Aspect consulting
IN-DEPTH PERSPECTIVE

MEMORANDUM

Project No.: 020118-05

April 7, 2003

To: Brian Sato, Washington State Department of Ecology

cc: John Schwartz, Barrientos
Chris Rogers, Seattle Art Museum
Lynn Manolopoulos, Davis Wright Tremaine

From: Lori Herman and David Heffner, Aspect Consulting

Re: **Remedial Measures to Address Upper Yard Direct Contact and Leaching Concerns, Former Unocal Seattle Marketing Terminal Property**

The Seattle Art Museum (SAM) and Museum Development Authority (MDA) are party to a Prospective Purchaser Consent Decree with the Washington State Department of Ecology (Ecology) to conduct cleanup at the former Unocal Marketing Terminal property (Site) located on the 3100 block of Elliott Avenue in downtown Seattle. SAM purchased the Site in 1999 with intentions to develop the industrial site into a landscaped open space with pedestrian access between a public sculpture park and public waterfront. Exhibit B to the Consent Decree is a Cleanup Action Plan (CAP) that describes, in general terms, remedial actions that will be performed in the course of property redevelopment to address issues related to residual petroleum-hydrocarbon contamination.

Unocal has conducted cleanup actions at the Site under an Order on Consent with Ecology within four compliance areas; the Upper Yard, Elliott Avenue, Lower Yard, and Off-Site areas. The cleanup actions to be conducted under the SAM/MDA Consent Decree are referenced to these same compliance areas.

This technical memorandum focuses on direct contact and leaching concerns in the Upper Yard (Figure 1). CAP requirements are reviewed, and information on the nature and extent of residual vadose zone soil contamination is summarized. Specific remedial measures are then proposed for this area of the property to reduce the potential for direct contact with residual impacted soil and contaminant leaching via surface water infiltration.

This is a revised version of a previous memorandum dated February 24, 2003. It addresses Ecology's comments on the previous memorandum.

Review of CAP Requirements

The following remedial action objectives (RAOs) are identified in the CAP for the Upper Yard:

1) Minimize potential for direct contact with residual petroleum-impacted soils in the vicinity of well MW-61A (see Figure 2);

2) Minimize potential for leaching of hydrocarbons from residual petroleum-impacted soils in the vicinity of well MW-61A;
3) Prevent potential indoor air impacts; and
4) Verify that ambient air quality meets Method B cleanup levels or is within background conditions.

The first two RAOs are addressed in this technical memorandum. A separate technical memorandum is being prepared describing proposed remedial measures that address the indoor air and ambient air RAOs.

The selected remedy described in the CAP includes installation of a reduced permeability layer in the northwest corner of the Upper Yard. Construction elements discussed in the CAP include the following:

- Grade the area to achieve a slope of 3 percent;
- Place a 1-foot-thick reduced permeability layer consisting of granular material with at least 10 percent fines, and having a vertical permeability of $1.2x10^{-4}$ to $1.0x10^{-6}$ cm/sec;
- Above the reduced permeability layer, install a 1-foot-thick gravel layer with perforated pipes to collect water and discharge it to the storm sewer; and
- Overlay the gravel layer with filter fabric and a minimum of 3 feet of sandy loam suitable for landscaping.

The CAP envisioned that this would address the leaching RAO by reducing infiltration by about 50 percent in the vicinity of well MW-61A. The Restrictive Covenant for the Upper Yard (Exhibit D to the Consent Decree) contains an institutional control to protect the reduced permeability layer by prohibiting activities that could potentially compromise the layer. This institutional control also serves to minimize the potential for direct contact with residual petroleum-impacted soils.

Nature and Extent of Vadose Zone Soil Contamination

In 1988, Unocal entered into an Order on Consent with Ecology to remediate petroleum-related contamination at its former marketing terminal. Pursuant to that Order (and its amendments), Unocal removed approximately 50,000 tons of petroleum-impacted soil from the Upper Yard during remediation activities in 1989 through 1990, and another 15,000 tons in 1997. Figure 1 shows existing (post-remediation) topography. In general, concentrations of total petroleum hydrocarbons (TPH) remaining in Upper Yard soils do not exceed the Order's 200 mg/kg cleanup level. However, a relatively small volume (estimated at 110 cubic yards) of impacted soils in the northwest corner of the Upper Yard could not be excavated because of its depth (approximately 16 to 26 feet below the adjacent street grade) and proximity to a shoring wall installed along Elliott Avenue.

Following soil removal, selected areas were backfilled with concrete, brick, rock, and stockpiled soils. Unocal completed Upper Yard remedial construction activities in late 1997, and installed and sampled monitoring wells MW-61A through MW-63A (locations shown on Figure 2) in March 1998. Well MW-61A, installed through the impacted soils left in place in the Upper Yard, did not exhibit evidence of separate-phase product or sheen at the time of installation or initial sampling. However, a thin layer of light non-aqueous-phase liquid (LNAPL) was encountered the following month. Since then, Unocal has been checking well MW-61A for LNAPL on a frequent (e.g., weekly) basis, and removing it when present. In addition, Unocal installed *in situ* submerged oxygen curtain (iSOC) equipment in well MW-61A in February 2002, and has operated the equipment on a continuous basis except for brief shutdowns for maintenance, groundwater sampling, and LNAPL removal. The iSOC system is intended to promote bioremediation of residual TPH by increasing the supply of oxygen to the subsurface.

Figures 2 and 3 present the estimated areal and vertical extents, respectively, of TPH-impacted vadose zone soils remaining along the northern portion of the Upper Yard's western boundary and the adjacent eastern half of Elliott Avenue. The explorations and sample locations shown on these figures (and on Figure 1) were used to estimate the extent of residual impacted soil. They include existing monitoring wells, soil borings advanced along Elliott Avenue (where no soil removal occurred), property line soil samples collected from behind the shoring wall installed along Elliott Avenue, and Upper Yard test pit and surface soil samples collected after completion of soil removal activities and prior to backfilling. Soil sample analytical results are also provided on the figures. Additional information on the extent of impacted Upper Yard soil that was inaccessible during the 1997 soil removal activities is provided in the Final Cleanup Report for the Upper Yard (GeoEngineers 1997).

Proposed Measures to Reduce Leaching and Direct Contact Potential

The following remedial measures are proposed to reduce leaching potential in the vicinity of residual TPH-impacted soils in the Upper Yard:

1) Installation of a reduced permeability layer; and
2) Grading and drainage features to promote surface water runoff.

