Feasibility Study

DSL Stevens Road Property
Bend, Oregon

for
Oregon Department of Environmental Quality

June 14, 2010

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DSL Stevens Road Property
Bend, Oregon

File No. 2787-052-00

June 14, 2010

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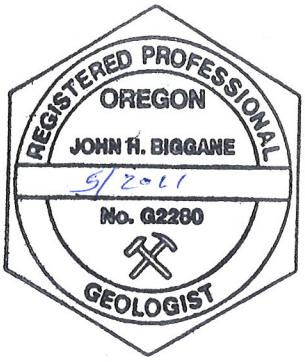

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ACRONYMS AND ABBREVIATIONS

ACM - asbestos containing material

bgs - below ground surface

CMMP - contaminated media management plan

COCs - contaminants of concern

DEQ - Oregon Department of Environmental Quality

DSL - Oregon Department of State Lands

ECSI - Environmental Cleanup Site Identification

EPA – U.S. Environmental Protection Agency

FS - Feasibility Study

ISA - Initial Site Assessment

LOF - locality of facility

OAR - Oregon Administrative Rule

PAHs - polynuclear aromatic hydrocarbons

PCBs – polychlorinated biphenyls

RAA - remedial action area

RAOs – remedial action objectives

RBCs - risk-based concentrations

VOCs - volatile organic compounds

EXECUTIVE SUMMARY

This Feasibility Study was conducted on behalf of Oregon Department of State Lands (DSL) through Oregon Department of Environmental Quality's Task Order Process to assess remedial action alternatives for the Stevens Road Tract in Bend, Oregon (Figure 1). A portion of the Tract consists of the former Arnold Landfill site. DSL obtained the property in 1997 and intends to facilitate development of the parcel as an asset to the Oregon Common School Fund.

The former landfill consists of approximately 35 acres as shown in Figure 2. Landfill debris is present in approximately 18.7 acres within the former landfill boundary. Data collected during the Initial Site Assessment indicate that the detected contaminants pose a low risk to human health under current and reasonably likely future land use scenarios. Asbestos containing materials appear to present the most risk. Therefore, the primary remedial action objective for the site is removal or in-place management of ACM, which in turn accomplishes effective management of other contaminants.

Remedial alternatives were screened for effectiveness and applicability based on land use and site conditions. Applicable alternatives were further screened based on effectiveness, reliability, implementability, risk, and cost. The following remedial alternatives were considered:

- No action.
- Constructing a fence around the former landfill.
- Capping the landfill and establishing institutional controls that restrict land use.
- Complete excavation of the landfill debris with on-site disposal.
- Limited excavation of the landfill debris with off-site disposal, capping and institutional controls.
- Complete excavation of the landfill debris and off-site disposal.

Based on the comparative evaluation, capping and institutional controls are the most viable option for the former Arnold Landfill site given current and proposed future land uses. This alternative assumes that the Conceptual Master Plan can be revised to modify the location of proposed open spaces with the goal being to eliminate or minimize, to the extent practical, the excavation or disturbance of known debris areas. The estimated cost for this alternative is approximately $1.6 million. The estimated cost for the other viable alternative considered for this FS (limited excavation and disposal, capping and institutional controls) is approximately $12.8 million.

Actual future development plans will determine the remedial action that is appropriate for the site. The remedial action costs are likely to fall in the range of these two alternatives.

1.0 INTRODUCTION

This report presents the results of the Feasibility Study (FS) completed by GeoEngineers for the Oregon Department of State Lands (DSL) Stevens Road Property located in Bend, Oregon (site). The FS was conducted on behalf of DSL through DEQ's Task Order Process. This project is being funded by Oregon Department of Environmental Quality's (DEQ's) "*State Response*" Cooperative Agreement with the Environmental Protection Agency (EPA). GeoEngineers conducted the FS in general accordance with our Budget and Assumptions Proposal dated March 11, 2010. This report has been prepared for the DEQ under Task Order 58-08-25.

2.0 BACKGROUND

2.1 Site Location and Description

The Stevens Road Tract consists of an entire section of land (640 acres), legally described as Section 11 of Township 18 South and Range 12 East of the Willamette Meridian (Figure 1). The Tract is generally bound by Stevens Road to the north, Southeast 27th Street to the west, Ferguson Road to the south, and Ward Road to the east. The property is vegetated by typical high desert species including bunch grasses, sagebrush and scattered juniper and pine trees.

