the Site is zoned for agricultural and commercial use and divided into five areas or cells (Zones A through E) based on accepted waste designations. The actual waste cells are named by their zone letter. In this document the term “Zone B” refers in general to the BCS drum disposal area. The specific footprint where the drums were disposed of will be referred to as the “cell”. Zone B is located about 1,200 feet east of the Municipal Landfill Access Road and about 600 feet north of the existing transfer station.

1.2 Project Background

The Site originally operated as an open burning facility from 1958 through 1971. After 1971, the Site operated as a municipal landfill and accepted various bulk liquids, septic

tank wastes, sewage sludges, and animal fat emulsions. The Site began accepting industrial waste in 1972, which was reported to be primarily bulk sludges and drummed wastes. The acceptance of industrial waste was terminated in December of 1974.

In 1984, the Site was investigated as part of the United States Environmental Protection Agency's (EPA) nationwide dioxin investigation. No dioxin contamination or organic contaminants were detected in groundwater; however, during further investigations in 1985 volatile organic compounds (VOCs) were detected in groundwater. The Site was added to the National Priority List in 1990. Phase I of the remedial investigation (RI) was completed in 1994. Phase II of the RI activities began in 1995. In the summer of 1995, VOCs were found in off-site groundwater, which prompted an expanded off-site investigation to identify impacted residential wells, if any. Ongoing quarterly groundwater monitoring continues to indicate that there are no impacts to the groundwater from the Zone B herbicide wastes.

Interim RAs at the Site began in 1996. In March 2002, URS Corporation and Philip Services Corporation (PSC) completed an interim action within Zone B, as documented in the *Interim Action Completion Report Zone B Removal* (URS, 2002). Generally, the work consisted of the excavation and off-site incineration and disposal of approximately 5,500 cubic yards (CY) of drummed herbicide production wastes and impacted soils. Following excavation, confirmatory samples were collected from the floor of the cell. Upon completion of confirmation sampling, the cell was filled and graded to ensure proper drainage using soils from surrounding areas. A layer of reinforced 12-mil plastic was installed as an interim cover over the entire footprint of the cell. The cover was secured on its edges by a perimeter anchor trench and ballasted with sandbags to resist uplift.

To demonstrate the effectiveness of the March 2002 interim action performed at Zone B of the Pasco Landfill (URS, 2002), surface soil samples were collected by BCS in February 2005. The results of the surface soil sampling in 2005 indicated that polycyclic aromatic hydrocarbon (PAH) detections exceeded some of the MTCA Method B Cleanup Levels at one location (PZB 05; Figure 2), and the 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8 TCDD) toxic equivalency (TEQ) draft Ecology Ecological Cleanup Level of 5 picograms per gram (pg/g) (Ecology, 2007) was exceeded at four locations (PZB 03, PZB 12, PZB 14, and PZB 15; Figure 2). The samples were collected from the 0- to 6-inch below ground surface (bgs) interval. Results of the 2005 surface soil sampling event were presented to Ecology in the "Zone B Confirmation Surface Soil Sampling Technical Memorandum", dated July 11, 2005 (AMEC, 2005).

To develop a reasonably and appropriately conservative soil excavation strategy for the interim RA described in this final work plan, BCS conducted pre-excavation surface soil sampling at Zone B in July 2009. In addition to sampling at the 6- to 12-inch bgs interval at locations that showed exceedances in 2005 above the MTCA Method B Cleanup Levels for PAHs or Ecology's draft Ecological Cleanup Level for dioxin TEQ, BCS sampled at ten additional locations outside the perimeter of Zone B (OZB 1-10; Figure 2). The sampling was performed by AMEC in accordance with the Revised Final Pre-Excavation Surface Soil Sampling and Analysis Plan dated May 14, 2009 (AMEC, 2009a), and approved by Ecology on June 19, 2009 (Ecology, 2009).

Results of the July 2009 sampling event indicated the draft ecological cleanup level of 5 pg/g dioxin TEQ was exceeded only in the 6- to 12-inch bgs interval at PZB-14 (26.1 pg/g) and the 0- to 6-inch bgs interval at OZB-01 (18.5 pg/g) (Figure 2). All other dioxin TEQ results from the pre-excavation soil sampling event ranged from 0.008 to 2.16 pg/g. BCS instructed the contract laboratory to analyze archived samples from the 12- to 18-inch bgs interval at PZB-14 and the 6- to 12-inch bgs interval at OZB-01. The dioxin TEQ results from these analyses, 2.55 and 0.752 pg/g, respectively, did not exceed 5 pg/g. PAHs were not detected in the samples from the pre-excavation soil sampling event. The sampling event and results are described in detail in the Pre-Excavation Surface Soil Sampling Technical Memorandum submitted to Ecology November 17, 2009 (AMEC, 2009b).

As presented in this final work plan, based on the July 2009 analytical results, BCS plans to expand the surface soil excavation area by about 4,000 square feet (sf) beyond the surface area presented in the original work plan.

2.0 REMEDIAL OBJECTIVE

The objective of this proposed RA is the installation of a RCRA Subtitle C Landfill Capping System that is intended to serve as an interim remedial action pending the determination of a final site remedy for Zone B and the rest of the Pasco landfill Site. The RA fulfills the following objectives:

1. Provide a physical barrier between soil within cell B and potential human or ecological receptors (minimization of risk by elimination of the "direct contact" exposure pathway);

2. Reduce stormwater infiltration into cell B and, thereby, reduce the potential for mobilization of residual chemical constituents; and

3. Provide engineering and institutional controls to limit access to Zone B.

3.0 DESIGN CRITERIA

The following design criteria were considered in the development of the proposed remedial design (RD):

- Fulfillment of the remedial objective;
- Protection of human health and the environment;
- Consistency with the final anticipated clean-up action;
- Cost effectiveness and constructability;
- Ease of implementation (implementability);
- Development of a design that utilizes standardized specifications and easily obtainable (i.e., local, “off-the-shelf”) materials; and
- Minimization of operation and maintenance costs.

4.0 BASIS OF DESIGN

The proposed design was based on the Subtitle C requirements of RCRA for cover systems over landfills containing hazardous waste, and the cover systems previously constructed in the other zones at the Site.

5.0 REMEDIAL STRATEGY

In order to meet the remedial objective, the proposed actions are:

- The excavation of surface soils above MTCA Method B and Ecology’s draft Ecological Cleanup levels from around the perimeter of the cell;
- The relocation of the excavated soils on to the existing interim cover;
- The installation of a cover system (Cap) over the cell that meets the RCRA Subtitle C requirements; and
- The sampling of post-excavation confirmation surface soil to confirm that the excavation of soils from around Zone B successfully removed any material that is above MTCA Method B and Ecology’s draft Ecological Cleanup levels.

5.1 Surface Soil Excavation and Relocation

BCS will excavate and relocate approximately 1,000 cubic yards (CY) of contaminated shallow soil located immediately adjacent to the Zone B cell, consistent with Area of Contamination allowances. The proposed area of excavation is approximately 27,000 sf and is located adjacent to the south, southeast, and southwest edges of the

cell. The proposed excavation depth is 1-foot bgs. Post-excavation confirmation surface soil sampling and analysis will be conducted after the surface soil excavation to confirm that soils around Zone B that were above MTCA Method B and Ecology's draft Ecological Cleanup criteria have been successfully removed. Post-excavation sampling is discussed in Section 7.0.

The soil will be placed over the existing 12-mil cover and graded as part of the subgrade for the Cap. Placing the soils beneath the Cap is a convenient and cost effective on-site disposal method and will provide the bulk of the material necessary for the Cap subgrade shaping and preparation.

All excavations will be backfilled to approximate original grades using certified-clean, imported fill. Fill outside of the landfill footprint will be compacted to 85% maximum dry density; fill inside the landfill footprint will be compacted to 90% maximum dry density, as determined by ASTM D698. Following earthwork activities, all areas shall be immediately hydroseeded with native grasses to prevent soil losses by wind and precipitation.

5.2 Capping

The primary functions of caps are water management and protection of potential receptors by the creation of physical barriers. At the minimum, a RCRA Subtitle C Cap includes a vegetative layer, a drainage layer, and a barrier layer. The components of the proposed Zone B Cap exceed these minimum requirements. The surface area of the proposed design is approximately 30,600 sf and consists of the following major components:

- A Geosynthetic Clay Liner (GCL) and overlying geomembrane that act as primary low permeable layers. The GCL will provide a low permeability, flexible barrier to reduce the amount of water infiltration. The geomembrane overlying the GCL will function as a secondary low permeability, flexible barrier;
- Stormwater runoff controls that convey runoff to an infiltration area downgradient of the cell;
- Stormwater controls that convey runoff originating upgradient around the cell;
- Permanent fencing around Zone B that will inhibit human and ecological contact with the completed Cap; and
- Erosion control measures, as needed, to maintain engineered runoff paths and the integrity of the Cap.

5.2.1 Cap Components

GCL

A GCL will be used as an infiltration barrier and will be placed over the relocated and graded surface soils and, if necessary, additional fill. A GCL is a composite geomembrane consisting of bentonite clay sandwiched within geotextile layers. The geotextile layers resist puncture, prevent desiccation of hydrated clay, and act as a reinforcement matrix for the clay. The clay is hydro-philic with known swell characteristics, which, when punctured, can swell around an object and seal against leakage.

Geomembrane

A 40-mil thick high density polyethylene (HDPE) geomembrane will be placed over the GCL as an impermeable layer. HDPE geomembrane panels will be welded from panel to panel using specialized heat welding machines. The production, delivery, and installation will be tightly monitored and controlled through comprehensive quality control (QC) and quality assurance (QA) measures.

Drainage Collection System

A drainage collection system will be installed consisting of a series of geotextile encased perforated and non-perforated HDPE pipes within the drainage layer and placed on the geomembrane. The collected water will be routed to multiple outlets at the downhill (southernmost) edge of the Cap. The outlets are specifically designed and will be constructed to diffuse the kinetic energy of the conveyed water, to distribute the water for efficient infiltration/evaporation, and to be easily removed for cleaning the drainage pipe network. The outlet flow will be distributed on erosion protection rock and will dissipate through infiltration and evaporation consistent with current and surrounding stormwater runoff patterns.

Drainage Layer

A layer of medium-to-coarse sand will be placed over the HDPE geomembrane to allow collection and drainage of water from rainfall that infiltrates through the topsoil. The sand will be highly permeable and poorly graded with less than 5% fine-grained material to allow efficient flow within the layer.

Geotextile Filter Fabric

A geotextile filter fabric will be placed between the topsoil and the drainage layer to prevent migration of fine-grained particles from the overlying layer into the drainage sand while still allowing water passage.

Vegetative Layer

A vegetative layer will be constructed with a 2-foot thick layer of imported topsoil seeded with native grasses. The imported topsoil will have similar nutrient composition to the surrounding native soils and will be placed over the geotextile filter. The vegetation will provide resistance to erosion from wind and rainfall and, by utilizing native vegetation, the need for long-term irrigation will be eliminated.

Additional details about these actions, as well as ancillary activities that will be performed, are provided in Section 6.0, Remedial Action Implementation.

6.0 REMEDIAL ACTION IMPLEMENTATION

6.1 Constituents of Concern

The constituents of concern (COCs) for Zone B consist of the following:

- Dioxins/furans;
- Chlorinated herbicides; and
- Semi-volatile organic compounds (SVOCs).

6.2 Pollution and Erosion Control Measures

In order to minimize erosion during construction, the RA contractor will, at a minimum, be required to provide the following as preconstruction submittals:

- A description of any hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring;
- A spill prevention, countermeasures, and control (SPCC) plan with notification procedures, specific cleanup and disposal instructions for different products, emergency response containment and clean up measures, proposed methods for disposal of spilled materials, and employee training for spill containment;
- Designation by flagging or other visible means the limits of clearing associated with site access and construction to prevent excessive ground disturbance;
- Emergency sediment control and oil-absorbing materials at the work site; and

- Temporary erosion controls appropriately installed around work area.

Additionally, the RA contractor will be required to: ensure secondary containment around auxiliary fuel tanks at all times; inspect all vehicles daily for fluid leaks before leaving the vehicle staging area; and repair any leaks detected in the vehicle staging area before the vehicle resumes operation.

6.3 Establishment of Work Zones

Prior to the initiation of construction, the RA contractor will be required to establish the 'Work Zones' necessary to safely perform the work. The Site will be subdivided into the working or exclusion zone, the contamination reduction zone, and the clean or support zone. Only appropriately trained and certified personnel, meeting the requirements of 29CFR1910.120 and applicable Washington State requirements, will be allowed to enter the contamination reduction and exclusion zones. Additionally, the contractor will be required to establish and construct stockpile, staging, and loading and unloading areas within the support zone. It will be mandatory that these areas are clearly marked with high visibility indicators and that a site map with the zones indicated is posted in a common gathering area such as a construction trailer. Access to the exclusion zone will be restricted to properly trained personnel performing the work, supervisors, inspectors, and appropriately trained regulators.

6.4 Proposed Remedial Action Construction Activities

RA construction activities will substantially conform to the lines and grades shown on the final design plans and detailed in the final specifications. Verification of substantial conformance will be accomplished by implementation of a construction quality assurance plan (CQAP) including conformance certification from a Professional Engineer (PE) responsible for the quality QA program. The responsibility of implementing the QA program is typically assigned to a third party independent from the RA Engineer. This document will refer to the responsible party as the QA organization.

Typically, landfill cap construction involves an RA contractor, a survey subcontractor, a geosynthetic and geomembrane installation subcontractor (installation subcontractor), and may include an earthwork subcontractor if the RA contractor is not also the earthwork contractor. The specifications for the Cap construction will prescribe the qualifications necessary for all of the potential subcontractors based on the component to be constructed. Geosynthetic and geomembrane installation subcontractors have the most stringent qualification requirements and are the most specialized. Their roles and responsibilities during construction are very specific to ensure proper handling, manufacturer quality control (MQC) certification, installation, and QC testing of the

geomembrane and geocomposites. The following subsections briefly describe the expected construction activities using these contractor designations.

6.4.1 General Construction Execution Requirements

Survey Control

The RA contractor will be required to perform or coordinate surveys to the extent necessary to layout features, determine required lines and grades, and to document completion of the work. Selection of the survey method(s) will be at the discretion of the RA construction contractor; however, the methods of control and progress monitoring will be by traditional surveying and grade-checking equipment or by pre-approved methods that are verifiable by the Engineer.

Protection of Site Features

The specifications will stipulate that, unless specifically stated in writing by the Engineer, all existing site features not specifically slated for decommissioning or removal on the design drawings, above and below the ground, are to be protected from damage during construction. Furthermore, damage caused by construction activities will be repaired by the RA contractor.

6.4.2 Well Decommissioning

The RA contractor will decommission the well indicated on the drawings. Well decommissioning will be carried out in accordance with all applicable local, state, and federal regulations.

6.4.3 Site Clearing and Grubbing

Small shrubs, grasses, and any other above-ground vegetation within the work areas will be removed to the ground surface and consolidated for off-site disposal at an appropriate facility. Vegetation extending into the underlying soils will be grubbed during the excavation process and will be treated as surface soil.

6.4.4 Surface Soil Excavation

The selection of the means and methods of excavation will be left to the discretion of the RA contractor; however, under the requirements of the project specifications, the means and methods will be approved in advance by the Engineer. The Engineer considers excavation by use of typical earthmoving equipment such as rubber-tired front-end loaders and hoe type excavators allowable, but will consider reasonable alternatives.

The RA contractor will be in charge of controlling the depth and extent of the excavation, but verification by the Engineer will be required.

6.4.5 Relocation of Excavated Surface Soils

Excavated soils will be placed on the existing 12-mil cover. The soils will be distributed over the12-mil cover to the lines and grades shown on the project plans. The means and methods of transporting, depositing, and spreading will be left to the discretion of the RA contractor under the requirements of the project specifications and with prior approval by the Engineer. Only rubber-tired equipment will be permitted to travel directly on the existing cover. Tracked equipment will be allowed to spread the soil over the cover provided that the tracks are traveling on soil that is at least 1 foot thick. Excavated soil placed on the cover will be compacted to 90% maximum dry density as determined by ASTM D698.

6.4.6 Cap Construction

Cap construction can only commence following receipt of acceptable post-excavation soil sampling analytical results.

Subgrade construction and preparation will be accomplished by grading with typical earthmoving equipment such as bulldozers and graders. Soil will be compacted to 90% maximum dry density as determined by ASTM D698. Prior to placement of the GCL, the surface will be inspected and certified as acceptable by the QA organization and the earthwork contractor.

The GCL and geomembrane will be delivered in rolls. Each will be labeled with a unique traceable number for MQC verification and construction QC purposes. Off-loading will be performed by the installation subcontractor using material specific equipment. The installation subcontractor will be required to handle the materials carefully. Installation will be accomplished using specifically designed equipment to suspend the roll while it is carefully unrolled by the installation crew. The GCL is a lapped seam material and does not require panel to panel attachment. The geomembrane is deployed in a similar fashion; however, it is a welded seam material. The panels will be welded together in place on-site using a double track hot wedge welding apparatus. The panel welds will be tested by non-destructive and destructive methods with verification of conformance by the QA organization.

As the geomembrane installation is completed and before placement of the drainage layer, the geotextile wrapped perforated drainage pipe will be installed along with the non-perforated conveyance piping. The drainage sand will be carefully placed on the geomembrane utilizing thickened access roads (36-inches or greater) for dumping and

low ground pressure tracked equipment for distribution. The RA contractor will be required to maintain a minimum of 1 foot between the low ground pressure tracked equipment and geomembrane.

Geotextile filter fabric will be installed on the drainage layer using methods similar to those used for the GCL and geomembrane. As an area is covered with geotextile the vegetative layer will be installed. The contractor will be required to install the vegetative layer in a protective method similar to the installation of the drainage layer over the geomembrane. Vegetative layer soil will be compacted to 90% maximum dry density as determined by ASTM D698.

6.4.7 Stormwater Collection and Management

The Soil Conservation Service (SCS) Curve Number (CN) Method, in accordance with *the Stormwater Management Manual for Eastern Washington,* Chapter 4.5 (Ecology, 2004), was used to calculate design stormwater runoff volumes for a 2-year, 24-hour and a 25-year, 24-hour storm event. In the event of a 2-year, 24-hour storm event and a 25-year, 24-hour storm event, the estimated runoff volumes are 8,017 gallons and 4,875 gallons, respectively. The estimated initial abstraction volume of the Pasco Zone B Cap is approximately 48,300 gallons. The calculations are provided in Appendix D. No substantial erosion channels or arroyos have developed in the Zone B area over the past 7 years. Furthermore, no such channels were observed in the several acres surrounding Zone B.

Surface water runoff from upgradient drainage areas will be directed around the Cap and into existing flow paths and matching historical drainage patterns of the region. Further measures to preserve the integrity of the Cap will include a 6-inch-thick layer of crushed rock placed around its perimeter, labeled as Erosion Protection Rock on the Design Plans.

7.0 POST-EXCAVATION CONFIRMATION SURFACE SOIL SAMPLING AND ANALYSIS

7.1 Soil Sampling

For the purpose of evaluating the adequacy of the performed soil excavation activities, post-excavation confirmation soil sampling activities will occur immediately following the surface soil excavation described in Section 5.1. Surface soil sampling will be conducted at a total of eight locations: six locations previously sampled in February 2005 (AMEC, 2005) and July 2009 (AMEC, 2009b) where there were exceedances of MTCA Method B Cleanup Levels for PAHs or the Ecology draft Cleanup Level for dioxin TEQ (Figure 2); and two additional locations at the northern edge of the

proposed soil excavation area in response to comments received from the Pasco Sanitary Landfill Industrial Waste Area Generators Group II (IWAG) that were discussed with Chuck Gruenenfelder on December 22, 2009.

Ecology's draft dioxin TEQ Ecological Cleanup Level of 5 pg/g was exceeded at five sampling locations: PZB-03 in 2005; PZB-12 in 2005; PZB-14 in 2005 and 2009; PZB-15 in 2005, and OZB-01 in 2009 (AMEC, 2005; AMEC, 2009b). The polycyclic aromatic hydrocarbon (PAH) MTCA Method B Cleanup Levels were exceeded at sampling location PZB-05 in 2005 (AMEC, 2005; AMEC, 2009b). Four surface soil samples will be collected at each of these six former sampling locations within the proposed soil excavation area. One sample will be collected from the same approximate location and three additional samples will be collected approximately 5 feet equidistant from the original sampling location. The proposed post-excavation sampling locations, which may be adjusted based on field observations, are identified on Figure 2.

These post-excavation confirmatory surface soil samples will be collected following the proposed soil excavation activity from 0 to 6 inches below ground level of the newly exposed surface at each of the six proposed sampling locations using a stainless steel hand auger and then placed into individual 1-gallon plastic bags and homogenized. All 24 of these soil samples will then be immediately transferred into the appropriate sample containers provided by the contract laboratory and submitted to the contract laboratory for analysis, as described below and summarized on Tables 1 and 2. None of these samples will be a composite of soils collected from multiple locations.

In addition to these 24 samples, post-excavation confirmation surface soils also will be collected from new proposed sampling locations OZB-11 and OZB-12, as shown on Figure 2 and discussed with Chuck Gruenenfelder on December 22, 2009. These locations will be positioned approximately three feet beyond the limits of the proposed soil excavation area. Soil samples will be collected 0 to 6 inches bgs in this non-excavated area using a stainless steel hand auger and then placed into individual 1-gallon plastic bags and homogenized. These two 0 to 6-inch samples will then be immediately transferred into the appropriate sample containers provided by the contract laboratory and submitted to the contract laboratory for analysis, as described below and summarized on Tables 1 and 2. In addition, soil samples at locations OZB-11 and OZB-12 also will be collected from both the 6 to 12-inch depth and the 12 to 18-inch depth and sent to the contract laboratory for archiving purposes.

7.2 Analytical Testing

Soil samples and one equipment rinsate blank will be analyzed on a quick turn around time for the following analytical methods:

- PAHs by EPA Method 8270-selective ion monitoring (SIM); and/or
- Polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF) by EPA Method 1613B.

Specific sample identifications and their associated analyses are summarized in Table 1. All samples will be collected and submitted to the contract laboratory following the procedures described in the attached standard operating procedures (Attachments). Samples will be collected in the appropriate sampling containers listed in Table 2.

7.3 Data Evaluation

Post-excavation soil sample results will be evaluated against the MTCA Method B Cleanup Levels for PAHs and Ecology's draft Ecological Cleanup Level for dioxin TEQ to evaluate the adequacy of the soil excavation.

Final capping activities will not commence until post-excavation soil samples confirm that the remaining soils are below cleanup standards. If post-excavation sampling indicates that concentrations of PAH's or dioxin TEQ exceed the clean-up levels, additional excavation and/or sampling and analysis will be discussed with Ecology and conducted accordingly.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

QC during construction will be accomplished by the establishment and application of a project specific QA/QC program. QC refers to the Engineer prescribed procedures, methods, and tests that are to be preformed by the RA contractor or materials manufacturer to assure that the work is being performed and the materials supplied to the project for installation are in accordance with the project plans and specifications. The specifications will require that the RA contractor designate a qualified quality control inspector (QCI) that will be responsible for the tracking and submittal of all test results and data prescribed in the specifications. QA refers to the oversight inspection of constructed features and the review of QC submittals supplied by the RA contractor for compliance with the project Plans and Specifications.

The Construction Quality Assurance Plan (CQAP) will be delivered to the QA organization to ensure that the QA/QC program is implemented. The CQAP will be a guidance document for the QA personnel, and will be utilized throughout construction for procedural reference and clarification. The following section presents a outline of the CQAP and Sections 8.2 through 8.4 present an overview of the QA/QC program that will be covered in the CQAP.

8.1 CQAP Outline

1. Introduction
2. Construction Management
   - Organizational Chart
   - Project Schedule
   - Project Specific Communications
   - Change Orders
3. Construction Quality Control
   - QA/QC Requirements
   - QA/QC Reporting Requirements
4. Documentation

8.2 Construction Management

Construction management consists of several components. This section presents a general description of the components that will be covered in detail in the CQAP.

Organizational Chart

Successful project implementation is dependent on clearly defined roles and responsibilities and lines of authority. An organizational chart will be included in the CQAP that visually illustrates the relative authority of project personnel.

Project Schedule

Project schedules are important for scheduling project personnel, coordinating the delivery of materials and supplies, tracking progress, and assessing performance. Details for the production and maintenance of the project schedule will be presented in the CQAP. The RA contractor will be required to supply a baseline project schedule prior to construction. Additionally, the RA contractor will be required to supply a revised schedule if significant delays or changes are encountered during construction. "Significant delays" are defined by delays to the project schedule that result in a change in the Contract Completion date.

Project Specific Communications

Project construction communications will follow industry standard protocols. The CQAP will describe in detail the requirements for project communications.

Change Orders

Changes in the scope of work or procedures for implementation of the work, as defined in the final project Plans and Specifications, may be necessary. Changes that have an actual fiscal impact to the contractor or their sub-contractor(s) will be addressed by the change order procedures. Successful change order management is the responsibility of the RA contractor, the QA organization, and the Engineer. The CQAP will describe the change order process and the responsibilities of the project personnel. Changes to the scope of work will be submitted to Ecology for review and approval prior to implementation.

8.3 Construction Quality Control

This section of the CQAP will present the QC test requirements by material type, a reference to the related specification section, the limit/criteria, the test method, the frequency requirements, and QA responsibilities in a tabular form. Although QA/QC requirements for implementation of a RCRA cap are extensive, the procedures and required tests are very well defined and are industry standard protocols.

8.4 QA/QC Reporting Requirements

For complete documentation of the QA/QC requirements and procedures there will be daily and periodic construction reporting submittal requirements. In addition, there will be specific close-out reporting and documentation requirements. The CQAP will present the specific reporting requirements to ensure the fulfillment of the specified requirements.

9.0 LONG-TERM MONITORING, INSPECTION, AND MAINTENANCE

To ensure the long-term functionality and performance of the Cap, an inspection and maintenance program will be developed. Because operation of the Cap does not include the operation of mechanical and/or electric systems, the Engineer has titled the operation and maintenance manual for this RA the Cap Inspection and Maintenance Plan (CIMP). As with any operation and maintenance plan development, the final plan will not be completed until construction is complete. A copy of the CIMP is included in this document in Appendix B. The inclusion of this document was considered appropriate to allow for the evaluation of the level of long-term involvement necessary

by the lead agency during review of the Preliminary Design Plans as prescribed in the *RD/RA Handbook* (EPA, 1995).

An important design criterion for the Cap was minimal long-term maintenance. In order to accomplish this, however, there are a few critical components that will require inspection and may require short-term maintenance. Therefore, this program will distinguish between short-term and long-term inspection and maintenance requirements. Additionally, this document will distinguish between scheduled (tasks performed at stated intervals), non-regularly scheduled (tasks that are expected but are not needed regularly), and un-scheduled (emergency repairs) maintenance. This well planned inspection and maintenance program will reduce the need for costly un-scheduled maintenance.

During the inspections, the overall condition of the Cap, including the vegetation and stormwater control systems, will be observed. Defects in the Cap that are noted during inspections will be reported to the Owner and/or Engineer for repair coordination. Ecology will be notified in advance of completing any major cover system repair actions that are indicated in response to routine inspections. An annual Inspection and Maintenance Report will be prepared for submittal to Ecology. The annual Inspection and Maintenance Report will consist of the following:

- Summary of the inspections and associated reports for that year;
- Summary of major repairs, minor repairs, or maintenance activities conducted that year; and
- Field maintenance, monitoring, and repair reports, which will be included as appendices to the annual report.

10.0 HEALTH AND SAFETY

The RA contractor will implement the RA activities in accordance with all applicable requirements as administered by the Washington Department of Labor and Industries under the Washington Industrial Safety and Health Act. The RA contractor will act as the controlling employer for the Site during RA construction activities. As such, the RA contractor will prepare a site-specific Health and Safety Plan (HASP), and designate a specific person as site safety officer (SSO). The selected RA contractor's SSO will be responsible for ensuring that the RA contractor's employees, oversight personnel, regulators, visitors, and BCS representatives adhere to all applicable regulations and requirements.

10.1 Air Monitoring

The Engineer will oversee an air monitoring program at the Site during implementation of the RA. The air monitoring plan will be developed under the oversight of a Certified Industrial Hygienist (CIH) and will be included in the Engineer's HASP. The air monitoring plan will specify the parameters to be monitored, the monitoring methods, the frequency of readings, and the equipment used for monitoring. BCS plans to monitor dust particulates in the air during cap implementation, as well as air temperature and estimated wind velocity. Periodic watering will be used to control dust emissions as needed. The air monitoring plan will provide operation instructions for placement of air monitoring equipment based on prevailing and specific wind directions, and provide directions for monitoring and recording data from each type of equipment at the Site. During implementation, the Engineer's on-site representative will maintain frequent contact with the CIH to discuss air monitoring results and general construction conditions. The CIH will modify the air monitoring plan as appropriate based on actual conditions at the Site. The elements of the air monitoring program will be delivered to the RA contractor for inclusion in their HASP.

11.0 ANTICIPATED IMPLEMENTATION SCHEDULE

Implementation of this RA is anticipated to begin in summer 2010. Final reporting of the RA is anticipated to be complete and submitted to Ecology by winter 2010.

12.0 REPORTING

After construction, a Remedial Action Completion Report will be prepared by the Engineer. The report will be prepared in accordance with Washington Administrative Code (WAC) 173-340-400 and the *RD/RA Handbook* (EPA, 1995).

The report will include:

- Documentation of all remedial activities at the Site;
- A certification from the RA Engineer that the construction was performed in substantial compliance with the plans and specifications for the project;
- Record drawings of all constructed features; and
- The Final CIMP.

Four hard copies and an electronic copy of the Remedial Action Completion Report will be submitted to Ecology on behalf of BCS. Results of the post-excavation soil sampling will be included in the completion report.

REFERENCES

Attorney General of Washington, 2008. Re: Bayer Crop Science Closure and Settlement Proposal for Zone B Pasco Landfill Site, Pasco, Washington, March 24, 2008.

AMEC, 2005. *Zone B Confirmation Surface Soil Sampling Technical Memorandum, Pasco Landfill Zone B,* prepared for Bayer CropScience, LP, prepared by AMEC Earth & Environmental, submitted to Washington Department of Ecology, July 11, 2005.

AMEC, 2006a. *Draft Interim Remedial Action Work Plan and Preliminary Design, Pasco Landfill Zone B*, prepared by AMEC Earth & Environmental, submitted to Washington Department of Ecology, November 1, 2006.

AMEC, 2006b. *Addendum 1 to Draft Interim Remedial Action Work Plan, Post-Excavation Confirmation Surface Soil Sampling and Analysis Plan, Pasco Landfill Zone B*, prepared by AMEC Earth & Environmental, submitted to Washington Department of Ecology, November 28, 2006.

AMEC, 2009a. Revised Final Pre Excavation Surface Soil Sampling and Analysis Plan, Pasco Landfill Zone B, Pasco, Washington, prepared by AMEC Earth & Environmental, submitted to Washington Department of Ecology May 14, 2009.

AMEC, 2009b. Pre Excavation Surface Soil Sampling Technical Memorandum, Pasco Landfill Zone B, Pasco, Washington, prepared by AMEC Earth & Environmental, submitted to Washington Department of Ecology November 17, 2009.

U.S. Environmental Protection Agency, 1995. *Remedial Design/Remedial Action Handbook*, June 1995.

URS, 2002. *Interim Action Completion Report Zone B Removal, Pasco Sanitary Landfill,* prepared by URS Corporation for Philip Services Corporation, July 2002.

The *Superfund/Hazardous Waste Cleanup Memorandum of Agreement*, August 8, 2000.

Washington State Department of Ecology (Ecology), 2000. In the Matter of Interim Actions at: Pasco Sanitary Landfill, Pasco Washington, No. DE 00TCPER-1325 Enforcement Order, June 30, 2000

Ecology, 2006. RE; Pasco Landfill Zone B, Draft Interim Remedial Action Work Plan and Preliminary Design document dated November 1, 2006 and Addendum 1 to the Work Plan, dated November 28, 2006, December 5, 2006.

Ecology, 2007. RE: Pasco Sanitary Landfill Site – Draft Cleanup Standards, April 24, 2007.

Ecology, 2009. RE: Revised Final Pre Excavation Surface Soil Sampling and Analysis Plan, June 19, 2009.

Washington State Department of Health, 1999. *Risk Assessment/Cleanup Level Analysis Document, and Feasibility Study,* prepared by the Washington State Department of Health for Ecology (August, 1999).

LIMITATIONS

This report was prepared exclusively for Bayer CropScience by AMEC Earth & Environmental, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Final Interim Remedial Action Work Plan for the Pasco Zone B RCRA Cap is intended to be used by Bayer CropScience for the Pasco, Washington Sanitary Landfill only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

TABLES

TABLE 1
Post-Excavation Confirmation Surface Soil Analyses
Pasco Landfill Zone B

Location	Sampling Media	Sample ID	PAH by EPA Method 8270SIM	PCDD/PCDF by EPA Method 1613B
PZB-05	Soil	PZB-05A	√	
		PZB-05A Dup	√	
		PZB-05B	√	
		PZB-05C	√	
		PZB-05D	√	
PZB-03	Soil	PZB-03A		√
		PZB-03B		√
		PZB-03C		√
		PZB-03D		√
PZB-12	Soil	PZB-12A		√
		PZB-12A Dup		√
		PZB-12B		√
		PZB-12C		√
		PZB-12D		√
PZB-14	Soil	PZB-14A		√
		PZB-14B		√
		PZB-14C		√
		PZB-14D		√
PZB-15	Soil	PZB-15A		√
		PZB-15B		√
		PZB-15C		√
		PZB-15D		√
OZB-01	Soil	OZB-01A		√
		OZB-01B		√
		OZB-01C		√
		OZB-01D		√
OZB-11	Soil	OZB-11A[1]		√
		OZB-11B[2]		√
		OZB-11C[3]		√
OZB-12	Soil	OZB-12A[1]		√
		OZB-12B[2]		√
		OZB-12C[3]		√
Rinsate Blank	Water	Rinsate Blank	√	√

Notes:

EPA	United States Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PCDD/PCDF	Polychlorinated Dibenzo-p-Dioxins/Polychlorinated Dibenzofurans
SIM	Selective Ion Monitoring

[1] Sample Depth 0-6 inches

[2] Sample Depth 6-12 inches, to be archived for future analysis if needed.

[3] Sample Depth 12-18 inches, to be archived for future analysis if needed.

