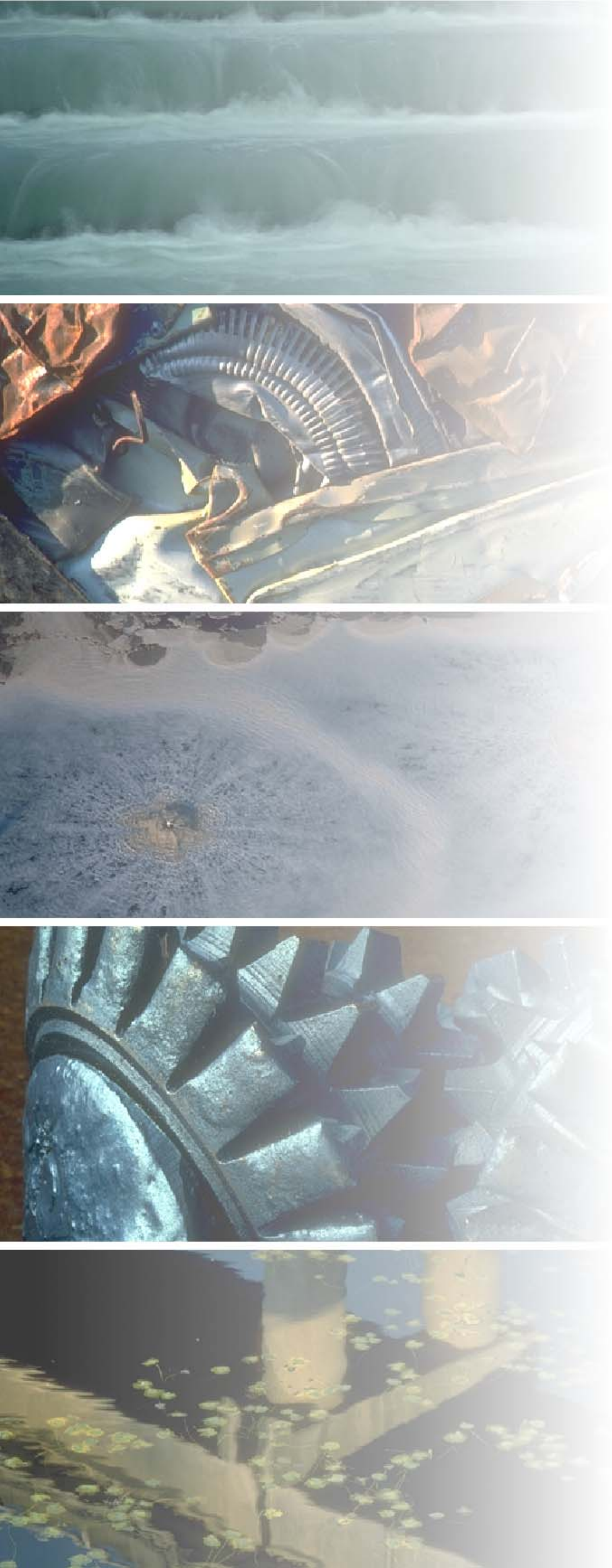

Basis of Design Report
Santosh Landfill
Scappoose, Oregon

Prepared for
Oregon Department of Environmental Quality

December 14, 2007
15563-01/Task 3

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SANTOSH LANDFILL
SCAPPOOSE, OREGON

1.0 INTRODUCTION

This report presents the Basis of Design for interim remedial actions at the Santosh Landfill near Scappoose, Oregon. The Santosh Landfill was a privately owned landfill, operated from the early 1970s until the early 1980s. During operation, the landfill was the primary municipal landfill for Columbia County, accepting both municipal and industrial wastes. This Basis of Design Report (BDR) has been prepared for the Oregon Department of Environmental Quality (DEQ) under Task Order No. 73-03-53.

1.1 Purpose and Scope of Work

The purpose of this BDR is to present preliminary design assumptions, criteria, and requirements upon which a low-permeable landfill cap will be designed. This BDR represents an approximate 30 percent design effort and is based on EPA guidance (EPA, 1995), the results of data analyses, and preliminary input from DEQ. This BDR includes the following components:

- Project site setting, conditions, history, site investigation summary, and potential site risks (Section 2.0)
- Interim remedial action objectives and description (Sections 3.1 an 3.2)
- Design objectives and criteria (Sections 3.3 and 3.4)
- Key design components (Section 3.5)
- Capping Alternatives and Evaluation (Section 3.6)
- Sources of Fill Materials (Section 3.7)
- Design elements (Section 4.0)
- Regulatory and permitting requirements (Section 5.0)
- Preliminary construction schedule (Section 6.0)
- Preliminary cost estimate (Section 7.0)

These components are discussed in further detail in the sections that follow. This BDR was based on previous design work completed for the project as described in Section 1.2. Supporting information for this BDR can be found in the previous design documents referenced in Section 8.0.

1.2 Previous Design Work

Previous design work completed for the project included the preparation of a BDR for a soil cap and seep mitigation work in February 2007 (Hart Crowser, 2007a). Hydrologic modeling using the Hydrologic Evaluation of Landfill Performance (HELP) model was performed during this design effort to evaluate the effectiveness of various soil cap profiles on infiltration reduction (USACE, 1997). The results of the modeling indicated that a soil cap would not achieve the design objectives of significantly reducing infiltration into the landfill and that a low-permeable layer with a target minimum permeability of 1×10^{-6} centimeters per second (cm/sec) would be required to achieve the design objectives. DEQ concurred that a low-permeable cap would be designed and constructed for the landfill.