2.2 Use Summary

The federal government originally owned and managed the site. The U.S. Bureau of Land Management issued a land use permit to Deschutes County to operate a landfill on site from August 1956 to November 1972. DSL obtained the Tract in 1997 and intends to facilitate the development of the Tract as an asset to the Oregon Common School Fund.

The landfill area is generally referred to as the former Arnold Disposal Site (DEQ Environmental Cleanup Site Identification [ECSI] number 4295) and the former Arnold Sludge Disposal Site (DEQ ECSI number 4296). These two sites occupy approximately 40 acres of the larger 640-acre parcel and are the focus of this FS (Figure 2).

The DSL prepared a Conceptual Master Plan for site development that includes residential, low-income housing, open space parks, school and commercial uses. The Conceptual Master Plan for the area as related to the former Arnold Landfill is shown in Figure 3.

2.3 Environmental Site Assessments

GeoEngineers completed a Phase I Environmental Site Assessment of the Stevens Road Tract in 2007. Historical aerial photographs of the site allowed for preliminary mapping of the former landfill areas.

PBS Engineering + Environmental completed an Initial Site Assessment (ISA) for the site in 2009 that included a geophysical survey, subsurface exploration, analytical testing and gas vapor monitoring to characterize the nature and extent of waste. The results of the ISA indicated:

- Landfill debris is present at depths ranging from the ground surface to greater than 17 feet below the ground surface (bgs). The majority of landfill debris was generally covered by two feet of soil. The landfill material consists mainly of household and building debris with lesser amounts of automotive-related and ranching-related debris.
- Suspect asbestos containing material (ACM) was observed in approximately 50 percent of the test pits at depths as shallow as 2.5 feet bgs. The ACM includes sheet flooring, cement asbestos board, felt paper insulation, air cell insulation, thermal board liner, and roofing material.
- Petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), trace metals and polychlorinated biphenyls (PCBs) are present in soil samples collected above and below the landfill debris.
- Volatile organic compounds (VOCs) and organochlorine pesticides were not detected in soil samples collected above and below the landfill debris.
- No significant measurable accumulations of methane were detected in the gas vapor probes or at the entrances of four "caves" located within the landfill debris area.
- Evidence of the suspected sewage disposal area was not identified during the ISA activities.

2.4 Conceptual Site Model

The ISA included a conceptual site model that indicated that the most likely current and future human health exposure pathways to contaminants on site are through direct contact by ingestion, inhalation and dermal contact. Residential, occupational and recreational land uses are possible under existing and/or future land use.

2.5 Locality of the Facility

The locality of the facility (LOF) is defined by the DEQ as any point where a human or ecological receptor contacts or is reasonably likely to come into contact with site-related hazardous substances. The LOF takes into account factors such as existing site conditions, regional and local hydrogeology and the likelihood of contaminants migrating over time. The LOF was defined in the ISA as the area encompassing the known landfill debris as shown in Figures 2 and 3. It is important to note that the LOF includes areas with no known debris.

3.0 CONTAMINANT DESCRIPTION

Contaminants of concern (COCs), as mentioned above, include petroleum hydrocarbons, PAHs, trace metals, PCBs and asbestos. Of these, two PAH compounds, one PCB aroclor and one metal (arsenic) are present at concentrations greater than DEQ risk-based concentrations (RBCs) (DEQ 2009) for applicable exposure pathways at the site as described below:

- The PAH compounds benzo(a)pyrene and dibenzo(a,h)anthracene were detected at concentrations greater than applicable RBCs in one sample from TP-20 at a depth of 9 feet bgs.
- PCB aroclor 1254 was detected in one sample at a concentration greater than applicable RBCs from TP-14 at a depth of 20 feet bgs.

- Arsenic was detected in nearly all of the soil samples collected on site at concentrations ranging between 0.55 mg/kg and 3.22 mg/kg. These concentrations are well below the general default background concentration for arsenic of 7 mg/kg for soils in Oregon (DEQ 2002).
- ACMs were found at depths as shallow as 2.5 feet bgs. ACMs pose a human health exposure concern if inhalation of friable asbestos fibers occurs as a result of disturbance of the ACM. The buried ACM present the most problematic management challenge from a land use development perspective because of their shallow and widespread presence at the site.

The detected concentrations of soil contaminants pose a low risk to human health under current and reasonably likely future land use scenarios if managed properly. The contaminants are not considered to be highly mobile and are not acutely toxic if managed properly. Other issues to consider include:

- Miscellaneous solid waste such as metal, glass and other sharp objects are potential physical hazards that should be addressed.
- Buried waste may present nuisance odors.