TABLE 2
Laboratory Containers, Preservation, and Holding Times
Pasco Landfill Zone B

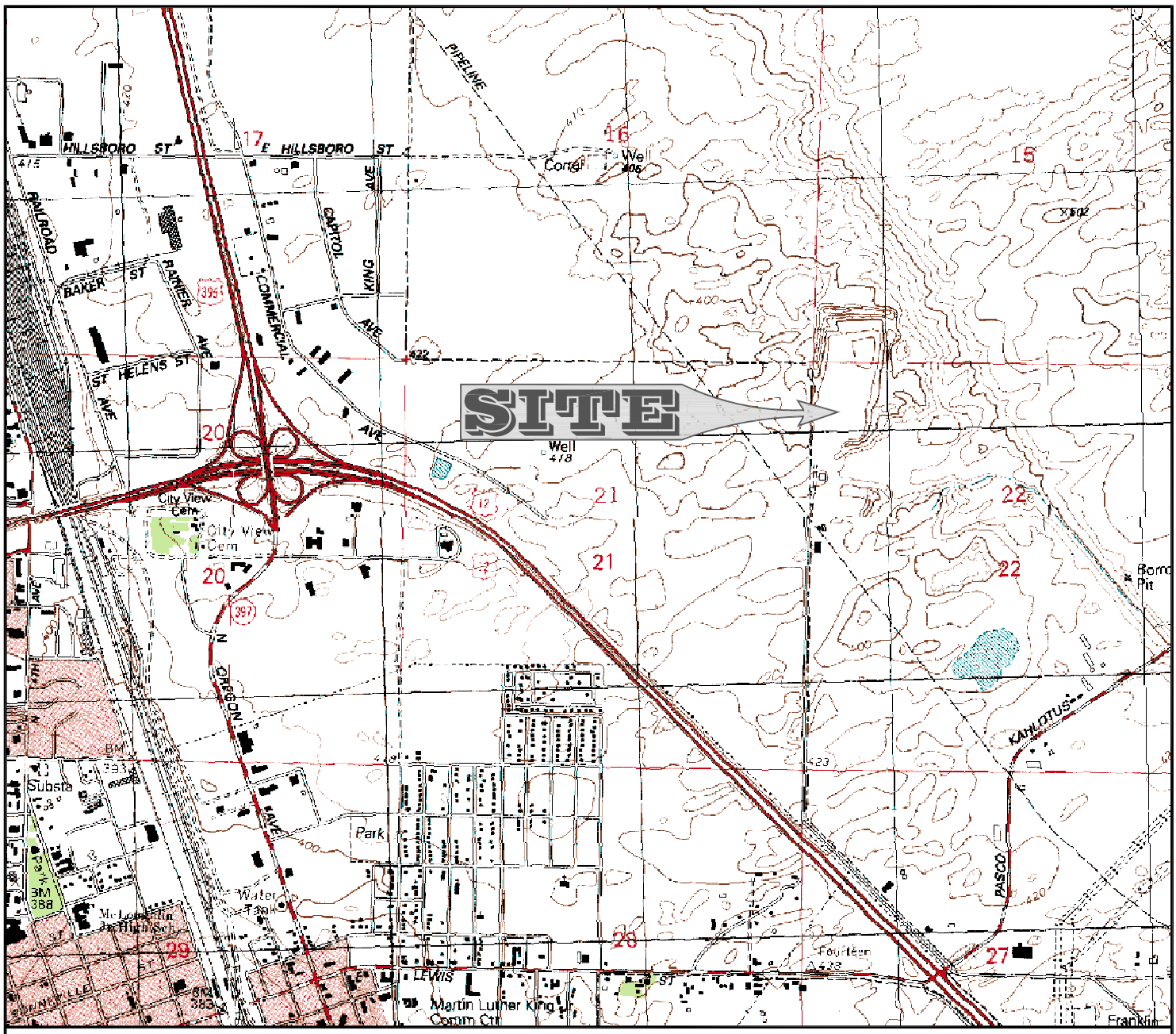
Method	Analysis	Container	Preservation	Holding Time
Soil Media				
EPA 8270SIM	PAH	4 oz glass jar	Cool to 4°C	14/40 days[1]
EPA 1613B	PCDD/PCDF	4 oz glass jar	Cool to 4°C	1 year
Water Media				
EPA 8270SIM	PAH	2 - 1L Amber Glass Bottles	Cool to 4°C	7/40 days[1]
EPA 1613B	PCDD/PCDF	2 - 1L Amber Glass Bottles	Cool to 4°C	1 year

Notes:

[1] Number of days from sample collection until extraction/number of days from sample extraction until analysis.

EPA	United States Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PCDD/PCDF	Polychlorinated Dibenzo-p-Dioxins/Polychlorinated Dibenzofurans
SIM	Selective Ion Monitoring

FIGURES



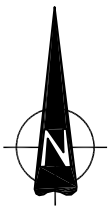
ROAD CLASSIFICATION

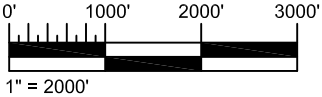
- Heavy-duty
- Medium-duty
- Light-duty
- Unimproved dirt
- U.S. Route
- State Route
- Interstate Route

QUADRANGLE LOCATION

GLADE, WASH.

46119-C1-TF-024
1992
DMA 2176 I SE - SERIES V891





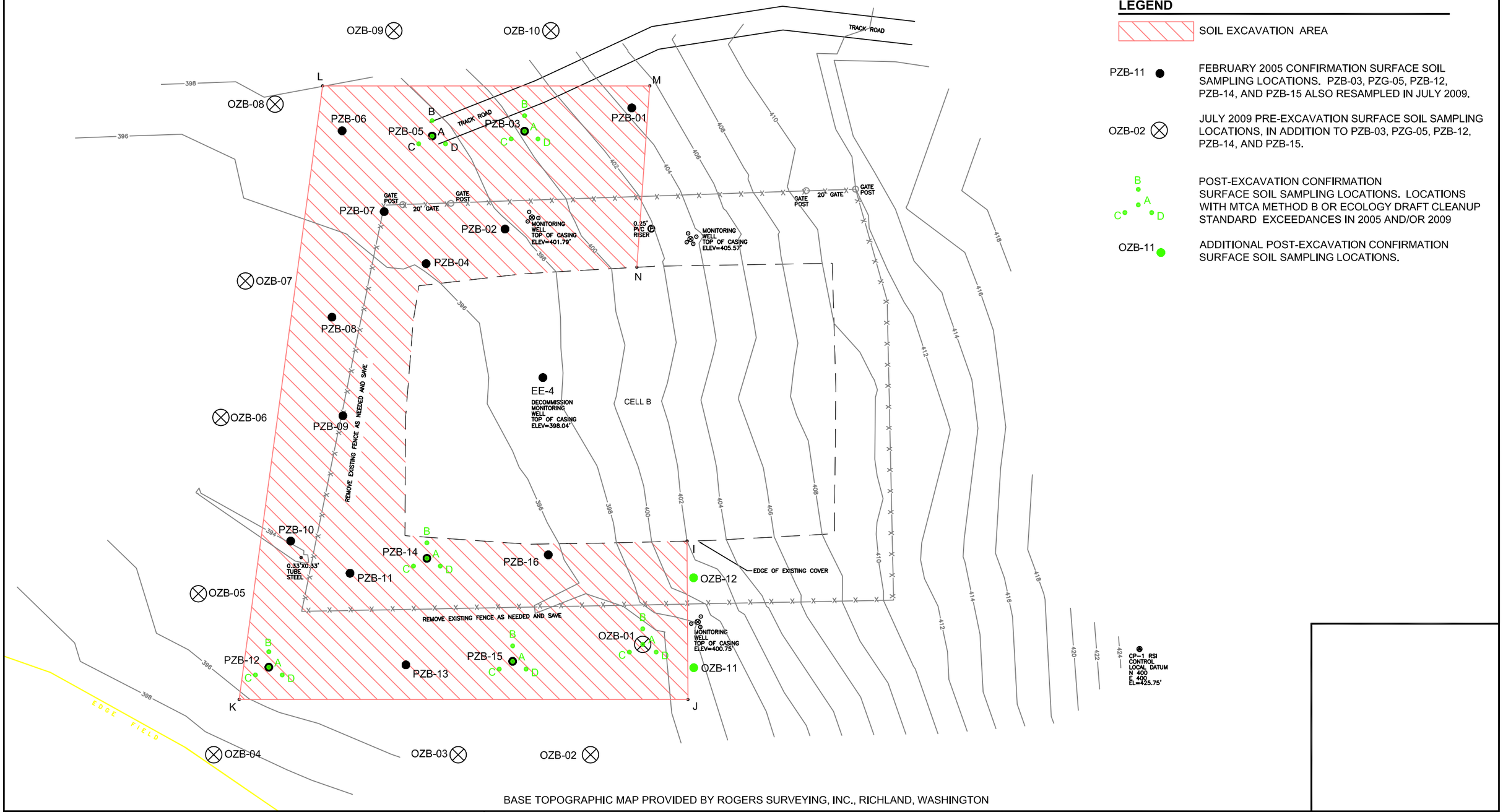
1" = 2000'

AMEC Earth & Environmental
7376 S.W. Durham Road
Portland OR. U.S.A. 97224

CLIENT
PASCO LANDFILL
PASCO WASHINGTON

PROJECT: PASCO LANDFILL	DWN BY: DD	DATUM: -	DATE: SEPTEMBER 2009
TITLE: SITE LOCATION MAP	CHK'D BY: MK	REV. NO.: -	PROJECT NO: 4-61M-107051
	PROJECTION: -	SCALE: 1" = 2000'	FIGURE No. 1

K:\10000\10700\10705\10705-1\RAWP\Revised RAWP\DWG\SITE LOCATION MAP.dwg – Layout1 – Dec. 23, 2009 12:40pm – patrick.mccarthy



LEGEND

- SOIL EXCAVATION AREA
- PZB-11 ● FEBRUARY 2005 CONFIRMATION SURFACE SOIL SAMPLING LOCATIONS. PZB-03, PZG-05, PZB-12, PZB-14, AND PZB-15 ALSO RESAMPLED IN JULY 2009.
- OZB-02 ⊗ JULY 2009 PRE-EXCAVATION SURFACE SOIL SAMPLING LOCATIONS, IN ADDITION TO PZB-03, PZG-05, PZB-12, PZB-14, AND PZB-15.
- B, A, C, D POST-EXCAVATION CONFIRMATION SURFACE SOIL SAMPLING LOCATIONS. LOCATIONS WITH MTCA METHOD B OR ECOLOGY DRAFT CLEANUP STANDARD EXCEEDANCES IN 2005 AND/OR 2009
- OZB-11 ADDITIONAL POST-EXCAVATION CONFIRMATION SURFACE SOIL SAMPLING LOCATIONS.

BASE TOPOGRAPHIC MAP PROVIDED BY ROGERS SURVEYING, INC., RICHLAND, WASHINGTON

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
-	-	-	-	-	-	-

CLIENT: Bayer CropScience

AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR. U.S.A. 97224

0' 20' 40' 60'
1" = 40'

DRAWN BY: PM
DESIGNED BY: HB
CHECKED BY: RJ
PROJECT MANAGER: RTG
SCALE: 1"=40'

PROJECT: PASCO LANDFILL ZONE B
PASCO, WASHINGTON

TITLE: POST-EXCAVATION CONFIRMATION SURFACE SOIL SAMPLING LOCATIONS

DATE: DECEMBER 2009
PROJECT NO: 4-61M-107051
DRAWING : FIGURE 2
SHEET NO.: 1 OF 1

K:\10000\10700\10705\10705-1\RAWP\Revised RAWP\DWG\FIGURE 2 - Post-Exca Conf Surf Samp Locs.dwg - C-1 - Dec. 24, 2009 9:24am - brian.johnson

ATTACHMENTS

SOPs

SOP-1 - Discrete Soil Sampling Using a Shovel, Trowel, or Hand Auger

SOP-2- Decontamination Procedure

PASCO LANDFILL ZONE B
SOP - 1
DISCRETE SOIL SAMPLING USING A SHOVEL, TROWEL, OR HAND AUGER

1.0 PURPOSE

This standard operating procedure (SOP) describes the general instructions for collecting discrete soil sampling using a hand auger, shovel, or trowel. Samples will be collected in accordance with the applicable field sampling plan.

2.0 EQUIPMENT LIST

1) Shovel and stainless steel auger (including sand auger, and planer auger bits for loose granular soils), spoons, and trowels
2) Tape measure
3) Appropriate field sampling form, field logbook, and indelible pens
4) Digital camera
5) Hand held global positioning system unit (GPS)
6) Survey stakes and ribbon
7) Sample containers, labels, coolers, and ice
8) Resealable 1 to 2 gallon and smaller (sandwich-size) plastic bags for compositing
9) Decontamination equipment (see SOP - 2, Decontamination Procedure and sampling plan for additional site-specific requirements)
10) Site map and site Health and Safety Plan (HASP)
11) Personal protective equipment appropriate for site (see HASP)

Figure 1: Planer Auger designed to remove loose slough material from hand auger boring in preparation for a discrete core sample (AMS, Inc.).

Figure 2. Sand auger bit designed with restricted opening to retain loose sand samples (AMS, Inc.).

PROCEDURES

Soil Sample Collection

1) Obtain sampling supplies and equipment and ensure appropriate sample containers are prepared and ready for sample collection.
2) Mobilize sampling equipment to appropriate sampling location.
3) Label the outer surface of a 1 to 2 gallon, double-bagged plastic bag with the sampling location identification, sample interval, date, and time.
4) Remove the any vegetation at the sample location.
5) Use trowel, shovel, stainless steel hand auger, or soil core samplers to obtain surface soil samples (0 to 6 inches below ground surface [bgs] or other targeted depths per the appropriate SAP). With full sample recovery, the 2 ¾- inch-diameter by 6-inch-long auger will recover approximately 12 ounces of soil.
6) For dry, loose sandy soils, a stainless steel sand auger bit can be used to collect the soil samples targeted below 6 inches below ground surface. The restricted opening of the sand auger bit would aid in retaining the sample. Prior to collecting a discrete subsurface soil sample (e.g. 6 to 12 inches or 12 to 18 inches bgs), as much slough as possible should be removed from the borehole. A planer auger (Figure 1) can be used to remove slough that is too loose to remove with the sand auger bit. A measurement of the borehole should be made to determine the thickness of the slough that remains in the bore hole. This slough material will be removed and discarded from top of the soil core interval. Separate core retrievals will be necessary for each 6 inch interval. If sample recover is poor, more than one hand auger boring will be needed at each sample location to obtain the required sample volume. As an alternative method to minimize slough material in the borehole, a shovel can be used to remove the loose surface soil approximately 12 to 18 inches surrounding the borehole location.
7) Place representative soil into a 1 to 2 gallon double-bagged resealable plastic bag and thoroughly mix the sample inside the plastic bag. Fill additional plastic bags for adequate sample volume as needed. Remove any tar ball material observed in the sample.

8) Transfer the bagged surface soil samples to the appropriate sample containers (see appropriate table in SAP). Disposable surfaces (e.g., plastic sheeting and/or aluminum foil) will be used to prevent cross contamination when handling soil samples.
9) Transfer the soil into the appropriate pre-cleaned and certified soil sample containers provided by the contract laboratory.
10) Record sample date, time, and sampler name on sample label and record in the field logbook and on the sample identification matrix log sheets.
11) Photograph the sample location and the sample core. Include a label with the sample location name and depth in the sample core photograph.
12) Record samples on chain-of-custody forms and place in coolers.
13) Place a stake, labelled with the sample ID, at each location. Use the GPS to obtain map coordinates for the location and if possible measure the offset from a permanent site feature with a measuring tape.
14) Coordinate transportation to appropriate analytical laboratory(ies).

PASCO LANDFILL ZONE B
SOP - 2
DECONTAMINATION PROCEDURE

1.0 PURPOSE

This standard operating procedure (SOP) is specific to decontamination of non-disposable equipment performed at sites where environmental contamination is known or suspected. This is done to minimize the potential for cross-contamination between sampling locations (potentially resulting in unrepresentative samples and/or causing the spread of contamination) and also to protect human health and safety.

2.0 EQUIPMENT LIST

1) Deionized water
2) Plastic buckets
3) Spray bottles
4) Disposable rags or paper towels
5) Alconox, methanol, hexane
6) Potable water (can be replaced by deionized water)
7) Site map and site Health and Safety Plan (HASP)
8) Personal protective equipment appropriate for site (see HASP if applicable)

3.0 PROCEDURE

Sampling equipment (e.g., samplers, shovel, stainless spoons, etc.) will be decontaminated as follows:

1) Soap wash (dilute solution of Alconox or equivalent in potable water solution);
2) Potable water rinse;
3) Solvent rinse (methanol, hexane, or similar); and
4) Distilled/deionized water rinse.

Decontamination fluids will be stored in an appropriately labeled container. This will occur on the day of generation.

APPENDIX A

A-1 Design Drawings

A-2 Interim Remedial Action Technical Specifications

A-1

Design Drawings

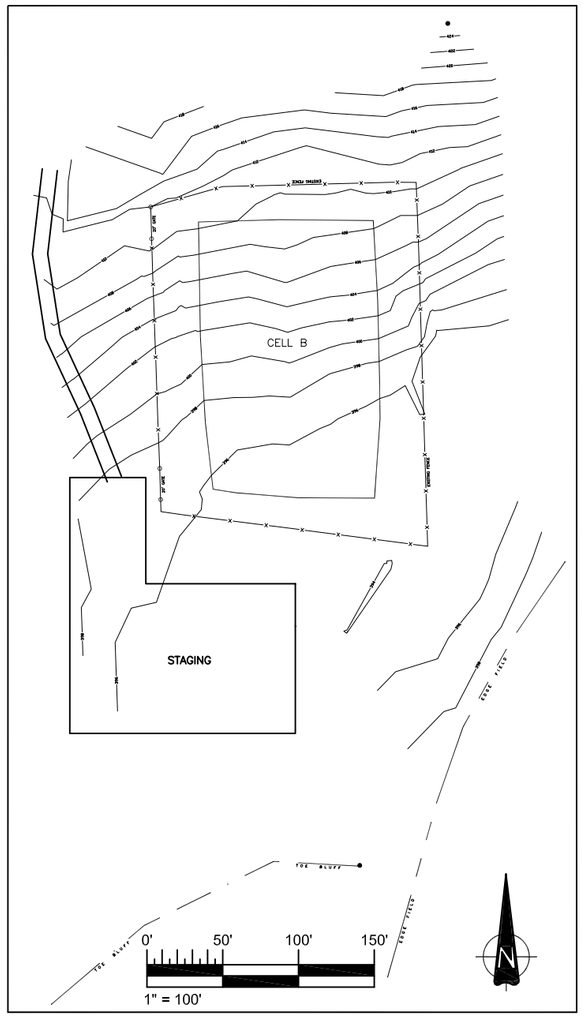
PASCO LANDFILL ZONE B
PASCO, WASHINGTON

LIST OF DRAWINGS

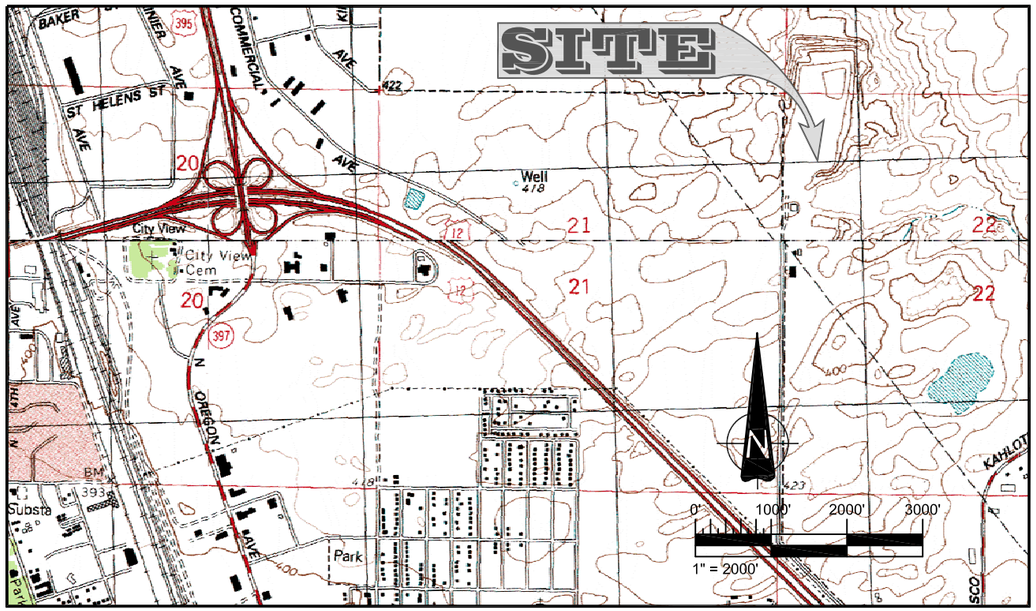
DRAWING	DRAWING TITLE
	GENERAL DRAWINGS
G-1	TITLE SHEET, VICINITY MAP, AND INDEX
	CIVIL DRAWINGS
C-1	GENERAL SITE PLAN
C-2	SITE GRADING AND CAP PLAN
C-3	SECTIONS
C-4	DETAILS

LEGEND

- CONTOURS WITH ELEVATION IN FEET (EXISTING)
- CONTOUR WITH ELEVATION IN FEET (NEW)
- FENCE LINE (EXISTING
- FENCE LINE (NEW)
- SURFACE SOIL EXCAVATION AREA
- CONSTRUCTION CONTROL POINTS (SEE C-2)
- MONITORING WELL
- CONTROL POINT (SEE C-1)
- EDGE OF EXISTING INTERIM COVER
- NON-PERFORATED DRAINAGE PIPE
- PERFORATED DRAINAGE PIPE WITH FLAP
- EDGE OF GEOSYNTHETIC CLAY LINER AND GEOMEMBRANE
- EXISTING GROUND
- EROSION PROTECTION ROCK
- LOCATION OF SECTION (A / C-3)
- LOCATION OF DETAIL (2 / C-4)



SITE PLAN



VICINITY MAP

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
1	19	09	2009	Issued for IWAG & BCS Review	CRP	-

CLIENT: Bayer CropScience

amec
AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR. U.S.A. 97224

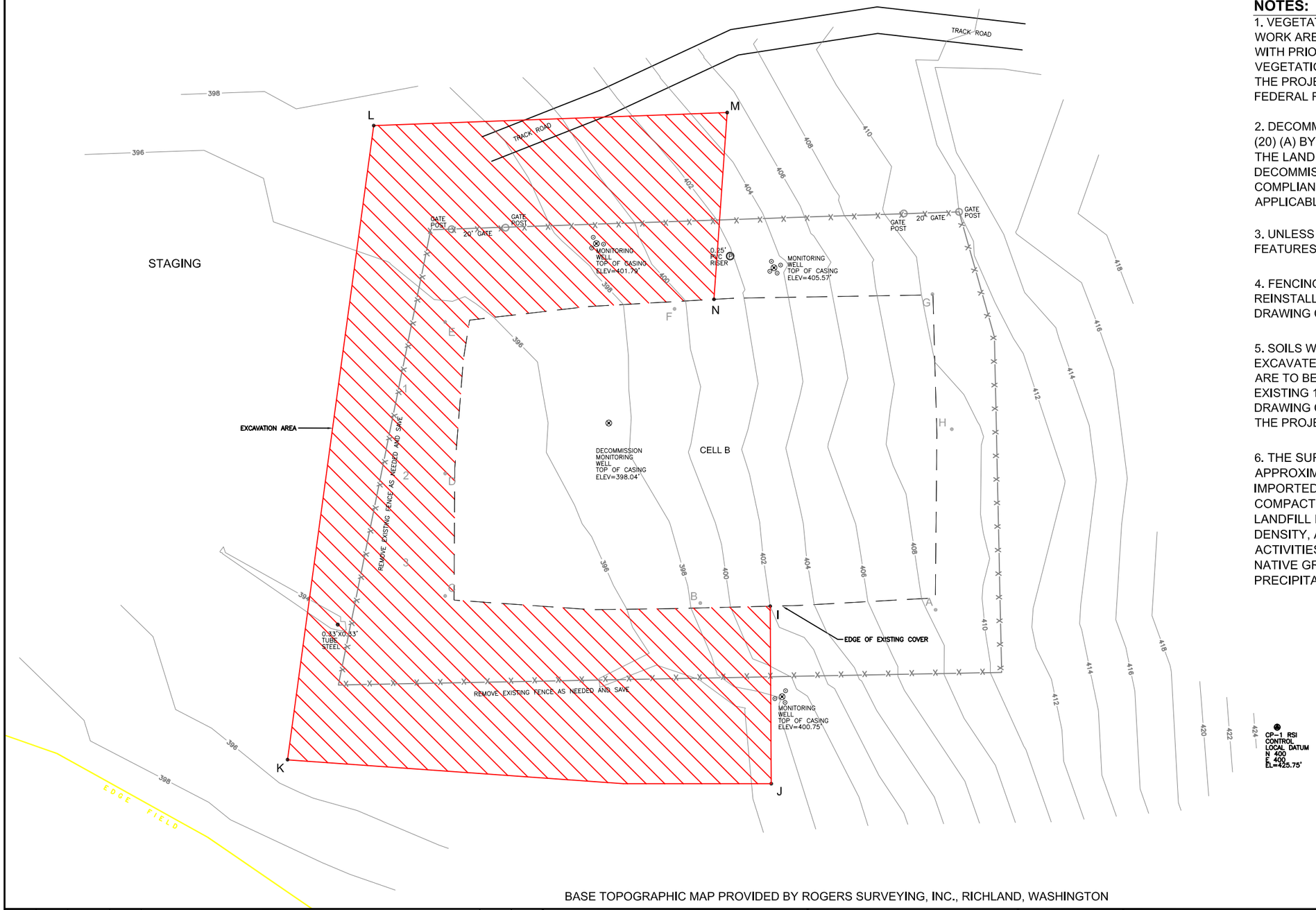
DRAWN BY:	PM
DESIGNED BY:	MK/AM/GR
CHECKED BY:	CRP
PROJECT MANAGER:	RTG
SCALE:	AS NOTED

PROJECT: PASCO LANDFILL ZONE B, PASCO, WASHINGTON

TITLE: TITLE SHEET, VICINITY MAP, AND INDEX

DATE:	NOVEMBER 2009
PROJECT:	4-61M-107051
DRAWING:	G-1
SHEET:	1 OF 5

K:\10000\10700\10705\10705-1\RAWP\Final RAWP\App A\DWG\G-1.dwg – G-1 – May. 12, 2010 3:03pm – patrick.mccarthy



NOTES:

1. VEGETATION AND DEBRIS SHALL BE CLEARED FROM DESIGNATED WORK AREAS AND ELSEWHERE AS NECESSARY TO FACILITATE WORK WITH PRIOR WRITTEN APPROVAL BY THE ENGINEER. REMOVED VEGETATION AND DEBRIS SHALL BE DEPOSED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND ANY APPLICABLE STATE OR FEDERAL REGULATIONS.

2. DECOMMISSION MONITORING WELL INDICATED PER WAC 173-160-460 (20) (A) BY FILING THE CASING FROM THE BOTTOM OF THE WELL TO THE LAND SURFACE WITH NEAT CEMENT GROUT. WELL DECOMMISSIONING AND DERIVED WASTE HANDLING SHALL BE IN COMPLIANCE WITH THE PROJECT SPECIFICATIONS AND ANY APPLICABLE STATE OR FEDERAL REGULATIONS.

3. UNLESS SPECIFICALLY NOTED, PROTECT ALL SITE WELLS AND FEATURES FROM DAMAGE DURING CONSTRUCTION.

4. FENCING REMOVED FOR CONSTRUCTION ACTIVITIES MUST BE REINSTALLED OR REPLACED IN THE CONFIGURATION SHOWN ON DRAWING C-2, SHEET 3 AND IN GOOD WORKING ORDER.

5. SOILS WITHIN THE SURFACE SOIL EXCAVATION AREA SHALL BE EXCAVATED TO 1 FOOT BELOW GROUND SURFACE. EXCAVATED SOILS ARE TO BE TRANSPORTED AND PLACED WITHIN CELL B ON THE EXISTING 12-MIL POLY COVER TO THE LINES AND GRADES SHOWN ON DRAWING C-2 AND IN ACCORDANCE WITH APPLICABLE SECTIONS OF THE PROJECT SPECIFICATIONS.

6. THE SURFACE SOIL EXCAVATION AREA WILL BE BACKFILLED TO APPROXIMATE ORIGINAL GRADES USING CERTIFIED-CLEAN, IMPORTED FILL. FILL OUTSIDE OF THE LANDFILL FOOTPRINT WILL BE COMPACTED TO 85% MAXIMUM DRY DENSITY; FILL INSIDE THE LANDFILL FOOTPRINT WILL BE COMPACTED TO 90% MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D698. FOLLOWING EARTHWORK ACTIVITIES, ALL AREAS SHALL BE IMMEDIATELY HYDROSEEDED WITH NATIVE GRASSES TO PREVENT SOIL LOSSES BY WIND AND PRECIPITATION."

BASE TOPOGRAPHIC MAP PROVIDED BY ROGERS SURVEYING, INC., RICHLAND, WASHINGTON

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
1	19	09	2009	Issued for IWAG & BCS Review	CRP	-

CLIENT: Bayer CropScience

amec
AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

0' 20' 40' 60'
1" = 40'

DRAWN BY: PM
DESIGNED BY: MK/AM/GR
CHECKED BY: CRP
PROJECT MANAGER: RTG
SCALE: 1"=40'

PROJECT: PASCO LANDFILL ZONE B
PASCO, WASHINGTON

TITLE: GENERAL SITE PLAN (ZONE B)

DATE: MAY 2010
PROJECT: 4-61M-107051
DRAWING: C-1
SHEET: 2 OF 5

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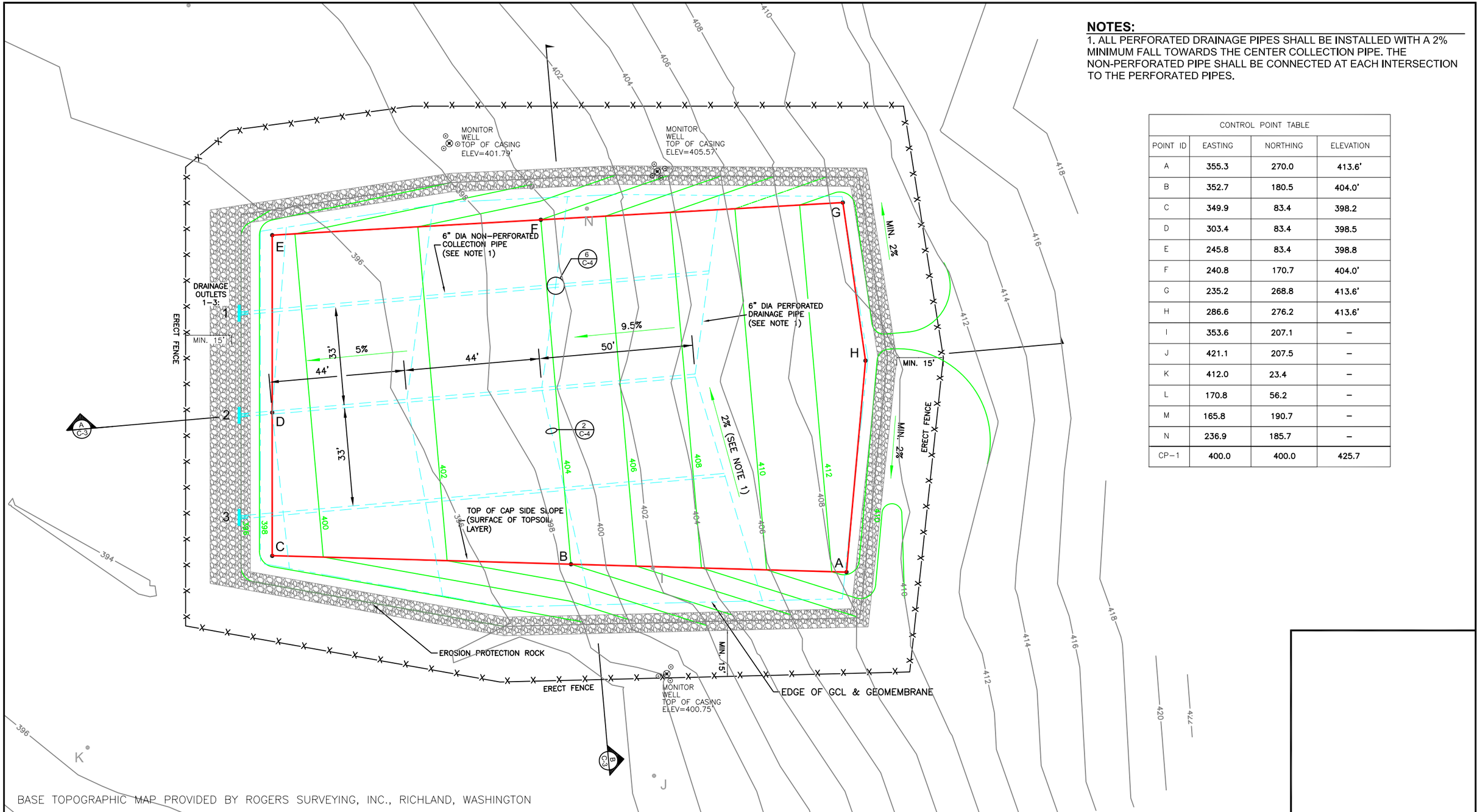

BASE TOPOGRAPHIC MAP PROVIDED BY ROGERS SURVEYING, INC., RICHLAND, WASHINGTON

NOTES:

1. ALL PERFORATED DRAINAGE PIPES SHALL BE INSTALLED WITH A 2% MINIMUM FALL TOWARDS THE CENTER COLLECTION PIPE. THE NON-PERFORATED PIPE SHALL BE CONNECTED AT EACH INTERSECTION TO THE PERFORATED PIPES.