Installation of a Reduced Permeability Layer

Figure 4 shows plan and section views of a proposed reduced permeability layer which will divert infiltrating water before it reaches residual TPH-impacted soils in the Upper Yard. As discussed in a separate technical memorandum, a large (approximately 30-feet thick) layer of clean imported fill is proposed in this area to address the ambient air RAO. The reduced permeability layer will be installed within this clean fill layer, at the approximate grade of Elliott Avenue. It will consist of a minimum 12-inch thickness of controlled density fill (CDF) or other granular material or combination of granular materials having a maximum vertical permeability of no greater than 10^{-5} cm/sec. Alternatively, a geomembrane consisting of 60-mil high-density polyethylene (HDPE) or equivalent may be used. The layer's dimensions (approximately 57 feet by 190 feet) are derived from a rectangle projected upward and outward at an angle of 2 horizontal:1 vertical (2H:1V) from the outermost edges of the underlying impacted soil layer. This is based on the very conservative assumption that water migrating through the unsaturated zone can move laterally at an angle of up to 2H:1V. Note that the rectangular projection intersects the existing ground surface along a portion of its northern edge. We do not propose to excavate additional Upper Yard soils to install a reduced permeability layer in this area. Instead, the layer will extend northward to abut the existing ground surface, as shown on Figure 4.

The reduced permeability layer will be sloped to drain toward Elliott Avenue at a minimum 3 percent grade. The layer's western edge will abut either the existing shoring wall or another low permeability layer (e.g., concrete sidewalk along Elliott Avenue), thus providing a continuous barrier to infiltration. A perforated pipe will be installed immediately above the layer along Elliott Avenue to drain infiltrating water to sewer.

Grading and Drainage Features to Promote Surface Water Runoff

To reduce infiltration into the area above the low permeability layer, a graded slope with a well-drained gravel pathway and vegetation is proposed at the finished park surface to promote surface water runoff. We used the King County Runoff Time Series (KCRTS) model to estimate the reduction in infiltration that can be expected over the current condition. The park surface area over which infiltration is a potential concern was defined in the same way as was used to define the low permeability layer area. Since the 2H:1V projection extends to the finished park surface in this case, the resulting rectangular area is larger. This area is indicated by a dashed line on Figure 4. Figure 5 shows proposed park topography and finished surfaces (e.g., gravel path and grass areas) within the area of potential infiltration concern. Using this information, the KCRTS model predicts a 63 percent reduction in surface water infiltration within this area compared to the current condition. Details of the infiltration analysis are provided in Attachment A.

Protection Against Direct Contact Exposure

In addition to a reduced permeability layer, approximately 30-feet of clean fill will be placed over the residual impacted soil. This soil cover will provide additional protection against direct contact exposures.

Proposed Revision to the Restrictive Covenant

Section 1 of the Restrictive Covenant for the Upper Yard (Exhibit D to the Consent Decree) prohibits any activity on the property that may result in the release or exposure to the environment of residual TPH contaminated soil. It states:

> *Some examples of activities that are prohibited in the capped area include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capability, piercing the surface with a rod, spike, or similar item, bulldozing or earthwork.*

Since it is now proposed that the reduced permeability layer be covered with over 20 feet of imported fill material, most of these examples of prohibited activities would no longer be of concern. Therefore, we propose that the Restrictive Covenant include a figure showing the areal extent and depth of the reduced permeability layer, and prohibit any activity that may compromise this layer.

Conclusion

The installation of a low permeability layer over the residual TPH-contaminated soils will restrict direct infiltration of precipitation on the site through this area. The addition of over 20 feet of fill graded to drain runoff and a storm water collection system which conveys storm water away from the contaminated area will further reduce the potential for infiltration through this area. The fill also addresses the direct contact RAO by eliminating any potential for direct contact with residual contamination.

References

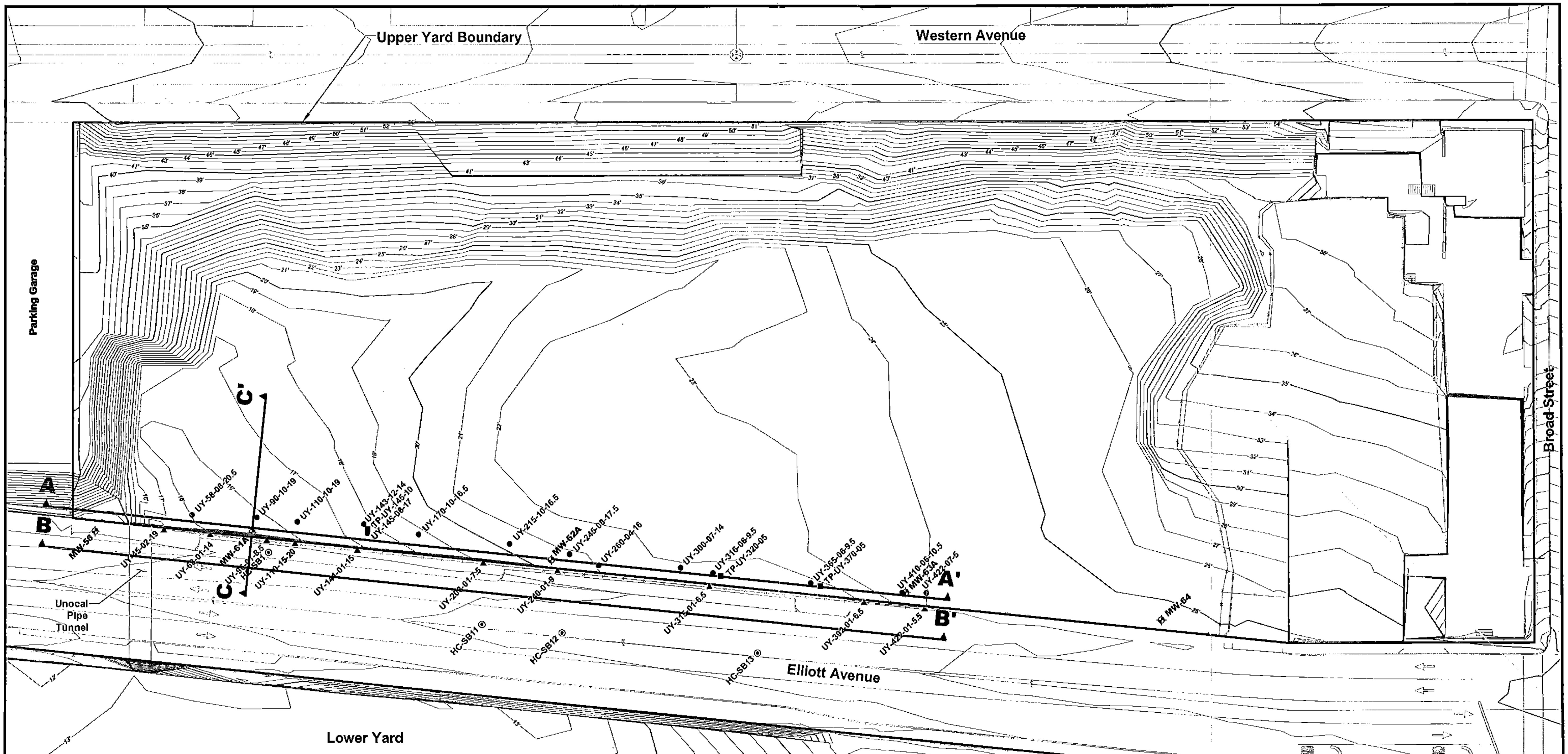
GeoEngineers 1997. Final Cleanup Report, Remedial Excavation Monitoring, Upper Yard, Former Unocal Seattle Marketing Terminal Property, Seattle, Washington, Volume I of III. December 10, 1997.