It was determined that the design and construction of a low-permeable cap would need to be performed in two phases to allow sufficient time and funding to complete the work. Phase 1 was to include the site clearing and grubbing, initial landfill grading, haul road and soil staging area construction, and seep mitigation work and was anticipated for the 2007 construction season. Phase 2 was to include the construction of the low-permeable cap with site drainage and gas venting, and was anticipated for the 2008 construction season. A Final Design Report for Phase 1 work was prepared and submitted in May 2007 (Hart Crowser, 2007b). Bid solicitation for the Phase 1 work was conducted in June 2007, however, the bids received were significantly higher than the available funding. DEQ decided to complete only the seep mitigation work during the fall of 2007 and incorporate the remaining Phase 1 work (i.e. site clearing and grubbing, initial landfill grading, haul road and soil staging area construction) into the Phase 2 work for 2008. Hence, this BDR combines the previously completed Phase 1 landfill cap design work with the Phase 2 design.

1.3 Design Submittals

In addition to this BDR, the design process for the low-permeable landfill cap will include the preparation of the following submittals:

- Prefinal Design Report (90 percent), which will include an updated BDR that incorporates DEQ's input and comments on the BDR. The Prefinal Design will also include all drawings and specifications (CSI

MasterFormat, 2004 Edition) necessary to complete the project (draft bid documents), a draft Construction Quality Assurance Plan (CQAP), for the cap, an updated construction schedule, and revised construction cost estimate. A final determination of regulatory and permitting requirements will be provided.

- Final Design Report (100 percent), which incorporates revisions to the Prefinal Design Report based on DEQ review. The Final Design Report will include the final BDR, final drawings and specifications, final CQAP, final construction schedule, and final construction cost estimate.

1.4 Limitations

Work performed by Hart Crowser for this project and the preparation of this report was conducted in accordance with generally accepted professional practices in the same or similar localities, related to the nature of the work accomplished at the time our services were performed. This report is for specific application to the referenced project and for the exclusive use of DEQ. No other warranty, express or implied, is made.

2.0 BACKGROUND

The following sections present the site setting, surrounding area information, site use history, a description of the current site conditions and observations, and a summary of the recent site investigation results and potential risks.

2.1 Site Setting and Surrounding Area

The Santosh Landfill is located approximately 1 mile north-northeast of the City of Scappoose, Oregon (Figure 1). The site is located at the intersection of Sections 29, 30, 31 and 32 of Township 4 North, Range 1 West Willamette Meridian. The southern end of the landfill is approximately 1,500 to 2,000 feet north-northeast of the intersection of East Honeyman Road and Hogan Ranch Road along the western boundary of Hogan Ranch Road.

The site is bounded to the north and west by undeveloped lowlands, to the south by Scappoose Creek, and to the east by Hogan Ranch Road (Figure 2). Scappoose Creek meanders north from south of the site along the western edge of the lowlands area located immediately west of the landfill. The southernmost reach of the Santosh Slough Barge Canal is located east of the northeast quadrant of the site, east of Hogan Ranch Road, and a gravel quarry pond, which is part of the Glacier Northwest gravel quarry operations, is located to the southeast of the site. Currently, the site is part of a larger hunting preserve.

However, access to the site is restricted by the presence of wetlands to the north and west of the landfill and dense blackberry briars along the majority of the landfill berm.

2.2 Site Use History

Prior to the 1970s, the site consisted of undeveloped lowlands. Operation of the landfill began in the early 1970s and continued until September 1983. The site was the primary municipal landfill for Columbia County during that time. Both municipal and industrial wastes were disposed at the landfill.

The landfill was constructed of unlined, berm-like cells. The berms were intended to contain the solid waste and leachate, and prevent the infiltration of floodwaters from Scappoose Creek into the landfill. The berms were reportedly constructed of byproducts generated from the gravel mining operation located southeast of the site. Landfill operations ceased in 1983 and the operator covered/capped the landfill at that time. The DEQ later determined that the landfill construction was not capable of containing the leachate. Leachate seeps have historically been observed along the landfill perimeter, and in October 2007, the leachate seeps along the southern landfill perimeter were repaired by constructing an impermeable cap over the seep areas.

Wastes known to have been disposed at the landfill include industrial wastes, household and commercial garbage, emptied pesticide containers, street sweepings, waste tires, construction debris, wood wastes, sewage treatment plant grits and screenings, drilling muds from exploratory petroleum borings, waste oil and waste oil containing debris, urea-formaldehyde, solidified boric acid solution, acrylic latex solutions, and polyurethane diisocyanate. Additional wastes that may have been disposed at the facility include creosote, clarifier sludge from a paper pulp mill-processing facility, and dredge solids from a waste treatment pond at a fiberboard manufacturing plant.

Based on the known and suspect wastes that were disposed of at the landfill, chemicals of potential concern include, but are not limited to, the following: metals, petroleum hydrocarbons, bituminous tars, polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) including penta- and tetrachlorophenols, pesticides and herbicides, asbestos, polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins and dibenzofurans, cyanide, methane, and hydrogen sulfide.

2.3 Site Description and Existing Conditions

The landfill encompasses an area of approximately 18 acres, including the berms, while the area inside the berms is 15 acres. The landfill refuse is approximately 25 feet thick. The landfill was capped upon cessation of operation in the early 1980s. Much of the landfill and perimeter berms are covered with dense vegetation consisting primarily of blackberry briars.