CONTROL POINT TABLE			
POINT ID	EASTING	NORTHING	ELEVATION
A	355.3	270.0	413.6'
B	352.7	180.5	404.0'
C	349.9	83.4	398.2
D	303.4	83.4	398.5
E	245.8	83.4	398.8
F	240.8	170.7	404.0'
G	235.2	268.8	413.6'
H	286.6	276.2	413.6'
I	353.6	207.1	–
J	421.1	207.5	–
K	412.0	23.4	–
L	170.8	56.2	–
M	165.8	190.7	–
N	236.9	185.7	–
CP-1	400.0	400.0	425.7

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
1	19	09	2009	Issued for IWAG & BCS Review	CRP	-

CLIENT: Bayer CropScience

AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

0' 15' 30' 45'
1" = 30'

DRAWN BY: DD/LM
DESIGNED BY: MK/AM/GR
CHECKED BY: CP
PROJECT MANAGER: RTG
SCALE: AS NOTED

PROJECT: PASCO LANDFILL ZONE B
PASCO, WASHINGTON

TITLE: SITE GRADING AND CAP PLAN

DATE: MAY 2010
PROJECT: 4-61M-107051
DRAWING: C-2
SHEET: 3 OF 5

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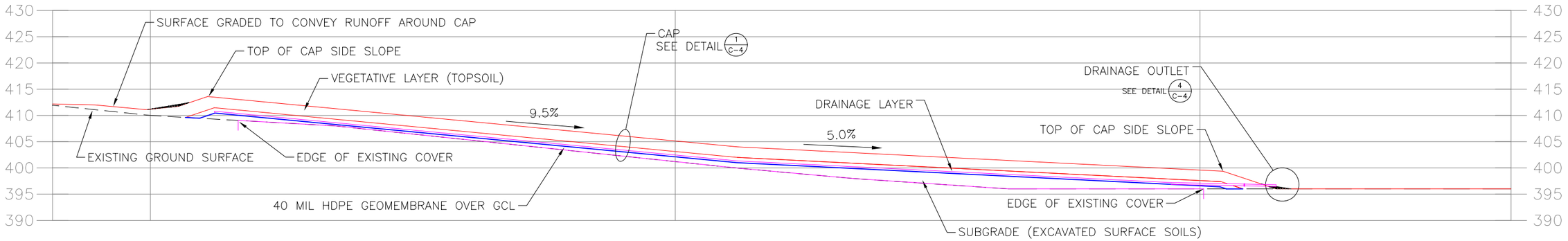
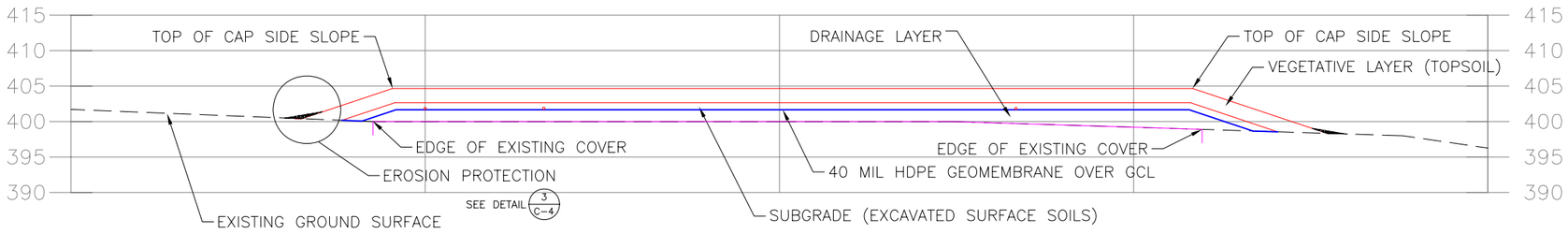


SECTION A
1"=20'
A / C-2



SECTION B
1"=20'
B / C-2

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
1	19	09	2009	Issued for IWAG & BCS Review	CRP	-

CLIENT: Bayer CropScience

amec
AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

0' 10' 20' 30'
1" = 20'

DRAWN BY: PM
DESIGNED BY: MK/AM/GR
CHECKED BY: CRP
PROJECT MANAGER: RTG
SCALE: AS NOTED

PROJECT: PASCO LANDFILL ZONE B
PASCO, WASHINGTON

TITLE: SECTIONS

DATE: MAY 2010
PROJECT: 4-61M-107051
DRAWING: C-3
SHEET: 4 OF 5

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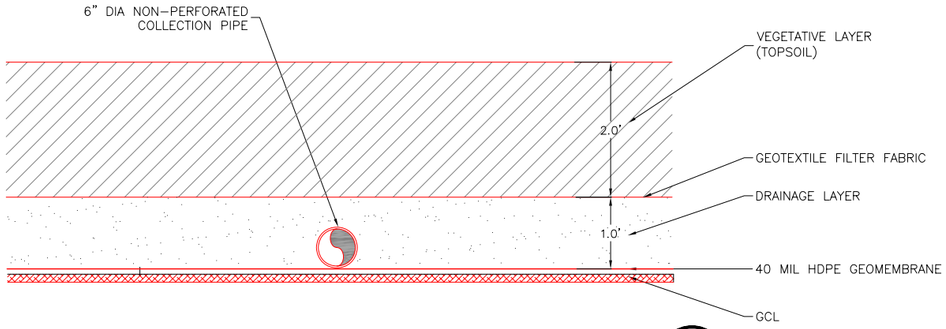
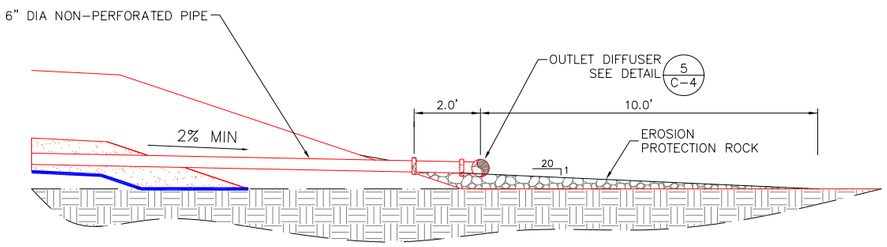


CAP DETAIL
NTS — 1 / C-3

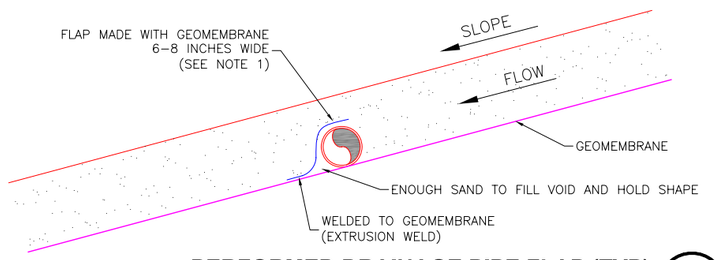


DRAINAGE OUTLET DETAIL
NTS — 4 / C-3

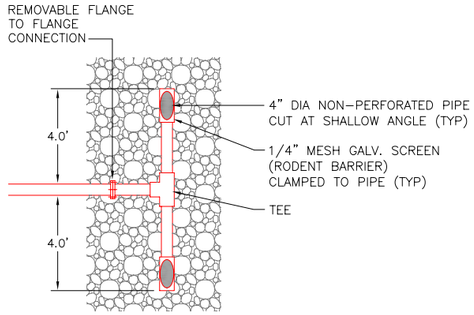
NOTES:

1. THE FLAPS ARE TO BE FABRICATED BY THE GEOMEMBRANE INSTALLATION CONTRACTOR USING THE SAME GEOMEMBRANE MATERIAL TO WHICH IT IS WELDED. THEY ARE TO BE CONSTRUCTED IN A CONFIGURATION THAT FORCES THE WATER FLOWING IN THE DRAINAGE LAYER INTO THE PERFORATED COLLECTION PIPE. THEY ARE TO BE APPROXIMATELY 6-8 INCHES IN WIDTH; EXTRUSION WELDED TO GEOMEMBRANE; AND POSITIONED DURING DRAINAGE LAYER PLACEMENT SO THAT THE TOP OF THE FLAP IS 1-2 INCHES ABOVE THE CENTER OF THE TOP OF PIPE.

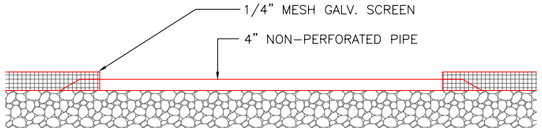
2. THE DIVERSION FLAPS ARE TO BE CONSTRUCTED SIMILARLY TO THE FLAPS, AND ARE INTENDED TO DIVERT WATER THAT IS FLOWING NEXT TO THE NON-PERFORATED PIPES INTO THE PERFORATED PIPES. DETAIL #6 IS A CONCEPTUAL PRESENTATION. ALTERNATIVES THAT MEET THE DESIGN INTENTION WILL BE ACCEPTED.



PERFORMED DRAINAGE PIPE FLAP (TYP)
NTS — 2 / C-2

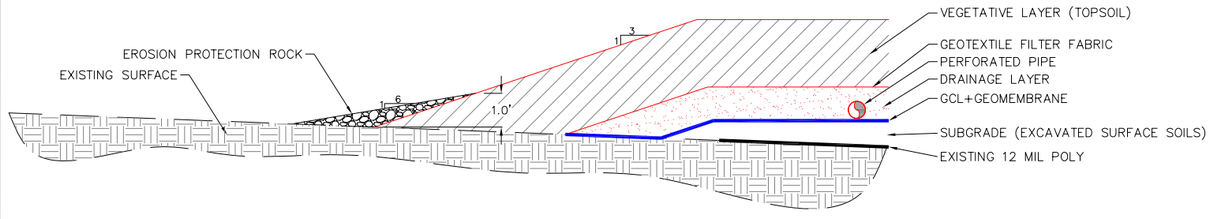


TOP VIEW

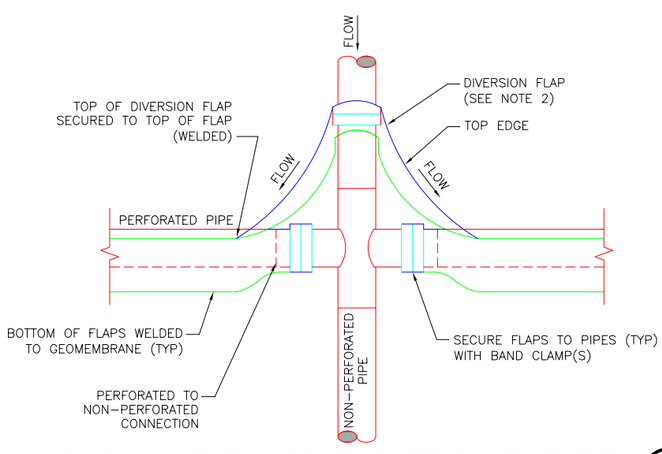


END VIEW

OUTLET DIFFUSER DETAILS (TYP)
NTS — 5 / C-4



EROSION PROTECTION DETAIL
NTS — 3 / C-3



FLAP CONNECTION POINT / DIVERSION FLAP (TYP)
NTS — 6 / C-2

REV	DATE	MONTH	YEAR	REVISION DESCRIPTION	ENG	APPR
1	19	09	2009	Issued for IWAG & BCS Review	CRP	-

CLIENT: Bayer CropScience

amec
AMEC Earth & Environmental
7376 S.W. Durham Road
Portland, OR, U.S.A. 97224

DRAWN BY: PM
DESIGNED BY: MK/AM/GR
CHECKED BY: CRP
PROJECT MANAGER: RTG
SCALE: AS NOTED

PROJECT: PASCO LANDFILL ZONE B
PASCO, WASHINGTON

TITLE: DETAILS

DATE: MAY 2010
PROJECT: 4-61M-107051
DRAWING: C-4
SHEET: 5 OF 5

A-2

Interim Remedial Action Technical Specifications

INTERIM REMEDIAL ACTION
TECHNICAL SPECIFICATIONS

PASCO LANDFILL ZONE B
Pasco, Washington

Prepared by:

AMEC Earth & Environmental, Inc.
7376 SW Durham Road
Portland, Oregon 97224

4-61M-107051/Phase 1

TABLE OF CONTENTS

SECTION 00020
INVITATION TO BID

Bayer CropScience (BCS) is requesting proposals from qualified contractors for the Pasco Landfill Zone B Remediation project located at Pasco, Washington. The work includes excavating, transporting, and placing designated soils on existing landfill, and installation of RCRA Subtitle C Cap System.

Sealed paper bid submittals and an electronic copy of a complete bid package for the Pasco Landfill Zone B project must be received 5:00 pm local time XXXXX, XXXXX XX, 2010 at the below address.

Original to:

Christopher Poulsen
AMEC Earth & Environmental, Inc.
7376 SW Durham Road
Portland, Oregon 97224

SECTION 00100
INSTRUCTIONS TO BIDDERS

1.1 BIDDING DOCUMENTS

A complete set of Bidding Documents must be used in preparing Bids: neither BCS nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of an incomplete set of Bidding Documents.

1.2 QUALIFICATIONS OF BIDDERS

Bidders will be required to submit evidence that they have a practical knowledge of the particular Work bid upon, and that they have the financial resources to complete the proposed Work. Each Bidder must be skilled and regularly engaged in the general class and type of work called for under this Contract and must be licensed in accordance with provisions of the State of Washington.

BCS may request that the Contractor submit information, in addition to that described below, to permit BCS to reasonably evaluate the Contractor's performance and ability to perform the work at the bid price.

Each Bidder shall complete and submit with their bid, Section 00420 Certification of Bidder's Experience and Qualifications.

1.3 TAXES AND PERMITS

All Federal, State, and local taxes of every kind and character applicable to the work and the cost of Contractor's permits and notifications shall be paid by Contractor. The Bid prices shall include all such taxes and the cost of all required permits and notifications.

1.4 INTERPRETATIONS OF DRAWINGS AND DOCUMENTS

Each Bidder shall examine the Bidding Documents carefully and, not later than 7 days prior to the date for receipt of bids, shall make written request to the Engineer for interpretation or corrections of any ambiguity, inconsistency, or error therein which it may discover. Any interpretation or correction will be issued as an Addendum to the Bidding Documents. Only a written interpretation or correction by Addendum shall be binding. Oral and other interpretations or clarifications will be without legal effect. Question shall be addressed in writing or by fax to:

AMEC Earth & Environmental, Inc.
Attention: Christopher Poulsen
7376 SW Durham Road
Portland, Oregon 97224
TEL: 503-639-3400
FAX: 503-620-7892

1.5 BIDDER RESPONSIBILITY

Before submitting its bid, each prospective Bidder shall familiarize itself with the Work, the site where the Work is to be performed, local labor conditions, and all laws, regulations and other factors affecting performance of the Work. The Bidder shall carefully correlate its observations with requirements of the Contract Documents and otherwise satisfy itself of the expense and difficulties attending performance of the Work. There will be no subsequent financial adjustment for lack of such familiarization.

1.6 PRE-BID MEETING

There will be a pre-bid meeting at the site at 10:00 am local time on XXXX XXXX XX, 2010. Please bring a maximum of two representatives to the site walk. Any and all conditions evident during the site visit shall be established as the norm and form the basis for the cost estimate. Only substantial previously unknown or new conditions (communicated in writing to BCS and AMEC) that may surface after work is underway will be considered for change orders. Change order rates will be identified and agreed upon based on the nature of the change item. Any contractor not attending the site visit will have same responsibility to provide valid cost estimate as contractor attending the pre-bid site visit. Please contact Christopher Poulsen at AMEC by 3:00 pm Pacific Standard Time on XXXX XXXX XX, 2010 to confirm your attendance. Provide names of individuals to attend, and obtain directions to the site.

1.7 SCHEDULE

BCS and AMEC desire to complete this work in an expeditious manner. The desired schedule for this work is:

Milestone	Time Frame/Deadline
RFP Distribution:	
Pre-Bid Site Meeting:	
Bid Due Date:	
Tentative Planned Award Date:	
Notice to Proceed:	
Contractor Mobilize to Site:	
Contractor Complete Work:	
Contractor Demobilize from Site:	
Complete Final Submittals Due:	

1.8 CONTRACT AWARD

The project will be awarded to the Bidder whose bid is most advantageous to BCS with all factors considered. A purchase order will be issued to the successful Bidder.

1.9 TECHNICAL QUESTIONS

Questions of a technical nature must be submitted in writing via email or facsimile to AMEC with a copy to BCS (see addresses below). Questions and answers will be compiled by AMEC and periodically forwarded to all bidders.

Original to:

AMEC Earth & Environmental, Inc.
Attention: Christopher Poulsen
7376 SW Durham Road
Portland, Oregon 97224
TEL: 503-639-3400
FAX: 503-620-7892
Email: christopher.poulsen@amec.com

- END OF SECTION -

SECTION 00300
BID

The bid form attached to this section shall be used without alteration. Bidder accepts all of the terms and conditions of the Section 00020 Invitation to Bid and Section 00100 Instruction to Bidders. This Bid will remain Subject to acceptance for 60 days after the day of Bid opening.

Bidder shall familiarize itself with the nature and extent of the Contract Documents, Work, Site, Locality, all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

The following attachments are included in and made a part of this Bid.

1. Completed Bid Form, Section 00300;
2. Bidder's Experience and Qualifications, Section 00420;
3. Proof of insurance consistent with contract terms and conditions;
4. Written certification that bidder shall comply with all contract terms and conditions;
5. Written certification that all work shall be performed by properly trained/certified individuals in accordance with the Specifications and any/all applicable Federal, State, and local regulations/requirements, and to the complete satisfaction of BCS, AMEC, and regulatory agencies;
6. Project organization description;
7. Resumes of key personnel (Superintendent and Project Manager);
8. Preliminary Construction Schedule;
9. List of Contractor's proposed equipment;
10. Proposed subcontractors, Section 00430; and
11. Complete list and description of any Contractor exceptions or inconsistencies to the bid based on these Specifications.

BID FORM

To: AMEC c/o Christopher Poulsen

CC: BCS

For: Pasco Landfill Zone B

SUBMITTED BY (State full name and address of Bidder)

_____

Person to contact for additional information on this submittal:

_____

(NAME)

_____

(ADDRESS)

_____

(PHONE/FACSIMILE/E-MAIL)

Bid Item Number	Bid Item	Unit	Estimated Quantity	Unit Price	Total Price
1	Mobilization/Demobilization and Project Preparation				
a.	Mobilization/Demobilization	Lump Sum	1		
b.	Submittals	Lump Sum	1		
2	Environmental Management Services	Lump Sum	1		
3	Site Fencing	Lump Sum	1		
4	Decommissioning of Monitoring Well	EA	1		
5	Clearing	0.1 Ton	4		
6	Surface Soil Excavation and Backfill	SF	27,000		
7	Subgrade Preparation	CY	867		
8	GCL	SF	24,635		
9	Geomembrane	SF	24,635		
10	Geotextile	SF	27,895		
11	Drainage Layer	CY	912		
12	Drainage Collection and Conveyance				
a.	Perforated pipe with Geotextile sock	LF	504		
b.	Non-perforated pipe	LF	460		
c.	Drainage Outlets	Per unit	3		
d.	Geomembrane Flaps	Lump Sum	1		
13	Vegetative Layer	CY	2,126		
14	Erosion Protection Rock	Ton	62		
15	Site Restoration and Clean up	Lump Sum	1		
16	Post-Excavation Sampling Standby	Lump Sum	1		
Pre-tax Total					
Total (Incl. Tax)					

(BID SUBMITTAL DATE)

(COMPANY NAME)

(TYPE NAME AND TITLE)

(SIGNATURE)

- END OF SECTION -

SECTION 00420
CERTIFICATE OF BIDDER'S EXPERIENCE AND QUALIFICATIONS

Bidder certifies that it is, at the time of bidding, and shall be throughout the period of the contract, licensed in the State of Washington, to do the type of work presented in the Contract Documents. The Bidder further certifies that it is skilled and regularly engaged in the general class and types of work called for in the Contract Documents. Any Bidder not so licensed shall be subject to all legal penalties imposed by law, including, but not limited to, any appropriate disciplinary action by the Contractor's State License Board.

Demonstrate qualifications. Contractor may provide up to three recent projects examples of a similar nature in the table below.

	Project No. 1	**Project No. 2**	**Project No. 3**
Project Name			
Owner			
Bid Price			
Final Construction Cost			
Construction Time			
Owner's Representative			
Owner's Representative Telephone Number			
Completed on Time? [1]			
Claims or disputes filed? [2]			

Notes [1] If no, explain
[2] If yes, explain

- END OF SECTION -

SECTION 00430
PROPOSED SUBCONTRACTORS

The Bidder shall submit a list of each subcontractor that will be used in the Work if the Bidder is awarded the Contract.

Name	Business Address	Work Description	Percent

Name of Bidder:_____

- END OF SECTION -

SECTION 00440
PRELIMINARY CONSTRUCTION SCHEDULE

The bidder shall provide a preliminary construction schedule within the Construction Operations Plan (Section 01310) which shall include, at a minimum, the following:

A. Mobilization and Site Preparation.

B. Surface Soil Excavation, Relocation, and Placement with GCL Subgrade Preparation.

C. Backfilling and Grading of Surface Soil Excavation Area.

D. GCL and Geomembrane Installation.

E. Drainage Layer Installation.

F. Geotextile Installation.

G. Vegetative Layer Installation.

H. Erosion Protection Rock Installation.

I. Site Restoration (fencing and hydroseeding).

J. Demobilization.

- END OF SECTION -

SECTION 00460
PROOF OF QUALIFICATION AND LEGAL STATUS

Bidder shall complete all applicable sections of this Bid Form.

LEGAL STATUS OF BIDDER

If the Bidder is an individual:

_____
Name

_____
Signature

_____
Business Address

_____
Home Address

If the Bidder is a partnership, list all general partners:

_____
Name

_____
Business Address

_____
Home Address

_____
Signature of General Partner

_____
Name

_____
Business Address

_____
Home Address

_____
Signature of General Partner

If the bidder is a corporation:

Name

Incorporated Under the Laws of the State of

Home Office Address

President or Chief Executive Officer:

Name

Home Address

Other Directors:

Name

Home Address

Name

Home Address

Name

Home Address

Name of Officer authorized to sign bid:

Title

NOTE: Certified copy of the by-laws or resolution of Board of Directions shall be furnished with the bid showing the authority of the officer signing the bid.

If the Bidder is a joint venture, give details of each joint venture partner:

Company Name

Business Address

Name of Principal Officer

Home Address

Company Name

Business Address

Name of Principal Officer

Home Address

Name of representative of joint venture authorized to sign bid:

Title

NOTE: Certified copy of resolution or agreement empowering the representative to execute the bid and bind the joint venture shall also be furnished with the bid.

- END OF SECTION -

SECTION 00500
CONTRACT

SUBCONTRACT

Subcontract Type (Check One): Firm-Fixed Price ____ Time and Materials ____

Seller:	**AMEC office and billing address:** AMEC Earth & Environmental, Inc. ("Buyer")	**Subcontract No.:**
		Modification No.:
Telephone No.: Facsimile No.: **Seller's Taxpayer ID No.:**	Attn: Chris Poulsen	**Date:**

Prime Contract No.:_____ **Flow down or other provisions attached?**

Prime Client Name: _____ ("Client") **Yes ☐** **No ☐**

Item	Description of Work to be Performed	Qty	Unit Price	Total Price
	Provide all materials, equipment, and labor required to fulfill all provisions of the drawings and specifications for the Pasco Landfill Zone B Cap Project, of which this contract is part. **See Bid Form, Section 00300**			
	TOTAL AMOUNT OF SUBCONTRACT:			**$**

Project No.:_____

Seller Acknowledgment:

Signature:_____
Name:_____
Title: _____

Buyer approval:
Signature:_____
Name: _____
Title:_____

Please return signed acknowledgment and insurance certificate as per terms and conditions prior to commencing performance or delivery.

General Terms and Conditions to Subcontract:

1. ENTIRE AGREEMENT. This Subcontract when accepted by Seller, either in writing or by shipment of any article or other commencement of performance of services hereunder, constitutes the entire contract between Seller and Buyer concerning its subject matter and supersedes all previous proposals, offers and other communications with respect hereto. Any changes or contrary or additional conditions proposed by Seller are hereby rejected, unless expressly stated in the Subcontract or incorporated by a change order. Seller shall make no changes in this Subcontract without Buyer's written consent. Buyer reserves the right to alter Subcontract quantities and specifications at any time. If changes initiated by Buyer affect price or delivery, Seller shall give immediate written notice to Buyer of the effect of such changes. Buyer and Seller shall agree to any price change not covered by a previously established price agreement, before it becomes effective. Seller shall conduct all operations in Seller's own name as an independent contractor and not in the name of, or as agent for, Buyer.

2. INVOICES AND PAYMENT TERMS. Invoices will clearly reference the Subcontract Number shown on the top of this Subcontract. Invoices may be submitted not more frequently than monthly. Final invoices must be submitted within 60 days of the end of the period of performance. Invoices received more than 60 days from the end of the period of performance will not be paid. Payment on Seller's invoices will be made within 15 days of Buyer's receipt of payment from the Client when such payment includes payment for amounts properly invoiced by Seller. Buyer's receipt of payment from the Client is a condition precedent to payment from Buyer to Seller. Seller's right to payment is contingent upon Buyer's approval and acceptance of the Work but payment shall not be evidence of Buyer's final acceptance of that which is called for by this Subcontract. Payment shall be subject to subsequent adjustment for shortage and allowance for articles or services rejected. Seller agrees that payments owed to it for performance under this Subcontract may be offset by Buyer by amounts equal to what Seller owes Buyer under any other contract arrangement between Buyer and Seller. This provision does not apply 1) where there are contractual and/or regulatory restrictions on offsets or 2) where payment on amounts owed Buyer is due to a reasonable dispute. During the term of this Subcontract and for a period of three (3) years thereafter, Buyer and/or Buyer's authorized representatives shall have the right to conduct audits of Seller's records, financial or otherwise, to the extent that they relate to this Subcontract. Seller shall maintain all records relating to this Subcontract at Seller's sole expense until the termination of Buyer's rights hereunder.

3. WARRANTY AND DEFECTIVE WORK CURE. All services shall be performed in a competent manner and shall reflect Seller's best professional knowledge, judgment and accepted industry practice. All articles, materials, work and services (the "Work") shall at all times be subject to Buyer's review and inspection, but neither Buyer's review and inspection nor failure to review or inspect shall relieve Seller of any obligation hereunder. If, in Buyer's opinion, the Work fails to conform to specifications or is otherwise defective or inadequate, upon notice to Seller, Seller shall, at Buyer's sole option, promptly replace, correct or re-perform same promptly and at Seller's expense. In the event that Buyer must re-perform or procure Work that has been deemed by Buyer as inadequate or insufficient, Seller shall incur all expenses of such re-performance or procurement. No acceptance or payment by Buyer shall constitute a waiver of the foregoing. Nothing herein shall exclude or limit any warranties implied by law.

4. TAXES. Seller shall pay all sales, use, excise, gross receipts and other taxes, charges, and contributions now or hereafter imposed in any way on the Work furnished hereunder or the compensation paid to persons employed in connection with performance of the Work hereunder. Any invoice submitted to Buyer that does not delineate tax information will be presumed to contain tax, where applicable, in the total.

5. COMPLIANCE WITH LAWS. Seller agrees to fully observe and comply with all applicable local, state, and federal laws, regulations, and orders pertaining to the Work, including but not limited to, the Fair Labor Standards Act of 1938, Executive Order 11246, the Rehabilitation Act of 1973, the Vietnam Era Veterans Readjustment Act of 1974, Executive Order 11625, and the Occupational Safety and Health Act of 1970. Seller is responsible for the health and safety of its own employees, subcontractors and consultants and will ensure that all necessary safety requirements are enforced.

6. INSURANCE. Without in any way limiting any of Seller's obligations, indemnities, or liabilities, Seller shall maintain at all times the following minimum insurance at Seller's expense: (a) workers' compensation insurance - statutory limits, regardless of statutory exemption; (b) employer's liability insurance - limit of $1,000,000 each occurrence; (c) commercial automobile liability insurance - bodily injury and property damage combined single limit of $1,000,000; (d) commercial general liability insurance (including contractual liability coverage) - bodily/personal injury and property damage - limit of $1,000,000 per occurrence; (e) professional liability insurance - $1,000,000 per claim - required if Seller will be professionally certifying a work product (drawings, plans, permit applications, etc.) or performing professional services such as surveying where an error or omission could affect the design of a project or impact a construction schedule; (f) pollution liability insurance - $1,000,000 per claim - required if Seller will be (i) performing drilling services,

(ii) testing services and/or soil analysis which requires drilling beyond a depth of two feet or (iii) transporting or hauling hazardous waste; and (g) MCS-90 endorsement to general and automobile liability - required if Seller will be transporting or hauling waste material (regardless of classification). In addition, if the Subcontract contains asbestos-related work, Seller shall maintain a commercial general liability insurance policy with (i) a minimum limit of $2,000,000 per occurrence, and (ii) no exclusion under the policy for asbestos-related claims. Seller shall name Buyer and the Client identified above as additional insured under the above (b), (c), (d), and (f) policies and so state on its certificate(s) of insurance. Prior to beginning Work, Seller shall provide Buyer with a certificate(s) of insurance evidencing all required coverage, and upon Buyer's request, Seller will provide Buyer with a certified copy of Seller's insurance policy (ies). The types and limits of insurance specified herein shall in no way limit Seller's liability under this Subcontract.

7. PROPRIETARY INFORMATION. All reports, drawings, plans or other documents (or copies) furnished to Seller shall be returned upon completion of the Work. All reports, drawings, plans, or documents (or copies thereof) in any form prepared by Seller hereunder are prepared for the sole and exclusive benefit of the Buyer. Seller agrees it will keep confidential and not use any material, and documents (including but not limited to designs, sketches, specifications, drawings, computer programs and software, or other data or information) generated hereunder or furnished by Buyer for any purpose whatsoever other than as herein specified.

8. OWNERSHIP OF WORK PRODUCT. All technical data, evaluations, reports and other work products developed by Seller hereunder are Works Made for Hire and are the property of Buyer and shall be delivered to Buyer upon completion of the Work. Seller may retain copies thereof for its files and its internal use. Buyer must first approve in writing any publication of information directly derived from the Work performed or data obtained in connection with services rendered under this Subcontract.

9. PATENTS. Whenever any invention or discovery is made or conceived by the Seller in the course of, in connection with, or under the terms of the Subcontract, the Seller shall immediately furnish to Buyer complete information thereon. Buyer shall have the sole power to determine whether or not and where a patent application shall be filed and to determine the disposition of the title and the rights under any application or patent that may result. The judgment of Buyer on these matters shall be accepted as final. Seller agrees that it and its employees will execute all documents and do all things necessary or proper to carry out the judgment of Buyer. Seller shall indemnify and defend Buyer and the Client identified on the face of this Subcontract against all claims, suits, liability, and expense alleging infringement of any patent, copyright, trademark or licensing agreement, resulting from or arising in connection with the manufacture, sale, normal use or other normal disposition of any article or material furnished hereunder

10. LIENS. Seller shall deliver the Work free and clear of any encumbrances and claims ("Lien(s)"). Buyer may withhold payment pending receipt of a complete waiver and release of Liens from Seller in a form acceptable to Buyer. If any Lien remains unsatisfied after all payments are made, Seller shall reimburse Buyer for any and all costs and expenses (including attorneys' fees and court costs) incurred by Buyer in discharging such Lien.

11. DEFAULT. Time is of the essence in the performance by Seller of the Work. Buyer's right to require strict performance by Seller shall not be affected by any previous waiver, forbearance or course of dealing. If Seller breaches any provision hereof or becomes insolvent, enters bankruptcy, receivership or other like proceeding (voluntarily or involuntarily) or makes an assignment for the benefit of creditors, Buyer may, in addition to any other rights it may have hereunder or by law, without any liability to Seller: (1) terminate all or part of this Subcontract by giving Seller written notice and (2) complete or procure the completion of the performance of the Work. In such event, title to the Work, whether completed or partially completed, as well as all materials prepared, procured or set aside by Seller for use in the Work, shall, at Buyer's option, vest in Buyer and Buyer may enter Seller's premises and remove the same therefrom, and Seller shall be liable to Buyer for all costs and expenses incurred by Buyer in completing the Work.

12. STOP WORK OR TERMINATION FOR CONVENIENCE. Buyer may, at its sole discretion, stop the Work or terminate the Work for its own convenience at any time. Where Seller is not in default hereunder, Buyer agrees to pay Seller for all work done in conformity with the requirements of this Subcontract up to the point when the Subcontract is terminated.

13. DISPUTES. Any dispute arising hereunder shall first be resolved by taking the following steps where a successive step is taken if the issue is not resolved at the preceding step: 1) by the technical and contractual personnel for each party performing this Subcontract, 2) by executive management of each party, 3) by mediation or 4) through a court system of competent jurisdiction. Notwithstanding the dispute, Seller shall continue to perform its obligations, unless Buyer terminates or otherwise suspends performance hereunder. Buyer shall be entitled to a reasonable sum for attorneys' fees (including those incurred prior to the action being filed), court costs and any costs incurred in enforcing a judgment or settlement.

14. ASSIGNMENTS AND SUBCONTRACTS. This Subcontract may not be assigned or subcontracted without the prior written consent of Buyer. This limitation shall not apply to the purchase of standard commercial supplies or raw materials.

15. WAIVER. Waiver by Buyer of any provision of this Subcontract shall not constitute a waiver as to any other provision and shall not affect the right to thereafter exercise any right or remedy in the event of any other default, whether similar or not.

16. LIMITATION OF LIABILITY. *Notwithstanding any other provision of this Agreement, the total liability of Buyer, its officers, directors and employees for liabilities, claims, judgments, demands and causes of action arising under or related to this Subcontract, whether based in contract or tort, shall be limited to the total compensation actually paid to Seller for the Work or $50,000, whichever is less. All claims by Seller shall be deemed relinquished unless filed within one (1) year after substantial completion of the Work. Buyer shall NOT be responsible for any consequential, incidental or indirect damages.*

17. INDEMNITY. The Seller shall indemnify, defend and hold the Buyer and the Client identified on the face of this Subcontract harmless from and against any and all liability, claims, demands, damages, fees, fines, expenses, and costs of every kind and nature for injury to, or death of, any and all persons (including, without limitation, employees or representatives of the Buyer or of the Seller or of any subcontractor, or any other person or persons) and for damage to, or destruction or loss, consequential or otherwise, of any and all property, real or personal (including without limitation, property of the Buyer and the Client identified, or of the Seller or of any subcontractor, or of any other person or persons), resulting from or in any manner arising out of or in connection with the performance of the Work.

18. PRIME CONTRACT. Where Buyer has made an agreement (the "Prime Contract") with the Client, the terms and conditions, if any, of the Prime Contract pertinent to Seller's responsibilities are hereby incorporated by reference and available on request. In cases of conflicting or duplicate terms, the stricter provision shall apply.

19. GOVERNING LAW, VENUE, AND SEVERABILITY. This Subcontract is to be governed by and construed in accordance with the laws of the state of the Buyer's billing address as identified on the face of this Subcontract and any action instituted for the enforcement of this Subcontract shall be resolved only in the federal or state courts of that state. In the event that any of the provisions, portions, or applications of this Subcontract are held to be unenforceable or invalid by court of competent jurisdiction, the parties shall negotiate an equitable adjustment in the provisions of this Subcontract with a view toward effecting the purpose of this Subcontract. The validity and enforceability of the remaining provisions, portions, or applications shall not be affected.