Attachments:

Figure 1 – Site Map with Selected Exploration/Sample Locations
Figure 2 – Estimated Areal Extent of Residual TPH-Impacted Soil
Figure 3 – Cross Sections A-A', B-B', and C-C'
Figure 4 – Plan and Section Views of Proposed Reduced Permeability Layer
Figure 5 – Proposed Finished Park Surfaces in Area of Potential Infiltration Concern

Attachment A Aspect Consulting Memorandum dated March 19, 2003
Infiltration Analysis for Olympic Sculpture Park Upper Yard

S:\SAM\UpperYardTechMemoApril_7_2003.doc



Legend

MW-X	⊕	Monitoring Well
HC-SBX	◎	Boring
TP-UY-X-X	■	Test Pit
UY-X-X-X	●	Post-Excavation Surface Soil Sample
UY-X-X-X	▲	Property Line Soil Sample *(collected from behind shoring wall)*
X — X'		Cross Section Location and Designation
---13'---		Existing Elevation Contour (in Feet)

True N

Site

0 50 100

Feet

Elevations are based on SEANET Datum

Note 1) The explorations and samples shown on this figure were used to estimate the extent of residual TPH-impacted vadose zone soils along the northern portion of the Upper Yard's western boundary and the adjacent eastern half of Elliott Avenue (See Figures 2 and 3).

Aspect consulting
IN-DEPTH PERSPECTIVE
179 Madrone Lane North, Bainbridge Island, WA 98110, (206) 780-9370
811 First Avenue #480, Seattle, WA 98104, (206) 328-7443

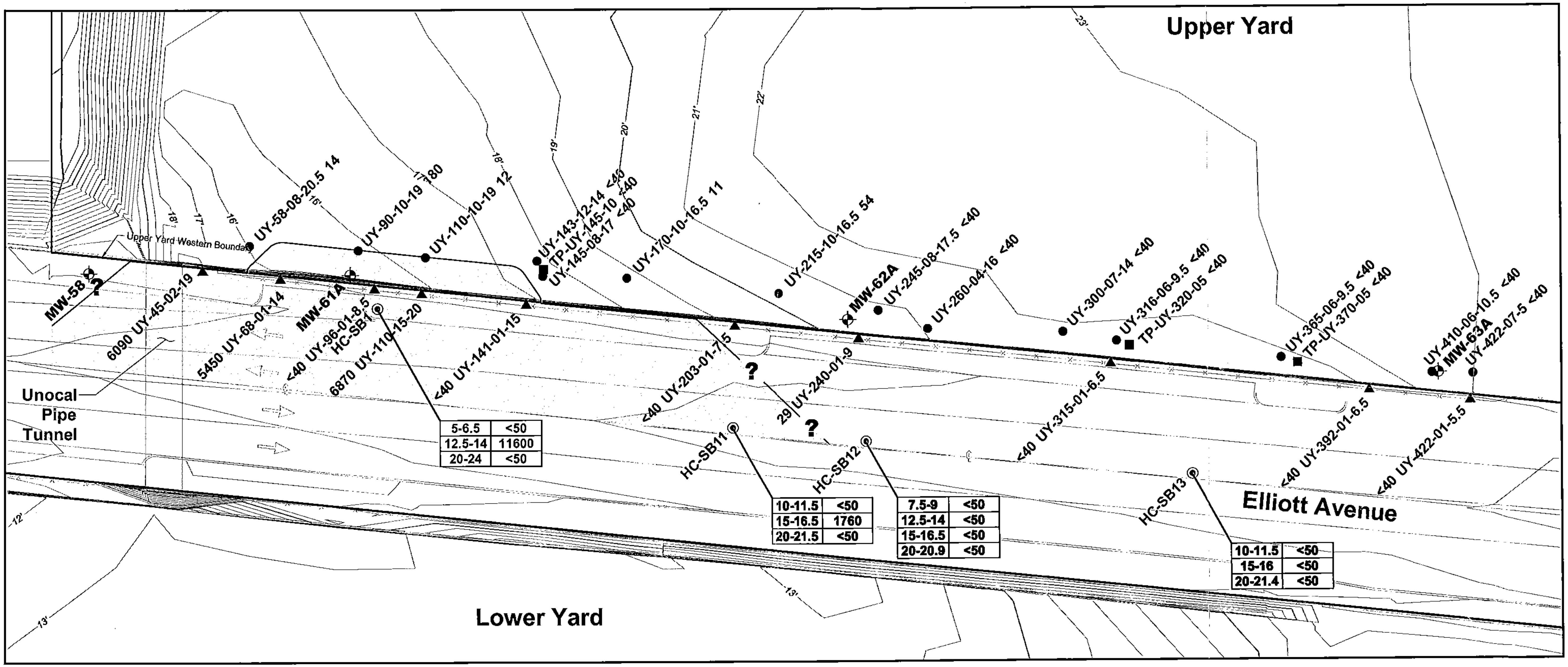
Site Map with Selected Exploration/ Sample Locations[1] - Upper Yard

Seattle Art Museum / Olympic Sculpture Park

Seattle, Washington

DATE: 2/7/03	PROJECT NO. 020118
DESIGNED BY: DAH	
DRAWN BY: SDM	FIGURE NO. 1
REVISED BY:	

