Parametrix, Inc. *Consultants in Engineering and Environmental Sciences*

5808 Lake Washington Blvd. NE, Suite 200, Kirkland, WA 98033-7350
425-822-8880 • Fax: 425-889-8808

TRANSMITTAL FORM

To: **Muffy Walker**
P.O. Box 3755 (98124-3375)
U.S. Army Corps of Engineers
4735 E. Marginal Way S.
Seattle, Washington 98134-2385

Date: **November 2, 2001**
Project Number: **556-2912-001-03**
Project Name: **STIA MPU Natural Resource Mitigation**

We are transmitting the following materials:

Responses to ACOE Questions on 26 October 2001 Submittals

Comments:

Attached is the information you requested of the Port on October 31, 2001.

Please call if you have any questions.

These are:
- ☐ PER YOUR REQUEST
- ☒ FOR YOUR INFORMATION
- ☐ FOR YOUR REVIEW AND APPROVAL
- ☐ FOR YOUR FILES
- ☐ FOR YOUR ACTION

Sent Via:
- ☐ U.S. MAIL
- ☒ COURIER
- ☐ EXPRESS OVERNIGHT
- ☐ OTHER – INTEROFFICE
- ☐ HAND DELIVERY/PICK UP

Sincerely,

cc: Elizabeth Leavitt, Port of Seattle

AR 026273

Jim Kelley, Ph.D.

RESPONSE TO ACOE QUESTIONS ON 26 OCTOBER 2001 SUBMITTALS

November 2, 2001

Parametrix, Inc.
Jim Kelley

1. The air photo and overlay previously provided are correct. As stated in the submittal (page 2, Item 4), the air photo was taken in 1980 when the area was in residential use. Wetlands do indeed occur where some houses once stood. I am providing a 1990 photo and overlay which also shows that many houses are present, a few where wetlands are present. The scale of these photos is 1 inch equals about 400 feet. Regarding Wetland B14, it was surveyed and mapped as occurring partially in a street right of way (see overlay and other wetland maps). The air photo shows that about 10 years ago 2-3 houses were once located in the area that is now wetland. A 1964 air photo of Borrow Area 4 is also provided.

2. The Miller Creek basin (excluding the Walker Creek sub-basin is about 5,140 acres in size. The Walker Creek sub-basin is about 540 acres in size. The Des Moines Creek basin is about 3,750 acres. Tables 2 and 3 of the *Cumulative Impact* Supplemental Information previously provided to the Corps (also attached) provides King County GIS Land Use information for the watersheds.

Wetlands are included in the land use data values.

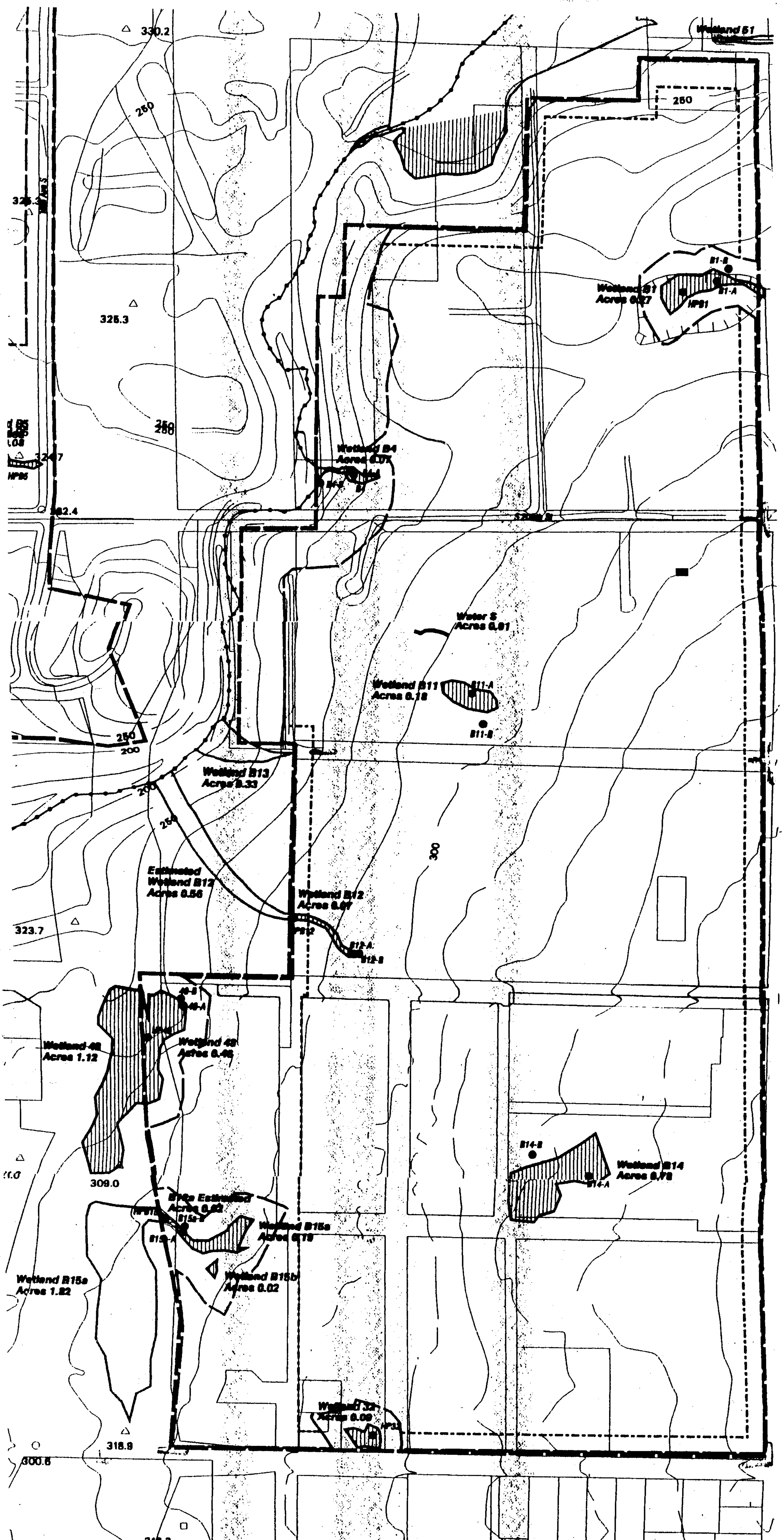
3. The Low-Flow analysis addresses impacts to Walker Creek, and a low flow vault is planned to mitigate low flow impacts. Infiltration has been evaluated and included where feasible. For Pond F, in the Walker Creek Basin, soil conditions were found to be unsuitable for infiltration (see attached memorandum by Hart Crowser (May 23, 2001).