With the exception of ACM, the detected COCs generally reflect conditions in soil above and below the landfill debris and not COCs that may be present in the landfill debris. Therefore, the primary focus of remedial actions at the site is on proper management of buried ACM.

4.0 REMEDIAL ACTION OBJECTIVES AND EVALUATION CRITERIA

The purpose of this FS is to evaluate cleanup alternatives that are feasible and manage risks to levels that are protective of human health and the environment (the remedial action objectives [RAOs]). The FS has been prepared to address the requirements of Oregon Administrative Rule (OAR) 340-122-085 and in accordance with DEQ and EPA guidance. This FS presents a workable number of alternatives, which achieve the RAOs and are protective of public health, safety and welfare, and the environment.

The primary RAO is to prevent human exposure to contaminants of concern present at concentrations above acceptable risk levels and to prevent human exposure to ACM. This can be achieved by elimination of contaminants from the site or by eliminating the exposure pathway though engineering and/or institutional controls.

4.1 Proposed Cleanup Standards

Data collected during the ISA indicate that petroleum-, PAH-, PCB-, metal- and asbestos-contaminated soil at the site poses extremely low risk to human health under current and reasonably likely future land use scenarios. The proposed RAO for the site is removal or management in-place of all COC including ACM. Human exposure to buried COC including ACMs is prevented by meeting this RAO.

4.2 Remedial Action Area

The remedial action area (RAA) consists of portions of the site where COC are present at concentrations exceeding natural background concentrations and one or more human or

ecological risk screening criteria. As noted in Section 3.0, ACM is the primary COC at the site and the focus of this feasibility study.

The former landfill consists of approximately 35 acres as shown in Figure 2. Landfill debris is present in approximately 18.7 acres of the former landfill boundary based on the ISA.

Figure 3 is a comparison of the Conceptual Master Plan and LOF. It is important to note that the Conceptual Master Plan is subject to modification; therefore, the comparison of the Master Plan and LOF is presented as one method for evaluating potential remedial action areas and associated costs.

Based on our calculations, approximately 9.9 acres of the LOF are located outside of the area designated as "open space." Within the approximate 9.9 acres, only 5.4 acres include areas with known landfill debris (the LOF contains areas with no known debris.).

4.3 Evaluation Criteria

The feasibility of a potential remedial action was evaluated by balancing remedy selection factors contained in OAR 340-122-090(3) and (4). These balancing factors are:

- Effectiveness - ability and time-frame of remedial action to achieve protection through eliminating or managing risk;
- Long term reliability - reliability of remedial action to eliminate or manage risk and associated uncertainties;
- Implementability - ease or difficulty of implementing remedial action, considering technical, mechanical, and regulatory requirements;
- Implementation risk - potential impacts to workers, the community, and the environment during implementation; and
- Reasonableness of cost - includes capital costs, operations and maintenance, and periodic review.

The evaluation of potential remedial alternatives was also based on the following considerations:

- Current land use zoning.
- Other land use designations.
- Land use plans as established in local comprehensive plans and land use implementing regulations of any governmental body having land use jurisdiction.
- Concerns of the facility owner, neighboring owners and the community.

5.0 HOT SPOT ANALYSIS

Oregon DEQ Cleanup Rules specify that the balancing factors used in final remedy selection be weighted differently for media that is considered a contamination "hot spot" as compared to media that is not. Hot spots are areas of contamination that exceed DEQ hot spot criteria and pose a relatively high level of risk to human or ecological health (OAR 340-122-0115). If a hot

spot is identified, DEQ Cleanup Rules require treatment and/or excavation and offsite disposal of hot spots to the extent that such actions are feasible. If a hot spot is present, the feasibility of treatment or excavation is evaluated based on the balancing factors (effectiveness, long-term reliability, implementability, implementation risk and reasonableness of cost) with a higher threshold on the reasonableness of cost.

This section of this report provides a preliminary evaluation of the presence of screening level-based hot spots and an evaluation of the reasonableness of cost for treating or excavating these preliminary hot spots versus the benefits created through risk reduction.