Landfill Cover. Test pits were completed by Hart Crowser in December 2006 to determine the thickness and characteristics of the existing cover material. Test pits were completed at 30 locations within the landfill to depths of four feet. Results of this investigation were presented in Appendix A of the February 2007, Basis of Design Report (Hart Crowser, 2007a). The thickness of the cover material varied by location, and ranged from 8 inches to over 48 inches. Generally, the cover was thicker in the southern and central portions of the landfill. A clay layer was encountered in discrete areas along the west and northern ends of the landfill. The cover materials were predominantly gravely, silty sands.

Landfill Surface Water Ponding. The capped surface of the landfill is generally mounded with a convex surface. However, there are depressions throughout the surface of the landfill where stormwater tends to pond. The ponding water appears to be more prevalent in the central and southern portions of the landfill. The presence of the ponding water is generally coincident with the rainy season.

Based on the coincident seasonal variability and proximity of the ponded water to the leachate seeps, the leachate seeps and the ponded water may be hydraulically connected. It is therefore hypothesized that, if the ponded water atop the landfill (assumed water source for the seep) is eliminated; the seeps may cease to exist.

Three seeps along the southern landfill berm were repaired during October 2007. Additional minor seeps were observed during the seep repairs at the time of the vegetation removal. This suggests that additional unidentified seeps along the western and northern berms may exist beneath the thick vegetation.

2.4 Anticipated Future Land Use

The site is expected to remain zoned as industrial. Future uses of the site that involve building or other intrusive activities are not anticipated. Since the site is located within the hunting preserve and surrounded to the north and west by undeveloped lowlands and wetlands, and to the south by Scappoose Creek, future use of the site as a managed natural area is a possibility.

2.5 Site Investigation Summary and Risk Screening

Several site investigations have been performed since 1993 to assess environmental conditions at and in the vicinity of the Santosh landfill. The most recent investigation was performed in 2005 to evaluate groundwater, soils, landfill gases, surface water, and sediments at and adjacent the landfill (Hart Crowser, 2005). The analytical results of this investigation were compared to relevant regulatory screening levels, including the EPA preliminary remediation goals (PRGs) for residential and industrial exposures, and the DEQ Level II screening level values (SLVs) for ecological receptors, to determine the potential for risk to human health and the environment. Where available, concentrations were also compared to local background levels supplied by the DEQ.

Groundwater Samples. Groundwater samples were collected from 10 monitoring wells throughout the landfill and the surrounding area. Multiple SVOCs, VOCs, metals, pesticides, dioxins/furans, and other constituents exceeded their respective tap water PRGs and/or the freshwater SLVs for aquatic animals.

Subsurface Soils. Subsurface soils samples were collected at a minimum depth of 10 feet below ground surface (bgs) during well explorations. The concentrations of three SVOCs exceeded their respective residential soil PRGs, industrial soil PRGs, and soil SLVs for mammals. Thirteen metals exceeded their respective residential soil PRGs, industrial soil PRGs, and the soil SLVs for plants, invertebrates, birds, and mammals. The concentration of 4,4'-dichlorodiphenyltrichloroethane (DDT) exceeded the soil SLV for mammals. Based on a minimum collection depth of 10 feet bgs, the exposure pathway would be limited to leaching to groundwater.

Native Surface Soils. Native surface soils samples were collected along the toe of the north, west, and east berms to a depth of 6 inches bgs. Several metal concentrations (arsenic, barium, chromium, iron, lead, manganese, mercury, titanium, vanadium and zinc) exceeded their respective residential soil PRGs, industrial soil PRGs, and soil SLVs for plants, invertebrates, birds, and mammals.

Surface Water. Surface water samples were collected from Scappoose Creek, Santosh Slough Barge Canal, and from standing water at the toe of the north and west berms. Concentrations of metals (arsenic, barium, iron, manganese, and vanadium) in all sample locations exceeded their respective tap water PRGs and the freshwater SLV for aquatic animals. The concentrations of weak acid dissociable cyanide and ammonia also exceeded their respective freshwater water SLVs for aquatic animals in all sample locations.

Sediments. Sediment samples were collected from Scappoose Creek and the Santosh Slough Barge Canal. SVOCs, pesticides, dioxins and furans, and cyanide were detected at concentrations below applicable regulatory levels for all sample locations. Metals (arsenic, cadmium, copper, zinc) were detected in several samples at concentrations that exceeded their respective sediment bioaccumulation SLVs and sediment freshwater SLVs. However, the concentrations of these metals in upstream sediment sample were as high or higher than the other samples collected from Scappoose Creek.

2.6 Potential Site Risks

As previously described, the thickness of the existing soil cover varies, with some areas of the landfill consisting of 8 inches of cover or less. There is a potential for exposure to the wastes by human and ecological receptors. In addition, it is likely that not all leachate seeps have been identified or repaired, and potential for exposure to these leachate seeps exists by the following pathways: (1) direct contact with humans, livestock, and wildlife; (2) ingestion by livestock and wildlife; and (3) surface migration of leachate to adjacent water bodies, such as Scappoose Creek. To address these potential risks to human health and the environment, DEQ has proposed to implement interim remedial actions.

3.0 DESIGN ASSUMPTIONS AND CRITERIA

This section presents the objectives and description of the interim remedial actions. The design objectives, criteria and key design components for the landfill cap. A description and evaluation of the capping alternatives under consideration are also provided. Potential sources of fill material are also identified and described.