P:\SAM\Drafting\020118-02.dwg



Legend

MW-X	⌖	Monitoring Well
HC-SBX	◉	Boring
TP-UY-X-X	■	Test Pit
UY-X-X-X	●	Post-Excavation Surface Soil Sample
UY-X-X-X	▲	Property Line Soil Sample *(collected from behind shoring wall)*
<40		Total Petroleum Hydrocarbons (TPH) in mg/kg
5-6.5 | <50		TPH (Total) in mg/kg; Soil Sample Depth Interval (in Feet)
25'		Existing Elevation Contour (in Feet)

True N / Site N

Scale: 0 — 30 — 60 Feet

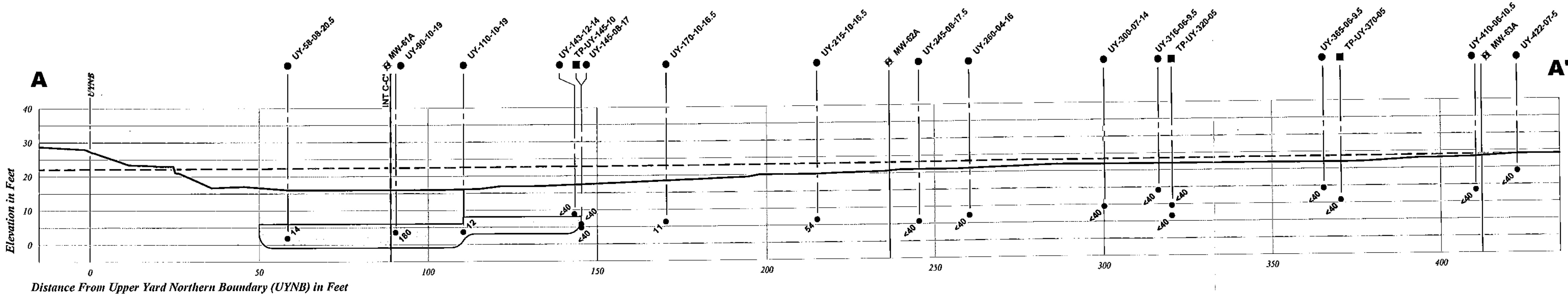
Elevations are based on SEANET Datum

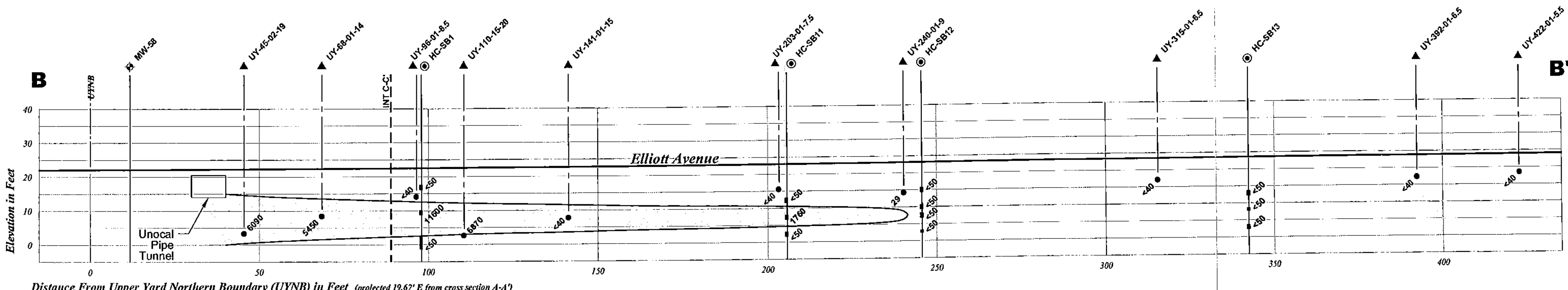
Aspect consulting — IN-DEPTH PERSPECTIVE
179 Madrone Lane North, Bainbridge Island, WA 98110 (206) 780-9370
811 First Avenue #480, Seattle, WA 98104 (206)-328-7443

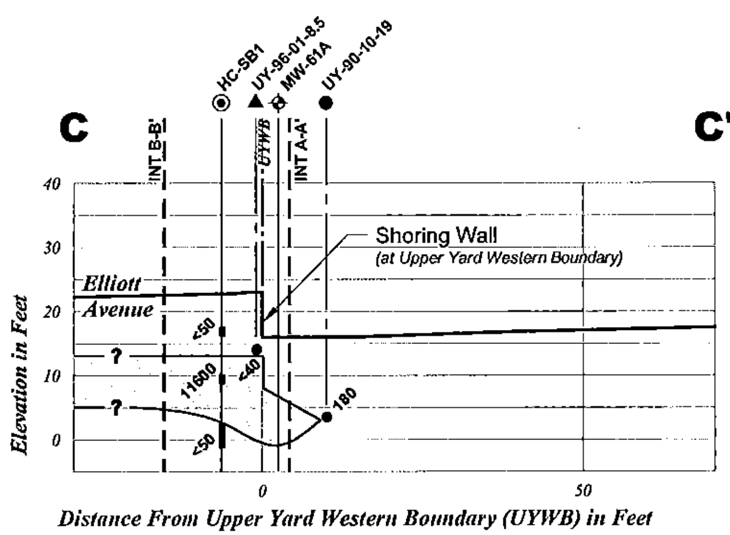
Estimated Areal Extent of Residual TPH-Impacted Soil - Upper Yard
Seattle Art Museum / Olympic Sculpture Park
Seattle, Washington

DATE:	2/7/03
DESIGNED BY:	DAH
DRAWN BY:	SDM
REVISED BY:	
PROJECT NO.	020118
FIGURE NO.	2

P:\SAM\Drafting\020118-02.dwg







Legend

- Existing Ground Surface
- Generalized Elevation of Elliott Avenue
- • <40 Total Petroleum Hydrocarbons (TPH) in mg/kg
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg

0 30 60
Feet

Elevations are based on SEANET Datum

Aspect consulting
IN-DEPTH PERSPECTIVE

179 Madrone Lane North, Bainbridge Island, WA 98110, (206) 780-9370
811 First Avenue #480, Seattle, WA 98104, (206)-328-7443