5.1 Hot Spot Evaluation

OAR 340-122-115(32)(b) defines hot spots in media (other than water) as hazardous substances that present a risk to human health or the environment exceeding the acceptable risk level determined through a risk assessment and that meet any of the following criteria:

- Are highly concentrated, present in concentrations exceeding risk-based concentrations corresponding to:
  - 100 times the acceptable risk level for human exposure to each individual carcinogen.
  - 10 times the acceptable risk level for human exposure to each individual non-carcinogen.
  - 10 times the acceptable risk level for individual ecological receptors or populations of ecological receptors to each individual hazardous substance.
- Are highly mobile:
  - Reasonably likely to migrate to such an extent that a significant adverse effect on beneficial use(s) of water would be created for which treatment is reasonably likely to restore or protect such beneficial uses within a reasonable time, as determined in a feasibility study;
  - Reasonably likely to migrate to such an extent that they would create an unacceptable risk in a media other than water (e.g., sediment) that is a "highly concentrated" condition as described above; or
  - Reasonably likely to migrate to such an extent that they would create an unacceptable risk in a media other than water (e.g., sediment) under conditions where the hazardous substances are not reliably containable, as determined in a feasibility study.
- Are not reliably containable, as determined in a feasibility study.

The following subsections evaluate each of the hot spot criteria.

5.2 Highly Concentrated Hot Spot Criteria

The DEQ Hot Spot Guidance (DEQ 1998) includes pre-calculated “highly concentrated” hot spot levels in soil for human exposure via ingestion, inhalation and dermal contact. The “look-up” table in this guidance does not contain a hot spot level for asbestos. As such, the ACM does not appear to be considered a highly concentrated hot spot as defined by the DEQ Hot Spot Guidance.

5.3 Highly Mobile Hot Spot Criteria

If hazardous substances in soil can migrate to groundwater or surface water and cause significant adverse effects to the beneficial uses of the water, and if treatment is reasonably likely to restore or protect such beneficial uses within a reasonable time, the area of impacted soil is considered a "highly mobile" hot spot. The cleanup rules clearly contemplate that this mobility includes mobility that may be associated with infiltration and leaching of subsurface soils into groundwater; it may also be associated with stormwater runoff into surface water. Based on the ISA, the leaching to groundwater pathway is not considered significant in this hot spot evaluation.

Hazardous substances from the site could also be considered hot spots if they are reasonably likely to migrate to such an extent that they would create an unacceptable risk in media other than water, such as in sediments, and that risk is "highly concentrated" as defined above, or the hazardous substances are uncontainable as determined in a feasibility study. Due to the lack of wetlands or usable groundwater, this risk is minimal. Therefore, no “highly mobile” hot spot areas are identified.

5.4 Not Reliably Containable Hot Spot Criteria

The extent to which hazardous substances cannot be reliably contained is generally evaluated in the feasibility study. As discussed in future sections of this report, all the potential remedies considered except the “No Action” alternative can reliably and effectively contain soil contaminants. Therefore, there are no "not reliably containable" hot spot areas identified.

6.0 REMEDIAL ACTION ALTERNATIVES AND PRELIMINARY SCREENING

GeoEngineers conducted a preliminary screening of remedial alternatives that could be effective for managing contamination at the site. The objective of the preliminary screening is to reduce the number of remedial alternatives that are subject to detailed evaluation by eliminating alternatives that are not protective of human health and the environment, have implementation costs that are significantly disproportionate to level of cleanup realized, or are inconsistent with contemplated redevelopment scenarios. The preliminary screening was conducted in general accordance with Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Office of Solid Waste and Emergency Response Directive 9355.3-01 (EPA 1998) and OAR 340-122-085.

Alternatives were chosen based on the applicability of the technology to site conditions, contaminants characteristics and demonstrated effectiveness at other similar sites. For each alternative, a conceptual remedial approach was developed, along with a corresponding cost estimate. Assumptions were made that contribute some uncertainty to the cost estimate. While these costs are useful for planning purposes, final cost estimates will depend on the scope of the final remedial design. The preliminary screening of remedial alternatives included the following response actions:

- No action.
- Fencing the RAA.

- Capping and institutional controls.
- Complete excavation with on-site disposal.
- Limited excavation with off-site disposal, capping and institutional controls.
- Complete excavation and off-site disposal.

The following general assumptions were used in defining the remedial alternatives:

- Cost estimates do not include any additional assessment of data gaps.
- Permitting costs include only those costs needed to pay the associated fees and demonstrate compliance with the permit requirements.

6.1 Alternatives Removed From Further Consideration

The following remedial alternatives were not selected for further evaluation for the reasons listed below.

6.1.1 No Action

The no action alternative assumes that no remediation activities occur at the site in order to achieve the stated goals and objectives of this remedial action. DEQ guidance requires that the no action alternative be evaluated. Protection of human health and the environment would not be achieved through implementation of this alternative. Exposure to the COC is possible. The no action alternative allows for the potential for release of contaminants from the site via exposure pathways.