3.1 Interim Remedial Action Objectives

The overall objective of this interim remedial action is to reduce the potential risks to human health and the environment associated with the landfill. Specific remedial action objectives for this interim action include:

- Prevent migration of leachate from the landfill;
- Reduce or eliminate human exposure through direct contact with landfill wastes and direct contact with leachate seeps; and
- Reduce or eliminate exposures to ecological receptors from wastes in the landfill and the leachate seeps.

3.2 Description of Interim Remedial Action

The major components of the interim remedial actions for the Santosh Landfill include capping of the landfill surface with a low-permeable cap. Prior to constructing the cap, the landfill surface will be cleared of vegetation and an access road will be constructed to allow for equipment and materials to be brought to the site. The existing surface of the landfill will then be graded by cutting and filling to desired elevations to promote drainage and provide a sub-base or foundation for the low-permeable and top soil layers of the cap. Due to concerns with potentially exposing the buried wastes in the landfill, site grading will be conducted such that the overall amount of material cut is minimized. A suitable fill material will be imported, placed, and compacted to complete the foundation layer. The low-permeable layer selected will be placed on the foundation layer, covered with a clean soil meeting the design criteria, and seeded with native plant species. Areas with steeper slopes will be covered with an erosion control blanket or mat.

3.3 Design Objectives

The design objectives for the landfill cap include the following:

- Provide a protective, reliable, and cost-effective barrier to underlying wastes;
- Reduce ponding of water on the landfill surface by improving surface drainage;
- Reduce or eliminate the infiltration of precipitation into the landfill to minimize leachate generation while allowing the release of landfill gases;
- Minimize disturbance to existing cover material and underlying wastes;
- Minimize the amount of soil to be imported; and
- Utilize available soils from identified, low-cost sources to the extent possible.

3.4 Design Criteria

In order to meet the design objectives listed above, preliminary design criteria were developed for the cap. These design criteria are consistent with other similar landfill and capping projects and are described below.

- The sub-base or foundation layer will provide a stable base for the overlying cap material and top soil layer, and to minimize subsidence and drainage problems.

- The foundation layer will consist of granular soils with a soil permeability between 1×10^{-4} to 1×10^{-3} cm/sec.

- The desired thickness of the foundation layer is a minimum of 12 inches.

- The low-permeable layer of the landfill cap material will have a permeability of less than 1×10^{-6} cm/sec.

- The desired thickness of the top soil layer is a minimum of 18 inches and will be suitable for establishing and supporting native vegetation.

3.5 Key Design Components

The key design components for the cap include preparation of the existing landfill surface by grading, construction of the foundation layer, installation of a low-permeable layer (cap), a top soil cover layer, and establishment of a vegetative cover. Other key components include the stormwater management and gas venting systems. Specific requirements for surface drainage will be developed as the design progresses and will be based on the final cap profile, surface areas, and slopes selected.

As described below in Section 3.6, various capping options were considered for this project. The differences between the various cap options are associated with the material type for the low-permeable layer. Site grading, foundation layer, top soil cover layer, stormwater management, gas venting, and the vegetative cover are common components to all of the cap options.

3.5.1 Site Grading

The existing surface of the landfill will be graded by cutting and filling to desired elevations to promote drainage and provide a foundation for subsequent layers of the soil cap. Site grading will be conducted such that the overall amount of material cut is minimized to reduce the potential for exposing the buried wastes in the landfill.

Based on the current elevation grade lines within the landfill and desired final grades, an AutoCAD program was used to determine an optimal cut and fill material volume balance. The volume of the cut material was calculated to be 3,284 cubic yards (cy). The volume of the fill material was calculated to be

23,915 cy. The net volume of soil needed, which would be imported, is 20,630 cy. Drawings showing the final grade lines and cross section grid, and the various profiles of cut and fill for each cross section are provided in Appendix C of the May 2007, Final Design Report for Phase 1, (Hart Crowser, 2007b).

The average thickness of the 23,915 cy of fill material spread out over the landfill would be approximately 12 inches. The actual thickness of the fill material will vary by location and range from 0 to 4 feet.

3.5.2 Foundation Layer

The foundation layer will consist of a granular fill material to provide a stable sub-base layer for the overlying cap material. The foundation will be designed and constructed to meet the design objectives and criteria specified in Sections 3.3 and 3.4. Sources of material for the foundation layer are currently being identified and evaluated, and are further described in Section 3.7.

The minimum volume required is 23,915 cy (of which 20,630 cy is imported) based on the site grading cut/fill balance described in Section 3.5.1 and would provide an average thickness of 12 inches. A continuous 18-inch foundation layer across the site would require approximately 36,600 cy of material and provide for added stability for the overlying cap layers. For cost estimating purposes (Section 7.0), an average thickness of 12 inches was assumed for the foundation layer.

3.5.3 Low-Permeable Layer

The low-permeable layer will be designed and constructed to meet the design objectives and criteria specified in Sections 3.3 and 3.4. Based on the previous HELP modeling conducted for the site, a layer with a permeability of less than 1×10^{-6} cm/sec would be needed to achieve the design criteria (Hart Crowser, 2007b). The HELP model showed that a clay layer with a minimum thickness of 24 inches, would meet the low-permeability requirements. Other options for the low-permeable layer include the use of geomembranes, such as high-density polyethylene (HDPE) or poly-vinyl chloride (PVC), or geosynthetic clay liner (GCL), and are further described in Section 3.6.2.