20. BRIBERY AND CORRUPTION PROHIBITED. The Seller undertakes to protect the standards of business practice of Buyer at all times and to act in such a way as to uphold the Buyer's good name and reputation and not to do or attempt to do any act or thing which is intended and/or which in fact causes any damage to or brings discredit upon the Buyer. In particular, the Seller shall not, directly or indirectly:

(a) Offer or give or agree to give to any director, officer, employee, or agent of the Buyer or of the Client any gift or consideration of any kind as an inducement or reward for doing or for forbearing to do or for having done or forborne to do any action in relation to the obtaining or execution of this Subcontract, the Prime Contract, or any other contract with the Buyer or the Client or for showing or forbearing to show any favor or disfavor to any person in relation to this Subcontract, the Prime Contract, or any other contract with the Buyer or the Client.

(b) Induce or attempt to induce any officer, servant, employee, or agent of any private or public body to depart from his or her duties to his or her employer nor be involved with any such arrangement.

Copies to: Requestor, Subcontracts, and Accounts Payable

SECTION 00610
PERFORMANCE BOND

We,_____, as Principal, and_____, as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to AMEC for payment of the penal sum of _____Dollars ($_____), lawful money of the United States. AMEC has awarded Principal a contract for the construction of the Interim Remedial Action at the Pasco Landfill Zone B.

The condition of the obligation is such that if the Principal and its subcontractors, heirs, executors, administrators, successors or assigns, shall in all things abide by and well and truly keep and perform the covenants, and agreements in the said Contract, and any alteration thereof made as therein provided, on its part to be kept and performed at the time and in the manner therein specified, and shall indemnify and save harmless AMEC, and their consultants, and each of their directors, officers, employees, and agents, as therein stipulated, this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

Principal and Surety agree that if AMEC is required to engage the services of an attorney in connection with the enforcement of this bond, the responsible party(s) shall pay AMEC's reasonable attorney's fees incurred, with or without suit, in addition to the above sum.

Whenever Contractor shall be, and declared by AMEC to be in default under the Contract, AMEC having performed AMEC's obligations thereunder, the Surety may:

1. Complete the Contract in accordance with its terms and conditions, or

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if AMEC elects, upon determination by AMEC and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and AMEC, and make available as Work progresses (even though there should be a default or a succession of defaults under the contractor contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by AMEC to Contractor under the Contract and any amendments thereto, less the amount properly paid by AMEC to Contractor.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than AMEC named herein of the heirs, executors, administrators or successors of AMEC.

The undersigned surety, for value received, hereby agrees that no extension of time, change in, addition to, or other modification of the terms of the contract or work to be performed thereunder, or of the specifications or other contract documents, shall in any way affect its obligation on this bond, and the Surety does hereby waive notice of any such extension of time, change, addition, or modification.

In testimony whereof, Contractor has hereunto set its hand and the Surety has caused these presents to be executed in its name and its corporate seal to be affixed by its attorney-in-fact at:

_____ on this _____ day of _____, 20___

_____ (SEAL)
(Principal)

By: _____

_____
(Title)

_____ (SEAL)
(Surety)

_____
(Address)

By: _____
(Attorney-in-Fact)

(Accompany this bond with attorney-in-fact's authority from the Surety Company) Surety company executing bond must appear on the Treasury Departments most current list (circular 570 as amended) and be authorized to transact business in the State of Washington.

- End of Section -

SECTION 00620
PAYMENT BOND

We,_____, as Principal, and_____, as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to AMEC for payment of the penal sum of _____Dollars ($_____), lawful money of the United States. AMEC has awarded Principal a contract for the construction of the Interim Remedial Action at the Pasco Landfill Zone B.

If Principal or any of its subcontractors, heirs, executors, administrators, successors or assigns fails to pay any of the persons named in the applicable Civil Code, or amount due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld, and paid over to the applicable Tax Board from the wages of employees of Contractor and its subcontractors pursuant to the Revenue and Taxation Code of the state where the Work is being performed, with respect to such work and labor, then Surety will pay the same in an amount not exceeding the sum specified above, and also will pay, in case suit is brought upon this Bond, such reasonable attorneys' fees as shall be fixed by the court.

THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly Make Payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the Principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with AMEC that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work of labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due Claimant, and have execution thereon. AMEC shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

a. Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following; the Principal, AMEC, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy tile amount claimed and the name of the party to whom the materials were furnished, or for whom the work of labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, AMEC or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

b. After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

c. Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanic's liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

Surety agrees that no change, extension of time, alternation, or addition to the terms of the Contract, or the work to be performed thereunder, or the plans and specifications shall in any way affect its obligation on this Bond, and it does hereby waive notice thereof.

Principal and Surety agree that should AMEC become a party to any action on this Bond, each will also pay AMEC's reasonable attorney's fees incurred therein addition to the sum above set forth.

Executed in four original counterparts on _____, 20___.

_____ (SEAL if Corporation)
(Principal)

By:_____

_____
(Title)

(Attached Acknowledgement of Authorized Representative of Principal)

Any Claims under this Bond may be addressed to:

_____ (Name and Address of Surety)

_____

_____

_____ (Name and Address of Surety's agent for service of process in _____ if different from above.)

_____

_____ (Telephone number of Surety's agent in _____.)

(Attach Acknowledgement of authorization)

_____
(Surety)

By:_____

_____
(Attorney-in-Fact)

NOTICE:

No substitution or revision to this Bond Form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in Washington. Certified copy of Power of Attorney must be attached.

Surety company executing bond must appear on the Treasury Departments most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

- End of Section -

SECTION 00700
TERMS AND CONDITIONS

When applicable and except when superseded by contract provisions stated in these specifications, the terms and conditions of the Washington State Department of Transportation (WASHDOT) Standard Specifications for Road, Bridge, and Municipal Construction, latest edition, Division 1 shall govern this work. References within the WASHDOT specifications to the State of Washington shall be replaced with AMEC Earth & Environmental.

- END OF SECTION -

SECTION 01010
SUMMARY OF WORK

PART 1.0 GENERAL

1.1 DESCRIPTION OF WORK

A. In general the work shall include, but may not be limited to, the following:

1. Mobilization and site preparation which shall include but may not be limited to:

   a. Equipment and personnel mobilization

   b. Establishment of working zones

   c. Delivery and set-up of temporary facilities

   d. Clearing

   e. Establishment of equipment maintenance and storage areas, and material delivery and storage areas

2. Surface soil excavation, transportation, and placement on to the existing 12-mil interim cover:

   a. Surface soils shall be excavated to 1-foot below ground surface (bgs) to the extent indicated on the Drawings

   b. The excavated soils shall be transported and placed directly on to the existing cover

   c. The placed soils shall be distributed and compacted to match the lines and grades to create the subgrade shown on the Drawings

   d. The excavation shall be backfilled and generally graded to allow drainage utilizing soil from the designated borrow area shown on the Drawings

3. Post-Excavation Sampling Standby – The Contractor will be required to stand-by/demob following excavation and prior to placing capping system or backfill.

4. Installation of a cover system (Cap) that meets the Subtitle C requirements of the Resource Conservation and Recovery Act (RCRA) as shown on the Project Plans and specified herein with below listed components:

   a. An impermeable layer consisting of a geosynthetic clay liner (GCL) placed on the subgrade described in subsection 2.C, above. and a 40-mil thick high density polyethynlene (HDPE) geomembrane directly on the surface of the GCL

   b. A drainage and water collection layer consisting a 12-inch-thick layer of highly permeable sand with imbedded perforated and nonperforated collection pipes

   c. A geotextile filter fabric barrier layer

d. A 24-inch thick vegetative layer of imported topsoil seeded with native grasses

5. Installation of an erosion protection feature on the perimeter of the constructed Cap utilizing 1.5-inch minus crushed rock.

6. Site restoration, fencing, hydroseeding, clean-up, and Demobilization.

1.2 REGULATORY STATUS

A. The Superfund/Hazardous Waste Cleanup Memorandum of Agreement (August 8, 2000) defines the Washington Department of Ecology (Ecology) as the lead agency for the Pasco Landfill Site. Therefore, cleanup actions will be conducted under the authority of the Washington Model Toxics Control Act (MTCA), Chapter 70.105D RCW and accompanying regulations, Chapter 173-340 WAC.

B. The work specified herein is an interim action as the final remedy criteria for the Zone B of the Pasco Landfill has not yet been issued. The objective of this interim remedial action is compliance with the applicable portions of the Washington Model Toxics Control Act (MTCA).

1.3 PROJECT BACKGROUND

A. Interim remedial actions at the landfill began in 1996. In March 2002, URS and Philip Services Corporation completed an interim action within Zone B which, is documented in the Interim Action Completion Report Zone B Removal (URS, 2002). Generally, the work consisted of the excavation and off-site transportation for incineration and disposal of approximately 5,000 drums of herbicide production wastes and impacted soils. Following the interim action the floor of the Zone B cell was sampled. Upon completion of confirmation sampling, the cell was filled and graded to ensure proper drainage using soils from surrounding areas. After which, reinforced 12-mil plastic was installed as an interim cover over the entire footprint of the cell or drum removal area. The cover was secured on its edges by a perimeter anchor trench and ballasted to resist uplift with sandbags.

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

Not Used

- END OF SECTION -

SECTION 01020
MEASUREMENT AND PAYMENT

PART 1.0 GENERAL

1.1 DESCRIPTION

A. Descriptions of major categories of the work are included in this section. The descriptions are not intended to be exclusive descriptions of work categories, and the Contractor shall determine and include in the unit prices all materials, equipment and incidentals for performing all work through completion of all work as shown and specified.

1.2 UNIT QUANTITIES

A. The contractor shall take or coordinate to have all measurements taken and all quantities computed accordingly as required for certifying payment purpose. Quantities and measurements verified by the designated BCS representative will be paid.

1.3 MEASUREMENT AND PAYMENT

A. **Bid Item 1 -** Mobilization/Demobilization and Project Preparation, measurement and payment for this item shall be on a lump-sum basis for:

Bid Item 1a - Mobilization/Demobilization

1. Mobilizing adequate personnel, equipment, and supplies including incidentals
2. Provision of all licenses, insurance, bonds, and permits required by all federal, state, and local agencies having jurisdiction over the site and the work being performed at the site
3. Attendance at preconstruction and project meetings
4. Furnishing, installing, maintaining, and removing all materials, equipment, field offices, temporary utilities, and other incidentals necessary for mobilization and demobilization
5. Preparation and maintenance of project schedules
6. Preparation and maintenance of specified project plans
7. Provisions for utility and subsurface feature identification and protection
8. Provision of all construction aids

9. Acquisition of all equipment and supplies necessary for starting and carrying out the work

10. Provisions for site security

11. Demobilization and Site cleanup

12. Incidentals include salaries of office staff, transportation, per diem, fees, insurance, bonds, quality control, Health and Safety training, and all other items required in Division 1 of these specifications unless specifically covered elsewhere.

Bid Item 1.b - Project Preparation including: Construction Operations Plan, Construction Quality Control Plan, and All Other Submittals: Measurement and payment for Bid Item 1.b shall be based on lump sum compensation for:

Preparation, submittal, and revision/resubmittal as necessary, in accordance with Sections 01300 and 01310, of all Project Plans, documentation, shop drawings, product data, material samples, test reports, health and safety reports, certificates, certifications, records, field logs, field drawings, record drawings, contract closeout documentation, and other information.

B. **Bid Item 2 -** Environmental Management Services consists of the necessary preparatory work and operations including but may not be limited to the costs for:

1. Obtaining and maintaining compliance with all required environmentally related permits

2. The making of all required notifications

3. Stormwater pollution prevention and production of the required stormwater pollution prevention plans

4. Air pollution prevention (migratory dust, volatile organic, etc.)

5. Personnel and equipment decontamination

6. Fire protection

7. Environmental protection

8. Production of a site specific health and safety plan (SSHP); and all other environment related requirements in these Specifications or required by governing agencies

9. Measurement and payment for Environmental Management Services shall be on a lump-sum basis.

C. **Bid Item 3 -** Site Fencing consists of all the costs associated with the specified removal of the chain-link fencing, gates, posts, and hardware; preservation of reusable materials; establishment of a temporary storage area and transportation of reusable materials to the temporary storage area; the legal disposal of non-reusable

materials; and the reinstallation as indicated on the Drawings to an as good or better working condition to that which existed prior to removal. Note that this item shall include the additional fence, posts, and hardware to install the fence in the new location. Measurement and payment for Site Fencing shall be made on a lump-sum basis.

D. **Bid Item 4 -** Decommissioning of the monitoring well indicated on the Drawings consists of all costs associated with well decommissioning, handling, and disposal of the associated process derived wastes in accordance with all local, state, and federal regulations. Measurement and payment shall be made on a per well basis. Boring log(s) are available upon request.

E. **Bid Item 5 -** Clearing, consolidation, and appropriate off-site disposal of surface debris and vegetation from the Surface Soil Excavation Area and Support Zone. Measurement and payment for Clearing shall be made on per 0.1 tons cleared basis. The tonnage shall be measured to the nearest 0.1 tons at a certified scale.

F. **Bid Item 6 -** Surface Soil Excavation and Backfill, measurement and payment for Bid Item 6 shall be on a square yard basis for: excavation, transportation, and direct placement of soil from the Surface Soil Excavation Area, designated on the Drawings, to the existing interim cover area, the surface area covered by 12-Mil plastic; and the backfilling and minimal grading to eliminate surface water pooling within the Surface Soil excavation utilizing soil from the designated borrow area. Measurement for payment shall be based on the aerial square yards of excavation measured and calculated by the Contractor and verified by the designated BCS representative.

G. **Bid Item 7 -** Subgrade Preparation consists of the grading and compaction of excavated surface soils on the existing interim cover to the lines and grades shown on the Drawings. Measure and payment shall be made on the cubic yards in-place. In-place cubic yards shall be measured and calculated by a Washington licensed land surveyor with verification of conformance to the lines and grades by the designated BCS representative.

H. **Bid Item 8 -** Procurement, Delivery, and Installation of the Geosynthetic Clay Liner (GCL) layer, measurement and payment for this item shall be based on the installed square footage. The installed square footage is defined as the surface area in square feet covered by GCL that conforms to the project specifications and the manufacturer recommendations as certified by the installer and verified by the designated BCS representative. The installed square footage shall be determined by a Washington licensed surveyor and shall not include any wastage or overage beyond the limits of the edge of the GCL shown on the Drawings.

I. **Bid Item 9 -** Procurement, Delivery, and Installation of the Geomembrane layer, measurement and payment for this item shall be based on the installed square footage. The installed square footage is defined as the surface area in square feet covered by Geomembrane that conforms to the project specifications and the manufacturer recommendations as certified by the installer and verified by the designated BCS representative. The installed square footage shall be determined by a Washington licensed surveyor and shall not include any wastage or overage beyond the limits of the edge of the Geomembrane shown on the Drawings.

J. **Bid Item 10 -** Procurement, Delivery, and Installation of the Geotextile Filter Fabric, measurement and payment for this item shall be based on the installed square footage. The installed square footage is defined as the surface area in square feet covered by Geotextile Filter Fabric that conforms to the project specifications and the manufacturer recommendations as certified by the installer and verified by the designated BCS representative. The installed square footage shall be determined by a Washington licensed surveyor and shall not include any wastage or overage beyond the limits of the edge of the Geotextile Filter Fabric shown on the Drawings.

K. **Bid Item 11 -** Drainage Layer, measurement and payment for this item shall be for the procurement, deliver, placement, and grading of drainage material conforming to the specification as certified by the Contractor and verified by the designated BCS representative and shall be based on the in-place cubic yards. The in-place cubic yards shall be calculated by a Washington licensed surveyor with verification of conformance to the lines and grades by the designated BCS representative.

L. **Bid Item 12 -** Drainage Collection and Conveyance, consists of the procurement, delivery, and installation of materials that conform to the plans and specifications as verified by the designated BCS representative. Measurement and payment shall be as follows:

Bid Item 12a - Perforated collection pipe and Geotextile filter sock shall be paid based on the linear feet installed as measured by the Contractor and verified by the designated BCS representative. This item shall include all connectors, fittings, and incidental materials required for the installation.

Bid Item 12b - Non-perforated collection pipe shall be paid based on the linear feet installed as measured by the Contractor and verified by the designated BCS representative. This item shall include all connectors, fittings, and incidental materials required for the installation.

Bid Item 12c - Drainage Outlets, payment for this item shall be per unit installed and shall include all connectors, fittings, and incidental materials required for the installation of the three outlets.

Bid Item 12d - Geomembrane Flaps shall be paid on a lump sum basis for the procurement of the materials and installation in configurations indicated on the Drawings

M. **Bid Item 13 -** Vegetative Layer, measurement and payment for this item shall be for the procurement, deliver, placement, and grading of the Vegetative Layer material (topsoil) conforming to the specification as certified by the Contractor and verified by the designated BCS representative and shall be based on the in-place cubic yards. The in-place cubic yards shall be calculated by a Washington licensed land surveyor with verification of conformance to the lines and grades by the designated BCS representative.

N. **Bid Item 14 -** Erosion Protection Rock, measurement and payment for this item shall be for the procurement, deliver, placement, and grading of the Erosion Protection Rock material conforming to the specification as certified by the Contractor and verified by the designated BCS representative and shall be based on the tons delivered and installed. The tonnage shall be measured at a certified scale.

O. **Bid Item 15 -** Site Restoration and Cleanup includes the necessary preparatory work, equipment, materials, personnel, and incidentals for establishing vegetation by hydroseeding, mulching, and fertilizing of seeded area. Measurement and payment shall be on a lump-sum basis.

P. **Bid Item 16 –** Post-Excavation Sampling Stand-by includes costs for Contractor to demobilize from and remobilize to the site while confirmation sampling for dioxins and PAHs occurs. It is assumed that one standby event will take place. Measurement and payment shall be on a lump-sum basis.

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

Not Used

- END OF SECTION -

SECTION 01060
SAFETY, HEALTH, AND ENVIRONMENTAL PROTECTION REQUIREMENTS

PART 1.0 GENERAL

1.1 GENERAL

A. The work covered by this section shall include, but not be limited to, the development and implementation of a Health and Safety Program. The Contractor shall provide all expertise, supervision, labor, materials, and equipment necessary to develop, prepare, and implement the Health and Safety Program as detailed in this section.

1.2 REFERENCES

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
33 CFR 328	Definitions of Waters of the United States
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification
40 CFR 68	Chemical Accident Prevention Provisions
49 CFR 171 - 178	Hazardous Materials Regulations

1.3 RELATED SECTIONS

A. Section 01300: Submittals

B. Section 01310: Construction Operations Plan

1.4 SUBMITTALS

The following shall be included in the Construction Operations Plan (COP), Section 01310:

A. Site Specific Health and Safety Plan

B. Proposed Work Zone boundaries

C. Training certificate and related document

D. Environmental Protection Plan

E. Air Monitoring Plan

1.5 SITE SPECIFIC HEALTH AND SAFETY PLAN

A. Contractor shall prepare and maintain a valid/compliant Site Specific Health and Safety Plan (SSHP) in accordance with any/all applicable regulations within 10 days after notice-to-proceed (NTP) and before commencing work at the site. The SSHP shall be made available in accordance with 29 CFR 1910.120, (b)(1)(v) and 29 CFR 1926.65, (b)(1)(v).

1.6 PRECONSTRUCTION SAFETY MEETING

A. A preconstruction safety meeting shall be conducted prior to the start of site activities and after submission and approval of the contractor's SSHP. The objective of the meeting will be to discuss health and safety concerns related to the impending work, discuss project health and safety organization and expectations, review and answer comments and concerns regarding the SSHP or other health and safety concerns the Contractor may have. The Contractor shall ensure that those individuals responsible for health and safety at the project level are available and attend this meeting.

1.7 HAZARDOUS WASTE OPERATIONS TRAINING

A. All Personnel performing duties with potential for exposure to on-site contaminants shall meet and maintain the following 29 CFR 1910.120/29 CFR 1926.65 (e) training requirements:

B. 40 hours of off-site hazardous waste instruction.

C. 3 days actual field experience under the direct supervision of a trained, experienced supervisor.

D. 8 hours refresher training annually.

1.8 PERSONAL PROTECTIVE EQUIPMENT

A. On-site personnel exposed to contaminants shall be provided with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for on-site fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

B. The Contractor's designated Site Safety and Health Coordinator shall establish and evaluate as the work progresses the levels of protection for each work activity. The Site Safety and Health Coordinator shall also establish action levels for upgrade or downgrade in levels of PPE. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE evaluation protocol shall address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1.9 SITE CONTROL MEASURES

A. Initial anticipated work zone boundaries (exclusion zone, contamination reduction zone, support zone, all access points and decontamination areas) are to be clearly delineated on the site drawings by the contractor and approved by AMEC. As work progresses and field conditions are monitored, work zone boundaries may be modified (and site drawings modified) with approval of BCS or its representative. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the on-site office. Work zones shall consist of the following:

1. **Exclusion Zone (EZ):** The Exclusion Zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the contamination reduction zone (CRZ).

2. **Contamination Reduction Zone (CRZ):** The Contamination Reduction Zone is the transition area between the EZ and the Support Zone (SZ). The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.

3. **Support Zone (SZ):** The Support Zone is defined as areas of the site, other than the EZ and CRZ, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The SZ shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in the SZ.

1.10 PERSONAL HYGIENE AND DECONTAMINATION

A. Personnel entering the EZ or CRZ or otherwise exposed to hazardous chemical vapors, gases, and liquids shall decontaminate themselves and their equipment prior to exiting the CRZ and entering the SZ. A detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced throughout site operations.

B. The Contractor shall initially set up a decontamination line in the CRZ. Employees shall exit the EZ through the CRZ and shall implement the applicable decontamination procedures and techniques, if needed, must comply with 29 CFR 1910, Section.141 and EM 385-1-1, 02 C, Washing Facilities. It is the Site Safety and Health Coordinator's responsibility to recommend techniques to improve personnel decontamination procedures, if necessary.

1.11 EQUIPMENT DECONTAMINATION

A. The Contractor shall furnish labor, materials, tools and equipment, and other supplies and materials, within the CRZ for decontamination of all equipment that have been in the EZ. Additionally, equipment operated in clean zones, or on Zone B after placement of the GCL, shall be considered free from contamination and must be washed in accordance with any Federal, State, and local construction regulations prior to exiting the work area. The Contractor retains full responsibility to comply with regulations. Any decontamination of equipment and workers prior to leaving the site shall be at the expense of the Contractor. The Contractor shall appropriately decontaminate equipment as frequently as necessary during the work and prior to removing equipment from the site to ensure no improper waste/residue transport/disposal/removal from the job site. Pre-departure truck inspection and decontamination records shall be documented and maintained on-site at all times. Any debris that may come in contact with the on-site vehicle flow path or on roadways must be properly removed immediately.

B. Heavy equipment operators shall remain in the cab when inside of the EZ to prevent cab areas from being contaminated. In the event this is not possible, cab floors shall be decontaminated prior to leaving the CRZ.

C. The contractor shall be responsible for constructing and deconstructing a temporary decontamination pad to wash equipment exiting the EZ. The location of the pad shall be smoothed and leveled by the contractor. The pad shall be constructed over the 12-mil liner covering the existing Zone B cell and lined using impermeable plastic sheeting and contained using a 1 foot barrier side wall constructed of clean fill as defined by WAC 173-350-100 and of the same material to be used for the drainage layer. Equipment decontamination shall be performed by steam cleaning to reduce

the quantity of wash water generated. Following decontamination and upon approval from the BCS representative, wash water and clean fill used to construct the decontamination pad barrier walls shall be spread evenly over the excavated surface and allowed to evaporate.

1.12 ENVIRONMENTAL PROTECTION REQUIREMENTS

A. The Contractor shall minimize environmental pollution and damage that may occur as the result of demolition, remediation, and construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract. The Contractor shall comply with all applicable employee protection and environmental Federal, State, and local laws and regulations. The Contractor shall be responsible for any delays resulting from failure to comply with employee protection and environmental laws and regulations.

1.13 ENVIRONMENTAL PROTECTION PLAN

A. Prior to commencing construction activities or delivery of materials to the site, the Contractor shall submit an Environmental Protection Plan, included in Section 01310 the Construction Operations Plan, for review and approval by BCS or its representative within 10 days after NTP. The purpose of the Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which the Contractor must address during construction. Issues of concern shall be defined within the Environmental Protection Plan as outlined in this section. The Contractor shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). The Environmental Protection Plan shall be current and maintained on-site by the Contractor.

B. No requirement in this Section shall be construed as relieving the Contractor of any applicable Federal, State, and local environmental protection laws and regulations. During Construction, the Contractor shall be responsible for identifying, implementing, and submitting for approval any additional requirements to be included in the Environmental Protection Plan.

C. The Environmental Protection Plan shall include, but may not be limited to, the following:

1. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.

2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site, if applicable.

3. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

4. Description of the Contractor's environmental protection personnel training program.

D. An erosion and sediment control plan which identifies the type and location of the erosion and sediment controls to be provided. The plan shall include monitoring and reporting requirements to assure that the control measures are in compliance with the erosion and sediment control plan, Federal, State, and local laws and regulations. A Storm Water Pollution Prevention Plan (SWPPP) may be substituted for the erosion and sediment control plan.

E. Drawings showing locations of proposed material storage areas, structures, sanitary facilities including methods to control runoff and to contain materials on-site.

F. Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plan shall include measures to prohibit the amount of mud transported onto paved public roads by vehicles or runoff.

G. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas including methods for protection of features to be preserved within authorized work areas.

H. The Spill Prevention, Control, and Countermeasures (SPCC) plan shall include the procedures to prevent spills; response procedure in the event of a release; and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355, and/or regulated under State or local laws and regulations.

1. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify BCS or its representative in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity is released to the environment. The plan shall contain a list of the required reporting channels and telephone numbers.

2. The name and qualifications of the individual who will be responsible for implementing and supervising the containment and cleanup.

3. Training requirements for Contractor's personnel and methods of accomplishing the training.

4. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

5. The methods and procedures to be used for expeditious contaminant cleanup.

I. An air pollution control plan detailing provisions to assure that dust, debris, materials, trash, etc., do not become air borne and travel off the project site.

J. A contaminant prevention plan that: identifies potentially hazardous substances to be used on the job site; identifies the intended actions to prevent introduction of such materials into the air, water, or ground; and details provisions for compliance with Federal, State, and local laws and regulations for storage and handling of these materials. A copy of the Material Safety Data Sheets (MSDS) and the maximum quantity of each hazardous material to be on-site at any given time shall be included in the contaminant prevention plan. As new hazardous materials are brought on-site or removed from the site, the plan shall be updated.

K. A waste water management plan that identifies the methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities including, but not limited to, clean-up water, and dewatering of ground water.

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

3.1 WORK AREA LIMITS

A. Prior to commencing construction activities, the Contractor shall mark the areas that shall not be disturbed under this contract. Isolated areas within the general work area which are not to be disturbed shall be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, any markers shall be visible in the dark. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

3.2 LANDSCAPE

A. Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work area.

3.3 EROSION AND SEDIMENT CONTROLS

A. The Contractor shall be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations. The

erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum.

3.4 WATER RESOURCES

A. The Contractor shall monitor construction activities to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation unless otherwise indicated. All water areas affected by construction activities shall be monitored and protected by the Contractor.

3.5 AIR RESOURCES

A. Equipment operation, activities, or processes performed by the Contractor shall be in accordance with all Federal and State air emission and performance laws and standards.

B. Dust particles, aerosols, and gaseous by-products from construction activities shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, temporary access roads, and other work areas within or outside the project boundaries free from airborne particulates which would cause the Federal, State, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient equipment and competent personnel available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs or has the potential to occur. Additionally, the Contractor shall comply with all State and local visibility regulations.

C. Odors from construction activities shall be controlled at all times. The odors shall not cause a health hazard and shall be in compliance with State regulations and/or local ordinances.

D. The Contractor shall keep construction activities under surveillance and control to minimize environmental damage by noise. The Contractor shall comply with the provisions of the State of Washington rules and local regulations.

E. Burning and smoking are prohibited on the project Site.

3.6 SPILLS

A. In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify BCS or its representative immediately. If the spill exceeds the reporting threshold, the Contractor shall perform immediate containment actions to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable Federal, State, and local regulations. As directed by BCS or its representative, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to BCS or its representative.

3.7 FUEL AND LUBRICANTS

A. Storage fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil shall be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. Used lubricants and used oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations.

- END OF SECTION -

SECTION 01200
PROJECT COORDINATION MEETINGS

PART 1.0 GENERAL

1.1 GENERAL

A. Before commencing construction activities, within 10 calendar days following the Notice to Proceed, a preconstruction meeting shall be held to review Contract requirements; establish a detailed schedule of operations; discuss Site safety procedures and policies; review the Contractor's Site Safety Plan; discuss material handling; introduce project personnel; and resolve outstanding issues.

B. During construction, weekly meetings shall be held to review project progress; review project work schedule; discuss problems that require management level resolution; discuss any accidents or near misses; and discuss and, if possible address, any other matters of concern.

1.2 REFERENCES

Not used.

1.3 NATURE OF MEETINGS

A. The meetings are to be formal in nature. They are to be attended by the Contractor's project managers and/or Site Superintendent, and designated key personnel both contracting and oversight (e.g., QA and designated BCS representatives).

B. Nothing in this section should preclude informal meetings held between the Contractor's, Engineer's representative, and quality assurance personnel.

1.4 DOCUMENTATION

A. The designated BCS representative shall prepare a summary of each meeting within 2 working days of the meeting, especially noting any pertinent topic discussed, decisions made, and listing of action items with assignments and scheduled completion.

B. The Contractor shall review the summary of the meeting within 2 days of receiving the summary and immediately inform the Engineer's representative if it believes the summary is not representative of the topics discussed, the resolutions made, and the action items assigned and scheduled.

1.5 SCHEDULING MEETINGS

A. Preconstruction conference: See Part 1.1A, above. The preconstruction meeting shall be held at a time mutually agreeable to all parties coordinated by the Engineer.

B. Weekly progress meetings will be held on the construction site on a day and at a time determined to be mutually agreeable to all parties.

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

Not Used

- END OF SECTION -

SECTION 01300
SUBMITTALS

PART 1.0 GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor Shall submit to the Quality Assurance organization or BCS designated representative for review: plans, shop drawings, test reports, data on materials and equipment, and material samples as required within the sections of these specifications and as necessary for the proper control of work.

B. The contractor is to maintain an accurate updated submittal register, shall bring this to each scheduled progress meeting, and shall provide the completed register with the Contract Closeout Documents.

1.2 SUBMITTALS

A. Provide a draft submittal form with the Construction Operations Plan (Section 01310).

B. Provide a draft submittal register with the Construction Operations Plan.

1.3 SUBMITTAL PROCEDURE

A. The Contractor is to develop a transmittal form that includes, at a minimum, the following:

1. A space for a sequential tracking number
2. A space for the date of delivery
3. A space for specification section reference
4. A space for Contractor and/or vendor certification of compliance
5. A signature block and space to confirm receipt
6. An area for comments regarding acceptance or denial by the Quality Assurance organization

B. Deliver each submittal with a transmittal form to the Quality Assurance organization or BCS representative.

C. Deliver three copies of each transmittal with the transmittal letter. One is to remain on-site with the Quality Assurance organization, one for the owner's records, and one for the Engineer.

D. Sequentially number the transmittal form. For revised submittals add an alphabetic suffix to the original number.

E. Identify the project, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate.

F. Apply suppliers stamp, sign or initial to certifying that review, verification of Products required, field dimensions, and coordination of information is in accordance with the Specifications.

G. Log the date of delivery on the submittal register.

H. The date received shall be documented in the confirm receipt area by a signature and date.

I. The Quality Assurance organization is to provide a copy of the transmittal letter with signed receipt to the Contractor for logging on the Submittal Register.

J. Allow sufficient time if not specifically stated for review prior to ordering materials, products, or services.

K. Documentation of the results of the review will be provided on a copy of the transmittal form.

1.4 SUBMITTAL REGISTER

A. Upon award of the project and review of all Contracts Documents including, but not limited to, the Project Plans and Specification, the Contractor shall prepare a submittal register for review and approval by the designated BCS representative. The submittal register shall include all submittal items listed in the Project Specifications and shall also provide the following information, at a minimum:

B. Project name

C. Contractor's project or reference number

D. Submittal title and description of item including required delivery date (schedule)

E. Submittal reference number sequentially numbered

1.5 SUBMITTAL LIST

A. The contractor shall submit the following items to the designated BCS representative. Absence of a specified submittal from the list does not relieve the Contractor of submittal responsibility.

TABLE 1
Submittal List

Section	Item/Description	Required Submittal Date	Date(s) Submitted	Comments
00440	Preliminary Construction Schedule	Within the COP, 14 Days after the notice to proceed		
01060	Site Specific Health and Safety	Within the COP, 14 Days after the notice to proceed		
01060	Environmental Protection Plan	Within the COP, 14 Days after the notice to proceed		
01060	Personnel Training Certificate and Related Documents	Within the COP, 14 Days after the notice to proceed		
01300	Draft Submittal Transmittal Form	Within the COP, 14 Days after the notice to proceed		
01300	Draft Submittal Register	Within the COP, 14 Days after the notice to proceed		
01310	The Construction Operations Plan (COP)	Within 14 Days after the notice to proceed		
01400	The Construction Quality Control Plan	Within the COP, 14 Days after the notice to proceed		
01400	Daily Progress Reports	Daily		
01700	Certificate of Completion Letter	With final payment request		
01700	Bonding Company Certification Letter	With final payment request		
01700	Contractor Claim Release Letter	With final payment request		
01700	Record Drawings	Prior to final payment request		
01750	Certificate of Warranty and Guarantee	With final payment request		
02801	Product acceptance testing (Sand and Topsoil)	7 Days prior to ordering materials		
02801	Perforated and Non-perforated Drainage pipe Product Data	7 Days prior to ordering materials		
02801	Manufacturer Installation Manual for Drainage piping	7 Days prior to ordering materials		
02801	Conformance Sampling Test Results for Sand and Topsoil	For each 500 cubic yards delivered		

Section	Item/Description	Required Submittal Date	Date(s) Submitted	Comments
02802	Intended Manufacturer and Certification of qualifications	Within the COP, 14 Days after the notice to proceed		
02802	Product Data, Material Samples, Installation instructions, and QC Manuals for each type of geosynthetic from each manufacturer	Within the COP, 14 Days after the notice to proceed		
02802	Samples of Draft QC Forms and Formats	Within the COP, 14 Days after the notice to proceed		
02802	Panel Layout and Detail Drawings for GCL and Geomembrane	Within the COP, 14 Days after the notice to proceed		
02802	Qualifications of Manufacturer, installer, QC inspector, QC Laboratory	Within the COP, 14 Days after the notice to proceed		
02802	Manufacturer's certified compliance letter and test reports (MQC Data) for each roll	7 days prior to shipment of Geosynthetics		
02802	QC and QA Samples (Conformance Samples)	Upon delivery of each 8,000 square feet of material to site		
02802	QC Laboratory Conformance Test Results	48 hours after sampling		
02802	Certificate of Subgrade Acceptance for GCL, Geomembrane, and Geotextile	Prior to placement of Geosynthetics		
02802	Non-Destructive Field Seam Continuity Testing Results	Daily during installation		
02802	Destructive Field Seam Testing Results	Daily during installation		
02802	QC inspector certification of Destructive Seam Test Repairs	Daily during installation		
02802	Record Drawings	Prior to final payment request.		
02802	Manufacturer's Warranty Statement	After installation		
02802	Final Record Drawings	Prior to final payment request		
02900	Chain-link fence product data	7 Days prior to purchasing materials		
02940	The name of Suppliers and Certifications letters for Seed Mixture and associate Hydroseeding materials	7 Days prior to purchasing materials		

1. Before Excavation Survey, Section 02200
2. After Excavation Survey, Section 02200
3. After Backfilling Survey, Section 02200

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

Not Used

- END OF SECTION -

SECTION 01310
CONSTRUCTION OPERATIONS PLAN

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall provide to the Engineer a Construction Operations Plan (COP) which shall be a consolidation of preconstruction submittals as specified in the related sections and shall identify and present the qualifications of key personnel; and include the proposed means and methods for accomplishing the work and related construction quality control.

