

**PRELIMINARY
CONCEPTUAL DRAINAGE REPORT
FOR
AIRPARK INDUSTRIES, L.L.C.**

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Revised
RECEIVED

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CITY OF ARLINGTON

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TABLE OF CONTENTS

Introduction:.....	1
Summary of Results:.....	3
Basin Summaries:	10
Runoff Curve Number and Time of Concentration:	21
Detention Basin Design Data:.....	37
Drainage Area Map:.....	42
Geotechnical Report:	44

INTRODUCTION

The following report presents the design of a storm water detention system for the Airpark Industries, LLC industrial development. The proposed development includes the construction of a new 14,800 square foot industrial building with associated parking and approximately 20 acres of gravel surface for an auto storage and auction facility. The 40-acre project site is located south of State Route 531 along the east side of 51st Ave NE in the city of Arlington.

PRE DEVELOPED DRAINAGE CONDITIONS

The project site is partially developed with one existing house and some farm outbuildings. The site is regarded as a pasture and was utilized for agricultural and livestock purposes. There are approximately 4.0 acres of wetlands located mostly in the southern half of the property. The site drains from north to south to the existing wetlands. The topography of the site is flat with slopes between 0 to 2 percent. Edgecomb Creek parallels the east boundary of the property and a type 3 stream runs adjacent to sections of the north and west property lines. The type 3 stream is approximately 3 feet deep with an average 8-foot bottom width. The site consists of mostly Norma loam and Custer-fine sandy loam soils, which is in the hydrologic soil group D. The site is located within the Quilceda/Allen Watershed and is part of the Marysville aquifer recharge zone.

PROPOSED DRAINAGE CONDITIONS

Existing drainage patterns on the site will be maintained. The site has been separated into 5 different basins, with each individual basin having its own drainage facility and design.

Basin 1 is approximately 5.5 acres and consists of the industrial building and paved parking areas. The existing type 3 stream that runs parallel to the west boundary line will be shifted and stream habitat enhancement measures will be implemented. 12 feet of right-of-way dedication will facilitate the construction of additional travel lane, curb, gutter and sidewalk. The area from the back of sidewalk east to the proposed parking area will be utilized as an area for stream protection and enhancement. This area is not tributary to the remaining section of the basin. The new stream channel will have an 8-foot bottom width and 30 feet of buffer plantings on each side, which exceeds the required 25 feet. The thulwag of the stream will meander within the 8-foot bottom width. Runoff from the remaining portion of the basin will sheet flow to the southeast into the proposed detention facility. Runoff from the remaining portion of the basin will sheet flow to a series of catch basins and storm-drain pipes transporting water south into the proposed detention facility. The detention facility is located in the southwest section of the site and has an L-shaped configuration. The detention pond will have 2 feet of depth with 3:1 side slopes. The detention pond will release runoff into a proposed level spreader, which will disperse runoff into a vegetated water quality treatment area before discharging into the existing adjacent wetland buffer

Basin 2, which is approximately 6.4 acres, will drain to the south towards the second detention facility. The detention pond nearly spans the length of the basin and has a bottom width of 27.5 feet and a depth of 2 feet with 3:1 side slopes. Water quality is provided by the same treatment approach used in the Basin 1 detention facility. In addition, a 10-foot wide filter strip will surround the edge of the detention basin to provide further water quality measures. The filtered runoff will be discharged to the existing wetland buffer system.

Runoff from basin 3, which is approximately 2.2 acres, will flow towards the south into the third detention pond. The basin-3 detention pond has an irregular shaped configuration with 2 feet of storage and 3:1 side slopes. Runoff releases into a level spreader like the other basins and into a vegetated water quality treatment area before entering the adjacent, existing wetland buffer. A 10-foot filter strip will be used at the north edge of the detention basin.

Runoff from basin 4, which is approximately 13.8 acres, shall sheet flow north and south into the fourth detention facility located in middle of the basin. This pond, like the basin 2 detention pond, spans the length of the basin, but has a bottom width of 28 feet. A level spreader and vegetated treatment area that discharges to the existing wetland system supplies water quality. A 10-foot wide filter strip will encircle the detention facility to provide additional water quality.

Basin 5, which is approximately 3.7 acres, will drain towards the north, south and west into two separate detention facilities located above and below the isolated wetland. The southern detention basin has a bottom width of 18 feet and releases to a level spreader and then a vegetated water quality treatment area before discharging into the isolated wetland. The other detention pond is the same size and configuration with 2 feet of storage and 3:1 side slopes. It releases to a level spreader located along the east boundary line, where runoff is then dispersed to the east. The area to the east is part of the no disturbance area associated with the 150-foot proposed Edgecomb Creek buffer.

Approximately 36 acres of pasture farmland, which is just north of the property, is tributary to the site. Most of the runoff is infiltrated into the existing ground before reaching the subject property.

All of the detention systems were designed to release 2-year runoff at one-half the existing rate. In addition, the release rates for 10- and 100-year runoff were designed not to exceed the existing rates. A 50% factor of safety increase was applied to the storage volume of the individual detention facilities per Department of Ecology standards. The level spreaders and vegetated water quality treatment areas were designed in accordance for treating conventional pollutants.

The boundaries of the proposed drainage areas tributary to the detention facilities are delineated on the drainage area map at the end of this report. The "Waterworks" program with the Santa Barbara Unit Hydrograph (SBUH) Method and Type 1A rainfall distribution was used to design the proposed facilities.

SUMMARY OF RESULTS

Total Area of Project Site:	40.098 Acres
Less Right of Way Dedication:	0.184 Acres
Less Wetland, Buffer and Landscape Not Tributary to Basins:	9.044 Acres
Equals Total Retained Area (Basins 1-5):	30.870 Acres

PROPOSED DETENTION (BASIN NO.1)

Total Area Tributary to Detention Basin:	5.110 Acres
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2 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :	0.30cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}/2$:	0.15cfs
Peak Inflow to Detention Pond:	1.7 cfs
Proposed Release Rate:	0.15cfs
Design Water Surface Elevation:	120.45
Approximate Volume of Storage Required (Design Volume):	18,646 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):	27,969 cf

10 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :	0.69 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:	0.69 cfs
Peak Inflow to Detention Pond:	2.58 cfs
Proposed Release Rate:	0.49 cfs
Design Water Surface Elevation:	120.67
Approximate Volume of Storage Required (Design Volume):	21,396 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):	32,094 cf

100 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :	1.33 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:	1.33 cfs
Peak Inflow to Detention Pond:	3.78 cfs
Proposed Release Rate:	1.26 cfs
Design Water Surface Elevation:	120.87
Approximate Volume of Storage Required (Design Volume):	24,051 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):	36,076 cf

PROPOSED DETENTION (BASIN NO.2)

Total Area Tributary to Detention Basin: 6.040 Acres

2 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.38 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}/2$: 0.19 cfs
Peak Inflow to Detention Pond: 2.17 cfs
Proposed Release Rate:..... 0.17 cfs
Design Water Surface Elevation: 120.85
Approximate Volume of Storage Required (Design Volume): 24,306 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 36,459 cf

10 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.86 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 0.86 cfs
Peak Inflow to Detention Pond: 3.21 cfs
Proposed Release Rate:..... 0.55 cfs
Design Water Surface Elevation: 121.06
Approximate Volume of Storage Required (Design Volume): 28,107 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 42,160 cf

100 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 1.67 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 1.67 cfs
Peak Inflow to Detention Pond: 4.63 cfs
Proposed Release Rate:..... 1.34 cfs
Design Water Surface Elevation: 121.25
Approximate Volume of Storage Required (Design Volume): 31,490 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 47,235 cf

PROPOSED DETENTION (BASIN NO.3)

Total Area Tributary to Detention Basin: 2.180 Acres

2 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.13 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}/2$: 0.07 cfs
Peak Inflow to Detention Pond: 0.78 cfs
Proposed Release Rate: 0.07 cfs
Design Water Surface Elevation: 119.69
Approximate Volume of Storage Required (Design Volume): 7,123 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 10,684 cf

10 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.31 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 0.31 cfs
Peak Inflow to Detention Pond: 1.16 cfs
Proposed Release Rate: 0.19 cfs
Design Water Surface Elevation: 120.18
Approximate Volume of Storage Required (Design Volume): 10,029 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 15,043 cf