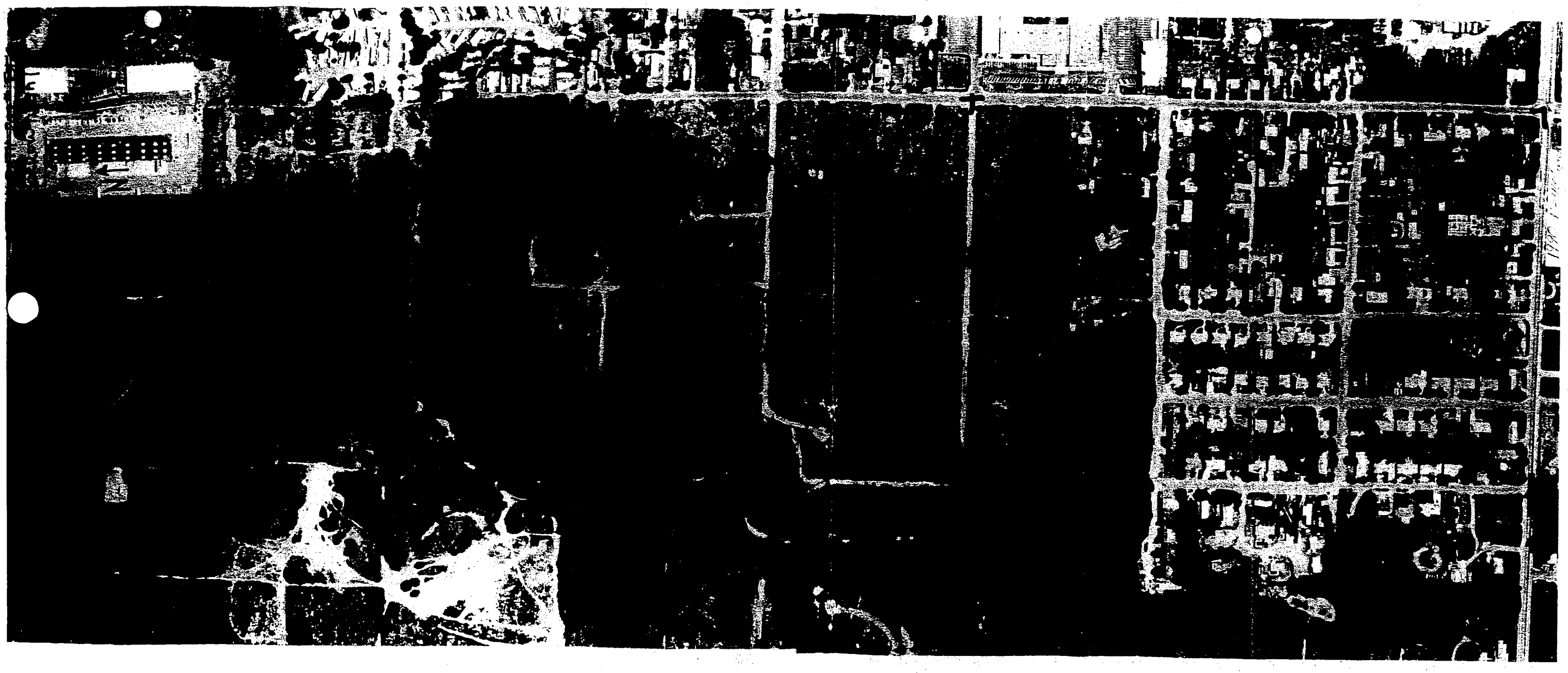
4. The requested information is provided in the table below. For Miller Creek, this accounts for several wetlands and lakes that are upstream of the Port's study area, as well as wetland restoration at Vacca Farm, Lora Lake, and the Des Moines Way Nursery. For Des Moines Creek, it includes Bow Lake and Wetland B of the WSDOT SR509 studies. The analysis includes both temporary and permanent impacts. Restoration also accounts for the fact that temporary impact areas will be restored. A table providing more detailed analysis is attached.

Wetland/Open Water	Miller Creek	Walker Creek	Des Moines Creek
Current Acres	111.08	37.50	101.57
With Project Acres	106.58	35.97	97.68
Percent Change	-4.0%	-3.3%	-3.8%