3.5.4 Top Soil Cover Material

The top soil layer will consist of a material capable of supporting vegetation, and will be designed and constructed to meet the design objectives and criteria specified in Sections 3.3 and 3.4. Sources of material for the top soil layer are currently being identified and evaluated, and are further described in Section 3.7.

Similar to the foundation layer, the soil volumes required for the top soil layer will vary depending upon the capping option selected for the landfill. A minimum continuous 18-inch layer across the site is recommended for the HDPE, PVC, and GCL capping options, and would require approximately 36,300 cy of material. A minimum continuous top soil layer of 24 inches is recommended for the compacted clay capping option to minimize desiccation or other damage to the clay layer. The 24-inch top soil layer would require approximately 48,400 cy of material or an additional 12,000 cy of material more than the other capping options.

3.5.5 Vegetative Surface

To stabilize the top soil layer from erosion and accommodate future use of the site as a natural area, native grasses, wildflowers, and shrubs species will be seeded or planted. A specific vegetation plan will be provided as part of the Prefinal Design. In addition, steeper slopes (i.e. greater than 2 horizontal to 1 vertical) may require the use of an erosional control matting or blanket to prevent excessive erosion. Specific requirements for the erosion control measures on the steeper slopes will be determined as part of the final design.

3.5.6 Site Drainage

Stormwater management will be necessary to reduce the potential for erosion of the top soil layer (exposing the cap material) and unintentional ponding of stormwater on the landfill surface. The extent to which stormwater needs to be managed will depend upon the cap profile and slopes. Stormwater management features may include the use of bioswales, subsurface drains, or culverts. Specific requirements and components of the stormwater management system for the cap will be identified and described in the Prefinal Design documents. It is anticipated that the design for the stormwater management system will be based on the 25-year, 24-hour storm event for Columbia County.

3.5.7 Gas Collection and Venting

Based on gas monitoring conducted to date, gas venting will be required to minimize pressure that may build up beneath the impervious cap material. The extent to which gas collection needs to be managed will depend upon the final selected cap profile and slopes. Gas venting management features may include the use of a passive, subsurface gas collection system with vertical vents. The vertical vents may include a passive carbon treatment system. Specific requirements and components of the gas collection and venting system for the cap will be identified and described in the Prefinal Design documents.

3.6 Capping Alternatives and Evaluation

Several soil capping alternatives were evaluated using the HELP model during previous design efforts to evaluate the effectiveness of the various soil cap profiles on infiltration reduction (Hart Crowser, 2007a and 2007b). This evaluation is summarized in Section 3.6.1. The results of the HELP model indicated that a soil cap would not achieve the design objectives of significantly reducing infiltration into the landfill and that a low-permeable layer with a target minimum permeability of 1 x 10^{-6} cm/sec would be required to achieve the design objectives. As such, capping options using compacted clay, HDPE, PVC, and GCL are described and evaluated in Section 3.6.2.

3.6.1 Evaluation of Soil Cap Profiles

Initially, six soil cap profiles were evaluated using the HELP model. The cap profiles varied with respect to the thickness of the foundation layer (12 to 18 inches) and top soil layer (18 to 24 inches), and none of the profiles included a low-permeable layer. The HELP model results indicated that the current soil cover on the landfill allows for 47 to 49 percent of precipitation percolating into the landfill wastes. The other soil cap profiles evaluated resulted in reducing percolation to between 42 and 43 percent. Results of this evaluation are provided in Appendix E of the February 2007, Basis of Design Report. (Hart Crower, 2007a). It was concluded that the soil cap alternatives, without a low-permeable layer, would not substantially reduce percolation into the landfill compared to baseline conditions.

Six additional cap profiles were evaluated using the HELP during the final design. These cap profiles included a low-permeable, 24-inch clay layer, with various thicknesses of the foundation layer (12 to 18 inches) and various soils types for the 12-inch top soil layer. The results of this evaluation are provided in Appendix A of the May 2007, Final Design Report (Hart Crowser, 2007b). It was concluded from this evaluation that a low-permeable layer, with a permeability of 1 x 10^{-6} cm/sec or less, would decrease the volume of water percolating through the landfill by about 50 percent compared to baseline conditions.

3.6.2 Low-Permeable Layer Options

Options for the low-permeable layer include the use of compacted clay, HDPE, PVC, and GCL. These materials, if properly installed, could all meet the design criteria for permeability of less than 1 x10^{-6} cm/sec. Cost estimates for each of these options were developed for evaluation purposes and are provided in Table 1. The costs estimates included common tasks for all of the options, such as mobilization and demobilization, site clearing and grubbing, site grading, a 12-inch foundation layer, construction of the temporary haul road and soil staging area, gas venting, site drainage, placement of a 18-inch top soil layer, and hydroseeding and erosion control. For each option, the cost estimates included materials and installation, and assumed a production rate for installation based on discussions with vendors. Option 1 includes a 24-inch compacted clay layer with a 24-inch top soil layer. Option 2 includes a 60 mil HDPE material. Option 3 includes a 30 mil PVC material. Option 4 includes the use of a GCL material, similar to that installed for the seep repair work.

The cost estimates show that Option 4 with the GCL was the least costly of the four options at a total cost of $2,825,282. The final determination of the low-permeable material to be used in the final design will be based on input from DEQ.

3.7 Sources of Fill Materials

Several sources of materials for use in the cap construction are currently being considered for both the foundation layer and top soil layer, and are described below.