100 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.59 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 0.59 cfs
Peak Inflow to Detention Pond: 1.67 cfs
Proposed Release Rate: 0.51 cfs
Design Water Surface Elevation: 120.30
Approximate Volume of Storage Required (Design Volume): 10,762 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 16,143 cf

PROPOSED DETENTION (BASIN NO.4)

Total Area Tributary to Detention Basin: 13.830 Acres

2 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} : 0.83 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}/2$: 0.41 cfs
Peak Inflow to Detention Pond: 4.85 cfs
Proposed Release Rate: 0.41 cfs
Design Water Surface Elevation: 120.75
Approximate Volume of Storage Required (Design Volume): 55,137 cf
Approximate Total Volume of Storage Provided (150% of Design Volume): 82,705 cf

10 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} : 1.91 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$: 1.91 cfs
Peak Inflow to Detention Pond: 7.19 cfs
Proposed Release Rate: 1.10 cfs
Design Water Surface Elevation: 121.06
Approximate Volume of Storage Required (Design Volume): 68,952 cf
Approximate Total Volume of Storage Provided (150% of Design Volume): 103,428 cf

100 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} : 3.70 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$: 3.70 cfs
Peak Inflow to Detention Pond: 10.38 cfs
Proposed Release Rate: 2.27 cfs
Design Water Surface Elevation: 121.32
Approximate Volume of Storage Required (Design Volume): 80,321 cf
Approximate Total Volume of Storage Provided (150% of Design Volume): 120,481 cf

PROPOSED DETENTION (BASIN NO.5)

Total Area Tributary to Detention Basin: 3.340 Acres

2 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.23 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}/2$: 0.12 cfs
Peak Inflow to Detention Pond: 0.63 cfs
Proposed Release Rate: 0.11 cfs
Design Water Surface Elevation: 122.09
Approximate Volume of Storage Required (Design Volume): 5,404 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 8,106 cf

10 YEAR STORM

Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 0.53 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 0.53 cfs
Peak Inflow to Detention Pond: 1.16 cfs
Proposed Release Rate: 0.33 cfs
Design Water Surface Elevation: 122.22
Approximate Volume of Storage Required (Design Volume): 6,563 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 9,804 cf

100 YEAR STORM

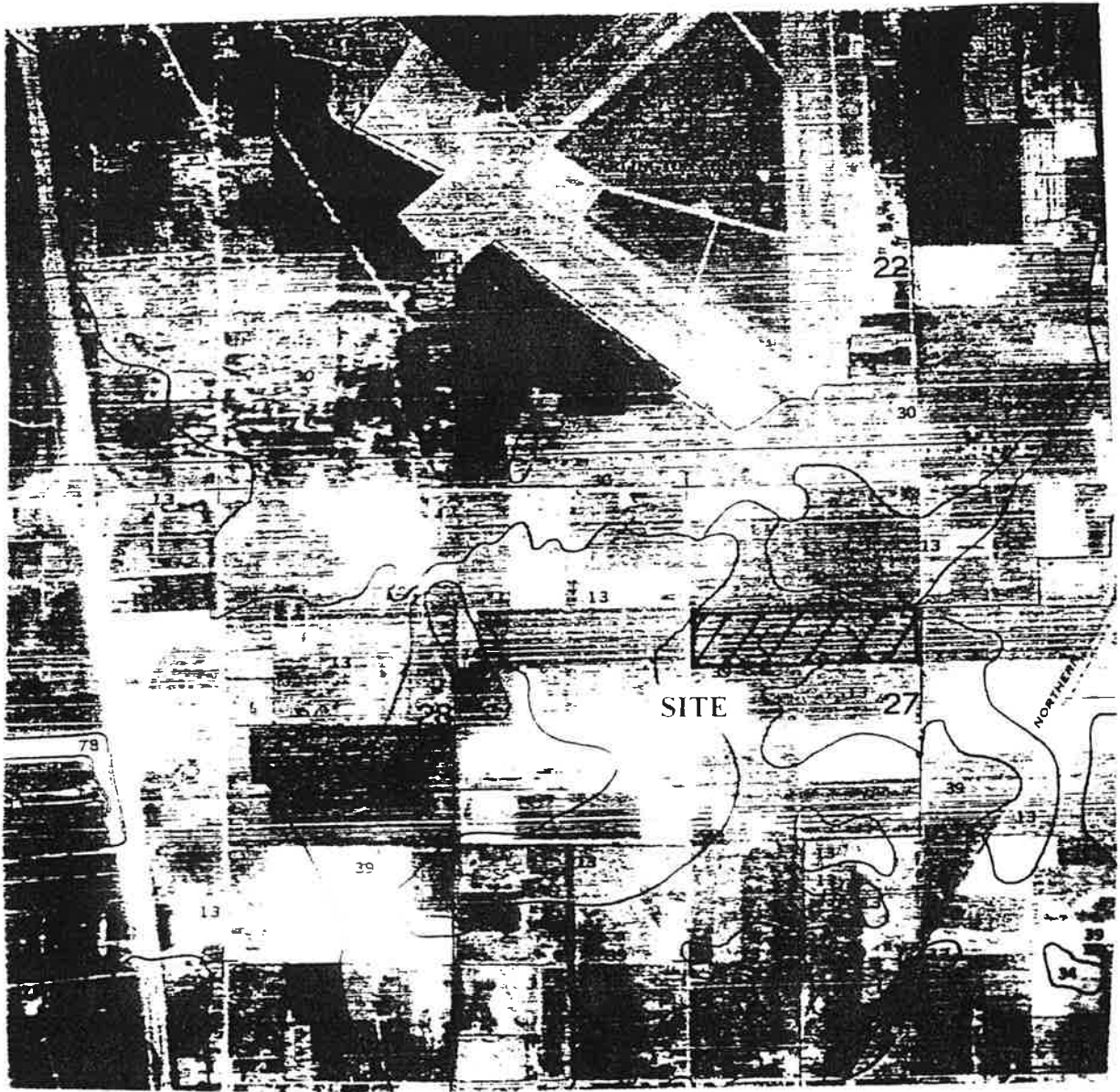
Peak Discharge for Pre Developed Conditions (Retained Area), Q_{ex} :..... 1.03 cfs
Allowable Release Rate From Detention System, $Q_r = Q_{ex}$:..... 1.03 cfs
Peak Inflow to Detention Pond: 1.94 cfs
Proposed Release Rate: 0.89 cfs
Design Water Surface Elevation: 122.38
Approximate Volume of Storage Required (Design Volume): 8,075 cf
Approximate Total Volume of Storage Provided (150% of Design Volume):..... 12,112 cf

**HISTORY OF HYDROGRAPH ACTIVITY
STORM ROUTINGS**

LPOOL 1 "POND 1 2YR STORM" 0.150000 B1DV002 STO-1 CMB-1 1									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 1 2YR STORM	0.15	1.70	STO-1	CMB-1	120.45	0.15	1	18645.99	cf
LPOOL 2 "POND 1 10YR STORM" B1EX010 B1DV010 STO-1 CMB-1 2									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 1 10YR STORM	0.69	2.58	STO-1	CMB-1	120.67	0.49	2	21396.18	cf
LPOOL 3 "POND 1 100YR STORM" B1EX100 B1DV0100 STO-1 CMB-1 3									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 1 100YR STORM	1.33	3.78	STO-1	CMB-1	120.87	1.26	3	24051.04	cf
LPOOL 1 "POND 2 2YR STORM" 0.190000 B2DV002 STO-2 CMB-2 4									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 2 2YR STORM	0.19	2.17	STO-2	CMB-2	120.85	0.17	4	24306.48	cf
LPOOL 2 "POND 2 10YR STORM" B2EX010 B2DV010 STO-2 CMB-2 5									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 2 10YR STORM	0.86	3.21	STO-2	CMB-2	121.06	0.55	5	28107.37	cf
LPOOL 3 "POND 2 100YR STORM" B2EX100 B2DV100 STO-2 CMB-2 6									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 2 100YR STORM	1.67	4.63	STO-2	CMB-2	121.25	1.34	6	31490.65	cf
LPOOL 1 "POND 3 YR STORM" 0.065000 B3DV002 STO-3 CMB-3 7									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 3 YR STORM	0.07	0.78	STO-3	CMB-3	119.69	0.07	7	7123.14	cf
LPOOL 2 "POND 3 10YR STORM" B3EX010 B3DV010 STO-3 CMB-3 8									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 3 10YR STORM	0.31	1.16	STO-3	CMB-3	120.18	0.19	8	10028.90	cf
LPOOL 3 "POND 3 100YR STORM" B3EX100 B3DV100 STO-3 CMB-3 9									
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume	
POND 3 100YR STORM	0.59	1.67	STO-3	CMB-3	120.30	0.51	9	10761.96	cf