6.1.2 Fencing RAA

This alternative assumes a permanent fence and warning signs will be installed around the RAA to prevent access to areas of buried waste. Protection of human health and the environment would be achieved through this alternative from an effectiveness and reliability standpoint, and the alternative is readily implementable. The fencing alternative is not feasible from a development standpoint. The loss of land by fencing of 35 acres would result in a significantly reduced cost benefit for the land developer and loss of open space that is a key livability issue to the idea of a "complete community" as is desired for this development. For these reasons, this alternative has been eliminated from consideration.

6.1.3 Excavation and On-site Disposal

Under this scenario, contaminated soil and debris would be excavated, loaded into trucks, and transported to a location on-site for burial disposal. The excavation and reburial of the material on site is not practical because the ACM is already buried in centralized areas. The Conceptual Master Plan calls for the bulk of the former Arnold Landfill to be located beneath open space.

6.1.4 Excavation and Off-site Disposal of the Entire RAA

This alternative would include the excavation and off-site disposal of the entire RAA (approximately 18.7 acres). Due to the estimated size, depth and volume of the landfill area, the excavation of all contaminated soil and buried debris is not practical due to the estimated excavation costs and disposal fees.

6.2 Alternatives Retained For Further Consideration

The following remedial alternatives were retained for further consideration. Detailed discussions of the retained alternatives are presented in Section 7.0.

- Capping and institutional controls.
- Limited excavation with off-site disposal, capping and institutional controls.

7.0 DETAILED ANALYSIS OF RETAINED REMEDIAL ACTION ALTERNATIVES

The following sections describe remedial alternatives that may be appropriate for addressing contamination at the site. The estimated costs for the remedial alternatives given below should be used only for relative comparison of the remedial alternatives and not for budgetary purposes related to remediation or future site development.

7.1 Alternative 1 - Capping and Institutional Controls

Under this scenario, all soils that have been identified to contain fill (~18.7 acres) would be covered with geotextile fabric as a demarcation layer and capped with at least 2-feet of clean fill. Actual fill placed would vary from about 1- to 3-feet depending on location because most of the landfill debris already appears to be covered by about 2-feet of clean fill. Two feet of "new" fill has been assumed for remedial alternative cost comparison purposes.

This alternative would also require an adjustment of the Conceptual Master Plan. The current Master Plan boundaries have residential and commercial facilities on approximately 5.4 acres of land that is underlain by landfill debris. In order to cap the entire site, the Conceptual Master Plan would be modified to only allow open spaces over the RAA. The cap would prevent human and ecological exposure to contaminated soil and debris. This alternative would require implementation of a restrictive covenant mandating indefinite maintenance and monitoring of the cap. In addition, the use of signage and a contaminated media management plan (CMMP) would be necessary for the site.

The approach outlined above would have relatively low pre-implementation costs. It may be possible to integrate capping efforts with overall site development plans (i.e. parking areas, roadways, open space, and/or building footprints over the contaminated material), reducing the incremental costs of remediation. Implementation would result in some long term land use restrictions; specifically, 1) requirements for long term or indefinite cap maintenance and monitoring; and 2) the implementation of a CMMP to govern future activities that involve disturbance of contaminated soil (i.e. if irrigation is installed within fill material).

7.2 Alternative 2 – Limited Excavation with Offsite Disposal, Capping and Institutional Controls

This alterative is substantially similar to Alternative #1, except that the Conceptual Master Plan would not be modified; instead, all portions of the RAA (areas with debris) outside of designated open spaces would be excavated and disposed off at an offsite landfill. All other requirements of Alternative 1 (long term cap maintenance, CMMP, signage, etc) would be implemented under Alternative 2.

8.0 COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

The comparative evaluation of the selected remedial alternatives is based on the ability to meet the RAO and consideration of the criteria for remedial actions as provided in OAR 340-122-0090; specifically: effectiveness, long-term reliability, implementability, implementation risk and reasonableness of cost. In order to evaluate reasonableness of costs, planning-level cost estimates were developed for each alternative. These planning-level cost estimates were based on a conceptual design for each option. While sufficiently accurate and useful for decision-making purposes, the cost estimates are subject to change based on actual costs for the final remedial design.

The comparative evaluation of all alternative options is summarized in Table 1. The preliminary engineering cost estimate for each alternative is shown in Tables 2 and Tables 3.

The comparative evaluation was made by completing a head-to-head comparison of each alternative for the alternative's ability to attain the RAO, as well as the balancing factors for remedial alternative evaluation. One point is awarded to the more favorable alternative for each head-to-head ranking. In the event of a tie, each alternative received 0.5 points. The results of the scoring system are presented in Table 4.