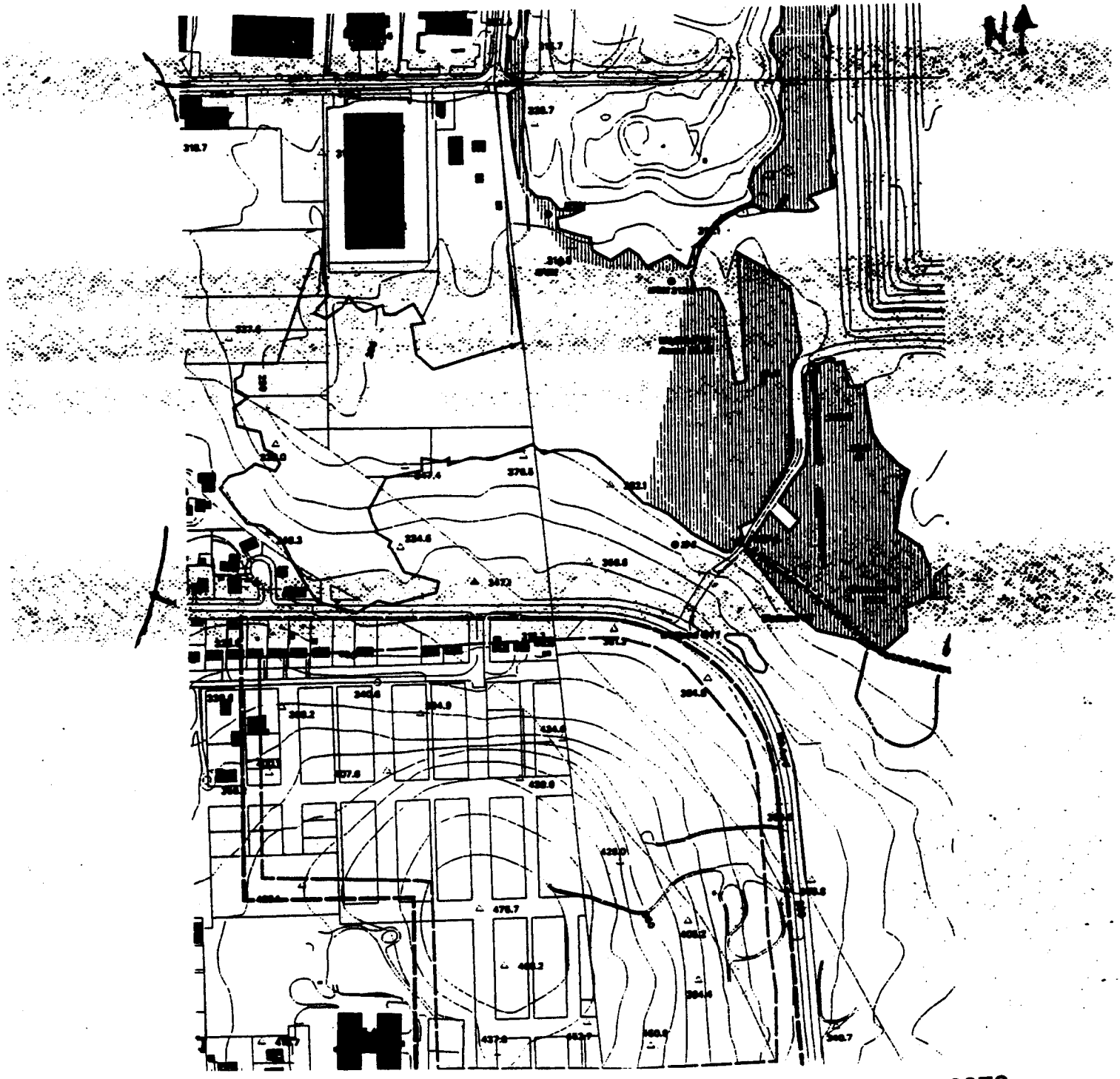
5. Per discussion at previous meetings, the presence of cattail is a concern only at the mitigation site in Auburn, because other mitigation sites are designed to be shrub or forested wetlands that would be too shaded for cattail. The performance standards for the Auburn site (Table 7-7.1) require less than 10 percent cover of emergent areas by cattail.