1.2 RELATED SECTIONS

A. Section 00420: Certificate of Bidder's Experience and Qualifications

B. Section 00460: Proof of Qualification and Legal Status

C. Section 01060: Safety, Health, and Environmental Protection Requirements

D. Section 01300: Submittals

E. Section 01400: Quality Control

1.3 CONTENTS OF THE COP

A. The COP shall outline the overall construction sequencing and procedures to be followed during the site work activities. The plan shall contain a thorough and concise summary of how the work will be accomplished, and shall include, at a minimum:

B. Technical Approach. The technical approach shall include general work procedures and means and methods to accomplish all work activities discussed in Specifications and presented on the Plans

C. Equipment to Be Utilized for the Site Activities. All equipment to be used to complete the site work activities shall be described. At a minimum the description shall include: the proposed equipment for excavation and hauling surface soils, preparation of the Cap subgrade, the placement and grading of the drainage layer, and the placement and grading of the vegetative layer

D. Personnel Qualifications. Names, qualifications, and work experience of the Site Superintendent, the Site Safety and Health Coordinator, and Construction Quality Inspector. These shall be provided in accordance with the Contractor's bid, where applicable. If the personnel identified in the COP are not available at the start of the project, the Contractor shall submit, prior to mobilization, the names and qualifications of substitute personnel, with equal or more extensive experience

E. Lower Tier Contractors. The subcontractors and any subcontractors to subcontractors shall be identified and the prescribed qualifications of key personnel presented, including current valid training certificates (OSHA, EPA, etc)

F. Health and Safety Plan and Environmental Protection Plan. The plans specified within Section 01060 (Safety, Health, and Environmental Protection Requirements)

G. The Construction Quality Control Plan. The specified plan and related documentation in Section 01400 (Quality Control).

1.4 SUBMITTALS

A. Within 14 days of the Notice to Proceed, the Contractor shall provide the Engineer with three copies of the COP for review and acceptance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Maintain an up-to-date copy of the COP on-site at all times.

- END OF SECTION -

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall provide all supervision, expertise, labor, materials, and equipment necessary to implement work as stated in these specifications. The Contractor shall provide a Construction Quality Control Plan (CQCP) as a preconstruction submittal within the Construction Operations Plan (Section 01310). The CQCP shall identify personnel and procedures to be used in carrying out the requirements of this project and shall include but may not necessarily be limited to information specified in subsection 1.4, below.

B. The Contractor shall provide Daily Reports as prescribed in subsection 1.5, below.

1.2 RELATED SECTIONS

A. Section 01310: Construction Operations Plan.

B. Section 02200: Earthwork

C. Section 02801: Drainage and Vegetative Layers

D. Section 02802: Geosynthetics

1.3 REFERENCES

A. Quality Assurance and Quality Control for Waste Containment Facilities, David E. Daniel and Robert M Koerner, Risk Reduction Engineering Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268, IPA/600/R-93/182, September 1993.

1.4 CONTENTS OF THE CQCP

A. The CQCP shall be in accordance with the reference in subsection 1.3 above.

B. The CQCP shall include the following:

C. Identification of a Quality Control Inspector (QCI), the Contractor shall identify a member of their staff to be the QCI. The QCI shall perform QC procedures and implement the CQCP. The QCI may have other duties on-site but shall not be the Contractor's Project Manager or Site Superintendent. The QCI shall have the authority to communicate directly with the Contractor's home office management and shall have the authority to stop the work if critical components are not functioning as intended. The QCI shall be on-site at all times when work is actively being performed. The resume of the QCI shall be included with the CQCP and shall show both formal training in QA/QC procedures and at least 2 years of cumulative experience acting in a similar role on other

project(s) of a similar scope. The Engineer reserves the right to reject the proposed QCI.

D. A description of Documentation Procedures, at a minimum, the QCI shall maintain a QC Field Notebook documenting all inspections and observations made by the QCI. This notebook shall be available upon demand at all times by the Engineer or BCS representative and shall be submitted with contract closeout documentation.

E. A QC Checklist, as part of the CQCP, the Contractor shall develop a checklist indicating items that must be observed and the frequency of observation. Additionally, all required tests shall be identified. In developing the checklist, the Contractor shall list every Specification section and all specific items in each section that must be inspected.

F. A description of Corrective Action Procedures, the CQCP shall identify general types of corrective measures to be taken if problems occur.

G. Identification of an Independent Laboratory, the Contractor shall identify one or more independent laboratories or specialized inspection firms to perform specialized tests as may be required by other sections of these Specifications.

1.5 DAILY REPORTING

A. The Contractor shall submit a written daily report to the designated on-site BCS representative. The report shall include: a summary of activities performed, an estimate of the scheduled task percentage complete for the day, copies of delivery tickets and associated data, bills of lading and manifests for materials removed from the site, any problems encountered and their proposed resolution, status of the schedule, an area for review comments by the BCS representative, and the relevant information listed below.

B. List of subcontractors on-site

C. List of contractors performing work on-site

D. An accurate account of personnel, equipment usage by type, and daily man power utilization

E. Any accident, incident, or near miss reported

F. Field Memo, Field Directive, or Notice of Non-conformance issued and received (copies attached)

G. A brief description of unusual events and/or regulatory agency or official inspections (provide name, contact information, and nature of visit and any concerns/issues noted, and contractor plan to rectify any issues)

H. Change Orders received and implemented

I. Each Daily Report shall be signed by QCI asserting that the contents of the report are accurate and complete. Daily Reports shall be submitted no later than 12:00 (noon) of the following working day to the designated BCS on-site representative for review and acceptance.

1.6 SUBMITTALS

A. The CQCP shall be submitted as part of the COP as described in Section 1310.

B. Daily Progress Report shall be submitted daily by 12-noon of the following day.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

A. Implement the QC program in accordance with the approved CQCP.

B. Completion of the specified Daily Reporting.

- END OF SECTION -

SECTION 01500
TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

PART 1.0 GENERAL

1.1 DESCRIPTION

A. The work covered by this section includes, but may not be limited to, the delivery, installation, hook-up, maintenance, and removal of the temporary construction facilities. The temporary construction facilities and controls covered by this section include field offices, utilities, dust and pollution control, protection of personnel and work areas, and creation and maintenance of access roads and parking areas.

1.2 FIELD OFFICE

A. No field office shall be required; however the Contractor may provide and maintain, at no cost to BCS or its designated representative, adequate field offices for its own use at a location nearby the site or on the site as approved by BCS or its designated representative.

1.3 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide, maintain, and pay for all sanitary accommodations for all personnel on the project. Facilities shall be located in areas convenient to personnel. Facilities shall be temporary, pre-fabricated, chemical-type toilets with proper enclosures. At least one unit shall be provided for every 15 persons.

1.4 TEMPORARY ELECTRICITY FOR CONSTRUCTION

A. The Contractor shall provide all temporary electricity necessary to complete the work.

1.5 WORK AREA PROTECTION

A. The Contractor shall protect all areas on and off the site that may be damaged by the Contractor's activities.

B. The Contractor shall provide, maintain, and pay for all barricades, temporary fencing, warning lighting, signage and other similar items necessary to comply with Washington OSHA guidelines for safe working environments for both site personnel and to prevent unauthorized entry onto the site. The Contractor shall provide adequate signage at the entrance of the site to identify the name of the site, the type of work being performed at the site, and the specific guidelines for proper access to the site.

1.6 ACCESS ROUTES AND PARKING AREA

A. Routes of ingress and egress to the site shall be clearly marked by the Contractor. The contractor shall maintain an access road in adequate condition such that vehicular traffic and pedestrian traffic can safely and easily negotiate the access ways and in accordance with applicable Federal, State and local requirements/regulations. Conditions which will be corrected by the Contractor shall include, but not be limited to, excessive ponding water, excessive mud, ice, snow, debris, or generation of dust.

B. Parking areas shall be maintained by the Contractor and shall be sized adequately to handle the quantity of vehicles generated by the site personnel.

1.7 POLLUTION CONTROL

A. The Contractor shall supply all expertise, labor, equipment, and materials necessary to implement pollution prevention measures in accordance with Section 01060, Safety, Health, and Environmental Protection Requirements.

1.8 SECURITY

A. The Contractor shall prevent unauthorized personnel or vehicular entry onto the project site and shall provide fences, gates, locks, signs and other means to control access. The Contractor shall be responsible for providing security within the site as contractor deems necessary for the protection of its own equipment, materials, or work from vandalism or theft.

PART 2.0 PRODUCTS

Not Used

PART 3.0 EXECUTION

Not Used

- END OF SECTION -

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 REQUIREMENTS

The Contractor shall deliver the following items before the final payment is made:

A. A letter from the Contractor that all work has been performed in accordance with the contract Plans and Specifications and is complete in every respect.

B. A letter from the bonding company stating that they have reviewed the Contractor's final request for payment and agree that payment thereof will not release the bonding company from any of its obligations under the bond.

C. A letter from the Contractor stating that final payment will be a release of the Contractor from any and all claims the Contractor might have against BCS.

D. Work completion records, certificates, guarantees, warranties, record drawings, and all other required submittals per Section 01300.

E. All letters shall be signed by an officer or principal of the Contractor, except the letter from the bonding company that shall be signed by a responsible party, with power-of-attorney attached.

F. Record drawings shall conform to the practice within the industry, in general, and more specifically, as specified herein.

G. The Contractor shall produce record drawings of both interim and completed construction showing the location and elevation of all major items of Work and all finish grades. Interim construction refers to temporary surfaces that will not exist at completed construction. At a minimum, the record drawings shall include the following:

H. Location (northing, easting), elevation, and dimension information for all utilities and any other subsurface or surface features crossed, protected, installed, relocated, repaired, or replaced.

I. The location and surface topography of the preconstruction surface for the cap based on maximum 50-foot survey intervals.

J. The location and surface topography of the prepared subgrade for the cap based on maximum 50-foot survey intervals.

K. The as-built horizontal extents of the installed geomembrane based on maximum 20-foot survey intervals.

L. The location and elevations of the components of the drainage pipe network.

M. The panel layout and seam test locations for geosynthetic (i.e., geomembrane, geocomposite, and geotextile) materials.

N. The location and surface topography Drainage Layer based on maximum 50-foot survey intervals.

O. The location and surface topography of the cap topsoil layer based on maximum 50-foot survey intervals.

P. The as-built details and location of new and relocated fencing and gate based on maximum 50-foot survey intervals.

Q. Contour intervals for all topography shown on record drawings shall be 0.5-foot (maximum).

1.2 RELATED SECTIONS

A. Section 01300 Submittals

B. Section 02200 Earthwork

C. Section 02801 Drainage and Vegetative Layers

D. Section 02802 Geosynthetics

E. Section 02900 Chain Link fence and Gates

1.3 SUBMITTALS

A. Certificate of completion letter per subsection 1.1 A above, with the final payment request.

B. Bonding company certification letter per subsection 1.1 B above, with the final payment request.

C. Contractor release letter per subsection 1.1 C above, with the final payment request.

D. Work completion records, certificates, guarantees, warranties, record drawings, and all other remaining submittals per Section 01300 prior to final payment request.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

- END OF SECTION -

SECTION 01750
GUARANTEE AND WARRANTY

PART 1 GENERAL

1.1 GUARANTEE AND WARRANTY REQUIREMENTS

A. Contractor shall warrant and guarantee that the entire work constructed under the Contract fully meets all requirements of the Contract.

B. The Contractor shall further warrant and guarantee that all work shall be free of deficiencies and defects for the guarantee period of one year after the date of the contract closeout.

C. The Contractor shall further warrant and guarantee to make or have made at Contractor's expense repairs, adjustment, replacements, or other corrective work necessary to restore or bring into full compliance with the requirements of the Specifications any part of the Work which during the guarantee period is found to be deficient with respect to any provision of the specifications.

1.2 SUBMITTAL

A. Certificate of Warranty and Guarantee with the final payment request.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

- END OF SECTION -

SECTION 02070
CONTROL OF WATER

PART 1 GENERAL

1.1 DESCRIPTION

A. The work covered by this section includes the temporary management, diversion, and handling of any surface water which exists in, flows into, precipitates onto, or infiltrates into active work area.

1.2 RELATED SECTIONS

A. Section 01060: Safety, Health, and Environmental Protection Requirements

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

1.3 GENERAL

A. The Contractor shall be responsible for keeping areas where excavations and earthwork are being performed dry, to the extent practical, and for removing stormwater from the active work areas and preventing it's accumulation at the surface. The Contractor shall divert and prevent stormwater runoff from entering into excavations in accordance with the approved environmental protection plan described in Section 01060.

B. Rainfall and stormwater that does not come into contact with excavated material may be allowed to flow along existing drainage patterns. Direct precipitation onto excavations may infiltrate.

- END OF SECTION -

SECTION 02100
MOBILIZATION, SITE PREPARATION, AND DEMOBILIZATION

PART 1.0 GENERAL

1.1 SUMMARY

A. Mobilization consists of the work, operations, associated costs, and incidentals, including but not limited to, that which is necessary for: the transportation of personnel, equipment, and supplies; the establishment of field offices, sanitation facilities, and other facilities necessary to safely and efficiently carry out the specified work; the acquisition of permits, bonds, and insurance that the Contractor must procure, which are not covered in other bid items or sections of these specifications.

B. Site Preparation consists of the work necessary to establish and construct stockpile, staging, loading, unloading, decontamination, storage, and/or other work areas, as necessary, and approved by the designated BCS representative.

C. Demobilization consists of the work, operations, associated costs, and incidentals, including but not limited to, that which is necessary for: the transportation of personnel, equipment, and supplies off-site; and the removal of field offices, sanitation facilities, and any other facilities established by the contractor.

1.2 RELATED SECTIONS

A. Section 01060: Safety, Health, and Environmental Protection Requirements

B. Section 01300: Submittals

C. Section 01310: Construction Operations Plan

D. Section 01500: Temporary Construction Facilities and Controls

E. Section 02200: Earthwork

F. Section 02802: Geosynthetics

1.3 SUBMITTALS

A. Contractor shall submit all required items under provisions of Section 01300 and as described herein.

B. Contractor shall submit as part of the COP (Section 01310) a detailed site layout plan indicating the locations of all work areas, parking areas, health and safety zones, decontamination stations, storage areas, staging areas, loading/unloading areas, field office, etc.

PART 2.0 PRODUCTS

Not used

PART 3.0 EXECUTION

3.1 GENERAL

A. Furnish and mobilize all equipment and materials required to prepare the site and complete all work as specified herein.

B. Facilities and equipment shall be mobilized to the site following approval of the COP (Section 01310). Materials shall not be delivered to the site until they have been approved in accordance with the submittal procedures (Section 01300).

3.2 CLEARING

A. Clearing shall consist of cutting, removing, and disposing of unwanted materials from the work surface including, but not limited to, trash, trees, brush, logs, stumps, weeds, grasses, and obstructions of any kind, natural or artificial. Work shall be performed in such a manner as to remove all evidence of the object's presence from the surface.

B. The Surface Soil Excavation Area and the designated Support Zone and Staging area shall be cleared.

C. The clearing debris shall be consolidated for disposal.

D. The clearing debris shall be disposed at an appropriate facility.

3.3 PROTECTION

A. Unless specifically noted, protect all site features above and below the ground surface from damage. If damaged, they shall be repaired or replaced at the Contractor's expense.

- END OF SECTION -

SECTION 02200
EARTHWORK

PART 1.0 GENERAL

1.1 SUMMARY

A. This section specifies requirements for excavation, backfilling, importation, grading, and compaction of earthen materials. Earthwork shall proceed consistent with the alignments, grades, and cross sections shown or indicated on the Plans and detailed in the Specifications. The work shall include, but may not necessarily be limited to:

B. Excavating soil for relocation

C. Importation, placement, and grading of Engineered fill.

1.2 RELATED SECTIONS

A.	Section 01020	Measurement and Payment
B.	Section 01300	Submittals
C.	Section 01320	Construction Operations Plan
D.	Section 01700	Contract Closeout
E.	Section 02070	Control of Water
F.	Section 02801	Drainage and Vegetative Layers
G.	Section 02802	Geosynthetics

1.3 REFERENCES

WASHINGTON ADMINISTRATIVE CODE (WAC)

WAC 173-350-100 (2005) Solid waste handling standards: Definitions

1.4 SUBMITTALS

A. The Contractor shall develop and submit as part of the Construction Operations Plan (COP), Section 01310, a detailed description of the proposed methods, means, and construction sequencing to be used to perform the work. The plan shall include, but not necessarily be limited to:

B. The proposed plans and equipment to excavate, haul, and place materials per the design

C. The proposed plans and equipment for placement and compaction of engineered fill and excavation backfill

D. The proposed materials and equipment storage and haul routes

E. The plans for the control of drainage, spills, waste, etc

1.5 PERMITS

A. The Contractor shall obtain required Federal, State, and local permits for all specified work. The Contractor shall include the cost for permits in their bid.

1.6 AIRBORNE PARTICULATE EMISSIONS

A. Contractor shall minimize the emission of airborne particulates (dust) by construction activities to the extent practicable and in accordance with applicable local, State, and Federal laws.

1.7 NOTIFICATIONS

A. The Contractor shall be responsible for fulfilling all notifications required by regulatory agencies or permits.

1.8 CONTROL OF WORK AND SURVEY

A. The control of work shall be by utilization of traditional grade control equipment and survey techniques. The means and methods for control shall be described within the COP.

B. The Contractor shall make provisions for and coordinate the necessary survey to control the work, quantify the work for payment purposes per Section 01020, Measurement and Payment, and document the work for the record per Section 01700, Contract Closeout.

C. Surveys shall be performed by a Washington State licensed surveyor.

D. Survey tolerances shall be as follows:

Type of Mark	Horizontal	Elevation
Permanent reference point	1 in 10,000 ft.	+0.1 ft.
General excavation and earthwork	1 in 2,000 ft.	+0.1 ft.

PART 2.0 PRODUCTS

2.1 SITE OBTAINED FILL

A. Excavated soil from the Surface Soil Excavation Area shall be utilized as subgrade material and placed on the existing interim cover.

B. Backfill material for the Surface Soil Excavation Area shall be certified clean imported fill.

2.2 IMPORTED FILL MATERIALS

A. Erosion protection rock shall be imported, clean fill as defined by WAC 173-350-100, granular fill material free of roots, organic material, contaminants, rocks larger than 1.5", and all other deleterious and objectionable material. The material shall be crushed, partially crushed, or naturally occurring granular material and shall be 1.5-inch minus rock with less than 5% passing the U.S. No. 200 sieve by weight.

B. Drainage Layer sand and Vegetative Layer topsoil shall meet the requirements prescribed in Section 02801, Drainage and Vegetative Layers.

PART 3.0 EXECUTION

3.1 GENERAL

A. Surface soils shall be excavated to a depth of one foot below ground surface in the area shown on the Drawings. Excavation depth shall not be less than 1-foot, nor greater than 16-inches; however, the designated BCS representative may direct the Contractor to over-excavate beyond these stated limits.

B. Materials utilized to construct the cap cover system shall be placed in a manner that does not damage the underlying layer(s) and in accordance with Section 2802, Geosynthetics.

C. Coordinate and complete a preconstruction survey, interim surveys necessary for measure and payment, and a post construction record survey (as-built).

3.2 EXCAVATION SEQUENCE

A. The Contractor shall conduct the work in orderly manner to ensure project construction is achieved in a logical and cost-effective manner and within reasonable conformance to their COP as approved by the Engineer.

B. Work must be coordinated with predicted weather forecasts and precautions taken by the Contractor to minimize the generation of precipitation-related wastewater.

Contractor is responsible to manage excavation progress and there is no allowance in the Base Bid for excavation dewatering or disposal of excavation water (groundwater or rainwater). Management of water shall be conducted in accordance with Section 02070, Control of Water, and is the responsibility of the Contractor.

3.3 MATERIAL STORAGE (STOCKPILING)

A. Excavated surface soils must be directly placed on the existing cover as shown in the Plans.

B. Stockpiling of the imported materials is allowed provided that:

- Stockpiles are segregated from one another
- Stockpile heights do not exceed 10-feet
- Side slopes are not steeper than 2H:1V

C. When removing materials from the stockpile, the materials are excavated in a systematic manner that prevents mixing with other materials or contamination (e.g., the stockpiled material is not mixed with existing site soils).

D. The stockpiles are covered with water impervious tarpaulins or polyethylene sheeting nightly and when not excavating or adding to the stockpile in a manner that prevents water infiltration, contamination, or erosion (wind or water). The covering shall be ballasted to the satisfaction of the designated BCS representative.

3.4 FINISH GRADING AND COMPACTION

A. The allowable deviations form the grade lines and elevations presented on the Drawings for finish grading of the Cap surfaces are +0.3 feet and -0.2 feet.

B. Prepare the subgrade for the GCL with excavated surface soils as follows:

C. Moisture condition top surface to approximately 6-inches of depth.

D. Finish grade to remove ruts, gouges, and deleterious material that would result in surface protrusions.

E. Compact with two passes of a smooth drum roller (do not use vibratory methods).

F. Round off grade changes to a 6-inch minimum radius.

G. Prepare the top surface of the drainage layer prior to placement of the geotextile as follows:

H. Moisture condition the surface.

I. Finish grade to remove ruts and gouges that may create bridging of geotextile.

J. Compact with two passes of a smooth drum roller (do not use vibratory methods).

K. Round off grade changes to a 6-inch minimum radius.

L. Topsoil shall not have compactive effort applied. Sufficient compaction is expected during placement and grading. Surface preparation for seeding shall be accomplished by "Track Walking". Track Walking is the process of surface preparation by making multiple passes with a low ground pressure bulldozer parallel to the slope grade in order to create uniformly distributed dimples.

- END OF SECTION -

SECTION 02600
WELL ABANDONMENT AND MODIFICATION

PART 1.0 GENERAL

1.1 SUMMARY

A. This section specifies the requirements for well abandonment and modifications. Numerous monitoring wells exist at the site as shown on the Drawings. One well is located within the Cell B footprint and shall be abandoned. The wells that are within the Surface Soil Excavation Area shall be modified, if necessary.

B. Only those wells specifically designated shall be abandoned.

C. Perform monitoring well work in accordance with Chapter 173-160 of the Washington Administrative Code (WAC), and as specified herein.

1.2 RELATED SECTIONS

A. Section 01020 Measurement and Payment

B. Section 01300 Submittals

C. Section 01310 Construction Operations Plan

1.3 REFERENCES

A. Washington Administrative Code (WAC) 173-160 & 173-162, Minimum Standards for Construction and Maintenance of Wells and Regulation and Licensing of Well Contractors and Operators, respectively.

1.4 SUBMITTALS

A. The Contractor shall develop and submit as part of the Construction Operations Plan (COP), Section 01310, a detailed description of the proposed plan, materials, and equipment for well abandonment and modifications.

B. Submit Monitoring Well Construction Notice (Start Card) to the Washington Department of Ecology (Ecology) region office before commencing the abandonment of the monitoring well, as required by WAC 173-160-151 and 173-160-420(a). Copies of notices shall also be submitted per Section 1300.

C. Submit all of the required information and reports (i.e. Monitoring Well Report and Well Abandonment Report) required by Ecology under WAC 173-160-141 and 173-160-420 (10). Each log shall be certified as correct by signature of the monitoring well constructor. Submit to Ecology within 21 calendar days after the

completion of the abandonment of the monitoring well. Copies shall also be submitted per Section 1300.

1.5 QUALIFICATIONS

A. Any persons who construct, alter, or abandon monitoring wells shall have a Monitoring Well Constructors License or work under the supervision of a licensed Monitoring Well Constructor, in accordance with WAC 173-162.

PART 2.0 PRODUCTS

2.1 GROUT SLURRY

A. Grout slurry used to abandon monitoring wells shall conform to the requirements of WAC 173-160-450.

PART 3.0 EXECUTION

3.1 ABANDONMENT

A. Abandon wells in accordance with the general construction requirements for resource protection wells prescribed in WAC 173-160-420 and the specific requirements for the decommissioning process for resource protection wells prescribed in WAC 173-160-460.

B. Grout slurries shall be mixed in the proper proportions as required by WAC 173-160-221 and 173-160-460 and placed within the hole in such a manner as to prevent excessive shrinkage, water loss, chemical breakdown, or bridging.

C. Grout slurries shall be placed from the bottom up by a grout pipe to avoid segregation or dilution of the sealant. The discharge end of the grout pipe shall be submerged in the grout to avoid breaking the seal while filling the annular space.

D. The abandonment procedure shall be recorded on a form provided by or previously approved by Ecology. The form shall include, as a minimum, all the requirements listed in WAC 173-160-141 and 173-160-420(10).

- END OF SECTION -

SECTION 02801
DRAINAGE AND VEGETATIVE LAYERS

PART 1.0 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 2434	Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 2487	(2000) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2974	(2000) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4972	(2001) pH of Soils

WASHINGTON ADMINISTRATIVE CODE (WAC)

WAC 173-350-100	(2005) Solid waste handling standards: Definitions

1.2 RELATED SECTIONS

A. Section 01020: Measurement and Payment

B. Section 01300: Submittals

C. Section 01320: Construction Operations Plan

D. Section 01700: Contract Closeout

E. Section 02200: Earthwork

F. Section 02802: Geosynthetics

1.3 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300:

Prior to Construction:

A. Provide test results for each required property test given in subsection 2.1, Topsoil, to the designated BCS representative for review at least 7 days prior to ordering the

material. The Contractor shall not order or deliver the topsoil to the site prior to approval.

B. Provide test results for each required property test given in subsection 2.2, Drainage Layer, to the designated BCS representative for review at least 7 days prior to ordering the material. The Contractor shall not order or deliver the sand to the site prior to approval.

C. Product Data: Provide data on perforated and non-perforated pipe, fittings, and accessories for approval by the BCS designated representative at least 7 days prior to ordering materials.

D. Provide manufacturers installation instructions for the perforated and non-perforated collection pipes at least 7 days prior to ordering materials.

During Construction:

A. Provide the conformance sampling test results for topsoil and sand per subsection 3.4, below.

PART 2.0 PRODUCTS

2.1 TOPSOIL

A. The material to construct the 2-foot thick vegetative layer shall consist of imported topsoil. The topsoil shall be friable surface soil that is from the "A" horizon as determined by the United States Department of Agriculture Conservation Service Soil Survey and is representative of soils in the vicinity which produce heavy growths of crops, grass, or other vegetation.

B. The imported topsoil shall be clean soils as defined by WAC 173-350-100 and the material shall not contain contaminants that could adversely impact the Waters of the State or public health.

C. Topsoil layers shall comply with the criteria listed in Table 1.

TABLE 1
Required Properties of Topsoil

Property	Test Value	Test Method
Max. particle size(inches)	1	ASTM D 422
pH	5-7	ASTM D 4972
Organic content (%)	5-20	ASTM D 2974

2.2 DRAINAGE LAYER

A. Drainage course shall consist of clean coarse-grained sand classified as SW or SP by ASTM D 2487.

B. The sand shall have a minimum in-place permeability of 1x10-1 centimeters per second at a relative density of 90% by ASTM D2434.

C. The sand shall have a gradation in which 100% passes the ¼-inch sieve and less than 5% passes the U.S. No. 200 Sieve by weight per ASTM D 422.

D. The sand shall be free of silt, clay, vegetative matter, and other objectionable material.

2.3 PERFORATED AND NON-PERFORATED COLLECTION PIPE

A. Manufacturers:

B. Advanced Drainage Systems: Corrugated perforated and non-perforated polyethylene pipe (CPE), or Engineer approved equal.

2.4 GEOTEXTILE SOCK

A. Provide perforated pipe with geotextile sock meeting the following requirements.

TABLE 2
Geotextile Sock

Test	Unit	Minimum Requirement
Mass/Area	Oz/yd^2	0.75
Fiber Size	Denier Per Filament	4.0
Grab Tensile Strength	lbs.	20 min.
Puncture Resistance	lbs.	80 min.
Mullen Burst	Psi	25 min.
Air Permeability	CFM/Sq. Ft.	500 min.
Specific Gravity		1.14
AOS	Mil	0.9
Flow Rate	$Gal/Min/Ft^2$	163

PART 3.0 EXECUTION

3.1 TOPSOIL

A. Topsoil shall not be placed when the sand drainage layer is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading.

B. Topsoil shall be placed in lifts with a minimum loose thickness of 12-inches.

C. Topsoil shall be compacted in accordance with Section 02200, Earthwork.

D. On slopes, topsoil shall be placed from the bottom of the slope upward.

E. Perform required record survey of the finish surface.

3.2 DRAINAGE LAYER

A. Place only when underlying geosynthetics and collection pipe installations are complete.

B. Construct haul routes over geomembrane and collection pipes that have a minimum material thickness of 30-inches. The 30-inch minimum coverage includes the initial material dumping and spreading areas, haul roads and stockpile areas, which cover the geomembrane and collection pipes.

C. Use grade control systems that will not damage the geomembrane.

D. When placing drainage layer to final thickness use low ground pressure track-mounted equipment.

E. Place in a single lift to the compacted thickness of 12-inches.

F. Careful placement of the drainage layer is necessary to avoid damage to the underlying collection pipes, geocomposites, and geomembrane, and to prevent the formation of wrinkles.

G. Avoid undue stress of the geomembrane by pushing up slopes, never down.

H. Compact by the application of water and 2 passes with a low ground pressure static drum roller.

I. Equipment must remain under 10 mph, sharp turns and quick stops are prohibited.

J. Material shall be placed when the temperature is above 35 degrees F. Areas of completed drainage layer or underlying courses which are damaged by freezing, rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material shall be corrected by the Contractor.

K. Perform required record survey of the finish surface.

3.3 DRAINAGE PIPE

A. Install pipe, pipe connections, and accessories in accordance with manufacturer's instructions.

B. The perforated corrugated drain pipe shall be laid in alignment with a continuous fall in the direction of flow as shown on the Drawings.

C. The drainage pipe geotextile sock shall comply with the requirements listed in Table 2.

D. Lift or roll pipe into position. Do not drop or drag pipe.

E. Place perforated pipe directly on geomembrane and uphill of the geomembrane flap weld. Backfill around sides and to top of pipe with drainage layer.

F. Maintain pipe in required position. Retain in place until after installation of drainage layer and adjacent fills. Ensure pipe remains in correct position and to required slope.

G. Survey the locations and elevations of the pipe network components prior to covering with sufficient detail to allow for relocation and maintenance. Network components include the pipe ends, joints, appurtenances, and couplings.

3.4 MATERIAL TESTS DURING CONSTRUCTION

A. During construction, conformance samples of the topsoil and sand shall be taken for testing at a frequency of approximately one every 500 cubic yards delivered. The samples shall be tested by the independent off-site laboratory for conformance with the product requirements specified in this section. The designated BCS representative will determine the timing of the samples and shall perform oversight throughout the sampling procedure.

3.5 PROTECTION

A. Erosion rills or other damage that occurs shall be repaired and grades re-established. Repairs to the select fill layer or topsoil layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests. Protect drainage pipe from damage or displacement until backfilling operation is in progress.

- END OF SECTION -

SECTION 02802
GEOSYNTHETICS

PART 1.0 GENERAL

1.1 SUMMARY

A. This section includes the requirements for furnishing and installing a geosynthetic clay liner (GCL), a 40-mil high density polyethylene (HDPE) geomembrane cover material, and a geotextile filter layer as shown on the Drawings.

B. Manufacturing and installation of the geosynthetics shall comply with all applicable procedures described in U.S. Environmental Protection Agency (EPA) guidance document "Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities", EPA/600/R-93/182, and as specified herein.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 638	(2003) Tensile Properties of Plastics
ASTM D 792	(2000) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 1004	(2003) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1204	(2002) Standard Test Method for Linear Dimensional Changes of Non-Rigid Thermoplastic Sheeting or Film at Elevated Temperatures
ASTM D 1505	(2003) Density of Plastics by the Density-Gradient Technique
ASTM D 1603	(2001) Carbon Black in Olefin Plastics
ASTM D 3895	(2004) Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D 4218	(1996; R 2001) Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D 4354	(1999) Sampling of Geosynthetics for Testing
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4437	(1999) Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
ASTM D 4491	(1999a) Water Permeability of Geotextiles by Permittivity

ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1999a) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(2002) Determining the Specification Conformance of Geosynthetics
ASTM D 4833	(2000e1) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D 5199	(2001) Measuring Nominal Thickness of Geosynthetics
ASTM D 5261	(1992; R 2003) Measuring Mass Per Unit Area of Geotextiles
ASTM D 5397	(1999e1) Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D 5596	(2003) Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D 5721	(1995; R 2002) Air-Oven Aging of Polyolefin Geomembranes
ASTM D 5885	(1997) Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
ASTM D 5887	(2004) Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
ASTM D 5888	(1995; R 2002e1) Storage and Handling of Geosynthetic Clay Liners
ASTM D 5889	(1997; R 2003) Quality Control of Geosynthetic Clay Liners
ASTM D 5890	(2002) Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D 5891	(2002) Fluid Loss of Clay Component of Geosynthetic Clay Liners
ASTM D 5993	(1999; R 2004) Measuring Mass Per Unit of Geosynthetic Clay Liners
ASTM D 5994	(1998; R 2003) Measuring Core Thickness of Textured Geomembrane
ASTM D 6072	(1996; R 2002) Obtaining Samples of Geosynthetic Clay Liners
ASTM D 6243	(1998) Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method
ASTM D 6392	(1999) Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
ASTM D 6496	(2004) Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
ASTM D 6497	(2002) Mechanical Attachment of Geomembrane to Penetrations or Structures
ASTM D 6768	(2004) Tensile Strength of Geosynthetic Clay Liners

GEOSYNTHETIC RESEARCH INSTITUTE (GRI)

GRI GM7	(1995) Accelerated Curing of Geomembrane Test Strip Seams Made by Chemical Fusion Methods
GRI GM9	(1995) Cold Weather Seaming of Geomembranes
GRI GM11	(1997) Accelerated Weathering of Geomembranes Using a Fluorescent UVA Device
GRI GM13	(2006) Test Methods, Test Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

B. U.S. EPA, 1993, "Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities", EPA/600/R-93/182

1.3 RELATED SECTIONS

A. Section 01300: Submittals

B. Section 01310: Construction Operations Plan

C. Section 01400: Quality Control

D. Section 01700: Contract Closeout

E. Section 02200: Earthwork

F. Section 02801: Drainage and Vegetative Layers

1.4 SUBMITTALS

A. The Contractor shall submit all required items under the provisions of Section 01300, Submittals, and described herein.