LPOOL 1 "POND 4 YR STORM" 0.410000 B4DV002 STO-4 CMB-4 10								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 4 YR STORM	0.41	4.85	STO-4	CMB-4	120.75	0.40	10	55137.15 cf
LPOOL 2 "POND 4 10YR STORM" B4EX010 B4DV010 STO-4 CMB-4 11								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 4 10YR STORM	1.91	7.19	STO-4	CMB-4	121.06	1.10	11	68952.98 cf
LPOOL 3 "POND 4 100YR STORM" B4EX100 B4DV100 STO-4 CMB-4 12								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 4 100YR STORM	3.70	10.38	STO-4	CMB-4	121.32	2.27	12	80321.72 cf
LPOOL 1 "POND 5 YR STORM" 0.120000 B5DV002 STO-5 CMB-5 13								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 5 YR STORM	0.12	0.63	STO-5	CMB-5	122.09	0.11	13	5404.10 cf
LPOOL 2 "POND 5 10YR STORM" B5EX010 B5DV010 STO-5 CMB-5 14								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 5 10YR STORM	0.53	1.16	STO-5	CMB-5	122.22	0.33	14	6563.32 cf
LPOOL 3 "POND 5 100YR STORM" B5EX100 B5DV100 STO-5 CMB-5 15								
Description	MatchQ	PeakQ	Sto	Dis	PkStg	OutQ	hyd	Volume
POND 5 100YR STORM	1.03	1.94	STO-5	CMB-5	122.38	0.89	15	8075.74 cf

**RUNOFF CURVE NUMBER
TIME OF CONCENTRATION**



SOILS MAP

SCALE: 1" = 2,000'

Reference: Soil Survey of Snohomish County
 Sheet Numbers 15 and 16

Soil 1: Symbol: [Symbol] [Symbol] [Symbol]
 Symbol: [Symbol] [Symbol] [Symbol]

AIRPARK INDUSTRIES, LLC
RUNOFF CURVE NUMBER CALCULATIONS

BASIN NO. 1
DEVELOPED CONDITIONS

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Impervious	98	4.790	469.420
Norma/Custer	C	Landscaping	86	0.320	27.520
Norma/Custer	C				
Totals				5.110	496.940

Runoff Curve Number = (RCN x A) / A: 97.25
 Runoff Curve Number Used in Basin Calculations..... 97.00

BASIN NO. 2
DEVELOPED CONDITIONS

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Impervious Gravel Areas	98	6.040	591.920
Norma/Custer	C	Pasture	85	0.120	10.200
Norma/Custer	C				0.000
Totals				6.160	602.120

Runoff Curve Number = (RCN x A) / A: 97.75
 Runoff Curve Number Used in Basin Calculations..... 98.00

**AIRPARK INDUSTRIES, LLC
RUNOFF CURVE NUMBER CALCULATIONS**

**BASIN NO. 3
DEVELOPED CONDITIONS**

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Impervious Gravel Areas	98	2.180	213.640
Norma/Custer	C				0.000
Norma/Custer	C				0.000
Totals				2.180	213.640

Runoff Curve Number = (RCN x A) / A: 98.00
 Runoff Curve Number Used in Basin Calculations..... 98.00

**BASIN NO. 4
DEVELOPED CONDITIONS**

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Impervious Gravel Areas	98	13.830	1355.340
Norma/Custer	C				0.000
Norma/Custer	C				
Totals				13.830	1355.340

Runoff Curve Number = (RCN x A) / A: 98.00
 Runoff Curve Number Used in Basin Calculations..... 98.00

AIRPARK INDUSTRIES, LLC
RUNOFF CURVE NUMBER CALCULATIONS

BASIN NO. 5
DEVELOPED CONDITIONS

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Impervious Gravel Areas	98	1.377	134.946
Norma/Custer	C	Pasture/Wetland	85	2.333	198.305
Norma/Custer	C				0.000
Totals				3.710	333.251

Runoff Curve Number = (RCN x A) / A: 89.83
 Runoff Curve Number Used in Basin Calculations..... 90.00

BASIN NO. 6 OFF-SITE AREA
EXISTING CONDITIONS

Soil Name and Hydrologic Soil Group		Cover Description	Runoff Curve Number RCN	Area (Acres) A	RCN x A
Name	HSG				
Norma/Custer	C	Pasture	85	35.800	3043.000
Norma/Custer	C				0.000
Norma/Custer	C				0.000
Totals				35.800	3043.000

Runoff Curve Number = (RCN x A) / A: 85.00
 Runoff Curve Number Used in Basin Calculations..... 85.00

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
PRE DEVELOPED CONDITIONS**

BASIN NO. 1

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.15
Flow Length ($L \leq 300'$), L_{sheet}	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.005 ft/ft
Tt Sheet	0.91 hours
Tt Sheet	54.78 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	200 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_s	5.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.35 fps
Tt Shallow	0.16 hours
Tt Shallow	9.43 min.

Channel Flow

Type of Channel	Pasture
Flow Length, $L_{channel}$	0 ft
Watercourse Slope, S_o	0.100 ft/ft
Time of Concentration Velocity Factor, k_c	3.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	0.95 fps
Tt Channel	0.00 hours
Tt Channel	0.00 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	1.07 hours
Total Tc or Tt	64.20 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the puget Sound basin, Chapter III

BASIN NO. 2

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.15
Flow Length ($L \leq 300'$), L_{sheet}	200 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.004 ft/ft
Tt Sheet	0.72 hours
Tt Sheet	43.30 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	50 ft
Watercourse Slope, S_o	0.004 ft/ft
Time of Concentration Velocity Factor, k_s	5.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.32 fps
Tt Shallow	0.04 hours
Tt Shallow	2.64 min.

Channel Flow

Type of Channel	Pasture
Flow Length, $L_{channel}$	850 ft
Watercourse Slope, S_o	0.004 ft/ft
Time of Concentration Velocity Factor, k_c	17.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	1.08 fps
Tt Channel	0.22 hours
Tt Channel	13.18 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.99 hours
Total Tc or Tt	59.11 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the Puget Sound basin, Chapter III

BASIN NO. 3

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.15
Flow Length ($L \leq 300'$), L_{sheet}	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.005 ft/ft
Tt Sheet	0.91 hours
Tt Sheet	54.78 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	100 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_s	5.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.35 fps
Tt Shallow	0.08 hours
Tt Shallow	4.71 min.

Channel Flow

Type of Channel	Ditch
Flow Length, $L_{channel}$	0 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_c	17.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	1.20 fps
Tt Channel	0.00 hours
Tt Channel	0.00 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.99 hours
Total Tc or Tt	59.49 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the Puget Sound basin, Chapter III

BASIN NO. 4

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.15
Flow Length ($L \leq 300'$), L_{sheet}	200 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.005 ft/ft
Tt Sheet	0.66 hours
Tt Sheet	39.60 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	100 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_s	5.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.35 fps
Tt Shallow	0.08 hours
Tt Shallow	4.71 min.

Channel Flow

Type of Channel	Ditch
Flow Length, $L_{channel}$	1200 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_c	17.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	1.20 fps
Tt Channel	0.28 hours
Tt Channel	16.64 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	1.02 hours
Total Tc or Tt	60.95 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the puget Sound basin, Chapter III

BASIN NO. 5

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.15
Flow Length ($L \leq 300'$), L_{sheet}	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.005 ft/ft
Tt Sheet	0.91 hours
Tt Sheet	54.78 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	50 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_s	5.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.35 fps
Tt Shallow	0.04 hours
Tt Shallow	2.36 min.