6. Page 6-5 containing Table 6-2 from the SMP is attached.

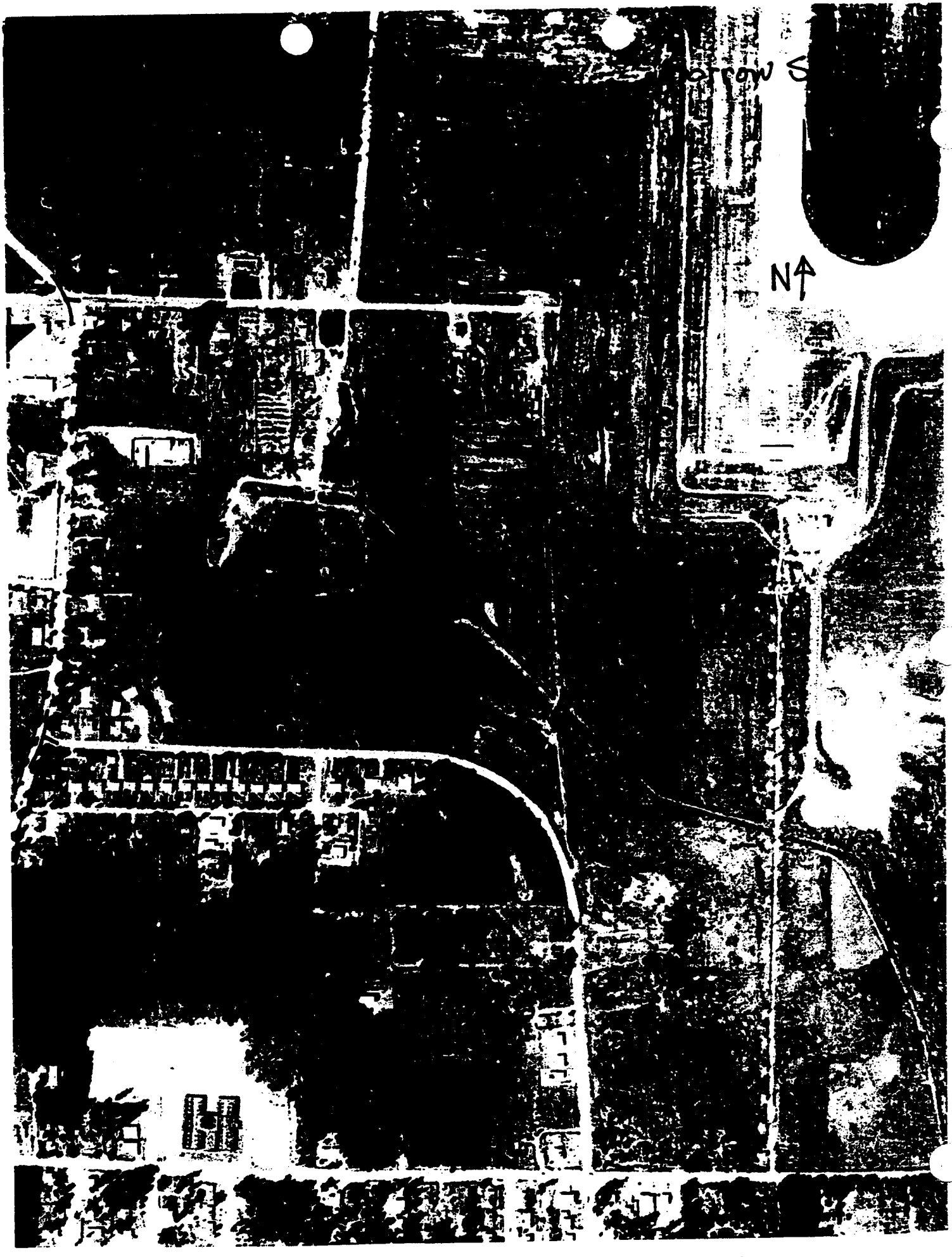

Wetland B1
Acres 0.27
Wetland B4
Acres 0.07
Water S
Acres 0.81
Wetland B11
Acres 0.18
Wetland B13
Acres 0.33
Estimated
Wetland B12
Acres 0.56
Wetland B12
Acres 0.07
Wetland 48
Acres 1.12
Wetland 49
Acres 0.46
Wetland B14
Acres 0.78
B15a Estimated
Wetland B15a
Wetland B15b
Acres 0.02
Wetland B15a
Acres 1.82
Wetland 32
Acres 0.09
330.2
325.3
323.7
309.0
318.9
300.6
318.3
322.4
250
200
300



BORROW SITE 4



AR 026278



AR 026279

Table 2. Current land uses (1995) in the Miller Creek watershed.

Land Cover Description	Area (Mi^2)	Area (Acres)	% Watershed
Industrial & Commercial	1.074	687.36	12.10
Bare Rock/Concrete	0.044	28.29	0.50
City Center, Industrial	0.502	321.20	5.65
Recently Cleared	0.059	37.81	0.67
High-Density Residential	3.431	2,195.82	38.64
Subtotal	*5.11*	*3,270.48*	*57.56*
Low/Medium Density Residential	**2.516**	**1,610.39**	**28.34**
Conifer - Early	**0.002**	**1.54**	**0.03**
Conifer - Mature	**0.000**	**0.00**	**0.00**
Conifer - Middle	**0.000**	**0.00**	**0.00**
Deciduous Forest	**0.669**	**428.46**	**7.54**
Mixed Forest	**0.093**	**59.61**	**1.05**
Grass - Brown	**0.236**	**150.92**	**2.66**
Grass - Green	**0.095**	**60.54**	**1.07**
Shrub	**0.108**	**69.21**	**1.22**
Open Water	**0.049**	**31.57**	**0.56**
Subtotal	*3.768*	*2,412.24*	*42.47*
TOTAL	8.879	5,682.71	100

Notes: Data compiled from King County Geographic Information System (GIS) data set based on 1995 Landsat satellite imagery.

Land uses listed in **bold** are types that are considered to provide low (residential and grass) to moderate or high (remaining types) habitat value to a variety of wildlife (see Chapter 5).

Table 3. Current land uses (1995) in the Des Moines Creek watershed.

Land Cover Description	Area (Mi^2)	Area (Acres)	% Watershed
Industrial & Commercial	1.373	878.47	23.43
Bare Rock/Concrete	0.056	35.71	0.95
City Center, Industrial	0.600	384.14	10.25
Recently Cleared	0.135	86.37	2.30
High-Density Residential	1.415	905.54	24.16
Subtotal	*3.579*	*2290.23*	*61.09*
Low/Medium Density Residential	**1.043**	**667.67**	**17.81**
Conifer - Early	**0.001**	**0.93**	**0.02**
Conifer - Mature	**0.000**	**0.00**	**0.00**
Conifer - Middle	**0.000**	**0.00**	**0.00**
Deciduous Forest	**0.567**	**362.84**	**9.68**
Mixed Forest	**0.067**	**42.61**	**1.14**
Shrub	**0.099**	**63.30**	**1.69**
Grass - Brown	**0.369**	**236.45**	**6.31**
Grass - Green	**0.114**	**73.02**	**1.95**
Open Water	**0.018**	**11.74**	**0.31**
Subtotal	*2.278*	*1458.56*	*38.91*
TOTAL	5.857	3,748.77	100

Note: Data compiled from King County Geographic Information System (GIS) data set based on 1995 Landsat satellite imagery.

Land uses listed in bold are types that are considered to provide low (residential and grass) to moderate or high (remaining types) habitat value to a variety wildlife (see Chapter 5).

Changes in wetland and aquatic habitat areas in the Miller, Walker, and Des Moines Creek basins.

Watershed and Sub-Area	Area	Impact	Restoration
Miller Creek Basin			
Arbor Lake	3.7	0.00	0.00
Lake Burien	30	0.00	0.00
Riparian wetlands near S. 144th Way	2.00	0.00	0.00
Tub Lake Peatland/N. SeaTac Park Wetlands	21.01	0.00	0.00
North Employee Parking Lot Wetlands 1,2	0.81	0.00	0.00
Des Moines Way Nursery	0.86	0.00	2.00
Runway Safety Areas/North End	27.84	2.75	0.40
Vacca Farm Mitigation	8.07	0.00	6.60
Miller Creek Riparian	1.05	1.05	0.03
Third Runway Embankment	15.74	11.03	1.2
Total	**111.08**	**14.83**	**10.23**
Net Change: -4.5 acres 4.0%			
Walker Creek Basin			
Wetland 43	33.43	0.00	0.00
Wetland 44	3.08	0.54	0.28
Miscellaneous	0.99	0.99	0.00
Total	**37.5**	**1.53**	**0.28**
Net Change: -1.25 acres 3.3%			
Des Moines Creek Basin			
WSDOT Wetland B	6.60	0.00	0.00
Bow Lake Wetlands	25	0.00	0.00
SASA Area	7.22	2.95	0.17
Borrow Areas	24.24	1.04	0.00
Tyee Valley Golf Course	38.51	0.07	0.00
Total	**101.57**	**4.06**	**0.17**
Net Change: -3.89 acres 3.8%			
PROJECT TOTAL	**250.15**	**20.42**	**10.68**
Net Change 9.74 acres 3.9%			

Table 6-2. Summary of required detention facility volumes.