B. The Contractor shall submit as preconstruction submittals within the Construction Operations Plan (COP), Section 01310, details of the Contractor's plan, materials, and equipment to install geosynthetics including, but not limited to, the following:

C. Manufacturer:

1. The name of the intended manufacturer(s) of the geomembrane, the GCL, and the geotextile with verification of experience requirements per subsection 1.5 A, Qualifications, below.

2. The quality control/quality assurance program manual or descriptive documentation (QC Manuals) for each type of geosynthetic from each manufacturer, if more than one.

3. Product data and material specifications for the proposed geosynthetics that meet or exceed those listed in subsection 2.1, Materials, below.

4. Samples of the proposed geosynthetics (2 samples at 12-inches by 18-inches).

5. Manufacturer's installation instructions, including repair procedures.

D. Installer:

1. The name and a statement of qualification of the intended geosynthetic installer along with the resumes of the master seamer and other seamers. The statement of qualification and resumes shall be in conformance with subsection 1.5, Qualifications, below.

2. A list of the ten projects in accordance with subsection 1.5 B, Qualifications, below, with a least three of the ten as reference projects. For each reference project include the facility name, location, owner, designer, contact information (phone number and name of individual at the facility that had an active role), and the total area covered. In addition, include the geomembrane manufacturer, type, thickness, and seaming method(s) used. For all others list the project and total area installed.

3. A List of proposed equipment and procedures to install the geosynthetic materials.

4. QC manual(s).

E. Testing Laboratory:

1. Qualifications of the independent testing laboratory that will be retained to perform quality control testing including verification that the laboratory is accredited via the Geosynthetic Accreditation Institute's Laboratory. The submittal from the QC laboratory shall include Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

2. Submit a letter stating that the testing laboratory is independent from and has no financial interest in the geomembrane installer, manufacturer, or Contractor.

3. Panel Layout Drawings (to scale) of the GCL and geomembrane showing the proposed panel and seam locations.

4. Sample forms or formats to be used during the GCL, geomembrane, and geotextile installation and testing including: Daily QC Log, Subgrade Acceptance forms, Daily Activity log, Equipment log, Panel Placement log, Field Trial Seaming log, Geomembrane Seaming log, Seam Air Pressure Test log, Repair log, Seam Destructive Sample log, and Certificate of Acceptance.

5. Submit the following Manufacturer Quality Control (MQC) certifications, information, and data for the:

F. GCL:

1. For each roll of GCL being delivered to the site submit certification and quality control test data indicating that the individual components of the GCL meet the material properties listed in subsection 2.1, Materials, Table 1, at a minimum of 7 days prior to shipment of geomembrane to the site.

2. Provide the following information marked on each roll:

    a. Manufacturer's name

    b. Product identification

    c. Lot and roll number

    d. Roll dimensions and weight

G. Geomembrane:

1. For each roll being delivered to the site submit certification and copies of quality control test data that the geomembrane meets the material properties listed in subsection 2.1, Materials, Table 2, at a minimum of 7 days prior to shipment of geomembrane to the site.

2. With each geomembrane shipment to the site, submit the following:

    a. The origin and identification of the raw materials used to manufacture the geomembrane including the supplier's name, production plant, brand name, and type.

    b. Copies of quality control certificates issued by the producer of the raw materials.

    c. Copies of quality control certificates for each roll of geomembrane identifying the date of production, roll identification number, and that each roll was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, foreign materials, tears, punctures, and blisters.

    d. MQC data conforming to the requirements listed in subsection 2.2, Manufacturer Quality Control.

3. With extrudate rod or bead delivered to the site, submit the following:

    a. Certification that that bead or rod is the same type, from the same manufacturer, or is compatible with the resin in the geomembrane.

    b. Lab certification for extrudate product requirements.

H. Geotextile:

1. Submit the specified QA Conformance Samples per subsection 3.4, below.

2. Submit Conformance Testing results and documentation per subsection 3.5, below.

1.5 QUALIFICATIONS

A. The manufacturer shall have produced the proposed geosynthetic for at least 5 years and for 10 completed projects having a total minimum area of 10 million square feet.

B. The installer is responsible for field handling, deploying, seaming, anchoring, and field Quality Control (QC) testing of the geosynthetics. The installer shall have installed the proposed materials for at least 5 years and for 10 completed projects having a total minimum area of 10 million square feet. For geomembrane installation the installer shall provide at least one master seamer that has experience seaming a minimum of 5 million square feet, and provide, if necessary, other seamers that have completed a minimum of 1 million square feet of the proposed geomembrane using the same type of seaming equipment and geomembrane thickness specified for this project.

C. The QC inspector (QCI) is the person or corporation hired by the Contractor, who is responsible for monitoring and documenting activities related to the QC of the geomembrane from manufacturing through installation. The QCI shall have provided QC inspection during installation of the proposed geomembrane material for at least 5 completed projects having a total minimum area of 2 million square feet.

D. The QC laboratory shall have provided QC and/or Quality Assurance (QA) testing of the proposed geomembrane and geomembrane seams for at least 5 completed projects having a total minimum area of 2 million square feet. The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform.

1.6 DELIVERY, STORAGE, AND HANDLING

GCL:

A. Deliver materials to the site only after acceptance of the required pre-construction submittals by the designated BCS representative.

B. Delivery, storage, and handling of GCL shall be in accordance with ASTM D 5888. The QCI and installer shall be present during unloading of the GCL. Rolls shall be packaged in an opaque, waterproof, protective covering and wrapped around a central core. Tears in the packaging shall be repaired to restore a waterproof protective barrier. Packaging that is unwrapped to allow conformance sampling shall be rewrapped with an opaque, waterproof, and protective covering. Unloading of rolls from the delivery vehicles shall be done in a manner that prevents damage to the GCL and its packaging.

C. Field storage shall be in flat dry areas where water cannot accumulate and the GCL rolls can be protected from damage. Storage of the rolls on blocks or pallets will not be allowed unless the GCL rolls are fully supported as approved by the Contracting Officer. Stacks of GCL rolls shall be no greater than three high. Rolls shall be covered with a water proof tarpaulin or plastic sheet if stored outdoors to protect them from precipitation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

D. During handling, rolls shall not be dragged, lifted by one end, dropped to the ground, or otherwise damaged. A pipe or solid bar of sufficient strength to support the full weight of the roll without significant bending shall be used for all unloading and handling activities. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

E. Markings on each roll should provide the manufacturer's name, product identification, lot and roll numbers, and roll dimensions including weight.

Geomembrane:

A. The QCI and the installer shall be present during delivery and unloading of the geomembrane. Each geomembrane roll shall be labeled with the manufacturer's name, product identification number, roll number, roll dimensions, thickness, and date manufactured. Geomembrane must be free from pinholes, surface blemishes, scratches, or other defects and shall meet those material requirements as specified in subsection 2.1, Materials.

B. Temporary storage at the project site shall be on a level surface, free of sharp objects and stones, and where water cannot accumulate. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Rolls shall not be stored more than two high. Palleted materials shall be stored on level surfaces and shall not be stacked on top of one another. Rolls being stored at the project site shall be covered with a sacrificial opaque and waterproof covering or placed in a temporary shelter to protect against precipitation, ultraviolet exposure, and accidental damage. Damaged geomembrane shall be removed from the site and replaced with geomembrane that meets the specified requirements. A suitable means of securing the rolls should be used such that shifting, abrasion, or other adverse movement does not occur.

C. Rolls shall not be dragged, slid, pushed, lifted by one end, or dropped. A pipe or solid bar, of sufficient strength to support the full weight of a roll without significant bending, shall be used for all handling activities. The diameter of the pipe or solid bar shall be small enough to be easily inserted through the core of the roll. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The

spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the roll without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

Geotextile:

A. Delivery, storage, and handling of geotextile shall be in accordance with ASTM D 4873.

B. The QCI and installer shall be present during the unloading of geotextile rolls. Rolls shall be packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed by the designated BCS representative. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

C. Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

D. Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

1.7 WARRANTY

A. The manufacturer's warranty shall state that the geosynthetic materials meet all requirements of the contract documents and that for the intended use; the geosynthetics are warranted for 30 years against deterioration. The installer's warranty shall state that the geosynthetics shall not fail due to improper installation within 30 years.

1.8 WEATHER LIMITATIONS

A. The GCL and geomembrane materials shall not be deployed or field-seamed in the presence of excess moisture (i.e., rain, fog, dew), in areas of ponded water, or in the presence of excess wind. Unless authorized by BCS or its representative, no

placement or seaming shall be attempted at ambient temperatures below 32 degrees F or above 104 degrees F. Ambient temperature shall be measured at a height no greater than 6-inches above the geomembrane surface. If seaming is allowed below 32 degrees F, the procedures outlined in GRI GM9 shall be followed. In marginal conditions, seaming shall cease unless destructive field seam tests, conducted by the QC laboratory, confirm that seam properties meet the requirements listed in Table 3. Tests shall be conducted in accordance with subsections 3.6, Non Destructive Field Seam Testing, and 3.7, Destructive Field Seam Testing. The QCI is required to inspect and approve geomembrane rolls which have been displaced by wind prior to the commencement of further field operations.

B. Sufficient slack shall be placed in the geomembrane to compensate for the coldest temperatures envisioned so that no tensile stresses are generated in the geomembrane or in its seams either during installation or subsequently after the geomembrane is covered. The geomembrane shall have adequate slack such that it does not lift up off of the subgrade or substrate material at any location within the facility (i.e. no “trampolining” of the geomembrane shall be allowed to occur at any time. Overlying layers shall not be placed atop of the geomembrane if excessive wrinkles are present due to thermal expansion. Only place the layers at times when the ambient temperature is similar to that when the geomembrane was installed to prevent this condition.

1.9 EQUIPMENT

A. Equipment used in performance of the work shall be in accordance with the geomembrane manufacturer's recommendations and shall be maintained in satisfactory working condition.

PART 2.0 PRODUCTS

2.1 MATERIALS

GCL:

A. GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two geotextiles.

B. GCL shall conform to the material property requirements listed in Table 1 and shall be free of tears, holes, or other defects that may affect its serviceability.

C. Encapsulating geotextiles shall be mechanically bonded together using a needle punch or stitch bonding process.

D. Needle punched and stitch bonded GCLs shall be continuously inspected for broken needles using an in-line metal detector and broken needles shall be removed.

E. The GCL shall have continuous waterproof laplines and matchlines printed directly on the GCL 6-inches from the roll edge.

F. The minimum manufactured GCL sheet width shall be 13.5-feet and the minimum manufactured GCL sheet length shall be 98-feet.

TABLE 1
GCL Properties

Property	Test Value	Test Method
Bentonite		
Swell Index (min)	24 mL/2g min.	ASTM D5890
Fluid Loss (max)	18 mL	ASTM D5891
Upper Geotextile Properties		
Material Type	Nonwoven	
Mass per Unit Area (min)	5.8 oz/yd^2	ASTM D5261
Lower Geotextile Properties		
Material Type	Nonwoven	
Mass per Unit Area (min)	5.8 oz/yd^2	ASTM D5261
Composite Properties		
Mass per Unit Area of GCL (min)	0.83 lb/ft^2	ASTM D5993
Mass per Unit Area of Bentonite (min)	0.75 lb/ft^2	ASTM D5993
Moisture Content (max)	<28% MQC	ASTM D5993
Moisture Content (max)	<40% QC	ASTM D5993
Tensile Strength, MD (min)	23 lb/in	ASTM D6768
Peel Strength (min)	2.1 lb/in	ASTM D6496
Index Flux (max)	1x10^{-7}	ASTM D5887

Geomembrane:

A. Raw Materials: Resin used in manufacturing geomembrane sheets shall be made of virgin uncontaminated ingredients. No more than 10 percent regrind, reworked, or trim material in the form of chips or edge strips shall be used to manufacture the geomembrane sheets. All regrind, reworked, or trim materials shall be from the same manufacturer and exactly the same formulation as the geomembrane sheet being produced. No post consumer materials or water-soluble ingredients shall be used to produce the geomembrane. For geomembranes with plasticizers, only primary plasticizers that are resistant to migration shall be used. The Contractor shall submit a copy of the test reports and QC certificates for materials used in the manufacturing of the geomembrane shipped to the site.

B. Sheet Materials: Geomembrane sheets shall be manufactured as wide as possible to minimize seams. Geomembrane sheets shall be uniform in color, thickness, and

surface texture and meet the more stringent of either the GRI GM13 standards or those provided in Table 2. The sheets shall be free of and resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants and other imperfections.

TABLE 2.
40-mil HDPE Geomembrane Properties

Property	Test Value	Test Method
Thickness	40 mils	ASTM D 5199
Lowest individual of 10 values	-10%	ASTM D 5199
Density (min)	0.940 g/cc	ASTM D 1505 / D 792 Method B
Tensile Properties (1) (min avg)		ASTM D 638
-yield stress	84lb/in	
-break stress	152lb/in	
-yield elong	12%	
-break elong	700%	
Tear Resistance (min avg)	28 lb	ASTM D 1004
Puncture Resistance (min avg)	72 lb	ASTM D 4833
Stress Crack Resistance (2)	300hr	ASTM D 5397
Dimensional Stability (max. avg) (%)	±2	ASTM D 1204
Carbon Black Content	2.0-3.0%	ASTM D 1603(3)
Carbon Black Dispersion	Note (4)	ASTM D 5596
Oxidative Induction Time (OIT) (min avg) (5)		
Std OIT or	100 min	ASTM D 3895
High Pres OIT	400 min	ASTM D 5885
Oven Aging at 85 deg C (min avg) (5), (6)		ASTM D 5721
Std OIT or	55% at 90 days	ASTM D 3895
High Pres OIT	80% at 90 days	ASTM D 5885
UV Resistance (min avg) (7) High Pres OIT(8), (9)	50 % retained at 1,600 hours	GRI GM11/ASTM D 5885

Note (1): For HDPE geomembrane, break elongation is calculated using a gauge length of 2.0-inches.

Note (2): For HDPE geomembrane, the yield stress used to calculate the applied load for test method ASTM D 5397, shall be the manufacturer's mean value.

Note (3): Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation to ASTM D 1603 can be established.

Note (4): Carbon black dispersion for 10 different views:
-minimum 8 of 10 in Categories 1 or 2
-all 10 in Categories 1,2, or 3

Note (5): The manufacturer has the option to select either one of the OIT methods to evaluate the antioxidant content.

Note (6): Evaluate samples at 30 and 60 days and compare with the 90 day response.

Note (7): The condition of the test shall be a 20 hour UV cycle at 167 degrees F followed by a 4 hour condensation cycle at 140 degrees F.

Note (8): The standard OIT test (ASTM D3895) shall not be used in determining UV resistance.

Note (9): UV resistance is based on percent retained value regardless of the original HP-OIT value.

Geotextile:

A. Geotextile shall be a non-woven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides.

B. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure.

C. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile.

D. Post-consumer recycled material may also be used.

E. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges.

F. Geotextiles shall meet the requirements specified in Table 3. Where applicable, Table 3 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for apparent opening size (AOS) represent maximum average roll values.

TABLE 3
Geotextile Filter Layer Properties

Property	Units	Acceptable Values	Test Method
Grab strength	lbs	160	ASTM D4632
Puncture	lbs	320	ASTM D4833
Trapezoid tear	lbs	55	ASTM D4533
Apparent opening size	U.S. Sieve	0.024	ASTM D4751
Permittivity	SEC -1	0.02	ASTM D4491
Ultraviolet degradation	percent	50% at 500 hrs	ASTM D4355

2.2 MANUFACTURER QUALITY CONTROL

GCL:

A. The GCL shall be sampled and tested in accordance with the manufacturer's approved QC manual. The manufacturer's QC procedures shall be in accordance with ASTM D 5889. Test results not meeting the requirements specified in Table 4 shall result in the rejection of applicable rolls. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls on both sides of the original failing roll pass the failed parameter.

TABLE 4
GCL Manufacturer Quality Control Testing

Property	Test Value	MQC Testing Frequency	Test Method
Bentonite			
Swell Index (min)	24mL/2g min	Once during production	ASTM D5890
Fluid Loss (max)	18mL	Once during production	ASTM D5891
Upper Geotextile Properties			
Material Type	Nonwoven		
Mass per Unit Area (min)	5.8oz/yd^2	Once during production	ASTM D5261
Lower Geotextile Properties			
Material Type	Nonwoven		
Mass per Unit Area (min)	5.8oz/yd^2	Once during production	ASTM D5261
Composite Properties			
Mass per Unit Area of GCL (min)	0.83 lb/ft^2	Once during production	ASTM D5993
Mass per Unit Area of Bentonite (min)	0.75 lb/ft^2	Once during production	ASTM D5993
Moisture Content (max)	<28%MQC	Once during production	ASTM D5993
Moisture Content (max)	<40%QC	Once during production	ASTM D5993
Tensile Strength, MD (min)	23 lb/in	Once during production	ASTM D6768
Peel Strength (min)	2.1 lb/in	Once during production	ASTM D6496
Index Flux (max)	1x10^{-7}	Once during production	ASTM D5887

Geomembrane:

A. Raw Materials: Raw materials shall be tested in accordance with the approved MQC manual. Any raw material which fails to meet the geomembrane manufacturer's specified physical properties shall not be used in manufacturing the sheet. Seaming rods and pellets shall be manufactured of materials which are essentially identical to that used in the geomembrane sheet. Seaming rods and pellets shall be tested for density, melt index and carbon black content in accordance with the approved MQC manual. Seaming rods and pellets which fail to meet the corresponding property values required for the sheet material, shall not be used for seaming.

B. Sheet Material: Geomembrane sheets shall be tested in accordance with the approved MQC manual. MQC testing frequencies and requirements shall be the more stringent of either the GRI GM13 standards or those provided in Table 5.

TABLE 5
HDPE Manufacturer Quality Control Testing

Property	Test Value	Testing Frequency (min)	Test Method
Thickness	40 mils	per roll	ASTM D5199
Lowest individual of 10 values	-10%	per roll	ASTM D5199
Density (min)	0.940 g/cc	per 200,000 lb Once during production	ASTM D1505 / D792 Method B
Tensile Properties (1) (min avg)		per 20,000 lb Once during production	ASTM D638
-yield stress	84 lb/in		
-break stress	152 lb/in		
-yield elong	12%		
-break elong	700%		
Tear Resistance (min avg)	28 lb	per 45,000 lb Once during production	ASTM D1004
Puncture Resistance (min avg)	72 lb	per 45,000 lb Once during production	ASTM D4833
Stress Crack Resistance (2)	300 hr	per 200,000 lb Once during production	ASTM D5397
Dimensional Stability (max. avg) (%)	±2	per 20,000 lb Once during production	ASTM D1204
Carbon Black Content	2.0-3.0%	per 45,000 lb Once during production	ASTM D1603(3)
Carbon Black Dispersion	Note (4)	per 200,000 lb Once during production	ASTM D5596
Oxidative Induction Time (OIT) (min avg) (5)			
Std OIT or	100 min	per year and change in formulation	ASTM D3895
High Pres OIT	400 min	per year and change in formulation	ASTM D5885
Oven Aging at 85 deg C (min avg) (5), (6)			ASTM D5721
Std OIT or	55% at 90 days	per year and change in formulation	ASTM D3895
High Pres OIT	80% at 90 days	per year and change in formulation	ASTM D5885
UV Resistance (min avg) (7)			
High Pres OIT(8), (9)	50% at 1,600 hours	per year and change in formulation	GRI GM11/ASTM D5885

Note (1): For HDPE geomembrane, break elongation is calculated using a gauge length of 2.0-inches.

Note (2): For HDPE geomembrane, the yield stress used to calculate the applied load for test method ASTM D 5397, shall be the manufacturer's mean value.

Note (3): Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation to ASTM D 1603 can be established.

Note (4): Carbon black dispersion for 10 different views:
- minimum 8 of 10 in Categories 1 or 2
- all 10 in Categories 1,2, or 3

Note (5): The manufacturer has the option to select either one of the OIT methods to evaluate the antioxidant content.

Note (6): Evaluate samples at 30 and 60 days and compare with the 90 day response.

Note (7): The condition of the test shall be a 20 hour UV cycle at 167 degrees F followed by a 4 hour condensation cycle at 140 degrees F.

Note (8): The standard OIT test (ASTM D3895) shall not be used in determining UV resistance.

Note (9): UV resistance is based on percent retained value regardless of the original HP-OIT value.

Geotextile:

A. The Manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. Manufacturing quality control sampling and testing shall be performed in accordance with the manufacturer's approved quality control manual. At a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D 4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

PART 3.0 EXECUTION

3.1 PRIOR TO DEPLOYMENT

GCL:

A. The QC inspector and installer shall inspect the subgrade on which GCL is to be placed and certify in writing that the surface is acceptable. Verify that grade changes are rounded to a minimum of 6-inch radius, and verify that no particles are projecting above subgrade. Repairs to the subgrade shall be performed at no additional cost to BCS.

B. Rolls shall be delivered to the work area in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL.

Geomembrane:

A. Inspection and certification of the surface shall be performed prior to the placement of the geomembrane.

B. Prior to construction, the installer shall provide a Panel Layout Drawing per 01300, Submittals. The drawing shall show the proposed orientation of all geomembrane panels (i.e., panel layout plan). The drawing should show that panel to panel, longitudinal, seams are to be oriented parallel to the slope. Where panel end to panel beginning (roll end to beginning of new roll) seams are necessary across slope, seams are allowed, however, they should be minimized to the extent practicable.

C. Each panel shall be given an "identification code" consistent with the layout plan. This identification code shall be agreed upon by the Installer and the designated BCS representative. The code shall be as simple and logical as possible. Identification codes shall be used for all project records.

D. Each seam shall be given an "identification code" consistent with layout plan. The seam identification system shall differentiate between seam types. The seam identification system shall be compatible with the panel numbering system. The identification codes shall be used for all project records.

E. The QCI shall verify that panels are installed at the locations indicated in the Installer's layout plan or a modified configuration as approved by the designated BCS representative.

Geotextile:

A. Inspection and certification of the surface shall be performed prior to the placement of the geotextile. Verify that the surface underlying the geotextile is smooth and free of ruts or protrusions which could damage the geotextile.

3.2 DEPLOYMENT

GCL:

A. Deployment of GCL shall not occur in the presence of excessive moisture, precipitation, ponded water, or high winds.

B. GCL which has been hydrated prior to being covered by an overlying geomembrane shall be removed and replaced. Hydrated GCL is defined as having become soft as determined by squeezing the material with finger pressure or material which has exhibited swelling.

C. GCL shall be anchored at the top and deployed down the slope to minimize wrinkles.

D. Dragging of GCL panels over the ground surface shall be minimized. BCS or its representative has the option of requiring the use of a slip sheet.

E. Deployed GCL panels shall lie flat on the subgrade surface, with no wrinkles or folds.

F. Care shall be taken not to entrap objects or moisture beneath the GCL.

G. Deploy no more panels than can be covered in the same day.

Geomembrane:

A. Geomembrane shall be installed as soon as practical after completion and approval of the installation of the GCL.

B. Any equipment or tools used shall not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or other means.

C. No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.

D. The procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be replaced or repaired at no additional cost to BCS.

E. Direct contact with the geomembrane shall be minimized and the geomembrane in traffic areas shall be protected by geotextiles, extra geomembrane, or other suitable materials approved by the designated BCS representative.

F. Panels shall be installed one at a time and each panel shall be seamed immediately or as soon as possible after placement.

G. Only geomembrane panels that can be anchored and seamed together the same day shall be deployed.

H. Adequate ballast (i.e., sand bags) shall be placed on the geomembrane, without damaging the geomembrane, to prevent uplift by wind.

I. No vehicular equipment shall be operated on the top surface of the geomembrane.

J. Panel to panel seams shall be oriented parallel to the line of maximum slope per the approved Panel Layout Drawing.

K. Where seams can only be oriented across the slope, panel end to beginning of new panel, the upper panel shall be lapped over the lower panel.

L. Permanent (fold-over type) creases in the covered geomembrane shall not be permitted.

M. The QCI shall record the roll number, identification code, location, and date of installation for each panel placed.

N. Patching together multiple small pieces (under 200 square feet) of liner to finish panel placement shall not be allowed.

O. The methods used to place the drainage layer sand over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane.

P. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6-inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the installer's approved QC manual.

Q. The QCI and installer shall visually inspect each panel for damaged or suspect areas immediately after placement. Damaged panels or portions of damaged panels which have been rejected shall be marked and remised from the site by the installer.

Geotextile:

A. The geotextile shall be placed as shown on Drawings.

B. The geotextile shall be rejected if it has defects, rips, holes, clogging, flaws, deterioration or damage incurred during manufacture, transportation, or storage.

C. The geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

D. The in-place geotextile shall be ballasted, secured in-place, by sand bags.

E. The sand bags shall be removed as the vegetative layer is being placed.

F. The sand bags shall be filled with the drainage sand from the approved source and to the extent possible should be combined with the drainage sand layer when no longer necessary.

G. Trimming shall be performed in such a manner that the geotextile shall not be damaged in any way.

H. The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of cover soil shall be replaced by the Contractor at no cost to BCS.

3.3 JOINING AND SEAMING

GCL:

A. Overlaps:

B. Using the lapline as a guide, overlap a minimum of 6-inches along panel length.

C. Overlap a minimum of 12-inches at the ends.

D. Orient panels parallel to the line of maximum slope.

E. Minimize the number of field seams in corners, and odd shaped geometric locations and outside corners.

F. Keep horizontal overlaps at least 6-feet away from toe and crest of slope.

G. Shingle panels overlaps on all side slopes and grades that the surface waters flow across the seam flap not under it.

H. Spread loose bentonite or bentonite paste at the rate of 4 ounces per lineal foot of overlap. Bentonite along overlaps is not necessary if the Manufacturer can document that the permeability at the overlaps is no greater than the permeability of the GCL material. Approval to forgo the use of additional bentonite must be received in writing from the designated BCS representative before installation. The following conditions apply for bentonite installation:

I. Bentonite must be of the same material as GCL.

J. Use line spreader if powder is used to reduce wind-blown particles.

K. Do not sew or use mechanical connection.

Geomembrane:

A. Trial Seams: Trial seams shall be made under field conditions on strips of excess geomembrane and under the same conditions as actual seams. Trial seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and each piece of seaming equipment used that day. Additional trial seams shall be made when climatic conditions reflect wide changes in geomembrane temperature, when other conditions occur that could affect seam quality, or at the request of the QCI or designated BCS representative. The QCI shall observe all trial seam procedures and tests. Trial seam samples shall be collected and tested in accordance with ASTM D 6392. One sample shall be obtained from each trial seam. This sample shall be at least 36-inches long by 12-inches wide with the seam

centered lengthwise. Ten random specimens 1-inch wide shall be cut from the sample. Five seam specimens shall be field tested for shear strength and 5 seam specimens shall be field tested for peel adhesion using an approved quantitative tension meter. Where necessary, accelerated curing of trial seams made by chemical methods shall be conducted in accordance with GRI GM7. To be acceptable, 4 out of 5 replicate test specimens shall meet seam strength requirements specified in Table 3. If the field tests fail to meet these requirements, the entire operation shall be repeated. If the additional trial seam fails, the seaming apparatus or seamer shall not be used until the deficiencies are corrected by the installer and 2 consecutive successful trial seams are achieved.

B. Field Seams: Panels shall be seamed in accordance with the geomembrane manufacturer's recommendations. Seaming shall not commence until after successful completion of the specified trial seam by the seamer utilizing the same equipment as that which will be used to seam panels. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of panels. The seam area shall be free of moisture, dust, dirt, and foreign material at the time of seaming. Fish mouths in seams shall be repaired. Each seam shall be numbered in a manner compatible with the panel layout drawing for documentation of seam testing results. Field seams shall meet the requirements in following table:

TABLE 6
HDPE Seam Properties

Property	Test Value	Test Method
Seam Shear Strength (min) (1)	80 lb/in	ASTM D 6392
Seam Peel Strength (min) (1) (2)	48 lb/in	ASTM D 6392

Note (1): Seam tests for peel and shear must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area.

Note (2): Where applicable, both tracks of a double hot wedge seam shall be tested for peel adhesion.

C. Extrusion welding shall only be used for patching and seaming in locations where thermal fusion methods are not feasible. Attachments and seam overlaps that are to be attached using extrusion welds shall be ground prior to welding. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend beyond the extrudate after placement. Extrusion welding shall begin within 10 minutes after grinding. Where extrusion welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. The total depth of the grinding marks shall be no greater than 10 percent of the sheet thickness.

Geotextile:

A. Geotextile panels shall be continuously overlapped a minimum of 12-inches at all longitudinal and transverse joints.

B. Seams oriented across the slope are to be minimized. Panel to panel overlaps, longitudinal, across the slope are not allowed, however, in cases of where panel end to panel end overlaps are necessary, the upper panel shall be lapped over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.4 CONFORMANCE SAMPLING

GCL:

A. One conformance sample shall be obtained for every 8,000 square feet of material delivered to the site. Samples shall be collected, packaged, and transported in accordance with ASTM D 6072. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot and roll number. The date, a unique sample number, the machine direction, and the top surface of the GCL shall also be noted on the sample. The outer layer of the GCL roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the GCL sheet a minimum of 3-feet wide in the machine direction. An additional 24-inch by 24-inch QA sample shall be collected, labeled, and submitted to the designated BCS representative each time a QC samples is collected.

Geomembrane:

A. One conformance sample, QC sample, 18-inches in length, for the entire width of a roll, shall be obtained for every 8,000 square feet of material delivered to the site. Samples shall not be obtained from the first 3-feet of the roll. For accordion folded geomembranes, samples of equivalent size shall be collected from approved locations. The samples shall be identified by manufacturer's name, product identification, lot, and roll number. The date, a unique sample number, and the machine direction shall also be noted. In addition, a 12-inch by 12-inch QA sample shall be collected, labeled, and submitted to the designated BCS representative each time a QC sample is collected.

Geotextile:

A. Samples shall be collected upon delivery to the site for quality control testing ASTM D 4354 at a frequency of one per 8,000 square feet. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. The outer layer of the geotextile roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the

geotextile sheet a minimum of 3-feet long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

3.5 QUALITY CONTROL TESTING

GCL:

A. The Contractor shall provide QC samples to the QC laboratory to determine bentonite mass per unit area (ASTM D 5993), peel strength (ASTM D 6496), flux (ASTM D 5887), and tensile strength (ASTM D 6768). Tests not meeting the property requirements specified in Table 1 shall result in the rejection of applicable rolls.

Geomembrane:

A. The Contractor shall provide all QC samples to the QC laboratory to determine density, thickness, tensile strength at break, and elongation at break in accordance with the methods specified in Table 2. Sample results not meeting the specified requirements shall result in the rejection of applicable roll. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls on both sides of the original failing roll pass the failed parameter.

Geotextile:

A. The Contractor shall provide samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the material property requirements specified in Table 3. Geotextile product acceptance shall be based on ASTM D 4759. Tests not meeting the specified requirements shall result in the rejection of applicable rolls.

3.6 NON-DESTRUCTIVE FIELD SEAM CONTINUITY TESTING

Geomembrane only:

A. Field seams shall be non-destructively tested for continuity and integrity over their full length in accordance with the installer's approved QC manual. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming. The locations, date, test number, name of tester, and outcome of seam test shall be recorded. Any seams which fail shall be documented and repaired in accordance with the installer's approved QC manual. The QCI shall observe all non-destructive testing procedures.

3.7 DESTRUCTIVE FIELD SEAM TESTING

Geomembrane only:

A. A minimum of one destructive test sample per 500-feet of field seam shall be obtained at locations specified by the QCI. Additional tests may be taken in areas of contamination, offset welds, visible crystallinity or other potential cause of faulty welds at the request of the QCI or designated BCS representative.

B. Sample locations shall not be identified prior to seaming.

C. Samples shall be a minimum of 12-inches wide by 42-inches long with the seam centered lengthwise. Sample size may be increased in size to accommodate QC laboratory testing.

D. Each sample shall be cut into 3 equal pieces, with one piece retained by the installer, one piece given to the QC laboratory, and the remaining piece given to the designated BCS representative to be retained for the permanent record.

E. Each sample shall be numbered and cross referenced to a field log which identifies:

1. panel number
2. seam number
3. date and time cut
4. ambient temperature within 6-inches above the geomembrane
5. seaming unit designation
6. name of master seamer
7. seaming apparatus temperature and pressures (where applicable)
8. reason for sampling (e.g. statistical routine, suspicious feature, change in sheet temperature, etc)
9. date and time of testing
10. pass/fail description

F. Ten 1-inch wide replicate specimens shall be cut from the installer's sample. Five specimens shall be tested for shear strength and 5 for peel adhesion using an approved field quantitative tension meter. Jaw separation speed shall be in accordance with the approved QC manual. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 6. If the field tests pass, 5 specimens shall be tested at the QC laboratory for shear strength and 5 for peel adhesion in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 3. If the field or laboratory tests fail,

the seam integrity shall be assessed and be repaired in accordance with subsection 3.8, Defects and Repairs, below.

G. The QC laboratory test results shall be provided no more than 48 hours after receiving the samples.

H. For double wedge welded samples, test both sides in peel. Holes for destructive seam samples shall be repaired the same day they are cut.

I. The QCI shall observe production seam sample cutting and verify that proper identification and details accompany the test to the QC laboratory.

J. All sample locations shall be recorded on the Record Drawings per subsection 3.11 and shall be indicated by the sample number for cross reference.

K. The QCI and the designated BCS representative shall verify that passing laboratory test results have been obtained before the geomembrane is covered.