Channel Flow

Type of Channel	Pasture
Flow Length, $L_{channel}$	0 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_c	5.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	0.35 fps
Tt Channel	0.00 hours
Tt Channel	0.00 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.95 hours
Total Tc or Tt	57.13 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the puget Sound basin, Chapter III

BASIN NO. 6

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, n_{sheet}	0.30
Flow Length ($L \leq 300'$), L_{sheet}	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, S_{sheet}	0.003 ft/ft
Tt Sheet	1.95 hours
Tt Sheet	116.99 min.

Shallow Concentrated Flow

Surface Description	Pasture
Flow Length, $L_{shallow}$	1500 ft
Watercourse Slope, S_o	0.003 ft/ft
Time of Concentration Velocity Factor, k_s	11.00
Average Velocity, $V_{shallow} = k \times S_o^{0.5}$	0.60 fps
Tt Shallow	0.69 hours
Tt Shallow	41.49 min.

Channel Flow

Type of Channel	Pasture
Flow Length, $L_{channel}$	0 ft
Watercourse Slope, S_o	0.005 ft/ft
Time of Concentration Velocity Factor, k_c	5.00
Average Velocity, $V_{channel} = k \times S_o^{0.5}$	0.35 fps
Tt Channel	0.00 hours
Tt Channel	0.00 min.

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	2.64 hours
Total Tc or Tt	158.49 min.

Note:

1. Worksheet based on time equations from Stormwater Management Manual for the Puget Sound basin, Chapter III

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
POST DEVELOPED CONDITIONS**

BASIN NO. 1

Sheet Flow (Applicable to Tc only)

Surface Description	Paved
Manning's Roughness Coefficient, nsheet	0.01
Flow Length (L<=300'), Lsheet	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, Ssheet	0.005 ft/ft
Tt Sheet	0.11 hours
Tt Sheet	6.77 minutes

Shallow Concentrated Flow (See King County SWM Manual, Page 3.5.2.6)

Surface Description	Paved
Flow Length, Lshallow	100 ft
Watercourse Slope, So	0.005 ft/ft
Time of Concentration Velocity Factor, k	27.00
Average Velocity, Vshallow = k x So ^{0.5}	1.91 fps
Tt Shallow	0.01 hours
Tt Shallow	0.87 minutes

Channel Flow (See King County SWM Manual, Pages 3.5.2-6, 3.5.2-7))

Type of Channel		Pond
Flow Length, Lchannel		100 ft
Watercourse Slope, So		0.005 ft/ft
Time of Concentration Velocity Factor, kc		17.00
Average Velocity, Vchannel = k x So ^{0.5}		1.20 fps
Tt Channel		0.02 hours
Tt Channel		1.39 minutes

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.15 hours
Total Tc or Tt	9.03 minutes

Note:

1. Worksheet based on time equations from King County Surface Water Design Manual, Chapter 3

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
POST DEVELOPED CONDITIONS**

BASIN NO. 2

Sheet Flow (Applicable to Tc only)

Surface Description	Compacted gravel
Manning's Roughness Coefficient, nsheet	0.01
Flow Length (L<=300'), Lsheet	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, Ssheet	0.005 ft/ft
Tt Sheet	0.11 hours
Tt Sheet	6.77 minutes

Shallow Concentrated Flow (See King County SWM Manual, Page 3.5.2.6)

Surface Description	Gravel
Flow Length, Lshallow	0 ft
Watercourse Slope, So	0.005 ft/ft
Time of Concentration Velocity Factor, k	27.00
Average Velocity, Vshallow = k x So ^{0.5}	1.91 fps
Tt Shallow	0.00 hours
Tt Shallow	0.00 minutes

Channel Flow (See King County SWM Manual, Pages 3.5.2-6, 3.5.2-7))

Type of Channel		Detention Basin
Flow Length, Lchannel		0 ft
Watercourse Slope, So		0.005 ft/ft
Time of Concentration Velocity Factor, kc		17.00
Average Velocity, Vchannel = k x So ^{0.5}		1.20 fps
Tt Channel		0.00 hours
Tt Channel		0.00 minutes

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.11 hours
Total Tc or Tt	6.77 minutes

Note:

1. Worksheet based on time equations from King County Surface Water Design Manual, Chapter 3

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
POST DEVELOPED CONDITIONS**

BASIN NO. 3

Sheet Flow (Applicable to Tc only)

Surface Description	Compacted Gravel
Manning's Roughness Coefficient, n _{sheet}	0.01
Flow Length (L<=300'), L _{sheet}	200 feet
2-Year, 24-Hour Rainfall, P ₂	1.80 inches
Land Slope, S _{sheet}	0.005 ft/ft
T _t Sheet	0.08 hours
T _t Sheet	4.90 minutes

Shallow Concentrated Flow (See King County SWM Manual, Page 3.5.2.6)

Surface Description	Gravel
Flow Length, L _{shallow}	100 ft
Watercourse Slope, S _o	0.005 ft/ft
Time of Concentration Velocity Factor, k	27.00
Average Velocity, V _{shallow} = k x S _o ^{0.5}	1.91 fps
T _t Shallow	0.01 hours
T _t Shallow	0.87 minutes

Channel Flow (See King County SWM Manual, Pages 3.5.2-6, 3.5.2-7))

Type of Channel		Pond
Flow Length, L _{channel}		100 ft
Watercourse Slope, S _o		0.005 ft/ft
Time of Concentration Velocity Factor, k _c		17.00
Average Velocity, V _{channel} = k x S _o ^{0.5}		1.20 fps
T _t Channel		0.02 hours
T _t Channel		1.39 minutes

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.12 hours
Total Tc or Tt	7.16 minutes

Note:

1. Worksheet based on time equations from King County Surface Water Design Manual, Chapter 3

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
POST DEVELOPED CONDITIONS**

BASIN NO. 4

Sheet Flow (Applicable to Tc only)

Surface Description	Compacted Gravel
Manning's Roughness Coefficient, nsheet	0.01
Flow Length (L<=300'), Lsheet	300 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, Ssheet	0.005 ft/ft
Tt Sheet	0.11 hours
Tt Sheet	6.77 minutes

Shallow Concentrated Flow (See King County SWM Manual, Page 3.5.2.6)

Surface Description	Compacted Gravel
Flow Length, Lshallow	300 ft
Watercourse Slope, So	0.005 ft/ft
Time of Concentration Velocity Factor, k	27.00
Average Velocity, Vshallow = $k \times So^{0.5}$	1.91 fps
Tt Shallow	0.04 hours
Tt Shallow	2.62 minutes

Channel Flow (See King County SWM Manual, Pages 3.5.2-6, 3.5.2-7))

Type of Channel		Ditch
Flow Length, Lchannel		0 ft
Watercourse Slope, So		0.005 ft/ft
Time of Concentration Velocity Factor, kc		17.00
Average Velocity, Vchannel = $k \times So^{0.5}$		1.20 fps
Tt Channel		0.00 hours
Tt Channel		0.00 minutes

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.16 hours
Total Tc or Tt	9.39 minutes

Note:

1. Worksheet based on time equations from King County Surface Water Design Manual, Chapter 3

**AIRPARK INDUSTRIES, LLC
TIME OF CONCENTRATION
POST DEVELOPED CONDITIONS**

BASIN NO. 5

Sheet Flow (Applicable to Tc only)

Surface Description	Pasture
Manning's Roughness Coefficient, nsheet	0.02
Flow Length (L<=300'), Lsheet	200 feet
2-Year, 24-Hour Rainfall, P2	1.80 inches
Land Slope, Ssheet	0.005 ft/ft
Tt Sheet	0.15 hours
Tt Sheet	9.14 minutes

Shallow Concentrated Flow (See King County SWM Manual, Page 3.5.2.6)

Surface Description	Compacted Gravel
Flow Length, Lshallow	150 ft
Watercourse Slope, So	0.005 ft/ft
Time of Concentration Velocity Factor, k	27.00
Average Velocity, Vshallow = $k \times So^{0.5}$	1.91 fps
Tt Shallow	0.02 hours
Tt Shallow	1.31 minutes

Channel Flow (See King County SWM Manual, Pages 3.5.2-6, 3.5.2-7))

Type of Channel		Pipe
Flow Length, Lchannel		0 ft
Watercourse Slope, So		0.010 ft/ft
Time of Concentration Velocity Factor, kc		24.00
Average Velocity, Vchannel = $k \times So^{0.5}$		2.40 fps
Tt Channel		0.00 hours
Tt Channel		0.00 minutes