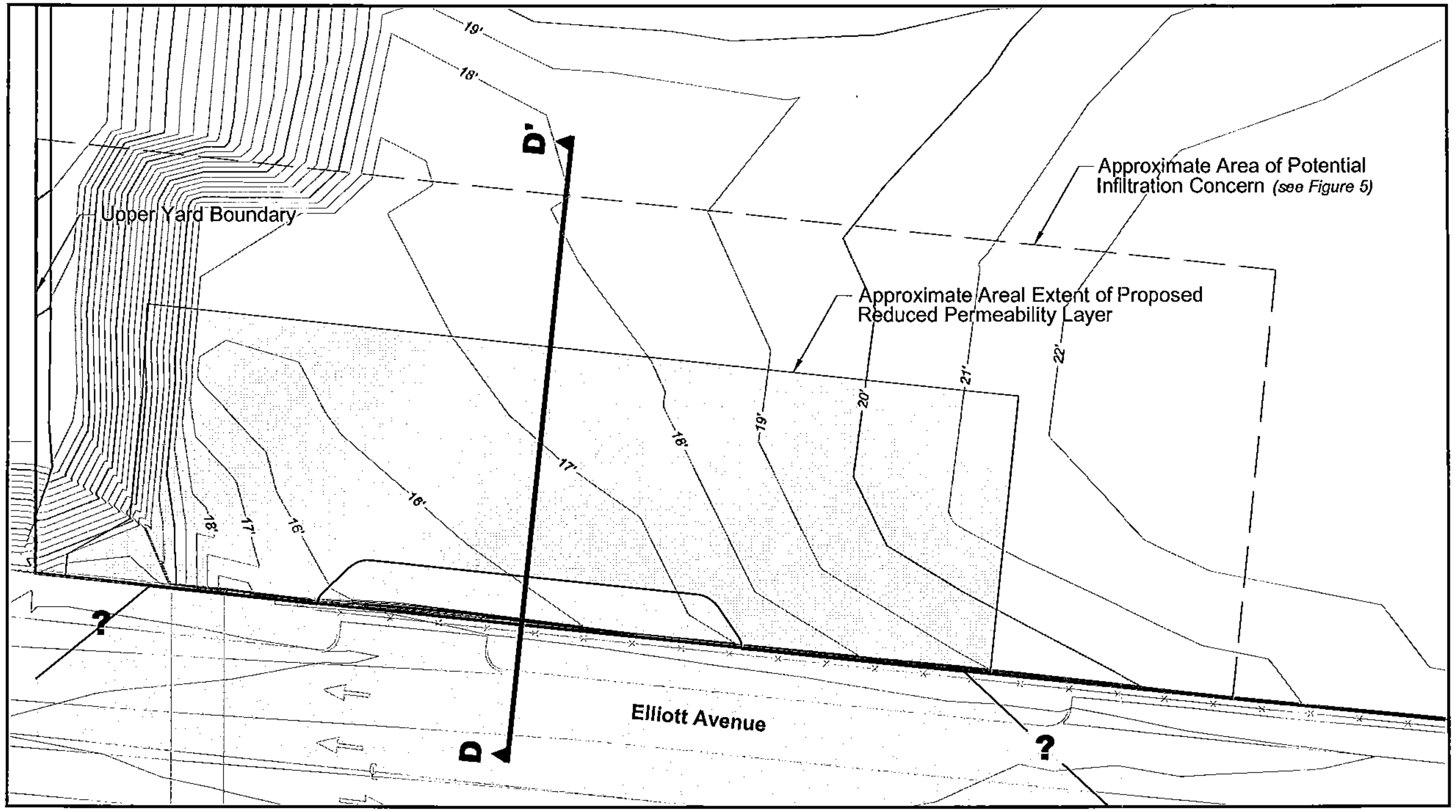
Cross Sections A - A', B - B' and C - C'
Upper Yard

Seattle Art Museum / Olympic Sculpture Park
Seattle, Washington

DATE:	2/7/03
DESIGNED BY:	DAH
DRAWN BY:	SDM
REVISED BY:	
PROJECT NO.	020118
FIGURE NO.	3

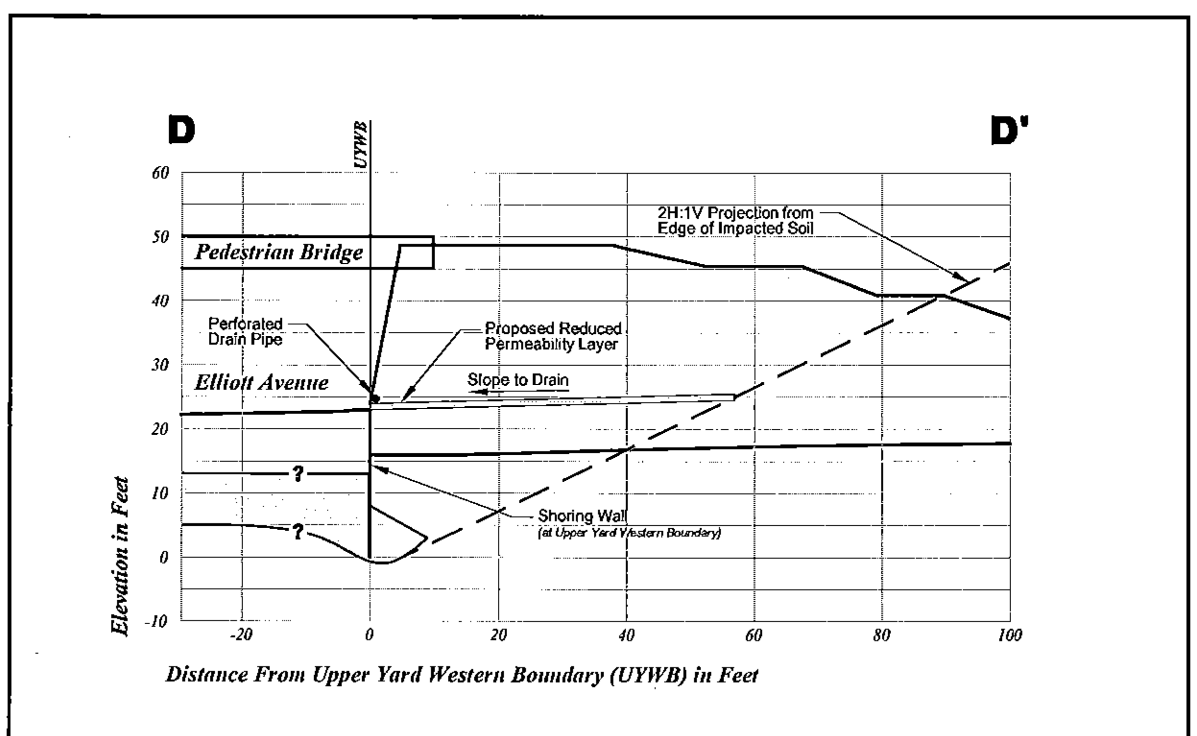
P:\SAMDrafting\020118-03.dwg

Plan View



Legend

- X — X' Cross Section Location and Desgnation
- 25' Existing Elevation Contour (in Feet)
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg



Section

Legend

- Existing Ground Surface
- Proposed Ground Surface
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg

True N

Site

0 30 60

Feet

Elevations are based on SEANET Datum

Aspect consulting
IN-DEPTH PERSPECTIVE

179 Madrone Lane North, Bainbridge Island, WA 98110, (206) 780-9370
811 First Avenue #480, Seattle, WA 98104, (206) 328-7443

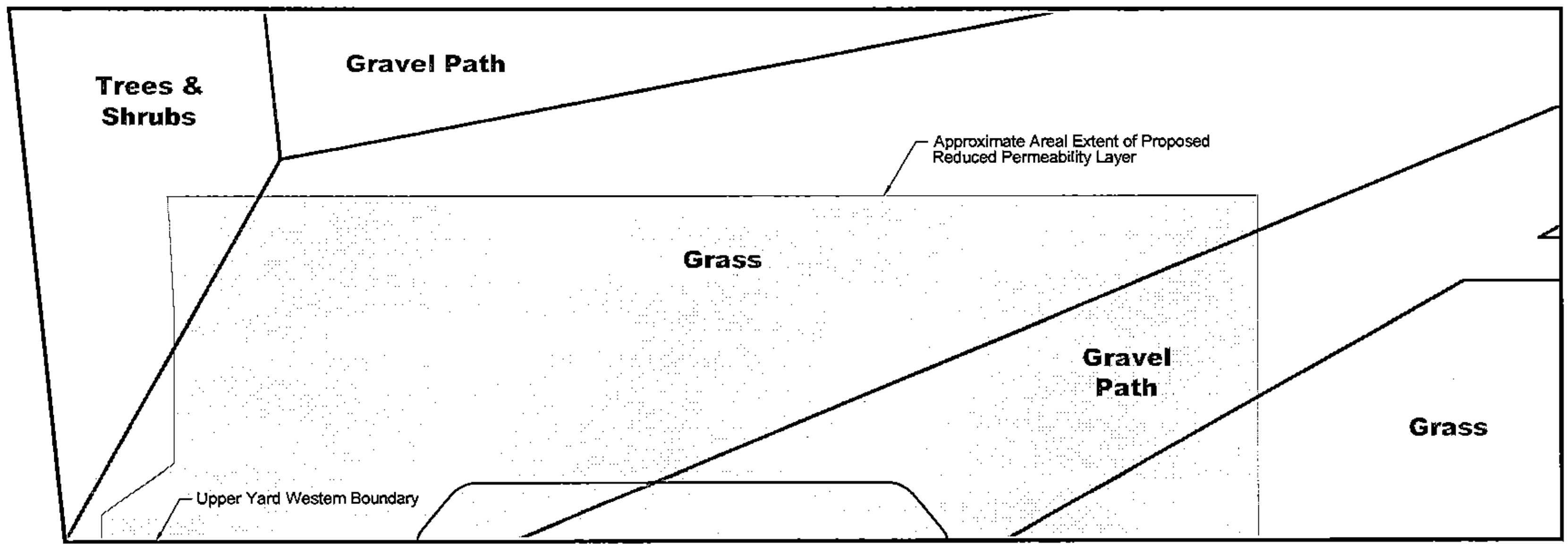
Plan and Section Views of Proposed Reduced Permeability Layer - Upper Yard
Seattle Art Museum / Olympic Sculpture Park
Seattle, Washington

DATE:	2/14/03
DESIGNED BY:	DAH
DRAWN BY:	SDM
REVISED BY:	

PROJECT NO. 020118

FIGURE NO. 4

P:\SAM\Drafting\020118-02.dwg



Elevations are based on SEANET Datum

Legend

(outline symbol)	Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg
Grass	Finished Surface Designation *(assumed for purposes of infiltration analysis)*

Aspect consulting
IN-DEPTH PERSPECTIVE
179 Madrone Lane North, Bainbridge Island, WA 98110, (206) 780-9370
811 First Avenue #480, Seattle, WA 98104, (206)-328-7443

Proposed Finished Park Surfaces in Area of Potential Infiltration Concern - Upper Yard

Seattle Art Museum / Olympic Sculpture Park

Seattle, Washington

DATE:	2/14/03	PROJECT NO.	020118
DESIGNED BY:	DAH	FIGURE NO.	5
DRAWN BY:	SDM		
REVISED BY:			

P:\SAM\Drafting\020118-02.dwg

MEMORANDUM

Project No.: 020118-001-05

March 19, 2003

To: Lori Herman and Dave Heffner

From: Owen Reese

Re: **Infiltration Analysis for Olympic Sculpture Park Upper Yard**

This Memorandum evaluates the change in the water balance resulting from filling and grading changes in the northwest corner of the Upper Yard of the Olympic Sculpture Park in Seattle, Washington. Consideration of the infiltration to groundwater component of the water balance is important because contaminated soils are present in the subsurface. Conceptually, water infiltrating from the surface could mobilize residual contaminants, resulting in increased risk to human health and/or the environment.

To prevent mobilization of contaminants, the Cleanup Action Plan describes a reduced permeability cap for this portion of the Upper Yard. In addition to including such a cap, the park design will incorporate surface grading and drainage features that promote runoff, and vegetation to enhance evapotranspiration, thereby reducing infiltration above the cap. This memorandum evaluates the water balance in this portion of the Upper Yard with respect to pre-development versus post-development conditions.

This memorandum is a revised version of the February 24, 2003 memorandum. The revisions primarily result from reanalysis of the water balance to incorporate the expansion of the area of concern and minor changes to the landscaping plan (Sheet L101 in the 60% design submittal).

Site Description

The area of concern in the northwest corner of the Upper Yard is a rectangle with north-south and east-west dimensions of approximately 250 feet and 90 feet, respectively. The western edge of the rectangle corresponds with the Upper Yard's western boundary, and its northern edge corresponds with the Upper Yard's northern boundary.

Existing Conditions

The area of concern has been subject to remedial activities consisting of soil removal. It is currently excavated below the grade of the adjacent street and surrounding areas of the Upper Yard, forming a closed depression or bowl that does not allow runoff to escape. The area is bare soil and/or vegetated with a poor grass cover. Native soils are silty sands and gravels. The native soils are overlain by loosely compacted fill comprised of silty and non-silty sand and gravel.