3.8 DEFECTS AND REPAIRS

A. Tears, holes, blisters, or other damaged and defective portions of the geosynthetics shall be repaired as follows:

GCL:

A. Place a patch of GCL extending a minimum of 12-inches beyond the edges of the hole or tear on all sides. If recommended by the manufacturer, granular bentonite or bentonite mastic shall be applied in the overlap area. Patches shall be secured with construction adhesive or other approved methods as recommended by the manufacturer.

Geomembrane:

A. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6-inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming as determined to be appropriate by the QCI and the designated BCS representative. Repairs shall be non-destructively tested.

B. Seams that fail destructive testing shall be assessed by additional testing at locations a minimum of 10-feet on each side of the failed test. At each location a 12-inch by 18-inch minimum size seam sample shall be taken for 2 additional shear strength and 2 additional peel adhesion tests using an approved quantitative field tension meter. If these tests pass, then the remaining seam sample portion shall be sent to the QC laboratory for 5 shear strength and 5 peel adhesion tests in accordance with

the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens must meet specified seam strength requirements. If these laboratory tests pass, then the seam shall be cap stripped or repaired using other approved methods between that location and the original failed location. If field or laboratory tests fail, the process shall be repeated. Seams that fail destructive seam testing may be overlaid with a strip of new material and seamed (cap stripped), or may be repaired with other methods with approval from the designated BCS representative. After repairs are completed, the repaired seam shall be non-destructively tested in accordance with subsection 3.6, above.

Geotextile:

A. Place a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 12-inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Clogged areas of geotextile shall be removed. Geotextile rolls which cannot be repaired shall be removed and replaced. Repairs shall be performed at no additional cost to BCS.

3.9 VISUAL INSPECTION AND EVALUATION

A. Immediately prior to permanently covering each of the geosynthetic layers, seams and non-seam areas shall be visually inspected by the QCI and the designated BCS representative for defects, holes, or damage due to weather conditions or construction activities. At the discretion of designated BCS representative or the QCI the surface of the geosynthetic shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material.

Geomembrane only:

A. Each suspect location shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing. Each location that fails non-destructive testing shall be repaired in accordance with paragraph Patches and non-destructively retested.

3.10 COVERING

A. No equipment shall be operated directly on top of any geosynthetic layer.

B. The QCI shall be available at all times during covering of geosynthetic layers.

C. Covering soil shall be pushed out over the geosynthetic in an upward tumbling motion and shall not be dropped onto the geosynthetic. Covering materials shall be

placed from the bottom of the slope upward. Furthermore, materials shall be placed such that tensile stresses in the geosynthetic are minimized and in a manner that prevents wrinkles from folding over onto themselves. For the geotextile, cover soil shall be placed in a manner that prevents soil from entering the geotextile overlap zone.

D. A minimum of 12-inches of cover soil shall be maintained between equipment with ground pressures less than 7.0-psi and the geosynthetic during the covering process. A minimum of 30-inches of cover soil shall be maintained between equipment with ground pressures greater than 7.0-psi and the geosynthetic during the covering process. Equipment placing the cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

E. The cover soil material type, lift thickness, total thickness, compaction, and testing requirements are described in 02801, Drainage and Vegetative Layers, and shall be recorded by the QCI.

3.11 RECORD DRAWINGS

A. Final record drawings shall be prepared per Specification Section 01700, Contract Closeout.

- END OF SECTION -

SECTION 02900
CHAIN-LINK FENCE

PART 1.0 GENERAL

1.1 ENVIRONMENTAL PROTECTION PLAN

A. Remove the existing chain-link fence, posts, and hardware to the extent shown on the project Drawings. Reuse of the chain-link fencing and hardware is allowed if the fencing is not damaged during removal, and the reuse of the materials will provide fencing in the same working order as removed.

B. Reinstall fencing (posts, gates, chain-link, and all associated hardware) in the configuration shown on the project Drawings.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 116	Zinc-coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A 121	Zinc-coated (Galvanized) Steel Barbed Wire
ASTM A 123	Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	Zinc Coating (Hot-dip) on Iron and Steel Hardware
ASTM A 392	Zinc-coated Steel Chain-Link Fence Fabric
ASTM A 428	Weight of Coating on Aluminum-Coated, Iron, or Steel Articles
ASTM A 446	Steel sheet, Zinc-coated by Hot-dip process, Structural Quality
ASTM A 585	Aluminum Coated Steel Barbed Wire
ASTM C 94	Ready-mix concrete
ASTM F 567	Installation of Chain-link Fence
ASTM F 1234	Protective coating on steel framework for fences
ASTM F 669	Strength Requirements of Metal Posts and Rails for Industrial Chain-link Fence
ASTM F 1083	Pipe, Steel, Hot-dipped Zinc-Coated Welded for Fence Structures

ASTM A 121 Zinc-coated (Galvanized) Steel Barbed Wire

Chain-Link Manufacturers Institute (CLFMI) Product manual

1.3 SUBMITTALS

A. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware.

1.4 DESCRIPTION

A. Fence Height: 6-feet nominal.

B. Line post spacing shall be at intervals not exceeding 10-feet.

C. Fence Post and Rail Strength shall conform to ASTM F669 for Light Industrial Fence Quality.

1.5 QUALITY CONTROL

A. Perform work in accordance with the manufacturer's instructions.

PART 2.0 PRODUCTS

2.1 MATERIALS

A. Framing (Steel) shall conform to ASTM F1083 be Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 kips per square inch, and coating conforming to ASTM F1234 Type A on pipe exterior and interior.

B. New Fabric Wire (Steel) shall conform to ASTM A116 galvanized wire.

C. Barbed Wire: Class III

D. Concrete shall conform to ASTM C94

2.2 COMPONENTS

A. Line Posts	2 7/8-inch schedule 40
B. Corner and Terminal Posts	2 7/8-inch schedule 40
C. Gate Posts	4-inch Schedule 40
D. Top and Brace Rail	1 5/8-inch Schedule 40
E. Gate Frame	1 7/8-inch Schedule 40

F.	Fabric	2-inch diamond mesh interwoven wire #9 gauge
G.	Tension Wire	#7 gauge single strand
H.	Tension Band	2 7/8-inch steel
I.	Tie Wire	Aluminum allow steel wire

PART 3.0 EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories in accordance with the manufacturer's instructions.

B. Place fabric outside post rails.

C. Set posts plumb in concrete footings with the top of footing 2-inches above finish grade. Slope top of concrete to allow water run-off.

D. Line post footing depth below finish grade shall be 3-feet.

E. Corner, gate, and terminal post footing depths are to be 4-feet below finish grade.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods.

G. Do not stretch fabric until concrete footings has cured for 7 days.

H. Position bottom of fabric 2-inches above finished grade.

I. Fasten fabric to top rail, line posts, braces, and bottom tension wire at a maximum of 15-inches on centers.

J. Install support arms sloped outward and attach barbed wire, tension, and secure.

K. Provide concrete center drop to footing depth and drop rod at center of double gate openings.

- END OF SECTION -

SECTION 02940
SITE RESTORATION AND CLEAN-UP

PART 1.0 GENERAL

1.1 GENERAL

A. The work specified in this section includes:

1. Site Restoration and Clean-up

2. Hydroseeding and mulching of native grasses and forbs.

1.2 SUBMITTALS

A. The following information shall be provided: the name of suppliers for proposed local seed mixtures, fertilizers, biological additives, tackifiers and mulch with respective certified test results verifying material equivalency with project specification requirements, 7 days prior to purchasing materials.

Note: seed provenance and germination rate certification must be within the last 12 months.

1.3 DELIVERY, HANDLING, AND STORAGE

A. Live seeds should be delivered at the time they are to be planted. Deliver and store materials in their original weather resistant containers, clearly marked with contents, date and location of manufacture, and other pertinent information required by these Specifications.

B. Items shall be delivered to the site in the manufacturer's original sealed container or packaging system, complete with labels and instructions for handling, protecting, storing, and unpacking.

C. Store and handle materials in a manner recommended by the Manufacturer and in accordance with the regulations of governing agencies.

D. Items subject to damage by the elements shall be stored in a warehouse or within a weather tight enclosure or wrap with adequate ventilation to prevent condensation. Temperature and humidity shall be maintained within the range required by the manufacturer's printed recommendations.

E. The Contractor shall supply appropriate equipment and trained personnel to handle materials, and equipment in a safe manner and in a manner that will not cause damage to the product, to construction in progress, or to work in place. Personnel who handle hazardous material or machinery shall be trained in the appropriate

precautions and personal protective equipment to use when working with such materials and/or equipment.

1.4 CLEAN-UP OF THE SITE

A. The Contractor shall clean up and remove all refuse, debris, and unused materials of any kind resulting from the work as the work progresses and immediately after completion of the work. Contractor also shall clean all sidewalks, whether new or existing.

PART 2.0 PRODUCTS

2.1 HYDROSEED MIXTURE

A. Seed mixtures are specified in Table 1. Table 1 provides temporary and permanent "live weight" application rates for hydroseed use on the earthen cap restoration planting.

B. Determine the amount of "live seed" in a container by the following formula: Net weight of seed in container multiplied by the purity percentage multiplied by the germination percentage. (If seed is 85% pure and tests 90% germination, then a 100 pound container would contain 75.6 pounds of "live seed".)

C. Seed mixtures are not to contain more than 0.5 percent by weight weed seed, and are to be free of prohibited noxious weeds. Additionally, the maximum amount of inert or other seed is to be less than 2.0 percent by weight.

D. The seed origination shall be certified in writing by the supplier to be of Southeast Washington genetic origin. From Franklin County if possible. Noxious or invasive seed species may not be used.

E. Hydroseed mixtures are to include hydromulch fiber. The hydromulch fiber is to be virgin wood fiber obtained from clean, whole wood chips processed to eliminate factors that inhibit growth and germination. Application rates of hydromulch are provided in Table 1.

TABLE 1

Seed Mixture	Pounds of Pure Live Seed (PLS) per Acre
Regreen (sterile wheat)	60
Or some sort of sterile erosion control	-
Grasses	-
Bromus marginatus	76.8
Elymus wawawaiensis	67.2
Leymus cinereus	67.2
Forbs/Legumes	-
Astragalus australis	12.0
Achillea Millefolium	4.8
Clarkia pulchella	4.8
Lupinus aridus	2.4
Lupinus lepidus	2.4
Trifolium latifolium	2.4
TOTAL PLS	**300**
***Mulch-Pound per Acre (or ~52 lbs/1,000 sq ft)**	**750**

* Includes hydromulch fiber
Alternate/Substitution Seed List
Grasses
Elymus lanceolatus
Poa secunda
Sporobolus cryptandrus
Forbs/Legumes
Astragalus caricinus
Lupinus wyethii
Lupinus pusillus
Monardella odoratissima
Penstemon acuminatus
Wyethia amplexicaulis

PART 3.0 EXECUTION

3.1 SEEDING

A. Seeding should occur either in the spring planting season (between February 1 and May 1) or the fall planting season (between October 15 and November 15) to ensure adequate precipitation for grass propagation.

B. Perform hydroseeding operations when no rainfall is anticipated for 24 hours.

C. Do not seed during windy weather or when the ground is excessively wet, frozen, snow covered, extremely dry, cloddy, hard pan, or not friable.

D. Fertilizer is not allowed in hydroseed mixtures unless topsoil is not suitable for rooting of native grasses and forbs. If soil amendments are needed for proper plant rooting and growth organic soil amendments may be added to the seeding mixture at the rate recommended by the manufacture for the project soil type.

E. No pesticide application is allowed, although mechanical or other methods may be used to control unwanted vegetation.

F. Hydrofiber mulch is to be air dried to an equilibrium moisture content of 12±3 percent. Packaged in new labeled containers; and in a condition appropriate for mixing into a slurry.

G. Hydromulch fibers are to be colored with water soluble, non-toxic green dye to assist in visual monitoring of hydroseeding application. The dye is to be biodegradable and is not to inhibit seed germination or plant growth.

H. Hydromulch fibers are to be blended with the seed mixture and tackifier to form homogeneous slurry. As applied to the ground surface, the hydrofibers are to from a moisture-retaining mat that binds to the topsoil. Application of hydromulch fiber should be such as to allow for percolation of precipitation.

I. A tackifier is to be used with the hydroseeding operation regardless of slope and is to be applied at the manufacturer's suggested rate. Tackifier is to be non-toxic and is not to inhibit growth or germination. Approved tackifier material includes Chemco Product No. 9107GD (Chemco Water Technology Inc., Vancouver, Washington).

J. Hand application of seed and mulch may be necessary in areas inaccessible to hydroseeding equipment.

- END OF SECTION -

APPENDIX B

Cap Inspection and Maintenance Plan

APPENDIX B

CAP INSPECTION AND MAINTENANCE PLAN
ZONE B CAP

PASCO LANDFILL SITE
Pasco, Washington

May 12, 2010

Submitted to:

Washington Department of Ecology
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Submitted on behalf of:

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4-61M-107051/Phase 1

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1.0 INTRODUCTION

On behalf of Bayer CropScience (BCS), AMEC Earth & Environmental, Inc. (AMEC) has prepared this Cap Inspection and Maintenance Plan (CIMP) for the Pasco Landfill Zone B cover system (Cap). In 2010, the subject Cap was installed to reduce the threat that residual chemical constituents may pose to human health or the environment by fulfilling the following objectives:

1. Provide a physical barrier between soil within cell B and potential human or ecological receptors (minimization of risk by elimination of the "direct contact" exposure pathway);

2. Reduce stormwater infiltration into cell B and, thereby, reduce the potential for mobilization of residual chemical constituents; and

3. Provide engineering controls to limit access to Zone B.

2.0 PURPOSE

The purpose of this document is the establishment of an inspection and maintenance program to ensure the long-term performance of the Cap. An important design criterion was minimal long-term maintenance. In order to accomplish this, however, there are a few critical components that require inspection and may require short-term maintenance. Therefore, this program will distinguish between short-term and long-term inspection and maintenance requirements. Additionally, this document will distinguish between scheduled (tasks performed at stated intervals), non-regularly scheduled (tasks that are expected but are not needed regularly), and unscheduled (emergency repairs) maintenance. This well planned inspection and maintenance program ensures that the cap elements continue to function properly and reduces the need for costly unscheduled maintenance.

3.0 INSPECTION AND MAINTENANCE

The following sections provide guidance for the personnel responsible for inspecting and maintaining the Cap and the Site.

Inspections are the tasks performed by field personnel to gather and convey information regarding the current site conditions and functionality of the Cap components to engineering staff and management, and conveying the information for evaluation by engineering staff and management. Inspection tasks include, but may not be limited to:

- Visual observations with written record logged in field notebooks or inspection specific forms;

- Photo-documentation with still cameras or video recorder; and
- Performance of surveys.

It is intended that the scope and frequency of the inspections will be at regular intervals; however, they may be varied to adapt to unexpected conditions.

Maintenance tasks are regularly scheduled and non-regularly scheduled tasks to ensure the continued performance and function of the Cap per design or restore the function as designed.

3.1 Inspection Plan

Table 1, below, presents the inspection frequency by Cap component:

Table 1 - Inspection Frequency

CAP COMPONENT	QUARTERLY	BIANNUAL	BIENNIAL
Cap Surface	X[1]	X	
Cap Surface Survey			X
Erosion Protection Rock	X[1]	X	
Drainage Outlets	X[1]	X	
Fence and Gates	X[1]	X	

[1] Short-term inspection frequency for the first two years after installation.

3.1.1 Cap Surface Inspections

Routine inspection of the Cap surface and surrounding area provides information regarding the overall performance of Cap components. Key times for inspection are Spring after the last frost and early Fall. Inspections at these times offer the best opportunity to observe vegetation conditions and to implement repairs, if necessary.

Visual inspections are to be performed in a manner that ensures that the surface is completely covered. A serpentine pattern with no greater than 10-feet between passes across the surface is recommended. The inspectors are to look for the following indications that the integrity and function of the Cap may be compromised:

- Poor health of the vegetation;
- Subsidence;
- The presence or evidence of standing water or ice;
- Erosion of topsoil on the Cap;

- Erosion of the surrounding area that has or eventually may reach the Cap; and
- Holes or other evidence of burrowing animals.

Growth density of native vegetation (grasses) varies. Assessment of the general health of the vegetation must take this into consideration. Comparison of the density to local native density may be an indicator of the relative health of the vegetation. Excessive grass growth and the presence of invasive species must be reported.

Because subsidence is such a critical issue for the integrity of the Cap, two methods are to be used to inspect for the condition. One will be during the visual inspections described in this section and the other will be through biennial topographic surveys described below in Section 3.1.2. The inspectors are to perform visual inspections quarterly for the first two years after installation. This short-term inspection frequency will allow for the timely correction of issues prior to becoming major problems. They are to pay special attention to the condition of the grades, the formation of depressions, and to the presence or evidence of pooled water or ice, which may indicate an area of subsidence. As with the other information gathered during inspections, evidence of subsidence is to be fully documented for inclusion in quarterly Inspection and Maintenance Reports. Additionally, timely notification of the engineering staff or management is to be made if there is confirmed or suspected subsidence.

When inspecting the surface for evidence of erosion, special attention is to be given in areas where water may converge or concentrate and points along slopes where runoff water volume or velocity may increase. Soil accumulation in the Erosion Protection Rock along the perimeter may be an indication of erosion by water. It may also be an indication of erosion by wind. The type of erosion and the severity may be evaluated by the type of material (i.e., gravel, sand, silt, clay) and the deposition pattern. Therefore, observation of soil deposition within the Erosion Protection Rock should be completely photo-documented, with location information, and diagrammed in the logbook with a written description.

Burrowing animals may cause significant damage to the Cap by burrowing through the geotextile fabric, the geomembrane, and the Geosynthetic Clay Liner (GCL) layers. Inspectors are to be aware and able to identify burrows and signs of burrowing animals. Timely notification of the engineering staff or management is to be made if evidence is observed.

3.1.2 Cap Surface Surveys

During the first year after installation, some uniform settlement is to be expected. Additionally, some necessary improvements or repairs may become apparent after the first winter of operation. Therefore, a baseline survey will be conducted in late fall of

2010. A survey will then be conducted biennially through 2016. These surveys will be compared to the baseline. The surveyor will be required to prepare a table after each survey which allows the comparison of the data obtained to the previous survey's data and to provide a drawing of the area with contour lines at 1-foot intervals. The data and drawings are to be included in the quarterly Inspection and Maintenance Report. Based on the data obtained through 2016, a decision will be made based on the need for additional surveys.

3.1.3 Drainage Outlet Inspections

An important component of the Cap system is the sand drainage layer. The function of the sand drainage layer is to remove water that infiltrates through the overlying soil cover. The drainage layer is made of a 1-foot thick layer of highly permeable sand, geotextile encased perforated drainage piping, and non-perforated conveyance piping. The outlets are intended to dissipate the energy of the conveyed water and sufficiently distribute the outflow over the Erosion Protection Rock to eliminate erosion. The drainage outlets are to be inspected for clogging of the outlet screens, drainage sand within the pipes, and evidence of localized erosion patterns. Sand within the pipe may indicate incorrect installation or damage to the drainage system pipe network. If excessive sand is encountered within the pipe network, areas of subsidence may be indicative of the problem area. If examination is required within the pipe network with a camera system, the outlets are designed to be removable and will allow camera access at the flange to flange connection point a few feet upstream of the outlet tees. Inspections are to be made during each Site visit and quarterly for the first couple of years (short-term frequency). After which, inspections are to be biannually.

3.1.4 Inspection of the Perimeter Fence and Gates

The fence and gates will be inspected quarterly for the first two years, and biannually thereafter. The fence will be inspected for holes in the chain link, loose or missing barbed wire, holes in the soil surface directly below the fence, and to verify the warning signs are present and secure.

3.2 Maintenance

As stated earlier, an important design criterion for the Cap was minimal maintenance requirements. The following sections present the initially expected scheduled maintenance and the recommended procedures for coordinating and performing non-regularly scheduled and unscheduled maintenance. In order to properly coordinate inspection and maintenance efforts it is recommended that the inspection personnel be different from the maintenance personnel. Only by separation of the assignments can the owner be assured that the maintenance is being appropriately performed and that the necessary inspections are identifying possible problems.

Maintenance will be coordinated by the Owner or the Owner's representative and should not be initiated without written approval

3.2.1 Scheduled Maintenance

The only components of the Cap that are expected to require regular scheduled maintenance are the drainage outlet screens. The outlet screens will require cleaning to ensure unrestricted outlet flow.

The outlet screens are to be disconnected from the outlet pipes by removal of the clamps. The screens are to be cleared of debris and restriction and replaced on a quarterly basis.

3.2.2 Non-Regularly Scheduled Maintenance

Only one Cap component is initially expected to require non-regularly scheduled maintenance and that is the vegetation. To ensure adequate establishment of the vegetation cover, isolated reseeding during the first two or three years of growth may be required. Additionally, areas may need to be reseeded or repaired due to damage from natural events. Initiation of this maintenance should be through the inspection process and coordination of the activity should be accomplished with input from management.

3.2.3 Unscheduled Maintenance

Unscheduled maintenance is the most costly form of maintenance as it is required when a failure is imminent or has occurred. To minimize the financial ramifications of this form of maintenance, some strategizing and contingency planning is appropriate. Early identification and the notification of management when situations that may lead to problems are observed during inspections can reduce the cost of a necessary repair. Additional contingency planning should include a small supply of materials specific to the Cap such as seed of the same seed mix; spare quantity of GCL, geomembrane, and geotextile; perforated drainage pipe; and sand or soil if not readily available. This reserve may improve the quality of a repair and may make the repair possible in a relatively short period of time.

4.0 REPORTING AND RECORDS MANAGEMENT

4.1 Inspection Reporting

The inspection personnel are to produce Inspection and Maintenance Reports documenting the results of the inspections as prescribed in this plan and the results of inspections of any maintenance performed during the reporting period. The reports

will be submitted to BCS. BCS, the engineering staff, and management are to evaluate the inspection reports and produce a maintenance schedule for coordination of the maintenance and repairs.

4.2 Regulatory Reporting Requirements

Reports will include copies of completed inspection reports, the photographic log, a brief summary of the condition of the remedial components, and a description of any repairs performed.

The frequency of regulatory reporting requirements has not yet been determined.

4.3 Records Management

Copies of the following documents will accompany inspection personnel during all site visits:

- Copy of this document; and
- All reports sent to Ecology.

REFERENCES

URS, 2002. *Interim Action Completion Report Zone B Removal, Pasco Sanitary Landfill* prepared by URS for Philip Services Corporation, July 2002.

Washington State Department of Health, 1999. *Risk Assessment/Cleanup Level Analysis Document, and Feasibility Study,* prepared by the Washington State Department of Health for Ecology (August, 1999).

LIMITATIONS

This report was prepared exclusively for Bayer CropScience by AMEC Earth & Environmental, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Cap Inspection and Maintenance Plan is intended to be used by Bayer CropScience for the Pasco Landfill in Pasco, Washington only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

APPENDIX C

Construction Quality Assurance Plan

APPENDIX C

CONSTRUCTION QUALITY ASSURANCE PLAN FOR INTERIM REMEDIAL ACTIVITIES ZONE B CAP

PASCO LANDFILL SITE
Pasco, Washington

May 12, 2010

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Submitted on behalf of:

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4-61M-107051/Phase 1

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List of Appendices

1.0 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) was prepared in support of an interim remedial action (RA) proposed for the Pasco Landfill, Pasco, Washington. The Pasco Landfill site is the location of a historical municipal and industrial waste disposal facility. The former industrial waste disposal area was divided into five areas (Zones A through E) based upon the nature of the waste accepted in each area. The actual waste cells are named by their zone letter. Zone B was used exclusively for disposal of approximately 5,000 drums of herbicide manufacturing wastes from the Chipman Chemical Company Portland, Oregon plant. In March 2002, URS Corporation and Philip Services Corporation (PSC) removed the drums and associated soils as an interim RA.

The proposed interim RA involves the excavation of surface soils that may have been contaminated during earlier site activities; the relocation of the excavated soil onto the surface of cell B; regrading of the relocated soils to form the subgrade for an impervious cover system; and the installation of the cover system. The cover system will be constructed in such a manner as to meet the requirements of a Resource Conservation and Recovery Act (RCRA) Class C landfill cap.

This CQAP was developed in accordance with United States Environmental Protection Agency (EPA) *Remedial Design/Remedial Action Handbook* (EPA, 1995) and in accordance with EPA's guidance document *Quality Assurance and Quality Control for Waste Containment Facilities* (EPA, 1993). The CQAP will be used in the field by quality assurance (QA), quality control (QC), and construction oversight/management personnel to provide guidance during construction and to ensure that construction and implementation of the interim RA are performed in accordance with the requirements set forth by the project plans and specifications as well as subsequent addenda or change orders, if issued.

1.1 Definitions

Construction Quality Assurance (CQA): A planned system of activities that provides the owner and permitting agency assurance that the facility was constructed as specified in the design. CQA consists of inspections, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. During construction CQA refers to measures to be taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications (EPA, 1993).

Construction Quality Control (CQC): A planned system of inspections that is used to directly monitor and control the quality of a construction project. Construction QC is normally performed by the geosynthetics installer or for natural soil materials by the earthwork contractor, and is necessary to achieve quality in the constructed or installed system. CQC during construction refers to the measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the plans and specifications for the project (EPA, 1993).

Manufacturing Quality Assurance (MQA): A planned system of activities that provides assurance that the materials were constructed as specified in the certifications documents and contract plans. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract plans for the project (EPA, 1993).

Manufacturing Quality Control (MQC): A planned system of inspections that are used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of the geosynthetic materials and is necessary to ensure that minimum or maximum specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract plans (EPA, 1993).

2.0 CONSTRUCTION MANAGEMENT

This section presents a discussion of the roles and responsibilities of the organizations and personnel involved, and describe general construction management activities including change order management, project scheduling, health and safety, project audits, corrective actions, and construction reporting.

2.1 Project Roles and Responsibilities

Successful construction management depends greatly on clearly defined roles and responsibilities, levels of authority, and lines of communication. This section summarizes the overall CQA organization and responsibilities of key personnel in accordance with EPA (1993). The construction QA/QC organization chart included in Appendix C-1 indicates the overall lines of authority of the key QA/QC personnel. This chart will be updated as staffing roles are defined when contractual agreements are completed and QA/QC assignments are established with the prime contractor.

- CQA Engineer: The CQA Engineer will be responsible for certifying to Bayer CropScience (BCS) and regulatory agency representatives that in his or her opinion, the construction has been completed within reasonable conformance with the project plans and specifications. The certification statement will be accompanied by a final CQA report that contains all the appropriate documentation, including daily observation reports, sampling locations, test results, and other relevant data.
- CQA Field Personnel: Construction QA field personnel will be responsible for documenting observations and performing field tests to ensure that a facility is constructed in accordance with the plans and specifications approved by the permitting agency. Any discrepancies with the specifications and the resolutions or corrective actions to the discrepancies also will be documented. The CQA field personnel will be employed by the same firm as the CQA Engineer. The CQA field personnel will report to the CQA Engineer for this project.
- BCS Representative: The designated BCS representative will act as a liaison between all parties involved in the Zone B interim RA; however, their primary duty will be to act as the Engineer's on-site representative.
- Contractor: The contractor will be responsible for physical implementation of the work and all operations pertaining to construction activities. These activities include but may not be limited to the purchase and installation of materials meeting the specifications, scheduling of construction operations, providing capable appropriately trained personnel meeting the project specific qualifications, obtaining all required permits, and the identification of an employee as the Quality Control Inspector (QCI).
- QCI: The QCI will be responsible for: the appropriate delivery and handling of all project materials, the coordination of all required QC testing, and the review, management, and distribution of all generated data. The QCI may have other duties on-site but will not be the contractor's Project Manager or Site Superintendent. The QCI will have the authority to communicate directly with the contractor's home office management and will have the authority to stop the work if critical components are not functioning as intended. The QCI will be required to be on-site at all times when work is actively being performed. The QCI will be required to have at least 2 years of cumulative experience acting in a similar role on other project(s) of a similar scope.
- GCL and Geomembrane Installer's Representative: The GCL and Geomembrane Installer's Representative (typically the crew foreman) will be responsible for certifying acceptance of the subgrade prior to the installation of the GCL and

geomembrane. At the completion of seaming, the GCL and Geomembrane Installer's Representative will conduct individual inspections of the installed GCL and geomembrane for panel and seam defects and will check that all panel and seam defects have been repaired.

3.0 CONSTRUCTION QUALITY ASSURANCE

3.1 Qualifications of CQA Representatives

The CQA representatives will include a CQA Engineer and CQA field personnel. The CQA representatives will have a thorough understanding of the content and intent of the project specifications. The responsibilities and qualifications of these individuals are described below.

- CQA Engineer: The CQA Engineer will be a registered professional engineer in the State of Washington with experience overseeing the construction of and competency in certifying like installations. Shall provide a signed statement of financial independence of the Contractor, BCS, and AMEC, for themselves and all CQA field personnel.
- CQA Field Personnel: The personnel will have experience and competency in individual elements of the project. The CQA Engineer and CQA field personnel will be employed by an organization that operates separately from the contractor, BCS, and AMEC. CQA field personnel shall be certified by the National Institute for Certification of Engineering Technologies (NICET) as recommended by EPA (1993).

3.2 CQA Documentation

A major purpose of the CQA process will be to provide documentation for those individuals who were unable to observe the entire construction process (e.g., representatives of the permitting agency) so that those individuals can make informed judgments about the quality of construction for a project. The CQA procedures and results will be thoroughly documented.

3.2.1 Daily Inspection Reports

Routine daily reporting and documentation procedures will be required. The CQA field personnel will prepare daily written inspection reports that may be included in the final CQA document. Copies of these reports will be available from the CQA Engineer.

The daily reports will include information about work that was accomplished, tests and observations that were made, and descriptions of the adequacy of the work that was performed.

3.2.2 Daily Summary Reports

A daily written summary report will be prepared by on-site CQA field personnel. The report will provide a chronological framework for identifying and recording all other reports and aid in tracking what was done and by whom. As a minimum, the daily summary reports will contain the following:

- Date, project name, location, facility under construction, personnel involved in major activities, and other relevant identification information;
- Description of weather conditions, including temperature, cloud cover, and precipitation;
- Summaries of any meetings held and actions recommended or taken;
- Specific work units and locations of construction underway during that particular day;
- Equipment and personnel being utilized in each work task, including subcontractors;
- Identification of areas or units of work being expected;
- Unique identifying sheet number of geomembrane and GCL for cross referencing and document control;
- Description of off-site materials received, including any QC data provided by the supplier;
- Calibrations or recalibrations of test equipment, including actions taken as a result of recalibration;
- Decisions made regarding approval of units of material, units of work, and/or corrective actions to be taken in instances of substandard or suspect quality;
- Unique identifying sheet numbers of inspection data sheets and/or problem reporting and corrective measures used to substantiate any CQA decisions described in the previous item; and
- Signature of the on-site CQA field personnel preparing the summary.

3.2.3 Inspection and Testing Reports

All observations, results of field tests, and results of laboratory tests performed on-site or off-site will be recorded on a suitable data sheet. Recorded observations will include the notes, charts, sketches, photographs, or any combination of these. A checklist will be developed to ensure that pertinent factors are not overlooked.

As a minimum, the inspection data sheets will include the following information:

- Description or title of the inspection activity;
- Location of the inspection activity or location from which the sample was obtained;
- Type of inspection activity and procedure used (reference to standard method when appropriate or specific method described in CQA plan);
- Unique identifying GCL and geomembrane sheet number for cross referencing and document control;
- Recorded observation or test data;
- Results of the inspection activity (e.g., pass/fail); comparison with specification requirements;
- Personnel involved in the inspection besides the individual preparing the data sheet; and
- Signature of on-site CQA field personnel and review signature by the CQA Engineer.

3.2.4 Problem Identification and Corrective Measures Reports

A problem is defined as material or workmanship that does not meet the requirements of the plans, specifications, or CQA Plan for a project; or any obvious defect in material or workmanship, even if there is conformance with plans, specifications, and the CQA Plan. At a minimum, problem identification and corrective measures reports will contain the following information:

- Location of the problem;
- Description of the problem (in sufficient detail and with supporting sketches or photographic information where appropriate) to adequately describe the problem;
- Unique identifying geomembrane sheet number for cross referencing and document control;

- Possible cause;
- How and when the problem was located (reference to inspection data sheet or daily summary report by inspector);
- Where relevant, an estimate of how long the problem has existed;
- Any disagreement noted between the CQA field personnel and the contractor about whether or not a problem exists or the possible cause of the problem;
- Suggested corrective measure(s);
- Documentation of correction, if corrective action was taken and completed prior to finalization of the problem and corrective measures report (reference to inspection data sheet, where applicable);
- Where applicable, suggested methods to prevent similar problems; and
- Signature of the on-site CQA field personnel and review signature by the CQA Engineer.

3.2.5 Record Drawings

Record drawings (also called as-built drawings) will be prepared by the contractor to document the actual lines, grades, and conditions. For some components, the record drawings will include survey data that show bottom and top elevations of a particular component, the plan dimensions of the component, and locations of all destructive testing samples. For geosynthetic components, the record drawings will show the dimensions of geomembrane and GCL field panels, the location of each panel, identification of all seams and panels with appropriate identification numbering or lettering, location of all patches and repairs, and location of all destructive test samples. Separate drawings will show record cross-sections and special features such as sump area.

3.2.6 Final Documentation and Certification

At the completion of the project BCS will submit a final report to the permitting agency. This report may include all of the daily inspection reports, the daily CQA field personnel's summary reports, inspection data sheets, problem identification and corrective measures reports, and other documentation such as QC data provided by manufacturers or fabricators, laboratory test results, photographs, as-built drawings, internal CQA memoranda or reports with data interpretation or analyses, and design changes made by the design engineer during construction. The document will be certified correct by the CQA Engineer.

3.2.7 Document Control

The CQA documents will be maintained under a document control procedure. Any portion of the document(s) which are modified must be communicated to and agreed upon by all parties involved. An indexing procedure will be developed for convenient replacement of pages in the CQAP with revision status indicated on appropriate pages.

A control scheme will be implemented to organize and index all CQA documents. This scheme will be designed to allow easy access to all CQA documents and will enable a reviewer to identify and retrieve original inspection reports or data sheets for any completed work element.

3.2.8 Storage of Records

During construction, the CQA field personnel will be responsible for all CQA documents. This includes a copy of plans, specifications, CQAP, and originals of all data sheets and reports. Duplicate records will be kept at another location to avoid loss of this valuable information if the originals are destroyed.

Once construction is complete, the document originals will be stored by the owner in a manner that will allow for easy access while still protecting them from damage. A final copy will be kept by the permitting agency. All documentation will be maintained through the operation and post-closure monitoring periods by the owner and the permitting agency in an agreed-upon format (hard copy, electronic medium, etc.).