Watershed	Hydrologic Evaluation Point	Volume Required (acre-ft)	Type of Facility[a]	Comments
Miller Creek	NEPL	13.9[b]	Vault	In addition to existing 4 acre-ft
	CARGO	4.5	Vault	
	SDN2x + SDN4x	14.9	Vault	
	SDN3/3x	25.6	Vault	
	SDN1	5.6	Vault	
	SDN3A	Pond: 14.8 / Vault: 7.0	Pond/Vault	
	SDW1A	Pond: 25.5 / Vault: 7.4	Pond/Vault	Infiltration used
	SDW1B	38.3	Pond	Infiltration used
Total Miller Creek		**157.5**		
Walker Creek	**SDW2**	**7.2**	**Pond**	
Des Moines Creek	SASA Detention Facility	33.4[c]	Pond	
	Interconnecting taxiway (SDS3A)	5.5	Vault	
	Third Runway South (SDS7 and 6)	21.6	Vault	
	SDS3	88.3	Vault	
	SDS4	12.9	Vault	
Total Des Moines Creek		**161.7**		

[a] Types of facilities: Vault – enclosure with multiple orifice outlets on vertical riser with overflow spillway; Pond – open earth construction with netting or other means to provide wildlife deterrent.

[b] Volume needed to retrofit existing facility.

[c] Retrofit STIA area only.

Current modeling presents a more comprehensive evaluation of the potential low stream flow impacts in Miller, Des Moines and Walker Creeks from the planned STIA improvements. The *Low Streamflow Analysis for Seattle-Tacoma Master Plan Update* (Earth Tech 2000) contains detailed information and references for this work. In summary, the HSPF model was first used to evaluate the expected low flow conditions during August and September in the three creeks based on a) 1994 conditions, and b) proposed conditions following all planned improvements at STIA in 2006. However, the following additional factors were also considered to assess the total potential impact of the planned STIA improvements:

HARTCROWSER
Delivering smarter solutions

Anchorage

MEMORANDUM

Boston

DATE: May 23, 2001

TO: Jim Thomson, HNTB

FROM: Michael Kenrick and Robert Middour, Hart Crowser Inc.

Chicago

RE: **Sea-Tac Third Runway Project**
Infiltration Feasibility at Pond F (Walker Creek Basin)
4978-06

CC: Tom Atkins, Parametrix

Denver

Summary

This memo describes field investigations performed by Hart Crower at the site of stormwater detention Pond F to determine the feasibility of stormwater infiltration. Three borings were drilled to the proposed depth of the pond; the material encountered was dense glacial till. The holes appeared dry, so water was added (as prescribed in the EPA percolation test method) to presoak the ground overnight. However, measurements made the following morning indicated more water had accumulated in the holes, showing saturated conditions in the till at this depth. The infiltration tests were abandoned because stormwater infiltration directly from Pond F is not feasible in these conditions.

Consideration also was given to the feasibility of shallow infiltration trenches constructed to the north of the pond. However, soil samples taken at a depth of 5 feet in each of the three borings revealed mottling indicative of shallow seasonal saturation, and weathered till overlying unweathered till was present within 5 to 8 feet of the surface. These conditions do not meet King County (1998) requirements for shallow infiltration facilities, so no further testing was performed.

Fairbanks

Jersey City

Juneau

Long Beach

Field Investigations

Portland

On April 25, 2001, investigative borings (designated HC01-B401, HC01-B402, and HC01-B403) were advanced east and northeast of the partially completed Pond F (see Figure 1). These three explorations revealed a surficial layer of silty, fine to medium sand approximately 5 feet thick overlying a dense to very dense, silty, gravelly, fine to coarse sand

Seattle

1910 Fairview Avenue East
Seattle, Washington 98102-3699
Fax 206.328.5581
Tel 206.324.9530

(glacial till) that was consistent down to the end of the borings (approximately 25 to 30 feet below ground surface). Water-bearing zones were not observed during drilling.

Down-hole percolation tests (EPA Falling Head Percolation Test Procedure - EPA 1980) were set up in three borings to test the infiltration capacity of soils at the base elevation of the proposed Pond F. The infiltration testing apparatus was set up in accordance with the EPA procedure. Four gallons of clean water were added to presoak the soils at the base of each hole. After presoaking the boreholes overnight, measured water levels were higher than those from the previous day.

Subsequent water-level monitoring revealed stabilized water levels (Table 1) that indicate saturated conditions within the glacial till. Note that the measured water levels do not form a consistent water table as such, but appear to be dependent on the depth of the individual borehole. These observations are consistent with a steep downward hydraulic gradient within the thick layer of low-permeability glacial till in this area. This hydraulic gradient is in equilibrium with natural infiltration and is not a true perched groundwater condition. Regional groundwater levels in the shallow regional (Qva) aquifer are around 260 feet elevation, well below the static water levels measured in the Pond F boreholes (AESI, 1999).

Conclusions

Three factors negate the feasibility of stormwater infiltration at or in the vicinity of Pond F:

- The presence of thick glacial till at the base elevation of Pond F;
- Variably saturated conditions within the till; and
- Mottled appearance of shallow till soils beneath the surficial sand layer, suggesting seasonally high water levels.

Based on these findings, infiltration of stormwater at Pond F, either via the pond bottom or through shallow infiltration trenches located adjacent to the pond, is not feasible.

References

King County, 1998. King County Surface Water Design Manual, King County and Department of Natural Resources.