Proposed Development
The proposed remedy for the northern portion of the Upper Yard includes placing up to 33 feet of additional fill, constructing a retaining wall for a pedestrian bridge over Elliott Avenue to the west, and a gravel path which diagonally crosses the southwest portion of the area of concern. The remaining area is largely landscaping consisting of sod, hydroseeded meadow, and trees and shrubs. Surface runoff from the area of concern is routed to a pond and stormwater detention system immediately to the East.

Water Balance Approach
The water balance for the site can be represented as:

Infiltration = Precipitation - Runoff - Evapotranspiration.

Using standard methods for predicting precipitation, runoff, and evapotranspiration, we estimated the fraction of water infiltrating under existing and proposed conditions. Water balance results are shown in Table A-1.

Table A-1 - Water Balance Results

Upper Yard Scenario	Precipitation	Runoff	Evapo-transpiration	Infiltration
Pre-developed	38.3	0	15.4	22.9
Post-developed	38.3	18.3	11.5	8.5
Percent Change	0%	N/A	-25%	-63%

Notes:
1. Average annual precipitation at SeaTac Airport (1931 to 2001)
2. Average annual runoff from 50 years of simulation with KCRTS (1948 to 1998)
3. Average annual evapotranspiration from 50 years of simulation with HELP3
4. Calculated as Infiltration = Precipitation - Runoff - Evapotranspiration

The methods used for predicting precipitation, runoff, and evapotranspiration are discussed in individual sections below.

Precipitation
The historical precipitation record from SeaTac Airport was used as an approximation for precipitation at the site. This is the closest long-term weather station and is often used for hydrologic modeling in western King County. The precipitation presented in Table A-1 represents the annual average precipitation from 1931 to 2001 at SeaTac Airport.

We also examined other potential sources of water to the site including lateral inflow and irrigation. Lateral inflow of surface water is not a component of the water balance because no surface water run-on occurs.

The water balance does not include landscape irrigation during the summer months. If irrigated properly, most of the applied water should be used in evapotranspiration. However, over irrigation could result in runoff and/or increased infiltration. The Landscape Irrigation

Plan (Sheet L102 of the 100 % Schematic Design) calls for irrigation targeted to the type of vegetation using rotors, sprayheads, and bubblers driven by moisture sensors and a programmable controller. We assumed that the increase in infiltration due to landscape irrigation was negligible, or offset by the conservative assumptions made for evapotranspiration.

Runoff

The King County Runoff Time Series (KCRTS) model version 4.42b was used to estimate runoff from the developed conditions (cleanup action) scenario. KCRTS is the model currently required by the County for estimating runoff and designing stormwater systems for most land use development proposals. The model was developed by the County based on simulations of typical local soils from a more complex model, Hydrologic Simulation Program Fortran (HSPF) developed by the USGS.

HSPF simulates the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams and well-mixed impoundments on an hourly (or shorter) timestep for extended periods. HSPF uses continuous rainfall and other meteorologic records to compute streamflow hydrographs. HSPF simulates interception soil moisture, surface runoff, interflow, base flow, snowpack depth and water content, snowmelt, evapotranspiration, groundwater recharge, channel routing, and reservoir routing.

KCRTS uses the runoff timeseries from HSPF to predict runoff from a site development scenario based primarily on the acreage of each land type. Land types are a combination of the soil type (outwash, till, impervious or wetland) and vegetative cover (forest, pasture and grass). The areas and land types used in KCRTS modeling are shown in Table A-2. The area takeoff calculations are included as Attachment A-1.

Table A-2 - Areas Used in Runoff Model

Upper Yard Scenario	Area in sf	Area in ac	KCRTS Land Type
Sod and Hydroseed	13,810	0.32	Till Grass
Trees and Shrubs	2,550	0.06	Till Forest
Gravel Path	5,375	0.12	Impervious

We modeled the fill material brought to the site as till, assuming that it would have some fines content because of its non-structural nature and the large quantity required. Outwash soils are highly permeable sands and gravels, and are generally too valuable to use as non-structural fill. This assumption is consistent with KCRTS guidance.

The other main input to KCRTS is precipitation. For the Olympic Sculpture Park, we used the SeaTac Airport precipitation record.

KCRTS was not used to estimate runoff from the existing condition because the area of concern is currently excavated to form a closed depression from which no runoff can escape. Water instead ponds on the ground surface and infiltrates and evaporates over time.

Evapotranspiration
Infiltration modeling was previously done for a portion of the Upper Yard using the Hydrologic Evaluation of Landfill Performance version 3 (HELP3) model (results are provided in Appendix B of Hart Crowser's Supplemental Focused Feasibility Study, dated September 30, 1999). One component of that modeling effort was estimating evapotranspiration under the existing condition. HELP3 estimates evapotranspiration by calculating the potential evapotranspiration using a modification of the Penman equation and synthetic climatic data generated from the historical record at nearby weather stations (in this case, SeaTac Airport). An average annual evapotranspiration of 15.4 inches per unit area was predicted for the pre-developed scenario, based on 50 years of simulation.This is the value used in the current infiltration analysis.

The proposed developed scenario was assumed to have an average annual evapotranspiration of 11.5 inches per unit area in the current analysis, or 25 percent less than the pre-developed scenario. This reduction is based on two assumptions:

1) The gravel path, which covers approximately 25 percent of the total area in the developed scenario, loses no water to evapotranspiration; and
2) The park's grass cover will have a unit evapotranspiration rate equivalent to the pre-developed scenario.

In reality, a small amount of evaporation will occur from the gravel path. In addition, the grass cover in the developed scenario is expected to be more lush than in the pre-developed scenario, which should result in a greater unit evapotranspiration rate. Thus, the amount of infiltration may be overestimated in the developed scenario.

Conclusions
The grading and vegetation associated with park development is predicted to reduce infiltration by 63 percent within the area of concern in the Upper Yard, a significant reduction from the existing condition.