8.1 Ability to Attain RAO

Each option will achieve the RAO but do not remove the COC including ACM. Option 2 does provide for a limited removal of ACM.

8.2 Effectiveness

Both options 1 and 2 were ranked equally for effectiveness. Neither option removes all the COC and requires the use of institutional controls.

8.3 Long-Term Reliability

Both options 1 and 2 were ranked equally for long-term reliability. Both options rely on implementation of the CMMP and maintenance of a cap.

8.4 Implementability

Option 1 was ranked highest for implementability. Option 2 requires the excavation and transportation of ACM off-site, increasing the difficulty of implementing the work.

8.5 Implementation Risk

Option 1 was ranked best for implementation risk. Option 2 requires the excavation and transportation of ACM, which increases the risk of exposure to site workers and other receptors.

8.6 Reasonableness of Cost

Estimated costs for each option are detailed in Tables 2 and 3. The ranking for reasonableness of cost is summarized as follows: 1) Alternative 1 (capping and institutional controls) - $1,618,671; and 2) Alternative 2 (limited excavation and capping) - $12,811,579. Based on the estimated costs, Option 1 was ranked the best for reasonableness of cost.

9.0 RECOMMENDED REMEDIAL ACTION ALTERNATIVE

Based on the comparative evaluation summarized in Table 4 and the discussion presented above, Option 1 (capping of entire RAA and the use of institutional controls) is the most viable option. This assumes that the Conceptual Master Plan can be revised to modify the location of the proposed open spaces. The goal of the Conceptual Master Plan revision is to eliminate or minimize to the extent practical the excavation or disturbance of the known debris areas.

Future and actual development will determine the remedial action alternative that is selected. The remedial action costs are likely to fall in the range of these two alternatives.

10.0 LIMITATIONS

We have prepared this report for the exclusive use of DSL and DEQ. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood. Appendix A contains a copy of the entire report limitations.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

11.0 REFERENCES

DEQ, Guidance for Identification of Hot Spots, 1998.

DEQ, Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites, Including Table of Generic Risk-Based Concentrations for Petroleum Constituents and Total Petroleum Hydrocarbons and Generic Remedy for Simple Risk-Based Sites, 2003, Revised September 2009.

DSL, Stevens Road Tract Conceptual Master Plan. Adopted June, 2007.

EPA, Guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA, 1998.

Means Environmental, Remediation Estimating Methods, 2003.

PBS, Initial Site Assessment Report, Stevens Road Tract, 2009.

TABLE 1

COMPARATIVE ANALYSES OF REMEDIAL ALTERNATIVES

CAPPING OF REMEDIAL ACTION AREA INSIDE OPEN SPACE AND EXCAVATION OF AREAS OUTSIDE OF OPEN SPACES

DSL STEVENS ROAD PROPERTY

BEND OREGON

Alternative	Able to Attain Remedial Action Objective	Effectiveness	Long-Term Reliability	Implementability	Implementation Risk	Approximate Cost
Alternative 1 Capping and Institutional Controls	Achieves RAO through elimination of exposure pathways.	Would effectively manage long term risks to human health. May result in development constraints due to deed restrictions.	Long-term reliability is dependent on proper management and maintenance of caps.	This alternative could be readily implemented and could be integrated with future development.	There are minor implementation risks associated with worker exposure to contaminated media and heavy equipment during implementation and	$1,619,000
Alternative 2 Capping, Excavation and Institutional Controls	Achieves RAO through removal of contaminants and elimination of exposure pathways.	Would effectively manage long term risks to human health. May result in development constraints due to deed restrictions.	Long-term reliability is dependent on proper management and maintenance of caps.	This alternative could be readily implemented and could be integrated with future development.	There are minor implementation risks associated with worker exposure to contaminated media and heavy equipment during implementation and	$12,812,000

Notes:

RAO = Remedial Action Objective

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TABLE 2

ENGINEERING ESTIMATE - ALTERNATIVE #1

CAPPING OF ENTIRE REMEDIAL ACTION AREA AND INSTITUTIONAL CONTROLS

DSL STEVENS ROAD PROPERTY

BEND OREGON

Activity	Unit	Amount	Unit Cost	Extended Cost	Assumptions/ Estimate Source
Pre-fieldwork					
Engineered Cap Design	ls	1	$25,000.00	$25,000	Conservative estimate.
Permitting	ls	1	$2,500.00	$2,500	Conservative estimate.
Modifications to Conceptual Master Plan	ls	1	$10,000.00	$10,000	Conservative estimate.
Health and Safety Plan and Dust Management Plan	ls	1	$5,000.00	$5,000	Conservative estimate.
Capping					
Placement of geotextile fabric - demarcation layer	sf	814,566	$0.50	$407,283	Assumes an area of 18.7 acres (Means 2003).
Placement of soil cap	cy	69,390	$3.25	$225,518	Assumes an area of 18.7 acres. Assumes a 15% estimate for edge grading for a two foot soil cap. Placement and regrading. Assumes the cap will be generated from the soil removed from other portions of the site (Means 2003).
Grading of cap	cy	69,390	$1.04	$72,166	(Means 2003).
Compaction of containment cell cover	cy	69,390	$3.96	$274,784	(Means 2003).
Compaction testing of containment cell cover	ls	20	$1,250.00	$25,000	20 days of compaction testing.
Consultant field oversight	day	32	$1,200.00	$38,400	Based on similar project oversight. Assumes visits once a week for duration of project (4 months).
Consultant reimbursables (lodging, meals, PPE, etc)	day	32	$200.00	$6,400	Based on similar project.
Long term operation and maintenance of cap	year	50	$5,000.00	$250,000	Assumes 50 years of cap operation and maintenance.
Design, Reporting and Project Management					
Contaminated Media Management Plan	ls	1	$10,000.00	$10,000	Based on previous reporting costs.
Preparation of deed restrictions	ls	1	$6,000.00	$6,000	Based on previous reporting costs.
Closeout Report	ls	1	$30,000.00	$30,000	Based on previous reporting costs.
			Subtotal	$1,375,551	
			Inflation factor (12%) for 2003 Means	$68,696	
			10% Contingency	$144,425	
			TASK SUBTOTAL	$1,618,671	

Other Assumptions:

Costs were derived from cost assemblies in Means 2003, vendor quotes and GeoEngineers previous project experience.

ls = lump sum

cy = cubic yard

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TABLE 3

ENGINEERING ESTIMATE - ALTERNATIVE #2

CAPPING OF REMEDIAL ACTION AREA INSIDE OPEN SPACE AND EXCAVATION OF AREAS OUTSIDE OF OPEN SPACES

DSL STEVENS ROAD PROPERTY

BEND OREGON

Activity	Unit	Amount	Unit Cost	Extended Cost	Assumptions/ Estimate Source
Pre-fieldwork					
Engineered Cap Design	ls	1	$25,000.00	$25,000	Conservative estimate.
Permitting	ls	1	$2,500.00	$2,500	Conservative estimate.
Health and Safety Plan and Dust Management Plan	ls	1	$5,000.00	$5,000	Conservative estimate.
Excavation Outside of Designated "Open Space"					
Mobilization/Demobilization	ls	1	$10,000.00	$10,000	Conservative vendor estimate.
Grading of top soil from debris areas	cy	8,656	$1.04	$9,002	Assumes a 5.36 acre area with a top soil thickness of 1-foot (Means 2003).
Removal of solid waste and other non-hazardous debris from excavation areas	ls	1	$10,000.00	$10,000	Conservative estimate.
Excavation of debris	ton	129,839	$13.00	$1,687,903	Based on a conservative estimate from previous work. Assumes a 1.4 ton/yard conversion factor and an average debris thickness of 15 feet. Assumes excavation work will take 90 days to complete.
Dust suppression	day	90	$875.00	$78,750	Provide dust suppression equipment, implementation and containment and disposal of free liquids (if generated). Rates based on conservative estimate from previous work.
Certified asbestos supervisor oversight with air sampling	day	90	$750.00	$67,500	Based on similar project.
Excavation contractor personal protective equipment	day	90	$200.00	$18,000	Field personnel PPE.
Truck liners	each	16,228	$50.00	$811,400	Assumes 4 per load, double lined (truck and pup) with 4,057 loads (32 tons per load).
Loading and transportation of debris to Knott Landfill	ton	129,839	$20.00	$2,596,774	Based on similar project.
Disposal of debris at Knott Landfill	ton	129,839	$40.00	$5,193,548	Based on similar project.
Consultant field oversight	day	24	$1,200.00	$28,800	Based on similar project oversight. Assumes visits once a week for duration of project (3 months).
Consultant reimbursables (lodging, meals, PPE, etc)	day	24	$200.00	$4,800	Based on similar project.
Capping Within Designated "Open Space"					
Placement of geotextile fabric - demarcation layer	sf	581,522	$0.50	$290,761	Assumes an area of 13.35 acres (Means 2003).
Placement of soil cap	cy	49,537	$3.25	$160,995	Assumes an area of 13.35 acres. Assumes a 15% estimate for edge grading for a two foot soil cap. Placement and regrading. Assumes the cap will be generated from soil removed from other portions of the site (Means 2003).
Grading of cap	cy	49,537	$1.04	$51,518	(Means 2003).
Compaction of containment cell cover	cy	49,537	$3.96	$196,167	(Means 2003).
Compaction testing of containment cell cover	ls	15	$1,250.00	$18,750	15 days of compaction testing.
Consultant field oversight	day	24	$1,200.00	$28,800	Based on similar project oversight. Assumes visits once a week for duration of project (3 months).
Consultant reimbursables (lodging, meals, PPE, etc)	day	24	$200.00	$4,800	Based on similar project.
Long term operation and maintenance of cap	year	50	$5,000.00	$250,000	Assumes 50 years of cap operation and maintenance.
Design, Reporting and Project Management					
Contaminated Media Management Plan	ls	1	$10,000.00	$10,000	Based on previous reporting costs.
Preparation of deed restrictions	ls	1	$6,000.00	$6,000	Based on previous reporting costs.
Closeout Report	ls	1	$30,000.00	$30,000	Based on previous reporting costs.
			Subtotal	$11,596,768	
			Inflation factor (12%) for 2003 Means	$50,122	
			10% Contingency	$1,164,689	
			TASK SUBTOTAL	$12,811,579	