EPA, 1980. EPA Falling Head Percolation Test Procedure, Design Manual - Onsite Wastewater Treatment and Disposal Systems, EPA.

AESI, 1999. Seattle-Tacoma International Airport Ground Water Study, Associated Earth Sciences, Inc. and S. S. Papadopulos & Assoc.

Attachments:
Table 1 - Boreholes for Infiltration Feasibility at Pond F
Figure 1 - Site and Exploration Plan, Pond F
Appendix A - Exploration Logs

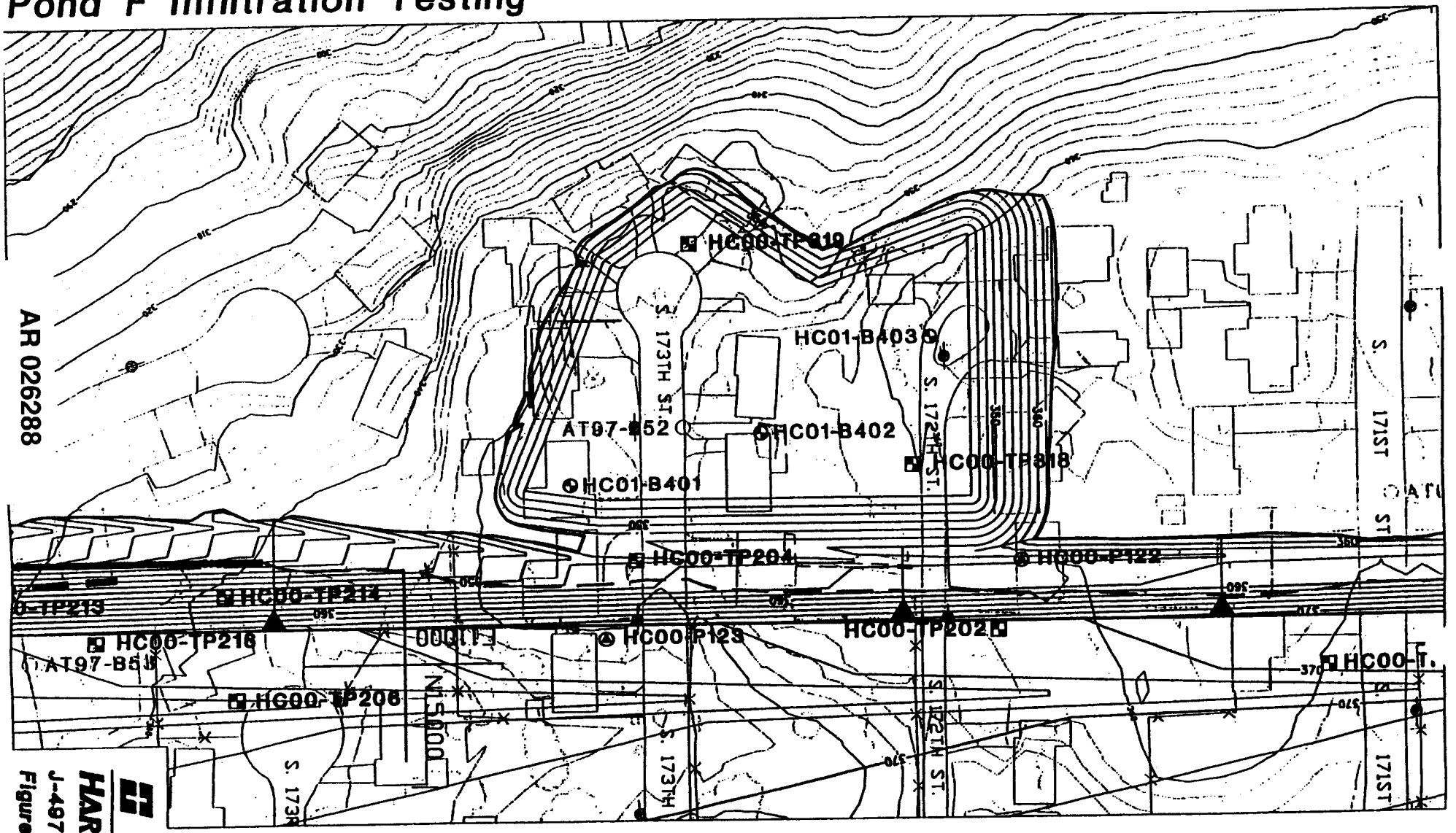
F:\Docs\Jobs\497806\PondFMemo.doc

Table 1– Boreholes for Infiltration Feasibility at Pond F

	GS Elevation in Feet	Borehole Depth in Feet	Borehole Bottom Elevation in Feet	Water Level Elevation in Feet
HC01-B401	349.6	19.8	329.8	331.4
HC01-B402	355.7	19.8	335.9	336.7
HC01-B403	361.7	24.8	336.9	340.6

RC 5/8/01 1=100 ...ee drawing file/charlie-8...80658

Pond F Infiltration Testing



AR 026288

Note: Base map prepared from drawing provided by HNTB entitled "X_TOPO0401.dwg", dated February 15, 2001. Wetlands delineations prepared from drawing provided by Parametrix entitled, "w_022201.dwg", dated February 22, 2001.