3.7.1 Foundation Layer

Morse Brothers/Angel Quarry, Northwest Portland. Available source material from the Angel Quarry consists of the spoils or fines generated from the gravel screening/washing process. The gradation of the spoils varies considerably depending upon the grain size of the original source material, but can be coarse material with up to approximately 50 percent rock chip waste. Grain size analyses were performed on four samples of this material and the results are provided in Appendix E of the February 2007, Basis of Design Report (Hart Crowser, 2007a).

Approximately 100,000 tons (80,000 cy) of this material were available during the 2007 construction season and is likely that similar quantities will be available for the 2008 construction season. Based on the average bids ($7.15 per ton material loading and transport to the site) received from contractors during the bid procurement process in June 2007, the estimated cost will be approximately $8.00 per ton during the 2008 construction season.

3.7.2 Clay Layer

A potential source of clay material is the Miles Sand and Gravel Company quarry near Tacoma, Washington. This facility has indicated that sufficient quantities of clay material are available and that it would meet the 1×10^{-6} cm/sec permeability requirement. Cost estimates provided by the facility varied depending upon the transportation method, and ranged from $18 per cy for barging to $27 per cy for trucking. Material testing results, including grain size, compaction, and permeability, have been requested from the facility.

3.7.3 Top Soil Layer

Morse Brothers/Riverview Quarry/St. Helens. Overburden material may become available this summer from the Riverview quarry. The overburden soil is expected to be similar in characteristics to the overburden material that was generated from the adjacent Reichold quarry and used for construction of the soil cap at the McCormick and Baxter Superfund site in Portland. The grain size analysis from an overburden sample collected from the Reichold quarry is provided in Appendix E of the February 2007, Basis of Design Report (Hart Crowser, 2007a).

The volume of overburden that may be available ranges between 20,000 and 100,000 cy. Based on bids received from contractors during the bid procurement process in June 2007, the actual cost will be approximately $8.00 per ton during the 2008 construction season.

4.0 DESIGN ELEMENTS

The major elements of the interim remedial action include site surveying, contractor mobilization, site preparation and clearing, temporary haul road and soil staging area construction, environmental controls, site grading, cap construction, vegetation seeding/planting, and site security. The Prefinal Design documents will include plans and specifications for these major elements.
The following subsections describe the approach for implementing these design elements.

4.1 Site Surveying

Prior to construction, an initial site survey will be performed to establish control points, key site features, and work limits. The initial site survey would delineate the alignment of the temporary haul road and soil staging area. A pre-construction topographic survey of the landfill is likely not required as topographic and photogrammetry surveys were recently performed in 2005. A final topographic survey would be performed after construction to establish final grade lines and drainage features of the landfill cap, verify thickness of the soil cap, and establish key topographic features of the seep mitigation area, including final berm toe and slope.

4.2 Contractor Mobilization

The interim remedial action contractor (Contractor) mobilization will include preparation and submittal of site-specific plans, setup of decontamination facilities and temporary office spaces, and delivery of materials handling equipment to the site. The site-specific plans to be prepared by the Contractor will be identified as part of the pre-final design and at a minimum, include a Contractor operations plan; health and safety plan (HSP); erosion and sediment control plan (ESCP); air quality monitoring plan; and soil cap construction plan.

4.3 Site Access and Utilities

Access to the site is by Hogan Ranch Road, which is an unpaved, gravel road used almost exclusively by the adjacent Glacier Northwest gravel quarry operations. Prior to initiating the work, DEQ will notify Columbia County, as owner of the road, and Glacier Northwest of the upcoming construction work, anticipated traffic volumes, and schedule. Coordination with Glacier Northwest regarding use of the road and traffic volumes will be an on-going task during the construction phase to ensure minimal disruptions to the Glacier Northwest operations.

Prior to initiating construction work, the Contractor will document the condition of Hogan Ranch Road from the north entrance to the site to the intersection with East Honeyman Road. During on-site work, the Contractor will maintain Hogan Ranch Road in equal condition and make provisions for traffic control as necessary, when trucks are entering or leaving the site.

There are no utilities available on the site. A possible source of water for use in dust suppression, the wheel wash, and equipment decontamination, is the adjacent Glacier Northwest facility. An agreement with Glacier Northwest would need to be obtained.

Glacier Northwest operates a truck scale and a wheel wash area on Hogan Ranch Road near the intersection with East. Honeyman Road. At this time it is not anticipated that the truck scale will be needed as no materials, with the possible exception of cleared vegetation, will be removed and hauled from the site. A temporary wheel wash will be installed on the north end of the site to clean trucks prior to entering Hogan Ranch Road. The Glacier Northwest wheel wash could be used as a secondary measure if needed. An agreement with Glacier Northwest for use of the wheel wash would also need to be obtained.

4.4 Site Preparation and Clearing

Site preparation activities will include identifying work and non-work areas, gas probe abandonment, monitoring well preservation, and clearing vegetation. The activities are described below.

Work Area Delineation. Based upon the initial site survey (Section 4.1), the work areas will be clearly delineated.

Gas Probe Abandonment. Twenty gas probes were installed on the landfill in 2005 to monitor methane gas. The gas probes were constructed of 5-foot lengths of 1-inch PVC pipe. These gas probes will be abandoned prior to site clearing and grading.

Monitoring Well Preservation/Modifications. Existing monitoring wells located within the landfill berms will be clearly marked and protected during construction activities. For those wells in areas where the grade will be raised, the well casings may require extensions.