Results: Watershed or Subarea Tc or Tt

Total Tc or Tt	0.17 hours
Total Tc or Tt	10.45 minutes

Note:

1. Worksheet based on time equations from King County Surface Water Design Manual, Chapter 3

**DETENTION BASIN
DESIGN DATA**

STAGE STORAGE TABLES

CUSTOM STORAGE **ID No. STO-1**
 Description: BASIN 1 STORAGE

STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-								
119.00	0.0000	0.0000	119.70	8995	0.2065	120.40	17990	0.4130	121.10	26260	0.6028
119.10	1285	0.0295	119.80	10280	0.2360	120.50	19275	0.4425	121.20	26820	0.6157
119.20	2570	0.0590	119.90	11565	0.2655	120.60	20560	0.4720	121.30	27380	0.6286
119.30	3855	0.0885	120.00	12850	0.2950	120.70	21845	0.5015	121.40	27940	0.6414
119.40	5140	0.1180	120.10	14135	0.3245	120.80	23130	0.5310	121.50	28500	0.6543
119.50	6425	0.1475	120.20	15420	0.3540	120.90	24415	0.5605	121.50	28500	0.6543
119.60	7710	0.1770	120.30	16705	0.3835	121.00	25700	0.5900			

CUSTOM STORAGE **ID No. STO-2**
 Description: BASIN 2 STORAGE

STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-								
119.50	0.0000	0.0000	120.10	10800	0.2479	120.70	21600	0.4959	121.30	32400	0.7438
119.60	1800	0.0413	120.20	12600	0.2893	120.80	23400	0.5372	121.40	34200	0.7851
119.70	3600	0.0826	120.30	14400	0.3306	120.90	25200	0.5785	121.50	36000	0.8264
119.80	5400	0.1240	120.40	16200	0.3719	121.00	27000	0.6198	121.50	36000	0.8264
119.90	7200	0.1653	120.50	18000	0.4132	121.10	28800	0.6612			
120.00	9000	0.2066	120.60	19800	0.4545	121.20	30600	0.7025			

CUSTOM STORAGE **ID No. STO-3**
 Description: BASIN 3 STORAGE

STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-	STAGE <----STORAGE----> (ft) ---cf--- --Ac-Ft-								
118.50	0.0000	0.0000	119.10	3590	0.0824	119.70	7180	0.1648	120.30	10769	0.2472
118.60	598.30	0.0137	119.20	4188	0.0961	119.80	7778	0.1786	120.40	11368	0.2610
118.70	1197	0.0275	119.30	4786	0.1099	119.90	8376	0.1923	120.50	11966	0.2747
118.80	1795	0.0412	119.40	5385	0.1236	120.00	8974	0.2060	120.50	11966	0.2747
118.90	2393	0.0549	119.50	5983	0.1374	120.10	9573	0.2198			
119.00	2991	0.0687	119.60	6581	0.1511	120.20	10171	0.2335			

STAGE STORAGE TABLES

CUSTOM STORAGE **ID No. STO-4**
 Description: BASIN 4 STORAGE

STAGE <----STORAGE---->			STAGE <----STORAGE---->			STAGE <----STORAGE---->			STAGE <----STORAGE---->		
(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-
119.50	0.0000	0.0000	120.10	26510	0.6086	120.70	53020	1.2172	121.30	79529	1.8257
119.60	4418	0.1014	120.20	30928	0.7100	120.80	57438	1.3186	121.40	83948	1.9272
119.70	8837	0.2029	120.30	35346	0.8114	120.90	61856	1.4200	121.50	88366	2.0286
119.80	13255	0.3043	120.40	39765	0.9129	121.00	66274	1.5215	121.50	88366	2.0286
119.90	17673	0.4057	120.50	44183	1.0143	121.10	70693	1.6229			
120.00	22091	0.5072	120.60	48601	1.1157	121.20	75111	1.7243			

CUSTOM STORAGE **ID No. STO-5**
 Description: BASIN 5 STORAGE

STAGE <----STORAGE---->			STAGE <----STORAGE---->			STAGE <----STORAGE---->			STAGE <----STORAGE---->		
(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-	(ft)	---cf---	--Ac-Ft-
121.50	0.0000	0.0000	122.10	5476	0.1257	122.70	10952	0.2514	123.30	16428	0.3771
121.60	912.65	0.0210	122.20	6389	0.1467	122.80	11864	0.2724	123.40	17340	0.3981
121.70	1825	0.0419	122.30	7301	0.1676	122.90	12777	0.2933	123.50	18253	0.4190
121.80	2738	0.0629	122.40	8214	0.1886	123.00	13690	0.3143	123.50	18253	0.4190
121.90	3651	0.0838	122.50	9126	0.2095	123.10	14602	0.3352			
122.00	4563	0.1048	122.60	10039	0.2305	123.20	15515	0.3562			

STAGE DISCHARGE TABLE

COMBINATION DISCHARGE ID No. CMB-1
 Description: COMBINATION FOR POND #1
 Structure: NW1 Structure:
 Structure: OR-1 Structure:
 Structure: RIS-1

STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--
119.00	0.0000	120.30	0.1397	121.60	5.4596	122.90	18.658
119.10	0.0388	120.40	0.1450	121.70	6.1475	123.00	19.588
119.20	0.0548	120.50	0.1501	121.80	6.8523	123.10	20.498
119.30	0.0671	120.60	0.3093	121.90	7.5716	123.20	21.388
119.40	0.0775	120.70	0.5938	122.00	8.3029	123.30	22.256
119.50	0.0866	120.80	0.9571	122.10	9.3519	123.40	23.103
119.60	0.0949	120.90	1.3819	122.20	10.664	123.50	23.925
119.70	0.1025	121.00	1.8579	122.30	12.147	123.60	24.724
119.80	0.1096	121.10	2.3775	122.40	13.768	123.70	25.496
119.90	0.1163	121.20	2.9350	122.50	14.737	123.80	26.240
120.00	0.1225	121.30	3.5258	122.60	15.750	123.90	26.956
120.10	0.1285	121.40	4.1457	122.70	16.740	124.00	27.641
120.20	0.1342	121.50	4.7914	122.80	17.709		

COMBINATION DISCHARGE ID No. CMB-2
 Description: COMBINATION FOR POND #2
 Structure: NW2 Structure:
 Structure: OR-2 Structure:
 Structure: RIS-2

STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--	STAGE (ft)	<--DISCHARGE--> ---cfs--
119.50	0.0000	120.70	0.1607	121.90	5.5608	123.10	20.274
119.60	0.0464	120.80	0.1673	122.00	6.3520	123.20	21.411
119.70	0.0656	120.90	0.1736	122.10	7.4784	123.30	22.541
119.80	0.0803	121.00	0.3549	122.20	8.8844	123.40	23.664
119.90	0.0928	121.10	0.6796	122.30	10.478	123.50	24.777
120.00	0.1037	121.20	1.0956	122.40	12.226	123.60	25.880
120.10	0.1136	121.30	1.5838	122.50	13.338	123.70	26.971
120.20	0.1227	121.40	2.1328	122.60	14.509	123.80	28.048
120.30	0.1312	121.50	2.7346	122.70	15.673	123.90	29.111
120.40	0.1392	121.60	3.3829	122.80	16.830	124.00	30.157
120.50	0.1467	121.70	4.0728	122.90	17.983		
120.60	0.1539	121.80	4.8000	123.00	19.131		

STAGE DISCHARGE TABLES

COMBINATION DISCHARGE ID No. CMB-3
 Description: COMBINATION FOR POND #3
 Structure: NW3 Structure:
 Structure: OR-3 Structure:
 Structure: RIS-3

STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---
115.50	0.0000	117.70	0.0509	119.90	0.0720	122.10	11.818
115.60	0.0109	117.80	0.0521	120.00	0.0729	122.20	12.562
115.70	0.0154	117.90	0.0532	120.10	0.0737	122.30	13.303
115.80	0.0188	118.00	0.0543	120.20	0.2287	122.40	14.039
115.90	0.0217	118.10	0.0554	120.30	0.5088	122.50	14.768
116.00	0.0243	118.20	0.0564	120.40	0.8675	122.60	15.796
116.10	0.0266	118.30	0.0575	120.50	1.2874	122.70	17.069
116.20	0.0287	118.40	0.0585	120.60	1.7580	122.80	18.495
116.30	0.0307	118.50	0.0595	120.70	2.2718	122.90	20.042
116.40	0.0326	118.60	0.0605	120.80	2.8230	123.00	20.919
116.50	0.0343	118.70	0.0614	120.90	3.4069	123.10	21.824
116.60	0.0360	118.80	0.0624	121.00	4.0195	123.20	22.688
116.70	0.0376	118.90	0.0633	121.10	4.6573	123.30	23.515
116.80	0.0392	119.00	0.0643	121.20	5.3170	123.40	24.305
116.90	0.0406	119.10	0.0652	121.30	5.9958	123.50	25.059
117.00	0.0421	119.20	0.0661	121.40	6.6909	123.60	25.777
117.10	0.0434	119.30	0.0670	121.50	7.3999	123.70	26.458
117.20	0.0448	119.40	0.0678	121.60	8.1204	123.80	27.102
117.30	0.0461	119.50	0.0687	121.70	8.8500	123.90	27.707
117.40	0.0473	119.60	0.0695	121.80	9.5867	124.00	28.272
117.50	0.0486	119.70	0.0704	121.90	10.328		
117.60	0.0498	119.80	0.0712	122.00	11.073		

COMBINATION DISCHARGE ID No. CMB-4
 Description: COMBINATION FOR POND #4
 Structure: NW4 Structure:
 Structure: OR-4 Structure:
 Structure: RIS-4

STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---
119.50	0.0000	120.70	0.3906	121.90	5.8811	123.10	18.036
119.60	0.1128	120.80	0.4066	122.00	6.5915	123.20	19.052
119.70	0.1595	120.90	0.5764	122.10	7.3203	123.30	20.044
119.80	0.1953	121.00	0.8718	122.20	8.0650	123.40	21.014
119.90	0.2255	121.10	1.2466	122.30	8.8230	123.50	21.961
120.00	0.2522	121.20	1.6839	122.40	9.5922	123.60	22.885
120.10	0.2762	121.30	2.1731	122.50	10.370	123.70	23.785
120.20	0.2984	121.40	2.7072	122.60	11.463	123.80	24.661
120.30	0.3190	121.50	3.2804	122.70	12.816	123.90	25.511
120.40	0.3383	121.60	3.8881	122.80	14.337	124.00	26.334
120.50	0.3566	121.70	4.5264	122.90	15.992		
120.60	0.3740	121.80	5.1918	123.00	16.993		

COMBINATION DISCHARGE ID No. CMB-5
 Description: COMBINATION FOR POND #5
 Structure: NW5 Structure:
 Structure: OR-5 Structure:
 Structure: RIS-5

STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---	STAGE (ft)	<--DISCHARGE--> ---cfs---
121.50	0.0000	122.20	0.2711	122.90	6.2731	123.60	13.579
121.60	0.0434	122.30	0.5673	123.00	7.2042	123.70	14.703
121.70	0.0614	122.40	0.9514	123.10	8.2210	123.80	15.842
121.80	0.0752	122.50	1.4079	123.20	9.2552	123.90	16.994
121.90	0.0869	122.60	2.2356	123.30	10.308	124.00	18.156
122.00	0.0971	122.70	3.3754	123.40	11.380		
122.10	0.1064	122.80	4.7332	123.50	12.471		

AIRPARK INDUSTRIES, LLC						
DETENTION POND NO. 1 (BASIN 1)						
STAGE / STORAGE CALCULATIONS						
W.S ELEV.	SURFACE AREA	AVG. AREA	DEPTH	INCREM. VOLUME	TOTAL VOLUME	DESIGN VOLUME
119.00	16,670.00				0.00	0.00
		19,305.00	2.00	38,610.00		
121.00	16,670.00				38,610.00	25,700.00
		8,335.00	0.50	4,167.50		
121.50	21,940.00				42,777.50	28,500.00

NOTE:

DESIGN VOLUME REFLECTS 50% REDUCTION IN TOTAL VOLUME PER DOE REQUIREMENTS

AIRPARK INDUSTRIES, LLC						
DETENTION BASIN NO. 2 (BASIN 2)						
STAGE / STORAGE CALCULATIONS						
W.S ELEV.	SURFACE AREA	AVG. AREA	DEPTH	INCREM. VOLUME	TOTAL VOLUME	DESIGN VOLUME
119.50	19,000.00				0.00	0.00
		27,000.00	2.00	54,000.00		
121.50	35,000.00				54,000.00	36,000.00

NOTE:

DESIGN VOLUME REFLECTS 50% REDUCTION IN TOTAL VOLUME PER DOE REQUIREMENTS

AIRPARK INDUSTRIES, LLC						
DETENTION POND NO. 3 (BASIN 3)						
STAGE / STORAGE CALCULATIONS						
W.S	SURFACE AREA	AVG. AREA	DEPTH	INCREM. VOLUME	TOTAL VOLUME	DESIGN VOLUME
118.50	7,470.00				0.00	0.00
		8,975.00	2.00	17,950.00		
120.50	10,480.00				17,950.00	11,966.67

NOTE:

DESIGN VOLUME REFLECTS 50% REDUCTION IN TOTAL VOLUME PER DOE REQUIREMENTS

AIRPARK INDUSTRIES, LLC						
DETENTION POND NO. 4 (BASIN 4)						
STAGE / STORAGE CALCULATIONS						
W.S ELEV.	SURFACE AREA	AVG. AREA	DEPTH	INCREM. VOLUME	TOTAL VOLUME	DESIGN VOLUME
119.50	54,450.00				0.00	0.00
		66,275.00	2.00	132,550.00		
121.50	78,100.00				132,550.00	88,366.67

NOTE:

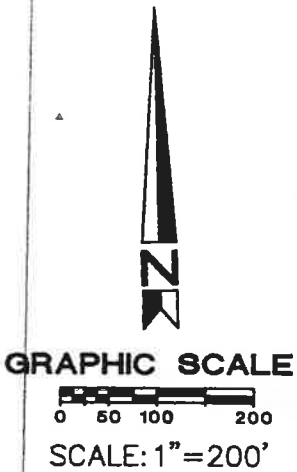
DESIGN VOLUME REFLECTS 50% REDUCTION IN TOTAL VOLUME PER DOE REQUIREMENTS

AIRPARK INDUSTRIES, LLC						
DETENTION POND NO. 5A, 5B COMBINED (BASIN 5)						
STAGE / STORAGE CALCULATIONS						
W.S ELEV.	SURFACE AREA	AVG. AREA	DEPTH	INCREM. VOLUME	TOTAL VOLUME	DESIGN VOLUME
121.50	10,200.00				0.00	0.00
		13,690.00	2.00	27,380.00		
123.50	17,180.00				27,380.00	18,253.33

NOTE:

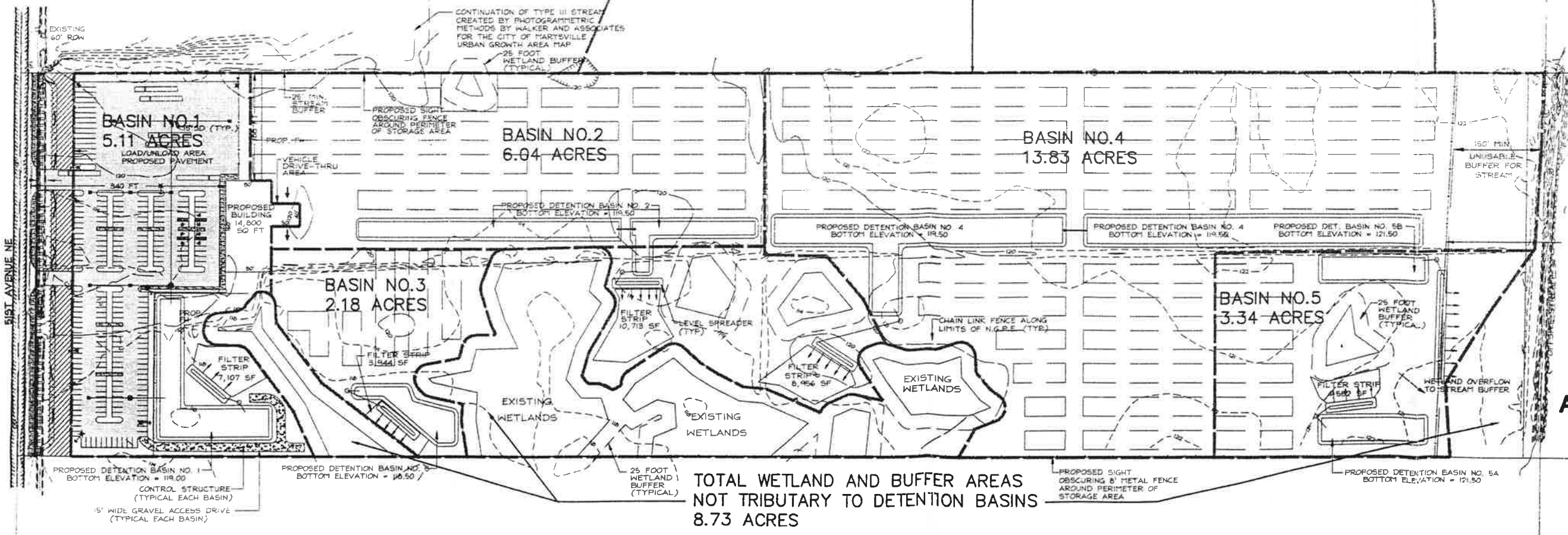
DESIGN VOLUME REFLECTS 50% REDUCTION IN TOTAL VOLUME PER DOE REQUIREMENTS

DRAINAGE AREA MAP



OFF-SITE AREA
TRIBUTARY TO SITE
35.80 ACRES

DRAINAGE DIVIDE



**DRAINAGE AREA MAP
POST-DEVELOPED
CONDITIONS
FOR
AIRPARK INDUSTRIES, LLC**
SCALE: 1"=200'

TOTAL WETLAND AND BUFFER AREAS
NOT TRIBUTARY TO DETENTION BASINS
8.73 ACRES

591 AVENUE NE

EXISTING 50' ROW

CONTINUATION OF TYPE III STREAM
CREATED BY PHOTOGRAMMETRIC
METHODS BY WALKER AND ASSOCIATES
FOR THE CITY OF MARTSVILLE
URBAN GROWTH AREA MAP
25 FOOT
WETLAND BUFFER
(TYPICAL)

PROPOSED SIGHT
OBSCURING FENCE
AROUND PERIMETER
OF STORAGE AREA

25' MIN.
STRAIGHT
BUFFER

VEHICLE
DRIVE-THRU
AREA

PROPOSED
BUILDING
14,800
50 FT

BASIN NO.1
5.11 ACRES
LOAD/UNLOAD AREA
PROPOSED PAVEMENT

BASIN NO.2
6.04 ACRES

BASIN NO.4
13.83 ACRES

BASIN NO.3
2.18 ACRES

BASIN NO.5
3.34 ACRES

150' MIN.
UNUSABLE
BUFFER FOR
STREAM

25 FOOT
WETLAND
BUFFER
(TYPICAL)

FILTER STRIP
1500 SF

WETLAND OVERFLOW
TO STREAM BUFFER

CHAIN LINK FENCE ALONG
LIMITS OF N.G.P.E. (TYP)

LEVEL SPREADER
(TYP)

FILTER STRIP
8,956 SF

FILTER STRIP
10,713 SF

FILTER STRIP
3,544 SF

FILTER STRIP
7,107 SF

PROPOSED DETENTION BASIN NO. 1
BOTTOM ELEVATION = 119.00

PROPOSED DETENTION BASIN NO. 3
BOTTOM ELEVATION = 116.50

25 FOOT
WETLAND
BUFFER
(TYPICAL)

PROPOSED SIGHT
OBSCURING 8' METAL FENCE
AROUND PERIMETER OF
STORAGE AREA

PROPOSED DETENTION BASIN NO. 5A
BOTTOM ELEVATION = 121.50

CONTROL STRUCTURE
(TYPICAL EACH BASIN)

5' WIDE GRAVEL ACCESS DRIVE
(TYPICAL EACH BASIN)

GEOTECHNICAL REPORT

Western Geotechnical Consultants, Inc.

4181 Saltspings Drive • Ferndale, WA 98248
Phone (360) 380-2507 • Fax (360) 380-2507

May 31, 2000

Legacy International
PO Box 270
Woodinville, WA 98072
ATTN: Dan Fitzpatrick

**Re: Report-Geotechnical Feasibility Study
Piezometer Installation & Initial Water Level Readings
Dan Fitzpatrick Property
East of 51st Avenue NE
Arlington, WA 98223**

Western Geotechnical Consultants, Inc. is pleased to present the results of our installation of five piezometers at the above referenced property. On May 17, 2000 a geotechnical engineer from our firm oversaw the installation of 5 piezometers in excavated test pits. Subsurface soil and groundwater conditions were evaluated and logged at each of the piezometer locations. The location of the piezometers is shown on the attached Site Plan, Figure 1. The soils encountered were classified in accordance with the Unified Soil Classification System (USCS).

Edited, tabulated test pit logs are attached to the report together with a description of the USCS. The subsurface soil profile consists of about 1-foot of topsoil which is underlain by slightly silty SAND (SP/SM by USCS classification). Test Pit 3 encountered gravelly sands below about 2 feet. We returned to the site and read the water levels in the piezometers on May 21, 2000. Groundwater was encountered in the test pits at 0.7 to 2.9 feet below present grade. We also evaluated data from a piezometer installed on the east side of the property during a previous geotechnical investigation (see Piezometer No. PM-1). PM-1 has a documented seasonal high water table 1.3 feet below present grade. The water table is lowest along the west and east sides of the property, becoming shallow towards the center of the property. The observed lower ground water table near the east and west property lines may reflect the fact that drainage ditches are present on the east and west sides of the property. Figure 1 provides rough preliminary ground water depth contours for the entire site.

A summary of the piezometer readings follows.

Piezometer No.	Depth to Water Table (feet)
1	2.9
2	1.9
3	2.0
4	0.9
5	0.7
PM-1	1.3

Based on the piezometer readings, it is our opinion that the seasonal high groundwater table will be less than 3 feet below the ground surface across the site. Therefore, a conventional detention/infiltration pit is not feasible and alternate storm water detention facilities will be required. A possible storm water detention system could involve construction of a vault with controlled outlet to the storm water ditch system.

We appreciate the opportunity to be of assistance to you on this project. If you have any questions regarding the contents of this report, or if we can be of further assistance, please contact our office.

Sincerely,

Western Geotechnical Consultants, Inc.