HC01-B403 ⊕ Approximate Boring Location and Designation

N

0 100 200

Scale in Feet

HARTCROWSER

J-4978-06 5/01

Figure 1

July 2001

APPENDIX A
EXPLORATION LOGS

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling Test Symbols

BORING SAMPLES

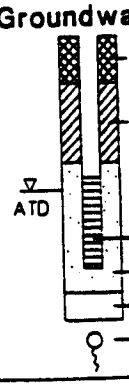
- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	In Situ Density Test



Groundwater Observations

1:1 A-1 STANDARD

HARTCROWSER

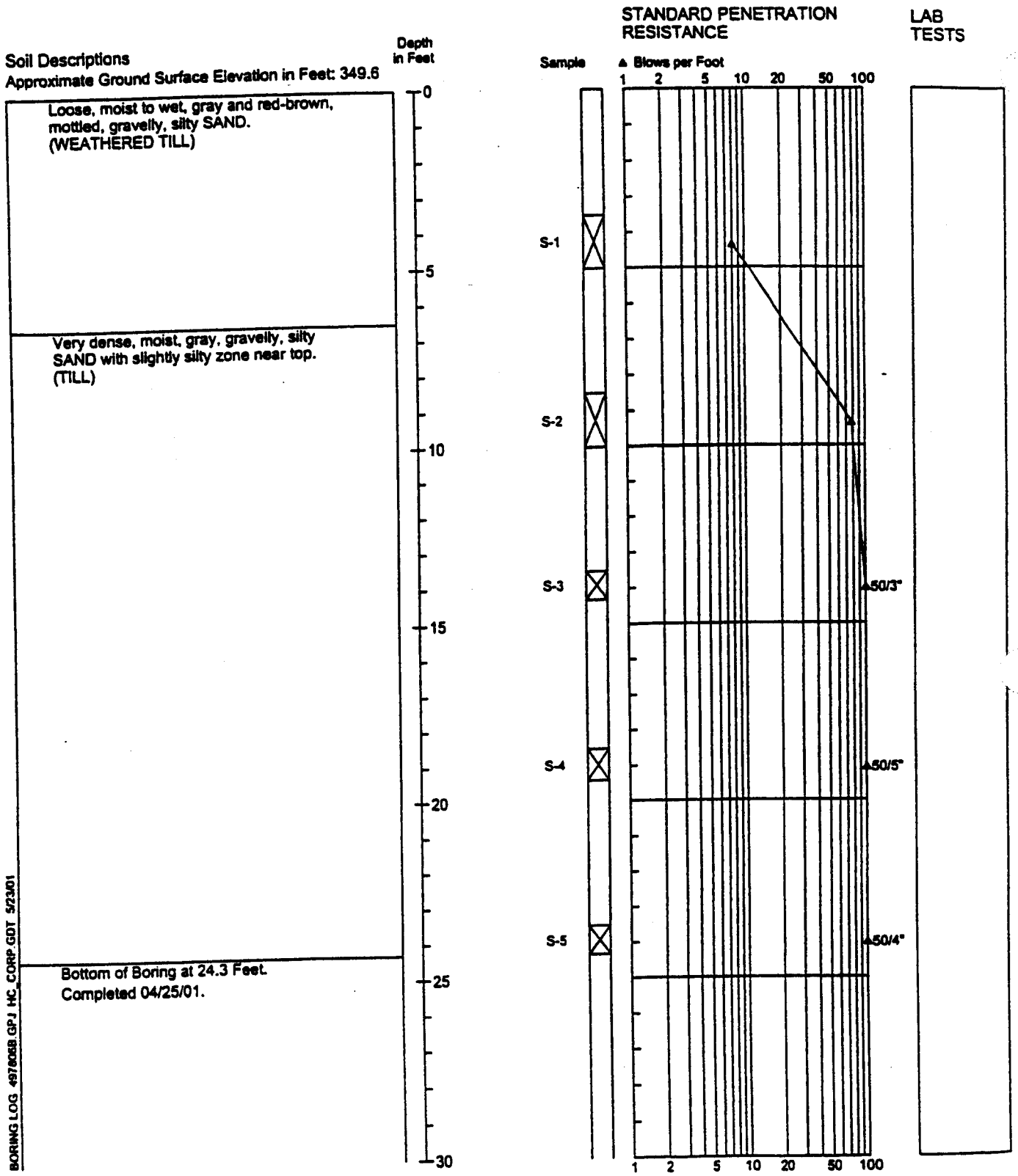
J-4978-06 5/01

AR 026290

Figure A-1 July 2001

556-2912-001 (28)