Vegetation Clearing. Vegetation will be cleared within the alignment of the temporary construction access road, on the surface of the landfill, and the interior slopes of the perimeter berms. Vegetation removal on the exterior slopes of the landfill berms will be minimized and only occur when necessary for constructing anchor trenches for geomembranes or GCL, and for drainage piping. A backhoe or excavator with a brush-cutting attachment will likely be used for those areas that are easily accessed.

4.5 Temporary Construction Road, Gates, and Soil Staging Area

A temporary construction haul road will be constructed on the landfill to provide a means for equipment and materials access to the work areas. The alignment of the temporary haul road and cross-section details are provided in Drawings F-1 and F-2 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b). The temporary haul road is 12 feet wide and constructed of 18-inch thick, compacted 1.5-inch minus size gravel. Due to the expected heavy volume of construction equipment and truck usage of the haul road, it is anticipated that the haul road will require periodic maintenance during the construction phase. Maintenance will consist of adding and compacting additional gravel as necessary. Upon construction completion, the temporary haul road will be upgraded to a permanent site access road by grading, adding and compacting additional gravel, and side sloping to allow drainage.

The two access gates presently at the site will be replaced with wider gates to accommodate larger construction equipment and trucks. The two entrance roads to the site will be improved by increasing the width and thickness of the gravel. Details on the two entrance roads are provided on Drawing E-1 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b). The stabilized haul road entrances will comply with the Columbia County erosion control measure requirements (see Section 5.1.3).

During construction, the traffic flow on the temporary haul road will be from the south to the north. Trucks will enter the site from the south site entrance and exit through the north site entrance. A wheel wash area will be constructed near the north exist to control tracking of soils onto roadways. Details of the wheel wash area are provided on Drawing E-1 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b).

A temporary soil staging area will be constructed at the location shown on Drawing F-1 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b), to provide off-loading and stockpiling of imported materials. The temporary soil staging area, located on both sides of the temporary construction haul road, is 310 feet long and 150 feet wide, and constructed of 18-inch thick gravel. Drawing F-2 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b) provides a detail of the temporary soil staging area. It is anticipated that approximately half of the surface area of the temporary soil staging area will be used for stockpiling and the other half for material unloading. The storage capacity is estimated to provide approximately 5 days of material storage, assuming an import rate of 1,600 cy per day (80 trucks per day at 20 cy per truck) and maximum stockpile heights of 9 feet.

4.6 Environmental Controls

The Contractor will use engineering measures for control of dust, stormwater, erosion, and equipment decontamination as necessary during all construction activities. The requirements for each of these measures are described below.

Dust Control. Dust controls will be designed to suppress visible dust above limits specified in the Contractor's HSP and Air Quality Monitoring Plan. The Contractor will be responsible for applying a suppressing agent (clean water or other approved agent) on all work and transportation surfaces, and stockpiles in accordance with a preventative schedule contained in the Contractor's

Operations Plan. The Contractor may be required to perform fugitive dust monitoring if visible dust is observed during performance of the work.

Stormwater Management/Erosion Control. The Contractor's ESCP, prepared in accordance with the Oregon Storm Water Construction General Permit, 1220-C (See Section 5.1.2), will identify and describe best management practices (BMPs) to be implemented during construction for stormwater management, erosion control, and work area stabilization. The ESCP will also incorporate applicable Columbia County erosion control measure requirements (see Section 5.1.3).

Stormwater BMPs may include, but are not limited to:

- Scheduling, including performing work in sensitive areas during dry periods (July 1 through September 1) to reduce the potential for runoff. This requirement is particularly applicable to the seep mitigation work;

- Runoff controls, including temporary berms and ditches to direct stormwater run-on away from active work areas and to prevent stormwater runoff from the work areas from leaving the site;

- Erosion prevention methods, including protection of existing vegetation on the berms to minimize impact, use of erosion control barriers, phasing of construction to avoid leaving exposed inactive areas prior to backfilling with granular material, covering stockpiled soils to minimize contact between rainfall and the soils, and maintaining temporary erosion control measures until vegetative cover is established;

- Peripheral erosion and sediment controls, including silt fences around the base of the landfill perimeter berms, around the seep mitigation work area, and at storm drain inlets (if any) to prevent sediment from leaving the site; and

- Sediment tracking reduction measures, including gravel surfaces at each exit from the construction site and wheel washes to prevent tracking of soils onto roadways (See Section 4.5).

Equipment Decontamination. A temporary decontamination pad may be constructed at the site for cleaning earth moving equipment prior to leaving the site.

4.7 Cap Construction

The Contractor will be responsible for all components of the cap construction including site grading, material handling, soil placement, spreading, and compaction, installation of the low-permeable layer, and vegetation seeding and planting. Site grading will be performed in accordance with the grade lines shown on the Drawings B-1 through B-10 in Appendix C of the May 2007, Final Design Report (Hart Crowser, 2007b). The Contractor's site-specific plans will describe methods for grading, material handling, stockpiling, soil placement and compaction, low-permeable layer installation, vegetation seeding and planting, and installation of an erosion control blanket or mat.

4.8 Demobilization and Site Restoration

Site restoration will include the removal of all of the Contractor's temporary facilities and rubbish. The Contractor will ensure that Hogan Ranch Road is in equal condition to that documented prior to initiating site activities, and will perform repairs, if necessary. The temporary fencing, wheel wash, and decontamination pads and wastewater will be removed from the site. Silt fencing will also be removed after erosion control measures have been implemented and vegetative covers have been established where specified.