Other Assumptions:

Costs were derived from cost assemblies in Means 2003, vendor quotes and GeoEngineers previous project experience.

lf = linear foot

cy = cubic yard

SP:\278705200FS_DSLTables.xls

TABLE 4

ENGINEERING SCORING SHEET

DSL STEVENS ROAD PROPERTY

BEND OREGON

Ability to Obtain RAO

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		0.5	0.5
Alternative 2 - Limited excavation and capping	0.5		0.5

Effectiveness

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		0.5	0.5
Alternative 2 - Limited excavation and capping	0.5		0.5

Long Term Reliability

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		0.5	0.5
Alternative 2 - Limited excavation and capping	0.5		0.5

Implementability

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		1	1
Alternative 2 - Limited excavation and capping	0		0

Implementation Risk

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		1	1
Alternative 2 - Limited excavation and capping	0		0

Cost

	Alternative 1 - Capping of entire RAA	Alternative 2 - Limited excavation and capping	Total
Alternative 1 - Capping of entire RAA		1	1
Alternative 2 - Limited excavation and capping	0		0

Summary

Alternative 1 - Capping of entire RAA	4.5
Alternative 2 - Limited excavation and capping	1.5

APPENDIX A
REPORT LIMITATIONS AND GUIDELINES FOR USE

APPENDIX A
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This Appendix provides information to help you manage your risks with respect to the use of this report.

Environmental Services Are Performed For Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of DSL and DEQ. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an environmental site assessment study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. No one except the DSL and DEQ should rely on this environmental report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

This Environmental Report Is Based On a Unique Set of Project-Specific Factors

This report has been prepared for the DSL Stevens Road Property located in Bend, Oregon. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you.
- not prepared for your project.
- not prepared for the specific site explored.
- completed before important project changes were made.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Reliance Conditions For Third Parties

Our report was prepared for the exclusive use of DSL and DEQ. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

with our Agreement with DEQ and generally accepted environmental practices in this area at the time this report was prepared.

Environmental Regulations Are Always Evolving

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance, change or if more stringent environmental standards are developed in the future.

Uncertainty May Remain Even After This FS Is Completed

No FS can wholly eliminate uncertainty regarding the potential for contamination in connection with a property. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely-spaced sampling locations completed by others. It is always possible that contamination exists in areas that were not explored, sampled or analyzed.

Subsurface Conditions Can Change

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, by new releases of hazardous substances, or by natural events such as floods, earthquakes, and slope instability or groundwater fluctuations. Always contact GeoEngineers before applying this report to determine if it is still applicable.

Soil and Groundwater End Use

The cleanup levels referenced in this report are site-and situation-specific. The cleanup levels may not be applicable for other sites or for other on-site uses of the affected media (soil and/or groundwater). Note that hazardous substances may be present in some of the site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject site or reuse of the affected media on site to evaluate the potential for associated environmental liabilities. We cannot be responsible for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject site to another location or its reuse on site in instances that we were not aware of or could not control.

Most Environmental Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in this

report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and GeoEnvironmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If DSL or DEQ desire these specialized services, they should be procured through a consultant who offers services in this specialized field.