Attachment A-1 - Upper Yard Area Takeoff Calculations

S:\SAM\Infiltration Memo Upper Yard - Rev 1.doc

Attachment A-1

Aspect consulting
IN-DEPTH PERSPECTIVE

811 First Avenue, Suite 480
Seattle, WA 98104
(206) 328-7443 Telephone
(206) 838-5853 Fax

179 Madrone Lane North
Bainbridge Island, WA 98110
(206) 780-9370 Telephone
(206) 780-9438 Fax

Name: OWEN REESE Date: 3/19/03

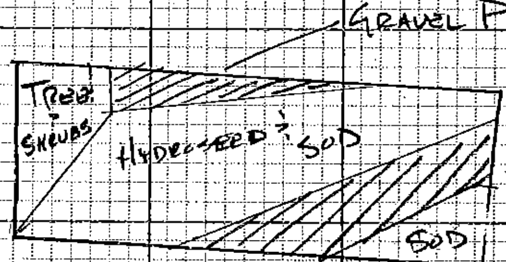
Project: SEATTLE ART MUSEUM Project No.: 020118-05

Subject: UPPER YARD AREA TAKEOFF CALCULATIONS

Reviewed by: D. Heffner 3/24/03

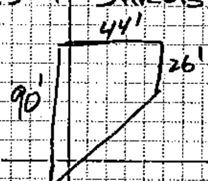
UPPER YARD -

DETERMINE AREAS OF EACH KCRTS LANDTYPE IN AREA OF CONCERN - I.E. AREA WHERE INFILTRATING SURFACE WATER COULD POTENTIALLY REACH CONTAMINATED SOILS.



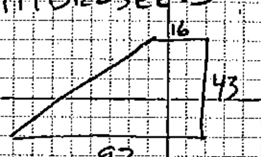
TOTAL AREA = 88' x 247' = 21,736 SF

TREES & SHRUBS

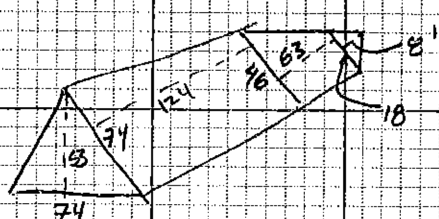


AREA = ½ (90+26) x 44 = 2552 SF

HYDROSEED & SOD



AREA = ½ (16+92) x 43 = 2322 SF



AREA = ½ 74 x 53 = 1961 SF
+
½ (46+74) x 124 = 7440 SF
+
½ (46+18) x 63 = 2016 SF
+ ½ 8 x 18 = 72 SF

11,489 SF

Aspect consulting
IN-DEPTH PERSPECTIVE

811 First Avenue, Suite 480
Seattle, WA 98104
(206) 328-7443 Telephone
(206) 838-5853 Fax

179 Madrone Lane North
Bainbridge Island, WA 98110
(206) 780-9370 Telephone
(206) 780-9438 Fax

Name: Owen Reese Date: 3/19/03

Project: Seattle Art Museum Project No.: 020118-05

Subject: Upper Yard Area Takeoff Calculations

Reviewed by: D. Heffner 3/24/03

Gravel Path

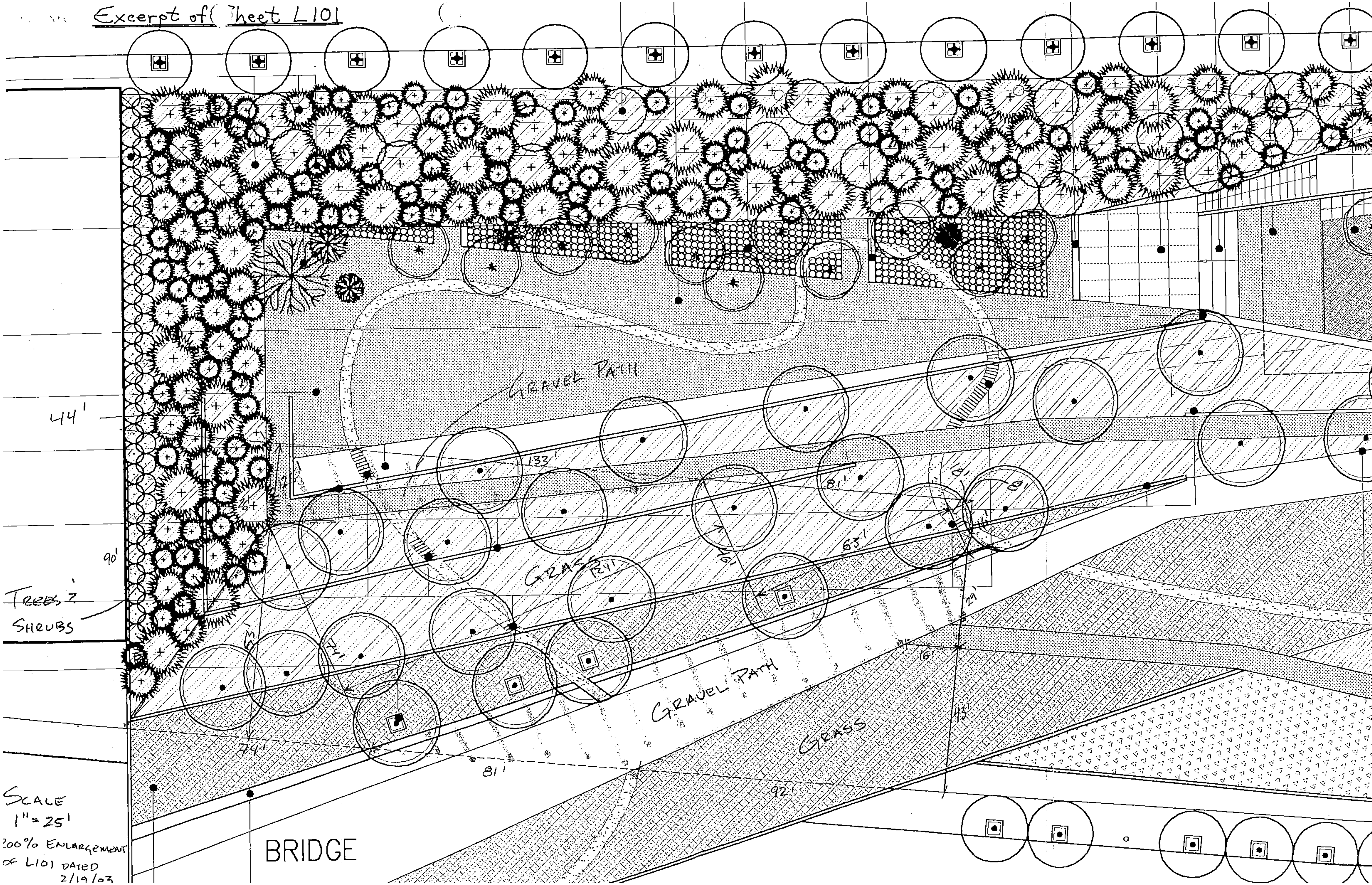
Calculated by Difference

Total = 21,736

Gravel Path = 21,736 − 11,489 − 2,552 − 2322

= 5,373 sf

Excerpt of Sheet L101



Scale 1" = 25'
200% Enlargement of L101 dated 2/19/03