Theodore A. Hammer, P.E.
Geotechnical Engineer

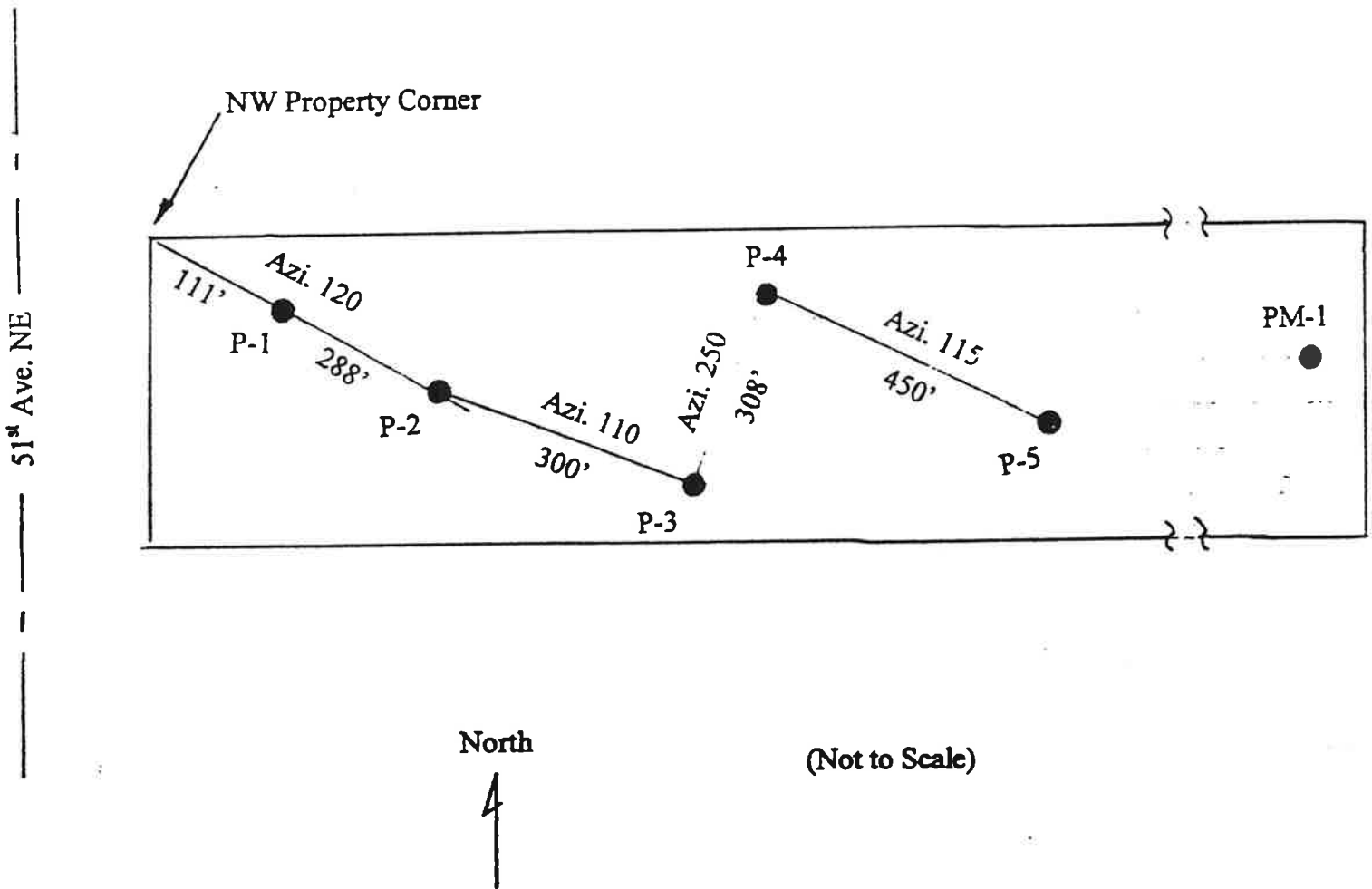


EXPIRES 12/27/01

Cc: Higa Engineering, Inc.

File:50501

Figure 1
Site Plan & Test Pit Locations
Dan Fitzpatrick Property
Arlington, Washington



UNIFIED SOIL CLASSIFICATION CHART (USCS)

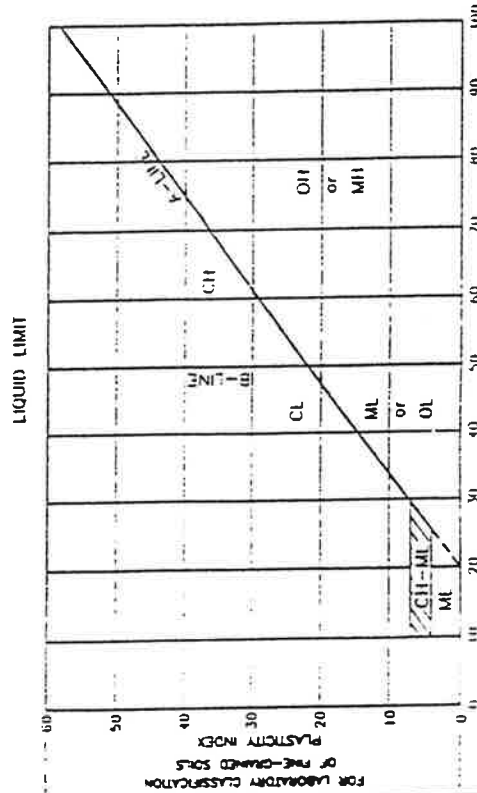
MAJOR DIVISIONS	GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES) < 5%	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GRAVELS WITH FINES (APPROXIMATE AMOUNT OF FINES) < 12%	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES) < 5%	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SANDS WITH FINES (APPROXIMATE AMOUNT OF FINES) < 12%	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SILTS AND CLAYS	LOW PLASTICITY SILTS AND CLAYS	ML, CL	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	HIGH PLASTICITY SILTS AND CLAYS	OL, OH	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
FINE GRAINED SOILS	LOW PLASTICITY FINE GRAINED SOILS	MH, CH	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	HIGH PLASTICITY FINE GRAINED SOILS	ML, CL, OL, MH, CH, OH	ORGANIC SILTS, MUCKS, OR ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, FAT CLAYS
HIGHLY ORGANIC SOILS	PT	PEAT, MARLE, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

GRADATION CHART

MATERIAL SIZE	PARTICLE SIZE			
	LOWER LIMIT MILLIMETERS	UPPER LIMIT MILLIMETERS	UPPER LIMIT MILLIMETERS	UPPER LIMIT MILLIMETERS
SAND	0.75	2.00	0.42	#40
	0.42	0.85	0.25	#60
	0.075	0.425	0.075	#200
GRAVEL	4.75	75	19	3/4"
	19	75	4.75	3"
COBBLES	75	200	30	1 1/2"
	200	750	75	3"
BOULDERS	750	2500	100	12"
	2500	7500	300	36"

• U.S. STANDARD • CLEAR SQUARE OPENINGS
 5 - 12% FINES (SILT & CLAY) TUAL GLASS

PLASTICITY CHART



Western Geotechnical Consultants, Inc.

4181 Sallsprings Drive • Ferndale, WA 98248
 Phone (360) 380-2507 • Fax (360) 380-2507

Key to Test Pit Logs Using the Unified Soil Classification System

DATE: 5/11/00
 SHEET: 4 OF 4

Log of Test Pits

Test Pit No.	Depth (feet)	USCS Classification	Soil Description
TP-1	0.0 -1.0	OL	Dark brown sandy organic SILT and roots (topsoil) (soft)
	1.0-3.8	SP/SM	Light brown fine SAND with trace silt (moist grading wet)

- Test Pit terminated at 3.8 feet.
- Groundwater encountered at 3 feet.
- Piezometer installed.
- Test pit backfilled on 5/17/00.

Test Pit No.	Depth (feet)	USCS Classification	Soil Description
TP-2	0.0 -1.1	OL	Dark brown sandy organic SILT and roots (topsoil) (soft)
	1.0-2.8	SP/SM	Light brown fine SAND with trace silt (moist grading wet)

- Test Pit terminated at 2.8 feet.
- Groundwater encountered at 2.2 feet.
- Piezometer installed to 2.8 feet.
- Test pit backfilled on 5/17/00.

Test Pit No.	Depth (feet)	USCS Classification	Soil Description
TP-3	0.0 -1.0	OL	Dark brown sandy organic SILT and roots (topsoil) (soft)
	1.0-2.3	SP/SM	Light brown fine SAND with trace silt (moist grading wet)
	2.3-2.5	GP/GM	Light brown sandy GRAVEL with trace silt (wet)

- Test Pit terminated at 2.5 feet.
- Groundwater encountered at 2.4 feet.
- Piezometer installed to 2.5 feet.
- Test pit backfilled on 5/17/00.

Log of Test Pits (cont.)

Test Pit No.	Depth (feet)	USCS Classification	Soil Description
TP-4	0.0 -1.0	OL	Dark brown sandy organic SILT and roots (topsoil) (soft)
	1.0-2.8	SP/SM	Light brown fine SAND with trace silt (moist grading wet)

- Test Pit terminated at 2.8 feet.
- Groundwater encountered at 2.0 feet.
- Piezometer installed to 2.7 feet.
- Test pit backfilled on 5/17/00.

Test Pit No.	Depth (feet)	USCS Classification	Soil Description
TP-5	0.0 -1.0	OL	Dark brown sandy organic SILT and roots (topsoil) (soft)
	1.1-3.0	SP/SM	Light brown fine SAND with trace silt (moist grading wet)

- Test Pit terminated at 3.0 feet.
- Groundwater encountered at 1.8 feet.
- Piezometer installed to 2.8 feet.
- Test pit backfilled on 5/17/00.