Boring Log HC0[illegible]3401



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

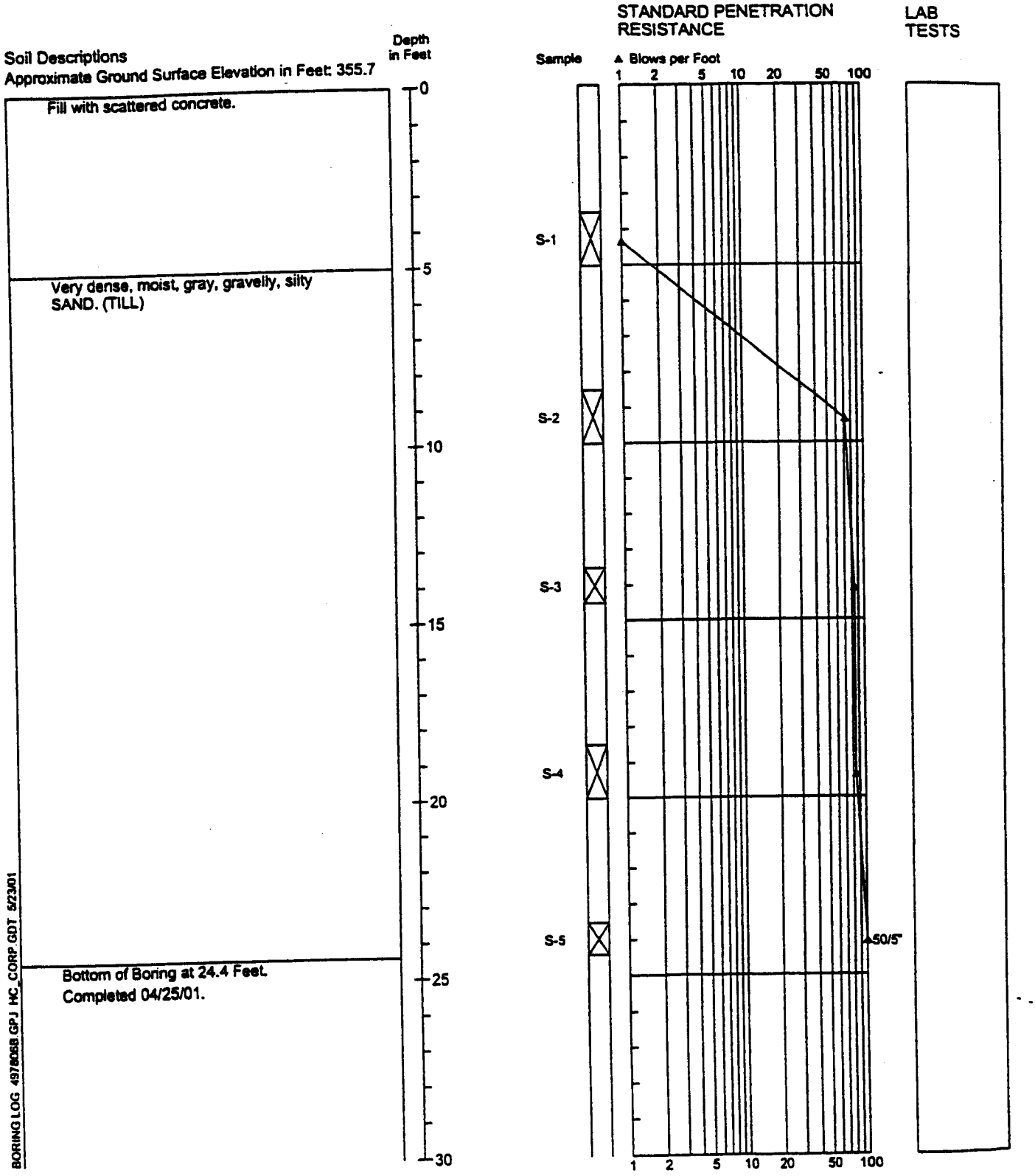
J-4978-06 04/01

Figure A-2

AR 026291

July 2001
556-2912-001 (28)

Boring Log HC0[illegible]3402



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

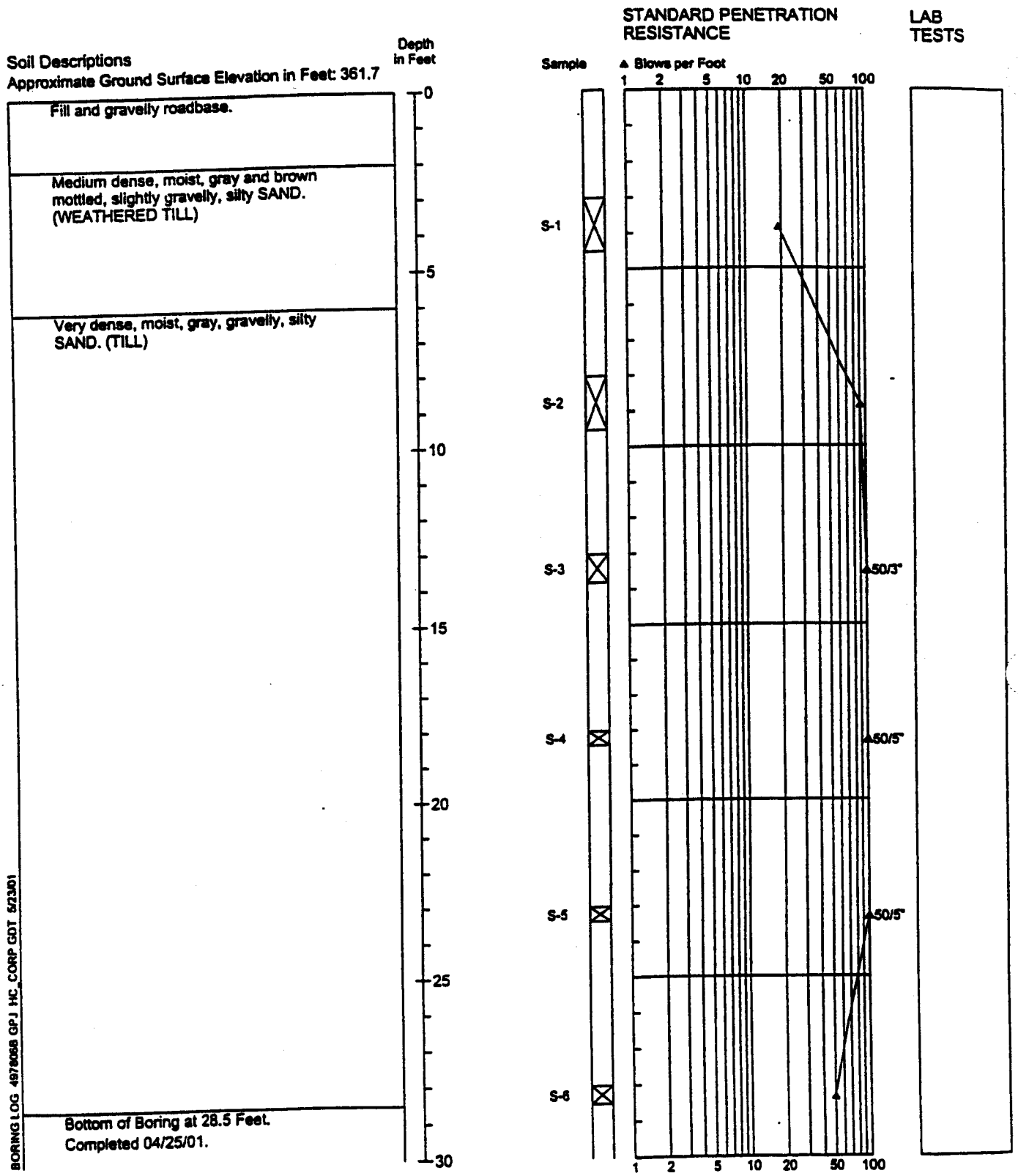
J-4978-06 04/01

Figure A-3 July 2001

556-2912-001 (28)

AR 026292

Boring Log HC01 :403



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

AR 026293

HARTCROWSER

J-4978-06 04/01

Figure A-4 July 2001

556-2912-001 (28)