4.9 Site Security/Perimeter Fencing

Fencing was previously installed along the eastern perimeter of the landfill (adjacent to Hogan Ranch Road) to deter unauthorized personnel from entering the site. Upon completion of construction activities, the fencing will be restored by the Contractor to its original condition. The new gates that were installed as part of the site construction haul road will remain after construction and will be lockable to limit site access by only authorized personnel. The fencing that limited access to the seep areas on the southern berm will also be restored.

5.0 REGULATORY AND PERMITTING REQUIREMENTS

Regulatory and permitting requirements for the interim remedial actions have been preliminarily identified and include federal, state, and local requirements. Section 5.1 identifies the applicable requirements for actions that involve construction and ground disturbing activities. Section 5.2 identifies applicable permitting requirements for post-construction operations.

Because the construction work will occur on the landfill surface within the bermed area, it is not anticipated that the surrounding wetlands will be impacted. Therefore, the regulatory and permitting requirements for work in wetlands are not expected to be applicable.

5.1 Construction/Ground Disturbing Action Requirements

Applicable federal, state, and local requirements for construction or ground disturbing activities are described below. Recommendations for satisfying the regulatory and permitting requirements are also provided.

5.1.1 National Historic Preservation Act

The National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of federal projects on any historic properties listed on, or eligible for inclusion on, the National Register of Historic Places, and to avoid, minimize, or mitigate any adverse effects on such properties (16 United States Code 470). Because the Santosh Landfill is not a federal project, the NHPA requirements are not directly applicable; however, they may be applicable to off-site properties where fill soils are obtained. Compliance with the NHPA requirements may be addressed through a cultural resource survey prior to any ground disturbing activities and through archeological monitoring during the ground disturbing activities. Once the source(s) of the fill soils are identified, a final determination of the applicability of the NHPA requirements will be made. If applicable to the project, a plan for satisfying the requirements will be completed as part of the final design.

5.1.2 Clean Water Act/Storm Water Permit

DEQ administers the federal National Pollution Discharge Elimination System (NPDES) water quality program for the State of Oregon. Under this program, an NPDES #1200-C storm water general permit would be required for project construction activities that disturb one or more acres. Additionally, an Erosion and Sediment Control Plan (ESCP), incorporating best management practices into their construction work, is required to be submitted with the NPDES #1200-C permit application. These requirements apply to the interim remedial action at the Santosh Landfill as the soil cap construction will disturb approximately 18 acres.

The construction contractor will be required to obtain the NPDES permit and prepare the ESCP.

5.1.3 Columbia County Grade and Fill Permit

Columbia County, Land Development Services, requires a grade and fill permit for construction activities. If the grading permit involves disturbing more than 2,000 square feet, additional provisions for stormwater and erosion control apply. The additional erosion control measures include (1) a gravel construction entrance; (2) installation of sediment fences at the base of the disturbed area where slopes exceed 5 percent; (3) covering of stockpiles with plastic sheeting or straw mulch during the wet weather season (October 1 through April 30); and (4) re-establishment of ground cover prior to removing the erosion control measures.

The construction contractor will be required to obtain the grade and fill permit and prepare any applicable stormwater and erosion control plans. The requirements pertaining to the erosion control measures will be implemented during construction activities.

5.2 Post-Construction Requirements

Depending upon final design of the stormwater management system for the landfill soil cap, stormwater from the site may or may not be directly discharged into a surface water body. If stormwater leaves the site and is discharged into a surface water body, then an NPDES storm water discharge permit may be required. A specific determination on the need and requirements for this permit will be made as part of the final design.

6.0 PRELIMINARY CONSTRUCTION SCHEDULE

The construction of the landfill cap is anticipated to occur during the spring and summer months of 2008. For the compacted clay cap, over 117,430 cy of material will need to be imported for the foundation, clay, and top soil layers. Based on typical earth moving production rates, an estimated construction duration between 100 to 120 days is anticipated. For the HDPE cap, an estimated duration of approximately 60 days is anticipated. For the PVC cap, an estimated duration of approximately 55 days is required. Finally, for the GCL cap, an estimated duration of 65 days is anticipated. A more-detailed construction schedule will be developed as the source of capping materials and final cap option are determined, and submitted as part of the Prefinal Design document.

7.0 PRELIMINARY COST ESTIMATE

Based on recent contractor bids received for construction work and vendor quotes, cost estimates for the various capping alternatives were developed and are provided in Table 1. The cost estimate for the 24-inch compacted clay cap option is $3,816,010. The HDPE cap option was estimated to cost $3,006,835. The PVC cap option was estimated to cost $2,853,312. The GCL cap option was estimated to cost $2,825,282.

8.0 REFERENCES

Hart Crowser, 2005. *Focused Site Investigation Report, Santosh Landfill, Scappoose, Oregon*. July 15, 2005.

Hart Crowser, 2007a. *Basis of Design Report, Santosh Landfill, Scappoose, Oregon*. February 14, 2007.

Hart Crowser, 2007ba. *Final Design Report, Santosh Landfill Cap and Seep Mitigation, Phase 1, Scappoose, Oregon*. May 21, 2007.

U.S. Army Corps of Engineers (USACE), 1997. Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07, November 1, 1997. Developed by the USACE Environmental Laboratory, Waterways Experiment Station.

U.S. Environmental Protection Agency, 1995. *Remedial Design/Remedial Action Handbook*, EPA 540/R-95/059, June 1995.