3.3 Meetings

Communication is extremely important to quality management. Quality construction is easiest to achieve when all parties involved clearly understand their responsibility and authority. Meetings can be very helpful to make sure that responsibility and authority of each organization clearly understood. During construction, meetings can help to resolve problems and misunderstandings, and to find solutions to unanticipated problems that have developed.

3.3.1 Pre-Bid Meeting

The first meeting will be held to discuss the project plans and specifications. The pre-bid meeting will be held after the permitting agency has issued a permit for the facility and before a construction contract has been awarded. The pre-bid meeting will be

held before construction bids are prepared so that the companies bidding on the construction will better understand the level of CQA to be employed on the project. Also, if the bidders identify problems with the plans and specifications, the owner has an opportunity to rectify those problems prior to bidding.

3.3.2 Pre-Construction Meeting

The pre-construction meeting is held after a general construction contract has been awarded and the major subcontractors and material suppliers are established. The purpose of this meeting will be to review the details of plans and specifications, to make sure that the responsibility and authority of each individual is clearly understood, to agree on procedures to resolve construction problems, and to establish a foundation of cooperation in quality management. The pre-construction meeting will be attended by the owner or representative, design engineer, the designated BCS representative, representatives of the general contractor and major subcontractors, the CQA Engineer and field personnel, and possibly a representative from the permitting agency.

The pre-construction meeting should include the following activities:

- Assign an individual to take minutes;
- Introduce parties and identify their responsibility and authority;
- Distribute the CQA plan, identify any revisions made after the resolution meeting, and answer any questions about the CQA plan, procedures, or documentation;
- Discuss responsibilities and lines of communication;
- Discuss reporting procedures, distribute documents, schedule for any regular meetings, and resolve construction problems;
- Review site requirements and logistics, including safety procedures;
- Review the design, discuss the most critical aspects of the construction, and discuss scheduling and sequencing Issues;
- Discuss CQA procedures that the installer or contractor will employ, for example, establish and agree on geomembrane and GCL repair procedures; and
- Make a list of action items that require resolution and assign responsibilities for these items.

3.3.3 Progress Meetings

Weekly progress meetings will be held for the duration of the project to resolve problems, identify action items, and improve overall quality management. Persons who will attend these meetings are those involved in the specific issues being discussed. At all times the CQA Engineer and the contractor, or designated representative, should be present.

4.0 CONSTRUCTION QUALITY ASSURANCE

4.1 Contractor's Responsibility

The contractor will be the principal responsible party for construction QC. The contractor will designate a QCI representative who will oversee all QC testing and observation. Testing shall follow those specified in Table 1 (Appendix C-2) and meet the limiting criteria. The QCI representative will provide all CQC test results and documentation to the CQA field personnel. The following sections present QC practices for the various phases of construction.

4.2 Surface Soil Excavation, Relocation, and Cap Subgrade Preparation

Construction QC testing and observations will be performed during the subgrade earthwork phase of construction. All earthwork will be performed in the presence of the CQA field personnel.

4.2.1 Pre-Construction

Prior to initiation of excavation activities the CQA field personnel will verify that the surveyed excavation area is as indicated on the project plans, that the established work zones are appropriate, and that the equipment and procedures as described by the contractor are the same as proposed in the Construction Operations Plan.

4.2.2 Construction

At a minimum, the following CQA activities will be performed during construction:

- Make field observation to verify that the extent and depth of the excavation is as shown on the drawings;
- Observe preparation and fill placement of GCL subgrade, including proof rolling the prepared subgrade;

- Make field observations to verify that spoils from the soil excavation are placed on to the existing 12 mil poly;
- Observe the thickness and compactive effort for each lift of soil placement; and
- Make field observations to verify that lines and grade of earthwork are in accordance with the specifications.

4.2.3 Post-Construction

Once the GCL subgrade layer has been placed and compacted, the CQA field personnel, the QCI, and a representative of the GCL installer will conduct a visual inspection of the prepared surface to ensure that no protrusions or unacceptable debris are present. The CQA field personnel, the QCI, and a representative of GCL installer will continue to monitor the conditions of the GCL subgrade until the GCL is placed.

4.3 GCL

The GCL acts as the primary layer within the barrier area, which provides a low permeability and flexible barrier to reduce the amount of water infiltration into the waste (Sharma and Lewis, 1994). Placement of the GCL will be performed under the continuous observation of the CQA field personnel, the QCI representative from the contractor, and a representative of GCL installer.

4.3.1 Pre-Construction

Construction QA activities prior to construction will include review of contractor submittals and inspection of the GCL subgrade. At a minimum, the following pre-construction CQA activities will be performed:

- Obtain and review the certification and QC test data submitted by the contractor to ensure that the delivered GCL is at least equivalent to the material specified, utilizing Table 1 (Appendix C-2) to check the test criteria. Review the names and qualifications of the manufacturer and installer, manufacturer's QC program, and supporting laboratory data, drawings showing proposed panel layout and penetration details, and GCL material samples.
- Observe the unloading of the GCL and ensure that the materials are properly handled and stored, such that the material is not damaged upon delivery or during unloading. Ensure that the GCL is protected from all potential future damage.

- Ensure that each roll delivered is properly labeled with the:
  - Manufacturer's name
  - Product identification
  - Lot and roll number
  - Roll dimensions and weight
- Inspect and obtain GCL installer's acceptance of prepared subgrade prior to placement.

4.3.2 Construction

Construction QA activities to be accomplished during construction will include, but are not necessarily limited to, the following:

- Observe and record weather conditions during installation and ensure that conditions of excessive moisture, precipitation, ponded water, or high winds are not present during deployment and installation of GCL;
- Observe that the contractor does not operate equipment or vehicles directly on top of the GCL. Ensure that the contractor operates construction equipment with ground pressures less than 7.0-pounds per square inch (psi) and a minimum cover soil depth of 12-inches for placing cover soil on top of the GCL. Ensure that the contractor maintains at least 30-inches of cover soil where construction equipment with ground pressures greater than 7.0-psi is operated;
- Observe installer's methods of placement and lap seaming for the GCL to verify accordance with specifications;
- Ensure conformance testing is conducted for each 8,000-square feet of GCL installed following the specifications provided in Table 1 (Appendix C-2). Observe that each sample is identified with waterproof markings for:
  - Manufacturer's name
  - Product identification
  - Lot and roll number
  - Date
  - Unique sample number
  - Machine direction

- Top surface

- Conduct visual inspections of all GCL panels, both seam and non-seam areas for defects, holes, or other forms of damage due to weather conditions or construction activities. Ensure that the GCL is properly cleaned for visual inspection and require installer to clean the GCL of dust, mud, or foreign material if the amount of these materials present on the GCL hinder visual inspection or the function of the overlying material.
- Observe that repairs to defects are secured with construction adhesive and covered with bentonite or bentonite mastic or performed in accordance with another manufacturer approved method.
- Observe all covering of GCL, and record:
  - Cover soil material type
  - Lift thickness
  - Total thickness
  - Compaction
  - Testing requirements

4.3.3 Post-Construction

Construction QA activities to be performed after construction include reviewing the contractor's as-built drawings and observing placement of the geomembrane.

4.4 Geomembrane

The geomembrane functions as a secondary low permeability and flexible layer placed above the GCL within the barrier area (Sharma and Lewis 1994). Placement of the geomembrane will be performed under the continuous observation of the CQA field personnel, the QCI, and a representative of the liner's installer.

4.4.1 Pre-Construction

Construction QA activities prior to construction will include review of contractor submittals and inspection of the geomembrane subgrade. At a minimum, the following pre-construction CQA activities will be performed:

- Obtain and review the QC certifications and test data submitted by the contractor to ensure that the delivered geomembrane is at least equivalent to the material

specified, utilizing Table 1 (Appendix C-2), and has met the criteria outlined by the manufacturer's QC manual. Review the names and qualifications of the manufacturer and installer, manufacturer's QC program, and supporting laboratory data, drawings showing proposed panel layout, and geomembrane material samples.

- Obtain and review extrudate rod or bead certifications to ensure that the material is of the same type, from the same manufacturer, or is otherwise compatible with the resin in the geomembrane.
- Observe the unloading of the geomembrane and ensure that the materials are properly handled and stored, such that the material is not damaged upon delivery or during unloading. Ensure that the geomembrane is protected from all potential future damage.
- Ensure that each geomembrane roll delivered is properly labeled with the:
    - Manufacturer's name
    - Product identification
    - Roll number
    - Roll dimensions and weight
    - Thickness
    - Date manufactured
- Inspect and obtain geomembrane installer's acceptance of prepared subgrade prior to placement.

4.4.2 Construction

Construction QA activities to be accomplished during construction will include, but are not necessarily limited to, the following:

- Observe and record weather conditions during installation and ensure that conditions of excessive moisture, precipitation, ponded water, or high winds are not present during deployment and installation of geomembrane.
- Conduct visual inspection and certification of the surface of all geomembrane panels prior to placement.

- Verify that all geomembrane panels are installed at the locations indicated in the installer's layout plan or a modified configuration as approved by the designated BCS representative.
- Ensure that no vehicles or equipment is operated on top of the geomembrane and that persons working on top of the geomembrane do not smoke, wear damaging shoes, or engage in any other activities which may cause damage to the geomembrane.
- Record the roll number, identification code, location, and date of installation for each geomembrane panel placed.
- Ensure permanent creases are not formed, the wrinkle height to width ratio does not exceed 0.5, and that wrinkles exceeding 6 inches in height are cut out and repaired.
- Conduct an inspection of each geomembrane panel for damage or suspect areas immediately after placement. Ensure that damaged panels are marked and removed from the site by the installer.
- Observe installer's methods of placement and seaming to verify accordance with specifications and installer's QC manual.
- Observe contractor conducting trial seam testing at the start of each day, whenever there is a change in seaming personnel or seaming equipment, and at least every four hours by each seamer and each piece of seaming equipment used that day. If climatic conditions reflect wide changes in geomembrane temperature or when other conditions occur that could affect seam quality. Request additional trial seam testing as deemed necessary.
- Ensure that field seams are numbered in a manner that is compatible with the panel layout drawing for documentation of seam testing results.
- Ensure that QC sampling is performed once for every 8,000-square feet of geomembrane following the specifications provided in Table 1 (Appendix C-2).
- Observe non-destructive testing of the full length of all field seams and ensure that testing is performed in accordance with the installer's QC manual. For each non-destructive field seam test, record the:
    - Location
    - Date
    - Test number
    - Name of tester

- Outcome of the test

- Record and ensure repairs to any seams, which fail seam testing, are completed in accordance with the installer's QC manual.
- Specify location of destructive field seam testing once for every 500-feet of seam installed, observe destructive seam test sample cutting, and submit to QC testing laboratory. Seams shall be tested following the specifications provided in Table 1 (Appendix C-2). Specify, obtain, and submit additional testing in areas of contamination, offset welds, visible crystallinity, or other potential cause of faulty welds. Ensure that each destructive field seam sample is numbered and cross referenced in the field log which lists:
  - Panel number
  - Seam number
  - Date and time of sample cut
  - Ambient temperature within 6-inches above the geomembrane
  - Seaming unit designation
  - Name of master seamer
  - Seaming apparatus temperature and pressures (where applicable)
  - Reason for sampling (e.g., statistical routine, suspicious feature, change in sheet temperature, etc)
  - Date and time of testing
  - Outcome of the test
  - Verify that laboratory test results are passing prior to geomembrane covering
- Observe reconstruction of failed seam tests and repair of defects. Determine whether localized flaws may be repaired by spot welding or seaming. Observe non-destructive testing of repairs and record as description above for non-destructive testing.
- Conduct visual inspection of all geomembrane panels, both seam and non-seam areas for defects, holes, or other forms of damage due to weather conditions or construction activities. Ensure that the geomembrane is properly cleaned for visual inspection and require installer to clean the geomembrane of dust, mud, or foreign material if the amount of these materials present on the geomembrane

hinder visual inspection or the function of the overlying material. Observe non-destructive testing of all suspect areas and ensure repairs accordingly.

- Observe all covering of geomembrane, and record:
  - Cover soil material type
  - Lift thickness
  - Total thickness
  - Compaction
  - Testing requirements

4.4.3 Post-Construction

Construction QA activities to be performed after construction including reviewing the contractor's as-built drawings and observing contractor backfilling over the geomembrane.

4.5 Geotextile

The geotextile layer acts as a filter placed between the soil drainage and topsoil layers; and prevents fines from clogging the pores within the sand layer (Sharma and Lewis, 1994). Placement of the geotextile will be performed under the continuous observation of the CQA field personnel, the QCI representative, and a representative of the liner's installer.

4.5.1 Pre-Construction

Construction QA activities prior to construction will include review of contractor submittals and inspection of the geotextile subgrade. At a minimum, the following pre-construction CQA activities will be performed:

- Obtain and review the QC certifications and test data submitted by the contractor to ensure that the delivered geotextile is at least equivalent to the material specified, utilizing Table 1 (Appendix C-2), and has met the criteria outlined by the manufacturer’s QC manual. Review the names and qualifications of the manufacturer and installer, manufacturer’s QC program, and supporting laboratory data, drawings showing proposed panel layout, and geotextile material samples.

- Observe the unloading of the geotextile and ensure that the materials are properly handled and stored, such that the material is not damaged upon delivery or during unloading. Ensure that the geotextile is protected from all potential future damage.
- Ensure that each geotextile roll delivered is properly labeled with the:
    - Manufacturer's name
    - Geotextile type
    - Product identification
    - Roll number
    - Roll dimensions and weight
    - Date manufactured
- Inspect and obtain geotextile installer's acceptance of prepared subgrade prior to placement. Verify that the surface that the geotextile shall be placed is smooth and free of ruts and protrusions.

4.5.2 Construction

Construction QA activities to be accomplished during construction will include, but are not necessarily limited to, the following:

- Observe and record weather conditions during installation and ensure that conditions of excessive moisture, precipitation, ponded water, or high winds are not present during deployment and installation of geotextile.
- Observe that the contractor does not operate equipment or vehicles directly on top of the geotextile. Ensure that the contractor operates construction equipment with ground pressures less than 7.0-psi and a minimum cover soil depth of 12-inches for placing cover soil on top of the geotextile. Ensure that the contractor maintains at least 30-inches of cover soil where construction equipment with ground pressures greater than 7.0-psi is operated.
- Conduct visual inspection and certification of the surface of all geotextile panels prior to placement.
- Ensure that no vehicles or equipment is operated on top of the geotextile and that persons working on top of the geotextile do not smoke, wear damaging shoes, or engage in any other activities which may cause damage to the geotextile.

- Observe installer's methods of placement and lap seaming for the geotextile to verify accordance with specifications.
- Ensure that QC sampling is performed once for every 8,000-square feet of geotextile and that testing follows the specifications provided in Table 1 (Appendix C-2). Each sample shall be labeled with waterproof marker with the:
    - Manufacturer's name
    - Product identification
    - Lot number
    - Roll number
    - Machine direction
    - Date
    - Unique sample number
- Ensure that damaged geotextile or geotextile that does not meet the QC criteria within the specifications are rejected.
- Observe and verify that all repairs to damaged or clogged areas of the geotextile are performed according to the specifications.
- Conduct visual inspection of all geotextile panels, both seam and non-seam areas for defects, holes, or other forms of damage due to weather conditions or construction activities. Ensure that the geotextile is properly cleaned for visual inspection and require installer to clean the geotextile of dust, mud, or foreign material if the amount of these materials present on the geotextile hinder visual inspection or the function of the overlying material.
- Observe all covering of geomembrane, and record:
    - Cover soil material type
    - Lift thickness
    - Total thickness
    - Compaction
    - Testing requirements

4.5.3 Post-Construction

Construction QA activities to be performed after construction include reviewing the contractor's as-built drawings and observing contractor backfilling over the geotextile.

4.6 Drainage Sand Layer and Topsoil Placement

The drainage sand provides a permeable layer to facilitate the drainage of infiltrated water away from the cap, while the topsoil supports vegetation to provide further protection of the underlying cap from wind and water erosion, vehicular traffic above the cap, and frost penetration (Sharma and Lewis, 1994). Construction QA for the drainage sand and topsoil placement will be performed per the following inspection and testing criteria. All drainage layer and topsoil placement will be performed under the observation of the designated BCS representative.

4.6.1 Pre-Construction

Review contractor's submittals for the drainage pipe, drainage sand, and topsoil layers. Ensure that the test results required by the specifications are met prior to ordering and delivering each material.

Review and certify acceptance of all contractor QC documentation regarding geomembrane installation, such as panel and seam sketches, seam testing logs, and defect logs.

4.6.2 Construction

During construction, CQA activities will include, at a minimum, observations and testing as described below:

- Observe and record weather conditions during installation and ensure that ambient temperature is at least 35-degrees F and that underlying cap layers are completed, not frozen, excessively wet or dry, or in a condition otherwise detrimental to grading.
- Ensure that underlying cap layers are free from contamination from sediments, dust, dirt, or foreign material and that any such contamination is corrected by the contractor.
- Ensure that the topsoil is comprised of clean soils.

- Ensure that the drainage sand is clean and free of silt, clay, vegetative matter, and other objectionable material.
- Verify that drainage pipe, connections, and accessories are installed in accordance with the manufacturer's instructions and does not cause excessive wrinkling of the geomembrane. Ensure that pipe is lifted or rolled into place and not dropped or dragged.
- Observe that the pipe is maintained in the correct position and at the required slope and ensure that the locations and elevations of the pipe ends, joints, appurtenances, and couplings are surveyed prior to covering for future location and maintenance.
- Observe that a minimum material thickness of 30-inches is placed on haul routes over the geomembrane and collection pipes, including any material dumping, spreading, and stockpile areas which cover the geomembrane and collection pipes.
- Observe that a minimum of 1-foot of drainage sand is placed and compacted as required by the specifications.
- Observe that a minimum of 2-feet of topsoil is placed loosely as required by the specifications.
- Observe that conformance sampling and testing is performed as required by the specifications, and provided in Table 1 (Appendix C-2) for quick reference, once per 500-cubic yards of material placed.
- Observe that all erosion rills or other damage is repaired and that grades are reestablished. Repairs should be documented as required by the specifications with:
    - Location of the repair
    - Volume of soil affected
    - Corrective action taken
    - Results of the conformance sampling and testing of repaired locations

4.7 Seeding and Vegetation Quality Control

These additional activities will be conducted by the CQA representative during vegetation and seeding of the topsoil component of the engineered cover.

4.7.1 Pre-Construction

Pre-construction CQA activities will include review of contractor submittals of material samples and specifications, equipment characteristics and capacities, and product QC certificates.

4.7.2 Construction

During construction of the vegetative cover, the CQA representative will observe fertilizing, seeding, and mulching operations to verify accordance with the specifications.

4.7.3 Post-Construction

After the vegetative cover is constructed, the CQA representative will make field observations to verify that the quality of the growth is acceptable and is in accordance with the specifications.

REFERENCES

Sharma, H.D. and Lewis, S.P., 1994, "Waste Containment Systems, Waste Stabilization, and Landfills: Design and Evaluation", John Wiley and Sons, Inc., New York, NY.

U.S. EPA, 1993, "*Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities"*, EPA/600/R-93/182.

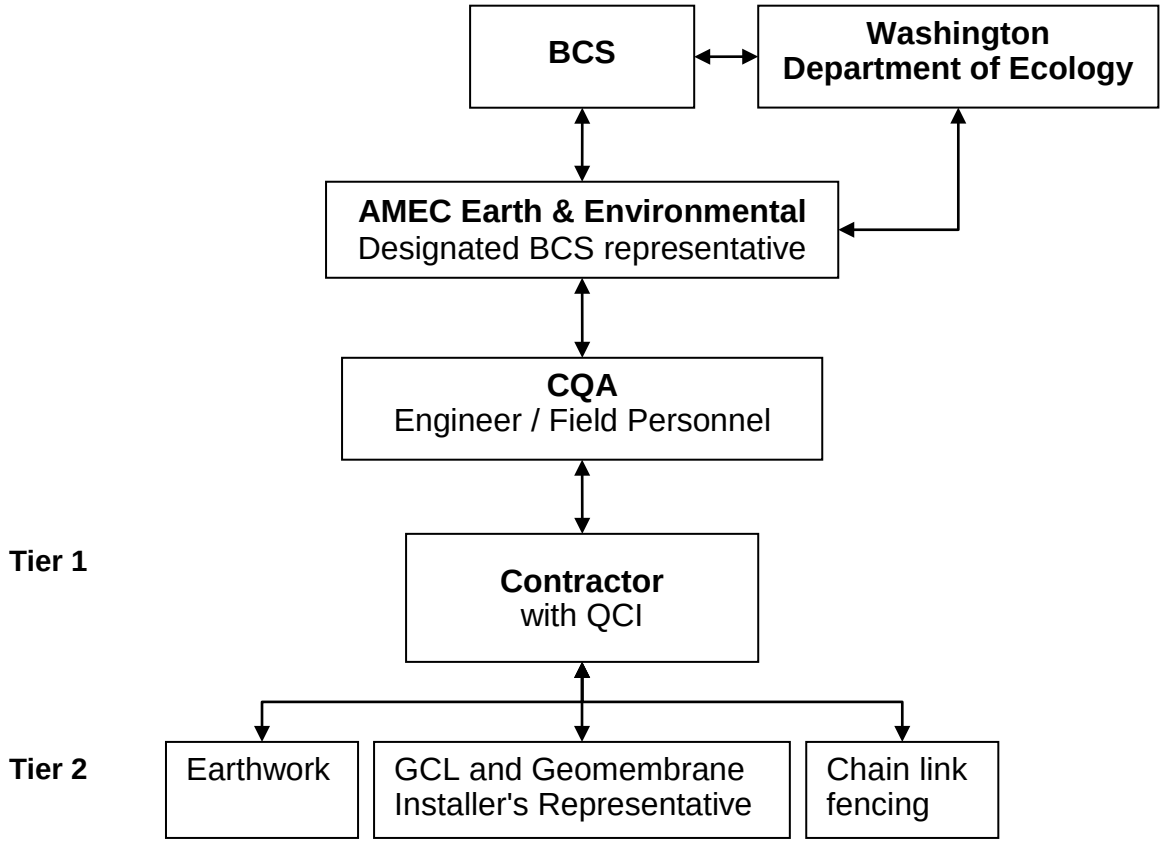
U.S. EPA, 1995, "*Remedial Design/Remedial Action Handbook*", EPA/540/R-95/059.

LIMITATIONS

This report was prepared exclusively for Bayer CropScience by AMEC Earth & Environmental, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This Construction Quality Assurance Plan is intended to be used by Bayer CropScience for the Pasco, Washington Landfill only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

APPENDIX C-1

Construction QA/QC Organization Chart


BCS
Washington Department of Ecology
AMEC Earth & Environmental
Designated BCS representative
CQA
Engineer / Field Personnel
Tier 1
Contractor
with QCI
Tier 2
Earthwork
GCL and Geomembrane Installer's Representative
Chain link fencing

APPENDIX C-2

Testing and Quality Assurance Table

TABLE 1
Testing and Quality Assurance
Zone B Cap
Pasco Landfill Site

Material Type	Specification	Limit/ Criteria	Test Method	Frequency of Tests	Quality Assurance Responsibilities
Topsoil:					
	Max. Particle Size	1 inch	ASTM D 422	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
	pH	5 to 7	ASTM D 4972	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
	Organic Content	5-20%	ASTM D 2974	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
Sand:					
	Soil Type	SW or SP	ASTM D 2487	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
	Minimum Permeability	10^{-1} cm/s at 90% relative density	ASTM D 2434	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
	Gradation	100% passing 1/4 inch Sieve and less than 5% passing U.S. No. 200 Sieve	ASTM D 422	Conformance testing: 1 per 500 yd^3	Review and compare to specification for conformance
Geotextile Sock:					
	Mass/Area	0.75 oz/yd^2		MQC testing:	Review MQC test results for conformance
	Fiber Size	4.0 denier per filament		MQC testing:	Review MQC test results for conformance
	Grab Tensile Strength (min)	20 lb	ASTM D 4632	MQC testing:	Review MQC test results for conformance
	Puncture Resistance (min)	80 lb	ASTM D 4833	MQC testing:	Review MQC test results for conformance
	Mullen Burst (min)	25 psi		MQC testing:	Review MQC test results for conformance
	Air Permeability (min)	500 cfm/ft^2		MQC testing:	Review MQC test results for conformance
	Specific Gravity	1.14		MQC testing:	Review MQC test results for conformance
	AOS	0.9 mil	ASTM D 4751	MQC testing:	Review MQC test results for conformance
	Flow Rate	163 $gal/min/ft^2$		MQC testing:	Review MQC test results for conformance

TABLE 1
Testing and Quality Assurance
Zone B Cap
Pasco Landfill Site

Material Type	Specification	Limit/ Criteria	Test Method	Frequency of Tests	Quality Assurance Responsibilities
GCL:					
Bentonite					
	Swell Index (min)	24mL/2g	ASTM D 5890	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
	Fluid Loss (max)	18mL	ASTM D 5891	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
Upper Geotextile					
	Material Type	Nonwoven			
	Mass per Unit Area (min)	5.8oz/yd^2	ASTM D 5261	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
Lower Geotextile					
	Material Type	Nonwoven			
	Mass per Unit Area (min)	5.8oz/yd^2	ASTM D 5261	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
Composite					
	Mass per Unit Area of GCL (min)	0.83 lb/ft^2	ASTM D 5993	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
	Mass per Unit Area of Bentonite (min)	0.75 lb/ft^2	ASTM D 5993	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
				Conformance testing:1 per 8,000 square feet	Review quality control test results for conformance
	Moisture Content (max)	<28% MQC	ASTM D 5993	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
	Moisture Content (max)	<40% QC	ASTM D 5993	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
	Tensile Strength, MD (min)	23 lb/in	ASTM D 6768	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review quality control test results for conformance
	Peel Strength (min)	2.1 lb/in	ASTM D 6496	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review quality control test results for conformance
	Index Flux (max)	1x10^{-7}	ASTM D 5887	MQC testing: 1 per production	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review quality control test results for conformance

TABLE 1
Testing and Quality Assurance
Zone B Cap
Pasco Landfill Site

Material Type	Specification	Limit/ Criteria	Test Method	Frequency of Tests	Quality Assurance Responsibilities
Geomembrane:					
	Thickness	40 mil	ASTM D 5199	MQC testing: 1 per roll	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review quality control test results for conformance
	Lowest Individual of 10 values	-10%	ASTM D 5199	MQC testing: 1 per roll	Review manufacturer's certification and MQC test results for conformance
	Density (min)	0.940 g/cc	ASTM D 1505 / D 792 Method B	MQC testing: 1 per 200,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Tensile Properties (min avg)				
	Yield Stress	84 lb/in	ASTM D 638	MQC testing: 1 per 20,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Break Stress	152 lb/in	ASTM D 638	MQC testing: 1 per 20,000 lb produced	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	
	Yield Elongation	12%	ASTM D 638	MQC testing: 1 per 20,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Break Elongation	700%	ASTM D 638	MQC testing: 1 per 20,000 lb produced	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	
	Tear Resistance (min avg)	28 lb	ASTM D 1004	MQC testing: 1 per 45,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Puncture Resistance (min avg)	72 lb	ASTM D 4833	MQC testing: 1 per 45,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Stress Crack Resistance	300 hr	ASTM D 5397	MQC testing: 1 per 200,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Dimensional Stability (max avg)	±2%	ASTM D 1204	MQC testing: 1 per 200,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Carbon Black Content	2.0-3.0%	ASTM D 1603	MQC testing: 1 per 45,000 lb produced	Review manufacturer's certification and MQC test results for conformance
	Carbon Black Dispersion		ASTM D 5596	MQC testing: 1 per 200,000 lb produced	Review manufacturer's certification and MQC test results for conformance

TABLE 1
Testing and Quality Assurance
Zone B Cap
Pasco Landfill Site

Material Type	Specification	Limit/ Criteria	Test Method	Frequency of Tests	Quality Assurance Responsibilities
Oxidative Induction Time (OIT) (min avg)					
	Std OIT or	100 min	ASTM D 3895	MQC testing: 1 per year or change in formulation	Review manufacturer's certification and MQC test results for conformance
	High Pres OIT	400 min	ASTM D 5885	MQC testing: 1 per year or change in formulation	Review manufacturer's certification and MQC test results for conformance
Oven Aging at 85 deg C (min avg)					
	Std OIT or	55% at 90 day	ASTM D 3895 / ASTM D 5721	MQC testing: 1 per year or change in formulation	Review manufacturer's certification and MQC test results for conformance
	High Pres OIT	80% at 90 day	ASTM D 5885	MQC testing: 1 per year or change in formulation	Review manufacturer's certification and MQC test results for conformance
UV Resistance (min avg)					
	High Pres OIT	50% at 1600 hr	GRI GM11	MQC testing: 1 per year or change in formulation	Review manufacturer's certification and MQC test results for conformance
Seam Strength					
	Non-Destructive Testing		per Specifications	Conformance testing: Full length of all seams	Review and observe tests performed by contractor
	Shear Strength (min)	80 lb/in	ASTM D 6392	Conformance testing: 1 per 500 ft of field seam or as specified by the QCI	Review and observe tests performed by contractor
	Peel Strength (min)	48 lb/in	ASTM D 6392	Conformance testing: 1 per 500 ft of field seam or as specified by the QCI	Review and observe tests performed by contractor

TABLE 1
Testing and Quality Assurance
Zone B Cap
Pasco Landfill Site

Material Type	Specification	Limit/ Criteria	Test Method	Frequency of Tests	Quality Assurance Responsibilities
Geotextile:					
	Grab Strength	160 lb	ASTM D 4632	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review and observe tests performed by contractor
	Puncture	320 lb	ASTM D 4833	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review and observe tests performed by contractor
	Trapezoid Tear	55 lb	ASTM D 4533	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review and observe tests performed by contractor
	Apparent Opening Size	0.024 U.S. Sieve	ASTM D 4751	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	
	Permittivity	0.02 s^{-1}	ASTM D 4491	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review and observe tests performed by contractor
	Ultraviolet Degradation	50% at 500 hr	ASTM D 4355	MQC testing: per MQC manual	Review manufacturer's certification and MQC test results for conformance
				Conformance testing: 1 per 8,000 square feet	Review and observe tests performed by contractor

APPENDIX D

Engineering Calculations

Date: 4/26/2010
Prepared by: CPP
Checked by: RRJ

GOAL: Determine storm volume and storage capacity for Zone B Landfill Cap in resposne to Ecology Comment 7, dated March 10, 2010.
Source: Stormwater Management Manual for Eastern Washington (SMMEW), Ecology, 2004.
Use SCS Curve Number Method (Chapter 4.5).

Calculations:

1) Calculate run-off volume using Soil Conservation Service (SCS) Curve Number (CN) Method.
Calculate for 2-Year, 24-Hour Event and 25-year, 24-Hour Event.

$Q = (P - 0.2S)^2 / (P + 0.8S)$
$S = (1000/CN) - 10$
$Q = 0$ for $P < 0.2S$

where:

Q = actual direct run-off depth, in inches
P = total run-off depth over area, in inches
S = potential abstraction or potential maximum natural detention over the area due to infiltration, storage, etc, in inches
CN = run-off curve number

and

Total Run-off Volume = $V = (3{,}630\ ft^3/acre\text{-}in) * Q * A$

where:

A = Acres

Assume soil type A(1). Therefore, from SMMEW Table 4.5.2 using Pasterland, Grassland, or Range, in good condition:

CN = 39

Therefore:

$S = (1000/39) - 10$
$= 15.64$ inches 15.64

Total rainfall in 24-hour storm:

$P_{wqs} = C_{wqs} * P_{xyr,24hr}$

where:

P_{wqs} = the 6-month,24-precipitation, in inches
C_{wqs} = the coefficient from SMMEW Table 4.2.9 for converting the x-year, 24-hour precipitation into the 6-month,24-precipitation
$P_{xyr,24hr}$ = the X-year, 24-hour precipitation from SMMEW Figures 4.3.1 through 4.3.7

From SMMEW table 4.2.9, Region 2:

C_{wqs} = 0.66

1a) 2-Year, 24-Hour Event

From SMMEW Figure 4.3.3:

$P_{2yr,24hr}$ = 0.8 inches

Therefore:

$P_{wqs} = C_{wqs} * P_{2yr,24hr}$
= 0.66 * 0.8
= 0.528 inches | 0.528

Therefore:

$Q = (0.528 - 0.2 * 15.64)^2 / (0.528 + 0.8 * 15.64)$ | 6.76
= 6.76 / 13.04 | 13.04
= 0.518 inches | 0.518

Total Run-off Volume = (3,630 ft^3/acre-in) * Q * *A (for 2-Year,24-Hour Event)*
= (3,630 ft^3/acre-in) * 0.518 inches * 0.57 acres[(2)]
= 1,072 ft^3 | 1072
= 8,017 gallons *(2-Year, 24-Hour Event)* | 8017

1b) 25-Year, 24-Hour Event

From SMMEW Figure 4.3.5:

$P_{25yr,24hr}$ = 1.6 inches

Therefore:

$P_{wqs} = C_{wqs} * P_{25yr,24hr}$
= 0.66 * 1.6
= 1.06 inches | 1.06

Therefore:

$Q = (1.06 - 0.2 * 15.64)^2 / (1.06 + 0.8 * 15.64)$ | 4.28
= 4.28 / 13.57 | 13.57
= 0.315 inches | 0.315

Total Run-off Volume = (3,630 ft^3/acre-in) * Q * A *(for 25-Year,24-Hour Event)*
= (3,630 ft^3/acre-in) * 0.315 inches * 0.57 acres
= 652 ft^3 | 652
= 4,875 gallons *(25-Year, 24-Hour Event)* | 4875

Total rainfall during regional storm events would be the same as calculated above because the conversion factor for a Region 2 regional storm in SMMEW Table 4.2.10 is 1.0.

2) Calculate initial abstraction volume, V_{cap}, in proposed Pasco Zone B Cap.

V_{cap} = Cap Area * (0.2*S), in gallons

= 24,829 ft^2 * (0.2*15.64) inches $\Rightarrow$ 24,829 ft^2 * 3.13 inches $\Rightarrow$ 24,829 ft^2 * 0.26 ft

= 6455.54 ft^3 6455.54

= 48,287 gallons 48287

CONCLUSION: The estimated initial abstraction volume of the Pasco Zone B Cap is approximately 48,300 gallons. In the event of a 2-Year, 24-Hour storm event or a 25-Year, 24-Hour storm event, the estimated runoff volumes are 8,017 gallons and 4,875 gallons, respectively. Therefore, the stormwater management measures identified in the Final Pasco Zone B Remedial Action Work Plan for the Zone B Cap are efficient.

References

(1) Natural Resources and Environmental Science - web soil survey.

(2) Zone B Cap is 0.57 acres, or 24,829 ft^2.